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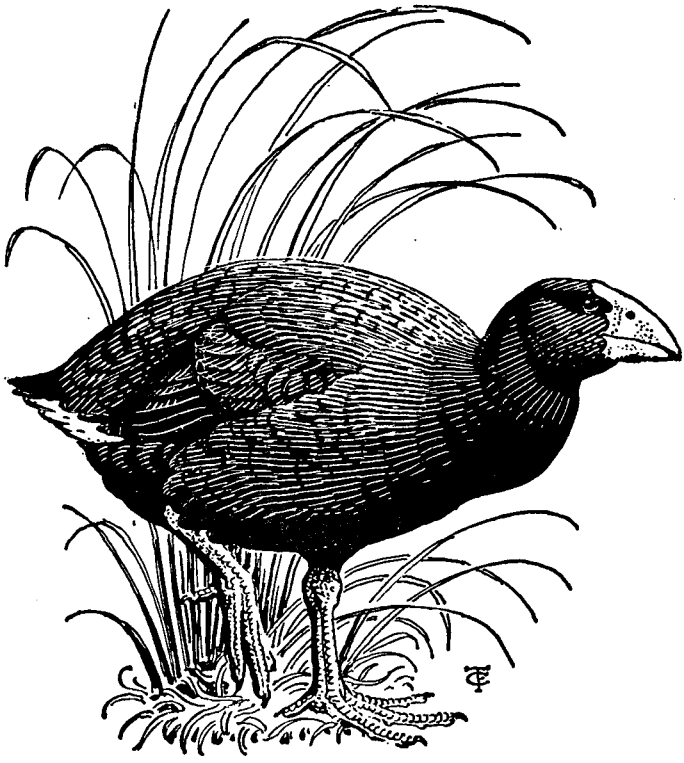

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2. Buller, W. L., 1888: A History of the Birds of New Zealand (2nd ed.) 2 vols., the author, London.

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NOTORNIS

In continuation of New Zealand Bird Notes

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Contents of Vol. 16, No. 1: March, 1969

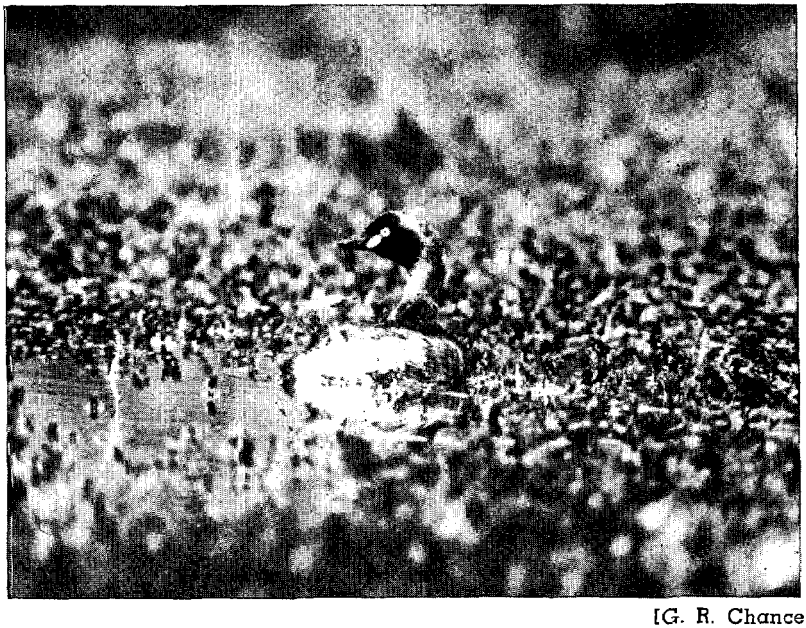
A NEW BIRD FOR NEW ZEALAND — AUSTRALIAN LITTLE GREBE, AT ARROWTOWN

By G. R. CHANCE

On 21/4/1968 Mr. Marsh Small observed a dabchick of apparent Australian origin on a dam near Arrowtown. Seven months later, following Mr. Small's directions on the afternoon of 29/11/68 I was able to locate this attractive visitor without difficulty. Later I set up a hide from which I obtained photographs which allowed a positive identification to be made.

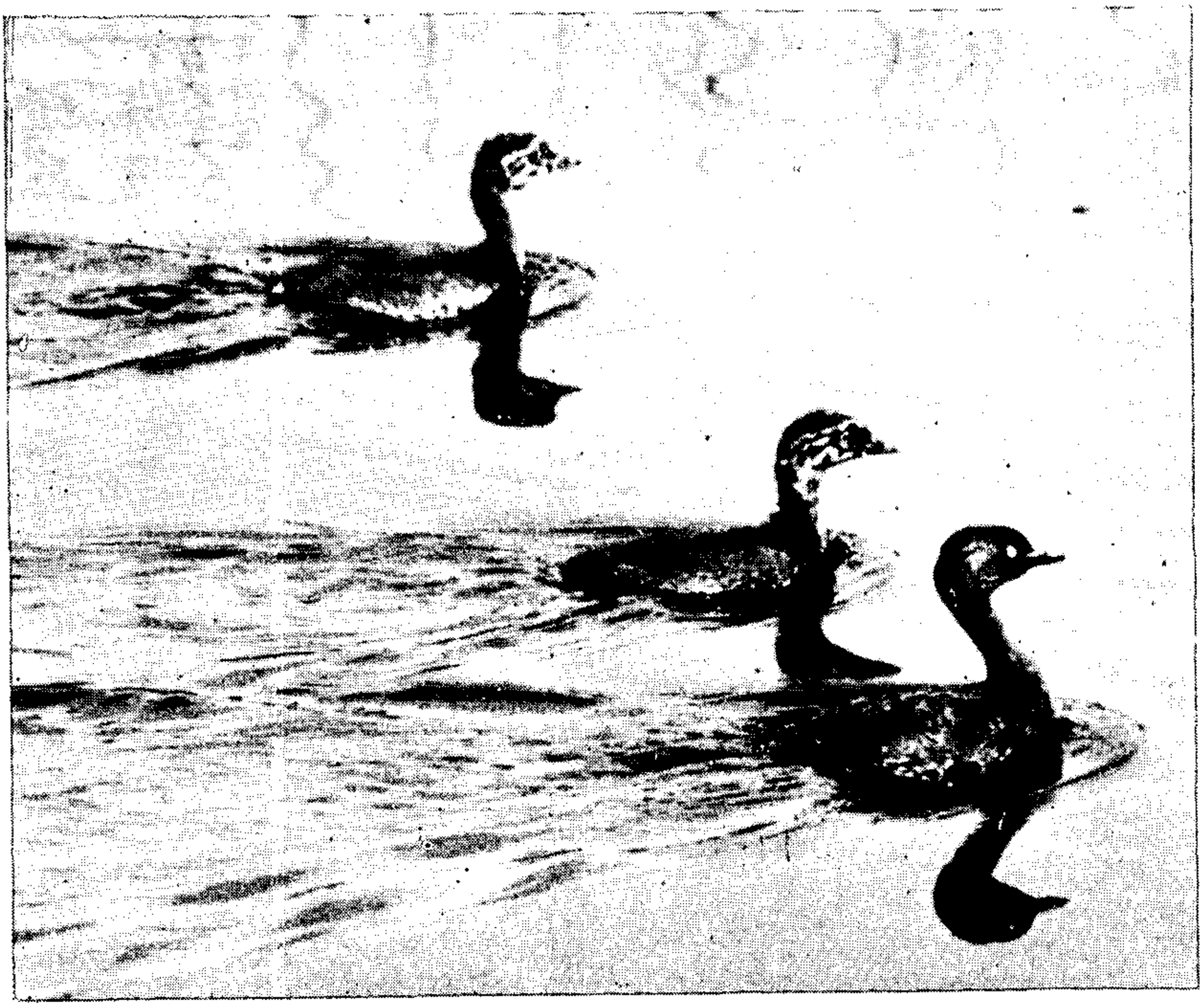
The dam, about 150 yards long and of lesser width, held a pair of Coot *(F. atra)* at each end. The Little Grebe was closely associated with a pair of Coot who were about to build a nest under some willows, and followed their activities with great interest, particularly when they invaded the territory of the other Coot. As if sensing a relationship with the Coot, it ignored the presence of waterfowl; Mallard, Grey Duck, Shoveller, Grey Teal and Scaup.

The Little Grebe was in full breeding plumage and the most obvious characteristic was the yellow patch from the base of the bill



[G. R. Chance

Plate I — Australian Dabchick **(Podiceps novaehollandiae)** near Arrowtown on 30/11/1968.



[Gavin Woodward

Plate II — New Zealand Dabchick **(Podiceps rufopectus)** on a small lagoon on the Wellington coast. Note the intricate pattern on the heads of the two well-grown youngsters.

to below the eye. This patch gave a singular appearance from a direct frontal view. The iris was orange and the bill was black with a pearly tip. The head and neck was grey except for a chestnut stripe originating from a base, half-way down the side of the neck and coming to a point behind the eyes. The throat was black as its alternative name would suggest. The wings were grey and the the undersurface of the wings and body cloudy white. The feathers on the back were brown tipped with black, gradually merging to a lighter brown on the sides, giving an unusual fluffy, hairlike impression.

Its low trajectory flight was reminiscent in power of that of the Crested Grebe, reacting under similar circumstances. When stimulated it gave a long ' chittering ' call, at first unexpected, but in character with this alert bird. An expert diver for periods of about 20 seconds, except when disturbed when it would dive and surface under cover, or sink hull down in surface weed making detection difficult.

From my observation made during two week-ends it would appear, that given the opportunity, this species would adapt well to conditions in New Zealand. It was still present on 17/1/69.

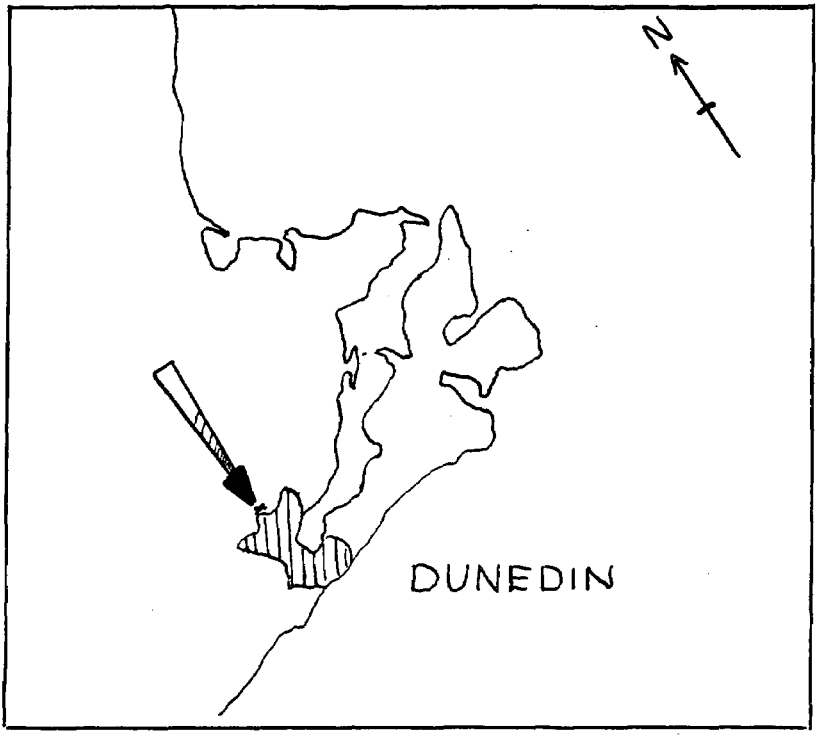
BREEDING BIOLOGY OF RIFLEMAN AT DUNEDIN

By R. S. GRAY

SUMMARY

Nest boxes were used to study the nesting cycle of Rifleman *(Acanthisitta chloris)* in second-growth bush near Dunedin city. During three nesting seasons, two to five territories were studied. It was found that the incubation period was 20-21 days; the nestling period was about 24 days; there was an interval of about 48 hours between successive eggs of a clutch; and clutches known to be complete varied from 2 - 4 eggs.

No pair raised more than two clutches per season, though several pairs built or at least started more than two nests. Losses occurred mostly during the building and egg stages, and were generally due to abandonment for reasons unknown. In only one nest were fledglings lost, and this was due to human interference, which would probably not have occurred if the nest had been in a natural site.



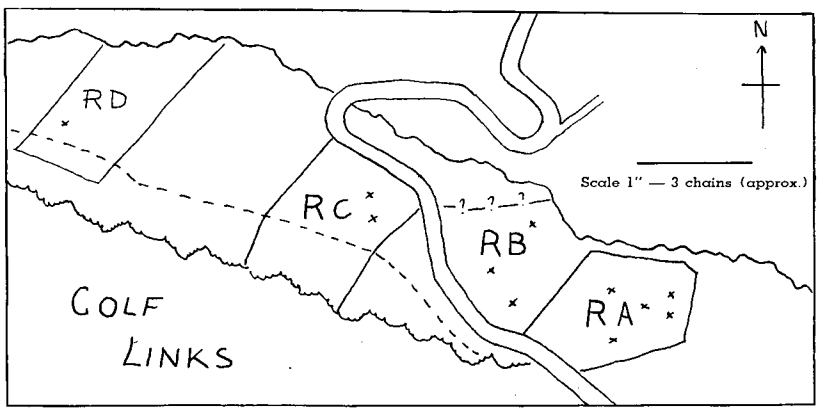
Map 1 — Map of Dunedin showing location of study area.

INTRODUCTION

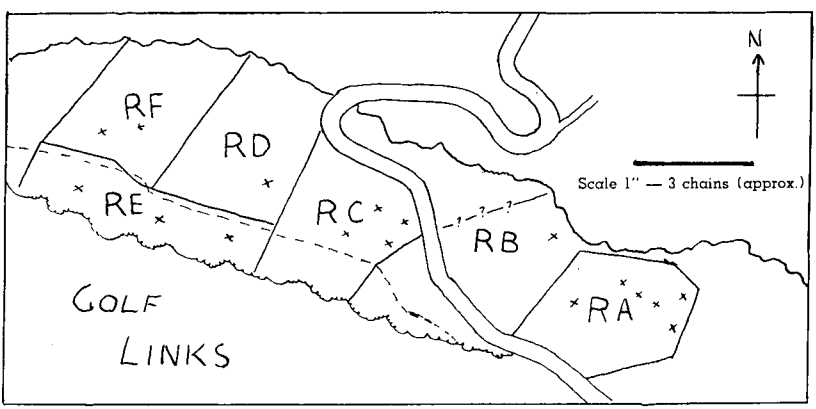
The study area is in a patch of bush near the Ross Creek Reservoir. This Reservoir is on the outskirts of Dunedin and approximately three miles from the centre of the city.

The Rifleman territories under observation are along one side of a small valley and are bounded by the Balmacewen Golf Links at the top and a small tributory of Ross Creek at the bottom. Altogether there were six territories — RA, RB, RC, RD, RE, RF — covering approximately seven to eight acres on ground sloping very steeply to the north.

In 1965, at week-ends, I followed up the birds in RA territory only, and discovered that my six nest boxes there were not quite large enough.



Map 2 — Map of study area 1966-67 season showing territories and positions of nest boxes.



Map 3 — Map of study area 1967-68 season showing territories and position of nest boxes.

In 1966-67 season I spread eleven larger boxes through territories RA, RB, RC, RD (Map 2). During the 1967-68 season I checked five territories RA, RC, RD, RE, RF) in which I had seventeen boxes (Map 3). As in the previous year, I visited these boxes on every day possible and spent as much time as I could at week-ends and during holidays in the five named Rifleman territories as well as other Rifleman territories outside the study area.

Being a school boy, I could visit nests only after school during the week. Also during each breeding season I spent several weeks away on Christmas holidays: in 1967-68 I was away between 8 December and 9 January; and in 1966-67 between 18 December and 3 January.

VEGETATION

The vegetation consists mainly of an upper canopy of Kanuka *(Leptospermum ericoides)* 40′ - 60′, a middle zone of Whiteywood *(Melicytus ramiflorus)*, and Lemonwood *(Pittosporum eugenioides)*. The lower zone contains young saplings, pepper trees *(Drimys axillaris)*, Red matipo *(Myrsine australis)*, and various Coprosmas. There is often a thick ground layer of the fern *Phymatodes diversifolium.*

In certain areas where the valley is steep, and wet with running creeks, there are areas of Tree Fuchsia *(Fuchsia excorticata)*, in addition to the shrubs and trees already mentioned. These, as I will explain later, are excluded from the study area.

The vegetation in each study area varies a little, and I will proceed now to deal with each in turn.

RA Territory — This supports a complete top canopy of Kanuka, and reasonably thick middle and lower zones of Whiteywood and Red matipo while the ' floor ' is composed of a continuous carpet of fern. This appears to be the ideal territory for Rifleman.

RB Territory — This consists mostly of Tree Fuchsia. For some reason the Riflemen seem to avoid this species of tree.. It may be that the trunks are too smooth for them to grasp and the old bark too frail for them to gain a foothold. In this territory Riflemen did not use the nesting boxes. Moreover, they built only two natural nests, neither of which was successful.

RC Territory — This can be divided into three areas according to its vegetation. The bottom western area consists of a canopy of Kanuka and very dense, damp middle to lower layers and floor zone. On the other hand, the top eastern corner contains practically no ground cover, lower or middle layers. The central zone, like the RA territory, consists of reasonably thick middle and lower layers and floor zone. The Riflemen seemed to favour this central area and to a lesser extent the top area. However, they were only very occasionally seen in the bottom area.

RD, RE, RF Territories — These are almost identical. They consist of a top canopy of Kanuka, a good fern layer and rather patchy middle and lower layers of Red matipo and Whiteywood. This vegetation coverage does not seem to be as suitable as that in the RA territory.

NATURAL NESTS

Unfortunately, I have not been able to look into natural nests Riflemen are in the process of constructing. However, from an examination of the contents of a nest after it had been used, it appears that these nests are constructed in the same way as box nests. The birds may build an extremely large mat, or they may build none at all. It seems that when the floor is too low or uneven, the pair will build it up until it is reasonably flat and then construct the nest on top of this in the same way as in the box nests.

An interesting example of this mat building was when a pair constructed a nest in a hollow fence post. This had a 9" high ridge where the pair decided to build (Fig. 2). The Riflemen stuffed material on either side of this until they had a flat mat some 9½" high in places on which they constructed their nest.

The natural nests in the study area are always located near the ground. This is presumably because the Kanuka and Broadleaf trees are young and the nesting cavities are only large enough at the base of the trees.

The sites where natural nests have been found in the study area and adjoining bush are:—

2 in fence posts
1 in the ground
1 in a Kanuka tree
2 in dead branches on the ground
4 in holes in Broadleaf trees
2 under the eave of a shed (walls of brick, roof of iron).

The ' ground-nest ' was not seen while it was being constructed. When subsequently it was extracted from the cavity, it was obvious the birds had enlarged an area under a large boulder by scraping away the earth with their feet.

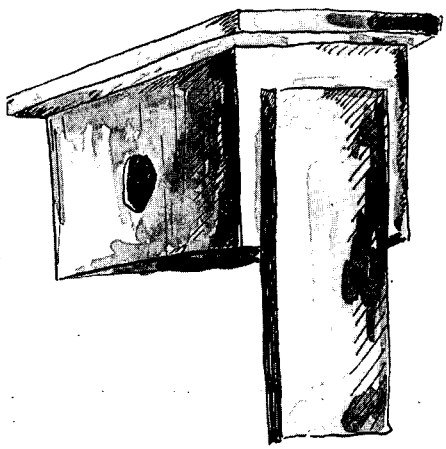


Fig. 1 — External view of nest box.

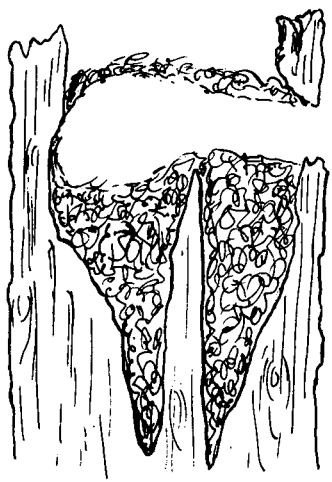


Fig. 2 — Cross section of natural nest (RI1) showing 9½" high mat.

NEST BOXES

The nest boxes are of rectangular shape, with a sloping roof and removable back, made from *Pinus radiata* timber half an inch thick (see Fig. 1).

The most suitable sizes seem to be: width 4.5", length 5.0", height 5.5" at the top end, and 5.0" at the other, so that the roof would slope away from the tree. The entrance hole is 1.5" high by 1.0" wide.

Boxes are stained a very light walnut to match the surrounding trees and to camouflage them from passers-by. A satin varnish is next applied to the boxes to protect them against the weather.

The boxes are nailed on trees about 5.5' from the ground in an area which I think will suit the Riflemen. The necessary conditions seem to be:

(a) Out of sight of passers-by
(b) Below a thick upper canopy
(c) Where the middle and lower layers contain moderately thick Whiteywood, Lemonwood and Red matipo
(d) Where a dense ground layer of fern is present.

In the 1967 season only two boxes out of eighteen in the study area had nothing placed in them by Riflemen.

Stage when nest abandoned	1965	1966	1967
Empty	5	5	2
Odd pieces of material	–	–	3
Mat	–	1	5
Complete nest	–	1	–
Laid Eggs	–	1	5
Hatched eggs	1	–	1
Chicks fledged	–	3	5
Total	6	11	21

Numbers of partial and complete nests

BOX NESTS

I have examined twenty-five completed and partially completed box nests used by pairs of Riflemen and found that these nests followed a common pattern of construction.

First of all a loose woven mat of fern rootlets and dead Kanuka twigs were placed on the floor of the box. Occasionally other material such as small dead leaves, lichen, moss, and bark were also found. The mat was built up to the entrance hole of the box which was cut about an inch above the floor. The mat sloped gently upwards to the back wall of the box where there was a shallow saucer-shaped depression about 1½" in diameter. Fern rootlets and then twigs were woven over the mat to form the tunnel.

The length of the tunnel, which varied widely between pairs, was partly determined by the dimensions of the box. The thickness

of material between the cavity and the back wall of the box varied from 2" to the thickness of one feather. The lengths of tunnels varied from 3" to a narrow but high lip projecting up across the opening of the box (see Fig. 3). Next twigs were placed up the sides of the back half of the box and woven into a strong dome.

It seems to depend on the pair of Riflemen whether the tunnel or the cavity is constructed first. In two nests the cavity was made first, and in one the tunnel. These nests were built by different pairs. The other nests were not seen at this stage of construction.

Once the tunnel and outer shell of the nesting cavity were completed leaf skeletons were tightly woven into the cavity to form a second shell. Finally after several days of rest, depending on the time of the nesting season, a thick lining of feathers was woven into the cavity. These were mainly contour feathers of Blackbird, Thrush and Wood Pigeon and a few flight feathers of small passerines.

Of the nests I analysed the following totals of material were gathered. (RH1 was from a nest box outside the study area and is included because it was an unusually large nest).

