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## FOOD HABITS OF THE NORTH ISLAND WEKA

By A. L. K. CARROLL

Until comparatively recent years, Wekas, *Gallirallus australis greyi*, abounded throughout the North Island, ranging freely wherever there was food and cover sufficient for their needs. Reports from early settlers contain frequent references to the amusing antics and annoying habits of these flightless birds, which were numerous and enterprising enough to become pests in many places. Following settlement of the land, they decreased in numbers, but it was not until approximately 40 years ago that they had disappeared almost completely, leaving a small residual population in the East Coast district and a few birds in the vicinity of Waipu, Northland (R. T. Adams, pers. comm., Int. Affairs file). It is possible that the sudden disappearance was due to an epidemic, as reports were received from people who had at that time seen numbers of Wekas in poor condition and infested with ticks.

Those surviving in the East Coast area soon multiplied rapidly and are now to be found occupying roughly 1,200 square miles, with highest concentration of numbers in the Gisborne-Tolaga Bay district, cf. Fig. 1.

Here they continue to flourish to such an extent that they have become a nuisance to local farmers and market gardeners, particularly in the dry summer months, when they peck the succulent tomatoes, melons and pumpkins, rob fowl-yards and dig up plants in search of insects. Oliver (1955) writes that against the Wekas' misdeeds must be set the fact that they consume large quantities of grass-grubs and other noxious insects, as well as rats and mice. However, as a result of complaints made to the Department, Wekas are now being trapped in the Gisborne district for subsequent liberation in selected sites in the North Island. These operations have met with varying degrees of success. In some areas it would appear that colonies have become firmly established as a result of liberations.

The primary purpose of the present investigation was to examine food habits of the Weka, but other work of a more general nature was also undertaken.

From June 1961 to December 1962 Wekas were collected in the Gisborne area at the rate of approximately five a month. These were frozen and sent to Wellington for examination. Altogether 94 specimens were studied — weight and external measurements taken, condition of internal organs noted, bursa, caeca and adrenals measured, reproductive organs examined and stomach contents sorted, identified and measured. A collection was made of wings and tails of these specimens as a basis

