VI.6c. The avifauna

CLAUDE DEJOUX

There are few publications on the avifauna of Lake Titicaca, but it is possible to give a fairly complete account of the species inhabiting its shore and islands from the works of Niethammer (1953), Aparicio (1957), Adger Smyth (1971), Hughes (1977) and Kempff Mercado (1985), supplementing the existing data in the literature with our own observations carried out on the Bolivian part of the lake.

Lake Titicaca is not an isolated ecosystem with its own special bird fauna. The species occurring here are usually widely distributed, either over the Altiplano or the entire Cordillera. Certain species, in contrast, are frequent in other lacustrine environments in these two regions, but have never (or rarely) been recorded from the lake.

The following list, which should not be considered as exhaustive, gives an overview of the main species inhabiting the lake and also those which live in its immediate surrounds and have been recorded in the literature. Species preceded by an asterisk are those normally inhabiting the lake surroundings, but not closely related to the lake environment. Those preceded by two asterisks are more closely related to aquatic biota, while those with three asterisks are permanent inhabitants of the lake itself. As far as possible we have given the vernacular names and the English names of the species listed.

Following the list we give some ecological observations on the species most characteristic of the lacustrine biotope.

TINAMIFORMES
  TINAMIDAE
    * *Nothura darwinii agassizzi* (Bangs). "Codorniz", "inambu chico común", "spotted nothura".
PODICIPEDIFORMES
  PODICIPEDIDAE
    ** *Rollandia rolland chilensis* (Lesson). "Zambullidor", "maca común", "patito pumpún", "white-tufted grebe".

C. Dejoux and A. Iltis (eds.), Lake Titicaca, 460–469.

*** *Rollandia micropterum* (Gould). "Ninra", "maca alicorto", "short-winged grebe".

PELECANIFORMES

PHALACROCORACIDAE

** *Phalacrocorax olivaceous olivaceous* (Humboldt). "Mehke", "olivaceous cormorant".

CICONIIFORMES

THRESKIORNITHIDAE

*** *Plegadis ridgwayi* (Allen). "Rua-rua", "chuwankera", "cuervillo de la puna", "puna ibis".

ARDEIDAE

** *Nycticorax nycticorax hoactli* (Molina). "Zonzon", "pájaro bobo", "martineta", "night heron".

ANSERIFORMES

ANATIDAE

* *Chloephaga melanoptera* (Eyton). "Huallata". "ganso andino", "andean goose".

*** *Anas georgica spinicauda* (Vieillot). "Pato del lago", "pato cola aguda", "yellow-billed pintail".

*** *Anas flavirostris oxyptera* (Meyen). "Ita", "pato barcino", "pato piojoso", "speckled teal".

*** *Anas versicolor puna* (Tschudi). "Kankana", "pato puna", "puna teal".

*** *Anas cyanoptera orinomus* (Oberholser). "Junta", "puka", "pato ala azul", "cinnamon teal".

*** *Oxyura jamaicensis ferruginea* (Eyton). " Pana", "pato zambullidor", "andean ruddyduck".

FALCONIFORMES

ACCIPITRIDAE

* *Phalcoboenus megalopterus megalopterus* (Meyen)."Cuervo", "matamico cordillerano", "mountain caracara".

* *Circus cinereus* (Vieillot). "Aguila", "anka", "cinereous harrier".

FALCONIDAE

* *Falco femoralis pinchinchae* (Vieillot). "Cernicalo", "alcón", "aplomado falcón".

* *Falco sparverius cinnamominus* (Cory). "Kilincho", "alconcito colorado", "american kestrel".

