UPDATING THE STATUS OF THE PERUVIAN PELICAN *PELECANUS THAGUS* FOLLOWING AVIAN INFLUENZA AND EL NIÑO EVENTS IN PERU

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ABSTRACT

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The Peruvian Pelican *Pelecanus thagus* is an endemic species of the Humboldt Current System. Between November 2022 and March 2024, the avian influenza epidemic and El Niño conditions significantly affected the pelican population. This study provides an update on the population size and breeding status of the species in Peru. Pelican abundance decreased by 31.5% to 37.6% within marine protected areas. The number of live pelicans ranged from 1,652 to 46,046 in 2023 and from 14,505 to 52,540 in 2024, based on counts conducted in natural protected areas by Peruvian government officials. Breeding primarily occurred on six islands between October 2023 and April 2024, despite the El Niño conditions that affected coastal conditions from March 2023 to March 2024. The combined effects of El Niño, zoonotic diseases, climate change, and other threats raise serious concerns about the long-term viability of this species.

Key words: avian influenza, El Niño, guano birds, Peruvian Pelican, Peru

INTRODUCTION

The Peruvian Pelican *Pelecanus thagus* is endemic to the Humboldt Current System, with its range extending from northern Peru to approximately 33.5°S in Chile (Harrison et al., 2021). The earliest record of pelican abundance dates to 1907, when 100,000 pelicans were recorded on Lobos de Tierra Island (06°24′48.2″S, 080°51′6.7″W) (Vogt, 1942). The pelican population in Peru was estimated to be 350,000 individuals in 1953, and the highest recorded population reached 509,000 in 1988 (Jahncke, 1998) (Fig. 1). However, in 2023, a significant population decline was reported, with numbers dropping from hundreds of thousands to only a few thousand due to an avian influenza outbreak in Peru (Convention on the Conservation of Migratory Species of Wild Animals, 2024). Additionally, pelicans likely migrate south to Chile, especially during El Niño events such as the 2023–2024 event (Tovar & Cabrera, 1985).

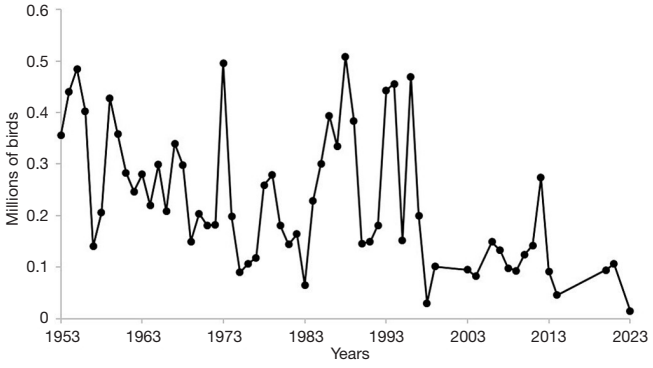

Fig. 1. Mean number of Peruvian Pelicans *Pelecanus thagus* (in millions) in Peru between 1953 and 2023. Data were extracted from Tovar et al. (1987) for the period 1953–1982, Jahncke (1998) for 1983–1996, Goya (2000) for 1997–1999, Barbraud et al. (2018) for 2000–2008, Zavalaga (2015) for 2009–2014, and Agro Rural (2021) for 2020–2023.

The Peruvian Pelican is classified as Near Threatened by the International Union for Conservation of Nature and is listed as Endangered in Peru (Convention on the Conservation of Migratory Species of Wild Animals, 2024). This species faces multiple threats, including poaching and human disturbance, particularly disruptions to breeding populations caused by guano extraction and interference from fishers on breeding islands (Convention on the Conservation of Migratory Species of Wild Animals, 2024). During El Niño events, the Peruvian anchoveta *Engraulis ringens*, the primary prey of pelicans, becomes less accessible as it moves to deeper, colder waters (Lavalle y García, 1912, 1917; Murphy, 1936). Severe El Niño conditions were recorded in Peru between March 2023 and March 2024 (Estudio Nacional del Fenómeno "El Niño" [ENFEN], 2024), resulting in elevated sea surface temperatures along the coast (Hu et al., 2019) and a subsequent reduction in the availability of anchovies for the pelicans (Passuni et al., 2018).

