

FIRST RECORD OF ALBINISM AND PIEBALDISM IN *ATELOGNATHUS PATAGONICUS* (GALLARDO, 1962) (ANURA: BATRACHYLIDAE), LAGUNA BLANCA NATIONAL PARK, ARGENTINIAN PATAGONIA

PRIMER REGISTRO DE ALBINISMO Y PIEBALDISMO EN *ATELOGNATHUS PATAGONICUS* GALLARDO, 1962 (ANURA: BATRACHYLIDAE), PARQUE NACIONAL LAGUNA BLANCA, PATAGONIA ARGENTINA

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Resumen.– Entre los distintos tipos de anomalías pigmentarias, el albinismo es la más frecuente en anfibios. La Críticamente Amenazada ranita patagónica (*Atelognathus patagonicus*) es endémica del noroeste de la Patagonia Argentina, donde habita pequeñas lagunas temporarias aisladas entre sí. Durante el monitoreo de dos sub-poblaciones de la especie, encontramos 32 individuos (4.5%; N = 714) con anomalías pigmentarias en la laguna Antiñir, dentro del Parque Nacional Laguna Blanca. Entre ellos, 31 fueron albinos (cinco renacuajos, dos metamorfos y 24 juveniles) reconocidos por poseer la piel transparente y los ojos rojos. Un individuo fue hallado con piebaldismo, presentando parches sin pigmentación y ojos de coloración normal. Este es el primer registro de anomalías pigmentarias para *A. patagonicus*, las cuales pueden tener implicancias ecológicas y de conservación para la especie.

Palabras clave.–Anfibios, anomalías cromáticas, mutación, Neuquén

Abstract.– Among the different types of pigmentary anomalies, albinism is the most common in amphibians. The Critically Endangered Patagonia frog (*Atelognathus patagonicus*) is endemic to the northwest Argentinian Patagonia, and inhabits small temporary lagoons isolated from each other. During the monitoring of two sub-populations of the species, we found 32 individuals (4.5%; N = 714) with pigmentary anomalies in Antiñir lagoon, inside Laguna Blanca National Park. Among them, 31 were albinos (five tadpoles, two metamorphs and 24 juveniles) recognized for having transparent skin and red eyes. One individual was found with piebaldism, presenting patches without pigmentation and eyes of normal color. This is the first record of pigmentary anomalies for *A. patagonicus*, which may have ecological and conservation implications for the species.

Keywords.–Amphibians, chromatic anomalies, mutation, Neuquén.

Albinism is defined as the absence of pigmentation in animals that are normally pigmented (Lawrence, 2005). This anomaly is usually attributed to genetic mutations that affect the production and distribution of melanocytes (Miura, 2018). The term albinism is often used in a narrow or a broader sense (Dyrkacz, 1981; Henle et al., 2017). Many times the terms ‘complete albinism’ or ‘partial albinism’ are used in the literature but they are inaccurate. What was once called ‘partial albinism’ is now better classified

as either ‘leucism’ or ‘piebaldism’ (Summers, 2009; Abreu et al., 2013). The term leucism refers to the lack of melanin in the entire body, except for eyes which retain normal coloration; in piebaldism certain patches or parts of the animal lack melanin; while true albinism can be recognized by the white phenotype in the whole body and reddish eyes (Abreu et al., 2013; Lucati & López-Baucells, 2017). Some authors use the expression ‘partial



Figura 1. Metamorfo albino de *Atelognathus patagonicus* en el centro, renacuajo normal a la izquierda y metamorfo normal a la derecha.

Figure 1. Albino metamorph of *Atelognathus patagonicus* in the center, normal tadpole on the left and normal metamorph on the right..

leucism' to refer what in here is denominated as piebaldism (Neff et al., 2015; Thomas & Follum, 2016).

Albinism is one of the most commonly reported color anomalies in amphibians (Henle et al., 2017). Within this group, albinism cases have been cited in caecilians (Bhatta et al., 2007; Venu et al., 2021), urodels (Flindt, 1985; Mitchell & Church, 2002; Diego-Rasilla et al., 2007) and anurans (Eales, 1933; Gill et al., 1970; Mitchell, 2005; Jiménez-Cazalla, 2011; Barros et al., 2018; Culebras & Angiolani-Larrea, 2023). In Argentina, few records of albinism in broader sense were reported for anurans species (Barg & Canepuccia 2003; Sanabria et al., 2010; López

& Ghirardi, 2011; Martinuzzi et al., 2016). The aim of this article is to present the first record of albinism and piebaldism in *Atelognathus patagonicus* (Gallardo, 1962), a Critically Endangered species (IUCN, 2019), endemic to the lagoons in the Northwest of Patagonian steppe, Argentina (Gallardo, 1962; Cei & Roig, 1968).