Box	Feathers	Twigs	Lichen	Grass	Moss	Leaf skeletons	Fern root	Wood chips	Pine-needles	Approx. total
RC2	300	160	0	75	9	64	84	4	4	700
RC3	450	40	0	7	1	350	50	0	0	900
RF2	90	50	0	0	1	400	60	0	0	600
RH1	360	250	0	80	6	600	0	0	40	1300
RA2 Mat	0	20	1	3	2	12	40	0	0	80
RA5 Mat	0	15	0	0	0	16	30	0	0	60
RA7 Mat	6	10	0	0	0	20	60	0	0	100

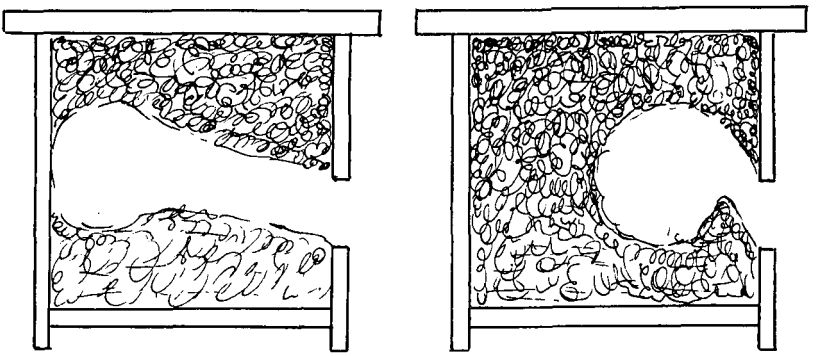
Totals of Material from selected nest boxes, 1967-1968 season

Most of the feathers were between 1.5" and 2.0" long with the exception of Wood Pigeon contour feathers, 3.5" - 4.0" long, and Blackbird primary feathers about 4.5" in length. Twigs ranged from 2.5" - 3.0" long, while leaf skeletons could be 2.0" - 5.0" in length. I have never seen Riflemen bring in more than one piece of material at a time.

Considering RA3 nest, this consisted of 700 pieces of material and was built in twenty-five days. Since both birds built the nest, each bird made approximately 350 trips. The average number of trips per day does not mean much because there were certain days when it appeared that no material was brought, whereas on other days large quantities were added to the nest.

Fig. 3 — Vertical sections of box nests:—

A — RE1 with 3" tunnel B — RD1 with high lip only.



A notable fact was that when the weather was wet for a day or two, a pair would speed up their rate of building. This was particularly noticeable at the stage when a pair was building the tunnel and cavity. For example, in the 1967 season we had three days of drizzle and cold weather. Because the birds had been building very slowly and little change could be expected I did not go down to the bush. When I did go down, I was amazed at the progress. Two nests which had been only ' mats ' three days previously were now complete except for the lining of feathers. Another nesting box which had been empty four days before, now contained a complete nest, except for the feathers (this was RA6). Also in the RA territory, the RA pair besides making a nest had built a ' mat ' in another box about twenty yards away and had placed a couple of pieces of rootlet in another box: all this during three days of wet weather and one day of fine weather.

For some reason Riflemen build a number of incomplete nests: why this is so, and just how many nests they start to build I do not know. In the 1967 - 1968 season, seven boxes were put up in RA territory and all had nests started in them.

(a) *Two* were completed nests, and in them the adults raised chicks;

(b) *Three* had a ' mat ' built up to the entrance;

(c) *One* had a few pieces of rootlet on the floor;

(d) *One* had a mound of rootlets and twigs just inside the entrance.

A solitary male was seen on several occasions near three boxes close to the border of the RA territory, and so it was possible that this bird built three of these incomplete nests. (See above table: nest d, and two of nests b.) It is also interesting to note what happened when one of the ' mats ' was taken from a box. I did this experimentally to see what would happen and one month later RA pair built another mat in the same box.

Totals for nests in the other territories (RC, RD, RE, RF) 1967 - 68.

3 were complete nests, and the Riflemen raised chicks.

5 were complete nests but the Riflemen did not raise chicks in them. (2 pairs left because of disturbance by humans — the other 3 left for some unknown reason.)

2 boxes had only a mat. (In one box the mat was made a second time.)

2 boxes were empty.

The pair in territory RC built a mat in one box then deserted. They then constructed a complete nest in another box and raised chicks. After the chicks had fledged they returned to the first box with the mat in it, and completed the nest. They laid four eggs, but after incubating for two days, abandoned the nest. They then constructed a natural nest.

Much the same procedure had taken place the previous year (1966-67) in the same territory. A pair started a box-nest and had almost completed the outer shell of material. This they deserted and then built a 'half nest' in another box about 20 yds. away. Several days later they returned to the first box, completed the nest and raised chicks. By this time I had removed the 'half' nest and broken it up and scattered the pieces around the box to see if the birds would use the box again. The same Riflemen pair, after they had raised their first brood, did return to the box where they had constructed a 'half' nest and found it empty. So they picked up the nesting material I had scattered about the base of the tree, and with additional material, completed the nest. No sooner had they laid two eggs than they deserted it. Why they left and where they went I do not know. Perhaps the location did not quite suit their needs.

In the 1967-68 season the pair in RD territory built a nest in a box and laid three eggs; but due to interference by animals or humans they abandoned the nest after a week of incubation. I removed the contents of the box — eggs and material. Fourteen days later a fresh 'mat' had been constructed but the pair did not complete the nest.

In the same season the pair in RE territory after building a mat in one box, left and built a complete nest in another box There they laid four eggs, which they incubated for two days before deserting it. I removed the nest and eighteen days later found another completed nest in the box. The pair then laid four eggs and hatched chicks.

EGG LAYING

When the nest is finished the eggs are laid. The eggs are not always laid immediately. At the beginning of the breeding season the birds may leave the nest for over three weeks before the first egg is laid; whereas in second brood nests there may be an interval of only two days.

An interval of about 48 hours elapses between laying of each egg. Then once the last egg is laid, usually the fourth, the pair immediately begin incubating. But they do not seem to settle down

very well on the first day of incubation. For example, at RC2 nest (1967-68) after the last egg had been laid I approached the nest at 7.15 a.m. and saw one of the parents fly out. This bird joined its mate and they flew off to feed. Twenty minutes elapsed before the female returned to the nest. She had incubated for five minutes before the male flew down to the nest and called, whereupon the female flew out and both birds went off feeding again. The next day they seemed to be incubating in a more composed and regular manner, one bird incubating while the other fed.

Twenty-one days after the last egg had been laid, the eggs hatch, generally all within twenty-four hours. It appears they all hatch within a few hours of one another, certainly between 5 p.m. and 7 a.m.

I will now describe a number of unusual egg laying cycles of pairs of Riflemen. RF1: The second egg was laid three days after the first, and the third egg two days after the second; the fourth egg was laid two days after the third egg. The pair began incubating the day before the last egg was laid. This was a total of seven days between the laying of the first and last egg instead of the normal six days for a four-egg clutch.

In RD1 (1967-68) nest, the first egg of the second brood was laid on the first of October, the second egg was laid two days later; but the third, in this case the last egg, was not laid until four days after the second egg. Moreover, the pair began incubating when the third egg was laid, that is seven days after the first egg was laid.

Nest RA8 contained only two eggs in the second brood but when these were laid I do not know.

RI1, not in the study area, nested in a fence post and I found only two chicks and no eggs. From previous observations I know that if an egg does not hatch it is left unmolested in the nest.

CHICKS

The chick, when it hatches, is completely featherless. Its eyes are closed and its body is orange in colour. Over the first few days very little change in its appearance is apparent. It is not until four or five days after hatching that the black flecks of feather tracts appear over the body. By the tenth day the chicks have become very active, and their eyes begin to open. When taken from the nest the chicks utter loud squawks which bring both parents around calling furiously. The parents actually dive bombed me, hitting me forcefully with their wings. These attacks vary with different Riflemen pairs. When I was banding the RA6 chicks the adult male flew round and round my legs, frequently hitting them, while the female flew back and forward within inches of my back, calling furiously. When I took out one of the second brood of RF chicks, the female flew on to the branches of a nearby dead Kanuka and dive-bombed me. She returned to the branch and repeated the process several times.

The chick at ten days is covered with black papillae 1 - 2 mm. in length in certain parts of their body (see Plate III (1)). The feather tips appear from the papillae in the next couple of days. The first feathers to appear are on the rump and down the sides of the breast and flank.

As soon as the feather tips appear on the rump the chick's sex can be determined. The male has greenish coloured tips while the female has tips of a dusty ochre colouring. The chick is between twelve and fifteen days old at this stage. As the feathers gradually grow, the bill darkens from yellow to black; and the feet change from pink to a brownish black.

About the 24th or 25th day after hatching the chicks leave the nest. They usually depart in the early morning, for I have visited nests in the late evening and found the chicks in occupation, but by 7 a.m. next morning they have gone. After some difficult stalking the chicks can usually be detected. They are often difficult to find because as soon as the observer approaches the area the parents come around calling furiously and the chicks, huddled together, stop calling. It is almost impossible to detect several small balls of feathers sitting motionless on a branch 60′ up in a Kanuka tree or even higher in the Pine trees or Rimus found in the territories beyond the study area. By the end of the first day the chicks move around a little but usually stay huddled together. After three days they may be scattered about in several trees with one parent feeding them.

The behaviour of parents while their chicks are still in the nest and in the fledgling stage needs more observation; but from my notes it seems that when the chicks hatch both parents attend the young. As the nestlings progress, however, the male appears less frequently around the nest until in the last few days he may only be seen around the nest at odd times. During this time he is away feeding by himself. If the nest is interfered with and the female is calling furiously at the observer, the male may not appear for five minutes or so. Even then he does not become as agitated as the female. This was particularly noticeable with the male from RF2 nest.

The male from the RA8 nest, however, was not as indifferent as this; but even he seemed to visit the nest less frequently than did the female during the latter part of the nesting period.

Since the male takes over the feeding of the fledglings, I presume he takes a smaller share in the building and incubating of the second nest than of the first, but I have not been able to show this conclusively.

Once the chicks have left the nest the male assumes the greater portion of the chick feeding duties while the female feeds by herself. For the first few days while the chicks are learning to adapt themselves to the new environment I have seen only the male feeding the chicks. But here again my time for watching a Riflemen family at this stage of breeding has been limited. These observations were not systematic, as I could visit the study area only between 4.30 p.m. and 5.30 p.m. on week days.

At this stage I should comment on the supposedly first brood of chicks which reappear around the nests of second broods. For example, pair RF1 raised their first brood of four chicks, each of which was banded with an aluminium and an orange colour band. At the second nest (RF2) an orange-banded juvenile was observed

first on 31 January, 1968. (The nest was found on 9 January with three eggs in it). However, the juvenile could have been around for some time before I noticed it. It was seen on almost every visit after that but never in or close to the nest, except when joining the parents to call at an observer. The juvenile fed with the male until the chicks of the second brood left the nest. After that the ' first brood ' juvenile accompanied the female, while the male tended the ' second brood ' fledglings. The orange-banded juvenile was never found feeding the chicks, nor did it appear to be attacked by the parents. At this stage two other broods had orange bands but they were several territories away and though it is possible I think it unlikely that the juvenile was any of these birds.

ENEMIES

I have gained the impression that Riflemen and their nests suffer very little from predation. This I think is due firstly to the impregnability of the nesting sites in cavities of tree trunks; and secondly, Riflemen themselves are seen on the ground only very occasionally, usually when they are collecting nesting material. On several occasions, however, I have seen instances of other species of birds attacking Rifleman. I have seen a male Tomtit attack a Rifleman fledgling which had been out of the nest for only a few hours. The Tomtit flew up behind the fledgling which was sitting on a branch and knocked it off. The Tomtit then chivvied the fledgling before it for a short distance. The Tomtit seemed to have hold of the short tail feathers as he did this. But since the incident occurred some 40' up in a tree, it was difficult to note details. While this bullying was going on the adult Riflemen hopped around calling loudly and vibrating their wings.

I have also seen Tomtits chasing adult Riflemen on a number of occasions. I observed, on the other hand, a pair of Riflemen calling at a Tomtit which perched several yards from their nest. They continued to call angrily until the Tomtit moved away.

Brown Creepers also chase Riflemen in much the same way as the Tomtit, but because Brown Creepers prefer the top canopy Riflemen are rarely bothered by them, at least about the nests in my study area.

DISCUSSION

The use of nest boxes in the study area may have affected some of the results obtained. Productivity in terms of eggs laid and of fledglings raised may have been increased or decreased. In the 1967-68 season a total of 33 eggs were laid by five pairs of birds; and 15 chicks fledged out of 19 hatched. The proportion of successful clutches to unsuccessful clutches was 1:1, five nests fledging chicks, four being lost at the egg stage and one by vandalism at the chick stage. The comparative losses between the egg and nestling stages could well have been affected by the nests being in boxes. The dry, secure cavity offered by a box should have increased productivity generally; but the almost neurotic building of partial nests e.g. RA pair in 1967-68, suggests that site selection behaviour may have been affected, even over stimulated. Also there is no doubt that a nest box is more conspicuous than the natural cavities that Riflemen usually use, and this could well have been a factor in abandonment.

Table of Nes

Territory Code Nest No.	Nest Found	State of Nest	Approximate date nest completed	1st egg laid between	2nd egg laid between	3rd egg laid between	4th egg laid between
RA_1	23 Aug	¾" mat	18 Sept	22 Sept 1700 23 Sept 1620	23 Sept 1620 25 Sept 1645	26 Sept 1710 27 Sept 1635	29 Sept 1620 30 Sept 1710
RA_2	10 Nov	complete except for feathers	16 Nov	16 Nov 1700 18 Nov 1700	18 Nov 1700 19 Nov 1340	21 Nov 1720 22 Nov 1715	23 Nov 1630 24 Nov 1645
RC_1	23 Aug	1" mat	16 Sept	25 Sept 1715 26 Sept 1730	28 Sept 1715 29 Sept 1650	30 Sept 1730 1 Oct 1105	2 Oct 1345 3 Oct 1735
RC_2	26 Aug	½" mat	I removed this nest and same pair built their second nest in it.				
RC_3	11 Nov	complete except for feathers	14 Nov	21 Nov 1730 22 Nov 1725	26 Nov 1420 28 Nov 1645		
RD_1	23 Aug	¾" mat and sticks up the walls					

Table of Nes

Territory Code Nest No.	Nest Found	State of Nest	Approximate date nest completed	1st egg laid between	2nd egg laid between	3rd egg laid between	4th egg laid between
RA_1	19 Aug	3 pieces of fern rootlet					
RA_2	23 Aug	mat on floor					
RA_3	27 Aug	bits of fern-root					
RA_4	27 Aug	2 pieces of fernroot					
RA_5	27 Aug	thin mat					
RA_6	27 Aug	completed except for feathers		2 Oct 1620 3 Oct 1630	4 Oct 1645 5 Oct 1630	6 Oct 1625 7 Oct 1145	8 Oct 1320 9 Oct 1710
RA_7	2 Nov	fernroot					
RA_8	29 Nov	complete except for feathers	30 Nov 5 Dec	30 Nov 1615 5 Dec 1630	5 Dec 1630 7 Dec 1415		
RC_1	21 Aug	floor covered with twigs and grass					
RC_2	22 Aug	some rootlets and twigs just inside entrance	17 Sept	24 Sept 0830 25 Sept 1630	26 Sept 1630 27 Sept 0700	28 Sept 1645 29 Sept 0730	30 Sept 1115 1 Oct 0715
RC_3	9 Nov	partly lined with feathers	12 Nov	11 Nov 1615 13 Nov 1620	14 Nov 1635 15 Nov 1630	16 Nov 1640 18 Nov 1435	18 Nov 1435 19 Nov 1500
RD_1	27 Aug	few small twigs on floor of box		30 Sept 1000 1 Oct 0730	2 Oct 1630 3 Oct 1645	6 Oct 1630 7 Oct 1145	
RE_1	17 Aug	few rootlets					
RE_2	18 Aug	few rootlets stuffed in entrance	12 Sept	23 Sept 0800 24 Sept 0815			
RE_3	21 Aug	½" mat	20 Sept	29 Sept 0700 1 Oct 0715	1 Oct 0715 2 Oct 1645	3 Oct 1645 4 Oct 1650	5 Oct 1640 6 Oct 1625
RE_4	26 Oct	complete except for feather lining		26 Oct 1700 31 Oct 1645	1 Nov 1630 2 Nov 1615	3 Nov 1630 4 Nov 1215	5 Nov 1 6 Nov 1
RF_1	12 Oct	½" mat	18 Oct	20 Oct 1650 21 Oct 0930	23 Oct 1145 24 Oct 1645	25 Oct 1700 26 Oct 1640	27 Oct 28 Oct
RF_2	9 Jan	complete nest with 3 eggs					

Histories, 1966-67

Incubation known to be in progress	Chicks hatched between	No. chicks No. addled eggs	No. chicks fledged	Chicks left nest	Nest abandoned	State of nest
29 Sept	18 Oct 1635 19 Oct 1630	2 chicks 2 addled eggs	2	12 Nov 1930		
23 Nov	12 Dec 1000 13 Dec 1215	2 chicks 2 addled eggs	2			
3 Oct	22 Oct 0945 23 Oct 0720	4 chicks 0 addled eggs	4	disturbed flew out 14 Nov 1730		
					2 Sept	partial nest
					28 Nov	2 eggs in nest
					29 Aug	outer structure almost complete

Histories, 1967-68

Incubation known to be in progress	Chicks hatched between	No. chicks No. addled eggs	No. Chicks fledged	Chicks left nest between	Nest abandoned	State of nest
					23 Aug	mat and tunnel started
					23 Aug	mat only
					2 Nov	thick mat
					27 Aug	2 pieces fern-root
					27 Aug	thin mat
9 Oct	26 Oct 1635 29 Oct 0830	3 chicks 1 addled egg	3	20 Nov 0930 20 Nov 1300		
					2 Nov	1" mat
		2 chicks	2	24 Jan 1700 25 Jan 1030		
					22 Aug	few fern root-lets added
1 Oct	20 Oct 1630 21 Oct 0900	4 chicks	4	13 Nov 1620 14 Nov 1630		
19 Nov					19 Nov 1500 20 Nov 1335	4 eggs in nests
7 Oct					10 Oct 1700 12 Oct 1730	complete nest with 3 eggs
					28 Aug	¾" mat
					24 - 26 Sept	complete with one egg
6 Oct					7 Oct 1215 8 Oct 1415	4 eggs in nest
6 Nov	24 Nov 1630 25 Nov 1130; 4th egg by 1215 26 Nov.	4 chicks			5 Dec	4 chicks
27 Oct	15 Nov 1640 16 Nov 1630	4 chicks	4	still in on 7 Dec 1500		
	22 Jan 1645 25 Jan 1130	1 addled egg 2 chicks	2	14 Feb 1700 16 Feb 1645		

It seems highly improbable that incubation and nestling periods were affected by the use of nest boxes, though there is just a possibility that egg laying intervals were. The total absence of an interval of 24 hours, the usual passerine interval, does suggest that this interval is more than 24 hours and *probably* 48 - 72 hours in natural nests.

Logically the stage most affected by the use of nest boxes should have been the nest construction stage, especially the length of time taken to build the nest. However, judging by the natural nests found the amount of material normally collected must vary enormously. Also judging by the way in which building operations sped up during wet weather and ceased entirely on other occasions for no apparent reason, it seems likely that the period from the start of building to the laying of the first egg is only minimally affected by the size of the nest cavity. Consider the disparity between RC2 and RF1 in 1967-68. The RC2 nest was discovered with a few twigs on the floor on 22 August and the first egg was not laid until 24 September. The RF1 nest was discovered with a half-inch mat on 12 October and the first egg was laid by 20 October.

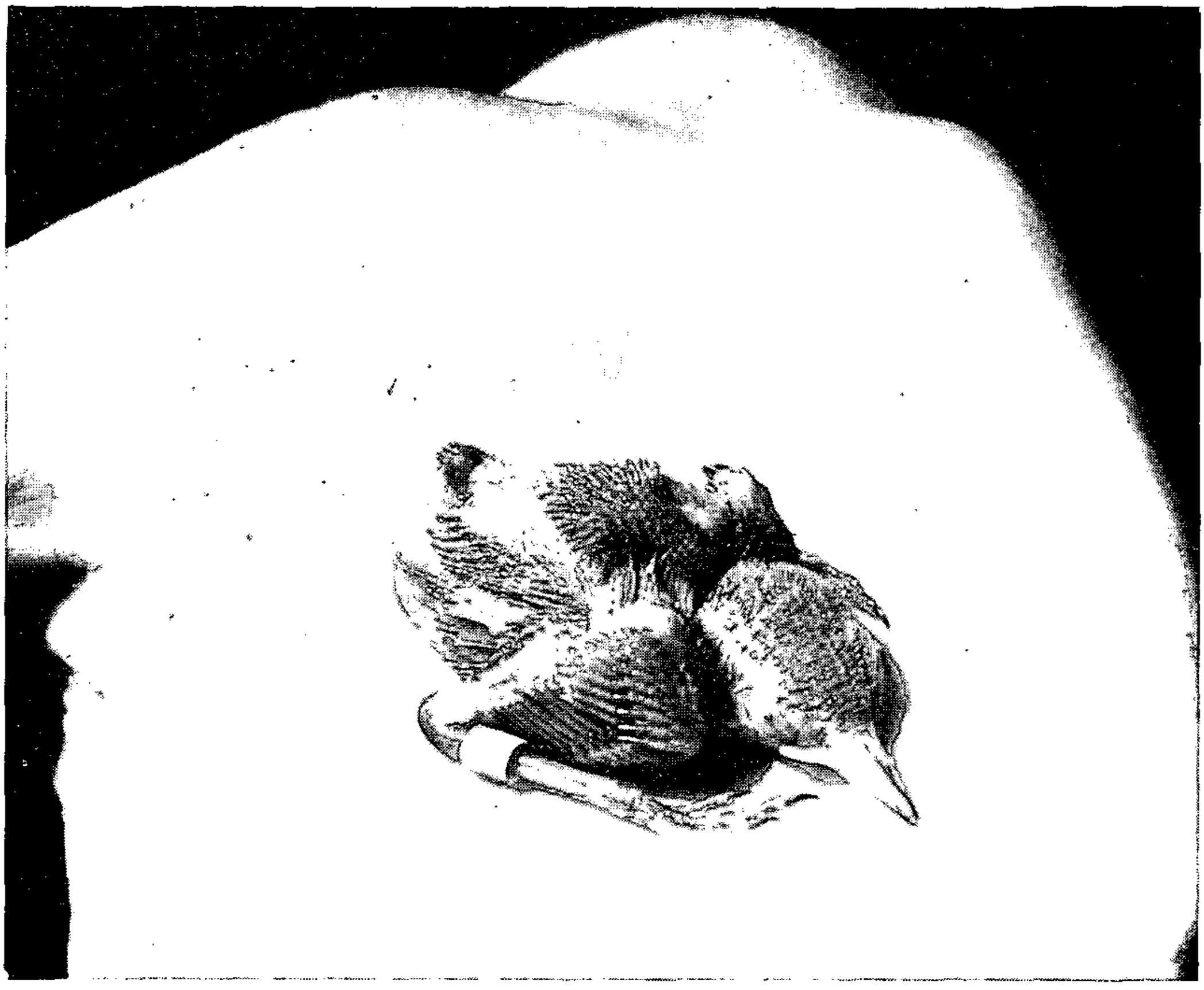
Code No.	*Clutch No.*	*Incubation Started*	*No. of Eggs*
RC2	1st	1 Oct.	4
RE3	1st	6 Oct.	4
RA1	1st	7 Oct.	3
RA6	1st	9 Oct.	4
RH1	1st	16 Oct. approx.	4
RF1	1st	27 Oct.	4
RE4	2nd	6 Nov.	4
RC3	2nd	19 Nov.	4
RA3	2nd	7 Dec. approx.	2
RH2	2nd	10 Dec. approx.	3
RI1	2nd	24 Dec. approx.	2
RF2	2nd	1 Jan. approx.	3

Table of Clutch Sizes in and around the study area, 1967-68

There is some indication from the small sample of nests so far obtained that clutch size is largest early in the season and declines towards the end. It is just possible that the nest boxes are in some way reducing the females' fertility for the second clutch, perhaps by a temperature affect. On the other hand the smaller clutches may be an adaptation to a smaller food supply later in the season after the first Spring flush of insect hatchings.

ACKNOWLEDGEMENTS

I wish to thank Mrs. J. B. Hamel for her advice and help throughout this study, in particular for her assistance in writing the discussion. I am grateful to Dr. R. F. Smith and Mr. R. Gledhill for help with the photographic work.



[R. F. Gledhill

Plate III (1) — Ten-day old chick of South Island Rifleman.

