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The distribution and numbers of Australasian crested grebe (kāmana) in New Zealand, January 2004

L.A. JENSEN
Department of Conservation, P.O. Box 8, Arthur's Pass, New Zealand. *ljensen@doc.govt.nz*

R.J. SNOYINK
6 Homebush Road, Glentunnel, Canterbury, New Zealand *rsnoyink@xtra.co.nz*

Abstract The Australasian crested grebe (kamana: *Podiceps cristatus australis*) is nationally endangered within New Zealand. A census, conducted on 24 January 2004 by 81 observers, recorded 300 adults and estimated a further 15 as present on 41 of the 93 lakes counted. Assuming approximately 30 grebes to be present on lakes not counted, the national population of adult crested grebes is estimated to be 340-350. This is 40% higher than the population recorded in 1980. In addition, 75 juveniles were counted on 18 lakes. As in the 1980 survey, approximately 55% of the adult crested grebes were recorded on Canterbury lakes. A significant regional change has occurred with birds now present on lakes in Otago, absent from Nelson lakes, and in reduced numbers in Marlborough, North Canterbury, Westland and Fiordland. In addition, a significant decline has occurred at Lake Alexandrina, one of the strongholds identified in the 1980s. Forty percent of the present adult population was recorded on two lakes, Lake Heron and Lake Hayes. We identify priority sites where management to reverse declines could be implemented and we recommend a suite of management actions.

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INTRODUCTION

The Australasian crested grebe (kāmana: *Podiceps cristatus australis*; Fig. 1) is native to New Zealand and Australia (Cramp & Simmons 1977). A large (50cm, 1100 g), totally aquatic bird, it now breeds on the clean, clear, cold waters of South Island high country lakes. Crested grebes have been in New Zealand since at least the Holocene (>10,000 years BP) (Turbott 1990) and vagrants still arrive from time to time (Baker 1991). They have decreased significantly in New Zealand during the last 100 years (O'Donnell & Fjeldsa 1997), having disappeared entirely from the North Island while, in the South Island, their range is shrinking in a southerly direction (Westerskov 1972; Sagar 1981).

Increasing concern about declining numbers has resulted in the species being classified under IUCN criteria as 'vulnerable' (O'Donnell & Fjeldsa 1997). Although the taxon exists in southern Australia, it is not numerous there, with a population believed to be less than 3000 (Marchant & Higgins 1990). In New Zealand the taxon is classified as 'nationally critical' (Hitchmough 2002) because of its small and declining population. In the 1980s and 1990s, the population was believed to be 200 – 300 adults (Sagar 1981; O'Donnell & Fjeldsa 1997).

The first national survey of crested grebes was undertaken in 1980, when 240-250 birds were recorded (Sagar 1981). We resurveyed the lakes censused then with the aim of gathering contemporary data on the numbers and distribution of the crested grebe in New Zealand. The intention is to use these data to update the assessment of conservation status and identify priority sites where management should be initiated to reverse past declines.

METHODS

Crested grebes are best counted during the breeding season when most birds are sedentary on lakes and where peak egg laying occurs in late December and throughout January (O'Donnell 1980; Marchant & Higgins 1990). We conducted our count on 24 January 2004 and counted all lakes simultaneously to minimise the possibility of movement between lakes.

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Table 1 Counts and estimates of crested grebes on South Island lakes 24 January 2004