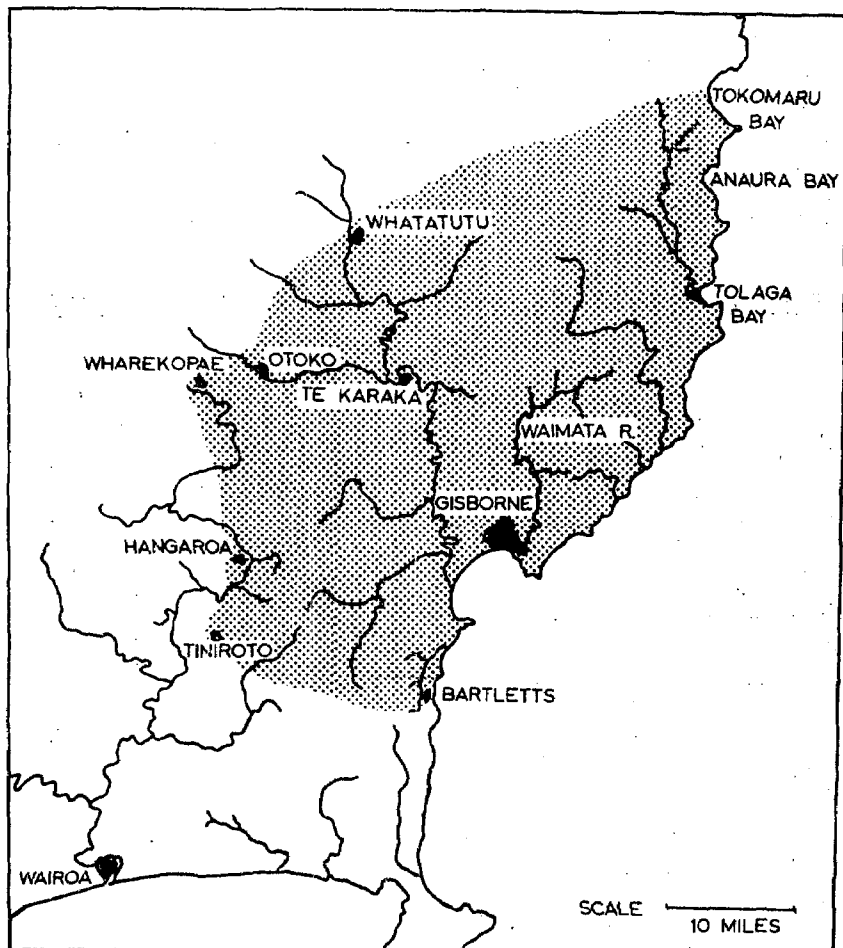


Fig. 1 — Showing maximum reported range of Weka population in East Coast area. November, 1962.

for future work on moult sequence. The number of birds studied thus was not great, but nevertheless should be considered as a reasonable sample.

In early November 1962 I visited Gisborne for the purpose of studying Weka habitat and conferring with Mr. T. P. Fisher, Senior Field Officer at Gisborne, who is responsible for all Weka work in that district. Specimens of plants were collected, Weka habitat inspected and photographed and local residents interviewed. This field study provided the background essential to completion of the work done in the laboratory.

## HABITAT

North Island Wekas range from sea level to 1,500 ft. Primarily birds of marginal bush and open scrubland (see Pl. 1), they have adapted themselves to a wide variety of conditions wherever there is cover and water sufficient for their needs. Although they may be seen on the beaches, in back-yards and in cultivated areas, they are particularly numerous in semi-open farmland on the hills behind Gisborne. Here there is rough pasture, scrub in the gullies and adequate water (see Pl. 2). An important feature in this area is the presence of 'under-runners,' formed by subsidence of the soil immediately below the surface, resulting in a network of burrow-like tunnels with numerous openings to the surface. These provide ideal covered runways. Sedge (*Mariscus ustulatus*) is the dominant plant in much of this country, the low-growing tussocks providing dense cover, while not hindering the rapid movement of the birds (see Pl. 3).

As a large proportion of the specimens examined in the laboratory were collected from the Waimata Valley, a special study has been made of this area. Conditions are as described above. The hills are sheep pasture with numerous mariscus clumps, especially on the banks of water courses. Scrub grows in the gullies and rushes are common on the flats. The hills are honeycombed with under-runners, while piles of cut and dried scrub provide additional cover.

Another particularly favoured type of Weka habitat is dense cover, such as blackberry (*Rubus fruticosus*), growing on the margins of cultivated fields. Drains provide excellent runs with maximum shelter, and plantations with undergrowth are favourite haunts, especially when inkweed (*Phytolacca octandra*), is present. Wekas are frequently to be seen on the roads, emerging from marginal drains or long grass, running swiftly across, neck outstretched, to disappear in similar cover on the other side. It is here that many are killed, indeed, in some places dead Wekas are almost as numerous on the roads as are dead hedgehogs (Pl. 4).

Wekas nest on the ground, most commonly in tall crops, in long grass at the base of bushes, or among the exposed roots of trees. However, I observed one nest quite in the open on a road-side bank and another in the tool-shed of a suburban garden in Gisborne.

## FEEDING HABITS

Although primarily carnivorous, Wekas are omnivorous. Thus not only do they hunt the wire-worms and cut-worms at the roots of young corn plants, but they eat the remains of the grain from which the plant has sprouted. Fig. 2 shows Weka damage to young corn. In the dry summer months they attack juicy fruits, such as tomatoes. This is probably in search of liquid, as gardeners tell me that if containers of water are placed among the plants the Wekas usually drink from these instead of pecking the fruit.

