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BEHAVIOUR OF FLEDGLING NEW ZEALAND FALCONS (*Falco novaeseelandiae*)

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Fox (1977) described three forms of New Zealand Falcon (Bush, Eastern, Southern) and extensively studied the Eastern form, including some observations on the fledgling period. Fitzgerald (1965) recorded observations of fledgling Falcons (Bush form) for 6 days. There are few studies of this critical period of life for raptors in general, Sherrod's (1983) study of Peregrines being a notable exception.

After trying without success to find a Falcon nest in the Rimutaka Ranges in November 1988, we found juvenile Falcons (2 female, 1 male) in the searched area on 2 February 1989 (Figure 1). Dependent fledglings had been seen nearby by others in February 1988.

STUDY AREA AND METHODS

The juveniles inhabited a forested stream gully which emerged into a river valley (Figure 1). The forest comprised emergent podocarps in a hardwood understorey with some beech on the drier ridges. The river valley had open, grassy flats containing some low scrub, and beyond the study area were farmlets.

The area of mature bush where the juveniles were discovered contained many possible nest sites. Most Falcon (Bush form) nests in bush have been high in trees in clumps of astelia (OSNZ nest records) but many have also been on the ground under a log or on a slip. Cliff faces have also been used (R. Wheeldon, pers. comm.). Fox (1977) recorded Falcon (Bush form) nests only in areas of mature bush and within 50-100 m of a creek or stream. The study area had these features.

As the birds were using a small (60 x 25 m) grassy bush clearing (Figure 2) we could at first make continuous observations. Using 8 x 40 binoculars we watched the birds from the periphery of the clearing or from a bush track running up the valley. Our presence did not appear to alarm the adults or juveniles. Our observations totalled 89 hours over 16 weeks from February to May.