Lake	Adults	Estimated	Juvenile	Total
MARLBOROUGH				
Rotorua	2	0	0	2
Rotoiti	0	0	0	0
CANTERBURY				
Sumner group				
Sumner	0	0	0	0
Mason/Little Mason	0	0	0	0
Loch Katrine	0	0	0	0
Taylor	0	0	0	0
Sheppard/Mary	2	0	0	2
Marion	0	0	0	0
Pearson group				
Sarah	2	0	1	3
Grasmere	2	0	0	2
Pearson	14	2	6	22
Hawdon	2	0	0	2
Marymere	2	0	0	2
Vagabonds Inn	0	0	0	0
Letitia	6	1	1	8
Minchin	0	0	0	0
Coleridge group				
Lyndon	0	0	0	0
Coleridge	6	0	3	9
Georgina	2	0	0	2
Ida	2	0	0	2
Little Lake Ida	1	1	1	3
Catherine	0	0	0	0
Evelyn	1	1	0	2
Selfe	7	0	1	8
Henrietta	0	0	0	0
Lilian	0	0	0	0
Coastal Canterbury group				
St Annes Lagoon	0	0	0	0
Ellesmere	0	0	0	0
Forsyth	0	0	0	0
Ashburton group				
Heron	78	0	21	99
Clearwater	5	1	4	10
Camp	0	0	0	0
Roundabout	0	0	0	0
Emma	3	0	0	3
Emily	2	0	0	2
Trinity	0	0	0	0
Maori Lake Back	2	0	0	2
Maori Lake Front	0	0	0	0
Denny	0	0	0	0
Mackenzie group				
Alexandrina	11	0	2	13
McGregor	0	0	0	0
Murray	0	0	0	0
Swan Lagoon	0	0	0	0
Ohau	0	0	0	0
Middleton	0	0	0	0
Ruataniwha	0	0	0	0
Wairepo Arm	6	0	0	6
Waitaki group				
Benmore	15	5	2	22
Aviemore	3	0	2	5
Waitaki	0	0	0	0
WESTLAND				
Hochstetter	0	0	0	0
Ahaura	0	0	0	0
Haupiri	0	0	0	0
Kaurapataka	0	0	0	0
Lady	0	0	0	0
Kangaroo	0	0	0	0
Brunner	0	0	0	0
Poerua	0	0	0	0
Kaniere	0	0	0	0
Mahinapua	0	0	0	0
Ianthe	6	2	2	10
Saltwater Lagoon (part)	2	0	0	2
Okarito Lagoon	0	0	0	0
Windemere	2	0	1	3
Mapourika	0	0	0	0
Matheson	0	0	0	0
Paringa	0	0	0	0
Moeraki	2	0	0	2
Ellery	0	0	0	0
OTAGO				
Anderson's Lagoon	0	0	0	0
Dunstan	10	1	5	16
Butchers Dam	1	0	0	1
Hawea	0	0	0	0
Wanaka	2	0	2	4
Wakatipu Frankton Arm	4	0	0	4
Wakatipu Whites Bay	1	0	0	1
Wakatipu Hidden Island	2	0	0	2
Hayes	57	0	18	75
Johnson	6	0	0	6
Von Tarns	3	0	0	3
Upper Mararoa	1	0	0	1
Dispute	0	0	0	0
Moke	0	0	0	0
Kirkpatrick	0	0	0	0
Mt Nicholas Lagoon	9	0	2	11
FIORDLAND				
Te Anau	1	1	0	2
Te Anau SW Middle Ford	2	0	0	2
Te Anau Township	2	0	0	2
Te Anau Boat Ramp	2	0	0	2
North Mavora	1	0	0	1
South Mavora	2	0	0	2
Fergus	0	0	0	0
Gunn	0	0	0	0
Lochie	0	0	0	0
Mirror	0	0	0	0
Manapouri	0	0	0	0
Green	4	0	0	4
Island	2	0	1	3
Totals	300	15	75	390

Of 150 South Island lakes identified as likely to harbour crested grebes, 93 were counted (Table 1). Thirty-five remote and low altitude lakes were excluded from the survey because assessment of recent and historical counts indicated there was little chance of finding crested grebes on them, and another 22 lakes intended for survey were missed on the day (see Appendix).

Observers comprised Department of Conservation (DoC) staff and groups from the New Zealand Fish & Game Council, Royal Forest & Bird, Ornithological Society of New Zealand, fishing guides, and other known grebe enthusiasts. They provided local knowledge, access information, encouragement, help on the day, and contact details of others who might assist with the count.

Observers were requested to complete a census of their allocated lake by walking or boating and by observing the shore line and open water using telescopes and binoculars. The details they reported were: region, lake name, observer name, weather and lake conditions, number of adult grebes counted, number of juvenile grebes counted, and number of grebes estimated to be present. Single birds seen patrolling raupo (*Typha orientalis*) beds or willow trees (*Salix* spp.) overhanging the water were considered to indicate an unseen incubating bird (Sagar & O'Donnell 1982) and these unseen birds were recorded as "estimates". Two maps of each lake were provided to observers; one on which to record the position of grebes seen, and another on which to record nesting habitat.

Weather at the time of the survey was fine, calm and clear over the entire South Island (Fig. 2). Lake Ellesmere was the only area where windy conditions prevailed.

RESULTS

Three hundred adult crested grebes were seen and 15 were estimated as present on 41 lakes. Seventy-five juveniles were recorded on 18 lakes (Table 1) indicating that chicks fledged on less than half (43%) of the lakes with adult populations.

The majority of crested grebes were in Canterbury and Otago. In Canterbury, 158 were seen or estimated as present on 22 of the 48 lakes surveyed (Table 1). In addition, 44 juveniles were recorded.