It would seem that they deserve their reputation for causing damage in fields and gardens, but impartial observers assure me that they probably do no more than pheasants and blackbirds. These peck at random throughout a crop, whereas Wekas feed in a limited area, usually close to cover. Thus the damage they do is obvious. Also their boldness brings them closer to habitation so that they are frequently observed.



Fig. 2 — Young corn plants showing Weka damage.

As Wekas have no crop, the gizzard contents provided the source of material for food studies. This meant that the food was finely ground, making sorting and identification a laborious process. It was impossible to make a true quantitative analysis of gizzard contents as the soft parts of the food soon disappeared, leaving a residue of harder portions of the plants and animals eaten. However, from these hard remains it was possible to make a qualitative food analysis.

Although 94 specimens were collected, the gizzard contents of only 86 were used in the final examination. Six young chicks were excluded and the other gizzards were either empty or decomposed beyond the possibility of examination.

It is important to note that measurements of both volume and weight were of dried material.

#### *Grit.*

Grit was nearly always present and commonly consisted of a few large, irregular stones together with a little fine sand. It comprised 18.69 per cent. of the total volume and 53.18 per cent. of the total weight of the gizzard contents.

In order to calculate percentage volumes and weights of different types of food in the gizzard, the grit was subtracted from the total contents leaving vegetable, seeds, animal and miscellaneous, which were then presented as percentages of the total food. This was done for each month as well as for the whole year.

Identification of plant material has been based on Allan (1961) and Hyde (n.d.), determination of insects and other invertebrates on Hudson (1892), Imms (1947 and 1951) and Parker and Haswell (1940). *Vegetable*.

This consisted of grass leaves and stalks, fibres (possibly from tough leaves and stalks, e.g. sedge), small pieces of wood, clover leaves, small leaves (e.g. manuka *Leptospermum scoparium*) and occasionally moss. There was usually a residue of finely-ground, unidentifiable vegetable matter. Grass was a consistent item of diet, occurring in 50 gizzards throughout the year, fibres were found in 31, small pieces of wood in 23 and clover leaves in 20; small leaves were found in 9 and moss in 3 specimens.

For the whole year the percentage volume of vegetable matter, excluding seeds, was 55.68 cc. and the percentage weight 46.17 gms. Examination of the monthly figures showed that there was a higher percentage of vegetable matter eaten in the winter months. The figure for June appeared to be an exception, but could be explained by the fact that during that month two of the seven gizzards were stuffed, one with maize and one with pumpkin seeds.

Possibly a significant proportion of vegetable matter was taken accidentally by the birds while foraging for larvae, earthworms and other ground-dwelling animals.

#### Seeds.

These comprised 13.20 per cent. by volume and 21.16 per cent. by weight of the total food. Although a great variety of seeds was taken, the most commonly occurring belonged to a few families. Most important of these was the family Graminae, with goosegrass (*Bromus*

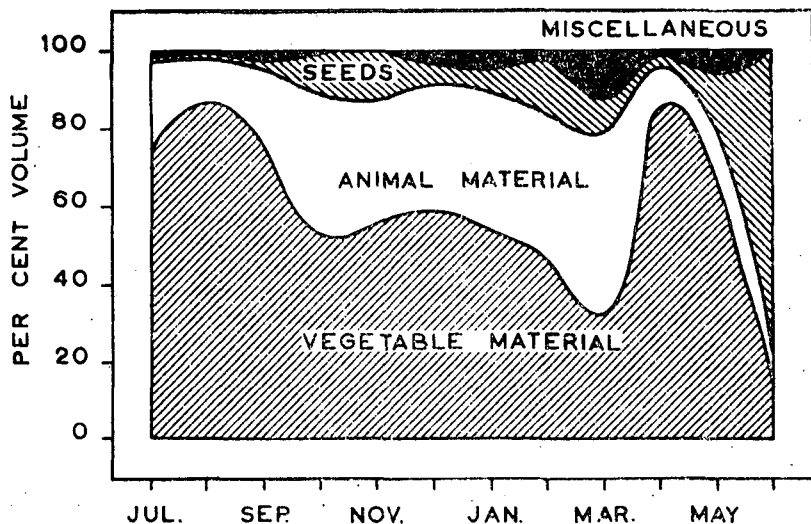


Fig. 3 — Showing seasonal variation in types of food taken by Wekas, expressed as percentages of the total volume (dried).

