

Perceptions of the Titicaca Grebe (*Rollandia microptera*) in a Peruvian Aymara Fishing Village

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Abstract This paper presents a qualitative analysis of people's attitudes and knowledge of the endangered endemic Titicaca Grebe (*Rollandia microptera*) in the Aymara fishing village of Karana, Peru, on the shores of Lake Titicaca. Most respondents hold no strong opinions on the Titicaca Grebe, and those who do tend to be hostile towards it. Hostility towards the species tends to come from fishers, who view the species as competition for fish and blame it for breaking their nets. As the majority of the interviewees lack formal environmental education, we suggest that increased environmental education about the grebe's endemic and endangered status may move some people from apathy towards support for grebe conservation. Since most of the source of the hostility towards the grebe from fishers stems from perceived competition with it for fish and its role in breaking nets, we suggest that further study of grebe diet and bycatch is needed to reduce direct grebe-fisher conflict. We also discuss the potential future of grebe-fisher conflict, as many of the fishers of Lake Titicaca begin to transition to pisciculture. This study is a pilot study for future conservation work on local attitudes and local ecological knowledge across the entirety of Lake Titicaca. It therefore informs as to how to conduct ethnobiological research in the region. We discuss what we learned about conducting ethnobiological research in the high Andes and how this study informed that larger ethnobiological project.

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Introduction

Historically, conservation biology focused on plants and animals, while ignoring the humans who lived with them (Dowie 2011). However, this has changed over recent decades, with many conservationists now recognizing that Local Ecological Knowledge (LEK) is crucial to conservation (Dayer et al. 2020; Joa et al. 2018). At the forefront of this change has been the increasing interest of integrating ethno-ornithological knowledge into conservation (Dayer et al. 2020). LEK has been especially important in developing conservation programs for species in remote areas, or which have not been well studied (Joa et al. 2018), and for the coproduction of conservation programs

between conservationists and local communities in a way that links conservation local cultural practices and concerns (Barman et al. 2020; Bonta 2010).

The Titicaca Grebe (*Rollandia microptera* Gould) is a flightless endemic found in the Lake Titicaca watershed of Peru and Bolivia (Fjeldså 2004), listed as Endangered (EN) in the IUCN RedList (BirdLife International 2020). Little is known about the population trends of the Lake Titicaca Grebe; surveys done in the early 2000s showed that the population had declined by 70% compared to the first population surveys done in the 1970s (Engblom et al. 2001; Martinez et al. 2006). However, no published

population surveys have been undertaken since then. While multiple causes have been proposed for the population decline, the most likely cause is fisheries bycatch in monofilament nets (BirdLife International 2020; Engblom et al. 2001; Martinez et al. 2006).

Fishing has existed in Lake Titicaca since at least 1,500 BCE (Capriles et al. 2014). However, for most of history, fishing was a minor source of food (Ibid.). The introduction of brown trout (*Salmo trutta* L.) and pejerrey (*Odontesthes bonariensis* Valenciennes) in the mid-20th century (Bouysson-Cassagne et al. 1992) created a fishing boom in Lake Titicaca (Everett 1973; Laba 1979), and fishing became the main economic activity of 151 villages on the Peruvian side of the lake by the 1990s (Levieil and Orlove 1990). This fishing boom has been associated with disruptions of the Lake Titicaca ecosystem, including the probable extinction of some native fish species, such as *Orestias cuvieri* Valenciennes (Lauzanne et al. 1992).

Given how little is known about the present status of the Titicaca Grebe, we decided to undertake an ethnobiological investigation of attitudes towards this species in the village of Karana, Peru. Because the grebe's observed population decline is thought to have been driven by fisheries by-catch, we have focused on interviewing fishermen, though also included non-fishermen in this study. Our focus was on understanding a) *Attitudes Towards the Grebe* what people thought of the grebe, b) *Self-Reported Knowledge of and Uses for the Grebe* of the grebe, and c) assess what LEK may exist regarding the grebe's natural history and conservation status.