Crested grebes were rare on northern and coastal Canterbury lakes with only two adults counted in the Lake Sumner group. Numbers in mid-Canterbury were concentrated in the Pearson group of lakes (39 birds) with the largest number on Lake Pearson (8 pairs, 6 juveniles), and at lakes near Lake Coleridge where 26 birds were spread evenly across the lakes. Highest numbers in Canterbury were recorded in the Ashburton lakes (116 birds) with the greatest concentration on Lake Heron (78 adults, 21 juveniles). In South Canterbury, 46 crested grebes were counted in the Waitaki catchment, Mackenzie and Waitaki groups (Table 1). Lake Benmore had the highest number with 15 adults, 2 juveniles and 5 estimated as present.

In Otago, 97 adult crested grebes were counted or estimated as present on nine of 14 lakes surveyed (Table 1), the majority being on Lakes Hayes (75 birds). Crested grebes were also counted in Marlborough (2), Westland (17) and Fiordland (18).

DISCUSSION

Sources of under-estimation

Our survey estimate of 315 adult crested grebes is likely to under-estimate the total population size because 35 of the 150 lakes identified for survey were intentionally excluded after review, and 22 others were missed on the day of the survey,. However, based on recent and historical counts, we consider it unlikely that significant numbers of birds were missed on the uncounted lakes (O'Donnell & West 1995, 1998). The number of grebes not observed but assumed from anecdotal evidence to be present on counted lakes is about 10 (O'Donnell & West 1995) while the number of grebes likely to be present on lakes that were not counted is approximately 20.

Some birds present may not have been detected. For example, any amongst large flocks of paradise shelducks (*Tadorna variegata*) and Canada geese (*Branta canadensis*) encountered on some lakes may have escaped notice (F. Barber pers. comm.); those hiding in willows because of disturbance by pleasure craft (D. & J. York pers.comm) may also have been missed. A section of Lake Aviemore and all of Loch Laird were unable to be counted while counts on Lakes Te Anau, Benmore and Wanaka were probably incomplete because large sections of their shorelines were inaccessible by road. We assume also that crested grebe inhabit some of the uncounted Fiordland lakes.

Comparison with the 1980 survey

Comparison with the 1980 survey (Sagar 1981) indicates that the number of Australasian crested grebe in New Zealand has increased , albeit slightly. Also, the distribution of grebes changed during the 24-year interval (Table 2).

In 1980, 170 adult grebes were counted, 20 were estimated as present (Table 2) and a further 50-60 birds were assumed to be on lakes not covered during

Table 2 Comparison of counts made during 1980 and 2004 surveys of Australasian crested grebe. 1980 data are from Sagar (1981); nc = not counted.

Group of lakes	1980 Adults	Est'd	2004 Adults	Est'd	Juvs.
Nelson	0	0	nc	nc	nc
Marlborough	1	3	2	0	0
North Canterbury	0	0	nc	nc	nc
Sumner	0	2	2	0	0
Pearson	13	2	28	3	8
Coleridge	15	1	19	2	5
Coastal Canterbury	nc	nc	0	0	0
Ashburton	50	4	90	1	25
Mackenzie	50	0	17	0	2
Waitaki	0	0	18	5	4
Westland	22	8	12	2	3
Otago	nc	nc	96	1	27
Fiordland	19	0	16	1	1
Total	170	20	300	15	75

the survey, bringing the total adult population to 240-250. In this survey, 300 adults were counted and 15 more were estimated as present. The addition of an undetected 10 birds on the counted lakes and a possible 20 on lakes not counted suggests the present New Zealand population of adult crested grebes is 340-350.

Current status

Although crested grebe numbers may have increased slightly since 1980, the population is still small and the threatened conservation status of "nationally critical" (Hitchmough 2002) seems appropriate.

Inland lakes of eastern South Island support the majority of crested grebes in New Zealand and two lakes, Lake Heron and Lake Hayes, together support about 40% of the entire population.

Whereas early records (Westerskov 1971, 1972; Falla *et al.* 1979) show birds were distributed throughout the South Island, lakes north of the Pearson group of lakes now appear to have a few stragglers rather than viable breeding populations. Numbers on the West Coast have also declined and the only healthy population there is on Lake Ianthe. The Fiordland lakes will need more study to determine their status.

Crested grebes are still declining in Marlborough, North Canterbury, Westland and Fiordland, a trend already noted by Westerskov (1971) and Sagar (1980). The count of only 11 adult crested grebes on Lake Alexandrina represents a dramatic decline in the population there. From 1964 to 1970, 10 – 12 pairs were present (Westerskov 1971) while, in 1980, the lake supported 38 adults, then the largest number on any New Zealand lake (Sagar 1981).

