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## OBSERVATIONS ON ROLLAND'S GREBE

ROBERT W. STORER

Rolland's Grebe, the "Macá común", (*Rollandia rolland*) is the most abundant and widespread grebe in Argentina, from Misiones to Tierra del Fuego. To the north, the range of this bird extends to central Perú (Junín), Bolivia, Paraguay, and southern Brazil. The very large insular race, *R. r. rolland*, is confined to the Islas Malvinas. Although these birds have not been reported from the high Andes of Argentina, I have found them nesting as high as 4300 meters at Laguna Alcacocha, 11 kilometers north northwest of Cerro de Pasco, Perú, and they are common on Lake Junín (3970 meters) and Lake Titicaca (3840 meters).

The field work on which this paper is based was conducted by Frank B. Gill and me between August 4 and December 8, 1961. Observations were recorded at the following places: Argentina, Buenos Aires Province: Estancia Las Nieves, near Las Flores, August 19 to 26; Estancia La Segunda near Chascomús, August 4 to 6 and August 29 to September 10. Perú, Dept. Pasco: Laguna Alcacocha, 11 kilometers north northwest of Cerro de Pasco, November 11 and 17; Dept. Junín: Lake Junín, November 13 to 16, 20 and 21; Dept. Puno: Puno, on Lake Titicaca, November 29 to December 8.

In the breeding season, Rolland's Grebe is one of the handsomest of its family, and its plumage is the most iridescent of grebes. The black of the back is strongly glossed with green, and the deep rufous underparts often have a coppery sheen. The white facial tufts stand out sharply against the black of the head and the neck. The white secondaries are conspicuous when the birds fly or raise their wings in display, and a patch of white feathers below the tail shows clearly when the bird's plumage is fluffed up. The eyes are bright carmine, deeper and less orange than those of the Silver Grebe (*Podiceps occipitalis*). The bill is black and the feet dull yellowish, grayish, or blackish. The pattern of the downy young has been described by Dabbene (1916 : 190), Brooks (1917 : 136), and Storer (1967 : 470) and the juvenal and winter plumages by Scott and Sharpe (1904 : 65-67). An adult in nuptial plumage is figured in Crawshaw (1907 : opp. p. 151).

Examples of the mainland populations of Rolland's Grebe are small: 14 specimens from Buenos Aires Province averaged 243 grams in weight with a range of 195 to 271 grams. As in most species of grebes, the males average brighter in plumage, larger, and longer billed than the females, but there appears to be overlap in all these characters with the possible exception of bill length. The Rolland's Grebes of Lake Junín, described as *Podiceps chilensis morrisoni* by Simmons (1962), are larger and longer billed than birds of the lowland populations. Examples from the Lake Titicaca basin are intermediate between the birds from Lake Junín and those from the lowlands in wing length but are small billed like the latter birds. All the mainland populations except that from Junín may be referred to the race *Rollandia rolland chilensis*. Birds from the Islas Malvinas (*R. r. rolland*) are far larger than any of the mainland examples. (A detailed analysis of variation in this species is being prepared for publication elsewhere).

The simultaneous molt of the remiges is probably the rule throughout the Podicipedidae. This type of molt has been recorded for Rolland's Grebe by Wetmore (1926 : 46) and Morrison (1939 : 645), whose specimens are among those which I have examined. On November 15 at Lake Junín, we watched an adult, which evidently had shed its remiges recently, rise up in the water and Wing-flap. I have examined the following 14 specimens of this species in which the remiges had recently been shed or were not completely grown: Perú: Dept. Junín, Lake Junín, 12, 12 and 19 March and 6 April; Dept. Arequipa, Quileca River, sea level, 4 December; Dept. Puno, Puno, 14, 18, and 18 August. Argentina: Prov. Jujuy, Volcán, 7000 feet elevation, 14 February; Prov. Río Negro, General Roca, 3 December. Chile: Llanquihue, 3 and 5 December; Punta Arenas, 22 February. Islas Malvinas, 8 February. These data suggest that at least in the northern part of the species' range, individuals may vary considerably in the time of molt of the remiges.

Rolland's Grebes are found on a great variety of waters from roadside ditches and potholes to large lakes, slow-moving rivers, estuaries, and the salt-water channels of the Magellanic region, but most nest on reed-bordered ponds and lakes. Many may be found on a given body of water, and they may associate in groups of ten or more, but they appear less gregarious than the Silver Grebe.