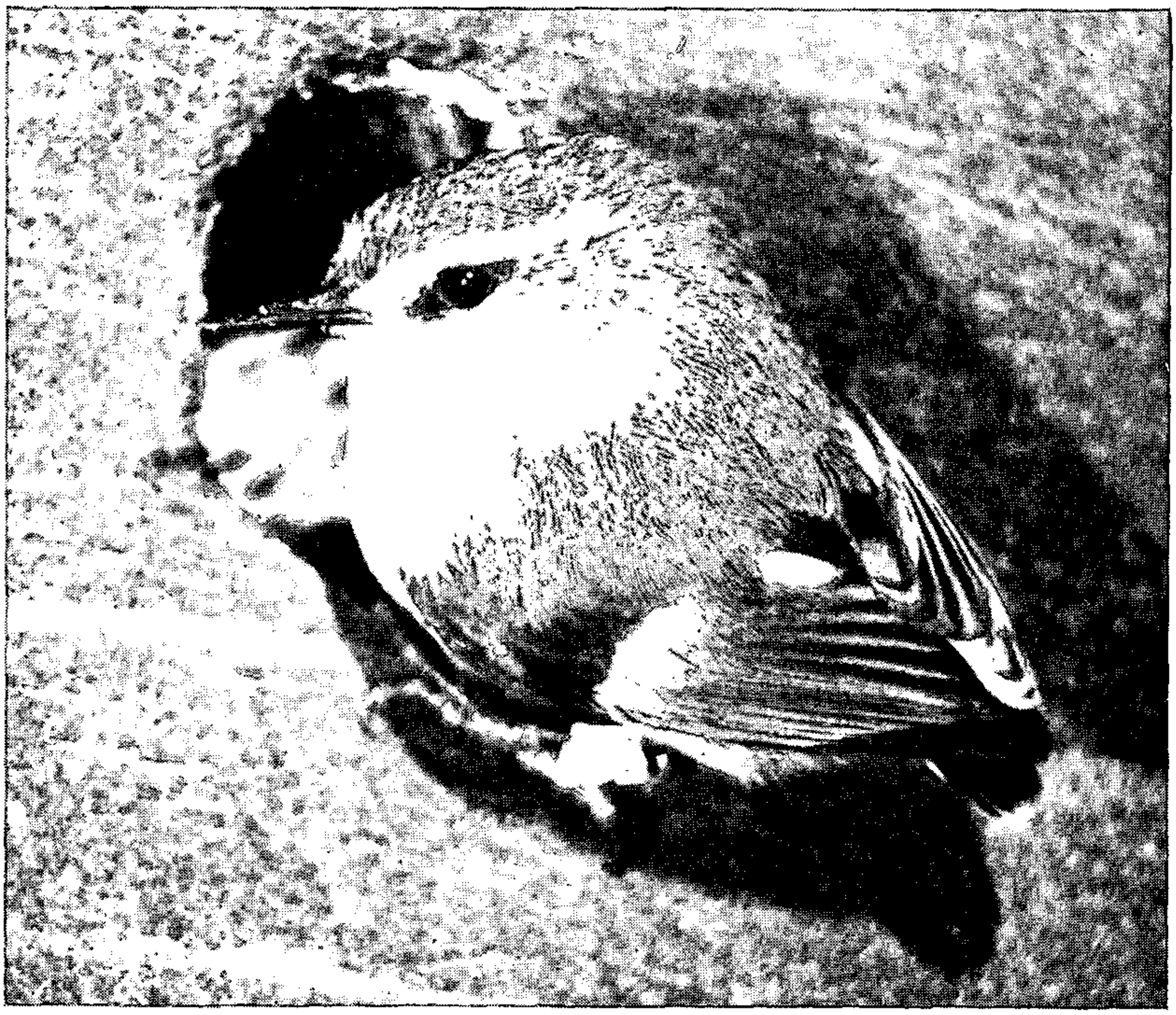


Plate IV (2) — Male Rifleman about to leave nest. [R. F. Gledhill

[R. F. Gledhill

Plate V (3) — Male Rifleman arriving with green caterpillar.

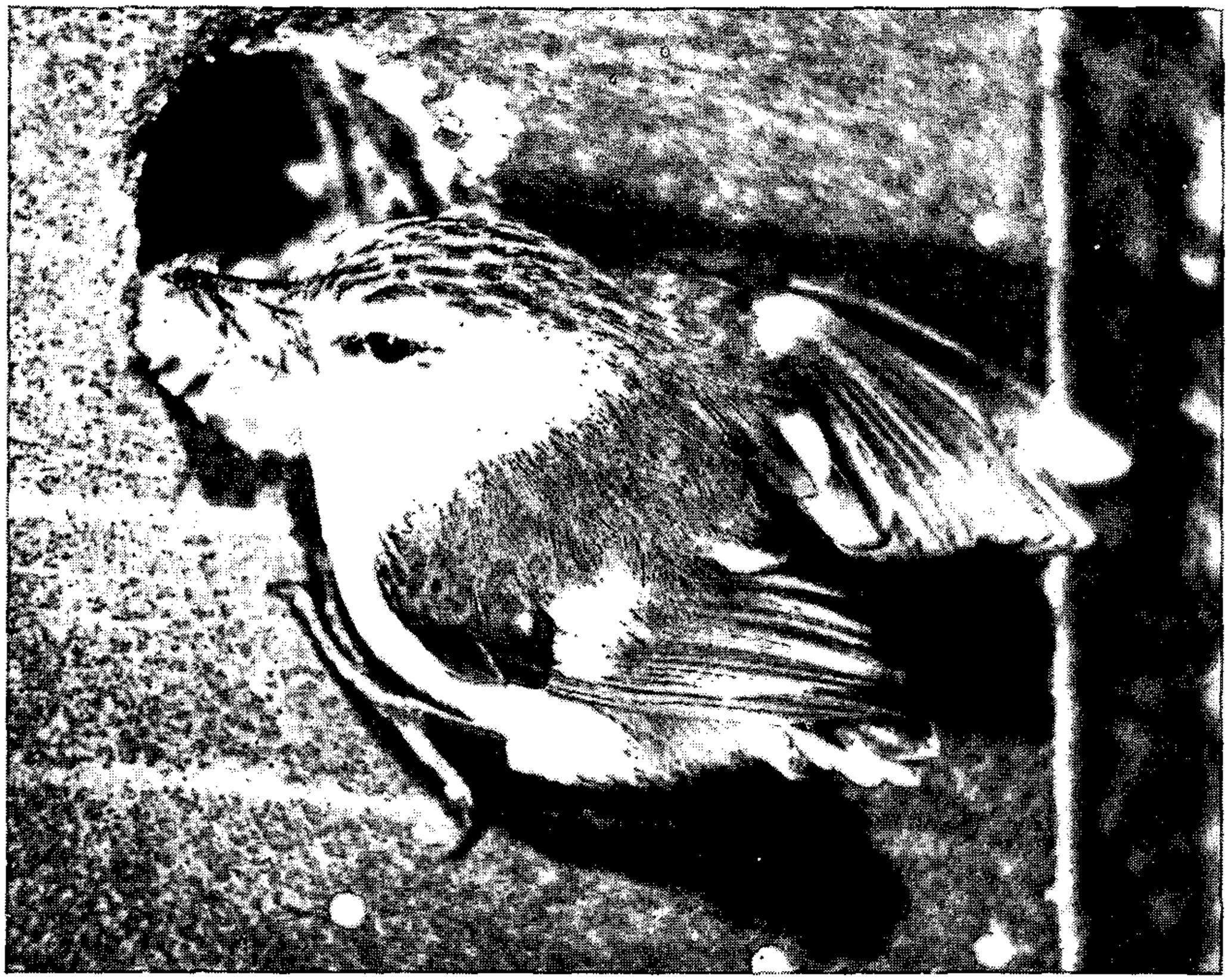


Plate VI (4) — Female Rifleman arriving with a small moth. [R. F. Gledhill

Plate VII (5) — Young female Rifleman being banded. [R. F. Gledhill

[R. F. Gledhill

Plate VIII (6) — Male Rifleman leaving nest with faecal sac.

COURTSHIP AND COPULATORY BEHAVIOUR OF THE NEW ZEALAND GREY DUCK

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The displays of most Anatini are well documented (Lorenz, 1953; von de Wall, 1963; Johnsgard, 1965) but detailed references to Australasian species are few. This paper describes displays associated with social courtship and pair-formation, and behaviour associated with copulation in the Grey Duck *(Anas superciliosa superciliosa)*. It is based on the observation of both wild and captive birds at the Mount Bruce Native Bird Reserve, Wairarapa, New Zealand.

DISPLAYS OF THE MALE

Head-flick — The simultaneous tossing and rotation of the head reveals the cream-coloured chin in contrast with the surrounding dark plumage. During social courtship, a male will perform several Head-flicks in rapid succession with an Introductory-shake or major display following the last of such a sequence. Head-flicking may occur on land or water.

Introductory-shake — This is a ritualized swim-shake (McKinney, 1965) differing from the comfort movement only in having an exaggerated preliminary tail-wag. The movement, which I have seen performed only on water and with the male usually positioned to one side of the female, involves a vigorous tail-wag, rapid paddling of the feet thereby raising the body out of the water, and the upward stretching of the neck and head. It occurs frequently among Head-flicks and like them indicates increasing sexual excitement. This display shows qualitative variation; the intensity of the Introductory-shake increases with increasing excitement and the drakes rear higher from the water until the threshold of a major display is reached and subsequently performed.

Lorenz (1958) has used the term " Head-flick " to include both Introductory-shake and Head-flick as here used. My observations indicate that a clear separation between the two displays exists, and in this respect I follow McKinney (1965).

Grunt-whistle — This has the lowest threshold of the three major displays and is performed with the male's body broadside to the female's. The bill is first dipped into the water, the head flicked toward the female, sending an arc of water droplets high in the air. As the bill returns to the water, chest and belly are raised high so that at the peak of body erection, the neck is stretched far forward and the head held low. A shrill whistle and deep grunt follows, the head straightens up and the body sinks back on to the water (Plate IX): A vigorous tail-wag and head-shake (occasionally head-flick) follows.

Head-up-tail-up (HUTU) — This major display has the effect of shortening and heightening the performer. The rump is first curved upward, the tail feathers directed vertically and the elbow simultaneously raised. The head, with chin almost touching the neck,

is then thrust backward and upward, the peak of head erection coinciding with that of the wing (Plate X). A muted " raeb " note is uttered and the head is abruptly turned toward the female. Rump and wings are then lowered, head remains upstretched and the body turns through 90° toward the female. The drake is now in the Turn-toward-female (TTF) posture. The head is next lowered and stretched forward and the drake shoots across the water Nod-swimming (NS), often describing an approximate semi-circle about the duck.

All three components of the display are rigidly linked, the full sequence of HUTU + TTF + NS being almost invariably followed. On two occasions (from a sample of 400 displays), the HUTU component was performed alone, followed immediately by a Down-up (see below).

This display provides a striking visual stimulus, the effect being derived chiefly from two sources:— The drake is always positioned broadside on to the duck and the raising of the elbow exposes the full extent of the metallic-green speculum. As the head is upthrust, the medial crown feathers are raised giving the head a rounded silhouette. This accentuates the black crown, which contrasts vividly with the cream face.

Grey Duck frequently show an abbreviated form of this display. The initial raising of wing and rump is omitted, the crown feathers alone are raised and more than one " raeb " note given. The male is always directed toward the female and this orientation and posture is typically that of the TTF component. This TTF is held longer than in the full display but the NS which follows has only a weak nodding component and the bird does not swim far.

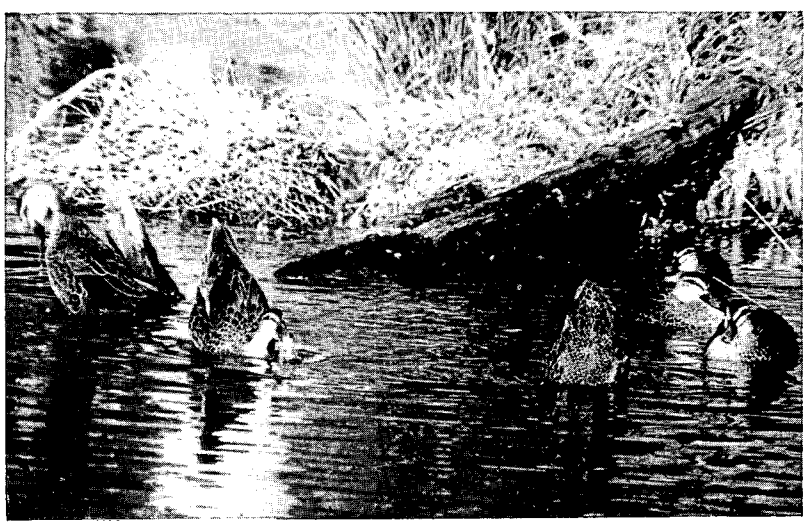

Plate IX — Social Courtship of Grey Duck. Simultaneous performance of Grunt-whistle (left) and Down-up (centre and right).

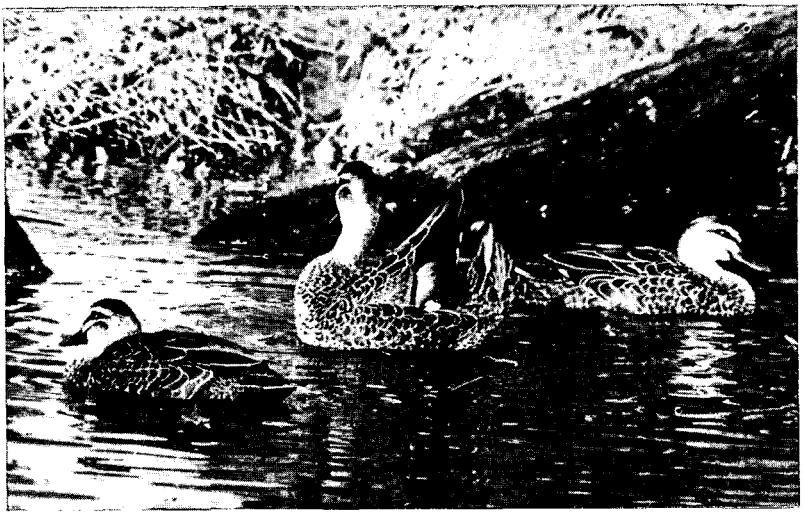

Plate X — Head up - tail up.

Down-up (DU) — The form of this display closely resembles the drinking movement which frequently follows the wing-flapping comfort movement. The chin is first lifted high, the head is then plunged downward until the bill makes contact with the water and at the same time the rear half of the body is lifted high (Plate IX). In the next movement, the head is flicked so as to lie horizontally and the neck upstretched — the result being that when the head is highest, the breast is deepest. So rapid is this upward head movement that a small fountain is raised. The body then resettles to the normal swimming pose.

The Down-up is the briefest and least gymnastic of the three major displays but has the highest threshold of stimulation, being usually performed only when two or more birds display simultaneously.

Nod-swim — Nod-swimming occurs as an independent display. During social courtship, drakes alongside the duck and facing the same way may suddenly swim directly away, moving the head rapidly backward and forward. This behaviour is not preceded by the adoption of any specific posture.

Johnsgard (1965) has referred to the " abbreviated HUTU " as an independent Nod-swim. I believe that a separation between the " abbreviated HUTU " and the Nod-swim not preceded by any specific posture does exist. The " abbreviated HUTU " has a typical TTF component and the bird must turn through 90 degrees before commencing the NS component. In the independent Nod-swim, specific body orientation also exists and the bird does not turn nor does it raise the head or call before displaying. Sequential analysis would confirm this separation.

Von de Wall (1963) described three types of Nod-swimming in the Mallard *(A. p. platyrhynchos)* and all are recognizable in the

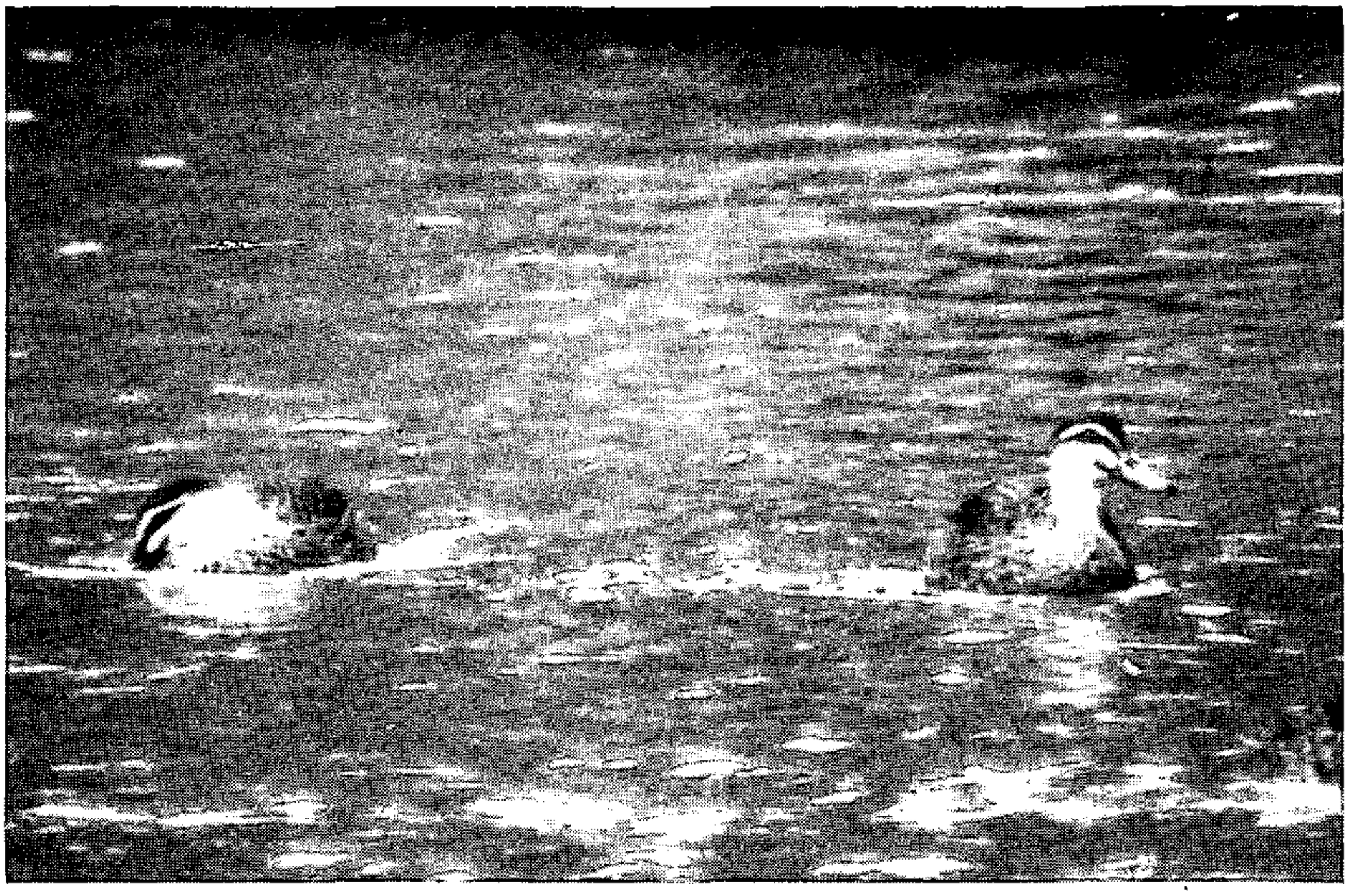

Plate XI — Male 'leading' in response to inciting female.

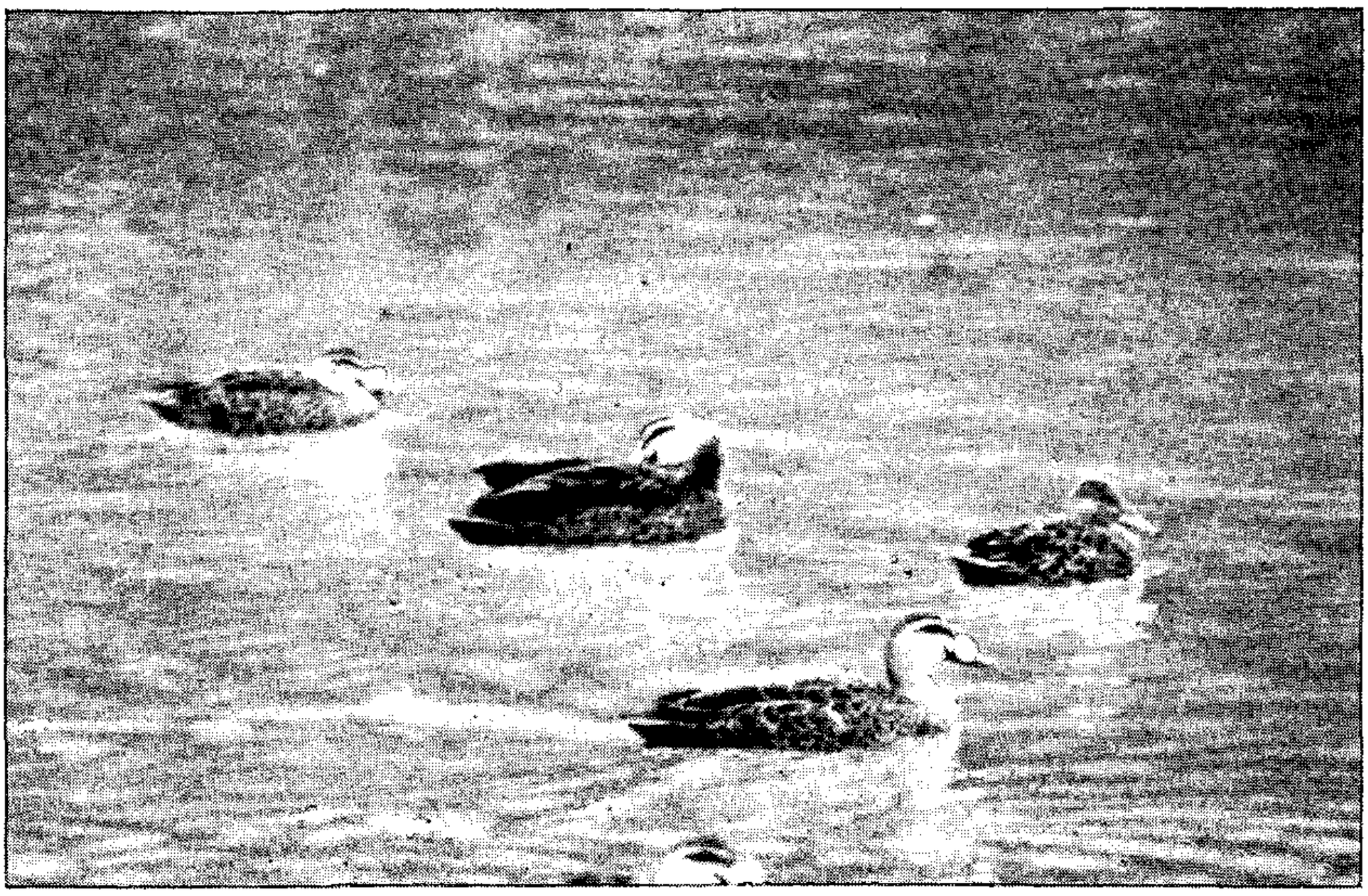

Plate XII — Male Preen - dorsal to female.

Grey, but restricted to specific displays. The first type, with weak nodding, is associated with the " abbreviated HUTU "; the second, with strong nodding is characteristic of the full HUTU + TTF + NS display and independent Nod-swim, while the third type, without nodding, but fast swimming typically follows the post-copulatory Bridle.

Turn-the-back-of-the-head (TTBOTH) — Often called "Leading," this display is the normal male response to female Inciting. The drake swims in front of the female holding his head erect and in such a position that the nape is directed toward her (Plate XI). It frequently follows the HUTU + TTF + NS display and the post-copulatory Nod-swim but may occur independently.

