

This flightless waterbird is confined to Lago de Junín in the highlands of west-central Peru, where it is seriously threatened by pollution from mining activities, by regulation of the water level for a hydroelectric plant supplying the mines, and by plans to divert water down the Pacific slope to supply Lima.

DISTRIBUTION The Junín (Flightless) Grebe (see Remarks 1) is restricted to Laguna Chinchaycocha de Junín (appearing on most maps as Lago de Junín or Laguna de Junín), a 14,320 ha lake (with an additional 11,900 ha of temporarily flooded meadows surrounding it), situated at 4,080 m in Junín department, western Peru (at 10°51'-11°06'S 76°17'-33'W) (Fjeldså 1981b). The species is now absent from the heavily polluted north-western end of the lake.

POPULATION Although several thousand birds may formerly have occurred on the lake, the total population now appears to be only between 200 and 300 individuals.

Morrison (1939b), who was at the lake without intermission from 18 January to 11 May 1938, found the species to be extremely abundant. In mid-November 1961, several hundred birds were seen at the southern end of the lake (Storer 1967, F. B. Gill verbally 1985, J. Fjeldså *in litt.* 1985), suggesting that well over 1,000 inhabited the lake at this time.

Along 9.5 km of the southern coast, 70 birds were counted in October 1977, with 75 counted there (along 12 km) in January 1978 (when some birds may have been brooding); during both counts no grebe was present far offshore, and extrapolation to the shores of the entire lake gave estimates of 390 and 330 birds, respectively (Fjeldså 1981b). Considering the absence of this species from the heavily polluted northern end, and information from locals suggesting that it is most numerous between Ondores and Pari, becoming gradually sparser north of Pari and towards the south-east of the lake but occurring inside a reed-barrier which separates small lakes outside Huayre and Carhuamayo, the population was estimated to be 300 birds including immatures: the number of birds observed taking part in displays or seen in pairs suggested that not many more than 100 pairs were present (Fjeldså 1981b). What was believed to be the entire population, 250-300 including young, was counted in May 1979, in the central part of the lake, with none near the reed-borders (Fjeldså 1981b; see also Harris 1981). For comparison with these numbers 45-55 Silvery Grebes *Podiceps occipitalis* and 3,500-4,000 White-tufted Grebe *Rollandia rolland* were estimated to inhabit the lake in 1977/1978 (Fjeldså 1981b).

Fifty-seven Junín Grebes were counted along 8 km of the southern coast in October 1981, thus suggesting a small decline in the total population to some 250 birds, although some could still have been present in the central part of the lake as no breeding behaviour was observed (J. Fjeldså *in litt.* 1987). Brief observations outside Ondores in November 1983 were inconclusive: some grebes were well offshore, as was the case in February 1985, when only 20 were seen between Ondores and Pari (J. Fjeldså *in litt.* 1987). Locals explained that although it had rained heavily in December-February 1983/1984 the rain had stopped early, so the water level in the dry season of 1984 was even lower than the exceptionally low level of 1983, forcing White-tufted Grebes (a food competitor) out of the reeds (into Junín Grebe habitat), with a resultant high mortality of the former (and possibly the latter) (J. Fjeldså *in litt.* 1987).

Little rain fell in the rainy season of 1984/1985, so in February 1985 the water level was already approaching that of October 1977 (J. Fjeldså *in litt.* 1987). From brief observations along the southern coast in 1983 and 1985, the population was estimated to be as small or smaller than in 1981 (J. Fjeldså *in litt.* 1987).

In July and August 1986 147 individuals were censused, all but one being observed over 1 km from the outer reed-border: censuses were carried out from a boat along two transects, one almost the full length of the lake, and one across the southern end at Ondores; a general decrease in the north-westerly direction along the length of the lake was noted (Balharry 1989). The long transect (6 km long, 0.4 km wide) had on average 25 birds on two trips, the 3.5 km transect 21 birds on six trips; extrapolation from these two transects gave 260 and 375 birds respectively (Balharry 1989). Considering the decrease of birds in the north-westerly direction, the population may have actually been c.250 birds, i.e. much the same as in 1981. A brief visit during May 1992 (relying on information from F. Tueros) suggested that the population may be only c.100 individuals, and that the birds had not been able to breed that season (T. Valqui and J. Barrio *in litt.* 1992; see Threats).