*mollis*), rough dogstail (*Cynosurus echinatus*), ratstail (*Sporobolus capensis*) and sweet vernal grass (*Anthoxanthum odoratum*) most frequently eaten. Legumes were also a popular item of diet, these being represented usually by clovers (*Trifolium repens* and *T. glomeratum*). Others occurring with moderate frequency were sedge (*Mariscus ustulatus*), black nightshade (*Solanum nigrum*), sheep's sorrel (*Rumex acetosella*), members of the thistle family (*Cirsium vulgare* and *C. lanceolatum*), *Coprosma* (family Rubiaceae) and inkweed (*Phytolacca octandra*).

#### Animal.

This furnished 28.54 per cent. by volume and 28.09 per cent. by weight of the total food consumed during the year. It formed a significantly lower proportion of the stomach contents during the winter months.

The Weka is well-equipped for obtaining ground- and wood-dwelling animals. Its long, powerful beak and strong claws enable it to dig for earthworms and larvae, also to tear open rotten wood in search of insects living under the bark or in the recesses of the wood itself.

The animal diet was found to be extremely varied, although, as one would expect in the case of a flightless bird, it was confined almost exclusively to animals dwelling in or close to the ground. The most important of these were undoubtedly insects, of which members of the beetle family predominated.

These were eaten during all months of the year with the exception of August. Beetles commonly taken, whether in adult or larval form, belonged to a relatively small number of species. Click beetles (Elateridae) and ground beetles (Carabidae) appeared in 24 and 23 stomachs respectively, while huhu beetles (Longicornia) were also popular, being present in 20 stomachs. Less important but still significant were other members of the Carabid family, also brown and green chafers (Scarabidae).

Orthopterous adults supplied an important part of the insect food, and in 4 specimens orthopterous egg-cases also were found. Of these, by far the most frequently taken were wetas (*Deinacrida megacephala*), appearing in 33 stomachs. It would appear that, in some cases at least, the hard mandibles of these insects were functioning as extra grit in the grinding of food. Grasshoppers and locusts, members of the families Acridiidae and Tettigoniidae, had been eaten by 13 birds, and cockroaches (Blattidae) were found in 3 specimens.

Next in importance among the insects were members of the Hymenoptera. Ants (Formicidae) were most commonly found, appearing in 10 gizzards, while ichneumon flies (Ichneumonidae) were in 2 gizzards. Round galls containing hymenopterous insects were found in 2 specimens. One bird had made such a large meal of galls that its gizzard was quite distended.

Other insects were lepidopterous pupae (*Porina* sp.) found in 7 specimens and shield bugs (Pentatomidae) in 3.

Insect eggs were a frequently occurring item of diet and had been eaten by 23 birds. Three specimens contained the puparia of blowflies (Calliphorinac).

Molluscs, represented by slugs (*Limax*) and very small snails, had been picked up by 18 birds. The only part of the slugs remaining was the internal shell. Snails were of various species although the most frequently occurring was *Potamopyrgus* sp. Only once was the radula of a land snail (*Helix*) found.

Crustacea appeared in 15 specimens. These were of two kinds — slaters (Isopoda) and small fresh-water shrimps (Amphipoda). Slaters were taken more frequently than shrimps and occurred in 12 birds.

Spiders (Arachnida) were found in 6 stomachs.

Of the remaining varied items of animal food, only two were of significant occurrence. Egg-shell fragments appeared in 7 stomachs and bones of a frog, *Hyla aurea*, were found in 4.