Preening — Two preening movements appear ritualized: Preen-dorsal (Plate XII) and Preen-behind-wing (Fig. 1). These are rarely observed during social courtship but occur frequently between members of an established pair. Such displays may serve to maintain or strengthen the pair-bond.

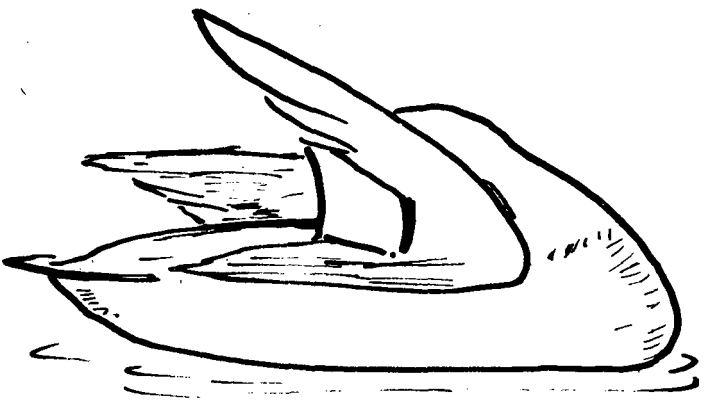

Fig. 1 — Preen-behind-wing

Drinking — Drinking is usually preceded or followed by some other display. The following associations were observed: preceded by Wing-flap (frequently), Down-up and Introductory-shake; followed by Preen-dorsal and Preen-behind-wing.

Drakes performing this display have their body broadside on to the female.

Wing-flap — This is frequently performed during social courtship. It is slower than the comfort movement and is always performed with the breast directed at the female (Plate XIII). On most occasions, Drinking follows.

Chin-lift — In the midst of social courtship, while other drakes are performing one of the major displays one or two drakes will lift the head and chin high. This movement appears identical to the initial movement of the Down-up and may be merely an incomplete expression of that display.

DISPLAYS OF THE FEMALE

Inciting — This is identical with Inciting in the Mallard, the duck swimming after her chosen drake and at the same time threatening others by movement of the head sideways and back over the shoulder. (Plate XI). The threatening is accompanied by a characteristic gabbering sound, each third syllable of which is stressed.

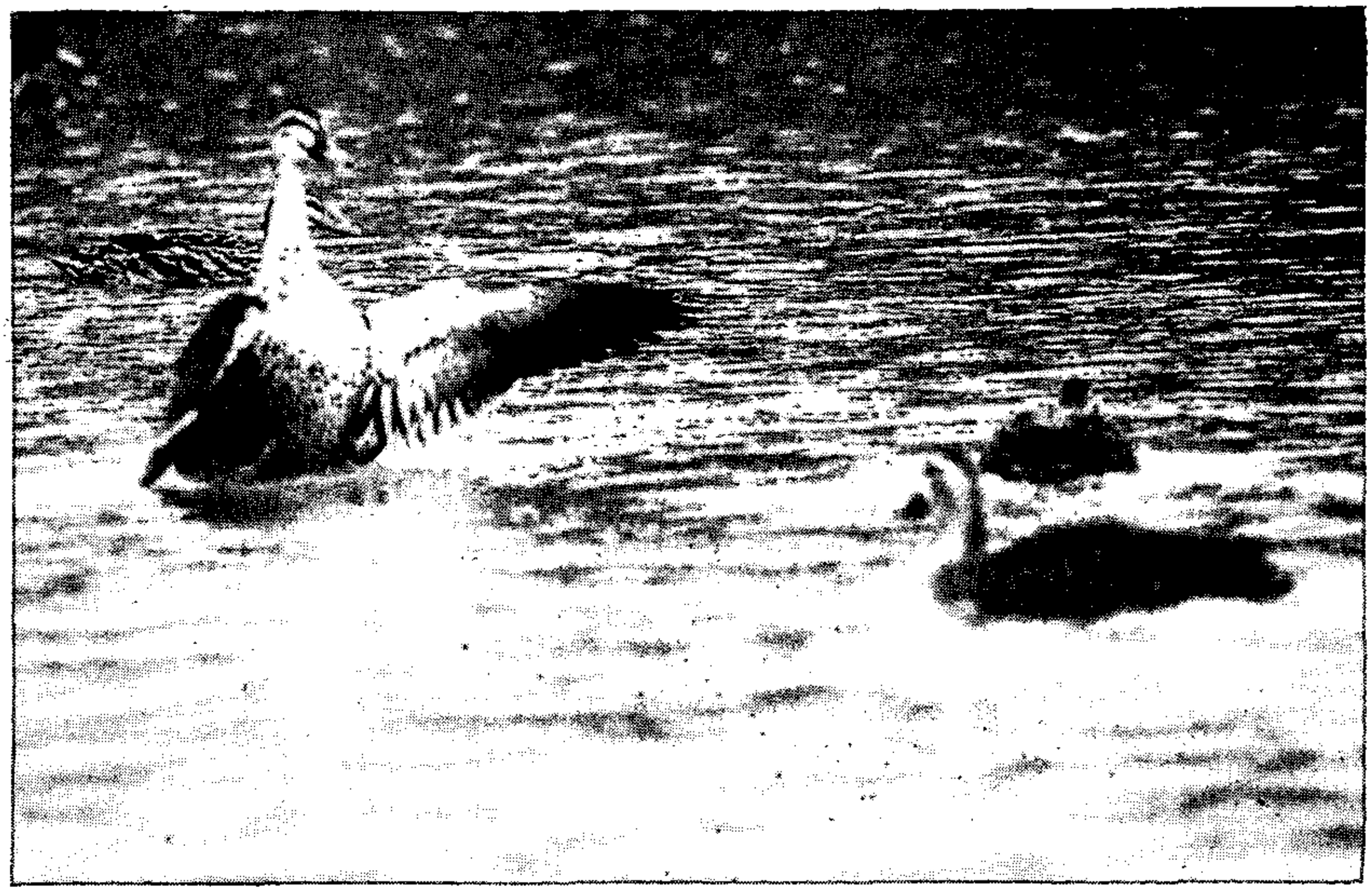

Plate XIII — Wing-flap.

Inciting may occur at almost any time, on both land and water. On water it frequently follows the male HUTU display. Male response to Inciting is the TTBOTH posture.

Nod-swim — This is an independent display identical in form with that of the drake. I have never observed a high-intensity (no nodding) Nod-swim by a duck. Female Nod-swimming during social courtship stimulates males to further display.

Preening — Two ritualized preening movements, Preen-dorsal and Preen-behind-wing, were observed. They were performed both during social courting and between members of a pair, particularly following copulation.

Decrescendo Call — This is a six-syllabled (sometimes more) call with the second syllable being the loudest and of highest frequency. On several occasions I have seen the drake swim back to the duck on hearing the call. Mutual Preen-behind-wing followed shortly after.

SOCIAL COURTSHIP

Courtship in the Grey Duck is "social"*, males gathering together in the presence of one or more females to perform the various sexual displays. Courting begins in late summer (February) after recovery from the brief post-nuptial and longer post-juvenile moults in adults and juveniles respectively. Such early social courtship groups, composed entirely of adults, persist only briefly and may form in the complete absence of females. Major displays are seldom recorded from such groups. When females are present, they may or may not

* Strictly defined, "social" refers to **two** or more. A more correct term for these courtship groups would be "communal." However, for the sake of standardization of terminology, social is used here.

show obvious signs of stimulation, possibly because some birds are still in the regeneration phase of their gonad cycle (Marshall, 1961) and are therefore physiologically incapable of sexual stimulation. By late March - April all females are actively displaying, social courtship groups become more frequent and more persistent, and major male displays more numerous.

Most male displays require the body to be specifically orientated to the female. Activity within social courtship groups is therefore incessant, males competing with each other for the few favourable positions. Fighting is frequent. Females for the most part remain hunched and motionless. Their display stimulates an increased frequency of display from adjacent drakes but also causes more fighting because of a shift in position.

Courtship groups exert a contagious effect on other males. The sight of a courtship group in action will even attract already paired drakes to the scene. (Weidmann, 1956, has reported similar behaviour in Mallards.) Sexual stimulation is in some way derived from the competitive situation when males gather together; for early in the season, males will gather in the complete absence of females and perform some of the low intensity displays, e.g., Head-flick, and Introductory-shake.

Males display either singly or simultaneously with others (Plate IX). Single displays usually involve Head-flicks, Introductory-shakes and Grunt-whistles; simultaneous display bouts usually include Down-ups, Head-up-tail-ups and often Grunt-whistles. Johnsgard (1960) has demonstrated the relationships of these major displays in Mallards and Black duck *(A. rubripes)* and an almost identical relationship exists for the Grey duck (Williams, unpublished).

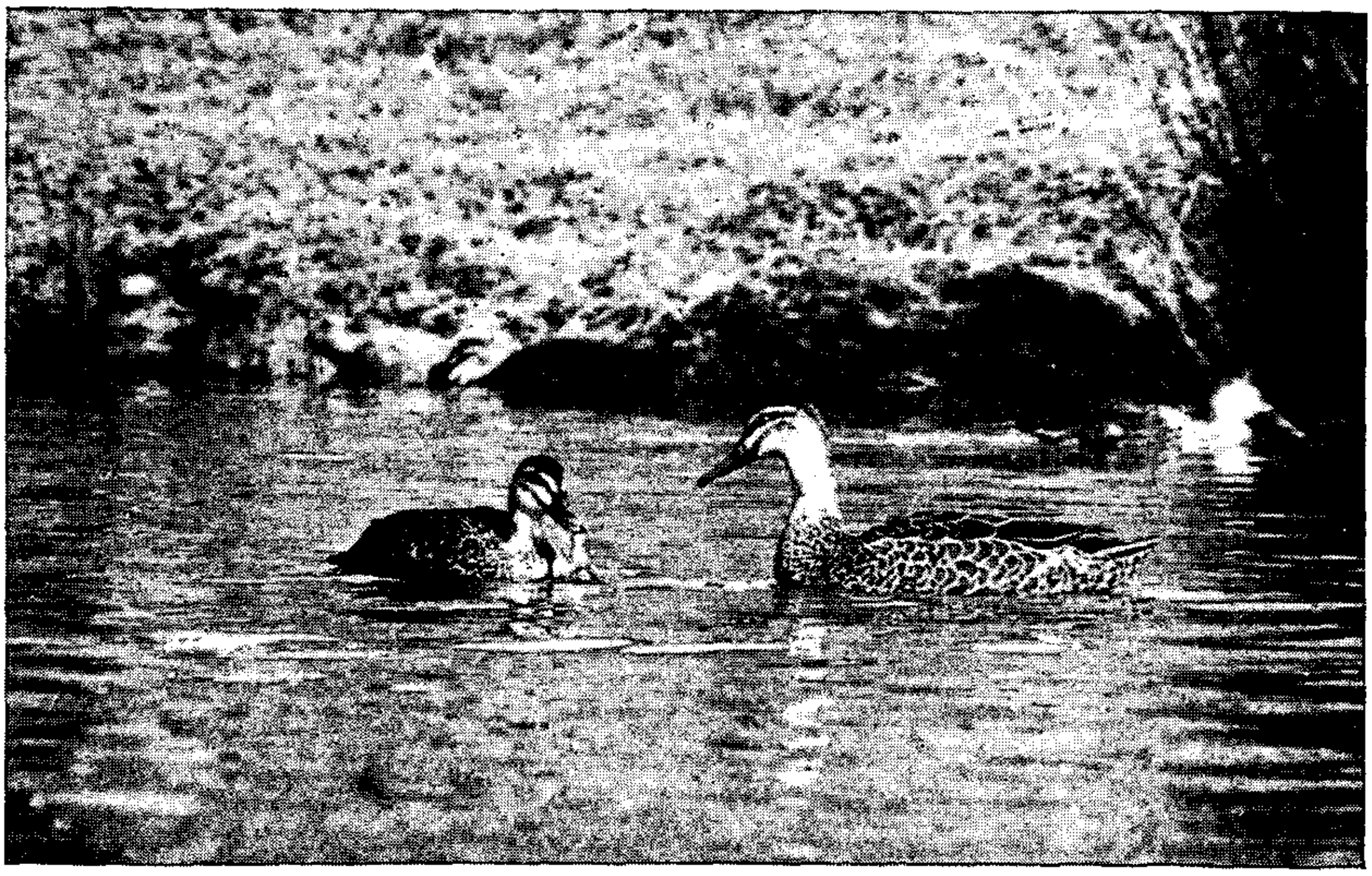

Plate XIV — Copulation I: Head-pumping. Drake on right.

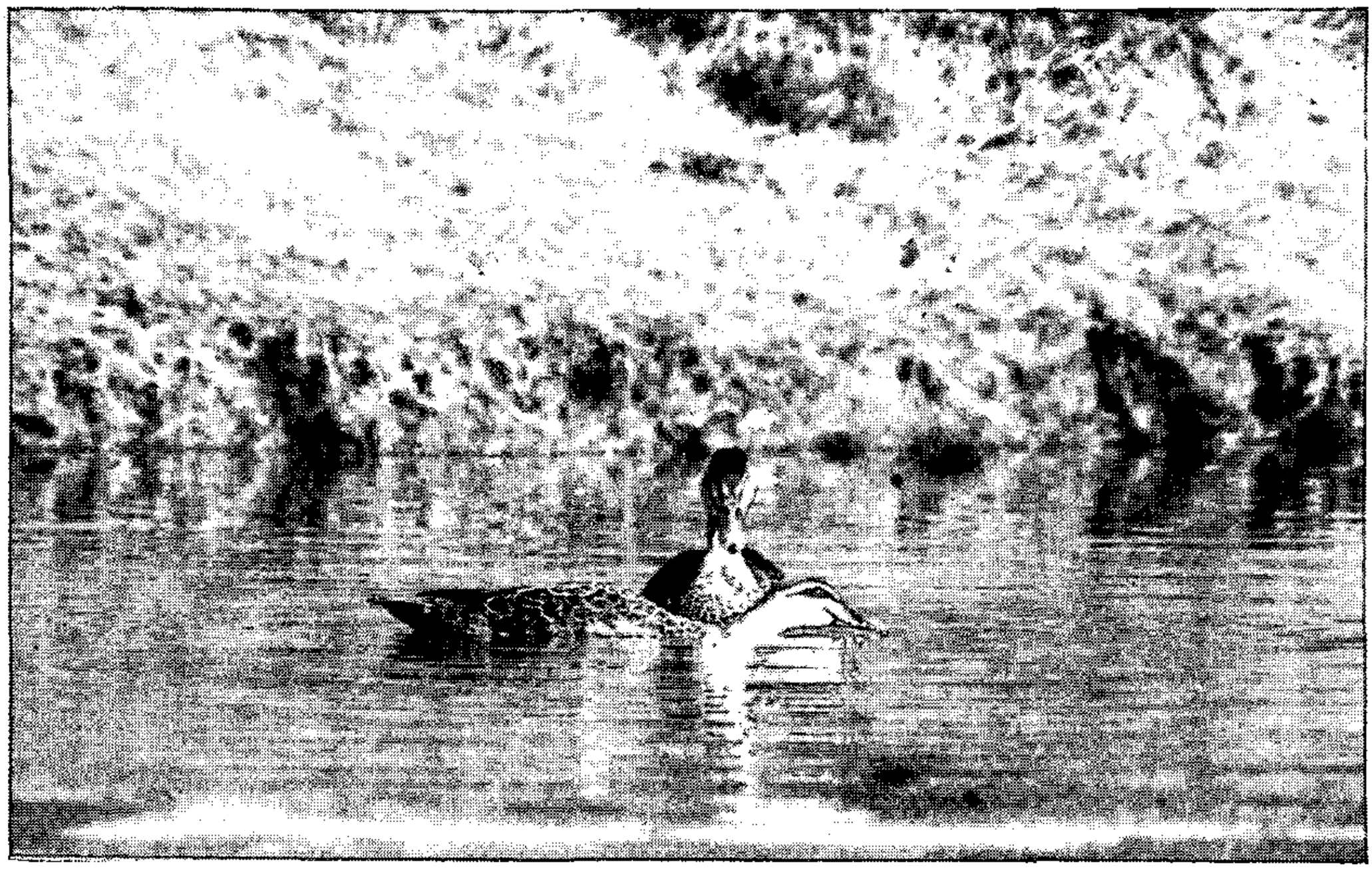

Plate XV — Copulation II: Female in prone position; drake about to mount.

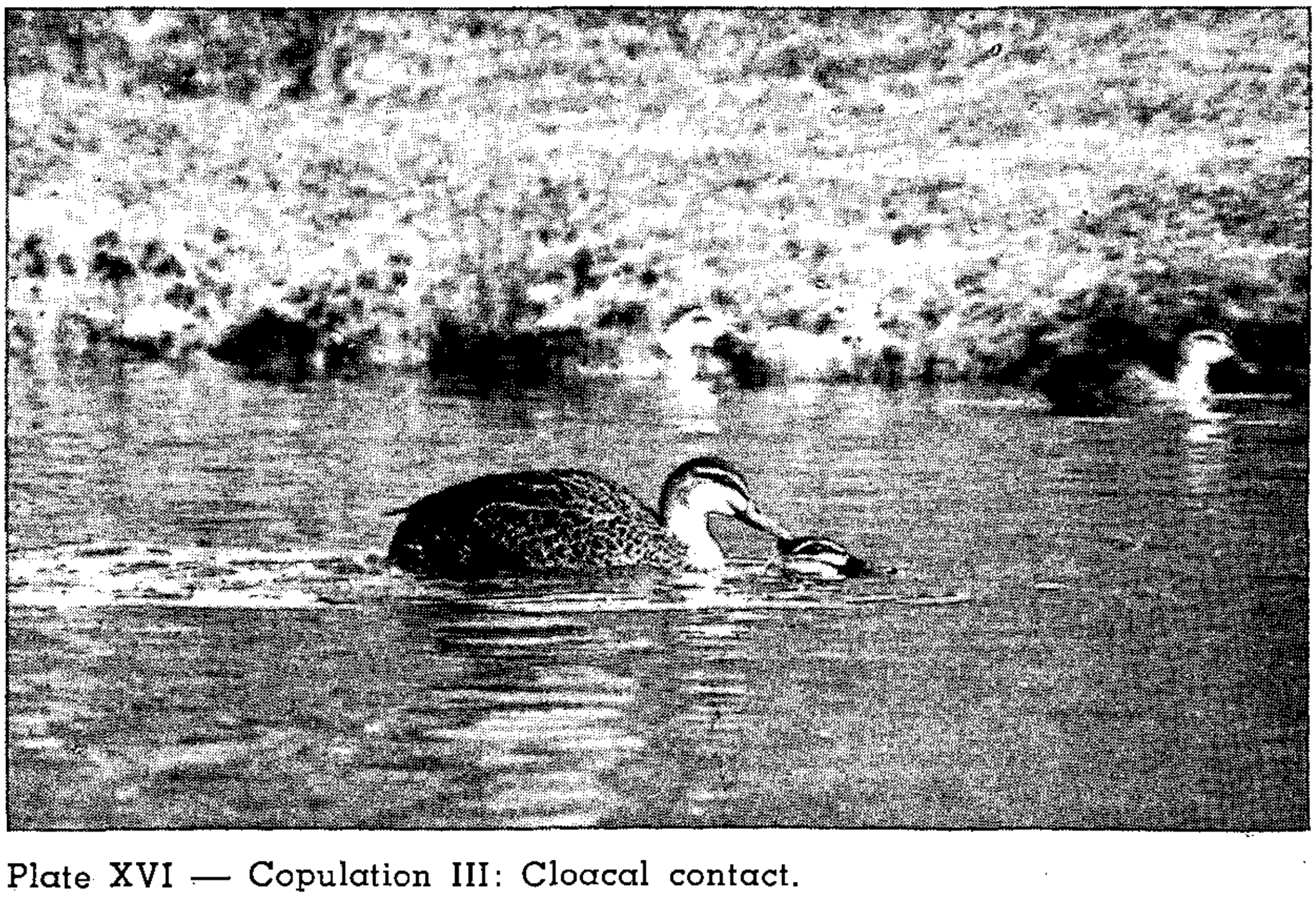

Plate XVI — Copulation III: Cloacal contact.

COPULATORY BEHAVIOUR

Copulation was observed to take place only on water. The pre-copulatory display of both sexes is Head-pumping (Plate XIV), the head being moved up and down with equal speed but with a short pause in the erect position. It is initially of equal intensity

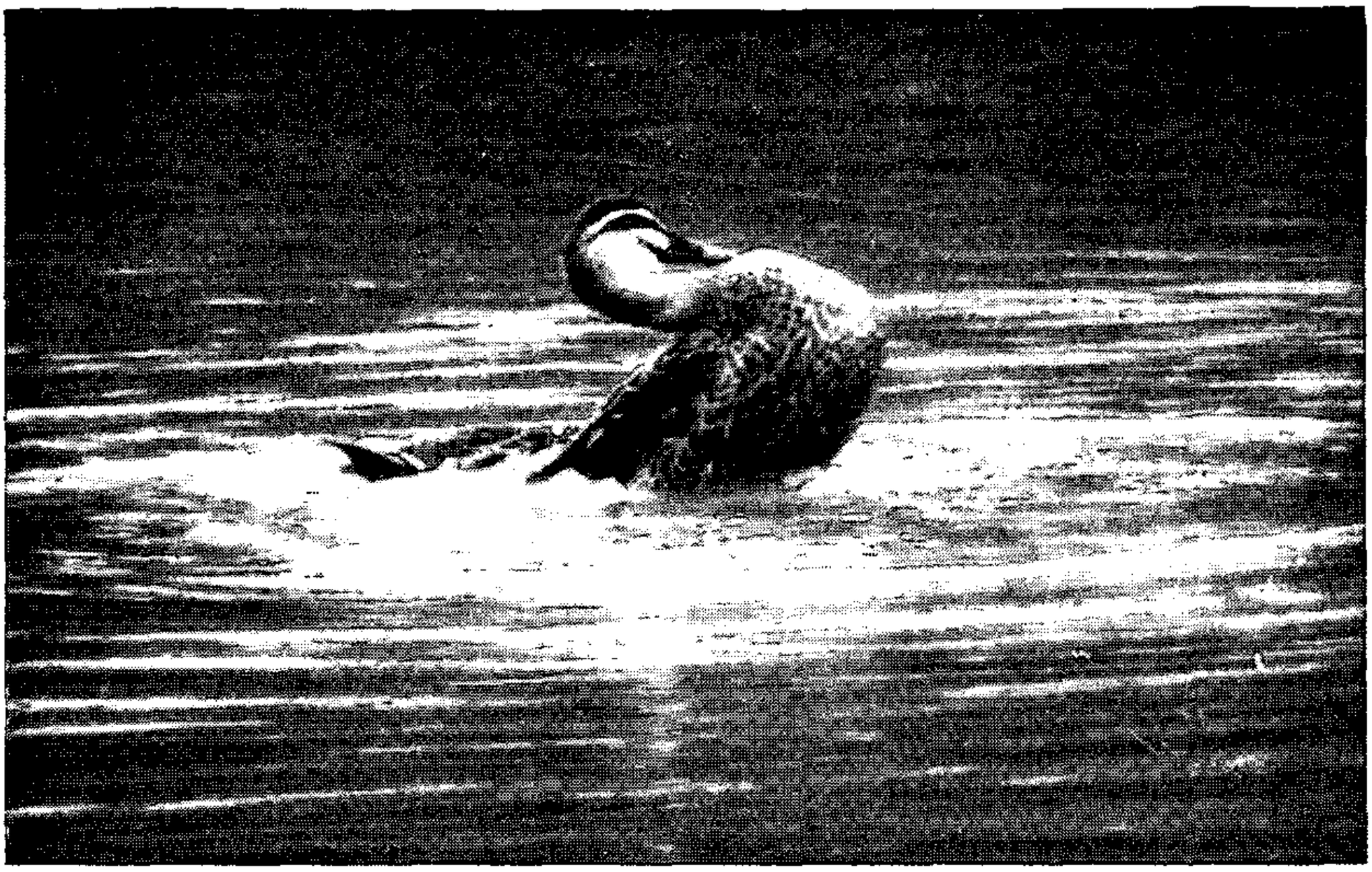

Plate XVII — Copulation IV: Post-copulatory Bridle by male.