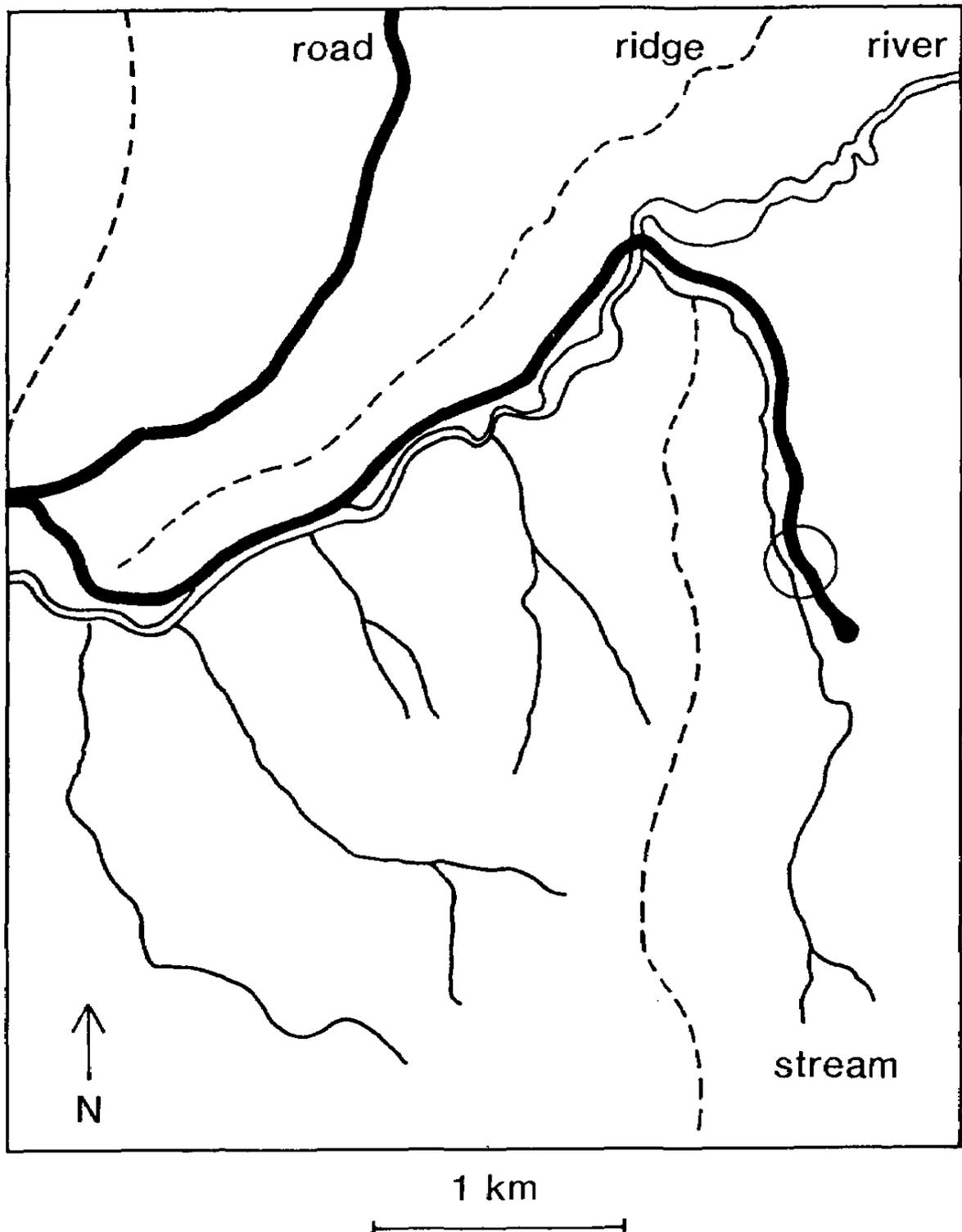


FIGURE 1 — The study area, Rimutaka Ranges. The circle is the bush clearing (see Figure 2).

Until aged 14 weeks the juveniles were easily located by their incessant whining and we could locate at least one bird at any time. During the first 4 weeks of observations around the clearing (age 10-14 weeks) they were watched constantly but sightings later became more difficult because trees obscured our vision as they expanded their range to the north. Later, in the more open river valley, they were again easily observed but from a greater distance.



FIGURE 2 — Telegraph poles, drain, emergent trees and grassy flat used by the juvenile Falcons

RESULTS

Range of movements

When first found the juvenile Falcons were making short (<50 m) weak flights and clumsy landings and so they had probably only recently fledged (Fox 1977). Buller (1888) stated that the young birds stay on the nest tree for several days after quitting the nest. We could not see natal or second down on the birds and so they were probably older than 5 weeks, but by their weak flight they were less than 7 weeks old.

Observations of captive bred Falcons of known age have indicated that down disappears about the time the birds are 6 weeks old (R. Wheeldon, pers. comm.). Also Fox (1977) stated that down is still visible on juvenile male Falcons at 35 days old and that, at 45 days old, young are flying well and capable of soaring.

For convenience we have assumed that the juveniles were 6 weeks old when found.

For the first 4 weeks, the juveniles used the small clearing and the bush up to the ridges on either side, although once all three soared high over a ridge 1 km to the south and then returned to the clearing.

At 11 weeks the birds began to drift to the north, downstream, and spent more time about the ridges on either side of the gully. During the following 4 weeks they slowly drifted further downstream, a total of 0.9 km from the clearing to the open river valley.

During the next 5 weeks the birds drifted a further 0.8 km, following the river to the south-west. The area ranged over by the fledglings increased from 0.7 km to 25.5 km over 4 months.

Behaviour on the ground

A juvenile (7 weeks old) seen walking out of a shallow drain that ran through the clearing had apparently been bathing because the stones around the edge had been splashed. Juveniles were seen perched on the edge of the drain on two other occasions. Twice a bird ran along the gravel road on to the grass and picked up twigs and pulled at grass. Two birds were also seen running and searching among the grass, possibly for insects. Large dragonflies (*Uropetala c. carovei*) were seen landing on the grass and we found remains under two telephone poles in the clearing (Figure 2). We did not see juveniles on the ground beyond 7 weeks. Fox (1977) also observed Falcons hunting invertebrates on the ground and recorded dragonflies in their diet.



FIGURE 3 — One of the juvenile female Falcons

Perches

During the first 3 days of observations the juveniles preferred as perches substantial branches or epiphyte clumps in emergent trees, and telephone poles.