Methods

Study Area

Lake Titicaca straddles the borders of Peru and Bolivia, in the *Altiplano* (the high tableland of central S. America) of the Central Andes. It has a surface elevation of 3,812 metres, and surface area of approximately 8,372 km. Lake Titicaca consists of two sub-lakes, the larger and deeper Lago Mayor, where this study took place, and the smaller and shallower Lago Menor. Within Lago Mayor, several major zones can be identified, including Puno Bay, a large, sheltered bay with extensive wetlands, thought to be an important breeding ground for the Titicaca Flightless Grebe (hereon referred to as the Titicaca Grebe or simply the grebe), and is home to the Reserva Nacional del Titicaca (Villar et al. 2023).

The study took place in the community of Karana (10°32'N 83°30'W) (Fig. 1), which is on the Lago Mayor, one hour's drive from the city of Puno, which is the largest city on the lakeshore. The Titicaca Grebe is found across the entire Lake Titicaca watershed. While the village of Karana lacks the large expanses of wetland found on the other side of Puno Bay, it is typical of the open water mosaic which constitutes most of the grebe's lakeshore habitat. Being near the city of Puno, Karana has more commercial ties and more tourism potential than the average *Altiplano* village. However, most of its inhabitants are still fishers and farmers, like the residents of most villages around Lake Titicaca.

Karana is an Aymara fishing village in Chucuito district, Puno Region, and has a population of 182, most of whom live in poverty according to the Peruvian government (Instituto Nacional de Estadística e Informática 2018). Karana was selected because dead grebes have been seen in its port (JQ and JZ pers. obs.) (Fig. 2), and because the authors have been developing research and conservation programs with the village community.

Data Collection

Semi-structured interviews were conducted face-to-face with the approval of the principal Karana authority (President) on December 18–19, 2020. The interviews took place within a kilometer of the port of Karana. The people interviewed consisted of a convenience sample of the residents of Karana. The interviewers formulated a qualitative, semi-structured questionnaire to guide their interviews, with a limited quantitative component which involved a Likert Scale of the opinion towards (rate 0–10) and self-perceived knowledge of the grebe (Creswell and Creswell 2017). After conducting interviews in Spanish, the authors translated, and proofed translations of responses. Original Spanish responses are included as footnotes in the Results. The questions asked in the semi-structured interviews can be seen in the supplemental materials to this paper.

Data Analysis

Rather than perform statistical analysis, we opted to use the anthropological technique of qualitative analysis (Newing 2011). This involves the close reading of the responses of interviewees to determine factors influencing attitudes towards the grebe. We opted for qualitative rather than quantitative data analysis because of the small sample size involved,