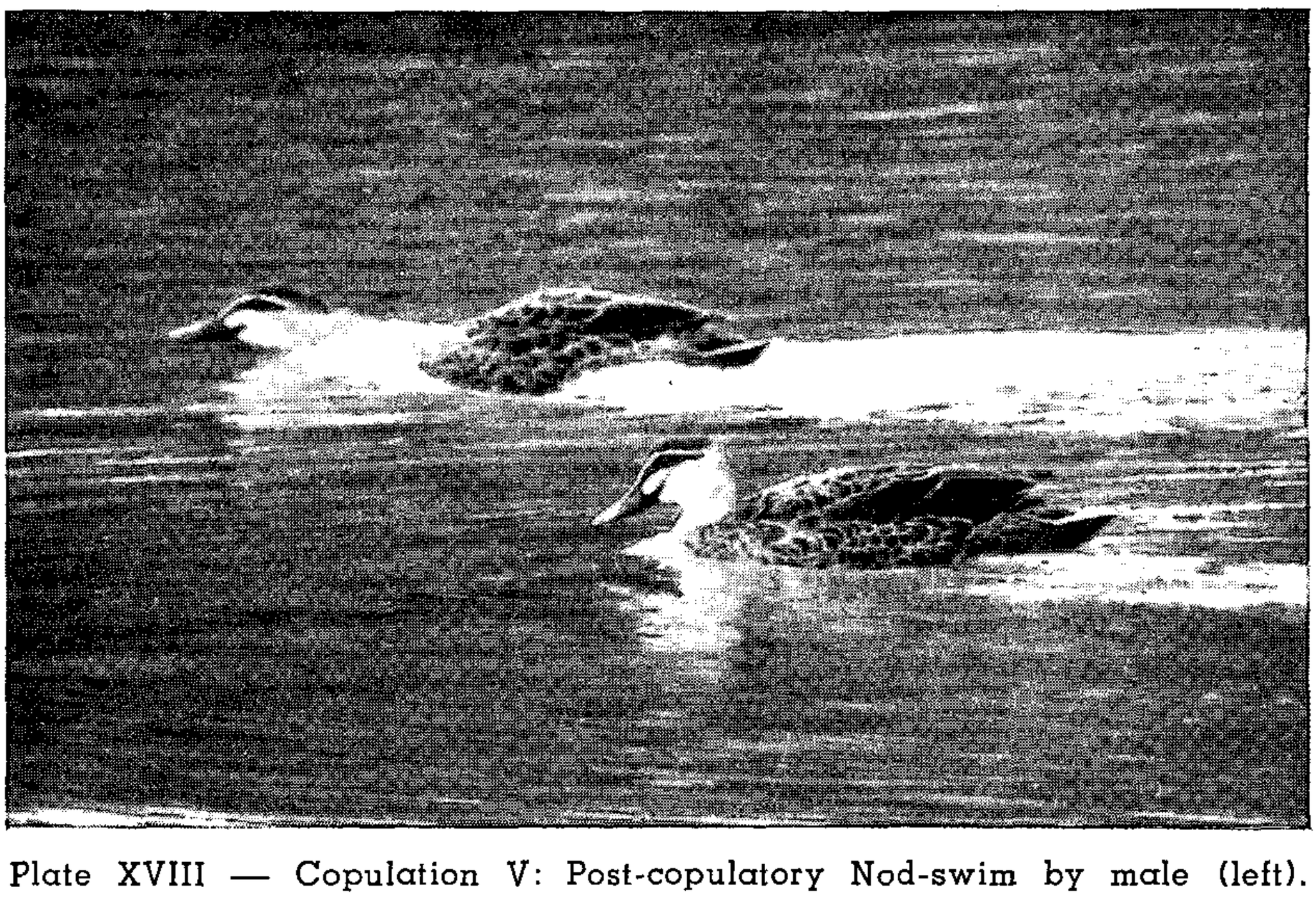

Plate XVIII — Copulation V: Post-copulatory Nod-swim by male (left).

in drake and duck but the female slows first, ceases the display and flattens herself into the Prone position (Plate XV). The drake mounts, usually from the side, and grasps the female's nape with his bill. Treading is characterized by a series of tail-wags of increasing exaggeration (this may assist extrusion of the penis), culminated by a sudden downward lunge at which time cloacal contact is presumably

made (Plate XVI). One such tail-wag-lunge sequence per copulation is normal although two or three sometimes occur. Dismounting, the male performs a strong Bridle (Plate XVII), a movement which involves the upward flinging of the chest well clear of the water. The Bridle is followed immediately by a high-intensity Nod-swim (lacking the nodding component) during which he swims in a broad semi-circle about the duck (Plate XVIII).

Female post-copulatory behaviour is variable but usually involves bathing (head-dip or somersault type — McKinney, 1965). Wetting of plumage during treading apparently provides the stimulus for this bathing.

Subsequent male behaviour is dependent on that of the female. Following the Nod-swim, the drake becomes erect in a typical TTF posture. The female may cease bathing and began Inciting. The drake then assumes the TTBOTH posture and Leads. Should the female persist in bathing, the male will also bathe, although with considerably less vigour. Mutual Preen-behind-wing displays frequently follow.

SUMMARY

The displays and copulatory behaviour of the New Zealand Grey Duck are briefly described. Courtship is "social," males gathering together in the presence of one or more females to perform the various sexual displays. Some displays (e.g., ritualized Preens) occur more frequently outside the social courtship groups, between members of a newly-established pair. Qualitative identity exists between displays shared by the Grey Duck and the Mallard.

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WHAT DO KEAS DIE OF?

By J. R. JACKSON

ABSTRACT

The evidence collected during a ten-year banding study of Keas is considered. It is concluded that starvation is the most important cause of death.

INTRODUCTION

An analysis of causes of death is basic to the understanding and conservation of any animal. This paper is a discussion of Kea mortality.

It would seem that starvation is the main cause of death; that all Keas have experience of disease and injury; and perhaps most Keas have eluded predators. Keas have a strict peck-order and social regulation of their numbers may be important. This regulation may result in starvation or illness of the doomed individual but seldom is the immediate cause of death. A bad season, as 1957-58 summer, can greatly reduce the number of Keas but again is not an immediate cause of death.

Where Keas and men meet, man directly and indirectly causes the death of many Keas. Man is certainly the most important predator.

KNOWN DEATHS OF BANDED KEAS

The cause of death of 74 banded Keas in the vicinity of Arthur's Pass is shown in Table 1.

TABLE 1

Cause	*Number of Deaths*	*Totals*
Shot	22	
Trapped and destroyed	7	
Drowned in water tanks	4	
Electrocuted	4	
Run over	4	
		41
Starvation	5	
" Scouring "	2	
Dislocated shoulder	1	
Destroyed because of injuries	2	
" Natural "	21	
Unknown	2	
		33
Total		74

The deaths of Keas in the first group are caused by man. Even some in the second group are suspect. In Westland and in National Parks the Kea is a protected bird and it is an offence to harm it. Elsewhere it is unprotected and many are quite legally destroyed on the sheep runs of the Southern Alps. If a Kea is shot where Keas are protected the culprit is hesitant to admit it. However,

many have been generous enough when they noticed that the Kea had been banded to report its death. Especially suspect is the category " run over."

Of two other Keas, which " scoured " and died, one had an empty gut and was a very light weight; and the second may have been poisoned. The Kea with a dislocated shoulder is listed separately for birds seldom dislocate a wing but rather break a bone. It is suspected that a muscular necrosis had set in, as described below, as in some Keas taken into captivity about the same time. The big group of natural deaths includes skeletons found hidden under tussocks and moraine boulders, away from human habitation and where the Kea presumably crept to die.

Two of the starving Keas, band numbers L1965 M. and L7110 M. died within one week of banding. They had been very light at banding, 0.74 K.g. on 8/5/60 and 0.66 K.g. on 21/5/66 respectively. Their slow reactions were noted. Each fed in a drum of rubbish, 5 yards away and hidden from other Keas. If a careful approach were made the bird would ignore the slight noise and the flushing of other Keas. It could be caught in the drum. Neither was wary. L1965 was dissected after death. In its stomach were stones and lumps of rotten wood, material providing no sustenance, i.e. it had a depraved appetite.

L1204 F., a first year hen, was found 22/7/61 soon after death. She weighed 0.50 Kg, the lightest full grown Kea weighed. These deaths are listed according to months in Table 2.

TABLE 2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1st Year Keas	0	1	0	1	2	2	4	4	4	5	2	0	25
Other Keas	2	1	2	5	4	6	0	10	7	8	2	0	47
All Keas	2	2	2	6	6	8	4	14	11	13	4	0	72
31 natural deaths and 4 run over	2	1	1	5	3	4	3	8	4	2	2	0	35
Starving Keas					1	1	1	2					5

In the autumn as nesting finishes adult Keas may die, as they go into moult, perhaps in poor condition. The greatest mortality for all Keas is from June to September when food is most scarce. Then green droppings (due to biliverdin) of starving Keas can often be noted. This late winter and spring part of the year will be of special interest in the following tables, which provide further evidence of starvation.

The further life after banding is shown in Table 3.

The number of months of survival of those Keas which died less than a year after banding is shown in Table 4.

TABLE 3

years	0	1	2	3	4	5	6	7	8	Total
Banded as 1st year Keas	34	7	5	2	2					50
Other Keas	10	4	3	1	1	0	1	1	1	22

TABLE 4

months survival	0	1	2	3	4	5	6	7	8	9	10	11	Total
1st year Keas	4	9	3	5	2	0	1	3	1	1	4	1	34
Other Keas	2	0	2	0	1	0	0	1	2	0	0	2	10

In both tables "other Keas" provides a control for "1st year Keas."

These tables show the large loss of Keas in their first year, especially soon after banding. Some of these Keas were inexperienced, recently fledged Keas. Others were banded and died in the spring when there is a large moving population, spurred by hunger.

Another control is the construction of a survival table, Table 5. This follows Haldane (1955), 2. Keas which died before their first January after banding are not entered; the first year in the table is from this January until the December of the same year.

TABLE 5

Dated Banded	Number Dead	Years	1	2	3	4	5	6	7	8	9	10
1956	5	10	1	2		1			1			
57	6	9	2	1			1	1		1		
58	4	8	1	1	2							
59	3	7	2				1					
60	9	6	4	4			1					
61	4	5	3	1								
62	3	4	1		2							
63	4	3	4									
64	0	2										
65	3	1	3									
Total	41		21	9	4	1	3	1	1	1	0	0

From these results the annual survival rate, S, and its complement, the annual mortality rate (1 — S) can be calculated.

$$S = (63.2 \pm 6.6)\%$$
$$(1 - S) = (36.8 \pm 6.6)\%$$

The Kea with the greatest known longevity is 26959 F. She was banded as an adult 10/8/56 and was still alive 21/1/68. She has lived at least 15 years.

RESULTS OBTAINED FROM LIVE BANDED KEAS

As described in Jackson (1960), 3, most Keas about Arthur's Pass township are banded by the time I leave after a visit. A month later when I make another visit unbanded Keas have appeared. An analysis of the appearance of unbanded Keas at Arthurs Pass is presented in Table 6 and provides evidence that young Keas wander in their first two or three springs. A large number of Keas have been banded not in the autumn, but in the spring, six months or more after they have been fledged. Also in August and September adult Keas move further from their homes for these are the hungiest months.

Besides the statistical results my records contain several recoveries of individual Keas to show the spring wandering. L1961 M. was banded at Arthurs Pass 17/4/60 when in his first year. He remained about the township through the winter and was seen there on 28/8/60. He was not seen later that year. He was seen 25/2/61 on the Edwards Valley bottom flats (three miles from the township) and later the same day another two miles away by the large Edwards Valley waterfall. He recognised me at nightfall 20/8/61 at the foot of the Pyramid, Hawdon Valley, three miles further on and eight miles east of the township. He was back at Arthurs Pass township 10/9/61 and remained there during that September. He was there again on 14/10/62. On 6/10/63 his home area on the Bruce Spur, six miles south of the township, was found.

TABLE 6

Keas newly banded

rate per month 1956-66

	Jan	Feb	Mar	Apl	May	June	July	Aug	Sep	Oct	Nov	Dec
Juveniles	3.4	1.8	5.7	1.6	2.6	3.2	5.7	9.6	11.0	10.3	5.6	5.6
Adults	0.6	0	0	0	0.4	1.1	1.2	4.8	3.1	2.1	1.1	0
Total number	40	18	57	16	30	39	62	115	113	112	60	50

Banded Keas identified

rate per month

	24.4	13.1	20.1	9.5	14.8	23.2	29.4	45.5	43.7	46.4	29.8	23.8

TABLE 7

Month banded	Jan	Feb	Mar	Apl	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Number remaining more than 2 years	3	0	4	1	2	4	5	15	7	4	3	9
Average short stay in months	5.3	0.9	4.2	4.0	6.0	4.2	5.2	3.3	2.6	3.7	4.2	5.3
Standard deviation	7.9	1.7	6.0	5.8	6.3	5.2	6.6	5.1	4.5	6.0	6.3	6.5

In autumn many juvenile Keas gather into large flocks, of fifty or even one hundred birds. Perhaps there is such a flock every 50 square miles. Unfortunately these flocks are not present in the same place in succeeding years. This makes the number banded in autumn very irregular from year to year. The Keas banded in spring arrive in small groups to scavenge in places such as Arthurs Pass. The autumn-banded Keas tend to remain about Arthurs Pass longer. Table 7 is for juvenile Keas, divided into two categories, those that remain more than two years, and those with a short stay, less than two years. This table should be considered with Table 6 showing the number banded each month.

It can be seen that a large number of Keas settle in August and September, perhaps because then there are empty spaces after the late winter losses of adults, but the average stay is brief in the spring months, for there is a large number of unsettled young Keas.

The weight of Keas increases during the winter and the variance of the weight increases, too. There are both heavy and very light Keas in winter. Three very light Keas, L1965, L7110 and L1204, have been mentioned. The results for mean weight with its standard error, and the variance with its standard error, are given in Table 8 (in the appendix) and Table 9. A close examination of Table 8 shows that the greatest number of first-year Keas reach their maximum weight in June, and in May have their largest variance. This suggests that in May a heavy mortality of inexperienced light-weight young Keas occurs. The maximum for adults is a month later; their skill probably enables them to find food for a month longer than the first-year Keas. This is contrary to the indications of Table 2.

Also in the spring the distribution of weights of adult hens is bimodal. There are some heavy hens. Perhaps they are in egg.

TABLE 8

Month	1st year ♂		Other ♂		1st year ♀		Other ♀	
	Mean. μ Kg./100	Variance. σ^2 $(\text{Kg.}/100)^2$	μ	σ^2	μ	σ^2	μ	σ^2
Jan.	87.7 ± 1.6	42.3 ± 15.5	92.1 ± 1.5	36.1 ± 13.2	69.7 ± 1.2	16.7 ± 3.0	76.6 ± 1.5	25.0 ± 4.5
Feb.	86.4 ± 1.7	51.5 ± 17.7	92.5 ± 4.0	62.3 ± 50.9	76.0		70.7 ± 1.6	18.7 ± 10.6
Mar.	88.8 ± 1.7	88.8 ± 22.9	91.6 ± 4.2	73.0 ± 51.1	73.1 ± 1.2	32.5 ± 10.3	78.4 ± 1.8	34.3 ± 15.2
Apr.	94.6 ± 1.6	90.9 ± 22.3	95.0 ± 3.1	47.5 ± 32.8	78.0 ± 1.9	40.2 ± 18.1		
May	93.8 ± 3.6	170.3 ± 62.5	98.0 ± 2.6	33.0 ± 23.1	75.0 ± 2.9	41.5 ± 29.1	75.0 ± 4.5	123.5 ± 86.4
June	97.0 ± 1.7	62.9 ± 19.1	97.3 ± 3.9	188.8 ± 80.8	79.8 ± 2.4	35.6 ± 27.3	83.0 ± 2.8	139.5 ± 46.5
July	96.6 ± 1.2	52.2 ± 12.5	99.2 ± 0.8	12.6 ± 4.2	73.4 ± 3.3	94.8 ± 47.4	88.3 ± 2.7	125.8 ± 44.5
Aug.	94.6 ± 0.8	43.6 ± 7.9	95.4 ± 1.5	83.2 ± 15.9	76.2 ± 1.4	56.1 ± 12.9	82.1 ± 1.3	74.3 ± 16.7
Sep.	92.4 ± 0.9	42.2 ± 8.4	96.9 ± 1.0	28.2 ± 7.8	78.7 ± 1.0	31.0 ± 8.0	81.8 ± 0.8	17.5 ± 4.9
Oct.	91.5 ± 1.0	58.9 ± 8.0	90.4 ± 1.4	48.5 ± 11.5	75.8 ± 1.3	57.9 ± 14.7	79.0 ± 2.0	72.9 ± 25.0
Nov.	91.3 ± 1.4	47.4 ± 14.0	94.4 ± 3.7	95.3 ± 56.4	77.9 ± 1.3	30.8 ± 10.0	80.9 ± 1.3	22.8 ± 8.9
Dec.	88.9 ± 1.4	52.4 ± 14.3	88.0 ± 2.4	28.5 ± 20.2	74.9 ± 1.4	33.6 ± 11.5	79.0 ± 2.4	46.4 ± 24.9

TABLE 9

Kea weights averaged through the year

Kea age and sex		Mean weight and standard deviation
Juvenile	Male.	$(92.4 \pm 8.7)\ \frac{Kg}{100}$
Adult	Male.	95.7 ± 7.4
Juvenile	Female.	75.9 ± 6.1
Adult	Female.	80.3 ± 7.0

THE BAD SEASON — OCTOBER 1957 - MAY 1958

When my study was beginning it was complicated by an eight-month period of very bad weather, a period general over the West Coast of the South Island and the Southern Alps. In each month the rainfall was greatly above average, especially from October to March, probably the significant months for the Kea.

Table 10 sets out the rainfall at Arthurs Pass in 1957-58, compares it with the mean (the figures were kindly given by the Meteorological Office) and the expectation found by interpolation in Seelye (1947), 5, Table III. The expectation of the total is found by treating it as a month and interpolating improperly.

TABLE 10

Rainfall at Arthurs Pass

Month	October	November	December	January	February	March	Total
1957-58	26.67in	24.35	47.01	19.38	20.34	20.41	158.16
mean	17.5	13.3	14.4	14.8	13.8	11.2	85.0
ratio	1.52	1.83	3.27	1.31	1.47	1.82	1.88
expectation	0.128	0.041	0.006	0.263	0.223	0.106	0.031

December was the worst month with an expectation of 0.006, or such a month is expected once in thirteen years approximately. This month is remembered by the Boxing Day storm 26-27/12/57 when the Waimakariri River broke its banks at Christchurch and the Arthurs Pass rail and road routes to the West Coast were both closed for some months. Between 9 a.m. on the two days 11 inches of rain fell, expected once in 12 years but between 2 p.m. 26/12/57 and 2 a.m. 27/12/57 9 inches fell, which Dr. M. A. F. Barnett, then Director of the Meteorological Office, reckons can be expected " roughly once in 50 years." There were frequent storms.

This period caused a great reduction in the Kea population. Perhaps it was reduced to two thirds normal, as the 1958 number in Table 11 suggests. The average number banded per year from 1957 to 1965 inclusive is $\frac{905}{9}$ or 100.6.

TABLE 11

Year	1956	57	58	59	60	61	62	63	64	65	66	Total
Number	49	156	70	60	131	119	105	103	82	79	22	976

Chicks were found dead in their nests, eating of eggs was first noticed, and many parent Keas disappeared. Usual foods failed. Among the plants that did not flower that summer were snow totara *Podocarpus nivalis,* snow tussock *Danthonia flavescens,* mountain flax *Phormium colensoi, Dracophyllum longifolium,* and five-finger *Nothopanax simplex.* That summer there was little nectar, and the following winter few berries. Starvation was the immediate cause of death of many Keas that summer.

ILLNESS AND DISEASE

Keas are afflicted with disease as other living flesh. Table 12 lists illness or indication of disease noted among 44 Keas of all those banded.

TABLE 12

Illness	*Number of Cases*
Unusually harsh grating call	1
Sniffing and sneezing	5
Blind eye with a cataract	1
Blind eye, perhaps caused by a wound	1
Bleeding nose	3
Colour breaks, all noticed on the head	17
Dislocated shoulder	1
Left wing down, permanently	1
Left wing down, temporarily	2
Bad co-ordination as in S. Vitus Dance	1
Stumbling and walking on tarsi	1
Thick tarsii	4
Bumble foot	2
Cracks in the joints of the toes	2
Growth, perhaps cancerous, on the foot	1
Itchy foot	1
Septic wound	2
Severe scouring	3
Grossly underweight	3
Permanently irregular plumage	1

Twenty-two of these cases, the colour breaks, the thick tarsi and the irregular plumage, are probably genetic or developmental. The colour breaks may develop later in life. I have several instances of not having noticed colour breaks in well-known Keas for some years. It is most interesting that all the colour breaks recorded are on the head, perhaps because I pay most attention to this part of the body but more probably because the break is explained as the outcome of the complex development of the head in the embryo. Most often a colour break is indicated by yellow instead of green, i.e. the feather follicle is not synthesizing melanin, and the bubbles resulting in the Tyndall effect may be flooded with liquid so that the blue portion of the green is lacking. The yellow colour remains.

There are several throat complaints; staphylococcal infection is the cause of the bumble feet, the septic wounds and perhaps the cataract. Here it is relevant to mention that bites by Kea fleas cause pustules on me which take a week or more to heal, quite unlike ordinary flea bites; apparently the severe bite is caused by the staphylococci carried by these fleas.

"Scouring" is indicative of food poisoning by some bacteria in the gut.

L1907 F. was the Kea with a wing down during 5 years and suffered no ill effects from this condition. L2415 M. was noticed 16/1062 with a dislocated wing. He was caught by running down. His wing was set by Mr. W. L. C. Purdie, a Christchurch veterinarian but unfortunately the wing would not stay in place. L2415 was returned to Arthurs Pass but would not leave its open cage and died.

At about the same time six Keas were captured and sent to Prof. J. A. R. Miles, of the Department of Microbiology, Otago Medical School. They all died soon after arrival as if of a contagious disease. Necroses of the muscles and the liver were found. A virus disease was suspected but the pathogen could not be found. Probably L2415, which was in contact with these other Keas for an hour or so, suffered from the same condition.

Mr. J. Kikkawa took several blood samples on 20/8/60 and found a wide variation in blood count. A Kea with a slightly low count would suffer no ill effects. However, overcrowding of Keas in winter causes a haemolytic anemia, a stress condition and a typical psychosomatic illness. Both the highest caste Keas, at the top of the peck order and the lowest are liable to develop this anemia. A healthy Kea may succumb in a fortnight.

PARASITES

Among parasites of Keas are:

an analgesid mite;

the lice:
1. *Neopsittaconirmus kea* (Kellogg) 1907
2. *Colpocephalum pilgrimi* (Price) 1967
3. *Heteromenopen kea* (Kellogg) 1907

and 4. *Echinophilopterus sp.*, believed to be a new species;

the flea *Parapsyllus nestoris* (Smit) 1965;

the psychodid flies
1. *Psychoda severini* (Tonnoir)

and 2. *Psychoda spatula* (Satchell)
identified by Dr. L. W. Quate of the Bernice P. Bishop Museum.

There are threadworms *Capillaria sp.* in most Kea intestines.

