ECOLOGICAL STUDIES OF THE AUCKLAND ISLANDS FLIGHTLESS TEAL[1]

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THE Auckland Islands Flightless Teal (*Anas a. aucklandica*) is one of three species of flightless ducks. The other two are steamer ducks of the genus *Tachyeres* also found in southern oceans, but in the Magellanic Region. The history of the discovery of the Auckland Islands Flightless Teal was reviewed by Scott (1971), but little else has been published about it in spite of several major expeditions to the islands (Taylor 1971). The general morphology of this drab, reddish brown duck was described by Phillips (1923: 89) and Delacour (1956: 84). Plumages vary individually, but most mature males have greenish iridescence on the head and a reddish breast similar to New Zealand Brown Teal (*Anas aucklandica chlorotis*) or the more brightly colored Chestnut Teal (*Anas castanea*) of Australia. Although these species are regarded as closely related or conspecific, male Flightless Teal and Brown Teal have strongly vermiculated sides (Falla and Stead 1938), which the Chestnut Teal lacks (Johnsgard 1965: 164). Females are a more even brown than males and lack vermiculations or chest spots. Adults of both sexes have a white eye-ring, green iridescence on the back, and a slight trailing white edge on the secondaries.

As a member of the Auckland Islands Expedition 1972/73, sponsored jointly by the U.S. National Science Foundation Office of Polar Programs and the New Zealand Department of Lands and Surveys, my specific objective was to study ecological adaptations of this duck for life on an isolated subantarctic island. Concurrently I attempted to gather data on all aspects of its breeding biology.

The Auckland Islands extend from 50° 26′ S to 50° 56′ S and 165° 62′ E to 166° 22′ E (Taylor 1971). The main Auckland Island and the smaller Adams Island constitute the major land mass, but the archipelago has about 12 smaller islands. The islands are rugged in topography, with sheer cliffs in the west, and broad-based mountains rising to 668 m on Adams Island. Uninhabited, the forested islands are dominated by rata (*Metrosideros umbellata*) forest, but *Dracophyllum longifolium, Hebe elliptica,* and *Myrsine divaricata* are subdominants (Taylor 1971).

Of the archipelago's 52 species of breeding birds, more than half are seabirds (Taylor 1971). Two other native ducks and one exotic have

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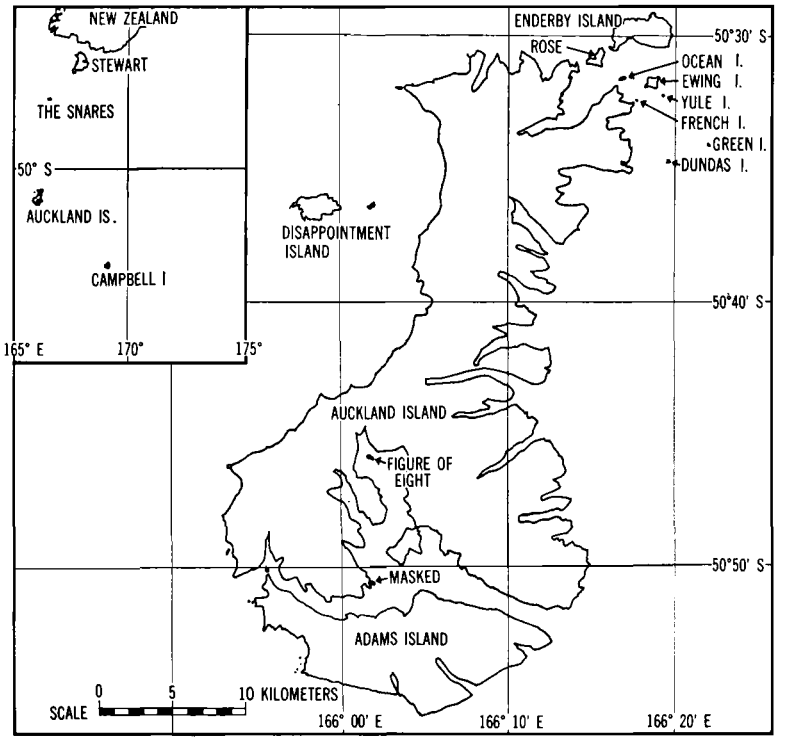

Fig. 1. Map of the Auckland Islands.