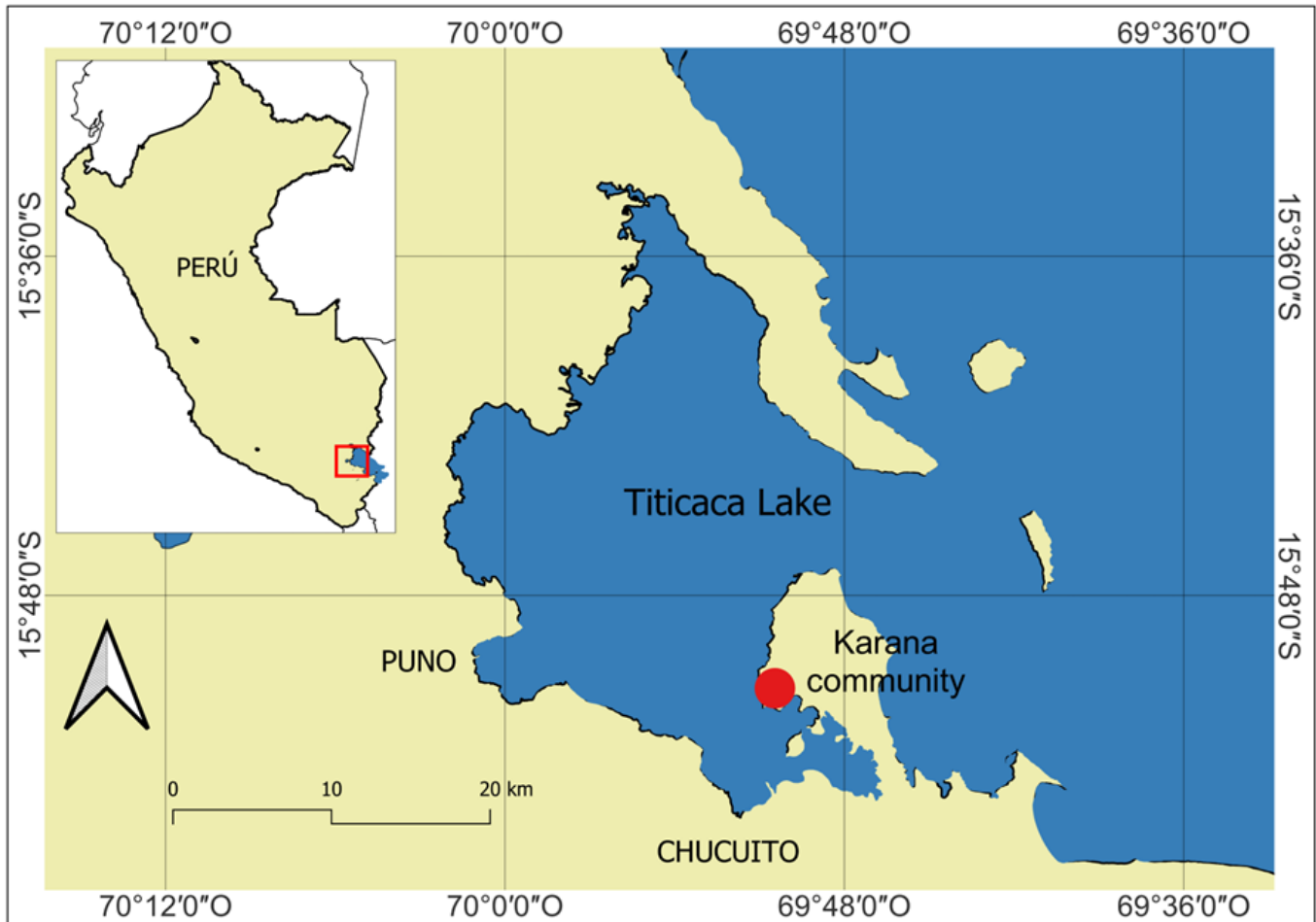


Figure 1. Map of Peru with inset showing the location of Karana (Author: Joel Zapana)

and because the focus of this study was to better understand why people hold the opinions they do about the Titicaca Grebe.

Results

Demographic Information

Thirty-eight people were approached. Of these, 24 initially agreed to an interview, but only 19 (5 female, 14 male) completed the full set of pre-determined questions, with the remaining 5 indicating that they had not realized how much time an interview would take and were too busy to complete it. Incomplete surveys were not included in our analysis. Fourteen people declined to answer the questionnaire, either because they were afraid to give personal information, had bad experience with outsiders, were not village residents, or did not speak a language in common with the interviewers as they were monoglot Aymara speakers. Although this is a small sample size as is

often necessary in qualitative social science research such as this (Guest et al. 2006), it represents 10.5% of Karana's population. Full results, including responses, are in the supplemental materials to the paper.

All correspondents were bilingual in Aymara and Spanish. Most individuals said that they were farmers, including both pastoralists and agriculturalists (N=10), with fishing being the next most common profession (N=5), and the remainder listing other occupations. Only one respondent lacked any formal education, but the majority (N=12) had not completed high school.

Key Finding #1: Attitudes Towards the Grebe

Only five respondents had heard of a bird called "Zambullidor del Titicaca". However, when shown a photograph of the grebe, every respondent said they recognized the bird. Every respondent said that the



Figure 2. Titicaca Grebe found dead in Karana' port, and gill nets commonly used for fishermen in green and red behind the body. (Photo by Jhazel Quispe)

local word for the bird was Keñola, save one who said it was “Onkaillo”.

Five respondents said that they had either no opinion or a neutral opinion, of the grebe, which meant a score of 5 on the Likert Scale. When asked to justify their neutral opinion, the justification used by one respondent was typical when he said, “*the bird just doesn't interest me*”. Only three respondents gave the grebe a score of over 5. When asked why they liked the grebe, one respondent said “*It looks pretty*”, but did not elaborate to say what she found about it that she thought was pretty.