Later, as the birds ranged further afield, they used the topmost foliage of emergent podocarps and beech trees equally as often. One particularly prominent tree was used frequently for perching or as a vantage point by all three juveniles for up to a week. Then, as they moved north, successive trees became the preferred perch. We watched short periods (less than 2 minutes) of preening on four occasions at different times of the day. Occasionally juveniles sunned themselves, feathers fluffed out and tail fanned, in the early morning sun.

Soliciting food

From 6-8 weeks of age, periods of perching varied from 2 to 30 min, interspersed with short flights. Periods of whining up to 10 minutes were heard, especially from unfed birds, whenever a sibling had just received food. The adult female once flew, without food, past perched juveniles, which then began whining but did not fly up to her. From age 9-13 weeks they spent less time perching quietly and more time flying and chasing one another. Up until 16 weeks old all three juveniles remained close together and their activity tended to be the same at any given time. At 14-16 weeks of age the juveniles spent long periods perched and whining and less time flying and the intensity of whining often increasing when an adult appeared. While whining, juveniles fluffed out their plumage, drooped their wings and held their heads up at 45 degrees. When the male was 14 weeks old we heard it give, during a period of 30 minutes' whining, a double or treble *whee-up* every 15 s.

After an unsuccessful attack on prey by this bird it began whining as it returned to its perch and continued to whine for 10 min.

During 17-22 weeks of age the juveniles drifted apart and generally perched quietly, only occasionally whining between periods of intently watching and hunting prey. We saw few interactions between juveniles at this stage.

Calls

The main juvenile call was the whining *whee-up* food-begging call described by Fox (1977). Both adults and juveniles uttered *kek-kek* calls. *Chittering* was sometimes given by juveniles in close confrontation in flight. Fox heard chittering between adults during the breeding period. Fox also recorded adults making a *chup* call, and we heard it uttered rarely by both parents and juveniles.

Flight behaviour

At 6-7 weeks of age the juveniles' flight was slow and uncertain. Most flights were for 20-30 m through prominent trees and short circular flights around

favourite perches. Flights consisted of flapping and gliding followed by fluttering on landing. Sometimes they missed the perch and had to try again. At times their tarsi struck the perch first and they then had to flutter up on to the perch.

At 7-8 weeks old their flight skills improved greatly. They regularly made strong direct flights and tight twists and turns through foliage. Soaring was first seen at this time. By 8 weeks old the birds had extended their range, making flights and glides of up to 250 m.

At 9-11 weeks old the birds soared higher over ridges and neighbouring valleys, but they always returned to the original valley. Several times all the birds appeared to be stimulated into flight when a breeze sprang up and they began soaring above emergent trees.

Playing with vegetation

On several occasions the juveniles pulled moss, twigs and pieces of bark from trees, carried them a short distance in beak or talons and discarded them.

Twice a juvenile flew to a drooping outer branchlet and tried to break it off by hanging upside down and flapping. Once a juvenile spent 15 minutes dismembering a fish-sized clump of lichen, closely watched by a sibling. On another occasion a juvenile flew about carrying a stick as long as itself and then dropped it. Sometimes, when a juvenile dropped an object, it and a sibling pursued the object, attempting to "recapture" it. Fox (1977, 1978) also saw young birds play with, and eat, vegetation near the nest.

Sibling play and aggression

At 6-7 weeks of age, juveniles began chasing one another in flight and driving one another off perches, screaming at times. At 7-8 weeks old, they made longer, faster, more aggressive flights. Repetitive steep dives were common, made by all three birds constantly changing roles of "prey and pursuer", sometimes even into the vegetation. Juveniles sometimes caught each other's talons during flight and then tumbled end over end before disengaging (Fox 1978a). Sometimes they made audible contact during direct stoops, causing a few feathers to fly. Occasionally the "pursuer" stalled and extended talons as it came up underneath the pursued sibling. Silent, constant aerial pursuits by all three birds lasted up to 10 min. By 15 weeks of age play between siblings seemed to have stopped.

At 7 weeks of age, the juveniles became more aggressive towards one another after one received food from an adult. The others pursued it in the air or tried to snatch the food while the bird was perched. Usually the bird carrying prey would fly off into thick cover, where it was not pursued.

