

APPARENT NATURAL POISONING OF NEOTROPICAL MIGRATORY BIRDS AT LAGUNA VERDE, COLOMBIA

Aparente envenenamiento natural de aves migratorias boreales en Laguna Verde, Colombia

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ABSTRACT

Laguna Verde is a lake located at an elevation of 4300 m in the Los Nevados National Park in the Central Andes of Colombia. During a visit in April 2000, a total of 52 dead birds were found along the lake shore, of which 27 were neotropical migratory birds of two species, 3 represented two local species and 22 were bodies of unidentified passerines. During two subsequent visits no more dead birds were found, and water samples were taken for analysis. These analyses revealed very high concentrations of potentially toxic ammonium salts. The neotropical migrants were well above their previously recorded upper altitudinal limits in Colombia.

Key words: neotropical migratory birds, Central Andes, Colombia, natural poisoning

RESUMEN

Laguna Verde es una laguna situada a una elevación de 4300 m en el Parque Nacional Natural Los Nevados en la Cordillera Central de Colombia. En una visita en abril de 2000, se encontraron 52 cadáveres de aves a lo largo de la orilla de la laguna, incluyendo 27 de dos especies de migratorias boreales, tres de dos especies locales y 22 de passeriformes no identificados. En dos visitas posteriores no se encontraron más cadáveres, y se tomaron muestras de agua para análisis. Los análisis revelaron concentraciones muy altas de sales de amoníaco potencialmente tóxicas. Los migratorios boreales estaban bien por encima de sus límites altitudinales previamente registrados para Colombia.

Palabras clave: aves migratorias boreales, Cordillera Central, Colombia, envenenamiento natural

Laguna Verde (75°21'W, 4°49'N) is a medium-sized lake (900 m long and 400 m wide) with an approximately ellipsoid shape, located at an elevation of 4300 m, 1.5 km south of El Cisne Volcano and 2 km northeast of Santa Isabel Volcano, inside Los Nevados National Park, Tolima Department, Colombia. According to the Holdridge life zone system, this area has been classified as Subalpine Rain Páramo (Anonymous 1963); it corresponds to the limit between Páramo and Superpáramo according to van der Hammen (1998). Low temperatures (ranging from 3° to 6°C), total annual rainfall of 1000–1500 mm, high humidity and strong winds characterize the climate in this zone (Anonymous 1963).

I first visited Laguna Verde on 19 April 2000 and walked along the north shore of the lagoon, which has a sandbar some 300 m long, finding a great number of dead birds. Most were easily identifiable, but some 40% had decomposed or had been largely eaten by scavengers. I counted and identified, to species if possible, all bodies on the shore. Further visits were made on 15 June and 15 October 2000 to search for

more bodies and take samples of water from the lagoon. The physico-chemical properties of these water samples were analyzed in the laboratory of Cenicafé in Manizales. Electric conductivity and pH were measured with a potentiometer and concentrations of Na⁺, K⁺, Mg²⁺, Ca²⁺, NH₄⁺, Cl⁻, NO₃⁻ and SO₄²⁻ were measured by atomic absorption spectrophotometry. In all, four samples were collected, two in each of the last two visits.

The first visit was the only one in which I found dead birds. I recorded a total of 52 corpses of at least four species (Table 1). Two species of boreal neotropical migrants were identified: Broad-winged Hawk (*Buteo platypterus*) and Scarlet Tanager (*Piranga olivacea*). The latter species included the major part of recovered bodies, 40% of the total (Table 1). Additionally, I identified two local species: Stout-billed Cinclodes (*Cinclodes excelsior*) and Purple Gallinule (*Porphyryla martinica*). However, I could not determine if there were more species of passerine migrants because of the decomposed state of many bodies (near 42%). It is interesting to note that the corpses of the Broad-winged Hawks and

Table 1. Number of dead individuals per species founded in the north sand bar of Laguna Verde, National Park Los Nevados, Tolima, Colombia (April 2000).

Species	Number of dead individuals	Total
Broad-winged Hawk <i>Buteo platypterus</i>	7	7
Purple Gallinule <i>Porphyryla martinica</i>	1	1
Stout-billed Cinclodes <i>Cinclodes excelsior</i>	2	2
Scarlet Tanager <i>Piranga olivacea</i>	5 females 15 males	20
Undetermined Passeriformes	22	22
Total		52

Purple Gallinule were encountered beyond 10 m from the shoreline, while those of the Stout-billed Cinclodes, Scarlet Tanagers and unidentified Passeriformes were observed within 5 m of the waterline. Furthermore, I observed that Broad-winged Hawk remains had been attacked by scavengers in all cases, while the rest were apparently untouched.