GRUIFORMES

RALLIDAE

*** *Rallus sanguinolentus tschudii* (Chubb). "Gallineta común", "plumbeous rail".

*** *Gallinula chloropus garmani* (Allen). "Tika", "gallineta de agua", "moorhen".

*** *Fulica americana ardesiaca* (Tschudi). "Ajoya", "gallareta americana", "american coot".

*** *Fulicula gigantea* (Eydoux and Souleyet). "Choka", "gallareta gigante", "giant coot".

CHARADRIIFORMES

LARIDAE

*** *Larus serranus* (Tschudi). " Gaviota andina", "kellwa", "andean gull".

** *Larus pipixcan* (Franklin). "Gaviota menor", "Franklin's gull".

CHARADRIIDAE

* *Vanellus resplendens* (Tschudi). "Continela", "tero serrano", "andean lapwing".

* *Charadrius alticola* (Berlepsch and Stolzmann). "Chorlito serrano", "puna plover".

SCOLOPACIDAE

** *Tringa melanoleuca* (Gmelin). "Chorlo mayor patiamarillo", "greater yellowlegs".

** *Tringa solitaria* (Wilson). "Chorlito solitario", "solitary sandpiper".

** *Tringa flavipes* (Gmelin). "Chorlo patas amarillas", "lesser yellowlegs".

** *Gallinago andina andina* (Taczanowski). "Sak'a-Sak'a", "Puna snipe".

PHALAROPODIDAE

** *Steganopus tricolor* (Vieillot). "Falaropo tricolor", "Wilson's phalarope".

RECURVIROSTRIDAE

** *Himantopus himantopus mexicanus* (Müller). "Ccota-año", "common stilt".

COLUMBIFORMES

COLUMBIDAE

* *Zenaida auriculata hypoleuca* (Bonaparte) "Paloma", "eared dove".

* *Metriopelia melanoptera melanoptera* (Molina). "Tórtola", "palomita moteada", "bare faced ground dove".

* *Metriopelia ceciliae gymnops* (Chubb). "Palomita ala dorada", "palomita aymara", "black ringed ground dove".

PSITTACIFORMES

PSITTACIDAE

* *Bolborhynchus aurifrons orbygnesyus* (Souance). "Kitaloro", "catita andina", "mountain parakeet".

APODIFORMES

TROCHILIDAE

* *Patagona gigas peruvianus* (Boucard). "Picaflor gigante", "giant hummingbird".

PICIFORMES
PICIDAE
* *Colaptes rupicola puna* (Cabanis). " Pito", "carpintero de las piedras", "andean flicker".
PASSERIFORMES
FURNARIDAE
* *Geossita cunicularia titicacae* (Philippi and Landbeck). Kiti-kiti", "pampero común", "common miner".
HIRUNDINIDAE
* *Petrochelidon andecola andecola* (Lafresnaye and D'Orbigny). "Golondrina andicola", "andean swallow".
MOTACILLIDAE
* *Anthus furcatus brevirostris* (Taczanowski). "Bisbitos", "cachirla de una corta", "short-billed pipit".
CINCLIDAE
** *Cinclodes fuscus albidiventris* (Sclater). "Mirlo acuático", "bar-winged cinclodes".
TURDIDAE
* *Turdus chiguanco chiguanco* (D'Orbigny and Lafresnaye). "Chiguengo", "chiguanco thrush".
TYRANNIDAE
* *Muscisaxicola capistrata* (Burmeister). "Dormilona corona castana", "ground tyrant".
* *Lessonia rufa rufa* (Sclater and Salvin). "Negrito", "rufous-backed negrito".
* *Tachuris rubigastra alticol*a (Berlepsch and Stolzmann), "Siete colores", "many-colored rush tyrant".
TROGLODYTIDAE
* *Troglodytes aëdon puna* (Berlepsch and Stolzmann). "Ruiz señor", "chichurico", "tropical house wren".
FRINGILLIDAE
* *Carduelis atrata fasciatus* (D'Orbigny and Lafresnaye). "Jilguero", "cabecita negra oscura", "negrillo", "black siskin".
* *Sicalis uropygialis uropygialis* (Lafresnaye and D'Orbigny). "Kelluncho", "jilguero cara gris", "bright-rumped yellow finch".
* *Zonotrichia capensis pulacayensis* (Manegeaux). "Pichisanka", "rufous collared sparrow".
* *Phrygilus plebejus plebejus* (Tschudi). "Fringilo plebeyo", "ash-breasted sierra finch".
FURNARIDAE
* *Phleocryptes melanops schoenobaenus*. "Totorero". "wren-like rushbird".