We conducted field surveys over a period of 24 days between January and March of 2023 in Laguna Blanca National Park, searching for *A. patagonicus*. We focused our sampling efforts on two lagoons within the park: Jabón lagoon (38.97931° S, 70.37423° W) and Antiñir lagoon (38.98402° S, 70.39712° W).



Figura 2. Juvenil albino de *Atelognathus patagonicus* a la izquierda, juvenil normal a la derecha.

Figure 2. Albino juvenile of *Atelognathus patagonicus* on the left, normal juvenile on the right.

We repeatedly register many cases of albinism only for the Antifiñir lagoon sub-population. In Jabón lagoon, out of a total of 812 individuals observed and individually marked, none exhibited albinism. In the other hand, in Antifiñir Lagoon, 32 individuals displayed pigmentary anomalies (4.5%; N = 714). Among these, 31 had true albinism, consisting of five tadpoles, two metamorphs, and 24 juveniles ($25.15 \pm 1.98\text{mm SVL}$). These specimens lacked the typical coloration of the species (greenish-brown with spots) and had a rather orange-yellowish color with red eyes (Figs 1-2). One juvenile was found with signs of piebaldism, presenting patches without pigmentation and normal coloration in the eyes (Fig. 3). None of these individuals showed signs of weakness or illness.

Albinism might increase selective predation pressure against these individuals as mentioned by Childs (1953), Petrovic (1973) and Toledo et al. (2011). We observed a relative high number of

albino metamorphosed individuals, indicating that predation on albinos' tadpoles is not total. Furthermore, most reported cases are linked to retarded growth (Childs, 1953; Rose, 1962; Sazima, 1974) or developmental abnormalities (Smallcombe, 1949; Browder, 1972; Smith-Gill et al., 1972). Considering that tyrosine, the precursor of melanin, is also a precursor of thyroid growth hormones, a defect in tyrosine would affect both coloration and growth (Bagnara et al., 1978). This might explain the finding of only small individuals. However, definitive conclusions are elusive, as this may stem from growth limitations, predation, non-survival due to various causes, or simply undetection.

When albino gene is present in an isolated population, the frequency of albinism may increase as a consequence of isolation and inbreeding (Russell et al., 2011; Gilhen et al., 2012; Prado-Martinez et al., 2013). In this case, the sub-population is related to an isolated small lagoon which can enhance inbreeding.



Figura 3. Individuo juvenil de *Atelognathus patagonicus* con piebaldismo, nótese los ojos normales y parches sin pigmentación.

Figure 3. Juvenile individual of *Atelognathus patagonicus* with piebaldism, note normal eyes and patches without pigmentation.

Among vertebrates, frequency of albinism varies between 1:10000 and 1:30000 individuals (Bechtel, 1995). Henle et al. (2017) compiled reports in amphibians ranging from 0.000005% to 1% (N > 5000). However, large numbers of albino tadpoles (21%) were observed by Childs (1953) in *Spea hammondi*. Corn (1986) reported an atypical high frequency from 7% to 12% for *Pseudacris triseriata* adults. The presence of so many individuals of *A. patagonicus* with this condition could indicate that this is not an exceptional case, but rather that albinism might be a relatively frequent phenomenon for this sub-population in Antiñir lagoon. However, samplings across successive reproductive events will be necessary to confirm this hypothesis. Likewise, future studies on the ecological implications of this condition in this sub-population would be of great relevance.