In contrast to most areas, crested grebes have increased on the Pearson group of lakes (by 215%), on the Ashburton group of lakes (180%), on the Waitaki group of lakes (100%) and on Otago lakes (100%) (Table 2). The Otago lakes were not counted in 1980 because there had been no recent records from within the region (Sagar 1981).

Crested grebes were recorded as having bred successfully (i.e. having fledged chicks) on 44% of lakes where adult pairs of grebes were observed. On Lake Hayes, 0.64 chicks/adult pair was recorded and 0.75/adult pair on Lake Pearson. These two chick/adult pair ratios, both considerably greater than the 0.47 chicks/adult pair recorded from all other lakes in the survey, are well below ratios recorded for crested grebe (*P. c. cristatus*) in Britain (1.3/pr, n = 431 pairs,1.5/pr, n = 169 pairs; Cramp & Simmons 1977). Data from the Ashburton Lakes, collected over five seasons between 1978 & 1984, indicates breeding success ranged from 0.04 to 0.8 chicks/per adult pair. Similarly, data from the Alexandrina Lakes collected over five seasons between 1971 & 1983, indicates the breeding success on the Alexandrina Lakes ranged from 0.02 to 0.72 chicks/per adult pair (C. O'Donnell pers.comm.); 0.02 chicks/pair was recorded in 1978-79 indicating very low productivity in that year.

If breeding was consistent across the range, we would have expected to record more pairs with fledglings during our survey. For example, at Lake Pearson there were at least six nests established at the lake in 2003-04 by an adult population of 16

birds (pers.obs.). If each pair raised only one chick, there should have been (and was) six chicks on the lake at the time of the survey. If this breeding rate is applied to the entire adult population recorded during our survey, we could have expected to observe at least 118 chicks (75% of 315 adults = 236 breeding birds making 118 pairs, each raising one chick). The number of chicks counted in the census was 75 (Table 1). Given that crested grebes can raise more than one chick in a brood (Figure 4) and that some pairs raise more than one brood in a season (Marchant & Higgins 1990; Chance 2002), we conclude the productivity of the New Zealand population to be very low.

Suggestions for management

Our survey has confirmed the threatened status of crested grebes in New Zealand and has highlighted two factors which contribute to ongoing population decline; low productivity and a patchiness of areas in which the grebe population has declined.

Possible threats to the survival of this species include (i) predation of nests from introduced mammals; (ii) human-induced lake level fluctuations, particularly hydro-electric developments; (iii) loss of original nesting habitats on lake margins; (iv) competition with introduced trout for native fish foods; (v) increased disturbance from water-based recreation; and (vi) predation of chicks by introduced trout (O'Donnell & Fjeldsa 1997).

No fledglings were observed on 56% of lakes with resident adult grebes suggesting an unnaturally high breeding failure and indicating low productivity has a significant, detrimental effect on New Zealand's crested grebe population. However, declining population trends can be reversed if crested grebes are appropriately protected (Cramp & Simmons 1977) and if the factors that have caused the decline can be eliminated or reduced significantly (O'Donnell & Fjeldsa 1997). We recommend several forms of protection to improve the grebes' productivity in New Zealand.

Nest protection

While grebe chicks can be taken by native avian and fish predators (Ackerly 1988; O'Donnell & Fjeldsa 1997), it is introduced mammalian predators that place great pressure on natural populations which have not evolved to handle such threats (Newton 2002). Predation of grebe nests by mustelids (*Mustela* spp.), feral cats (*Felis catus*) and rats (*Rattus* spp.) is thought to be a major problem (O'Donnell & Fjeldsa 1997). High levels of predation at nests observed using infrared videos at Lake Pearson in 2000-01 (7 of 18) suggests nest protection should be an early management response to increase breeding success (Newton 2002).

Crested grebe is a specialist aquatic species and birds rarely come ashore. Nesting is conducted on the water also, in floating nests attached to submerged vegetation close to littoral margins. Protection from land-based, introduced predators, particularly stoats (*Mustela erminea*), can be effective if traps are set around nesting areas during the egg laying and incubation periods when the birds are most at risk.

Nests are constructed of lake vegetation such as willow, weed and mud (Fig. 3) and may be fixed to trailing branches, be free floating, or built up from the bottom of the lake. They are a large pyramid shaped mound of intertwining vegetation, mostly lying below the water. In most cases only about 14 cm of the mound is above the water, with a shallow cup to hold the eggs (O'Donnell 1980). Changes in water levels, experienced with hydro-electric development, can leave a nest stranded on shore or swamped by water. In either case, the nest is no longer viable. Minimal interference with the natural water supplies to lakes is vital if nesting attempts are to be successful.