We saw a juvenile attack an adult only once; an unfed juvenile knocked the adult female off her perch after she had passed food to another juvenile. Once, when the adult female was perched holding prey, she refused to give it up to a juvenile female whining 1 m away. The juvenile made no attempt to snatch it. The juvenile male, when 17 weeks old, was dived at twice by the adult male. This juvenile was not seen again and may have been driven off by the adults.

We were not dived on by adults or juveniles at any time during the study.

Mobbing

Chaffinches (*Fringilla coelebs*) mobbed juveniles on at least four occasions. Three Australian Magpies (*Gymnorhina tibicen*) dived at a perched juvenile, which dodged their attacks and remained perched, whining. Later that day two Magpies dived at a flying juvenile for 2 minutes. Magpies were also seen in an adjacent valley pursuing a juvenile Falcon for about 50 m.

Magpies have often been recorded attacking Falcons (Fox 1977). We have seen Falcons retaliate against harassing Magpies by making short stoops and once knocking a Magpie to the ground.

Two Tuis (*Prothemadera novaeseelandiae*) were seen to swoop above soaring juveniles. We have often seen Tuis following and swooping above flying Falcons, but without close contact.

Territorial defence

When the juveniles were 9 weeks old, two of them were seen to drive off a Black Shag (*Phalacrocorax carbo*) which flew over the clearing. Both Falcons flew hard at the shag, swooping and diving at it for several hundred metres before turning back. In the following weeks shags were driven off on three occasions.

Once an Australasian Harrier (*Circus approximans*) flew over a perched juvenile Falcon, which then flew up making *kek-kek* calls and chased the Harrier for 100 m before returning to its previous perch. Fox (1977, 1978) also recorded aggression by juvenile and adult Falcons against Harriers and Black Shags when they approached within 0.5 km of the centre of the Falcons' territory.

Food passes

Food transfers from adults to juveniles were of three types: aerial drops, aerial talon to talon, and perched talon to talon (Table 1).

Aerial drops: The juvenile flew up to meet the incoming adult, which dropped the food when the juvenile was 0.5 m – 5 m below it.

Aerial talon to talon: Juveniles flew up to meet the adult and, twisting vertically, took the prey directly from the adult's talons.

Perched talon to talon: A parent arrived with food and perched. It was approached by a juvenile, which then took the food directly from the parent's talons.

Fitzgerald (1965) recorded juveniles being fed approximately once an hour, which agrees with our early observations (Table 1).

TABLE 1 — Food passes

Age of Juveniles (weeks)	Type of Food Pass			Frequency of Food Passes
	Aerial Drop	Aerial Talon-Talon	Perched Talon-Talon	
6-7	11	5	0	1 per 45 min
8-10	11	2	7	1 per 105 min
11-22	11	0	0	1 per 180 min

We did not see live prey passed from adult to juvenile, although Fox (pers. comm.) has occasionally seen live prey dropped. We have seen one live bird dropped from an adult male to a juvenile male in another brood, when the juveniles were 9-10 weeks old. Toward the end of the observation period the juveniles were forced to fly further and higher to receive food from the parents because the parents approached from a greater height. Mostly the parents were silent on arrival with food but gave *kek-kek* calls on 19 out of 47 occasions.

Several times parents arrived with food, calling, and perched in trees until the juveniles appeared, then rose up to drop the food. It seemed to us that the parents called when the juveniles were not immediately visible. The two adults brought in prey equally often.

When the juveniles were 7 weeks old, the adult male dropped a small bird to the juvenile male, which missed it. Both birds then dived vertically, twisting and turning, after it. The adult retrieved the prey in his talons, rose up and released it. This time the juvenile was successful.

Caching

Juveniles were seen caching food five times, the first at 7 weeks of age. Three times a juvenile, on receiving prey from a parent, flew to a perch, began plucking the prey and then flew to a clump of astelia, where it hid the food. Two different clumps of astelia were used. Once a juvenile took prey into a clump of astelia in a dead rata, where it perched for several minutes. It then walked into the astelia, disappeared from sight and emerged without the food. Twenty minutes later the Falcon came back and removed the prey to pluck it. After 10 more minutes it came back again and cached the prey in the same clump.

Fox (1977) recorded caching of food by Falcons frequently, at all times of the year, but did not see dependent juveniles caching.