One especially interesting find was the remains of a peripatus (*Peripatus novae-zealandiae*). This was in the gizzard of a bird collected in July from the Waimata Valley. These unusual animals, almost bridging the gap between arthropods and annelids, have not, to my knowledge, been previously reported from this area.

Of the remaining animal contents, by far the most important were earthworms (*Lumbricus*). These soft-bodied annelids were often detected only by the presence of residual setae, the rest having disappeared completely. Appearing in 65 stomachs, they frequently comprised a considerable proportion of the animal food taken.

Members of the class Myriapoda were found in specimens taken in every month of the year. Millipedes (Diplopoda) were the only representatives of this group, apart from one centipede (Chilopoda), and occurred in 23 gizzards.

#### Miscellaneous.

This material comprised 2.58 per cent. by volume and 4.58 per cent. by weight of the total food consumed. Most of the items appeared to be of casual origin, e.g. fragments of sheep's hoof and a piece of wire. I placed in this category also any inextricably mixed residues of powdered sand and organic matter, which occurred from time to time. It was of small importance and added little to the final picture of the Weka's feeding habits.

#### CHICKS

Six specimens were collected during the last three months of the year. They appeared to follow a feeding pattern similar to that of the adult birds, but, as was to be expected in chicks, with a higher intake of protein food.

#### SUMMARY

North Island Wekas, once plentiful, became almost extinct approximately 40 years ago, leaving only a small residual population in the Gisborne-East Coast area and Northland (Waipu). Since then they have multiplied rapidly in the vicinity of Gisborne and are now abundant in that part of the country.

Over a period of 18 months 94 Wekas were collected from the Gisborne district for study.

Gizzard contents were examined and were found to consist of vegetable matter, seeds, insects and other small invertebrates and occasionally birds' eggs and frogs.

Predominant items of diet were of plant origin — grass, fibrous material, small pieces of wood and clover leaves. A wide variety of

TABLE 1 — Total Volumes and Weights of Adult Stomach Contents (Dried)

Month	No. of Birds	Grit		Vegetable		Seeds		Animal		Miscellaneous	
		Vol. cc	Wgt. g	Vol. cc	Wgt. g	Vol. cc	Wgt. g	Vol. cc	Wgt. g	Vol. cc	Wgt. g
July	6	4.5	4.0	16.7	2.2	0.2	0.1	5.1	0.8	0.6	0.4
Aug.	5	1.8	2.0	7.4	1.0	0.1	trace	1.2	0.2	1.8	0.8
Sept.	6	7.2	7.9	10.4	1.6	0.2	0.13	1.0	0.1	—	—
Oct.	9	7.3	8.1	7.9	2.4	1.9	0.7	7.2	1.5	0.2	0.2
Nov.	16	11.2	12.4	41.9	3.7	9.7	1.3	24.1	3.4	0.3	0.2
Dec.	11	17.2	29.3	29.8	3.3	1.5	0.5	11.0	1.4	1.7	0.7
Jan.	6	4.0	4.9	11.8	2.3	1.3	0.6	9.3	3.5	1.3	0.8
Feb.	4	1.1	2.2	9.0	1.2	2.6	0.4	4.7	0.8	—	—
Mar.	5	2.7	4.0	5.1	0.7	3.6	0.7	9.3	1.4	3.2	0.4
April	5	1.7	1.9	21.7	1.6	0.3	0.1	1.5	0.2	—	—
May	6	5.2	3.7	9.4	1.5	1.6	0.6	4.1	1.8	0.9	0.3
June	7	7.8	8.5	6.9	1.0	30.0	5.8	1.2	0.1	0.1	0.5



TABLE 2 — Total Volumes and Weights of Chick Stomach Contents (dried)

Month	No. of Birds	Grit		Vegetable		Seeds		Animal		Miscellaneous	
		Vol. cc	Wgt. g	Vol. cc	Wgt. g	Vol. cc	Wgt. g	Vol. cc	Wgt. g	Vol. cc	Wgt. g
Oct.	6	1.8	1.9	7.1	0.9	0.2	0.1	8.0	1.2	trace	trace
Nov.											
Dec.											