Though these neotropical migratory birds had been reported previously in the park, they had not been observed at such high elevations before. J. A. Giraldo reported Broad-winged Hawks up to 3950 m at Laguna del Otún (Hernandez et al. 1985), while other sites (Laguneta, Toche, Río Toche) where this raptor had been recorded are below 3100 m. For Scarlet Tanager there is no detailed locality information within the park. Nevertheless, Hilty & Brown (1986) set the upper altitudinal limit of this species at 2600 m and report one sighting at 3000 m in Neusa Reservoir, near Bogotá in Cundinamarca. Thus Laguna Verde is 1300 – 1700 m higher than previous records of the species in Colombia. A dead Purple Gallinule was previously reported in the park at the base of La Olleta Volcano (M. Restrepo De Fraume

pers. com.) at 4500 m elevation. Like other rails (family Rallidae), this species moves regionally, perhaps in response to changing water levels in areas of seasonal rainfall (pers. obs.). W. McKay (in Hilty & Brown 1986) reported that this species presents local migrations in the Meta Department, and it has been recorded passing through the páramo of Chingaza National Park in the Eastern Andes. Therefore, I would consider the individuals at La Olleta Volcano and Laguna Verde as possible local migrants. All of the presumed migrant individuals presumably had stopped to drink at the lake to replenish water reserves used during their migrations; the tanagers in particular had perhaps strayed from their usual migratory routes. Of the birds identified among the corpses, only the Stout-billed Cinclodes is resident in the vicinity of Laguna Verde.

Twenty years ago Hernández-Camacho et al. (1985) pointed out that the water of Laguna Verde was not drinkable. However, until now no chemical analyses confirming this fact were conducted. Water samples taken from the lake exhibited a neutral pH, low concentrations of ions and therefore a low conductivity. Values of pH ranged between 6.37–6.6, which was very similar to values observed in Manzales aqueduct water samples taken as controls, 6.43. Both for cations and anions, concentrations were very low and never were the observed values higher than 1 ppm (Table 2). Conductivity ranged between 10–13 $\mu\text{S cm}^2$ (Table 2). The water samples exhibited no poisonous concentrations of Na^+ , K^+ , Mg^{+2} , Ca^{+2} , Cl^- , NO_3^- and SO_4^{-2} . However, analyses revealed the presence of ammonium (NH_4^+) in high concentrations. Recommended values, according to the European Economic Community, must be near 0.05 ppm and the maximum accepted is 0.5 ppm (Premazzi 1989). In three of the samples, Laguna Verde presented values above the recommended limits, being in one case twice the accepted maximum (Table 2). This makes the water of the lagoon not drinkable. These high concentrations of ammonium salts, which are toxic, could have been the cause of death of the birds although it is not clear whether they

Table 2. Results of the water analyses of four samples from Laguna Verde, Los Nevados National Park, Tolima Department, October 2000.

	Ion free	Manzales aqueduct	L. Verde surface 1*	Samples L. Verde surface 2*	L. Verde 0.5 m deep	L. Verde 1 m deep
pH	6.16	6.43	6.44	6.55	6.37	6.6
Conductivity ($\mu\text{S cm}^2$)	0.01	118	?	10	13	?
Na^+	0.00	4.86	0.89	0.44	0.73	0.54
K^+	0.00	2.14	0.72	0.31	0.58	0.70
NH_4^+	0.00	0.00	0.53	0.04	0.18	0.98
Mg^{++}	0.00	2.60	0.33	0.28	0.31	0.24
Ca^{++}	0.00	9.14	0.77	0.63	0.83	0.54
Cl^-	0.00	4.79	0.31	?	?	0.88
NO_3^-	0.00	1.65	0.00	?	?	0.00
SO_4^-	0.00	26.54	0.85	?	?	0.72

could have produced what appeared to be immediate fatal effects at the water's edge. Ammonium salts can have severe effects on animal health, producing death by pulmonary edema (Anonymous 2002). Poisoning through ammonium salts produces lung and nervous system dysfunctions, which result in hyperventilation, movement difficulty, hyperexcitability, convulsions and coma (Anonymous 2002).

These data should be viewed with caution, however, because several questions remain unanswered. Ideally, the water samples should have been taken when the birds were found but in fact were obtained in visits 2-5 months later. Given that no dead birds (especially local residents) were found during the latter visits, the water quality could have changed in the interim. In the analyses, it is noteworthy that conductivity was not measured in the samples with the highest concentrations of ammonium salts, and the highest concentration of the latter occurred in the sample from the deepest water, whereas the birds would have drunk surface water at the shoreline. It is not known whether concentrations of other elements and molecules present in the water samples taken from Laguna Verde could vary in time, reaching poisonous levels at some point.

The local inhabitants and park officers say that deaths of birds, and of mammals like the Little Spotted Cat (*Leopardus tigrina*), are relatively common in the area of Laguna Verde. According to M. Henao and G. Guillot (pers. comm.), there are three plausible sources of toxic compounds in lakes in volcanic areas such as the Los Nevados complex: 1) the existence of a volcanic hot spring beneath the lagoon, 2) the presence of a volcano crater in the lagoon with consequent leakage of volcanic gases, and 3) the growth of certain algae that release toxic chemicals, whose growth could be stimulated by either of the first two causes. Volcanic gases in particular may be released at intervals rather than continuously, causing water quality to vary with time (G. Guillot, pers. comm.). In all cases, the final effect could be the appearance of toxic sulphur compounds in high

concentrations, like H_2S and SO_4^{-2} , which could kill animals who drink this water or inhale air contaminated with some of those compounds when they are released as gases. Clearly it would be desirable to continue to monitor this lake for further instances of bird or mammal mortality, take water samples at the same time as dead animals are first noted, and perform more complete analyses on these samples, including evaluation of dissolved gases and microorganisms present.

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