11 respondents gave a low score under 5. When asked to justify why they disliked the birds, seven respondents mentioned either fishing or nets. As one respondent said “*It competes with us for fish and breaks our*

nets”. Three also mentioned that the bird was generally annoying; one respondent saying “*I hate it because there is no fishing*”⁴ a sentiment that appeared driven by the grebe getting caught in, and breaking, nets. This suggests that the dislike of the grebe is rooted in economic concerns, especially amongst fishers.

Key Finding #2: Self-Reported Knowledge of and Uses for the Grebe

Every respondent said that they had at least some knowledge of the grebe. The most common fact about it, given by seven respondents, was that it lives amongst the *titora* (*Schoenoplectus californicus* subsp. *titora* (C.A. Mey) Soják). *Titora* is a common sedge which forms one of the primary macrophyte areas of Lake



Titicaca (Raynal-Roques 1992). However, one respondent said that the bird “*lives in open water*”⁵. This comment, alongside one that says that it “*nests in the totora*”⁶ suggests that the grebe might have a different habitat depending on whether it’s breeding. Eight individuals commented on the grebe’s diet, with seven saying that it ate fish. However, none said which fish species it ate, save for saying that it probably only eats small ones.

Three individuals mentioned the eggs of the grebe, and they concurred on two facts; that the grebe has white eggs, and that it has between 2 and 3 eggs in the nest at any one time. Only one individual mentioned anything about the grebe’s social behavior, who said that the grebes “*travel in packs*”⁷. One respondent mentioned the grebe’s population decline, saying that “*there used to be many of them*”⁸.

When asked whether they had any practical use for the grebe, 11 of the respondents said no. Of the eight who replied yes, two individuals indicated that they hunted the grebe, one individual said she had a commercial use for the grebe, three said they had medicinal uses for the grebe, one responded he had an ornamental use for the grebe, and four said they had alimentary uses for the grebe. Those who mentioned alimentary uses for the grebe specified that they ate grebe eggs, rather than the meat itself, since the meat tastes and smells terrible. The hunters hunt the grebe for sport rather than for meat, with ducks and flamingos being preferred game birds for meat. One said “*I do not like it*”⁹. One respondent specified what the medicinal use of the grebe was, saying that “*its blood is good for you if you are malnourished*”¹⁰. In the authors’ experience, most of the cases where a cure for malnourishment is being discussed in the region, it is a cure for iron deficiency or anemia (DAV, pers. obs.). Lake Titicaca is polluted with agricultural, and industrial pollution (Guédron et al. 2017), and consumption of fish from the Lake Titicaca watershed is already associated with health problems (De Loma et al. 2019). Given the grebe’s position as an apex predator in Lake Titicaca, and the bioaccumulation of pollutants in apex predators, we can also assume that regular consumption of grebe’s eggs could cause health problems.

Key Finding #3: Conservation of the Grebe

The frequency at which grebes were netted by fishermen varied greatly, from five birds per year to ten per week, though this latter number may have been an exaggeration. The mean answer was 4.2

grebes caught per month, assuming a four-week month, and the median answer was 4.0 per month. While there are not good statistics on the total number of fishers active on Lake Titicaca, the latest published estimates suggested that there were around 3,000 active fishers on Lake Titicaca (Bouysse-Cassagne et al. 1992). If this number remains the same, which we suspect it has not, that would mean that roughly 12,000 grebes are caught as bycatch each month. This number is implausibly large, since even the latest estimates of the potential population of the Titicaca Grebe place its population, at the upper limit as 21,626 (Villar et al. 2023). Even accounting for decline in the number of fishers which has occurred on Lake Titicaca, as fish numbers have declined and pisciculture has replaced fishing, the rate of bycatch reported by fishers would suggest a species which should have gone extinct decades ago, assuming the population estimates of the low thousands reported in the early 2000s are accurate (Engblom et al. 2001; Martinez et al. 2006). We must therefore conclude that either the population of the Titicaca Grebe has been significantly undercounted for decades, that the grebe can reproduce far more rapidly than previously assumed, or fishers are exaggerating the amount of bycatch they get in their nets. Further studies are needed to determine which of these is the case.