TABLE 3 — Percentage Volumes and Weights of Chick Stomach Contents (dried)

Month	No. of Birds	Grit		Vegetable		Seeds		Animal		Miscellaneous	
		Vol. cc	Wgt. g	Vol. cc	Wgt. g	Vol. cc	Wgt. g	Vol. cc	Wgt. g	Vol. cc	Wgt. g
Oct.	6	10.6	47.1	46.9	42.4	1.3	4.6	51.8	53.0	—	—
Nov.											
Dec.											

TABLE 4 — Frequency of Occurrence of Food Items in Weka Gizzards: Plant Origin

	Total	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June
No. of Gizzards Examined	86	6	5	6	9	16	11	6	4	5	5	6	7
<i>Vegetable —</i>													
Grass leaves	50	4	4	3	6	7	4	3	2	4	5	5	3
Fibres	31	1	2	1	4	7	6		1	3	4	1	1
Small leaves (e.g. manuka)	9			1	1	1	1	2	1	2			
Clover leaves	20	1		3	2	1	4			1	4	2	2
Small pieces of wood	23	2	3	1	1	3	3		1	1	3	3	
Moss	3	1						1					1
Fine vegetable matter	26	3	4	1	1	1	5	3		1	2	2	3
<i>Seeds —</i>													
Grass. Graminae	33	4	1	4	3	4	4	1	1		3	4	4
Clover. Leguminaceae	17	3		2	2	4		1			3	1	1
Sedge. Cyperaceae	15	4	2				2	2	1		2	1	1
Nightshade. Solanaceae	11					3			1	3		2	2
Dock family. Polygonaceae	9	1			1	1	1	2			1	2	2
Coprosma. Rubiaceae	8						2	2			2	1	1
Inkweed. Phytolaccaceae	6		2					1			1	2	
Rush. Juncaceae	4					2	2						
Thistle. Compositae	9			1	1		2	2	2			1	
Blackberry. Rosaceae	2				1			1					
Araliaceae	2				1			1					
Liliaceae	2	1		1									
Urticaceae	3					1	1		1				
Umbelliferae	3			1		1				1			
Verbenaceae	1									1			
Chenopodiaceae	1	1											
Geraniaceae	1	1											
Labiatae	1					1							
Euphorbiaceae	1						1						
Ranunculaceae	1							1					
Papaveraceae	1											1	

TABLE 5 — Frequency of Occurrence of Food Items in Weka Gizzards: Animal Origin

		Total	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June
<i>No. of Gizzards Examined</i>		86	6	5	6	9	16	11	6	4	5	5	6	7
<i>Animal —</i>														
Beetles.	Coleoptera	65	5		5	8	15	9	6	4	3	4	3	3
	pupae	1						1						
	larvae	12	2		1			1	3	1	1	1	1	1
{ Wetas and	Orthoptera	38			1	3	6	5	4	4	4	3	4	5
{ Grasshoppers.	Egg cases	4	3		1									
Ants, etc.	Hymenoptera	18		1		1	3	6	1	1	2	1		2
Moths.	Lepidoptera													
	larvae	7	1			1		1				1	3	
Bugs.	Hemiptera	3	1				1	1						
Flies.	Diptera	1	1										1	
	puparia	3			1					1				
Springtails.	Collembola	2				1	1							
Peripatus.	Onychophora	1	1											
Spiders.	Arachnida	6				1					2	1	1	
Insect eggs.		23	1		3	2	1		1	1	5	4	3	1
Millipedes.	Myriapoda	23	3		1	3	1	2	1	1	2	2	3	2
Slaters, etc.	Crustaceae	15	3	1	1	3	2	3			1	1		
{ Slugs and	Mollusca	18			2	2	4	4	1	2	1		1	1
Snails.														
Frogs.	Amphibia	4				1	1	2						
Egg shell.		7	2				2	1	1	1			6	7
Earthworms.	Annelida	65		5	5	6	8	8	5	3	2	5		

seeds was found, most common being of the grass family, with clover and sedge next in order of importance. Insects predominated in the animal food taken, the most important being beetles, wetas and grasshoppers. Earthworms also were a major item of diet, while insect eggs and millipedes were frequently found.

