REPRODUCTIVE BEHAVIOR IN A COLONY OF GREATER FLAMINGOS (*Phoenicopterus roseus*) IN A CONTROLLED ENVIRONMENT

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INTRODUCTION

Captive individuals provide an effective experimental framework for investigating behavioral, ecological, and evolutionary traits that are often challenging to assess in wild populations. The opportunity to monitor ringed and individually identifiable subjects over time enables the collection of robust quantitative data, offering a reliable model for studying reproductive behavior under controlled conditions.

In this study, a colony of *Phoenicopterus roseus* hosted in a zoo in Northern Italy (Le Cornelle Faunistic Park) was used as a reference group to analyze reproductive behavior, with a specific focus on pair-bond stability and parental care during the incubation phase.

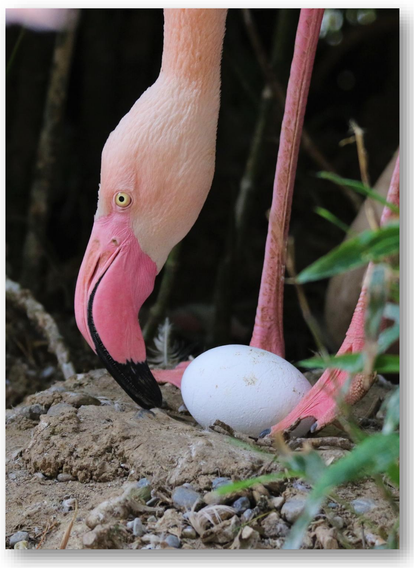
AIM OF STUDY

- ✓ Identify the pairs present in the colony and compare them with those of the previous year to assess the stability of pair bonds.
- ✓ Evaluate incubation behaviors of both pair members (♂ and ♀) including:
  - Behavioural time budget
  - Position (on nest, near nest, away from nest)
  - Posture (standing or sitting).
- ✓ Analyze the temporal evolution of parent–offspring relationships.

Behavioral Categories and Definitions

Category	Behavior	Description
Position relative to the nest	On the nest	The individual stands with both legs on the nest.
Position relative to the nest	Near the nest	The individual is located within one meter of the nest.
Position relative to the nest	Away from the nest	The individual is more than one meter away from the nest.
Posture	Standing	The individual remains upright on its legs.
Posture	Sitting	The individual rests in a sitting position.
Activity	Walking	The flamingo walks.
Activity	Running	The flamingo runs.
Activity	Feeding	The flamingo feeds using one of its foraging strategies.
Activity	Preening	The flamingo preens its feathers, sometimes applying uropygial secretion.
Activity	Bathing	The flamingo bathes in water.
Activity	Resting	The flamingo remains still without performing any activity.
Activity	Sleeping	The flamingo rests with eyes closed.
Activity	Interaction	The flamingo shows aggressive interaction with another individual.
Activity	Nest building	The flamingo builds or repairs the nest.
Activity	Egg care	The flamingo tends or inspects the egg.

Fig. 1



MATERIALS AND METHODS

- Study period: 2019
- Location: zoo facility, Northern Italy
- Study sample: 100 ringed adults with balanced sex ratio (38 pairs) and age structure. For behavioral analysis: 16 nesting pairs were selected
- Ethogram: 29 behavioural categories grouped into 10 macro-categories (Fig. 1)
- Observation schedule: 09:00–16:30 from March to November
- Metod: Focal sampling
- Observation effort: 280 hours. Focal observations lasting 10 minutes each were carried out in 16 daily sessions throughout the incubation period

RESULTS & DISCUSSION

In 2019 during the breeding season, 38 pairs were identified, of which 33 were reproductive, with a total of 55 eggs laid. Some eggs fell outside the nests or proved infertile; in such cases, females laid replacement clutches.

Most pairs consisted of individuals older than 12 years, with a few younger pairs (3–4 years old). An age-assortative pairing tendency was observed, with partners showing similar age or breeding experience.

The collected data were used to construct a behavioral time budget, analyzed separately for males and females on different position and posture (Fig. 2).

Results show that during incubation the main activities were equally shared between sexes. Overall, no statistically significant differences were detected between males and females, confirming an **equal division of parental duties**.

The analysis of spatial position showed that both sexes spent most of their time either on the nest or away from it, while the time spent in the immediate vicinity was shorter. Differences between males and females in the time spent in these different positions were not statistically significant, indicating a **similar spatial use by both sexes during incubation**.

Regarding posture, both males and females **spent more time sitting than standing**, as expected during incubation.