Ecological observations

Taking into account the fact that this list is, as we have already stated, not exhaustive, it can be seen that the lake and its immediate surroundings are populated by a rather diverse avifauna, with at least 13 orders, 27 families and 50 species being recorded. Despite this, Lake Titicaca cannot be considered as a distinct biogeographical area, as no species is strictly related to this biotope. The concept of a biogeographical area consisting of the Altiplano would be a much more pertinent ecological reality.

Among the 50 species mentioned, 28 (i.e. 56%) are not related to the aquatic environment and occur in numerous localities on the Altiplano when their food is available. It is certain however that the shores of the lake represent a rich environment, with a better developed and more diverse agriculture than on the rest of the Altiplano, which creates an area of attraction for numerous species of bird, enabling them to occur almost permanently in this habitat. Among these species are almost all of the passerines listed (some of them, such as *Phleocryptes melanops* being closely linked with totoras), as well as widespread orders such as the Columbiformes and Falconiformes.

Ten species are restricted to aquatic habitats, but are not permanent or frequent inhabitants on the scale of the lake. They are found occasionally on the islands or around the shoreline. These include the waders such as the Charadriidae and Scolopacidae which at certain seasons are locally abundant when they can find appropriate biotopes (mud flats or shallow water marshes) and abundant food. Large concentrations are rarely observed. One Ciconiiforme (*Plegadis ridgwayi*), which frequents similar habitats within the large shallow bays, does sporadically occur in large flocks searching for aquatic invertebrates among the macrophytes or on bare sediments. This species breeds around the lake margins, building its nests among the totora stems. Other species such as *Cinclodes fuscus* and *Rollandia rolland chilensis* are very uncommon and are only rarely observed.

The remaining dozen species form the basis of the aquatic avifauna of Lake Titicaca. They nearly all belong to families Laridae, Rallidae and Anatidae. The Andean gull (*Larus serranus*) occurs all the year round on the lake, both over and on the open water and along the shorelines. At the time of maximum emergence of the large species of *Chironomus* (October-November), they switch from feeding on fish to become strictly insectivorous, hawking these large dipterans over the Huiñaimarca.

The Rallidae live among the totoras where they nest and find shelter. At present *Fulica americana ardesiaca* is certainly the most abundant species, followed closely by *Gallinula chloropus*. These two species are also abundant on the Altiplano, in all the lacustrine environments rich in macrophytes, which constitute their main food, the totoras only serving as shelter and sometimes nest support. We have never observed *Fulica gigantea* in the Bolivian part of the lake, although it is frequent on the small lakes of the

northern Altiplano and has been recorded from Puno Bay (Aparicio, 1957; Adger Smyth, 1971).

At least five species of duck inhabit the lake. They are rarely abundant at any one locality and are usually met with in pairs or groups of 5 to 10 individuals at maximum. They share the habitat with coots and feed among the submerged aquatic macrophytes at the margins of the totoras. It would seem that they are increasing in numbers at present, probably in relation to the gradual lowering of the water level and the accompanying increase in the area of totora stands submerged macrophytes. They were very rare at the time of maximum lake level in 1986, and at present they are nowhere near as abundant as they were in 1983, when the lake level was a little lower than now.

Finally, mention should be made of two species of aquatic bird that are practically never recorded on the lake or its shores, whereas they can be very abundant elsewhere on the Altiplano. These are the Andean goose (*Chloephaga melanoptera*), which occurs all the year round in the higher valleys of the Cordillera and over the entire Altiplano, and the Chilean flamingo (*Phoenicopterus chilensis*), which is very abundant on Lake Poopo and the shallow salt pans of the southern Altiplano. The former species is very wary and perhaps prefers the solitude of the valleys of the Cordillera, whereas the latter prefers to search for food in waters more saline than those of Lake Titicaca, where the crustaceans that form the basis of its diet abound.