Little has been published on the food of Rolland's Grebe. Crawshaw (1907: 152) reported "fresh water crustacea" in the stomachs of all he examined in Tierra del Fuego (evidently four specimens). Barros (1927:264) recorded finely divided animal and plant material and feathers and remains of aquatic larvae and coleoptera, also diverse vegetable and mineral material and feathers of aquatic birds in the stomachs of birds taken in Chile. The stomach of one we took on Lake Titicaca contained the remains of insects including back-swimmers (Notonectidae). On at least four occasions we watched Rolland's

Grebes surface with fish up to 50 millimeters long in their bills, and once we watched them foraging in an extensive mat of floating vegetation, evidently taking emerging diptera or small aquatic arthropods. When the feeding habits of these birds are better known, their diet will doubtless be found to be even more varied.

At one place or another, we found Rolland's Grebes on the same body of water with Silver Grebes, Taczanowski's Grebes (*Podiceps taczanowskii*), Great Grebes (*Podiceps major*), Flightless Grebes (*Rollandia* [*Centropelma*] *micropterum*), or Pied-billed Grebes (*Podilymbus podiceps*). On Lake Junín, where both it and Taczanowski's Grebe were common, *Rollandia* was by far the more numerous in the reed-bordered channels and Taczanowski's Grebe predominated on the open water of the lake. At Laguna Alcacocha, both Rolland's Grebe and the Silver Grebe were common. On Lake Titicaca, both Rolland's Grebe and the Flightless Grebe were common, and we once saw two Silver Grebes there. Like Taczanowski's Grebes on Lake Junín, the Flightless Grebes tended to remain farther out on the lake than Rolland's Grebes. On a small pond near the coast of Chile, we found Rolland's Grebes living beside the Great Grebe. The most complex situation occurred on the lake at Estancia La Segunda, where Rolland's and Silver grebes were abundant and Pied-billed and Great grebes were uncommon. Of all these species, Rolland's Grebe appears the least specialized for feeding. Taczanowski's and Great grebes have long bills and feed largely on fish; Silver Grebes live almost exclusively on small invertebrates; Pied-billed Grebes appear adapted for feeding on large, hard-shelled crustaceans; and the heavy-billed Flightless Grebe is said by Allen (1876 : 359) to feed on "fishes, batrachians, etc." This evidence suggests that the plasticity in feeding habits of Rolland's Grebe may be an important factor in the success of this species in living in the same waters as so many other kinds of grebes.

*General Behavior.* — Almost nothing has been published on the behavior of Rolland's Grebe. These birds sit on the water with their flank feathers fluffed out, but not with the high-sterned look of the Silver and Eared grebes (*Podiceps nigricollis*). Just before diving the flank feathers are appressed, as are the feathers of the head. This "slicking down" of the head feathers is less pronounced in Rolland's Grebe than in the Eared or Horned grebes (*Podiceps auritus*), and the compression of the flank feathers is not exaggerated as in the Eared Grebe, in which it appears to have taken on a signal function.

With grebes in general, the feet are moved alternately while the bird is on the surface and synchronously while the bird moves rapidly under water. For Rolland's Grebe, we only have evidence of the former. These grebes are not infrequently seen skittering across the water (Figure 1 B), flapping their wings and paddling with their feet at the same time. On at least one occasion,

we watched groups of these birds skitter up-wind from the lee side of a canal, in a situation resembling that in which I have observed up-wind flights of Western Grebes (*Aechmophorus occidentalis*) and Horned Grebes.

While on the water, a Rolland's Grebe may dip the head into the water to watch another bird under water, and on one occasion, we saw a fleeing bird dive, then put only its head out of water before continuing fleeing below the surface.

*Comfort Movements.* — Most comfort movements of grebes vary little if at all from species to species, and many resemble corresponding movements of ducks so closely that many of McKinney's terms (1965) for the comfort movements of the Anatidae can be used for the comfort movements of grebes.