ECOLOGY The detailed studies of the Junín Grebe in the rainy season of 1977/1978 (Fjeldså 1981a,b) are, except when otherwise noted, the source used in the following account.

Lago de Junín is situated 4,080 m above sea level, but remains permanently ice-free, despite air temperatures well below freezing at night in the dry season (May–September). It is a shallow, weakly alkaline, gypstrophic lake, averaging 4 m deep (with a maximum depth of 10 m), with 143 km² of open water (of which c.25 km² are more than 1 km from the reed-border: Balharry 1989), surrounded by 156 km² of reedbeds of 0.5-2 m tall rush *Juncus andecolus* and, in the more fertile and permanently flooded parts, the 2-4 m tall tule *Scirpus californicus*. Thirty percent of the reedbeds are unbroken, the rest being shallow water with *Chara* (submergent) vegetation interrupted only by scattered patches and floating islands of *Juncus*. In some areas intricate mosaics of channels and small lakes are formed, while in others there are large open “lakes” within the reedbeds: most such areas dry up during the dry season. The grebe breeds in patches of tall *Scirpus* in deep water, and during the breeding season forages along the coast in open water, usually 8-75 m from the reed-border (although a few occur in the larger “lakes” in the reedbeds), only exceptionally venturing closer than 5 m or as far as 500 m from the reed-border. Considerable parts of the open lake are shallow with dense *Chara*-cover over the marl bottom, this lying close beneath the surface in the dry season, but 1.5-2.5 m deep in the rainy season, when it is the grebe's favourite habitat. In the dry season the grebes move into the deeper central parts of the lake (at depths of 5.5-9.0 m: Balharry 1989), where the bottom, besides *Chara*, may have taller weeds such as *Myriophyllum elatinoides*, *Potamogeton ferrugineum* and *P. strictus*, *Ranunculus trichophyllus* and *Zannichellia*, but usually has scanty growth and large bare areas. Nothing is known about the grebe's diet at this season, but in the rainy season fish of the genus *Orestias* form the majority of the biomass ingested. In the dry season numerous small *Orestias* survive in the reed and mud swamps, but when they disperse in the rainy season their population densities decrease.

Stomachs of the Junín Grebe (11 adults and two downy young taken in October and January) held chironomid midges, adults and nymphs of the corixid bug *Trichorixa reticulata*, *Orestias* fish, the amphipod *Hyaella simplex*, and maggots and pupae of ephydriid flies: 62% of the fish were less than 25 mm long and made up c.49% of the diet, bigger fish c.41.5%, corixids 6.2% and midges 2%. Considering the differential rate of digestion, some 93-95% of the effective diet is fish. In October there were on average 40 fish per stomach, in January (when most fish had moved into the tules) only 11 per stomach. The relation of diets to available food (as seen in plankton-net samples from the respective feeding areas), as well as the proportions of different types of prey in the stomachs, suggest that bugs act as a buffer food when the supply of fish fails; conversely, feeding on midges appears to be an opportunistic habit. Like its close relative the Silvery Grebe, which it also resembles in habitat selection, the Junín Grebe is a highly sociable species, spending most of the year in small close flocks, rarely as many as 12 together, but usually in twos followed by one or two singles (and sometimes a Silvery Grebe); when foraging they move in a line and dive synchronously, waiting for each other to catch up.

Egg-laying occurs from late November to March, nests being placed in colonies on semi-floating *Scirpus* beds, with 8-20 nests each 1-4 m apart, the clutch-size 1-3 but usually two. After hatching, the young are carried by the male (which is then nearly prevented from diving and thus poorly nourished) and fed by the (well-nourished) female. Pairs with young are solitary. Breeding success appears to be low. Of the pairs with known number of young seen in May 1979, 17 had one young, seven had two, one had three, and 63.4% of all apparently adult birds had no young.

