

# FOOD AND FEEDING BEHAVIOUR OF THE SOUTHERN CRESTED GREBE ON THE ASHBURTON LAKES

By COLIN F. J. O'DONNELL

## ABSTRACT

The food and feeding behaviour of the Southern Crested Grebe (*Podiceps cristatus australis*) were studied on the Ashburton Lakes (South Island, New Zealand) in 1979 and 1980. Of 47 food items eaten on the surface by adults, 55.5% were fish, 31.9% were insects and 12.6% were plants. Chicks in their first week ate mainly fish under 55 mm long. Both adults and chicks ate feathers. One pellet contained feather, fish, insect, plant and egg remains. Dives lasted on average 20-30 seconds. Feeding success of adults was high while they were feeding chicks.

The New Zealand and European subspecies are compared. Differences suggest that much less food is available in New Zealand, which may affect productivity and population size.

## INTRODUCTION

New Zealand literature gives little information on the food and feeding behaviour of the Southern Crested Grebe. Most standard texts make no mention of foods (Oliver 1955, Soper 1965, Williams 1973, Falla *et al.* 1979) and only brief mention of the grebes' diving habit. Reischek (1885) gave "fish and various insects," Moncrieff (1957) "chiefly fish" and Marshall *et al.* (1975) "mainly fish and crustacea" as grebe foods. In Europe the Great Crested Grebe (*P. cristatus cristatus*) eats fish, and to a lesser extent insects, crustacea, molluscs, seeds and small amounts of plant material (Cramp & Simmons 1977).

In this study I collected basic information on food and feeding behaviour while also studying breeding, behaviour, and habitat preferences of grebes on the Ashburton Lakes during 1979 and 1980.

Eleven named lakes are present in the Ashburton Lakes study area which lies at the foot of the Southern Alps, 130 km south-west of Christchurch (NZMS maps S73, S81). The lakes range in altitude from 624 to 685 m and in size from 5 to 729 ha. Crested Grebes bred on six lakes during this study (Lakes Heron, Clearwater, Emily, Emma, Denny and the Maori Lakes). The topography, lakes, climate, vegetation and fauna have been described in full by Adams (1978) and O'Donnell (1980).

## METHODS

Observations were made on most days from November 1979 to February 1980 using 8 x 30 binoculars, a x 20 spotting scope and a x 20-60 zoom telescope. I studied a population of 57 grebes, concentrating on the 37 grebes on Lake Heron. Grebes were not timid and were easy to observe. A quantitative study of foods was not possible because grebes swallow most items underwater. Observations were therefore confined to what grebes brought to the surface to eat, or when a feeding method other than diving was used. Size of fish eaten was estimated against bill length. Lake depths where grebes dived were measured from a canoe.

## FOOD

*Adults*

During the many hundreds of dives I watched I saw only 47 food items eaten on the surface. Over half these items were fish (Table 1), mainly exotic trout and salmon. Although 44.5% of these food items were insects and plants they formed only a small part of the total volume of food eaten. Fish taken by adult grebes were estimated to average 96 mm in length (SD 59.9, range 30-190 mm,  $n = 18$ ). Large fish took up to 5 minutes to manipulate and swallow. Smaller fish were eaten when chicks found them too large to swallow.

TABLE 1 — Food items of adult Crested Grebes on the Ashburton Lakes

FISH	n	%
Brown trout ( <i>Salmo trutta</i> )	10	21.4
Rainbow trout ( <i>S. gairdneri</i> )	3	6.4
Quinnat salmon ( <i>Oncorhynchus tshawytscha</i> )	6	12.8
Bullies (Eleotridae)	6	12.8
Smelt (Retropinnidae)	1	2.1
TOTAL	26	55.5
INSECTS		
Unidentified species	10	21.4
Midge pupae	4	8.4
Waterboatmen	1	2.1
TOTAL	15	31.9
PLANTS		
Algae	4	8.4
Myriophyllum	2	4.2
TOTAL	6	12.6
TOTAL	47	100.0

A wide variety of invertebrate larvae was also readily available in the lakes and these were probably eaten by grebes. The most abundant were stoneflies (Plecoptera), midges (Chironomidae), mayflies (Leptophlebiidae), damselfly (*Xanthocnemis zealandica*), dragonfly (*Procordulia grayii*), caddisflies (Trichoptera), adult water boatmen (Corixidae), and terrestrial insects on the water-surface film.