Shoreline vegetation

Crested grebe habitat is lost when vegetation e.g., willow and raupo, along sheltered lake edges is no longer available for the birds to use. Farm animals using the lake shores to access their water supply, eat and trample vegetation and, thus, destroy grebe habitat (pers.obs.). Removal of vegetation for easier access to the water's edge or to improve the view is equally destructive to sites suitable for nesting, particularly in the sheltered bays. Fencing to keep farm animals out of wetland areas, prohibiting vegetation removal, replanting suitable species or layering willows into the water can provide new habitat for grebes to use.

Disturbance

Human disturbance has become one of the dominant factors determining the structure and composition of wildlife communities (Gutzwiller 1995). The disturbance can be residential or recreational, and includes people 'manicuring' lake frontage, people enjoying the environs of the lake while walking, fishing or camping, people exercising domestic pets, and people using boats.

While all of these activities have the potential to impact on crested grebes, disturbance from watercraft may be particularly damaging.

For example, video monitoring of nests on Lake Pearson in 2000-01 revealed that, on days when motor-power boats were present, grebes spent less time on their nests, increased their number of nest departures, and increased the length of time off the nest when disturbed (Newton 2002). When incubating adults are disturbed and flushed from nests, eggs are left exposed to chilling and are accessible to predators (E. Kennedy pers. comm.).

Since the length of time birds stay off the nest may be influenced by the type of craft and the length of time it stays in proximity to the nest, we suggest restrictions on boat use e.g., banning motorised craft, imposing speed restrictions, and designating areas of the water "off limits" to boats as effective methods of preventing disturbance or injury to nesting grebes.

Public awareness of the grebes could also be promoted e.g., in the media, erection of lake-side interpretation panels, to advising people of the presence of crested grebes.

Restrictions on domestic pets running loose in areas where birds are nesting would also confer necessary protection to nesting birds.

Population recovery

Factors responsible for the decline of crested grebes on individual lakes may be many and varied. Research is needed to determine the dynamics of each situation and what action needs to be taken to protect the birds. For instance, lakes where adults were recorded without chicks but where nesting is known to take place, would likely benefit from a trapping program to control predators. Lakes where grebes were recorded but nesting attempts have failed due to lack of suitable habitat would benefit from revegetation or the building of artificial nesting platforms (O'Donnell & Fjeldsa 1997).

Crested grebes in Europe quickly find and colonize new sites. They are also accepting of human presence in the absence of destruction or direct injury (Cramp & Simmons 1977). One of the largest populations of crested grebe recorded during this survey was on Lake Hayes (Table 1), an increasingly popular recreational and residential area. Therefore, it is possible for humans and grebes to share the use of some habitat. As the global action plan for crested grebes (O'Donnell & Fjeldsa 1997) suggests, halting and reversing the degradation of grebe wetland habitats is an essential first response, together with educating the New Zealand public about this increasingly rare bird.

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APPENDIX

Lakes excluded from the survey

Nelson – Blue, Constance, Matiri, Rotoroa (St Arnaud), Rotoiti (St Arnaud); Marlborough – Elterwater, Grassmere; Canterbury – Pukaki, Tekapo, Opuha, Sedgemere Tarn; Westland – Bell Hill, Browning, Christabel, Denniston Dams, Daniels, Gillows Dam, Kumara Reservoir, Wahapo, Westport Reservoir; Otago –Mahinerangi, Greenland Reservoir, Manorburn Reservoir, Onslow, Poolburn Reservoir, Waihola, Waipori; Fiordland – Alta, Diamond, Grebe Valley, Hauroko, Hope, Isobel, Luna, Rere

Lakes missed on the day of the survey

Marlborough - Glenmore Tarns, Guyon, McRae, Molesworth Tarn, Tennyson; Canterbury - Loch Laird; Westland – Alpine, Darby, Joan, Rasselas, Raupo Lagoon, White Heron Lagoon; Fiordland – Hakapoa, Hector, Innes, Kiwi, Monowai, Poteriteri, Ronald, Shallow Lakes, Thomas, Wilmot.

Figure 1 A pair of Australasian crested grebes in a head-shaking display on Lake Hayes. Photo: George Chance

Figure 2 Survey conditions on Lake Roundabout, 24 January 2004. Photo: Warren Jowett

Figure 3 Australasian crested grebe on nest, Lake Alexandrina. Photo: George Chance

Figure 4 A pair of grebes with chicks, Lake Hayes. Photo: George Chance