As well as changing over the course of the year with the seasons and with the behaviour of the individual species, the bird population of Lake Titicaca also changes over periods of several years. For example, if the list drawn up by Aparicio in 1957, based on data collected at the start of the 1950s, is compared with later lists, there are many species not mentioned in later publications. It is not impossible that some misidentifications were made when specimens were not collected, but it is also possible that alterations have occurred to the lake ecosytem leading to changes in the bird populations. It is also possible that recent observations have been too limited geographically, or of too short a duration to have found all the species.

The list below gives those species recorded in the work of Aparicio (1957), but which have not been found again in more recent publications.

- *Podiceps occipitalis* Garnot. Podicipediformes
- *Podiceps occipitalis juninensis*. Garnot. Podicipediformes
- *Egretta thula thula* Molina. Ciconiiformes.
- *Theresticus caudatus branickii* Berlepsch & Stolzmann. Ciconiiformes
- *Plegadis falcinellus* (L.). Ciconiiformes.
- *Heteronetta atricapilla* (Merrem). Anseriformes.
- *Anas cyanoptera cyanoptera* Vieillot. Anseriformes.
- *Anas flavirostris oxyptera* Meyer. Anseriformes.
- *Anas speculariodes alticola* Ménégaux. Anseriformes.
- *Anas platalea* Vieillot. Anseriformes.

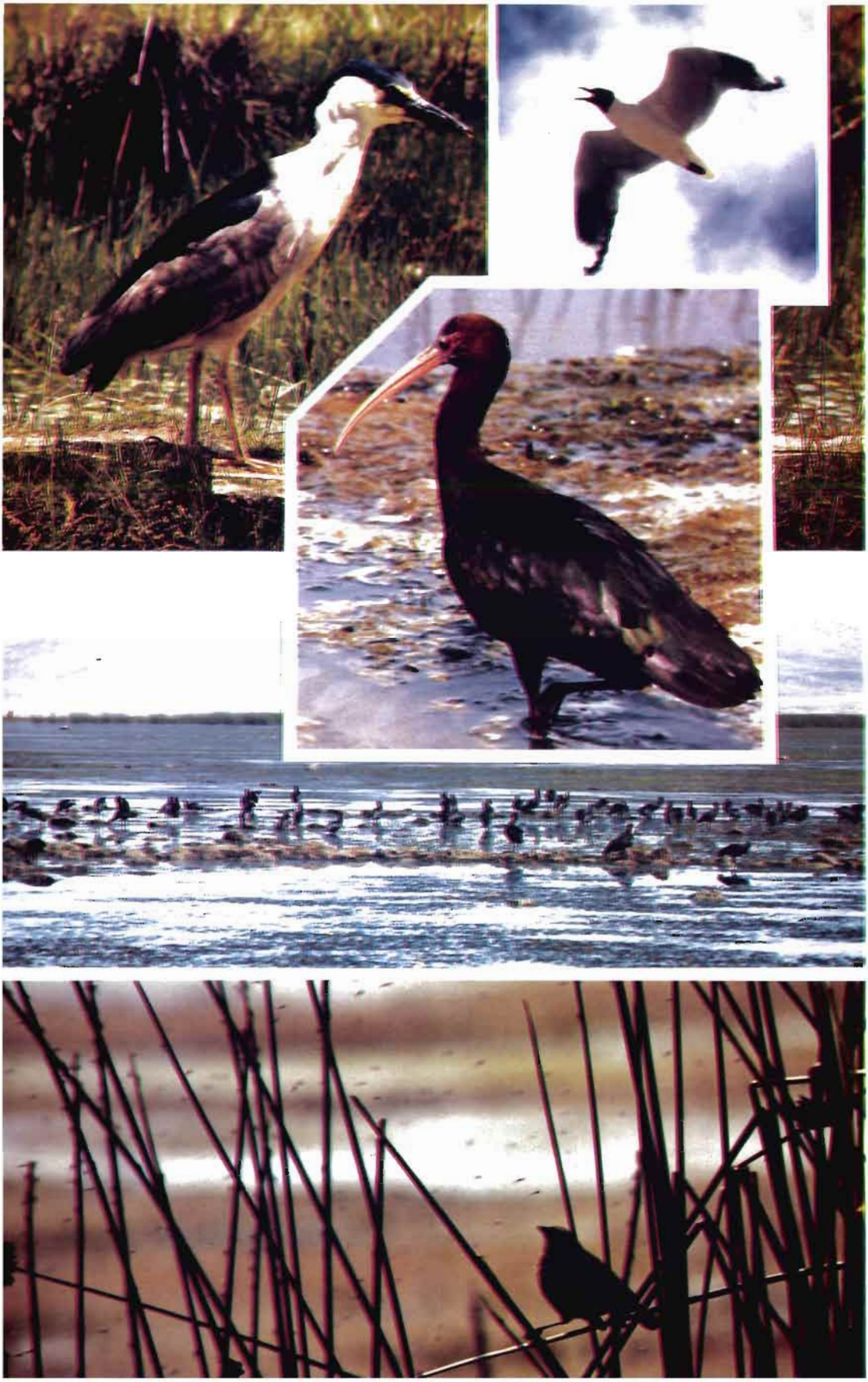
- *Merganetta armata leucogenis* Tschudi. Anseriformes.
- *Fulica leucoptera* Vieillot. Gruiformes.
- *Laterallus jamaicensis salinasi* Phillipi. Gruiformes.
- *Rallus limicola antarticus* King. Gruiformes.
- *Eudromias ruficollis* Wagler. Charadriiformes.
- *Pluvialis squatarola* (L.). Charadriiformes.
- *Larus maculipennis* Lichtenstein. Charadriiformes.
- *Larus dominicanus* Lichtenstein. Charadriiformes.