THREATS Lago de Junín has deteriorated greatly due to pollution over an ever-increasing area of the bottom (so far mainly in the northern end and in the deepest, central part, the latter being the wintering grounds of the Junín Grebe), with flocculated iron oxides from the mines that release waste into the río San Juan, and regulation of the water level since 1955 for a hydroelectric power plant supplying the mines (Fjeldså 1986b). The fluctuations in the water level have increased in recent years (Fjeldså 1986b), and abrupt changes of a metre or more, leaving bird nests and fish spawning grounds out of the water, have been noted (B. A. Luscombe *in litt.* 1988). In 1992, it was noted that the lake was experiencing one of the driest periods for decades, and that open water was only left in the centre: the resultant lack of suitable nesting habitat (and failure to observe any young) suggested that (as of the end of May) the birds had not been able to breed (T. Valqui and J. Barrio *in litt.* 1992: see Ecology). Presumably owing to lake bottom contamination, numerous dead fish (*Orestias* sp. of all sizes) were found along the northern shores in 1989, and during the first five months of 1992 up to 10 dead grebes were reported each month (three dead Junín Grebes were found along 2 km of shoreline during three days in May 1992) around the entire lake (T. Valqui and J. Barrio *in litt.* 1992).

In 1977 and 1978 plans were announced to make the lake a water reservoir for Lima: annual fluctuations in water level of up to 5 m were anticipated, which would alter the conditions in the lake completely and, although the pollution would be stopped, the great fluctuations in water level, combined with increasing possibilities for cattle-grazing (see Remarks 2) in the marsh areas during the dry season, would certainly destroy all tall marsh vegetation (Fjeldså 1981b). Junín Grebes could possibly nest on floating weeds (as can Silvery Grebes when necessary), but the complete seasonal dessication of the marshes might seriously alter food availability, partly because of much larger numbers of White-tufted Grebes entering Junín Grebe habitat, and partly because stable production of relevant foods would be impaired by the destruction of submergent vegetation (owing to seasonal drought and turbid water: Fjeldså 1981b). There might be short periods with great production of some invertebrates, which, however, would favour Silvery Grebes rather than Junín Grebes, and it is unlikely that the Junín Grebe would survive such changes (Fjeldså 1981b). Fortunately, worries on behalf of nature and local cattle-raising interests have, together with economic factors, caused postponement and division of the plan into several alternatives (Fjeldså 1984). Contamination with lead, mentioned as a possible danger by Vincent (1966-1971), does not seem to have reached alarming levels (Fjeldså 1981b). However, for unknown reasons, this species is heavily infested with stomach nematodes: although the direct impact of these parasites may be slight, this infestation was heavier than in other grebes (averaging at least 10 times more than other species analysed at the same time) and may indicate poor health (Fjeldså 1981b).

During October, when the grebes approach the reed-borders to breed, and the reedbeds are still too dry for the White-tufted Grebe to enter, the Junín Grebe may suffer severe competition for food from the much more numerous White-tufted Grebe (which, however, on average takes larger fish: overlap in exploitation during this period has, on the basis of diet studies, been calculated at 60-65% (Fjeldså 1981b).

Although the Silvery Grebe is seemingly unaggressive, other grebes avoid feeding in places with many of them, probably because their scudding to and fro disturbs hunting by other species; with the present small population of Silvery Grebe in Lago de Junín (c.50 individuals) there seems to be no great competition for space from that species, but it is very common in the numerous small lakes of the region, and an influx to Lago de Junín from lakes that dry up might occur (Fjeldså 1981b, J. Fjeldså verbally 1990).

MEASURES TAKEN Lago de Junín is a national reserve (Dourojeanni *et al.* 1968, IUCN 1992). A thorough study of the grebe and its requirements during the breeding season was undertaken in 1978/1979 (Fjeldså 1981a,b).

Translocation In November 1983 a search for a lake suitable for a transfer of some of the grebes was undertaken in view of their dwindling population and the general deterioration of Lago de Junín: Lake Chacacancha was chosen, as it was found to meet the requirements of the grebe, and locals claimed that

there were no trout in the lake (J. Fjelds  verbally 1983). In February 1985 four adult birds (a pair, a male and a female) were transferred (Goriup 1985, J. Fjelds  *in litt.* 1986); in August 1986 one or more birds still survived (Balharry 1989), but by January 1987 all had disappeared (Fjelds  1987). It turned out that there were trout in the lake after all (Fjelds  1987, Balharry 1989), and local fishermen suggested that the grebes had got caught in the nets used for catching them (J.Fjelds  verbally 1987). Further plans for transfers were frozen until a more suitable lake could be found: however, most larger lakes in the region are considered unsuited to the grebe (J. Fjelds  *in litt.* 1990).