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CITED LITERATURE

Abreu M.S.L., R. Machado, F. Barbieri, N.S. Freitas & L.R. Oliveira. 2013. Anomalous colour in Neotropical mammals: a review with new records for *Didelphis* sp. (Didelphidae, Didelphimorphia)

- and *Arctocephalus australis* (Otariidae, Carnivora). Brazilian Journal of Biology 73:185-194.
- Bagnara J.T., S.K. Frost & J. Matsumoto. 1978. On the development of pigment patterns in amphibians. American Zoologist 18:301-312.
- Barg M. & A.D. Canepuccia. 2003. Albinismo en una larva de *Bufo arenarum*. Boletín de la Asociación Herpetológica Española 14:29-30.
- Barros L.P.V., R.F. Muniz, J.P. Kloss-Degen, T.M. de Castro, J.C.F. Oliveira & C.F.D. Rocha. 2018. Albinism in a juvenile of *Rhinella crucifer* Wied-Neuwied, 1821 (Anura: Bufonidae) from southeastern Brazil. Herpetology Notes 11:599-600.
- Bechtel H.B. 1995. Reptile and Amphibian Variants: Colors, Patterns, and Scales. Krieger Publishing Company, Malabar Fla.
- Bhatta G., K.P. Dinesh, P. Prashanth & N.U. Kulkarni. 2007. A new species of the Indian caecilian genus *Gegeneophis* Peters (Amphibia: Gymnophiona: Caeciliidae) from the surroundings of Mahadayi Wildlife Sanctuary, Western Ghats. Current Science 93:1442-1445.
- Browder L.W. 1972. Genetic and embryological studies of albinism in *Rana pipiens*. Journal of Experimental Zoology 180:149-155.
- Cei J.M. & V.G. Roig. 1968. Telmatobiinos de las lagunas basálticas de Neuquén (Anura, Leptodactylidae). Physis 27:265-284.
- Childs Jr H.E. 1953. Selection by predation on albino and normal spadefoot toads. Evolution 7:228-233.
- Corn P.S. 1986. Genetic and developmental studies of albino chorus frogs. Journal of Heredity 77:164-168.
- Culebras J. & F.N. Angiolani-Larrea. 2023. First Record of Complete Albinism in a Species of the Genus *Pristimantis* Jiménez de la Espada, 1870 (Anura: Strabomantidae) in the Ecuadorian Andes. Revista Latinoamericana de Herpetología 6:32-35.
- Diego-Rasilla F.J., R.M. Luengo & L. Rodríguez-García. (2007). *Triturus marmoratus* (Marbled Newt). Albinism. Herpetological Review 38:68.
- Dyrkacz S. 1981. Recent instances of albinism in North American amphibians and reptiles. Society for the Study of Amphibians and Reptiles Herpetological Circular 11:1-31.
- Eales N.B. 1933. Albinism in the common frog. Nature 132:278-279.
- Flindt R. 1985. Latenter albinismos und missbildungen bei Kaulquapen von Wechselkröten *Bufo viridis* Laurenti, 1768. Salamandra 21:298-303.
- Gallardo J.M. 1962. Los géneros *Telmatobius* y *Batrachophrynus* (Amphibia, Leptodactylidae) en la Argentina. Neotropica 8:45-68.
- Gilhen J., G. Caswell, C. Drake, M. MacDonald & H. McKinnonramshaw. 2012. A partial albino hatchling Northern Ring-necked Snake, *Diadophis punctatus edwardsii*, from Big Tancook Island, Mahone Bay, Lunenburg County, Nova Scotia, Canada. The Canadian Field-Naturalist 126:336-339.
- Gill S.J., C.M Richards & G.W Nace. 1970. Biochemical and Developmental Studies on Albinism in *Rana pipiens*. American Zoologist 10:529.
- Henle K., A. Dubois & V. Vershinin. 2017. A review of anomalies in natural populations of amphibians and their potential causes. Studies on Anomalies in Natural Populations of Amphibians. Mertensiella 25:57-164.
- IUCN SSC Amphibian Specialist Group. 2019. *Atelognathus patagonicus*. The IUCN Red List of Threatened Species 2019: e.T56323A101427111. <https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T56323A101427111.en>. [Accessed on 21 September 2023].
- Jiménez-Cazalla F. 2011. Albinismo en un adulto de *Pelophylax perezi* en el sur de Cádiz (SO de la Península Ibérica). Boletín de la Asociación Herpetológica Española 22:62-65.
- Lawrence E. 2005. Henderson's dictionary of biology. Pearson/Prentice Hall, London, England.
- López J.A. & R. Ghirardi. 2011. First record of albinism in *Rhinella fernandezae* (Gallardo, 1957). Belgian Journal of Zoology 141:59-61.
- Lucati F. & A. López-Baucells. 2017. Chromatic disorders in bats: a review of pigmentation anomalies and the misuse of terms to describe them. Mammal Review 47:112-123.
- Martinuzzi C., P.M. Peltzer, A.M. Attademo, C.M. Junges & R.C. Lajmanovich. 2016. Albinism in larvae of the Chacoan frog *Leptodactylus chaquensis* (Anura, Leptodactylidae) from an urban lake from Argentina. Cuadernos de herpetología 30:69-73.