When asked what they did with the grebes caught in their nets, most refused to respond, and of those who did respond, most said that they throw the grebe overboard. When asked whether they knew that the grebe was endemic, 11 respondents said that they were not aware of that, and eight said that they were. Of the fishermen, only one knew that the grebe was endemic to Lake Titicaca; the one fisherman who knew that the grebe was endemic said he generally threw out grebes caught in his nets. The individuals did not indicate how they knew it was endemic, but we suspect that past environmental education and awareness programs done by the Reserva Nacional del Titicaca likely played a role.

When asked whether they knew that the species was endangered, ten respondents said that they were aware of this fact, and nine said that they were not aware. Three of the fishermen were aware of the grebe being endangered. Of those who were aware that the grebe was endangered, six were men and four were women. Of those nine people who were not aware, eight were men and seven people lacked a complete formal education. We once again suspect



that what knowledge of the grebe's endangered status exists can be attributed to the Reserva Nacional del Titicaca's environmental education program.

When asked what other birds, if any, they would want to see more frequently around Lake Titicaca, every respondent save one said *choka*, i.e., Andean Coot (*Fulica ardesiaca*) or *parihuana*, i.e., Andean Flamingo (*Phoenicoparrus andinus*). One individual named the pato pana, i.e., the Andean Ruddy Duck (*Oxyura ferruginea*). Every individual who expressed a desire to see more Andean Coots said it was because they wanted to either eat it or eat its eggs. The same was true for the individual who wanted to see more Andean Ruddy ducks. The reason for more Andean Flamingos was more varied, with respondents saying both that it looks pretty and that it has medicinal use.

Only four respondents gave additional comments at the end of the interview. Three requested hunting controls in the area, especially for non-community members. This did not just mean hunting of the grebe, but also hunting of other birds on the lake, such as ducks. There was a general agreement that these measures should be enforced by the local government, with the view of one respondent who suggested that "*governments should be the ones taking care of birds*"¹¹, being typical.

Discussion

While this pilot study only included a sample size of 19 individuals, it provides the starting point for ongoing collaborative research with local people on the conservation of the Lake Titicaca Grebe and local people's attitudes towards the species. Our experience shows us that while there are some questions which can help to understand the grebe better, informal discussions guided by general questions are the most likely to elucidate novel information about the ethnobiology of Lake Titicaca. The formalized questionnaire format seemed to dissuade many people, while some of the best informants engaged more enthusiastically when the interactions turned from formal questionnaires to informal conversation. We have therefore used a more informal approach in our subsequent, lake wide, ethnobiological survey of Lake Titicaca. We also found that language was a greater barrier to engagement than we expected; despite all interviewers being Peruvian, lack of knowledge of Aymara hindered our research. We have thus included Quechua and Aymara speakers in our subsequent ethnobiological research. Our study also suggests that fishers themselves have an inaccurate

picture of how often they catch fish in their nets. Whether fishers can be trusted to self-report bycatch has been a contentious issue in the literature for decades, but most cases of inaccurate reporting of bycatch have been fishers under-reporting bycatch (Psalty and Calkiewicz2021). This over-reporting of bycatch suggests either that a) the fishers are honest, and grebe populations are significantly above what they are thought to be, or b) that fishers may be boasting about how many of a "problem" species they have killed, or that there is something peculiar to the cultural context of Lake Titicaca that makes exaggeration of bycatch more common than under-reporting it. This has informed us that we cannot rely on self-reported bycatch numbers to be a reliable guide in Lake Titicaca, which is why in subsequent work we have undertaken to monitor nets as they are brought in each morning in each village for the period of our stay.

Our study suggests that the Titicaca Grebe is not a particularly culturally important bird for the Aymara fishing community who interact with it most. This does not bode well for its conservation, since individuals who hold positive attitudes towards the environment are typically the most active in driving conservation action (Heberlein 2012). Instead, the most common responses to the Titicaca Grebe are apathy or dislike. Apathy can be as much of a problem for a conservation program as active dislike for a species because people may continue to blithely maintain their quotidian routines which have harmed the species until it goes extinct (Kwan et al. 2017). Apathy also reduces the ability of projects to survive into the long term, since without active investment in the conservation of a species by a wider community, conservation projects tend to fade out once the committed individuals either get tired or leave. Apathy is often thought to originate in ignorance of the environment or the particular species, but that does not appear to be the case here. It should be noted that no specific answer could be given by respondents who indicated that they had no opinion of the grebe, and instead they had to state their opinion on a continuum from extreme dislike to extreme like.