occurred on the islands: The Auckland Islands Merganser (*Mergus australis*) is now extinct (Kear and Scarlett 1970). A few New Zealand Grey Ducks (*Anas poecilorhyncha*) nest, and Mallards (*Anas platyrhynchos*), which were introduced in New Zealand, recently have pioneered on the island, and some hybridize with the Grey Ducks. The cluster of islands off the northeastern tip of Auckland Island (Fig. 1) harbor the largest population of Flightless Teal, and any one could provide a suitable study site. Most of my 5 weeks (10 December 1972 to 13 January) I spent on Ewing Island (Fig. 2). Ewing Island is forested with rata centrally and by olearia around the perimeter. The southern and eastern shores are dominated by cliffs 4 to 20 m high, but it also has some gradual shorelines and protected bays to the north and northwest. My campsite was on the west side at Boat Bay. A few hours to a few days were spent on Auckland, Enderby, Adams, Rose, French and Ocean Islands.

I studied the teals' foods and feeding behavior in as many different habitats as possible and documented them on 35-mm still and 8-mm

Fig. 2. Male Auckland Islands Flightless Teal in pool on rock shelf, Ewing Island. *Olearia lyalli* forest in the background; bush at left is *Hebe elliptica;* sedge (Carex trifida) and tussock (*Poa foliosa*) surround the pool.

movie film. Because of the teals' scarcity, only three males were collected after they had fed for 25 to 37 min. Food contents of the digestive tract were removed within 15 to 30 min of collection, and items in the esophagus were separated from those in the proventriculus and gizzard. Feeding sites were sampled by hand-grab or net, but most sites did not lend themselves to quantitative sampling of available resources.

No blind was needed to watch courtship and territorial behavior because the birds did not seem influenced by my presence so long as I stayed still. I made some measurements of territory size by mapping locations of aggressive encounters of pairs and by playback of recorded calls.

HABITAT TYPES

In spite of rainfall in excess of 125 cm per year, the Auckland Islands have few lakes and ponds because of the rugged topography sloping to the sea and, perhaps, because the peaty forest soils hold the water. Auckland Island has two major lakes and Adams Island one, but teal have been seen only on Lake Turbott on Adams Island (Turbott, pers. comm.).

In the southern part of Auckland Island are major streams, 6 to 12 m wide at the mouth, and on the north part of Adams Island are streams

1 to 6 m wide. These streams are slightly peat-colored, and the stream at our Adams Island (Magnetic Bay) campsite had pH of 5.0 and a temperature of 10°C. On Enderby Island and at Ranui Cove in the northeastern part of Auckland Island are smaller, slow-moving, brown-colored streams. Many smaller streams are seasonally intermittent.

Depressions in the forest occasionally contain pools of water, but because of island topography, pools were more common on plateaus just above sea level where they received drainage from forested slopes. These coastal pools often were surrounded by tussock grass and sedge (Fig. 2) or antarctic cabbage (*Stilbocarpa polaris*) (Fig. 3). One tussock pool on Rose Island had a pH of 5.0 and a temperature of 14°C; two pools on Ewing Island had pH between 5.0 and 5.5. Amphipods were common in these pools, and teal frequented the surrounding vegetation.

Vertical cliffs rising from the sea are common, and few teal occurred in such areas. Those that do probably are nonbreeders, and flocks of nonbreeders generally occupied places without suitable access to potential nesting areas.

Distribution

According to observations by Expedition Leader Brian Bell, Physician Michael Soper, Ron Nilsson, and other expedition members, Auckland Islands Flightless Teal occur on all but the main Auckland Island. Although the western cliffs of Auckland Island are not conducive to duck use, numerous bays and inlets on the southern and eastern sides seem suitable for teal, but records of teal there are rare (Taylor 1971, Scott 1971).

My general observations on teal suggest that most are found on shorelines with easy access to higher ground, and they favor lower elevations or bays produced by a combination of marine and stream action. Such shelves often contain tussock and antarctic cabbage used for escape cover.

Most teal were seen near the seashore. Major foods were in or along the sea, and birds that moved away from the sea to rest during the day obviously returned at ideal feeding periods. Teal often were found wandering during the day in the forest more than ¼ mile from the sea. Their return to the sea would be very simple on a small island such as Ewing where the topography is level, but teal on larger and more precipitous islands might spend excessive time moving to and from marine food sources. Expedition members discovered both young and adult teal at nearly 300 m on Disappointment Island, in boggy fields of tussock and forbs where presumably they found their foods and reared their young away from the sea.