As these 18 species are all strongly related to the aquatic environment, there are finally nearly 40 species which inhabit more or less permanently in close contact with the lake, and find food and shelter here – a number sufficiently high to qualify the avifauna of Lake Titicaca as being quite diverse. The density of individuals, in contrast, is at present rather low.

As is the case with most deep lakes, it is the littoral zone which is the most frequented and which harbours the highest concentrations of birds. The great beds of totora in the Huiñaimarca and in the shallow bays of the Lago Grande (Puno, Ramis and Achacachi) are therefore of prime importance for the avifauna, especially as the submerged vegetation that borders them supports an abundant food supply. As this zone is the most unstable, because it is the most affected by changes in lake level, it is evident that any manipulation of the hydrological balance of the lake leading to a greater stability for the fringing vegetation would be beneficial for the survival of many bird species. It is also certain that too great a stability would bring about a profound change in species succession, and even the local disappearance of some of birds. This would particularly concern those which only inhabit the lake in any numbers under extreme hydrological conditions, either when low water uncovers large mudflats, or when high water levels flood vast areas.

The birds inhabiting Lake Titicaca undergo various forms of migration and some are long-distance migrants. This is the case for example of some of the Charadriidae, which either arrive from North America or from the extreme south, flying along the chain of the Andes. For example *Pluvialis squatarola*, which has a holarctic breeding distribution at high latitudes, appears regularly during the austral winter (July -September) on the lake shore but leaves before the northern hemisphere summer. In contrast *Pluvialis dominica dominica*, also arriving from its arctic breeding grounds in October or November, is only a passage migrant, moving on further south to winter as far as Patagonia. *Eudromias ruficollis* migrates in the opposite direction, leaving the lake in October to return to the extreme south of the continent to breed (Aparicio, 1957).