After apathy, the most common view of the grebe was dislike, mainly driven by individuals viewing it as either a direct competitor for fish or because it was trapped in nets. There is extensive literature on birds being treated by farmers as problem species (Nyhus 2016), but much less on birds being problem species



for fishers. However, assuming that the same lessons from farmer-bird conflict apply to fisher-bird conflict, any successful community conservation scheme would have to involve reducing both the actual and perceived competition between the grebe and fishers. Reducing negative attitudes towards a problem species can be one of the most difficult elements of a conservation program, and while education programs and compensation schemes for harm have both been found to assist in reducing human-wildlife conflict in other study systems (Nyhus 2016; Ardoin et al. 2020), they can often also fail to reduce hostility towards a species. The fact that Karana is less reliant on fisheries economically than most lakeside villages would be due to its proximity to Puno, which also suggests that hostility to the grebe might be even more pronounced elsewhere. This means that encouraging fishers to take part in conservation of the grebe, which is already difficult enough in Karana, might be almost impossible elsewhere. Further research is needed to better understand the actual overlap of competition between fishers and grebes, and whether there are steps that might be taken to reduce that overlap.

These surveys suggest that the average clutch size of the Titicaca Grebe is between 2 and 3 eggs. Knowledge of the clutch size of birds has proven to be valuable in the conservation efforts of other birds, and lack of knowledge of basic life history traits of a species is a data gap that must be filled for effective conservation (Conde et al. 2019). This study also provides some evidence on the main habitat of the Titicaca Grebe being in *titora* wetlands, as held by Fjelds  (2004) and Pulido Capurro (2018), as opposed to being in open water, as held by Mart nez et al. (2006).

The uses of the grebe by people merit further study. Medicinal uses of birds in the Lake Titicaca area have been noted before (Forbes 1870; Tschopik 1946), but mainly in surveys completed generations ago. While dependent on several factors, the conservation of a species may be aided if it is perceived to have human medicinal use (Chen et al. 2016). The medicinal use of the grebe seems to be limited to its blood, which is in keeping with previous ethnological work on the Aymara using bird blood as a treatment for anemia (La Barre 1951). That the Titicaca Grebe is generally not eaten by humans corresponds with Loza del Carpio et al. (2019). It is a concern that unregulated hunting occurs frequently enough to be complained about as a public nuisance.

Both hunters listed their profession as fishers, and indicated that they did not eat the grebes, suggesting that the hunting of grebes is either a form of recreational hunting or pest control, rather than being related to subsistence. Since hunting has been the cause of major population declines in other waterfowl, the practice ought to be closely monitored in Lake Titicaca. The eating of grebe' eggs is also worrying, given that predation of eggs has been associated with population declines and extinction of other birds (Loehle and Eschenbach 2012). However, further work is needed to see whether grebe eggs are targeted or collected opportunistically, and what effect, if any, grebe egg hunting has on the grebe population, and whether sustainable egg harvesting can be implemented.

Our study suggests that the Lake Titicaca Grebe is not a culturally significant bird in Aymara fishing villages like Karana. Most of those interviewed were apathetic about it, and those who were not, tended to be actively hostile. Hostility stemmed mainly from fishers viewing the grebe as a competitor for fish and blaming it for breaking nets. Detailed research on the grebe's diet is being undertaken. We suggest further research about fishing's effect on the grebe population, as well as the implementation of an environmental education program, to teach people that the grebe is endangered and endemic. This may assist in making the apathetic become more positive about the grebe, while a compensation scheme for fishers may reduce their hostility toward the bird. This study also allowed us to pilot an ethnobiological survey of the fisheries of Lake Titicaca and showed us what does and does not work when elucidating information.

Notes

¹ *No me interesa*

² *Es bonito*

³ *Come peces y da a las redes*

⁴ *Lo odio porque no hay pesca*

⁵ *Vive en el agua*

⁶ *Anida en totorales*

⁷ *Andan en grupos*

⁸ *Antes hab a muchos*

⁹ *No me gustan*

¹⁰ *Su sangre es buena para la desnutrici n*

¹¹ *Autoridades deben cuidar las aves*

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Conflicts of Interest: None declared

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