The density of teal in a given area was difficult to establish because they are so inconspicuous, but by repeated surveys of shoreline and grass-forb vegetation of Ewing Island, I estimated a minimum of 24 breeding pairs. In addition, a flock of from five to eight nonbreeders was present in Boat Bay. The precise size of Ewing Island is unknown but probably does not exceed 80 ha, with a shoreline of about 4.0 km. Birds in the forest would have been missed during these surveys; thus an estimate of 56 birds involving 24 breeding pairs is minimal.

On no other island was I able to obtain such estimates. Of the islands I visited, only Ocean and Rose Islands had densities approaching that of Ewing Island. On Ocean Island I found most teal hiding in tussock and antarctic cabbage within 75 m of the shore, but I did not have an opportunity to examine the island's extensive scrub patches. On Rose Island most teal were feeding in windrowed kelp along open shoreline. For cover they used fern, tussock, and burrows of the European rabbit (*Oryctolagus europaeus*).

GENERAL HABITS

Although some confusion on the degree of its flightlessness has existed, these teal are incapable of true flight. The remiges are reduced in both length and number (Gadow 1902). Teal skitter rapidly across the water with feet and wings splashing, but I never saw one rise above the water level even when it skittered 50 m or more. They used the thrust of both flapping wings and feet to jump onto ledges, and their wings when climbing steep slopes. Jumps onto ledges from the sea usually were synchronized with incoming waves. When pressured into making flights to the sea from ledges 2 to 4 m high, teal landed 4 to 8 m from the shore. They never tried to take flight from land, but used their wings to flap and skitter along the ground as most flightless birds do.

Terrestrial adaptations of these teal include behavior considered unusual in other ducks. They favor a canopy of vegetation or rock during almost all activities. Flightless Teal are efficient walkers and regularly wander through dense forbs (Fig. 3), through dense brush thickets, and under the forest canopy. On Ewing Island it was possible to see a teal in any type of cover at any time of day or night. The preference clearly was for shorelines, and more were seen in tussock and forbs than in forest edge, possibly because they could sun themselves in small openings close to escape cover. (Fig. 3). They usually sunned on exposed rocks only where they could jump into water. As is true of flightless steamer ducks, they sun with slightly spread primaries.

Teal used burrows of White-headed Petrels (*Pterodroma lessoni*) and Sooty Shearwaters (*Puffinus griseus*), evidently as resting spots during

Fig. 3. Male Auckland Islands Flightless Teal sunning in tussock and Antarctic Cabbage. Ewing Island.

the daytime, but also to avoid intruders. They also rested under rock ledges, in holes in columnar basalt, and Scott (1971) noted their use of caves on Enderby Island.

Auckland Islands Flightless Teal swim very little. When moving from resting to feeding grounds, a flock of teal on Ewing Island usually swam a short distance from rock outcrop to the shoreline where bladder kelp (*Macrocystis pyrifera*) and other algae were windrowed. They walked and probed in this plant debris on days when surf action was heavy and dabbled in the water on quiet days. When moving long distances on stormy days, they swam quickly through the breaker zone to more quiet water, and then moved parallel to the shore. Arriving at their destination, they again charged through the surf to shore. They rarely fed where surf struck them.

Responses to Potential Predators

Teal showed little fear of man. The previous expedition had been on Ewing Island 6 years earlier, but few people have spent more than a few days there since the whaling days of the early 1800s. If I watched quietly, teal sometimes moved by me feeding only 2 to 4 m away. Teal engaged in sexual or aggressive behavior also ignored my presence. Only when I followed them or moved rapidly did they avoid me. When I attempted to grab teal in dense grass, they proved responsive and evasive.

The response of teal to potential natural predators was noted on many occasions. Only aerial predators are present on Ewing and other offshore islands. Cats have been wild on Auckland Island for many years and, with feral pigs, may be responsible for the absence of teal on the main island. New Zealand Falcons (*Falco novaeseelandiae*) occur on Adams Island where there are teal, but I saw no encounters. It was obvious that teal constantly were alert to Southern Skuas (*Catharacta skua lonnbergi*) overhead, and it is probable that skuas are the major predator to which the protective behavior of teal evolved. Brian Bell, Michael Soper, and I all found remains of teal at skua nests. As teal fed in the open, they stopped and watched passing skuas, whereas they ignored other large birds like Giant Petrels (*Macronectes giganteus halli*) (unless they were on the ground), Light-mantled Sooty Albatrosses (*Phoebetria palpebrata*), or Southern Black-backed Gulls (*Larus dominicanus*). They also ignored southern sea lions (*Neophoca hookeri*) in the water or on shore, although I once saw a sea lion give a pseudochase to a teal, which moved off fearlessly. The male's major alarm call, a whistle like "pee-dit," is given to human intruders and during or following a scare by a skua. The bird stands erect and often holds the neck upstretched at this time. Considerable social conflict was caused by movements in response to passing skuas.