Plate 5. Some bird species occurring along the lake shore. Above left: *Nycticorax nycticorax*; Above right: *Larus serranus*; center: Concentration of the puna ibis *Plegadis ridgwayi*, feeding in the shallow Achacachi Bay (Lago Grande), and a near picture of the same bird. Down: a small Passeriforme feeding adult Chironomids in the totora belt. (Photos Claude Dejoux.)



In addition to these long-distance migrants, other species undergo altitudinal movements, usually controlled by changes in physical environmental factors (temperature and water levels), as well as by the availability of their preferred food. These vertical movements can take birds from sea level up to that of the lake (*Larus dominicanus*) or to much higher altitudes than that of Lake Titicaca as is the case of the American egret (*Egretta alba egretta*), which appears occasionally around the lake at the end of the rainy season, or for *Plegadis rigwayi*, which after having exploited the food reserves of the lake when the level is high, then migrates to lakes at higher latitudes.

A third type of migration is that involving birds which move about within the Altiplano in search of optimal feeding conditions, moving from one water body to another depending on the abundance of their preferred food, whose abundance is itself usually related to the physical characteristics of precise habitats.

There is generally little hunting around the lake, at least by the local population, which certainly explains why most of the species can still be observed at reasonable distances.

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References of chapter VI.6

ADGER SMYTH (J.), 1971. Observaciones ornitológicas en la región del lago Titicaca, Perú-Bolivia. UNTA, Puno, 4: 76–99.

ALLEN (W.R.), 1922. Notes on the Andean Frog, *Telmatobius culeus* Garman. *Copeia*, 106: 52–54.

ANGEL (F.), 1923. Sur un batracien nouveau du Pérou appartenant au genre *Telmatobius*. *Ann. Sc. Nat. Zool.*, 6: 107–111.

Anon., 1974. Observaciones sobre alimentación de anfibios del lago Titicaca en la bahía de Piata. Inst. Mar Perú, Puno, 5 p.

APARICIO (M.), 1957. Aves del lago Titicaca. UNTA, Puno: 120 p., multigr.

BARBOUR (T.), NOBLE (G.N.), 1920. Some amphibians from northwestern Peru. *Bull. Comp. Zool.*, 63: 393–421.

BARBOUR (T.), NOBLE (G.N.), 1921. Amphibians and Reptiles from Southern Peru. *Proc. U.S. Nat. Mus.*, 57: 609–620.

BARROS (R.), 1958. Citado por TOBAR (R.). *Bol. Hosp. Viña del Mar*, 14 (4), p. 173.

BOULENGER (G.A.), 1882. Catalogue of the Batrachia salienta in the collection of the British Museum, London. Ed. 2, 563 p.

BOULENGER (G.A.), 1894. On the genus *Phryniscus* of Wiegmann. *Ann. Mag. Nat. Hist.*, 14 (6): 374–375.

BOULENGER (G.A.), 1905. Description of new tailles batracians in the collection of the British Museum. *Ann. Mag. Nat. Hist.*, 16 (7): 180–184.

CASTELNAU (F. de), 1855. Expédition dans les parties centrales d'Amérique du Sud. 7. Animaux nouveaux ou rares. Paris, 2, 86 p.

COPE (E.D.), 1874. On some Batrachia brought from the Upper Amazon by professor Orfon. *Proc. Acad. Nat. Sci. Philadelphia*, 26: 120–132.

D'ORBIGNY (A.), 1835–1847. Voyages dans l'Amérique méridionale. Pitois-Levrault et Cie., Paris, 7 tomes, 11 vol.

DUMERIL (C.), BIBRON (G.), 1841. Erpétologie générale ou Histoire naturelle complète des Reptiles. 8, 452 p.

ESCOMEL (E.), 1929. Fauna de Arequipa: obras científicas. Lima, 1, 176 p.; 2, 297 p.