In addition, sandflies *Austrosimulium ungulatum* annoy recently fledged Keas in December and January.

Perhaps the most serious parasite is the flea. Autumn nests are very heavily infested. No instances have been noticed of these fleas congregating on the neck of checks, and causing a severe loss of plumage and weight as occurs with prions, attacked by another flea of this genus. Often the fleas carry large numbers of mites, part of the nest fauna.

The very large nest fauna includes:

mites 1. Eviphididae
2. Hypoaspidinae
3. Acaridae
and 4. Oribatidae.

There are many flies, especially blowfly maggots; Staphylinid and Dermatisid beetles; and, most conspicuously, the large beetle *Necrophilus prolongatum.*

INJURY

Table 13 lists the injuries noted of 69 Keas among the 976 Keas banded.

TABLE 13

Injury	*Number of Cases*
Temporary limp, sometimes with a minor wound visible	29
Permanent leg injury, so the leg is useless, often with a badly set femur or tarsus and atrophied muscles	12
Loss of foot	4
Permanent toe injury with badly knit bones	4
Broken wing	2
Bruised and bleeding chest	2
End of lower mandible broken off	1
Bleeding eye	1
Tail feathers missing	1
A small patch of temporarily missing plumage on the head	5
Cut on the face	2
Swelling under the band	7

These injuries are possibly of three causes:

1. Keas often feed on slips and steep faces where stones are liable to bounce down. Occasionally a bouncing stone would catch a Kea as it flushed. Also Keas know how to shelter on a rib from an avalanche, yet some may be caught.
2. The scar left after an unsuccessful attack by a predator.
3. Mistakes in flight, especially after dark and in a storm.

If these causes are conceded then at first sight as many wing injuries as leg injuries would be expected. Indeed, considering the comparatively large area of the wings, the fact that predators such as the Falcon *Falco novaezeelandiae* and the Black-backed Gull *Larus dominicanus* attack in flight, and, especially, the fact that the gull batters with its wings, more wing injuries would be expected. The smaller number of wing injuries shown in the Table is probably because a bird with a broken wing soon dies. However, a healthy Kea is extraordinarily tough. One Kea with a broken humerus glided 200 yards across the Bealey River to where a group of Keas were feeding.

Again facial imperfections are noticed. Perhaps these are caused by fighting. The large number of band injuries were caused not by the band being put on improperly but because a band prevents normal swelling of the leg, following a foot injury.

[M. Davis

Plate XIX — Female Kea eating one of her eggs, 6 p.m. 21/1/62.

Certainly injury would seem as important as illness as a cause of death.

PREDATORS

Several times I have seen Falcons attack Keas but always unsuccessfully. When a Falcon attacks a single Kea, the Kea rolls over and parries the blow, and at the first opportunity falls into the cover of the forest or the shelter of a large boulder. Similarly when Keas hear a Falcon they take shelter. And when in the open on a river flat or above the bush line they carefully watch any large bird flying high above. To do this it is necessary for them to twist the head sideways and while in this stance all the Kea's attention is occupied.

When a Falcon attacks a Kea among a flock of Keas in flight the Keas behave differently. The Falcon seeks to attack one Kea but is disconcerted by the interest the other Keas take in him. Soon he has Keas all around him, following him up as he climbs to swoop again. The Falcon flees. This behaviour is similar to that of the Red-backed Parrot, *Psephotus haematonotus,* when attacked by predators, as described by Forshaw (1962), 1.

Magpies *Gymnorhina hypoleuca* are often mentioned as attacking Keas. I have seen no instances. Keas are intensely interested in flocks of flying Magpies and often take flight to join them. Several times I have seen one or two Keas flying straight able to keep up with a flock of twenty or thirty Magpies which fly with loops and side slips. The Magpies take no notice of the Keas.

The relationship of Black-backed Gulls and Keas is uneasy. Normally Keas take precedence but in the air these gulls do not hesitate to attack a single Kea. Or if one or two Keas are feeding in a rubbish dump and fresh food is put out a dozen Gulls will descend, push in and guzzle the delicacies. Possibly significant behaviour of Keas is their retreat to the forest from feeding in the open on a river flat when the sun reaches them. Black-backs are late risers and come flying up the valleys about the same time as the sun reaches down into the valley.

In a riverbed in mid-summer Black-billed Gulls *Larus bulleri* and Black-fronted Terns *Chlidonias albostriatus* will attack a Kea perched on a log. A Kea takes no notice of their attacks. Similarly Keas take no notice of Wekas *Gallirallus australis.* However, a Weka could attack an unguarded nest.

During the last hundred years Keas have shared their environment with rats *Rattus spp.* and stoats *Mustela erminea.* I have found no evidence of these animals affecting Keas. However, it was interesting to find a successful Weka nest by the lake at the terminal face of the Douglas Glacier, South Westland, heavily infested with both rat fleas, *Nosopsyllus fasciatus* and Kea fleas. Twice I have found a dead opossum *Trichosurus vulpecula* within five yards of a Kea nest. The opossum frequently chooses holes similar to a Kea nest as a den and perhaps these two opossums prospected the Kea nests.

SOCIAL REGULATION OF KEA NUMBERS

Keas have a strict peck order. Grossly underweight Keas are at the bottom of the peck order and among these Keas a haemolytic anemia develops, all evidence of social regulation.

On occasion, the Kea hen destroys her own eggs and chicks (see photo). I have known five nests where the eggs have been eaten and one where the chicks were trodden into the floor of the nest. In the latter case many Keas were about when the chicks were killed. The hen left this nest to make a new nest two miles away and her cock disappeared.

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GIANT PETRELS AS MIGRANTS TO NORTHERN NEW ZEALAND

By R. B. SIBSON

Few winters now pass without reports of numbers of Giant Petrels (Nellies) *Macronectes giganteus* in the Waitemata and inner waters of the Hauraki Gulf. These waters offer comparative shelter during the season of south-westerly gales. Nellies are also attracted by shipping; and especially by the garbage-boat*, also known as the 'gut-boat,' which formerly emptied the refuse of the Auckland markets somewhere out beyond Rangitoto Beacon. Consequently, now in the middle of the twentieth century, more Nellies are recorded in Auckland Harbour than ever were noted in earlier days. It may be significant that the earliest skin in the Museum locally obtained came from Karekare on the west coast in 1930. It is likely that there has been a similar increase elsewhere, e.g. Wellington Harbour and Cook Strait where the whaling station in Tory Channel was known to be a powerful decoy not only for Nellies, but also for Cape Pigeons *Daption capensis*, as long as it was operating. (Notornis 8, 78). It may also be true that as the Fulmar *Fulmarus glacialis* is now ranging further south in the North Atlantic, so the Nelly and Cape Pigeon are ranging further north in the South Pacific.

Dr. R. A. Falla has told me that during the 1920's he would sometimes see one or two Nellies from the Auckland Harbour ferries. In the 1930's C. A. Fleming might see as many as six. On 24/10/39 when I made my first acquaintance with Rangitoto Channel, four were hopefully criss-crossing the wake of M.V. Rangitiki. In the winter of 1942, W. Sanderson noted about ten following a steamer up the Whangarei Harbour. Six near Rangitoto on 6/12/46 and eight about the Auckland wharves on 11/11/47 were probably the remnants of considerably bigger winter concentrations.

Since 1952 several local observers have kept an eye open for Nellies entering the Auckland Harbour and I gratefully acknowledge their figures which supplement my own counts. Few Nellies reach the Waitemata before July. They are most plentiful between August and October. Some may still be present in December. The lean period is between January and May, when the first of the new season's casualties may come ashore on the west coast; but even during the hottest months a few are scattered over adjacent seas. Six off Kawau Island on 9/2/58 reported by Miss A. Goodwin, must have been attracted by exceptionally good scavenging.

* Its memory is perpetuated in Gina Blanshard's vivid poem, "Auckland Harbour" —

Look out to Rangitoto and watch float,
The ramshackle filthy rubbish boat,
With seagulls crying in its wake
And feasting at its laden stern.

Counts of Nellies in Auckland Harbour since 1952

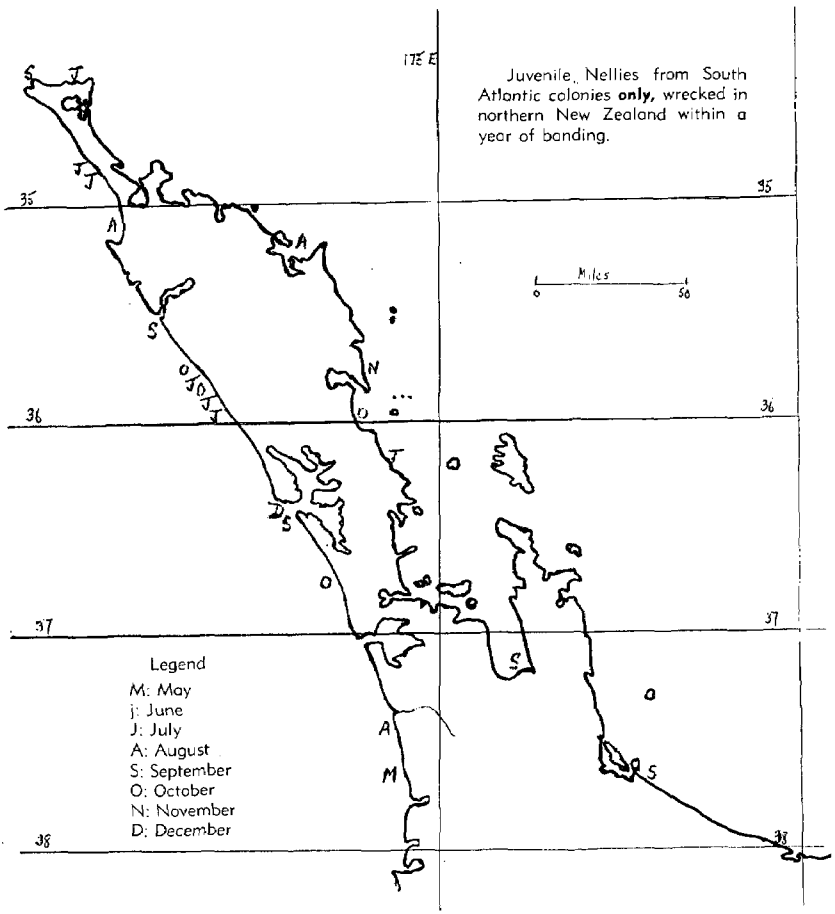
1952 6 on 27 Sept. (Miss N. Macdonald). 24+ on 26 Oct. (J. C. Davenport).
1953 c. 20 on 31 Aug.
1954 26+ on 22 Aug.
1955 16 on 22 Aug.
1956 10+ during August (Mr. and Mrs. J. Prickett).
1957 No observations.
1958 14 in early October off Moturoa feasting on a dead Blackfish (S. Chamberlin).
1959 8+ on 29 Aug.
1960 No observations.
1961 No observations.
1962 c. 30 on 18 Aug. 37 on 7 Sept.
1963 None on 3 July.
1964 No observations.
1965 12+ on 25 Sept.
1966 23 on 17 Sept.
1967 6 on 9 July (B. W. H. MacMillan), 15 on 12 Aug., 12 on 12 Sept., 8 on 7 Nov.
1968 12 on 22 July (J. A. F. Jenkins), c. 20 on 5 Aug. (Mr. and Mrs. Fooks), c. 30 on 6 Sept. (B. W. H. MacMillan).

The last stage of the long flight by which most Nellies reach the comparative shelter of the Hauraki Gulf must be up the Tasman Sea and round North Cape. In this respect Miss N. Macdonald's observation of seven outside Whangaroa Heads on 5/5/53 is significant. But while some continue northwards to reach Norfolk Island, Fiji and Tonga (Notornis 15, 158; 12, 158 and 14, 153), others succumb along the Auckland west coast, which in south-westerly weather becomes a lee-shore extending more than 250 miles. I can find no record of a Nelly's taking a short-cut from Tasman to Pacific across the Auckland Isthmus; nor have I ever seen a Nelly flying over the almost land-locked waters of Manukau Harbour; but E. K. Saul saw four off the end of Mangere Airport on 13/10/66.

Of fourteen deposited in the Auckland War Memorial Museum between 1930 and 1954, one was stranded in May, one in June, five in July, five in August, one in September and one in October. Nine of these came from Muriwai, where, for example, five were found ashore on 20/7/41, but not all were brought in.

Among the Muriwai Nellies are three of the four examples of the white phase which I can find recorded so far north in New Zealand. The first was found on 30/6/40 by C. A. Fleming and myself; the second on 25/7/54 by J. C. Davenport and H. G. Warburton. Further north A. T. Edgar on 24/9/66 found the old corpse of an almost completely white bird, at Taupiri Bay, south of Cape Brett. The fourth white specimen was salvaged from Muriwai by Lois Wagener on 17/8/68.

The winter of 1954 was very stormy and exceptional numbers of procellariformes from distant breeding grounds, such as Grey-headed Mollymawks *(D. chrysostoma)*, Light-mantled Sooty Albatrosses *(P. palpebrata)*, White-headed Petrels *(P. lessoni)*, Blue Petrels *(H. caerulea)*, Kerguelen Petrels *(P. brevirostris)* and Prions, especially *salvini, desolata* and *belcheri,* were driven ashore starving and



emaciated. (Notornis 6, 115-117). On the Awhitu peninsula and at Muriwai at least eight Nellies were found storm-wrecked. Meanwhile others were gathering in the Auckland Harbour, where the count of 26+ on August 22nd exceeded all previous counts. The peak period for casualties on the west coast is a week or two ahead of the biggest assemblages in the Waitemata.

Formerly the provenance of the Nellies which visit northern New Zealand was a matter of intelligent conjecture. But since the middle 1940's, thousands have been banded at their antarctic or subantarctic breeding grounds; and more than thirty have been recovered in New Zealand north of 38°S. The first relevant recovery appears to be of one banded in January 1952 at Heard Island and found the following winter near Raglan (Notornis 5, 184). However, if the ringing recoveries are a true guide, rather more of the Nellies which reach northern New Zealand come from the South Atlantic than from the South Indian Ocean. Some, too, come from rather

nearer home, especially Macquarie Island. The figures may be biased because by far the greatest numbers have been ringed in Falkland Islands Dependencies.

TABLE 1

RECOVERIES IN NORTHERN NEW ZEALAND OF GIANT PETRELS

(a) Banded in the Falkland Islands Dependencies
(b) Banded on other Subantarctic islands

	Place of Banding	Date	Place of Recovery	Date
(a)	Signey Is. South Orkneys	22/3/56	Kamo	17/11/56
	" " " "	10/3/58	Waipu	9/10/58
	" " " "	Feb/Mar 59	Waiotemarama	5/7/59
	" " " "	22/2/59.	Mayor Is.	25/6/61
	" " " "	21/3/60	Dargaville	1/7/60
	" " " "	18/3/60	North Kaipara Heads	9/1/61
	" " " "	21/3/60	20m. S.of Dargaville	Oct. 60.
	" " " "	12/2/61	Te Arai	2/7/61
	" " " "	13/2/61	Tom Bowling Bay	25/7/61
	" " " "	3/3/62	Port Waikato	5/8/62
	" " " "	3/3/62	Bay of Islands	24/8/62
	" " " "	31/3/64	Omamari	12/10/64
	" " " "	31/3/64	Tapu	3/9/64
	" " " "	10/3/65	Hokianga	10/9/65
	" " " "	10/3/65	Ninety Mile Beach	11/7/65
	" " " "	13/3/66	Pakiri	6/11/67
	King George I South Shetlands	31/3/59	Ninety Mile Beach	19/7/59
	West Nelson I " "	29/1/67	Muriwai	29/10/67
	South Georgia	Feb. 1959	Maunganui Bluff	30/7/59
	" "	"	Te Akau	24/5/59
	" "	"	Ahipara	7/8/59
	Bird Is. South Georgia	1/2/61	Kaipara Heads	3/9/61
	" " " "	13/2/64	Te Puke	15/9/64
	" " " "	13/2/64	North Cape	28/9/64
	" " " "	15/2/64	Tauranga	12/10/64
(b)	Heard Island	14/1/52	Raglan	29/ 6/52
	" "	14/2/64	Muriwai	25/ 7/54
	" "	20/2/63	Ninety Mile Beach	30/ 8/64
	Macquarie Island	23/12/55	Ninety Mile Beach	1956
	" "	2/3/59	Ninety Mile Beach	9/6/59
	" "	4/3/59	Maunganui Bluff	21/6/59
	" "	3/3/59	Muriwai	16/5/59
	" "	3/1/61	Ninety Mile Beach	6/7/61

A rather limited series of recovery dates suggests that Nellies from Macquarie Island pass up the west coast of the North Island ahead of those from the South Atlantic colonies. This is only to be expected. Nevertheless one youngster from South Georgia is known to have reached Te Akau scarcely three months from fledging; and one which succumbed at Suva, Fiji, in August had been banded as a nestling at Macquarie in the previous January. Many of the wrecked birds whose age is known from banding are about six months old; and most are well within their first year. But second-year birds have been found near Mayor Island and at Pakiri. However, mature birds with pale heads and necks are also winter visitors. One, unbanded, wrecked on Takatu Peninsula in August 1967, appeared to be a big old specimen of the Macquarie type (Wing 540, culmen 100, tarsus 98).

Nowadays Nellies that come ashore will very likely be found; and, if wearing a band, reported. Formerly in winter there were few human visitors to the exposed and rather inaccessible beaches of the west coast, except the occasional beach-combing naturalist and, in season, the ardent toheroa-digger. Muriwai, being handy to Auckland, became a rich source of skins for the Auckland War Memorial Museum. But now long stretches of coast west of Waiuku and Dargaville; and also the Ninety Mile Beach are easy of access. Surf-casting has become a popular sport and the weather has to be exceptionally bad to force anglers and others to stay away from the beaches. It seems something of an anomaly that so far so few banded Nellies have been recovered from Muriwai.

Bourne and Warham in a stimulating and persuasive paper on geographical variation in Giant Petrels (Ardea 1966, 54, 45-67) have suggested that there are two 'sibling species,' distinguishable in appearance, proportions and behaviour. The southern form, which must be called *giganteus*, is polymorphic and includes the white birds; its young birds are highly migratory. The northern form *halli* breeds earlier — egg laying August-September as compared with November-December — on islands in the subantarctic zone of surface water. To this form belong the Nellies which breed on the subantarctic islands of New Zealand, and they appear to be comparatively sedentary. But at Macquarie Island the two 'sibling species' breed side by side, *giganteus* in open colonies, *halli* in isolated pairs under shelter; yet the two forms remain apart.

Using the morphological criteria which these authors enumerate, I have examined a series of Nellies locally obtained and now in the Auckland War Memorial Museum, and many others as cast ashore on northern beaches. All appear to be of the more southerly form, which in its migrations appears to leap-frog the more stay-at-home subantarctic breeders. It would be interesting to obtain a clear-cut specimen of *halli* from sub-tropical waters. And, finally, what about the many Nellies which frequent Cook Strait and Wellington in winter? Does *halli* occur among them; or are they also in the main migrants from the more distant antarctic colonies?

ACKNOWLEDGEMENTS

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SEABIRDS FOUND DEAD IN NEW ZEALAND IN 1964

By M. J. IMBER and B. W. BOESON†*

ABSTRACT

During 1964, 45 members patrolled a total of 988 miles of coast and found 1,236 dead seabirds of 44 species. Mortality was highest in January and November, especially on some coasts exposed to westerly winds which were vigorous and prolonged in those months; on eastern coasts mortality was low throughout the year. There were no major wrecks. Fairy Prions (**Pachyptila turtur**) and Sooty Shearwaters (**Puffinus griseus**) were, typically, the most abundant species, especially on western beaches of the North Island in November. Unusual species included Silver-grey Fulmar (**Fulmarus glacialoides**), Black-winged Petrel (**Pterodroma hypoleuca nigripennis**), Scoty Tern (**Sterna fuscata**) and Little Whimbrei (**Numenius minutus**).

INTRODUCTION

This report differs from the earlier ones — listed by Boeson (1965) — in that records of gannets, shags, gulls and terns are tabulated in the same detail as for penguins and petrels; further, the records are grouped into 15 geographical zones instead of 18. The former zones of North Cape, Hawkes Bay and West Nelson have been deleted and their coastlines allocated among adjacent zones (Fig. 1).

RESULTS

During 1964, 45 people took part in the scheme. Their results are presented in Tables 1 to 5. Not included in these tables are 36 miscellaneous specimens among which the only one of particular interest was a Little Whimbrel *(Numenius minutus)* found in November on the Wellington West coast. The others were 6 Rock Pigeons, 6 Sparrows, 4 Magpies, 3 S.I. Pied Oystercatchers, 3 Greenfinches, 2 Black Swans, and 1 Bittern, Reef Heron, White-faced Heron, Northern Oystercatcher, Pukeko, Californian Quail, Shoveler, Paradise Duck, Starling, Blackbird and Goldfinch.

In Table 1 there are two measures of distance. 'Miles travelled' is the sum of the distances walked (or driven) by patrollers. 'Miles covered' is the length of coast actually inspected by patrollers. The

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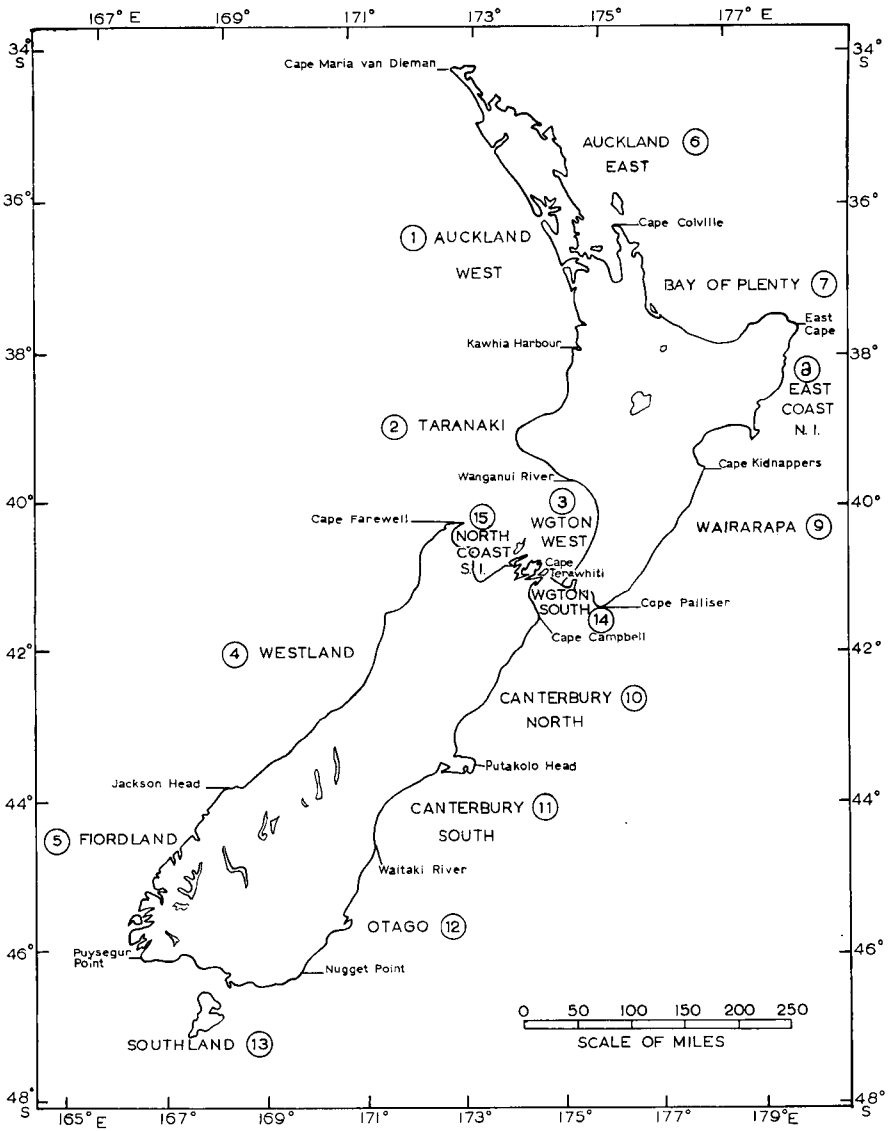

FIGURE 1 — New Zealand, showing the 15 sections of coastline within which Beach Patrols have been grouped.

latter adjustment enables better comparisons of data from coasts where repetitive patrolling was frequent with data from coasts where it was not.