Not only did skuas patrol shorelines by air, but they spent considerable time sitting quietly in the forest edge or openings at all hours of the day. Skuas commonly walked through the forest and visited a garbage pit at my campsite. Most of the skuas were banded by previous expeditions and they are long-lived; I noted at least three different skuas at Boat Bay. Skuas are a major predator on nocturnal petrels, and may be that they also kill teal at dusk or night. I saw one quasi-attack by a skua that was sitting under a tree near a watering pool used by a pair of teal; the skua flew toward, but never hit the teal. The female of the pair skittered into the forest (and toward a nest unknown to me at that time), and the male skittered to open water, where it hauled out on floating bull kelp and perched there precariously facing the skua about 5 m away. This "stand-off" lasted about 25 min, during which time the teal regularly gave its alarm call, a clear, whistled "pee-dit" (Fig. 4). The skua flew off without attacking the male.

On one occasion, five teal feeding in windrowed algae responded instantly to a pipit's alarm flight trill as a skua passed over. All teal skittered to sea, watched alertly, then returned to shore. On other occasions, teal were alerted by warning calls of Red-billed Gulls (*Larus novaehollandiae scopulinus*) and Blackbirds (*Turdus merula*). I never saw a skua dive at a teal in the water or resting in bull kelp.

Fig. 4. Male Auckland Islands Flightless Teal on bull kelp *Durvillea antarctica* while skua (not visible) waits on shore. Ewing Island.

Only once did I see extreme evasive behavior, and this occurred a few days after I had collected a teal from a small flock. When I approached the same place later, a single bird sneaked off, swam partly underwater, surfaced well out in the open, and sneaked toward its loafing area on some large boulders. Presumably such evasive behavior would typify a response to natural predators as well.

Skuas nested on the island in patches of tussock or finer grasses, and all were rearing young in late December and early January. Such grassy stretches also were resting places for teal. Once I tried to force a teal out of the grass and toward a skua nest 4 m away, but each time she reversed her direction and ran past me rather than toward the open spaces and the calling skuas.

Feeding Behavior and Foods

Auckland Islands Flightless Teal are extremely adaptable in choice of foods, feeding grounds, and manner of feeding. Although their feeding methods favored selection of invertebrate foods, they also ate plant foods. Teal on Ewing and Rose Islands fed mostly on the seashore by probing in windrowed algae (Fig. 5). One male teal collected while probing in kelp had eaten amphipods, armored isopods, kelp flies, and snails (Table 1, No. 1). Because they could feed in the kelp at almost any tide level except in severe storms and it was a rich source of food,

Fig. 5. Male Auckland Islands Flightless Teal feeding in decaying marine algae, Rose Island.

teal used it at all times of day and in all weather conditions. During banding operations Brian Bell saw them feeding on the seashore at night.

The heads of teal that probed in stranded algae became covered with slime from the rotting kelp. When teal fed between boulders, often only their tails were visible, and the male of pairs remained alert while females fed. After feeding for 5 to 25 min, they entered the water and

TABLE 1

FOOD ITEMS AND VOLUMES (ML) IN THREE MALE AUCKLAND ISLANDS FLIGHTLESS TEAL COLLECTED ON EWING ISLAND DURING LATE DECEMBER 1972 AND EARLY JANUARY 1973 [1]

	Manner of feeding		
Food item	No. 1 Probing	No. 2 Diving	No. 3 Dabbling
Amphipods	11.9	9.5	—
Isopods	4.2	13.2	—
Copepods	—	—	6.5
Snails	0.1	0.2	—
Kelp flies	0.1	—	—
Clams	—	tr	0.9
Crabs	—	0.2	2.7
Sand	0.5	0.1	tr
TOTAL	16.8	23.2	10.1

[1] Because there was little difference in contents of esophagi, proventriculi and gizzards, figures for each bird are totals for the three organs.

bathed vigorously. Then they preened and sometimes sunned before resuming feeding.