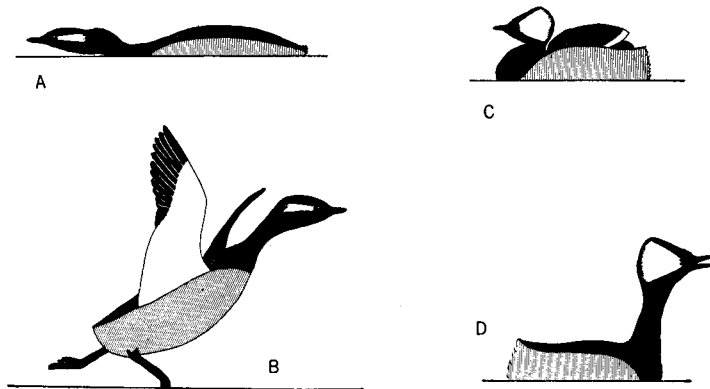


Figure 1. — Behavior of Rolland's Grebe. A, Threat ; B, Skittering ; C, Wing-raising ; D, Advertising

Although we made no concerted effort to record the repertoire of comfort movements of Rolland's Grebe, we noted or filmed Swimming-shakes, Wing-flaps, Wing-and-leg-stretches, Both-wings-stretches, Head-shakes, Oiling, Wing-shuffling, and various preening motions. Foot-shakes, Jaw-stretches, Head-scratching, Bill-dips, and the usual bathing motions are almost certainly performed as well. One comfort movement which does vary from species to species is the Both-wings-stretch. In some species (e.g. *Podiceps auritus*), the wings remain folded as they are raised above the body like those of a duck (McKinney, 1965, pl. I) ; in others, the wings are spread and arched over the water. In Rolland's Grebe, the Both-wings-stretch which we observed was of the latter type. The other comfort movements of Rolland's Grebe appeared to us like those of other grebes, but the preening and oiling movements seemed more rapid than those of larger grebes.

*Agonistic Behavior.* — The threat posture of Rolland's Grebe (Figure 1 A) is similar to that of other species which have been studied. A series of encount-

ers which we watched on the canal between Lake Junín and the Upumayo Dam illustrated the commonest types of aggressive behavior. Here, a pair was feeding a nearly full-grown chick, and at least one parent (the presumed male) defended an area along the windward edge of the canal in which the young stayed. His opponents were a group of the same species which periodically drifted toward the lee side of the canal and then skittered up-wind toward the defended area. When they came too close to the young bird, the male usually threatened and then dove, and the fleeing bird almost immediately followed suit. Less frequently, the aggressor, in the Threat Posture, swam rapidly after the invader or skittered across the water after it. In the latter situation, the invader fled by skittering until first the aggressor and then the pursued dove and the chase continued under the water.

Rolland's Grebes also defend an area around their nests. At Laguna Alca-cocha, we watched an encounter between two males which appeared to have nests approximately 5 meters apart on a grassy island in the lake. The encounter began when one male swam toward the island, near which the second male was sitting on the water. As the birds approached each other in the threat posture, bodies low and heads held low, just over the water (Figure 1 A), one would back away or turn around and swim away from the other, only to turn back quickly, at which the opponent in turn would turn away and swim in the opposite direction. Finally, they took up positions beside the island, each apparently in his territory opposite his nest. For about five minutes they followed a routine in which the male on our right would swim up to within one foot of the other and dive, coming up a few feet farther away. As soon as it dove, the other bird put its head into the water up to his eyes, evidently to watch the progress of his opponent. Occasionally both dove and came up almost touching, rising out of the water with their necks extended and bills open, before subsiding into the threat posture. Occasionally the two males raised their wings, showing the white rear edge of the secondaries as in the Wing-raising display. This series of threats was stopped when a third bird (presumably a female) came up to the left bird, who after ignoring her at first, finally approached her and both performed a brief mutual Wing-raising display. The male then returned to the threat routine which lasted for 30 seconds more, after which a presumed female joined the right male. The two pairs then separated, each performing a series of displays involving Wing-raising and turning.

The only fight we observed was between two birds which shortly before had copulated and then added material to the mating platform. I have never seen a comparable encounter in any other species of grebe, and I suspect that one of the birds was an intruder and was not recognized as such until the two came face to face during the nest building.

*Courtship Behavior.* — In grebes, pair formation takes place over a period of a least several days and before a nest site is selected. Usually it is only after a platform has been built that copulation occurs. The displays and sequences of displays constituting ceremonies which are important in forming, strengthening, and maintaining the bond between members of a pair are complex in Rolland's Grebe, as they are in many other species of the family. Our observations were sufficient only to describe some of these displays and ceremonies and to show that some of them differ strikingly from those of other species which have been studied. Wing-raising (already mentioned), Advertising, Head-shaking, Bumping, and Circling are components of the courtship behavior which we recorded.

*Advertising.* — In this display, which is accompanied by a call, the head is held high and slightly forward and the head feathers are spread, the white patches prominent. (See Figure 1 D). The posture resembles that of Advertising in the species of *Podiceps* except that the head is held somewhat farther forward. Most of our few observations of this display suggest that, as in the species of *Podiceps*, it is used by an unmated bird looking for a mate and by a mated bird separated from its mate.