Among the diseases affecting pelicans, highly pathogenic avian influenza (HPAI) A(H5N1) was first reported in Peru in November 2022 (Gamarra-Toledo et al., 2023). This study provides updated information on the status of the Peruvian Pelican population following the start of the HPAI epidemic and the El Niño event (November 2022–March 2024).

METHODS

Study area

The Peruvian coastline spans 3,079.5 km and includes 22 islands and 11 headlands that are managed under the National Reserve System of Guano Islands, Islets, and Headlands (Reserva Nacional Sistema de Islas, Islotes y Puntas Guaneras [RNSIIPG]). That system is part of the National Service of Natural Areas Protected by the State (Servicio Nacional de Áreas Naturales Protegidas por el Estado [SERNANP]). Other protected coastline areas include the Ancón Reserved Zone, the Lagunas de Mejía National Sanctuary,

and the following National Reserves: Paracas, San Fernando, and Illescas. Guano harvesting is overseen by Agro Rural, an agency operating under the Ministry of Agriculture (Gamarra-Toledo et al., 2023). The National Forest and Wildlife Service (Servicio Nacional Forestal y de Fauna Silvestre [SERFOR]) is the governmental agency responsible for managing wildlife outside protected areas.

Data acquisition

We requested information from Agro Rural regarding the abundance and distribution of breeding and non-breeding Peruvian Pelicans between January 2023 and April 2024. On the first two days of each month, a census of seabirds is conducted on guano-producing islands and headlands. The abundance of these birds is estimated using the planimetric method, which involves mapping the extent and shape of each colony on a scaled map of the respective island or headland. The colony's estimated area is then multiplied by bird density, determined through prior observations or established reference values (Agro Rural, 2023). Furthermore, we analyzed data provided by SERFOR, SERNANP, and Agro Rural (and compiled by Ministry of Health) on the number of dead pelicans recorded on beaches (SERFOR counts) and in protected areas (SERNANP and Agro Rural counts) from November 2022 to May 2023 (Centro Nacional de Epidemiología Prevención y Control de Enfermedades, n.d.; Servicio National de Sanidad Agraria, n.d.). The methods employed by the Peruvian government to monitor seabird mortality, as described by Gamarra-Toledo et al. (2023), involved monthly, biweekly, or weekly counts conducted by personnel trained in seabird identification and included geographic locations, species, and the number of dead specimens observed. The specimens were subsequently buried near protected areas or on nearby beaches (SERNANP, 2023).

RESULTS

In 2023, the number of Peruvian Pelicans in the RNSIIPG natural protected area ranged from a peak of 46,046 individuals to a low of 1,652. During the first four months of 2024, the population had a maximum of 52,540 and a minimum of 14,505 individuals (Fig. 2). The primary breeding colonies are located within this protected area, which encompasses 94.8% of Peru's islands (Instituto Nacional de Estadística e Informática [INEI], 2013). Pelicans bred on six islands of the RNSIIPG between January 2023 and April 2024, with breeding activities lasting up to eight months. Notably, breeding persisted for six months on Macabi Island, in northern Peru, while on two southern islands, breeding was limited to two or three months (Table 1). The peak breeding period occurred from October 2023 to April 2024, with the highest proportion of breeding pelicans (60%) recorded in December 2023.

Peruvian authorities reported between 39,633 and 47,414 pelican deaths from November 2022 to May 2023. Carcasses were found on beaches outside of protected areas (25,450 individuals), in the RNSIIPG (10,033–17,814 individuals; these numbers were reported by Agro Rural and SERNANP, respectively), and in other protected natural areas (4,150 individuals) (Centro Nacional de Epidemiología Prevención y Control de Enfermedades, n.d.). The surveyed beaches represent at least 5.2% of the Peruvian coastline, specifically beaches located within protected areas. Mortality for different regions of the coast was reported as follows: southern Peru (14°S–17°S, 44%–46%), northern Peru (05°S–11°S, 21%–29%), and central Peru (12°S–13°S, 12%–13%); the percentages within each region are listed as a range due to the differences in pelican numbers reported by Agro Rural and SERNANP for the same period.