Valuable data are obtained where a particular beach is examined monthly or more often during the year. If all dead birds are removed

TABLE 1: Numbers of Dead Seabirds Recorded and Miles Patrolled on Each Coast in 1964†

Coast	Code	NUMBERS OF DEAD SEABIRDS AND MILES COVERED EACH MONTH												Total Miles		Total Birds	Birds / Mile*
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Trav.	Cov.		
Auckland West	AW					1/14		27/29	55/44	27/29	30/33	128/32		361	181	268	1.5
Taranaki	T	2/2				9/13		4/8		17/10		3/1		41	34	35	1.0
Wellington West	WW	99/15	34/10	15/5	0/3	0/3	2/6	16/9	39/18	48/24		331/20	3/3	144	116	587	5.1
Westland	WD									0/1			1/7	8	8	1	0.1
Auckland East	AE	44/9			0/2	0/3	1/2							16	16	45	2.8
Bay of Plenty	BP	15/11	19/4	7/3	4/3	2/3	5/3	2/3	12/9	1/3		4/2	17/10	129	54	88	1.6
East Coast Nth. Isl.	EC				1/3								2/5	8	8	3	0.4
Wairarapa	WA							0/3						3	3	0	0.0
Canterbury North	CN	3/5	7/3	14/13	6/6	8/9	1/7	0/7	0/3	5/4	2/3	6/3	0/3	87	66	52	0.8
Canterbury South	CS	9/1		1/3					0/2					6	6	10	1.7
Otago	O	12/18	0/6	11/7	2/6	2/6	0/3	2/4	0/3	1/5	0/3	1/2	0/2	69	65	31	0.5
Southland	S		32/3	12/10	12/7	5/3	1/3	0/3	1/3	9/4	10/3	4/4	3/3	49	46	89	1.9
Wellington South	WS	0/2	4/6		0/1	0/1	4/8	1/2	3/7	5/8	3/1	2/3	0/2	54	41	22	0.5
North Coast Sth. Isl.	NS				1/4			1/4				0/4	3/1	13	13	5	0.4
Total Miles Travelled		90	60	48	51	62	42	142	190	106	75	83	39	988			
Total Miles Covered		63	32	41	35	55	32	72	89	88	43	71	36		657		
Total Birds		184	96	60	26	27	14	53	110	113	45	479	29			1,236	
Birds / Mile*		2.9	3.0	1.5	0.7	0.5	0.4	0.7	1.2	1.3	1.0	6.7	0.8				1.9

*Miles Covered

† There were no records for Fiordland coast.

from the beach each time (as they should be), then subsequent patrols yield only birds cast ashore in the intervening period, except for any covered or uncovered by moving sand. During 1964 certain beaches in Bay of Plenty (M. Hodgkins), Canterbury North (D. G. Dawson), Otago (W. T. Poppelwell) and Southland (Mrs. M. L. Barlow) were patrolled throughout the year and one Wellington West coast beach was examined less frequently by several observers (D.E.C., W.J.P., M.J.I.). The results are presented in Table 5. Comparison of Tables 1 and 5 shows that erratic patrols of many beaches in a zone, provided that they are well distributed throughout the year, give results reasonably similar to those from regularly patrolled beaches (note that 'birds/mile' in Table 1 corresponds with 'birds/mile/month' in Table 5).

Although Table 2 lists species infrequently found dead, several of these are nevertheless commonly seen alive on some coasts (for example Giant Petrels *M. giganteus,* the Shags *Phalacrocorax* spp., and Caspian Terns *H. caspia).* Rarely-reported species include the Chatham Island Mollymawk *D. cauta eremita,* Silver-grey Fulmar *F. glacialoides,* Black-winged Petrel *P. hypoleuca nigripennis* (fourth North Island record), and Sooty Tern *S. fuscata.*

TABLE 2: Seabirds of which from 1 - 5 Specimens were found Dead in 1964. Coast and Month of Discovery Given

Species or Subspecies	Number Found	Coast(s)	Month(s)
Diomedea sp.*	3	WW, BP,CN	1; 6; 5
exulans	1	AW	8
epomophora	1	AW	7
melanophris	3	T[2], WS	5; 6
chrysostoma	1	AW	8
cauta eremita	1	AW	8
Phoebetria			
palpebrata	1	AW	8
Macronectes			
giganteus	4	AW[2], WS,S	7, 8; 11; 4
Fulmarus			
glacialoides	1	WW	11
Pachyptila			
desolata banksi	2	WW, WS	7; 6
belcheri	2	T, WW	5; 9
Puffinus			
tenuirostris	4	AW, T, WW[2]	10; 5; 1
Procellaria			
cinerea	1	BP	12
aequinoctialis	1	AW	10
Pterodroma			
inexpectata	3	WW[2], S	2, 11; 2
brevirostris	1	AW	9
cooki	4	AW, AE, BP[2]	10; 1; 12
hypoleuca nigripennis	1	WW	3
Pelagodroma			
marina	3	AE, BP, CN	1; 1; 11
Phalacrocorax			
carbo	3	T, CN, S	11; 9; 5
varius	2	AW, CN	9; 6
melanoleucos brevirostris	3	BP[2],O	5, 6; 4
carunculatus chalconotus	4	O, S[3]	3; 2, 3, 5
Hydroprogne			
caspia	1	CN	5
Sterna			
fuscata	1	T	1
TOTAL	52		

*Species not identified

TABLE 3: Coastal Distribution of the More Common Seabirds Found Dead in 1964

Species or Subspecies	AW	T	WW	COAST WD	COAST AE	BP	EC	CN	CS	O	S	WS	NS	Total Birds
Eudyptula minor	27	5	28	.	23	19	.	1	.	.	7	1	2	113
albosignata	(1)	.	.	.	.	.	.	5	9	.	.	.	.	15
Diomedea cauta cauta	.	.	.	.	.	.	.	1	.	.	3	1	1	6
Daption capensis	4	.	2	.	.	1	.	.	.	.	.	2	.	9
Pachyptila sp.*	2	1	37	.	.	.	.	1	.	2	7	.	.	50
vittata	1	.	4	.	.	.	.	.	.	.	1	.	.	6
salvini	6	.	8	.	.	.	.	.	.	.	2	.	.	16
turtur	46	15	261	.	.	1	1	.	.	.	1	1	.	326
Puffinus sp.*	.	.	.	.	2	1	.	.	.	.	.	.	.	3
carneipes	.	.	1	.	3	19	.	.	.	.	.	.	.	23
bulleri	2	.	17	.	.	2	.	.	.	.	.	.	.	21
griseus	132	1	158	1	5	6	.	5	1	2	23	.	1	335
gavia gavia	11	2	10	.	5	5	1	.	.	.	.	1	.	35
gavia huttoni	.	.	1	.	.	.	.	8	.	.	.	.	.	9
assimilis	2	.	5	.	.	1	.	.	.	.	.	.	.	8
Pterodroma macroptera	.	1	.	.	.	6	.	.	.	.	.	.	.	7
lessoni	6	.	1	.	.	.	.	.	.	.	.	.	.	7
Pelecanoides urinatrix	2	1	21	.	.	9	.	.	.	.	4	2	.	39
Sula bassana serrator	9	2	3	.	2	1	1	.	.	.	.	1	.	19
Phalacrocorax punctatus	.	1	.	.	.	.	.	6	.	4	3	.	.	14
Larus dominicanus	4	.	12	.	.	1	.	11	.	17	25	8	1	79
novaehollandiae	.	.	6	.	2	6	.	4	.	.	6	2	.	26
bulleri	.	.	.	.	.	.	.	1	.	4	1	.	.	6
Sterna striata	1	.	3	.	1	3	.	4	.	.	.	.	.	12
TOTALS	256	29	578	1	43	81	3	47	10	29	83	19	5	1184

*Species not identified
() Not confirmed.

TABLE 4: Monthly Distribution of the More Common Seabirds Found Dead in 1964

Species or Subspecies	1	2	3	4	MONTH 5	6	7	8	9	10	11	12	Total Birds
Eudyptula minor	28	12	2	1	2	1	4	29	9	2	16	7	113
albosignata	10	2	2	.	.	.	.	(1)	.	.	.	.	15
Diomedea cauta cauta	.	2	1	1	1	.	.	.	1	.	.	.	6
Daption capensis	.	.	.	.	.	.	2	3	3	.	1	.	9
Pachyptila sp.*	16	18	.	.	2	.	2	8	.	.	4	.	50
vittata	1	.	.	.	.	.	.	1	2	1	1	.	6
salvini	.	.	.	.	.	.	9	4	.	3	.	.	16
turtur	24	5	5	.	.	1	16	37	61	4	172	1	326
Puffinus sp.*	1	.	.	.	.	1	.	.	.	.	.	1	3
carneipes	6	10	4	1	.	1	.	.	.	.	.	1	23
bulleri	3	2	1	.	.	.	.	.	.	1	13	1	21
griseus	42	14	14	4	3	2	.	.	1	10	239	6	335
gavia gavia	6	4	.	.	1	.	3	2	10	3	5	1	35
gavia huttoni	2	1	3	.	.	.	.	.	.	.	3	.	9
assimilis	1	.	.	.	.	.	2	.	.	.	4	1	8
Pterodroma macroptera	5	1	.	.	.	.	1	.	.	.	.	.	7
lessoni	1	.	.	.	.	.	.	2	1	2	1	.	7
Pelecanoides urinatrix	6	.	.	.	.	.	4	12	8	2	2	5	39
Sula bassana serrator	3	1	1	1	1	.	.	2	1	5	4	.	19
Phalacrocorax punctatus	.	2	5	.	2	.	1	.	3	1	.	.	14
Larus dominicanus	12	8	13	12	5	3	3	2	7	7	7	.	79
novaehollandiae	5	8	5	1	.	.	1	1	1	1	1	2	26
bulleri	3	1	1	.	.	.	.	.	1	.	.	.	6
Sterna striata	2	2	.	3	1	.	2	1	.	.	1	.	12
TOTALS	177	93	57	24	18	9	50	105	109	42	474	26	1184

*Species not identified
() Not confirmed.

TABLE 5: Numbers of seabirds found dead in beaches regularly patrolled during 1964.

Coast	Miles Covered	Total Seabirds Found	Birds Per Mile Per Month
Wellington West	6	267	3.7
Bay of Plenty	3	59	1.6
Canterbury North	3	41	1.1
Otago	2	7	0.3
Southland	3	68	1.9

DISCUSSION

Results of this year's patrols, which were well distributed round the coasts, show that seabird mortality was low in 1964 and there were no unusual wrecks. The number of birds per mile travelled was 1.2 (from Table 1) which compares with 1.8 in 1960, 3.7 in 1961, 1.9 in 1962 and 1.8 in 1963 (see relevant reports). Mortality was highest on the Wellington West coast and it was higher on most coasts exposed to westerly winds (AW, T, WW, S) than on eastward-facing ones. Moderate numbers reported from northeast coasts (AE, BP) were very largely species breeding on adjacent islands. On eastern coasts from East Cape southwards few birds were found throughout the year.

A typical pattern of monthly mortality is evident in Tables 1 and 4. This patern was partly influenced by higher mortality, associated with persistent strong winds, on some western coasts in January and November. The following extracts are from meteorological returns in the New Zealand Gazette of 1964: " — January 1964 will be remembered for the exceptionally strong and persistent winds from a westerly quarter during this period, — " (*1*, 8: 230); " The period from the 14th to the 20th (November) was one of typical westerly weather " and " The period from the 24th to the 29th (November) was another one of westerly weather " (*3*, 79: 2357). Nearly all birds found in January and February on west-facing coasts (T, WW, S) had died during the five weeks of westerlies which began in the last week of December 1963. The high return from Auckland East in January was caused by birds which had died the previous year. The most productive patrols in November on western coasts were made following the periods of onshore winds. Sooty Shearwater mortality was high then but this is typical. However, unusually high numbers of Fairy Prions were found in November on Wellington West coast.

ACKNOWLEDGEMENTS

Beach patrolling is a time-consuming and sometimes expensive recreation. Great credit is due to the following who contributed cards during the year: N. M. Adams, J. H. Allan, Mrs. M. L. Barlow, J. A. Bartle, B. D. Bell, B. W. Boeson, Dr. P. C. Bull, C. N. Challies,

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We wish to thank the following: M. J. Williams who gave considerable time to tabulating data; Dr. P. C. Bull and E. K. Saul who read the manuscript and made very helpful comments; and C. L. Morgan who drew the map.

REFERENCE

BOESON, B. W., 1965: Seabirds found dead in New Zealand in 1963. Notornis 12, 3, 169-175.

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SHORT NOTES

ARCTIC TERN IN MANUKAU HARBOUR

On a visit to a beach at Ihumatao on 29/6/68 I picked up a rather battered dead tern. There were two holes in the body and one leg was missing, but the remaining leg was brightly red, and the tarsus seemed very short. Later examination with Mr. H. R. McKenzie proved it to be a female Arctic Tern *(Sterna paradisea)*. Terry Jenkins was able to convert the wreckage into a very presentable study skin which is now in the Auckland War Memorial Museum (A.V. 1399.8). Its measurements are:— Wing 240 mm., tail 140, tarsus 15, bill 32.

The plumage is at an intermediate stage, showing a little feather wear on the upper wing coverts but none otherwise. The bill is black with scarlet at the base; but on the inside it is scarlet to the tip and the gape is scarlet. Face and forecrown are white: the top and back of the head black with white speckling. The back is pearl grey, the primaries slate grey. The tail is mainly white but the outer webs of the outer feathers are slate grey; and the next pair light grey.

The general colouring, the state of plumage and the date suggests that it was a sub-adult, on its way from the Antarctic to the Arctic, perhaps to breed for the first time.

— H. FREW

★

A HUGE REDPOLL FLOCK

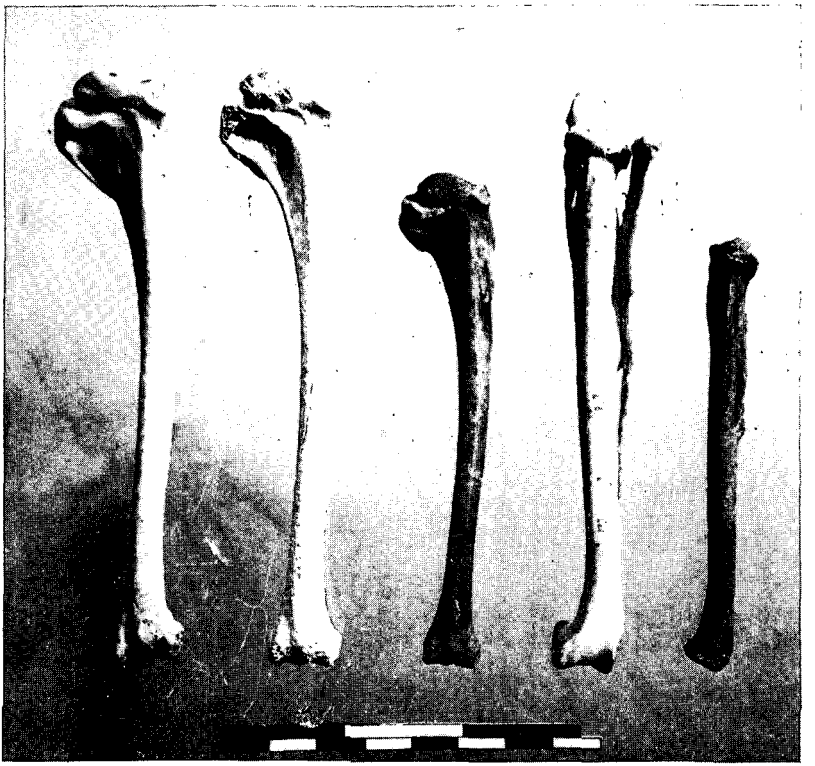
On 5/4/68, I was hunting about five miles north-west of Barryville, King Country, near the source of the Waipa River. A long wide stretch of old bush working, wider at its upper end, had failed to regenerate and was in blackberry, a poor growth of fern, some wineberry and much grass and weed. It was alive with Redpolls *(C. flammea)* and when a hawk flew over they rose like a swarm of bees. The flight was about a quarter of a mile long, fifty feet deep and a hundred yards wide. I estimated it to contain over a hundred thousand birds.

— F. P. HUDSON

THE OCCURRENCE OF THE MUSK DUCK, BIZIURA LOBATA (SHAW), IN NEW ZEALAND

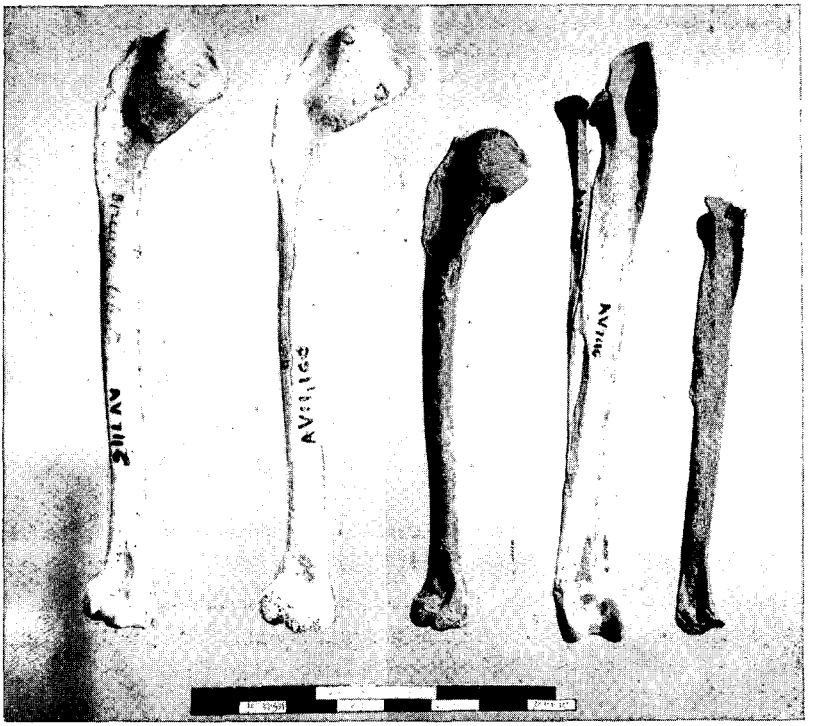
By R. J. SCARLETT, Canterbury Museum

In *The Transactions of the New Zealand Institute,* Vol. 24, p. 188, H. O. Forbes mentions a bone, or bones, of *Biziura* without specifying which bone he had, or its locality. The latter is, presumably, Enfield Swamp. He states: "The present species is named *Biziura lautouri* in compliment to Dr. H. de Latour, of Oamaru, to whom the author, as well as the Canterbury Museum, is deeply indebted for his kind aid in its acquisition of the recent important deposit of Dinornis



[Michael Trotter

Plate XX — Biziura lobata: Posterior aspect.
R. humerus AV. 7,116. M. Australia.
R. humerus AV. 11,160. ?M. Marfell Beach, Lake Grassmere, Marlborough.
R. humerus. ?F. Poukawa Swamp, Hawkes Bay.
R. tibio-tarsus. AV. 7,116. M.
Part R. tibio-tarsus. ?F. Poukawa Swamp, Hawkes Bay.



[Michael Trotter

Plate XXI — Biziura lobata: Anterior aspect.
R. humerus AV. 7,116. M. Australia.
R. humerus. AV. 11,160. ?M. Marfell Beach, Lake Grassmere, Marlborough.
R. humerus. ?F. Poukawa Swamp, Hawkes Bay.
R. tibio-tarsus. AV. 7,116. M.
Part R. tibio-tarsus. ?F. Poukawa Swamp, Hawkes Bay.

remains discovered near that town" (at Enfield Swamp). As the specimen, or specimens, mentioned by Forbes have disappeared, although it or they are possibly among the Forbes material in the British Museum of Natural History, one cannot be sure what he had. His description is inadequate and *"lautouri"* is a *nomen nudum.*

It is quite clear that Forbes considered his bone, or bones, as distinct from the Australian form, *Biziura lobata.* That he had a part skeleton of the latter for comparison is certain as it is still in the Canterbury Museum labelled in his handwriting.

In April 1963 Mr. J. R. Eyles found a right humerus in the sandhills at Marfell Beach, Lake Grassmere, Marlborough (C.M. AV. 11,160) which compares very well with the part skeleton Forbes left (AV. 7116, male). While in Australia recently, at the National Museum, Melbourne, I measured a series of skeletons of *Biziura*

lobata and there is no doubt that the Marfell Beach humerus belongs to this species, and is, so far as I am aware, the first New Zealand record.

On 10 August 1963 at Poukawa Swamp, Hawkes Bay, in Square M/10, Mr. Russell Price found a worn R. tibio-tarsus which also appeared to be a *Biziura.* As it was considerably smaller than the corresponding bone in the part skeleton I had for comparison I wondered if it might represent the form Forbes had. Since examining and measuring the skeletons in the National Museum of Victoria, I realised that it is well within the normal range of the species and is therefore the second New Zealand record. The part skeleton, AV. 7116, and the humerus from Marfell Beach, AV. 11,160, are from exceptionally large birds.

Unfortunately, the Australian skeleons had no indication of sex. Delacour, Vol. 3, p. 258, gives measurements which indicate that the female is much smaller than the male, although " there is a great deal of individual variation in size in both sexes." His measurements (on skins) are: " Male: wing 226-240 mm.; tail: 110-150 mm.; culmen: 43-51 mm.; tarsus: 48-52 mm. Female — wing: 180-218 mm.; culmen: 36-38 mm." No tail or tarsal measurements are given for the female.

I conclude, therefore, that AV. 11,160 is the humerus of a large male and Mr. Price's part tibio-tarsus is probably from a female.

I, also at the National Museum, examined skeletons of the Blue-billed Duck, *Oxyura australis* Gould, the wings and legs of which resemble *Biziura lobata* closely in bone structure, but which are much smaller.

MEASUREMENTS

	L.	P.	M.	D.	C.M.
Humerus:					
C.M. AV.11, 160	12.1	2.5	0.7	1.55+(a little worn)	
C.M. AV.7,110 male	11.9	2.45	0.65	1.525	
N.M. W.5353	9.7	2.1	0.55	1.15	
N.M. B.8662	9.7	2.05	0.55	1.225	
N.M. B.6808	9.4	1.9	0.55	1.0	
Tibio-tarsus:					
C.M. AV.7,110 male	11.9	1.4	0.725	1.5	
		---	0.6	---	
N.M. W.5353	9.9	1.1	0.55	1.2	
Poukawa actual -	9.0	---	0.6	---	
estimated -	9.7				
N.M. B.8662	9.45	1.025	0.525	1.2	
N.M. B.6808	9.0	1.05	0.55	1.125	

The National Museum, Victoria, specimens, and the Poukawa bone are probably female. I wish to thank Mr. A. McEvey for the opportunity to examine the Australia skeletons.

REFERENCES

DELACOUR, J., 1959: Waterfowl of the World, Vol. 3.

FORBES, H. O., 1892: **Preliminary Notice of Additions to the Extinct Avifauna of New Zealand (Abstract).** T.N.Z.I., Vol. 24, pp. 185-189.