*Head-shaking.* — Head-shaking displays are probably universal in grebes with elaborate patterns on the head; and in directing attention to these species-specific patterns, Head-shaking may assist in species recognition. These displays may also draw attention to individual differences in markings on the head and thereby lead to individual recognition.

We recorded Rolland's Grebes Head-shaking on eight occasions. Once, two or three very rapid Head-shakes preceded a Bumping Ceremony, and twice, Head-shaking accompanied Wing-raising. Members of a pair were seen to Head-shake after a separation, with or without further displays. On one occasion, we saw a lone bird emerge from the reeds into open water. It Advertised several times and crossed the opening, diving and swimming, while continuing to Advertise from time to time. As it reached the opposite side, three others swam out in a compact group. The Advertising bird shook its head once as it joined them, and the four swam off together. In this instance, it is possible that the Advertising and the Head-shaking were directed at the group rather than at a single bird. Slow Head-shaking may follow copulation, as described under Platform Behavior.

*Wing-raising.* — This display was observed on several occasions at Laguna Alcaocha and on Lake Titicaca. The displaying bird kept its head low, fluffed out its head and body feathers, raised its wings over its back, and spread its secondaries slightly in such a way that the white on the tips of these feathers showed conspicuously. (See Figure 1 C). At Laguna Alcaocha, two

males with adjacent territories Wing-raised several times in the course of an extended aggressive encounter. Later, when their mates had appeared, each pair performed a ceremony with the wings raised, the male and female approaching each other, turning away, swimming back together, and then doing a complete turn. Twice similar circling with Wing-raising was seen on Lake Titicaca. In this, the members of a pair, facing in opposite directions, swam in a tight circle. In one instance Wing-raising was used by both birds, in the other, only by the male. We also saw Wing-raising by a male Head-shaking with a female. After an aggressive encounter with another bird, a bird may return to his or her mate with a Wing-raising display.

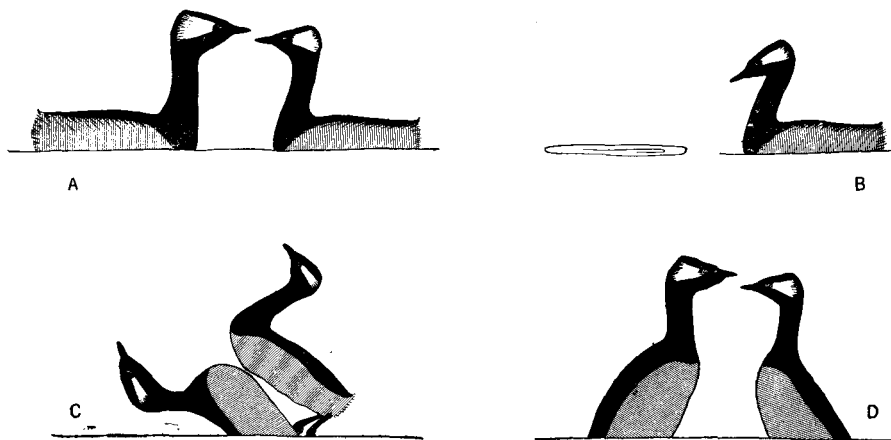


Figure 2. — The Bumping Ceremony of Rolland's Grebe

Wing-raising resembles the Cat Attitude of the Horned Grebe (Storer, MS.) and the Red-necked Grebe, *P. grisegena*, (Wobus, 1964 : 43) ; and like the Cat Attitude, it is used in both agonistic and sexual situations. On the basis of our limited evidence, it appears to be used more frequently than the Cat Attitude and in a greater spectrum of situations. When the behavior of Rolland's Grebe is better known, it may be found that these two displays are homologous.