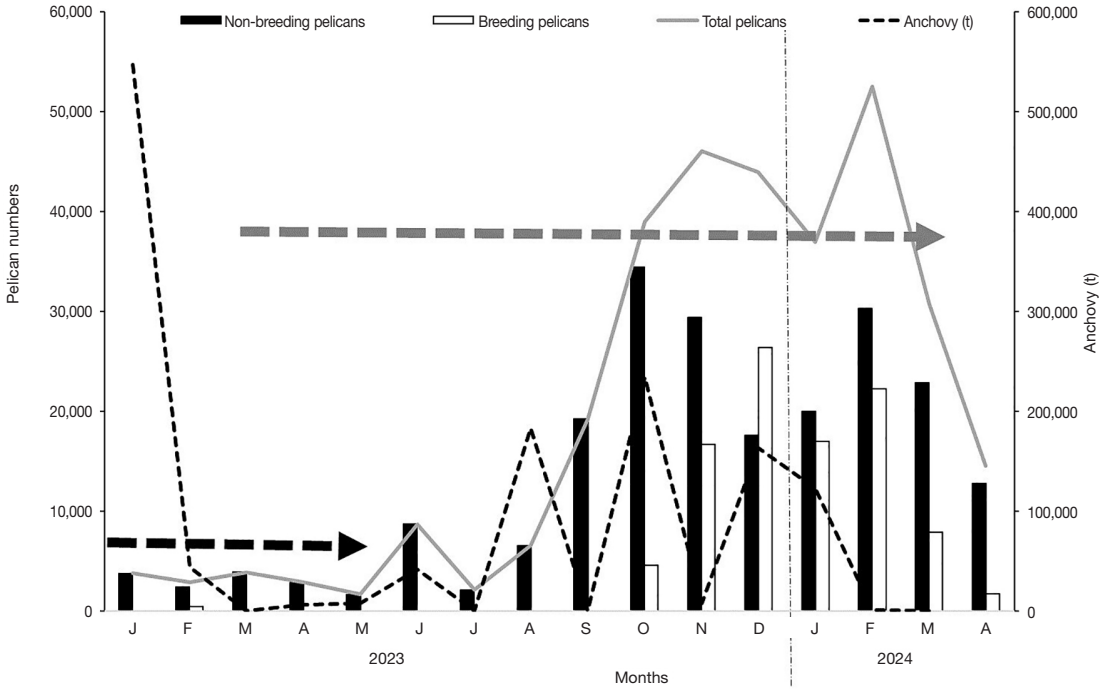

Fig. 2. Breeding and non-breeding numbers of Peruvian Pelicans *Pelecanus thagus* in the Reserva Nacional Sistema de Islas, Islotes y Puntas Guaneras (RNSIIPG) from January 2023 to April 2024. Anchovy landings are shown on the right axis (metric tons, t), and pelican numbers are displayed on the left axis. Mortality of Peruvian Pelicans associated with influenza was reported from November 2022 to May 2023 (indicated by black arrow), and El Niño occurred between March 2023 and March 2024 (indicated by gray arrow).

TABLE 1
Breeding sites of Peruvian Pelicans *Pelecanus thagus* and the months when breeding adults were reported in 2023 and 2024

		Breeding months								
Islands	**Location**	**Feb 23**	**...**	**Oct 23**	**Nov 23**	**Dec 23**	**Jan 24**	**Feb 24**	**Mar 24**	**Apr 24**
Lobos de Tierra	06°24′48.2″S 080°51′6.7″W	×		×	×	×		×		
Lobos de Afuera	06°54′11.74″S 080°45′2.28″W						×			
Macabi	07°48′54.4″S 079°30′2.2″W				×	×	×	×	×	×
Pachacamac	12°18′8.3″S 076°54′9.1″W				×	×				
Chincha Norte	13°37′24.9″S 076°24′4.7″W					×	×	×		
Santa Rosa	14°18′56″S 076°9′48″W						×	×	×	×

Pelican mortality was recorded from November 2022 to May 2023, although wild birds tested positive for influenza throughout 2023 (Centro Nacional de Epidemiología Prevención y Control de Enfermedades, n.d.). During the first three months of 2024, no cases of HPAI were detected in wild birds in Peru; however, one positive case in wild birds was reported in April and nine cases in May 2024 (Servicio National de Sanidad Agraria, n.d.). For the remainder of 2024, no further positive cases in wild birds were detected in Peru (Servicio National de Sanidad Agraria, n.d.).