ESPADA (M. J. de la), 1875. Viaje al Pacífico, Vertebrados, Batracios. *J. Ac. Lisboa*, 3, 621 p.

FITZINGER (L.), 1843. *Systema Reptilium*. 1, 105 p.

GARMAN (S.W.), 1876. Batracians, Reptiles. *In*: Exploration of Lake Titicaca. A. Agassiz and S.W. Garman. *Bull. Mus. Comp. Zool.*, 3, 276–278.

GIGOUX (E.R.), 1940. Los ofidios chilenos. *R. Mus. Nac. Hist. Nat.*, 18, 5.

HUGHES (R.), 1977. Franklin's gulls *Larus pipixcan* at Lake Titicaca, Peru. *Biotropica*, 9 (1): 52.

HUTCHINSON (J.), HAINES (H.), ENGBRETSON (G.), 1976. Aquatic life at high altitude. Respiratory adaptations in the Lake Titicaca frog, *Telmatobius culeus*. *Respiration Physiology*, 27 (1): 115–129.

KEMPF MERCADO (N.), 1985. Aves de Bolivia. Gisbert y Cie., La Paz, 156 p.

MACEDO (H.), 1960. Vergleichende Untersuchungen an Arten der Gattung *Telmatobius*. *Zeits. Wissensch. Zool.*, 163 (3/4): 355–396.

MERTENS (L.), 1952. 3. Amphibien und Reptilien. *In*: Beiträge zur Fauna Perus. Titschack ed., Ein Zool. Reisber., Iena, 8: 257–266.

MUÑIZ (N.), 1982. Contenido estomacal de *Telmatobius* (*sapo acuático*) en Chucuito del lago Titicaca. UNTA, Puno, Bitac. Biol. T. n° 1.

NEVEU-LEMAIRE (M.), 1906. Les lacs des hauts plateaux de l'Amérique du Sud. Imprimerie nationale, Paris, 197 p.

NIEDEN (F.), 1933. Das Tierreich 46, Anura I. Berlin und Leipzig, 584 p.

NIETHAMMER (G.), 1953. Vogelleben am Titicaca See. *Natur. V. Volk.*, 83: 409–416.

NOBLE (G.K.), 1928. The integumentary pulmonary and vasculary in the Amphibians. *Journ. Morph. Physiol.*, 40: 341–416.

ORTON (J.), 1873. The Andes and the Amazon. New York, 645 p.

PARKER (H.W.), 1934. Reptiles and Amphibians from South Ecuador. *Ann. Mag. Nat. Hist.*, 14 (16): 264–274.

PARKER (H.W.), 1940. 12. Amphibia. *In*: The Percy Sladen Trust Expedition to Lake Titicaca in 1937. *Trans. Linn. Soc. London*, ser. 3, 1 (2): 203–216.

PENTLAND (J.B.), 1848. The Laguna of Titicaca and the valleys of Yukai, Collao and Desaguadero in Peru and Bolivia from geodesic and astronomic observations made in the years of 1827 and 1828, 1837 and 1838. British Admiralty Chart, n° 1268, London.

PETERS (W.), 1875. Über neue oder wenig bekannte Gattungen und Arten von Batrachien. *Monats. D. Akad. Wiss.*,: 411–418.

ROHRHIRSCH (J.), 1968. Expedición Cousteau al Lago Titicaca. Informe del geólogo oceanógrafo Joseph Rohrhirsch, enviado por la Oficina de Investigaciones y Desarrollo de la Marina como observador, 7 p.

SCHENONE (H.), BERTIN (V.), MANN (G.), 1954. Un nuevo caso de ofidismo. *Bol. Chil. Parasitología*, 9 (3), p. 88.

SCHLEGEL (H.), 1937. Essai sur la physionomie des serpents. La Haye, 2, 467 p.

SCHMIDT (K.P.), 1954. Notes on the frogs of the genus *Telmatobius* with description of two new Peruvian species. *Fieldiana Zool.*, 34 (26):

SHREVE (B.), 1943. Notes on Ecuadorian and Peruvian reptiles and amphibians. *Proc. New England Zool. Club*, 18: 71–83.