*Bumping Ceremony.* — This ceremony starts with a pair of grebes facing each other on the water, the bodies horizontal, the necks stretched upward, that of one bird (presumably the male) somewhat higher than the other, and the crests raised (Figure 2). Then one dives and the other arches the neck so that the bill points perhaps 30 to 45° below the horizontal and appears to watch the submerged bird. The latter suddenly comes up under the waiting bird, sometimes with sufficient force to knock it clear of the waer. Although the contact is usually breast to breast, the bumping bird sometimes misses and hits the other bird with its head. This diving and bumping is then repeated



either by the same bird or by its companion. In four such ceremonies which we recorded, from six to more than eight bumpings occurred; in the fifth, which was probably not a complete ceremony, the presumed male bumped the female once, Head-shaking followed, the female dove and remained under water some time, while the male moved twice as though bumped gently, before the female emerged approximately a meter from him. In the case of three of the four longer ceremonies, we were able to determine that each bird played both roles, but there was no regular alternation in the roles played by any bird. In one of the longer ceremonies, as well as in the shorter one, the larger bird (the presumed male) dove and bumped first. Of the four ceremonies which were watched from the beginning, all started with the birds face to face with the necks stretched up and two were preceded by mutual Head-shaking. Bumping Ceremonies may end in one of several ways; two ended with the female diving and coming up with weeds two or more times and the birds then moving off to feed; one ended with Head-shaking, in the case of the bird emerging from the last bumping, preceded by a quick head flick to get water off the bill; one ended with the birds swimming in opposite directions; and one ended with one bird merely swimming away from the other.

As far as I know, this ceremony is only used by Rolland's Grebe. We observed it in birds which were in the early stages of building the nest; how much earlier and later in the breeding cycle it is used remains to be determined. In most of the species of grebes which I have studied, especially the Horned Grebe and the Western Grebe, the birds seem to fear attack by another grebe from under water. In aggressive situations when one bird (either the aggressor or the fleeing bird) dives, the other follows suit almost immediately. In the Great Crested Grebe (*Podiceps cristatus*) and the Red-necked Grebe, Token Diving (Simmons, 1955 : 139; Wobus, 1964 : 54 and personal observations of both species) is a rather commonly used threat. I believe that any ceremony like Bumping in which one member of a pair submerges and the other remains on the surface must be an effective means of reducing aggressiveness between the members of the pair and thus of strengthening the pair bond.

*Pair formation.* — Although we recorded no elaborate, stereotyped ceremony comparable with the Discovery Ceremony of the species of *Podiceps sensu stricto* or the Rushing Ceremony of the Western Grebe, the following series of displays which we recorded on Lake Titicaca may have been at least a partial pair formation ceremony. As one bird Advertised, a second bird approximately two meters away began swimming toward it with its head somewhat raised. The Advertising bird then raised its head and spread the feathers of its head fully, enlarging the apparent extent of the white cheek patch greatly. The second bird then dove and came up beside the Advertising

bird in a Wing-raising display. The two birds faced each other and each did several rapid Head-shakes. Finally both dove and reappeared a short distance away, and the displays ceased. It is probable that Bumping, as well as Head-shaking and Wing-raising, functions as a part of the pair-formation displays of this species, but much more field work is necessary before an accurate description of these displays can be written.

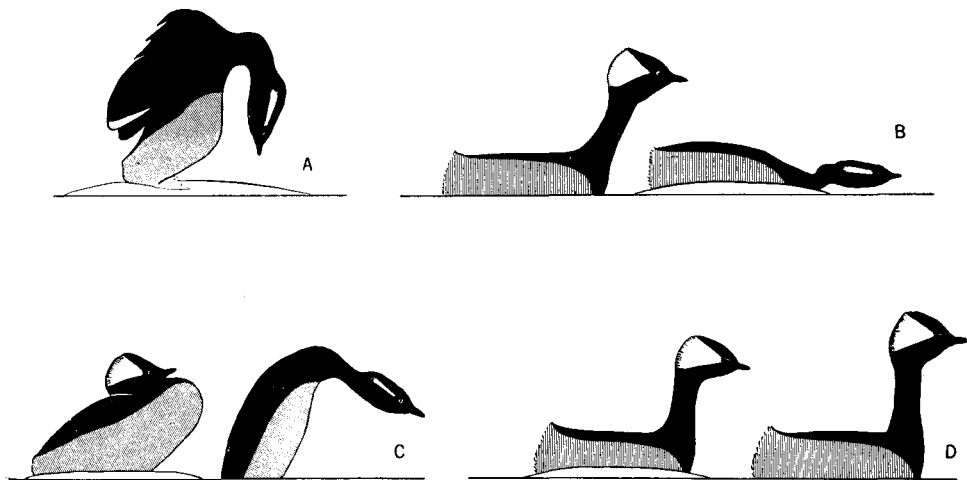


Figure 3. — Platform Behavior of Rolland's Grebe. A, Intense Rearing with Wing-quivering; B, Inviting by the female (right); C and D, Post-copulatory Behavior