We found a 31.5%–37.6% decline in the Peruvian Pelican population within marine protected areas. Prior to the avian influenza outbreak, 125,794 pelicans were recorded in protected areas in August 2022 (Zavalaga et al., 2024), and mortality between November 2022 and May 2023 was estimated at 39,633 to 47,414 individuals. Between November 2022 and March 2023, 21,199 pelicans inhabiting marine protected areas were reported dead due to the virus, representing 17% of the population in these regions (Gamarra-Toledo et al., 2023). It is important to note that seabird population surveys in Peru are typically limited to marine coastal protected areas (Passuni et al., 2018).

DISCUSSION

Over the last decade, the pelican breeding season in Peru has been reported to occur from July to March (Passuni et al., 2018). Within the 2022–2023 breeding season, the onset of the avian influenza outbreak occurred in November 2022. The breeding pelicans reported on Lobos de Tierra Island in February 2023 could have been affected by the outbreak. The following year, the breeding season occurred from October 2023 to April 2024 (Fig. 2).

Pelicans bred on six islands during our study period, despite the El Niño conditions that developed between March 2023 and March 2024 (Estudio Nacional del Fenómeno "El Niño" [ENFEN], 2024). The reduced mortality of pelicans reported by Peruvian authorities since June 2023 (Centro Nacional de Epidemiología Prevención y Control de Enfermedades, n.d.) may have facilitated breeding during their regular season, which coincided with the second half of the coastal El Niño, when reports of dead wild birds were minimal (Centro Nacional de Epidemiología Prevención y Control de Enfermedades, n.d.).

In addition, the second of two anchovy fishing seasons occurred from November 2022 to February 2023, overlapping with the onset of avian influenza (Ministerio de la Producción, 2023a). Fishing seasons were then extended for four more months (June 2023 and October 2023–December 2023) (Ministerio de la Producción, 2023b, 2023c). This period coincided with both the avian influenza outbreak and El Niño, which triggered the migration of Peruvian Pelicans into Chile, as had been described during previous El Niño events (Tovar & Cabrera, 1985). The movements of pelicans from Peru to Chile, driven by El Niño–related dispersion, may have facilitated viral transmission, as observed in the migratory patterns of breeding Northern Gannets *Morus bassanus* during an avian influenza outbreak in 2024, which was linked to heightened stress and poor breeding conditions (Careen et al., 2024).

Industrial farming practices have facilitated the emergence and spread of HPAI in poultry, wild birds, and humans (Grémillet et al., 2023). Peru is the 18th largest producer of chicken globally and ranks first in per capita chicken consumption in Latin America (Paredes Arana, 2021). Its large-scale poultry production areas are located near beaches, wetlands, and other habitats where shorebirds and waterbirds feed (Ghersi et al., 2009). Wild birds inhabiting poultry farms and interacting with domestic birds may serve as intermediaries for genetic flow from wild to domestic birds and, subsequently, to humans in South America (Hurtado & Vanstreels, 2016). In Peru, an evaluation of poultry processing practices in both formal and informal markets revealed risky practices, such as feeding chicken viscera to swine and the lack of personal protective equipment (Carnero et al., 2018).

Understanding the effects of this epizootic disease coupled with El Niño and the response of the wild population is crucial for assessing the potential for population recovery. This requires ongoing monitoring and the implementation of improved conservation measures, such as the effective protection of breeding sites and the establishment of new colonies to safeguard the species, given its alarming decline in recent decades. In accord with patterns evident during the last century (e.g., Murphy, 1936, 1981; Tovar et al., 1987), the pelican population in Peru decreased from 300,000 to 1,800 birds during the 1997 El Niño (Jahncke, 1998). Recovery from these events is likely to have been due to the movement of birds from Chile (Jahncke, 1998). However, the

combined effects of El Niño, zoonotic diseases, climate change, and other threats raise concerns about the long-term viability of the species.

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