- Miura I. 2018. Anomalies in the coloration of Japanese amphibians and their applications in genetic research. *KnE Life Sciences* 4:97-107.
- Mitchell J.C. 2005. Albinism in american bullfrog (*Rana catesbeiana*) tadpoles from Virginia. *Banisteria* 25:51.
- Mitchell J.C. & D.R. Church. 2002. Leucistic Marbled Salamanders (*Ambystoma opacum*) in Virginia. *Banisteria* 20:67-69.
- Neff M, S. Viernum, S. Twichell & J.C. Mitchell. 2015. Three more unusually-colored Salamanders from North America. *Herpetology Notes* 8:599-601.
- Petrovic C.A. 1973. An "Albino" frog, *Eleutherodactylus planirostris* Cope. *Journal of Herpetology* 7:49-51.
- Prado-Martinez J., I. Hernando-Herraez, B. Lorente-Galdos, M. Dabad, O. Ramirez, C. Baeza-Delgado, C. Morcillo-Suarez, C. Alkan, F. Hormozdiari, E. Raineri, J. Estellé, M. Fernandez Callejo, M. Valles, L. Ritscher, T. Schöneberg, E. De la Calle Mustienes, S. Casillas, R. Rubio-Acero, M. Melé, J. Engelken, M. Caceres, J.L. Gomez-Skarmeta, M. Gut, J. Bertranpetit, I.G. Gut, T. Abello, E.E. Eichler, I. Mingarro, C. Lalueza-Fox, A. Navarro & T. Marques-Bonet. 2013. The genome sequencing of an albino Western lowland gorilla reveals inbreeding in the wild. *BMC Genomics* 14:1-8.
- Rose F.L. 1962. A case of albinism in *Rana pipiens* Schreber. *Herpetologica* 18:72.
- Russell R.W., W. Beslin, M. Hudak, A. Ogunbiyi, A. Withrow & J. Gilhen. 2011. A second amelanistic Eastern Red-backed Salamander, *Plethodon cinereus*, from Nova Scotia, Canada. *The Canadian Field-Naturalist* 125:359-362.
- Sanabria E.A., L.B. Quiroga & A. Laspiur. 2010. First record of partial albinism and scoliosis in *Odontophrynus occidentalis* tadpoles (Anura: Cycloramphidae). *Brazilian Archives of Biology and Technology* 53:641-642.
- Sazima I. 1974. An albino hylid frog, *Phrynohyas mesophaea* (Hensel). *Journal of Herpetology* 8:264-265.
- Smallcombe W.A. 1949. Albinism in *Rana temporaria*. *Journal of Genetics* 49:286-290.
- Smith-Gill S.J., G.M. Richards & G.W. Nace. 1972. Genetic and metabolic bases of two "albino" phenotypes in the leopard frog, *Rana pipiens*. *Journal of Experimental Zoology* 180:157-168.
- Summers C.G. 2009. Albinism: classification, clinical characteristics, and recent findings. *Optometry and vision Science* 86(6): 659-662. <https://doi.org/10.1097/OPX.0b013e3181a5254c>.
- Thomas M.A. & S.C. Follum. 2016. *Anaxyrus americanus* (American Toad). Partial Leucism. *Herpetological Review* 47:102-103.
- Toledo L.F., N. Rodrigues Da Silva & O.G. Dos Santos Araújo. 2011. Albinism in two Amazonian frogs: *Elachistocleis carvalhoi* (Microhylidae) and *Lithobates palmipes* (Ranidae). *Herpetology Notes* 4:145-146.
- Venu G., G.N. Balakrishna, R.K. Browne, N.G. Raju, K. Varadh, S. Ramakrishna & G. Venkatachalaiah. 2021. First record of leucism in the amphibian order Gymnophiona: *Ichthyophis kodaguensis* Wilkinson et al., 2007 from the southern Western Ghats, India. *Herpetology Notes* 14:77-81.