Grebes cast pellets while feeding and loafing. A visual assessment of one dry pellet that measured 70 x 55 mm showed it to contain 40% feathers, 20% unidentified material, 15% fish bones, 10% vegetative remains and 5% each of insect cuticle, bird egg shell and fish scales by volume. Both adults and chicks were offered feathers to eat. Feather eating and pellet formation have been linked (Cramp & Simmons 1977). Feathers accumulate in the stomach (Chance 1970), where they probably catch indigestible food remains that may otherwise damage the intestine.

### Chicks

Of 43 food items fed to chicks in their first week, 85.9% were fish about 10-55 mm long (mean 28.6 mm, SD 15.5,  $n = 37$ ). Chicks refused fish over about 60 mm long. Midge pupae, waterweed and unidentified insects each made up 4.7% of chicks' food. Chicks were fed feathers from hatching onwards. A parent that had been away feeding often pecked a feather from its breast or flanks and took it to its mate, which dipped the feather into water and pulverised it with its bill before offering it to a chick. Chicks were reluctant to take fresh feathers.

A 3-month old juvenile was seen to catch two trout, each about 60 mm long.

## FEEDING BEHAVIOUR

### Adults

Grebes took most food underwater, submerging completely to do so. The dive was smooth, without a jump or splash. Usually grebes spent 20-30 seconds submerged, with females taking longer on average (mean 34.4 s, SD 14.8, range 5-85,  $n = 119$ ) than males (mean 26.7 s, SD 13.8, range 5-65,  $n = 87$ ). Diving times of parent grebes catching food for chicks were much shorter (mean 16.1 s, SD 13.4, range 7-56,  $n = 26$ ). The diving times of parents feeding themselves while attending chicks were also shorter with females averaging 28 s (SD 9.7, range 7-57,  $n = 72$ ) and males 20 s (SD 6.7, range 7-37,  $n = 152$ ).

Adults spent most of the day feeding. They had long periods of intensive diving interspersed with short periods of resting and preening. The mean time spent on the surface between dives ranged from 7.7 to 17.3 seconds. The number of dives per feeding spell varied from 5-10 dives over a short period to 55 dives in 25 minutes.

Grebes fed in lake depths of 0.5-6.0 m. Females feeding them-

selves dived in water depths averaging 3.4 m, males dived in average depths of 2.4 m. Grebes usually fed in shallower water 5-13 m from the shore, and up to 100 m offshore on rare occasions. Females tended to feed closer inshore (mean 10.2 m) than males (13.1 m) when feeding themselves. When caring for chicks, grebes fed much closer to shore (mean for female 5.3 m, male 5.2 m) and sometimes under overhanging vegetation. Grebes surfaced 3-4 m from where they dived.

Grebes were very tolerant of rough water (waves up to 0.7 m high) and poor visibility (as little as 0.2 m) when feeding. Throughout the spring, summer and early autumn strong north-westerly winds blew almost constantly and lasted 5 to 17 days at a time. On occasions, while swimming and diving in the lakes, I could feel strong water turbulence up to 6 m offshore and to depths of 5 m. In these conditions spells of feeding were long (15-20 minutes, interspersed with preening spells of 5-10 minutes) but dives were shorter (c. 15 seconds). During intense storms, grebes fed little and sheltered under dense willows.

Surface feeding was seen only 17 times. On sunny, calm days grebes fed for up to 30 minutes from the surface in very shallow water with only their heads submerged, often bringing their heads to the surface for only a few seconds at a time. They were apparently feeding on midge pupae floating in the water column and on molluscs and bullies. Grebes also made quick stabs from the surface at passing fish (five spells of up to 10 stabs each were seen). Grebes were seen to pick insect prey from marginal vegetation twice and from the surface film seven times.