#### ACKNOWLEDGEMENTS

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### BREEDING CYCLE OF THE NORTH ISLAND WEKA

It is common for Wekas to nest more than once a year although chicks are particularly numerous during the spring months. Mr. A. Blackburn of Gisborne observed a pair of Wekas which raised four broods during one year — the first in March, the second in June, the third in September and the fourth in December. Each brood numbered two or three chicks. Mr. C. Burland of Patutahi reported similarly, the broods he observed being raised in June, August, November and March. There are usually 3-4 eggs in a clutch although Mr. Blackburn reported 6 eggs as not abnormal and 5 quite usual.

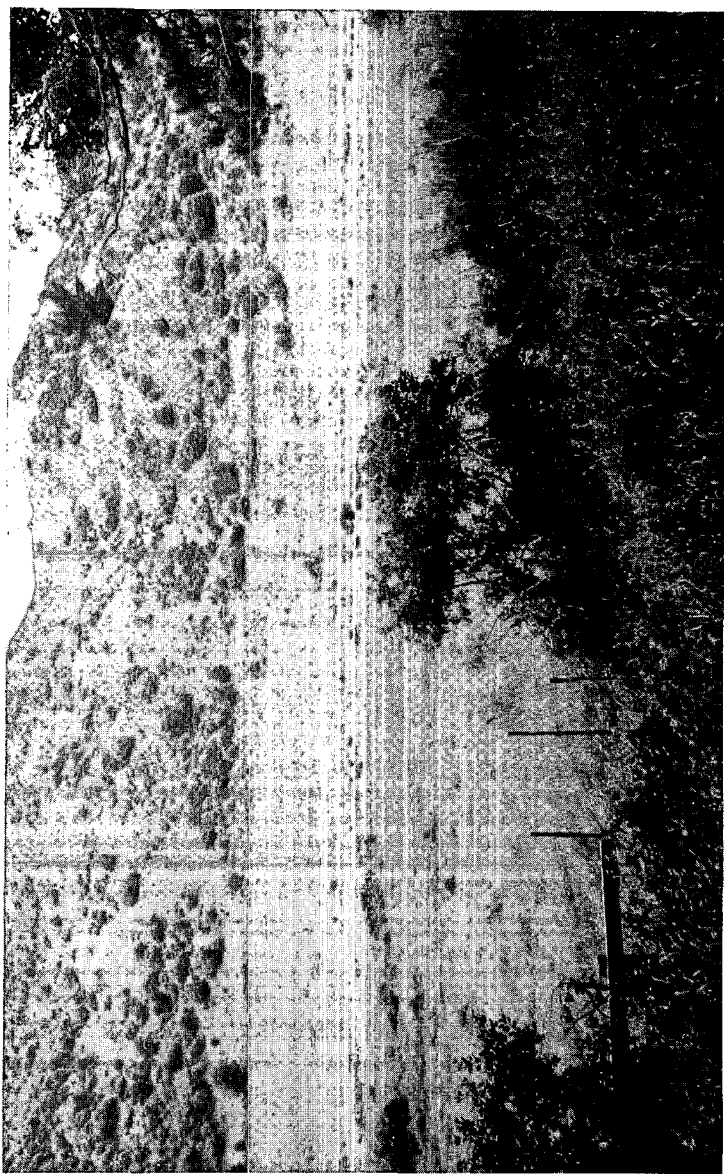
I have been able to find the following nesting records:—