On Adams Island a pair of teal and later a single male (presumably the paired male) fed on windrowed sea lettuce (*Ulva* sp.). They ate large pieces of the fresh green alga but also probed some in the debris, presumably for invertebrates.

The second most common method of feeding was by dabbling in attached algae at low tide. No teal were collected while feeding in that manner, but gammarids, snails, and small clams were plentiful in the algae. I watched one pair and later a single male feeding by dabbling in *Porphyra* sp. exposed at low tide. Most teal probed and dabbled in the still wet plants, and a few may have eaten some of the algae. A male teal on Adams Island dabbled in shallow water and upended, bringing up sizable pieces of sea lettuce, which it ate.

Feeding of Auckland Islands Flightless Teal is clearly tide-related. They can feed in windrowed kelp at any tide level, but they seem to favor a slightly ebbing tide. The nonbreeding males that loafed on rocks on Boat Bay commonly fed at low tide, especially when dabbling in exposed beds of algae. These birds were highly social, and the movement by one male from loafing rocks to the favored feeding ground usually prompted all the feed. After feeding an hour or more, the birds then returned to rest. Similar tide-related behavior has been noted in Brown Teal in New Zealand (Weller 1974).

Teal dived easily, but with some flapping of wings as seems characteristic of dabbling ducks. Brian Bell saw a diving bird come up with sea lettuce in its bill. A flock of six birds that I watched feeding in less than 1.5 m of water dived actively in open spots in leafy kelp. One bird collected after 25 min was full of armored isopods and amphipods, but also had eaten tiny snails, clams, and a crab (Table 1, No. 2).

Teal also fed by surface dabbling when tides or wind currents drifted plankton into Boat Bay. They fed like shovelers, with neck outstretched and a sweeping action of the head. A bird (Table 1, No. 3) collected after feeding that way was full of copepods, most of which were under 1.0 mm long. Under the same wind and water conditions, some individuals swam about with head lifted, obviously searching for larger items, which they grabbed.

Teal were seen in freshwater pools on several occasions, and I saw one dabbling in a puddle less than 15 cm deep between some boulders. Expedition member Hugh Best saw an adult filter-feeding like a shoveler in a freshwater pool on Enderby Island. I saw one downy young feeding by dabbling into the soil at water level of a freshwater pool in tussock on Rose Island.

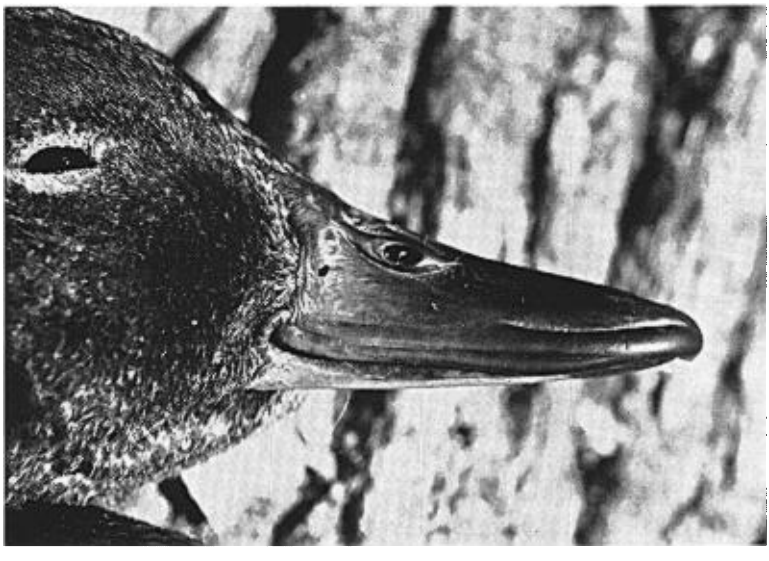

Fig. 6. Bill of male Auckland Islands Flightless Teal showing well protected commissural point.

One very dark night Peter Conners encountered a pair of teal probing in the loose soil of our camp garbage pit. Earthworms were common there and may provide a food supply. Subsequently we searched through the forest at night and found a single male and a pair walking around in wet spots. Even during the daytime I saw teal grab at items on the forest floor, so they may eat some strictly terrestrial foods. New Zealand Brown Teal also feed in the uplands both at night and day (Weller 1974).