### *Feeding young*

While chicks were still on the nest, food was often caught under marginal vegetation close to the nest. When chicks had left the nest, the adult diving rate increased markedly. The chicks of one brood left the nest site for good when the final egg of the clutch hatched and spent their first two days off the nest on the back of one or other parent. After a change-over of carrying duty, the parent just relieved fed the chicks and then fed itself. Only rarely did an adult which had been feeding for some time return with food for young. After two days, chicks swam begging towards a parent bringing food and competition among the brood increased. Food was moistened with water before being given to a chick. Each chick received one fish per feed and sometimes there was a long interval between feeding each member of the brood. The average interval between the chicks' feeds was 31.6 minutes (SD 17.1, range 5-65,  $n = 20$ ). Feeding success was high when catching fish for chicks. One pair providing food for two 1-week old chicks caught 14 fish in 23 dives (61% success).

One independent 3-month-old juvenile watched during a feeding spell made over 30 dives in quick succession. Dives were short (mean 18.3 s, SD 4.0, range 12-25,  $n = 32$ ), perhaps because the bird was inexperienced and its catch-rate low.

## DISCUSSION

The feeding ecology of the Southern Crested Grebe is different in several respects from that of the Great Crested Grebe in Europe.

1. The foods are similar (cf. Witherby *et al.* 1941, Simmons 1974, Cramp & Simmons 1977) but the available foods are much more varied in Europe. New Zealand has a small freshwater fish fauna (Waugh 1973, Falla 1975, McDowall & Whitaker 1975), and probably only four indigenous and three introduced fish species were in the Ashburton Lakes (Boud *et al.* 1959) whereas over 20 fish species are eaten in Europe.
2. Feeding was usually in depths between 0.5 and 6.0 m (once 15 m) in the Ashburton Lakes. In Europe the grebes usually feed in depths of 2-4 m or less (Cramp & Simmons 1977).
3. Crested Grebes in Europe have a wider ecological niche than in New Zealand, where they feed in cool to cold, fresh, moving waters. In Britain the grebes also commonly feed in artificial, standing, brackish and sea waters (Cramp & Simmons 1977).
4. The mean dive of adults feeding themselves lasted 30.5 (max. 85) seconds in the study area compared to means of 26.0, 24.0 and 19.5 (max. 56) seconds cited by Cramp & Simmons (1977). This may reflect the relative abundance of fish prey. In New Zealand, feeding was often difficult because of poor weather and was completely abandoned during many storms.
5. The rate at which young are fed in Europe may be much greater than in New Zealand. In Europe chicks were fed on average 12 times per hour (max. 95) compared to twice per hour (limited sample) on the Ashburton Lakes.

These differences suggest that supply of suitable food is very limited in New Zealand. In Europe, food is much more diverse, aquatic niches are more diverse, and grebes spend relatively less time feeding. Dives last much longer in New Zealand and much of the day is spent feeding. Rate of feeding young is much greater in Europe. The young of one New Zealand brood studied were left alone during adult feeding after two days off the nest. Simmons (1974) states that, unless food is scarce, young are constantly attended until 30 days old.

These facts may be pertinent to discussions on population decline (Westerskov 1971), very low breeding success (O'Donnell 1980), and the small number of Crested Grebe in New Zealand (Sagar 1981). Food availability is a major determinant of breeding success (Simmons 1974). The introduction of three species of salmonid predator to the Ashburton Lakes may have created important competitors for Crested Grebes. The impact of these introductions on native fish and invertebrates is not known, but there is some circumstantial evidence to suggest that native fishes have declined because of predation and competition by the salmonids (Waugh 1973).

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COLIN F. J. O'DONNELL, c/o 198 Blenheim Road, Christchurch 4



## SHORT NOTES

WHITEHEAD BREEDING, AND PARASITISM BY  
LONG-TAILED CUCKOOS

During a visit to Little Barrier Island from 28 January to 1 February 1982, I recorded all flocks of Whitehead (*Mohoua albigilla*) seen during walks along the four main tracks leading away from the ranger's house (Thumb, Valley, Main Summit, and Shag Tracks) and down a track called Number 3, which leads from the Thumb summit to the western coast. To try not to record the same birds twice, I did not record flocks if I backtracked during the day or if I re-used a track along which I had recorded flocks on previous days.

I noted 35 Whitehead flocks, ranging from 2 to an estimated 40 birds. I have regarded two birds as a flock because they could have included young birds. Of these 35 flocks, 22 (63%) did not