25/10/52	nest	(Notornis, 5: 222. J.D.C.)
5/8/52	nest with 3 eggs	(Notornis, 6: 94. J.M.M.)
24/5/54	nest, 4 hatched	(Notornis, 6: 94. A.B.)
10/9/54	nest with 2 eggs	(Notornis, 6: 94. Mr. P. Benson)
6/53	nest, 4 hatched, 3 reared	
8/53	nest, 2 hatched, 2 reared	
11/53	nest, 3 hatched, 3 reared	(Notornis, 6: 94. Mr. C. Burland)
3/53	nest, 3 hatched, 3 reared	
6/54	nest, 3 hatched, 3 reared	



[Kaj Westerskov

XXVII (1) — North Island Weka moves freely between open country and scrub.



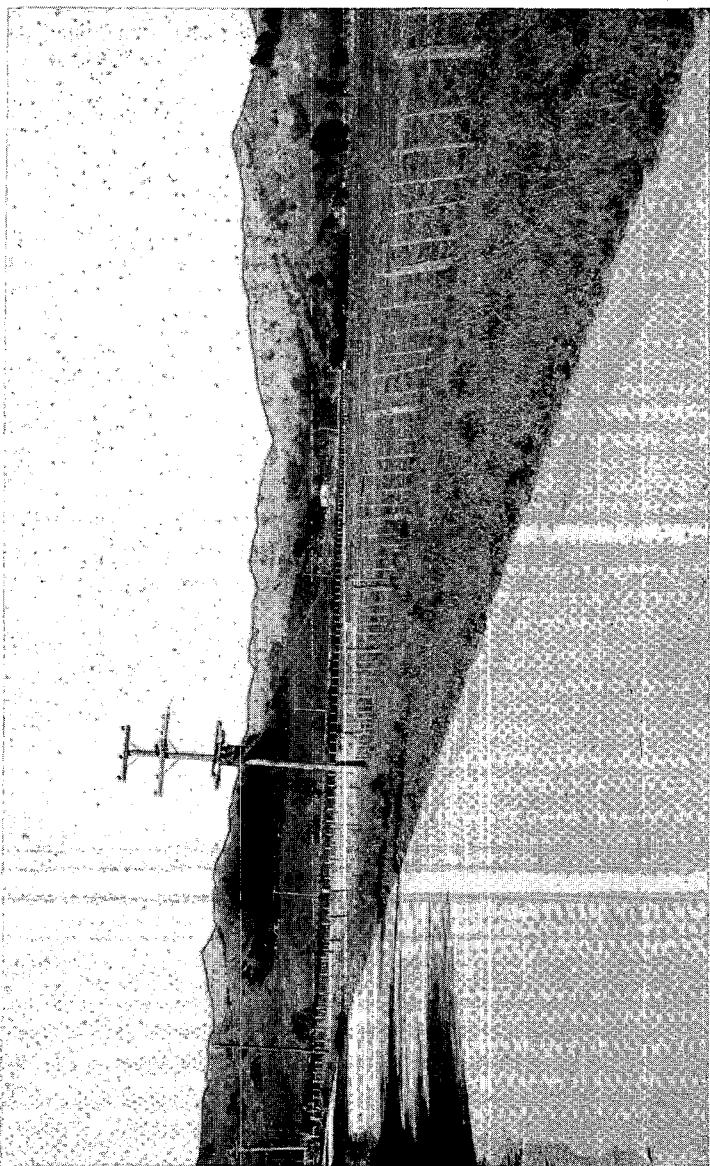
[A. L. K. Carroll

XXVIII (2) — Wekas abound on these hills near Gisborne.



[T. P. Fisher

XXIX (3) — Sedge (**Mariscus ustulatus**) provides excellent cover for Wekas.



[A. L. K. Carroll

XXX (4) — Typical Weka country, Taurau Valley, Gisborne.