In summary teal fed on invertebrates that varied in size from copepods of less than 1 mm to isopods and clams of 15 to 18 mm, and on sea lettuce. They utilized marine foods mainly, but probably take some freshwater crustaceans and terrestrial invertebrates.

Teal regularly drank fresh water. The members of the flock of nonbreeding teal on Boat Bay drank from seep water of overhanging cliffs. A nesting pair regularly bathed and drank in a boggy drainage pool 75 to 100 cm in diameter and 25 cm deep. Birds also drank and bathed at the mouths of freshwater streams on Adams Island, but I never saw a bird try to swim upstream.

POSSIBLE ANATOMICAL ADAPTION FOR FEEDING

Freshly killed birds showed a hardened spot at the commissural point that normally is inconspicuous and feathered in ducks (Fig. 6). This

hardened skin protrudes as a flap about 2 mm on either side, effectively broadening the food passage and protecting the edge of the mouth from damage. This structure was illustrated, but evidently not recognized as unique by Edward Wilson (Roberts 1967). A clue to the function of these calloused regions may be in the behavior during probe feeding. Teal often seemed to have difficulty swallowing food and moved the head and neck as if to assist in the passage of large items. The one teal collected while feeding in this manner (Table 1, No. 1) had taken large armored isopods that extend two sharp appendages when the body is rolled up. Although the position of the isopod in the mouth or esophagus would influence their ease of swallowing, hardened skin at the base of the bill would prevent damage by one or both appendages. This flap effectively increases the size of prey teal can take while maintaining the advantages of a narrow, probing bill for feeding in rock crevices.

Sexual and Aggressive Behavior

My visit to the Auckland Islands during early December to mid-January 1973 seemed correlated with the peak of the nesting period. Pairs were in evidence everywhere, aggressive behavior was common, and a nest and several broods were found during the last 2 weeks of the study period. Nesting could occur over a long time because of the mild temperature regime, as is true in other subantarctic islands (Weller 1972).

Although I was unable to mark individuals in the time available, behavior patterns observed strongly suggest that monogamous, long-nesting relationships were prevalent, at least during the breeding period. That females were incubating is suggested by the fact that males often were on territory alone much of the day. When joined by females, usually in midmorning, the males did little feeding, but the females fed voraciously. Two groups of seemingly nonbreeding birds also were noted. One on Ewing Island usually contained 5 to 7 males, but a pair was seen occasionally. Another group on Rose Island also contained some females. Although both groups may have been dominantly postbreeding birds, three collected from the Ewing Island group had poorly developed sex organs and worn dull plumage, like yearlings.

Boat Bay had at least five males or pairs that were spaced along the coast except for a cove where the group of nonbreeding males loafed. Linear territorial distance along the shoreline was approximately 32 m, 32 m, and 51 m between sites of aggressive encounters, which were mostly by displays of the male. The main call was a series of low whistlelike notes, forming a trill. During this call, the bill was open and lifted up 30° above horizontal, with the back of the head low

Fig. 7. Trill call of male Auckland Islands Flightless Teal. Female at right alert between feeding in wind-rowed bladder kelp (*Macrocystis pyrifera*). Note semiopen wings.

(Fig. 7). The trill call is highly directional. At times such trill threats made one or both males retreat. Chest-to-chest fighting was seen occasionally among territorial males. If a female also was present, rape chases often ensued with tremendous speed of skittering chases, and dives, biting, and pecking.

Once I flushed a teal from tussock by a small pool (Fig. 1). It swam across to the far side of the pool, only to be chased by a male in a rapid, skittering pursuit across the water and directly at me. The aggressor soon retreated to his own adjacent and interconnected pool. I saw two equally violent territorial encounters within the forest some 25 m from shore. Teal scurried about on the forest floor at amazing speed, and territorial boundaries seemed clearly defined. Aggressive males usually trilled and gave the "pee-dit" call after an encounter; chased males usually were silent.

That teal are territorial and that the trill is a territorial defense call was further substantiated by playing back recorded calls. When trill calls were played to teal in dense grass where they could not see me or my equipment, they came charging toward me through the grass, only to reverse direction when they saw me.

Rape chases occurred regularly on Rose Island, where one or more territories seemed to overlap with a favored feeding area used by a

small flock of teal. Four of the six teal were males and the females present were constantly harassed by males. All the birds had very worn plumage, but none had molted remiges. I suspect that these males were nonbreeding yearlings. No birds with molted remiges were seen during the study period.