Caching by adults did not seem to be related to prey abundance (Fox 1977), and so the purpose of caching by juveniles is not clear, unless they simply were not hungry.

Prey

Potential prey species in the Wainuiomata catchment include all the common North Island bush birds and introduced passerines. In adjacent Moores Valley and Wainuiomata City, Starlings (*Sturnus vulgaris*), House Sparrows (*Passer domesticus*), and domestic fowl (*Gallus gallus*) were particularly common and may have been important prey for adults.

Bird prey was usually too distant to be identified. Most birds were small unplucked birds between Silvereye (*Zosterops lateralis*) and House Sparrow size. One small rat or mouse was seen. The adult male also passed two downy domestic chickens to 7-week-old juveniles.

We searched the area of bush that the juveniles frequented until they were 8 weeks old for prey remains and possible nest sites. We found the skeleton, wing and tail feathers of a Fairy Prion (*Pachyptila turtur*) in the hollow end of a log on the forest floor and 1 metre away was a semicircle of Fairy Prion breast feathers. About 50 m away, Blackbird (*Turdus merula*)

wing, tail and breast feathers were found; the breast feathers again were scattered in a semicircle. We examined the bases of two telegraph poles frequently used by the juveniles, finding dragonfly wings and the thorax and feathers of a juvenile Chaffinch.

Hunting

We saw a total of five steep glide attacks (some at unseen prey), one direct flying attack and one swoop attack.

We first saw the juveniles attempt hunting when they were 7 weeks old. A cicada (*Amphipsalta* spp.) was taken on three occasions, by a direct flight from a perch or by a fast glide down to the prey. On two of these occasions the hunter was the male.

The first attack we saw on a bird was also when the young Falcons were 7 weeks old. A Falcon dropped sharply into undergrowth from a high, exposed perch, flushing a Blackbird, which escaped. An unsuccessful attack on a Song Thrush on the ground close to cover was seen when the Falcons were 17 weeks old. A similar attack on a small flock of Silvereyes was seen at 12 weeks of age, again unsuccessful.

Once a juvenile female Falcon flew directly at a Chaffinch, which then flew up in an undulating spiral, gaining height above the Falcon, which quickly gave up the pursuit.

A New Zealand Pigeon (*Hemiphaga novaeseelandiae*) flying 300 m above a clearing was chased by a juvenile female Falcon from below. The Falcon gained height to close within 50 m of the Pigeon before gliding back to near its original perch.

When the Falcons were 10 weeks old, several Southern Black-backed Gulls (*Larus dominicanus*) were seen soaring above a ridge, below a juvenile female Falcon, also soaring. When a gull became positioned directly below it, the Falcon closed its wings and silently stooped for about 20 m, striking the gull between its wings and dislodging a few feathers. The gull squawked and flew on while the Falcon rose up calling *kek-kek* and flew off in the opposite direction.

No successful attacks on birds were observed during the study.

Adults – general behaviour

Once, when the juveniles were 6 weeks old, the adult female Falcon arrived with prey and perched but would not pass the food to a nearby juvenile. Then a Harrier appeared 200 m away. The adult female pursued it and circled, calling, below the Harrier, gaining height. When the Harrier had flown away over a ridge the Falcon flew off in the opposite direction, without the prey.

The adult male Falcon chased a Harrier which had appeared 100 m from a perched 16-week-old juvenile. During the chase of 200 m the adult called *kek-kek* continuously. At this stage the juveniles had moved 1.5 km from the clearing we first found them in.

The parents were rarely seen hunting or perching in the vicinity of the juveniles. However, once, the adult male remained perched out of sight of the offspring for 1 hour 40 min after a food pass.

The adult female was seen 50 m north of the juveniles carrying a small bird into an emergent rimu (*Dacrydium cupressinum*), where it was cached.

The parent bird then perched in a shaded part of the tree for 30 min.

Fox (1978b) suggested that the territory occupied by breeding adult Falcons (Bush form) is approximately 75 km². The nearest probable nest site of another adjacent pair of Falcons was approximately 9 km away. By halving the distance between pairs and assuming the territory to be circular, we estimate the area occupied by the parents of these juveniles to have been about 64 km² ($\pi \times 4.5^2 = 64$). We are assuming that the juveniles, when discovered, were close to the nest site.

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