Monitoring and management of the lake Drill cores from various places in Lago de Jun n were taken in 1986 (Balharry 1989), and they could possibly serve as a standard for measuring changes in pollution of the lake (J. Fjelds  verbally 1990). This may also be possible through a continuation of the monitoring of water quality, started by the company "Binnie and Partners", hired to help with the water reservoir plans (Proyecto Transvase Mantaro), but halted in February 1987 (B. A. Luscombe *in litt.* 1987).

Future conservation of the lake and its endemic life is now in the hands of Asociaci n de Ecolog a y Conservaci n (ECCO) which has tried to obtain the cooperation of the national mining company (CENTROMEN) in order to stop abrupt changes in the water level and, if possible, to keep water levels high when the grebe commences breeding (B. A. Luscombe *in litt.* 1987). ECCO, with some financial aid from the Peruvian Consejo Nacional de Ciencias y Tecnolog a (CONCYTEC), acquired the ecological (including water-quality monitoring) results from the work of "Binnie and Partners", and launched four studies in 1988 and 1989 in Lago de Jun n, despite lack of funds and no boat: one on zooplankton, one on fish, one on the giant toad *Batrachophrynus macrostomus* and one on birds, the latter two not yet published (B. A. Luscombe *in litt.* 1989). Work is now dangerous owing to guerilla activity in the Lago de Jun n area (B. A. Luscombe *in litt.* 1989, T. Valqui *per* J. Fjelds  verbally 1990), which has led to an almost complete closure of the mines in this region: the advance of the pollution may have stopped temporarily (J. Fjelds  verbally 1990). A brief survey of the lake (on behalf of ICBP) was undertaken in May 1992, as a preliminary stage to more extensive work planned for July and August 1992 (T. Valqui and J. Barrio *in litt.* 1992).

MEASURES PROPOSED In October 1986 a proposal for research and conservation management relating to Lago de Jun n and the Jun n Grebe was submitted to the ICBP by J. Fjelds , suggesting: grebe counts covering the whole lake and studies of seasonal movements; sampling of potential grebe food in the various habitats used throughout the year, so as to reach a better understanding of the extent to which the apparent decline is caused by seasonal or occasional food shortage, or by competition and habitat degradation, as previous studies suggest; collection of data on nest-sites, time of breeding, clutch-size and breeding success; counts by local people (for Proyecto Transvase Mantaro) on other waterbirds in the lake and detailed studies of habitat use by all waterbirds during an annual cycle (preferably in the same areas as studied 1977/1978) to determine how the fluctuation in water level affects the birds of the lake; studies of whether seasonal variation in the lakes of the surrounding mountains causes a periodic influx of birds from these other areas, and to what extent this influx affects the local birds; monitoring of changes in some other nearby lakes for reference; investigation of Laguna Yanacocha, c.15 km west of Ondores, as a possible transfer site for the grebe; and research on other endemic and rare animals of Lago de Jun n (see Remarks 3). As a result of the preliminary work during May 1992, an ICBP-funded survey has been scheduled to go ahead during July and August 1992, aimed at realizing some of the proposals outlined above (T. Valqui and J. Barrio *in litt.* 1992).

REMARKS (1) The Jun n Grebe is closely related to the Silvery Grebe, and was probably derived from that species by isolation in Lago de Jun n during the last glaciation (Fjelds  1981a). (2) The meadows surrounding Lago de Jun n are grazed by almost 200,000 cattle (Fjelds  1986a). (3) Lago de Jun n is a biologically important area: besides endemic forms such as the toad *Batrachophrynus macrostomus*, the Jun n Grebe, and Jun n Rail *Laterallus tuerosi* (see relevant account), and possibly the virtually unknown Peruvian Rail *Rallus peruvianus* (see Remarks under Bogot  Rail *Rallus semiplumbeus*), it holds a full complement and larger concentrations of waterbirds than most other Andean lakes (Dourojeanni *et al.* 1968, Harris 1981, Fjelds  1983b).