In addition to the trill and "pee-dit" calls, both sexes had quiet feeding calls, which seemed to form communication while the pair fed. The male's call was whistlelike; that of the female had a quacking resonance. This or a similar call I also heard once as a precopulatory call.

Females also have an inciting posture and high-pitched quacking call typical of that of most species of *Anas* (see Johnsgard, 1965, for other species). Vocalizations other than inciting were of low volume compared with those of other dabbling ducks.

I saw copulation on two occasions when pairs were isolated and undisturbed in their territories. I suspected that both females were off the nest during a rest period. There was no special precopulatory behavior except the quiet vocalization and prone posturing of the female. Males gave the trill call afterwards, paused, and gave the "pee-dit." Both subsequently wingflapped and bathed.

Nesting

I found a nest of four eggs on 6 January 1973 on Ewing Island. The eggs are smooth, but not polished, light tan, and extremely large for the size of the bird (64.9 × 43.5 mm, 65.5 × 44.6 mm, 65.7 × 44.1 mm, 63.9 × 44.5 mm). This seems to be the usual figure, as Lack (1967) reported three or four eggs as compared with the usual six or more of the Brown Teal. The shallow nest was in fern (*Blechnum* sp.) (Fig. 8) and was lined with dense, dark gray down. The site was next to and 45 cm above a soggy watercourse, which, when wet, flowed to the seashore about 7 m away. A male, assumed to be the mate, commonly rested in a patch of antarctic cabbage and tussock less than 4 m away. The lone male often fed along the shore near the nest and was sometimes accompanied by a female; a check of the nest on two such occasions showed the hen not on it. The nest was shaded most of the day by nearby olearia trees, but the position provided a good view of the surroundings. That this nest site had been used before was indicated by eggshells and old down in and near the nest. The nest was last seen when it had been incubated about 18 days, and the male was still close by. The female was extremely broody and returned to the nest while I was only 2 m away.

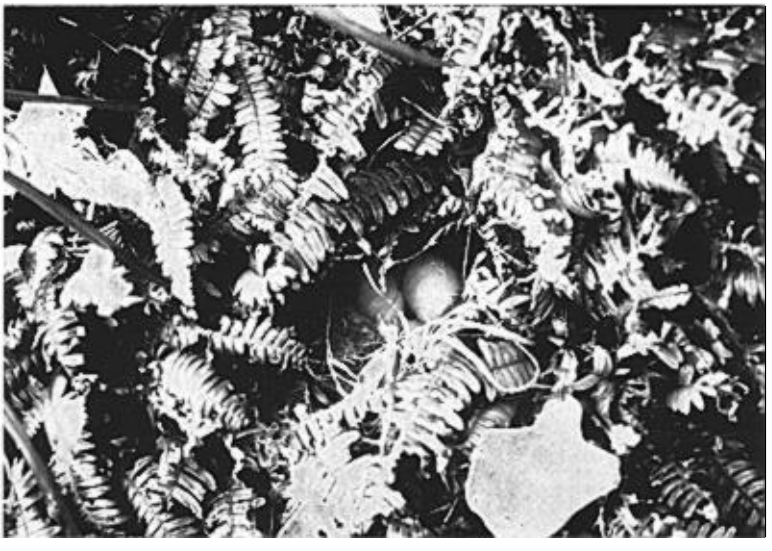

Fig. 8. Nest of Auckland Islands Flightless Teal in fern on Ewing Island.

BROOD HABITAT AND BEHAVIOR

I saw young of only two or possibly three broods, but three others were reported. Broods favor dense vegetation or wetlands close to escape cover, where young teal remain very quiet. An individual duckling reported by another expedition member, and one that I saw, were alone. Another duckling, possibly the same bird, was near a lone adult male. Two newly hatched young I saw with a lone female in dry tussock could have been pushed from the water as I approached. Two groups of ducklings, one with an adult, were reported in soggy tussock fields on Disappointment Island. G. R. Williams reported a juvenile in a tussock-rimmed tarn on Enderby Island. Two small downy young were found in a tidal pool in a fairly open spot, but these hid under rocks when chased. Thus only one of six potential broods was encountered on the seashore, and this may have been brackish or even fresh water inasmuch as the person who saw them did not check this.