STEINDACHNER (F.), 1867. Reise der Österreich Fregata Novara um die Erde. *Zool. Theil*, Wien, 70 p.

STEINDACHNER (F.), 1882. Batrachologische Beiträge. *Sitzs. Akad. Wien*, 85: 188–194.

STEJNEGER (L.), 1923. Results of the Yale Expedition, Batrachians. *Proc. U.S. Nat. Mus.*, 45: 542 p.

TERRAZAS (W.), 1980. La rana del lago Titicaca. *Rev. Soc. Bol. Hist. Nat.*, 2 (2): 39–40.

TITSCHAK (E.), 1951. Beiträge zur Fauna Perus. Ein Zool. Reisber., Iena, I, 403.

TOBAR (G.R.), 1942. Los ofidios chilenos son capaces de envenenar. *Bol. Hosp. Viña del Mar*, 3 (2), p. 42.

TOBAR (G.R.), 1958. Cinco casos de ofidismo. *Bol. Hosp. Viña del Mar*, 14 (4): 172–184.

TSCHUDI (J.J. von), 1844. Untersuchungen über die Fauna peruana auf einer Reise in Peru während der Jahre 1838–1842. St. Gallien, Herpetologie, 80 p.

VELLARD (J.), 1951. Adaptation des Batraciens à la vie à grande hauteur dans les Andes. *Tr. Inst. français. Et. andines*, Perú-Lima, 3: 88–114.

VELLARD (J.), 1951. Estudios sobre batracios andinos. 1. El grupo *Telmatobius* y formas afines. Memor. Mus. Hist. Nat. Javier Prado, Lima, 1: 90 p.

VELLARD (J.), 1953. El grupo *marmoratus* y formas afines. Memor. Mus. Hist. Nat. Javier Prado, Lima, 2: 53 p.

VELLARD (J.), 1954. Les *Telmatobius* du haut plateau interandin. *Tr. Inst. fr. Et. andines*, Paris-Lima, 4 (1): 1–57.

VELLARD (J.), 1955. Propriétés venimeuses de *Tachymenis peruviana* Wiegm. *Folia Biol. Andina*, 1: 1–14.

VELLARD (J.), 1957. El grupo *Gastrotheca*. *Folia Biol. Andina*, 4: 48 p.

VELLARD (J.), 1959. Distribución de los Batracios en las altas regiones andinas del Perú y Bolivia. Act. Primer Cong. Sudam. Zoología, La Plata, I: 279–292.

VELLARD (J.), 1959. El género *Bufo*. *Folia Biol. Andina*, 5: 48 p.

VELLARD (J.), 1960. Notas complementarias sobre *Telmatobius*. *Folia Biol. Andina*, 6: 18 p.

VELLARD (J.), 1966. El género *Pleurodema* en los Andes. *Folia Biol. Andina*, 7: 12 p.

VELLARD (J.), 1970. Contribución al estudio de los Batracios andinos. *Rev. Mus. Arg. Ci. Nat.*, Buenos Aires, 10 (1): 1–21.

VELLARD (J.), 1975. Les batraciens dans la magie et la médecine des Aymaras. C.R. 1er Coll. Ethnozoologie, Paris: 227–230.

WIEGMANN (J.F.), 1834. *In*: Reise um die Erde ausgeführt auf dem Kgl. Preuss Seehandlungsschiff Prinzessin Louise 1830–32 von F.. Meyen. *Zool. Ber.*, 3: 512 p.

WIEGMANN (J.F.), 1835. Amphibien. *In*: Reise um die Erde ausgeführt auf dem Kgl. Preuss Seehandlungsschiff Prinzessin Louise 1830–32 von F. Meyen. 7° Abhandlungen. *N. Acta Leopoldina*, 17, 262 p.

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