SHORT NOTES

BROWN BOOBY IN BAY OF ISLANDS

On 17/5/68 about an hour before full tide 22 Gannets and 26 Pied Shags congregated to feed on a shoal of small fish, close inshore below my house on Kerikeri Inlet. The feast continued for about half an hour and was the source of quite unusual excitement and activity. The water was full of diving and surfacing shags, amongst which the Gannets dived continuously, sometimes shallow diving at an acute angle to the surface of the water, sometimes high diving from a height of 20 - 40 feet. Normally rather silent birds, on this occasion the Gannets were surprisingly vocal, frequently uttering one or other of two calls, a short "kook" and a rather high-pitched "kerree" or "skerree." Diving and circling amongst the Gannets was a Brown Booby *(Sula leucogaster plotus)*. This bird had first been seen on 13th May, fishing with a few Gannets, but too far out in midstream for effective observation, and was at that time thought to be probably a young gannet. On 17th May there was no doubt of its identity as the diagnostic characters — dark neck and chest, white underparts, underwing pattern of white bordered with brown, narrowly on the leading edge and more broadly on the trailing edge — were clearly seen in flight.

Gradually the intense activity declined; one by one the shags withdrew to dry off on the rocks, and the Gannets and Booby settled over a wide area of water. The Gannets rested, the Booby rested and preened until after the turn of the tide, when all the birds moved upstream to fish in a more leisurely manner for about an hour and a half before departing down the Inlet towards the open sea. On 18th May, again at about full tide, 23 Gannets flew up the Inlet in line ahead formation, followed later by 5 more Gannets and the Booby and joined by 11 Pied Shags. After fishing for a time in mid-channel the Gannets and Booby followed a shoal close inshore and engaged in a short period of very active fishing only a few yards out from a coastal shell-bank.

On 19th May the Booby was again present, this time fishing with 8 Gannets, in midstream on a falling tide. From 20th May till 3rd June it has not been seen, although Gannets have been on the Inlet on several occasions.

Although the Booby attached itself to the Gannets on and when moving to the fishing grounds it acted independently after the main fishing period was over. On 18th May, while the Gannets drifted down the Inlet towards the sea without any haste, the Booby flew by itself, straight, fast and low over the water. On 19th May the Gannets finished fishing and left the area at about 1645 hours, but the Booby fished on alone till about 1720 hours, sat on the water for ten minutes, and eventually flew straight and fast down the Inlet at 1730 hours, just before dusk. During the period of intense activity on 17th May my impression was that the Booby performed much wider aerial circles between dives than did the Gannets.

Although most of the records of Brown Boobies in New Zealand have been in the period December-March (Hauraki Gulf, 1952, 1953 and 1955; Cavallis, 1955; Bay of Plenty, 1960; Raglan, 1961; Takatu,

1962; Firth of Thames, 1965) there are records for May (Otaki, 1957), July (Napier, 1884), and September (Hauraki Gulf, 1962). The Kerikeri bird may have been blown south by gales which occurred in the second week of April, 1968.

Body somewhat smaller than a Gannet's, wings slightly shorter and seemingly narrower, it appeared to be a young bird in transitional plumage. The underwing pattern has already been mentioned. The white underparts were only slightly sullied, clearly demarcated from the dark brown neck and chest. Crown a warm brown when seen in full sunlight; upper parts brown, and the feathers appeared to have narrow slightly paler fringes, noted on two occasions when the bird was flying away from me with the sun in the right direction. In bright sunlight the bill was so shiny that its colour was difficult to see; in a better light it was noted as slaty grey with a blue tinge; the facial skin was also greyish, rather lighter in shade than the bill. Feet orange yellow; this could not be distinguished in flight but during the preen which followed fishing activity on 17th May the bird lifted one foot out of the water and gave a good view at fairly close range. The feather maintenance was fairly prolonged and apparently included an oil preen, as the bird was seen pecking at its rump, tail fanned and twisted to one side. Later the bill was rubbed over the rump, and this was followed by stroking and drawing movements and nibble preening. While the preening bird was working on the region of rump and upper tail coverts some of the displaced brown feathers appeared to have whitish bases. — A. T. EDGAR

★

BROWN TEAL RELEASED ON KAPITI ISLAND

Ten Brown Teal *(Anas aucklandica chlorotis)* were released by the Wildlife Service onto Okupe Lagoon, Kapiti Island, on 5 June, 1968. The liberation comprised six males (five hatched early December 1967, one an adult originally from Great Barrier Island) and four females (three hatched September 1967, one in December 1967). The nine young birds were all reared at the Mount Bruce Native Bird Reserve. The lagoon was revisited on 15 October 1968 and one Brown Teal female accompanied by four day-old ducklings were seen. Further Kapiti liberations of Mount Bruce-reared birds are planned and from this nucleus it is hoped that the species will eventually re-establish itself throughout the Manawatu coastal lake system.

— M. J. WILLIAMS

★

SMALL FLOCK OF WRYBILLS INLAND IN HAWKES BAY

On 5/4/68 I visited Lake Hatuma near Waipukurau in order to show a friend the Welcome Swallows which are usually to be seen there now. We found twelve Wrybills *(A. frontalis)* feeding on the mud which is quite extensive when the water is low. The lake is shallow and during a dry spell there is a considerable beach. I have often seen Wrybills on the mudflats at Porangahau rivermouth, some twenty miles from L. Hatuma. — HAZEL WATERS

(Records of the Wrybill away from the coast in the North Island are very few. The attractiveness of L. Hatuma for migrant waders was mentioned in Notornis 13, 171-2. At Porangahau where Wrybills may now be regular visitors on their migrations, they were first noted by Guthrie-Smith in October, 1910. — Ed.)

GLOSSY IBIS IN CENTRAL OTAGO

A few miles southeast of Ranfurly, just above the confluence of the Taieri and Kyeburn Rivers, the maps show "Taieri Lake." This is not actually a lake but an area of low-lying pasture enclosed by a low hillside and a wide bend of the Taieri River, which becomes waterlogged and ponded when the river floods, which it invariably does every winter and periodically during the spring; in autumn it is often dry and on at least one occasion was sown out in turnips.

During the course of a visit to the Kakanui Range we camped overnight at this place and early on the morning of 17/12/68 made a quick survey of the birdlife. Among the hundreds of Pied Stilt, assorted ducks and other aquatic birds, we were agreeably surprised to record three Glossy Ibis *(Plegadis falcinellus)*. Two stayed close together on the far side of a wet area about 100 yards off while the third was approached to within about 30 yards on the near side. It was a perfectly clear morning (6.30 a.m.) and good views were had with the glasses. (Mr. J. A. Stringer, who farms the area, said there were 'about eight or nine' of these birds and that they had been here 'about a fortnight'; in the time available we searched most of the nearby wet area but could find no others; however, they could have been over at the river or at another marshy area a mile or so west.)

The birds were feeding in the weedy shallows and at one time took to wing with a flock of stilts, returning to the same spot. No calls were heard. The lone bird seemed a fraction smaller than the other two. In size they were comparable to a White-faced Heron, perhaps shorter in the neck and rather heavier in the body; the wing-beat slightly faster than the heron's and less 'floppy.' Head, neck, upper breast and back were a rich rusty colour, while the dorsal wings, rump and tail showed dark bronzy with purplish reflections, very irridescent in the early morning sunlight. The bill appeared 4 to 5 inches in length, typically ibis-shaped, and both bill and legs appeared charcoal grey.

I believe this to be the first recorded sighting of the Glossy Ibis in Central Otago.

— PETER CHILD

[Taieri Lake, an extensive green oasis in a rather dry land, was briefly visited on 17/1/69 by Dr. Bob Smith, Mr. F. C. Kinsky, Richard Gray and the editor. A flock of ten Glossy Ibises was quickly located feeding and resting in shallows not far from the railway line. — Ed.]

★

RAIL IN EEL

On 2/6/68 a very large eel, six feet long, was caught by Mr. J. Harper in a farm pond at Kohekohe on the Awhitu Peninsula. When the eel was opened up the remains of a Spotless Crake *(P. tabuensis)* were found in its stomach. Mr. E. G. Turbott assisted in the identification.

— H. R. McKENZIE

GODWITS IN SOUTH WESTLAND

On 8/10/67 Mr. R. Cleland, Chief Ranger, Mt. Aspiring National Park, informed me that he had seen some birds which he did not know among a group of oystercatchers south of Haast near the Nolans' homestead on the Okuru road. Accordingly I visited the area and found four Bartailed Godwits *(L. lapponica)* feeding in the short grass along with 12 S.I. Pied Oystercatchers *(H. o. finschi)*, 5 Black Oystercatchers *(H. unicolor)*, 8 Paradise *(T. variegata)* and some other ducks. One of the Godwits still had a trace of breeding plumage.

Mrs. R. Nolan, in front of whose home the birds were feeding, told me that they had been there for a week. When I revisited the area on October 14th and 28th there were still four Godwits but only six Pied Oystercatchers. A further visit on November 5th revealed twelve Godwits and no other waders or ducks. They were feeding widely spread over a large paddock, undisturbed by the dogs and cattle.

There are few, if any, records of these Godwits so far south in Westland.

— ALAN WRIGHT

★

MALE BELLBIRDS LOCKED IN COMBAT

Shortly before dusk on 25/9/68, while walking through beech forest in the Buller Valley near St. Arnaud, Nelson, I noticed what at first glance appeared to be an injured Bellbird *(Anthornis melanura)* on the forest floor. Closer inspection showed two Bellbirds locked tightly together.

The two birds were holding each other by claws dug deep into head and body. They were lying breast to breast with wings tightly folded; one bird was curled up with its head tucked in, while the other's head was free. The latter had an opponent's claw dug in only a few millimetres from one eye. Neither bird made any sound and except for occasional muscular contractions hardly moved even when picked up.

The birds were separated with difficulty, for on being pulled free the claws immediately took a new hold. The gripping of the birds' claws into each other, and into me when separating them, seemed to be a reflex action over-riding any desire to escape.

Deep purple plumage on the top and sides of the head indicated that both birds were males, and each weighed about 35 grams (taken on a 100 gram spring balance). The birds were released about three minutes after being separated. One flew only 10 feet to a low branch where it sat quietly for several minutes, while the other moved further away and was soon out of sight.

During September Bellbirds are establishing breeding territories, a period when a rise in the level of testosterone in the blood dramatically increases the aggressiveness of many birds (A New Distionary of Birds, ed. A. L. Thomson, 1964, p. 41). However, prolonged physical assault seldom occurs with wild birds, being replaced by aggressive movements, postures and vocal threats that repel or intimidate without recourse to actual fighting. Physical combat is in fact disadvantageous since it requires much energy and exposes the birds to attack by predators. Indeed the present birds would have been very vulnerable to a passing stoat, cat, or rat.

— R. H. TAYLOR

A FURTHER RECORD OF AMERICAN WHIMBREL

On a routine check of the birds at Mataitai, Clevedon, on 29/9/68, a close party of eight female Bar-tailed Godwits busily feeding, was noted in a wet field just inland from the tidal mudflat. When a four-foot telescope was swung round on its head-high tripod to check them, a feeding Whimbrel *(N. phaeopus)* was found about a chain from the Godwits. At about one hundred and twenty yards the big telescope revealed more detail. The size and uniformly dark brown colour indicated the possibility of its being an American Whimbrel, so the telescope was held on it until a Harrier put the birds up. The Whimbrel flew out on to the mudflat where a team of young birdwatchers was operating. The bird was disturbed and flew several times without going further away. Its back and rump were shown each time, but on three occasions distinctly, and they were as brown as the rest of the upper surface. It has become a habit with the writer to check all Whimbrels seen for the light rump and lower back of *variegatus,* the wholly strong brown of the upper surface of *hudsonicus,* and the cream and light chocolate of the upper tail of *tahitiensis.*

The wariness and restlessness of this bird, which had gone the next day, agreed with my experience with an American Whimbrel at Ohiwa Harbour, Bay of Plenty, in 1949 (Notornis 4, 18-21).

— H. R. McKENZIE

[Most Whimbrels in New Zealand, whether *variegatus* or *hudsonicus,* are flighty and restless. — Ed.]

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LETTER

The Authorship of *cristatus* for the Owlet-Nightjar

Mr. R. J. Scarlet's confusion in the matter of the authorship of *cristatus* for the Owlet-Nightjar is understandable because, as he mentions (*Notornis,* Vol. 15, 1968, p. 257), some recent authors attribute the name to John White (*Journal of a Voyage to New South Wales,* 1790) while others give the authority as Shaw *(loc. cit.).* However, as far back as 1834 Swainson (*A Preliminary Discourse on the Study of Natural History,* p. 65) indicated that the names of the birds described in White's *Journal* were given by Shaw, as did Sherborn in 1891 (*Ann. Mag. Nat. Hist.,* Vol. 7), the *Dictionary of National Biography* in 1897 (Vol. 51, p. 436) and Waite in 1904 (*Memoirs (2) N.S.W. Naturalists' Club*).

A perusal of the paper in the *Emu* (Vol. 23, 1924, pp. 209-215) dealing with White's *Journal,* and subsequent relevant correspondence (*Emu,* Vol. 24, p. 70, p. 71, p. 147) leaves no doubt at all that Shaw was responsible for the scientific names of both the birds and the fish described in White's *Journal* and that the botanical names and those of the mammals were given by Dr. Smith and John Hunter respectively.

The correct usage of *cristatus* Shaw in its present combination with *Aegotheles* is *cristata.*

The names mentioned above are well known in the realm of the natural sciences. William Swainson (1789-1855) was an outstanding English naturalist and a gifted delineator of natural history objects, being chiefly interested in ornithology, entomology and conchology. Many of his finely-drawn text figures were later used by Alfred Newton in *A Dictionary of Birds* (1893-6). Swainson emigrated to New Zealand, leaving London in 1840. He is not to be confused with his namesake, William Swainson, who seems to have reached New Zealand from England, by way of Tasmania, about the same time and who later became Attorney-General in New Zealand. William Swainson, the naturalist-author-artist, is buried in the cemetery at Lower Hutt, near Wellington.

Dr. Charles Davies Sherborn (1861-1942) was the great bibliographer and compiler of the *Index Animalium* (1890-1933). Smith was Dr. (later Sir) James Edward Smith (1759-1828), an eminent botanist, a close friend of Sir Joseph Banks, and one of the founders of the Linnaean Society of London of which institution he was President for forty years. In 1784 he purchased Linnaeus' famous collection. Dr. George Shaw (1751-1813) was also one of the founders of the Linnaean Society. He was Keeper of the British Museum and author of a number of books on natural history. John Hunter (1728-1793) was the famous surgeon and anatomist. Waite was Edgar Ravenswood Waite (1866-1928), an Englishman from Leeds who became Curator of the Canterbury Museum, Christchurch, New Zealand, in 1906 and, later, Director of the South Australian Museum.

John White (1756?-1832), in whose *Voyage* the name *cristatus* appears, was Surgeon-General of the colony founded at Sydney in 1788. He was an enthusiastic amateur naturalist and sent many specimens and drawings of plants and animals to scientific friends in England.

Sydney, Australia. — K. A. HINDWOOD

★

REVIEWS

Field Guide to the Alpine Plants of New Zealand, by Professor J. T. Salmon; A. H. & A. W. Reed, $5.60.

If you spend most of your days, as most of us do, in the lowlands but are able once in a while to make an excursion into the mountains, this is one of the books you must have in your car pocket or knapsack. We are assuming, of course, that you are an intelligent lover of the New Zealand scene with a discerning eye for its bewildering array of choice alpine plants and the curiosity to want to know what they are. For the naturalist there is a new world in the high country. It may have some sharp surprises for the uninitiated. If you have experienced the agony of sitting unexpectedly on one of the less tractable species of speargrass — incidentally, is it good for international relations to call them Wild Spaniards? — it may be some balm to your soul, if not to your seat, to be able to identify the spiny offender on the spot. Dr. Salmon's strongly bound field guide with its hundreds of admirable photographs is the magic key.

One word of warning to the birdwatcher. With this new botanical field guide to hand, he may easily be side-tracked; for above the bushline, while the ornithologist has only a bare handful of species

to lure him on, the botanist commonly finds himself in the midst of an almost fulsome *embarras de richesse.* While your birdwatcher seeks the elusive Rock Wren he may be diverted by the charm of shining clumps of Snow Marguerite — it is some consolation to learn that all the outlandish scientific names are not confined to ornithology; or as he watches the soaring Keas he may find some gratification in knowing that at his right hand there is growing a species of Maori Onion and at his left a native Edelweiss.

Let it be noted that this practical guide to our alpine flora has been assembled by an entomologist. To the ornithologist it offers an exciting opportunity to broaden his horizons. Birds as well as insects are very much related to their botanical environment.

— R.B.S.

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"The World of Birds," by James Fisher and Roger Tory Peterson. Publ. Macdonald, London. 5 Guineas.

Among the many exasperating follies of the mid-twentieth century, some signs of grace may yet be found; and one of these is the determination of its dedicated naturalists, aided by gifted artists and the skilled craftsmen of the publishing trade, to press on with the production of sumptuous volumes on natural history.

In " The World of Birds," two ornithologists of international standing have collaborated to compile ' a comprehensive guide to general ornithology.' The format is a happy blending of text and pictures. Here we have something for every birdwatcher whatever his special interest, and many a knotty term — e.g. convergence — is elucidated and graphically illustrated. James Fisher casts his net wide. His text is good red meat and it is admirably garnished by Roger Tory Peterson's vivid paintings. New Zealand is not neglected. It is pleasing to see on p. 128 a facsimile of one of Ross McKenzie's nest-record cards; and gratifying on p. 143 to find Notornis among the emblems of famous ornithological societies.

It may be invidious to single out for praise any special chapter; but those on fossil birds and evolution seem to be of outstanding merit especially for all amateurs who are minded to ponder these thorny topics. Also particularly enlightening is Chapter VIII on ' The Regiment of Birds.' Nearly 100 pages are given to distribution maps on the different orders, sub-orders and families. New Zealanders would be repaid by studying these maps. The authors make no bones about placing Piopio among the Whistlers, a view likely to be supported by taxonomists who have been able to watch the endemic ' Tamies ' of Norfolk Island.

A few slips and omissions have been noted; and minor blemishes though they are, in the interests of truth they should be mentioned.

p. 115. It is stated that since 1916 only two new seabirds have been discovered, Murphy's Petrel (1949) and Jouanin's Petrel (1955). Might not a New Zealander interject, " What about Pycroft's Petrel (1932) and Westland Petrel (1946)?" Moreover the identity of the once elusive Hutton's Shearwater has been substantiated and thanks to Geoff. Harrow its montane breeding grounds have been revealed. If Dr. Bourne's conjecture that *Pterodroma magentae* was the Taiko of the Chatham Islands is correct, its nesting was certainly known to Polynesian man and possibly to some early European settlers and seafarers.

p. 157. On the distribution map of the Pelicans, New Zealand is shown as a blank, though sub-fossil bones were found at Waikaremoana and described in 1931; and now similar bones have been recovered from a number of sites in the North and South Islands. There is, moreover, the story of an Australian Pelican shot on the Wanganui River in 1890.

p. 216. The colonisation of New Zealand by the Welcome Swallow since 1958 has escaped notice, although it is quite as dramatic as the spread of the Collared Dove across Britain. On the map New Zealand shows white, but has earned its blue.

p. 221. It should have been mentioned that the Hedge Sparrow was introduced to New Zealand and has become one of the most widely distributed passerines.

pp. 222, 234, 236. A false impression may be given by the phrasing as it stands. It is not made clear that Blackbirds and Song-thrushes, Skylarks and Starlings, and several species of finches, after being introduced to the two main islands, spread of their own accord across hundreds of miles of open sea to many outlying islands from Norfolk and the Kermadecs to Macquarie.

p. 230. There is no indication that Buntings are not indigenous to New Zealand.

p. 237. The colours have been transposed so that Australia is credited with Wattled Crows and New Zealand with Magpie Larks.

This is a noble and inspiring book which should be available to all students who are seriously concerned with the current problems of ornithology and conservation — the more so as on every copy sold a royalty is being paid to the World Wildlife Fund.

— R.B.S.

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A Portfolio of Australian Birds, by Wm. T. Cooper and K. A. Hindwood, A. H. & A. W. Reed, $9.95. Folio size 14 x 11 inches.

Several books of Australian birds of a somewhat similar type have been published over the past two or three years, but of them all, this book in my opinion is quite outstanding. It contains a random selection of 25 birds exquisitely painted by Mr. Cooper, who before turning to bird portraiture had already earned a reputation for his landscapes and seascapes. Each plate reveals the close study the artist has made of the bird in the field, and conveys its 'personality' to a marked degree. Keith Hindwood, one of Australia's leading field ornithologists, writes an interesting and informative text on each of the birds illustrated; and together the authors have certainly achieved their stated aim of indicating 'the beauty and interest that lies in the rich and varied avifauna of Australia.' Many ornithologists and bird-lovers are not disposed to invest in rather expensive publications of this kind; but this is a book with a difference. It is a book to gloat over, and to bring on a nostalgia in those who know something of Australia's birds. Whilst the book will surely have a wide appeal to the public, it is the discerning ornithologist who will really appreciate the accurate portrayal of each bird in plumage, attitude and stance, and background of foliage. May these authors produce other portfolios of equal perfection in due course.

— A.B.

Penguins. John Sparks and Tony Soper. Angus & Robertson Ltd. $6.50.

Penguins for some odd reason or accident are very much " in " at present. This is the second book on the subject I have been asked to review in the last six months (the other was written by Dr. Bernard Stonehouse). Though this is the larger and more comprehensive of the two, it is not so well written. My guess is that neither of its authors has ever seen a penguin in the wild. That authors have not been in the field with the animals they write about does not automatically preclude them from writing a good and lively book, but it does make such an accomplishment more difficult.

The first chapter, which is on penguins as birds, is the most interesting though perhaps rather untidily written. The remaining chapters deal with courtship and nest-making, family life and return to the sea, food and predators, the evolution of penguins, their discovery, their exploitation and notes on the various species. There is a fairly extensive list of references, a short appendix on keeping penguins in captivity, and an index.

Illustrations (photographs, drawings, charts and maps) are plentiful and good. An unusual but useful feature is the series of full-page coloured drawings, with attendant notes, of each of the 17 species recognised by the authors.

With so much material being used at second hand, minor misprints and errors are inevitable. For example, on page 56 Adelies are said to have travelled at a speed of eight miles an hour in a homing experiment; surely eight miles a *day* is what is meant. Stephens Island has became St. Stephens Island on page 21 and Caughley is spelt Cuahley on page 243. Regrettably the authors refer to "the increased logistic capability" and the " bio-economics " of Antarctica on page 128, but such gobbledygook is mercifully rare.

This is a good book on the general biology of penguins and it is gratifying that New Zealand workers on the species are so well documented in it. The authors have done their reading widely and well.

— G.R.W.

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LITERATURE AVAILABLE

The following are available on order from Mrs. H. R. McKenzie, Box 45, Clevedon:

Back Numbers of Notornis at 50c each. Large orders for full or part sets at special prices.

O.S.N.Z. Library Catalogue, 70 pp., 50c.

Banding Reports, Nos. 8 to 14, 50c each. Nos. 1 to 7 are incorporated in early issues of 'Notornis.'

Kermadecs Expedition, 1964, by A. T. Edgar. Reprints at 45c.

From all bookshops:

A Field Guide to the Birds of New Zealand, by R. A. Falla, R. B. Sibson and E. G. Turbott. $4.50.

From O.S.N.Z., Box 40-272, Upper Hutt:

A Biology of Birds, by B. D. Heather. $1.33 post free.

From B. A. Ellis, 36 Hartley Avenue, Christchurch 5:

Field Guide to the Waders, by Condon and McGill. Price 65c.

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OTAGO: Dr. R. F. Smith, Dept. of Chemistry, University of Otago
SOUTHLAND: R. R. Sutton, P.O., Lorneville, Invercargill

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LABOUR DAY WEEK-END STUDY COURSES, 1969

Preliminary advice is given of week-end courses to be held in October 1969 in the following areas:—

North Island: Not yet arranged.
South Island: Lake Ellesmere.

Full details will be announced later.