DISCUSSION

The Auckland Islands Flightless Teal is well adapted for island life by its unique terrestrial behavior, its utilization of foods of diverse kinds and sizes, its nocturnal feeding, lack of flight, and its ability to cope with an efficient aerial predator.

Few ducks approach the breadth of food utilization or habitat use seen in the Auckland Islands Flightless Teal. The South Georgia

Pintail (*Anas g. georgica*) also is highly terrestrial and eats a wide range of food, but obviously is more recently differentiated and has fewer anatomical adaptations for island life (Weller 1975). Lack of competition with other species probably influenced the evolution of the teals' wide niche use. At one time Auckland Islands Mergansers occurred on the islands, but it is assumed that they used mostly the streams and specialized on fish and stream invertebrates (Kear and Scarlett 1970), whereas teal do not seem to use either regularly. Grey Ducks, Mallards, and their hybrids are seen periodically and do nest, but are not plentiful.

The body shape produced by abbreviated wings is probably an efficient one for moving through the forest, for use of burrows, and for greater diving efficiency. The heavy, short neck is comparable in proportion to that of a Falkland Island Flightless Steamer Duck (*Tachyeres brachypterus*). The bird also has a reduced keel like the steamer ducks, but the legs are not so well developed. Teal spend far less time diving than do steamer ducks, and were only seen diving in water less than 3 m deep.

As is typical of many island birds, flightlessness in the Auckland Islands Flightless Teal has evolved in the absence of mammalian ground predators but predation is still an influential force in the evolution of the teals' hiding and feeding patterns. The skua is the only bird known from nest remains to prey on teal, and the fear the teal show for skuas supports this supposition. Skuas seem to hunt and kill teal from the ground, probably at dusk or even dark. Thus a flightless bird seems to have evolved with an avian "ground" predator. This relationship supports the concept that flightlessness in island birds may be an energy saving device (Olson 1973) or a loss of dispersal power advantageous to maintenance of the breeding stock (MacArthur and Wilson 1967: 158).

It is generally assumed that the Auckland Islands Flightless Teal originated from the Brown Teal of New Zealand (Newton 1896). More recent workers have accepted the Chestnut Teal as the probable ancestor of the Brown Teal. Either species (Frith 1967) would have been preadapted to marine food resources by their preference for estuaries, and Brown Teal are especially common on islands where they are highly terrestrial.

Flightless Teal also were found in small numbers on Campbell Island, about 150 miles southeast of the Auckland Islands. Once treated as a separate genus (Fleming 1938), it is now considered a separate subspecies (*Anas a. nesiotis*), but even this differentiation is questionable because it is based on so few specimens that differ only slightly in size and color (Delacour 1956: 85–86; Westerskov 1960: 63–66).

The status of the Auckland Islands Flightless Teal presently is secure. Islands of all sizes in the archipelago support teal, except for the main island, which has both cats and pigs. It is assumed that these ground predators have reduced or eliminated the teal there. The chances of eradicating either predator from the main island are slim, but all efforts should be made to prevent accidental dispersal of these predators to other islands. This is a unique species on a unique island system, and all efforts must be made to preserve it.

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SUMMARY

The Auckland Islands Flightless Teal occurs on all the islands of the Auckland group except the main island where cats and pigs abound. Teal spend more time on land than in water, but seem most abundant along seashores, where they feed on amphipods, isopods, and other dominant invertebrates. Teal feed mainly by probing in windrowed algae, but also dabble for amphipods, snails, and clams, and eat some marine algae. They may dive for foods or strain like shovelers for minute copepods. They also seem to feed in the uplands at night, but may be seen in the forest at any time of day. They use petrel and rabbit burrows and rock crevices for protection.

Remains of teal found at skua nests show Southern Skuas to be the major predator. No direct attacks were seen, and probably skuas kill most teal at dusk or even dark when they also take petrels.

Teal seem to be monogamous and have pair bonds that last at least through incubation, and probably are permanent. Teal vocalizations include an alarm "pee-dit," and a trill call used in territorial defense and courtship. Males defend both shoreline zones and parts of the forest used by the pair. The single nest found was near the seashore in fern and held four eggs.

The Chestnut Teal usually is considered the ancestor of both the New Zealand Brown Teal and the Auckland Islands Flightless Teal, but this remains unsettled. Flightless Teal presumably evolved from birds reach-

ing the islands directly from New Zealand. Flightlessness may better adapt the teal for both terrestrial life and for diving concurrently, it saves energy and prevents loss of breeding stock.

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