*Platform Behavior.* — The displays associated with copulation are much like those of other grebes. Rearing and Inviting (Simmons, 1955 : 243-246) were both observed. The former resembles that of species of *Podiceps*. In the less intense form, the bill is held forward and downward, much as in the photograph of *Podiceps auritus* in Hosking and Newberry (1946 : pl. 78, p. 115). From this posture, the bird may assume a more intense form of the display (Figure 3 A) with the body more nearly vertical and the bill pointing downward. Wing-quivering may be performed when the bird is in this intense Rearing posture. In Wing-quivering, the closed wings are raised a little above the back and vibrated rapidly. The white of the secondaries may show as a band along the posterior edge of the wing during the quivering. We observed Rearing and Wing-quivering by large birds in relatively bright plumage (presumably males) and by smaller, duller birds (presumably females). We did not record Inviting by presumed males or reverse mounting, but I think this was due to the paucity of our observations.

The two copulations which we recorded were both preceded by Rearing, with Wing-quivering, and Inviting by the female. On one occasion prior to mounting the male assumed a posture resembling that shown for *Podiceps*

*auritus* in Hosking & Newberry (1946 : pl. 65, p. 112). I have shown this in Figure 3 B. After copulation, the male waddled off over the female's head and tread water in the usual grebe manner, but with his head in a posture like that in the less intense form of Rearing, while the female assumed an attitude not unlike the Bouncy Dive posture used by several species of *Podiceps* in the Discovery Ceremony, but with the anterior end of the body raised (Figure 3 C). In at least one instance, this was followed by slow Head-shaking by both birds, facing in the same direction with raised heads (Figure 3 D). The postures shown in Figure 3 C have not been recorded in the post-copulatory sequences of other grebes, nor have I observed them in comparable situations in other species. Post-copulatory Head-shaking like that we observed has been reported in the Great Crested Grebe by Simmons (1955 : 248-249).

#### THE SYSTEMATIC POSITION OF ROLLAND'S GREBE

As I have pointed out earlier (1963), this grebe is best placed in the genus *Rollandia* with the flightless species, *micropteryx*, of Lake Titicaca. The hypotarsus in these species has a small canal for the tendon of *M. flexor perforatus digiti II*, as in the species of *Tachybaptus* and *Podilymbus*. However, in *Rollandia*, this canal is smaller and located more directly below the large central canal than in the other genera. *R. rolland* resembles the species of *Podiceps* and differs from those of *Podilymbus* and *Tachybaptus* in its copulatory behavior. The Bumping Ceremony is unlike any other behavior pattern known in grebes, and the degree of iridescence in the plumage is the extreme for the family. (It is most closely approached by examples of "*Podiceps*" *major*). The pattern of the downy young (Storer, 1967 : 470) is quite unlike that of any other grebe, except *micropteryx*, in lacking both a bare crown spot like that in young of *Aechmophorus* and *Podiceps sensu stricto* and a well-defined patch of rufous on the crown like those in the young of other grebes. This and the peculiar mosaic of characters it shares with various other genera suggest that Rolland's Grebe may be closer to the ancestral stock which diverged into an *Aechmophorus-Podiceps* line and a *Podilymbus-Tachybaptus* line than any other living species. The presence of a "primitive" species and the fact that South America has the most diversified grebe fauna of any continent could be used as arguments that the family was of South American origin.

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#### SUMMARY

Rolland's Grebe is abundant and widespread in temperate South America. It is found on both large and small bodies of water and feeds on many kinds of animals from small invertebrates to fish. Its day-to-day activities resemble those of other grebes. Its courtship patterns include Advertising, Head-shaking, Wing-raising, and a peculiar Bumping Ceremony. It is best placed in the genus *Rollandia* with the flightless species *micropteronum*.

#### RESUMEN

*Observaciones sobre el Macá común.* El Macá común (*Rollandia rolland* = *Podiceps rolland*) es una especie abundante y ampliamente distribuida en la región templada de Sudamérica. Se encuentra tanto en grandes como en pequeños cuerpos de agua y se alimenta de muchas clases de animales, desde pequeños invertebrados hasta peces. Su comportamiento sexual incluye un "Advertising", un "Headshaking", un "Wing-raising" y una peculiar "Bumping Ceremony". Corresponde mejor colocar a este macá en el género *Rollandia* junto con la especie no voladora *micropteronum*.

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*The University of Michigan Museum of Zoology, Ann Arbor, Michigan. November 24, 1966.*