In the post-hatching phase, chicks were observed to stand and walk short distances as early as three days after hatching. After about ten days, chicks were able to walk more confidently and move away from the nest, accompanied by at least one parent, and showed an early tendency to aggregate, often remaining close to one another. The chicks were also monitored, with particular attention to **feeding bout** (bill-to-bill feedings) provided by both parents. A total of 80 feeding bouts were recorded, of which 32 (40%) were performed by females and 48 (60%) by males, with a 20% difference between sexes. During the first week of life, feedings were frequent but brief; the longest recorded lasted 5 min and 42 s. As chicks grew older, feeding frequency decreased while duration tended to increase. After approximately 30 days, chicks began to feed independently, leading to a progressive reduction in parental feedings. The longest feeding overall was recorded at 34 days of age, lasting **16 min and 25 s**. Of the 80 total feedings, only 9 occurred after the fourth week, compared to 18 recorded in a single day during the first week (Fig. 3). The color of the crop milk, initially very intense, gradually faded as the chicks aged.

Out of the 55 eggs laid, 7 chicks hatched and 6 survived until fledging, corresponding to an overall reproductive success of 10.91%. Compared with the previous year 2018 (6.26%), this represents a slight increase, though not sufficient to indicate a significant improvement. In 2018, all individuals had their primary feathers clipped to limit flight, whereas in 2019 the practice was suspended to assess whether improved physical balance and courtship performance could enhance reproductive success. Despite this management change, the breeding success remained similar.

A comparison between pairs identified in 2018 (33 pairs) and 2019 (38 pairs) also revealed a high correspondence, with most partners maintaining the same mate between years. This **inter-annual fidelity** is typical of populations kept under controlled conditions, whereas in the wild, mate change occurs in about 98% of cases.

CONCLUSION

The results offer new insights into the organization of biparental care and the reproductive dynamics of the species in a controlled environment. This work enriches the ethological profile of *P. roseus* and supports the refinement of ex-situ conservation strategies, particularly in the absence of well-established reference data from wild populations.

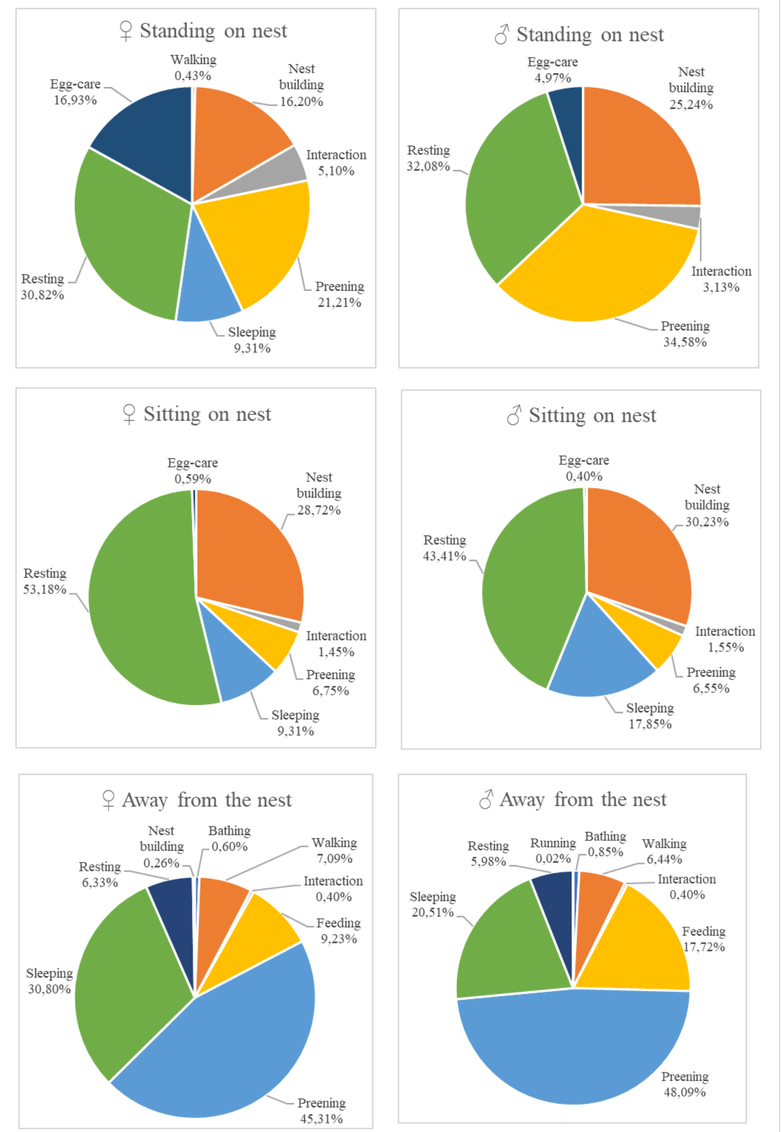


Fig. 2

Fig. 3

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Bibliography

- Richter N. A., & Bourne G. R. (1990). Sexing Greater Flamingos by Weight and Linear Measurements. Zoo Biology, 9, 317-323.
- Johnson A. & Cèzilly, F. (2007). The Greater Flamingo.
- Studer-Thiersch A. (1986). Tarsus length as an indication of sex in the flamingo genus Phoenicopterus. International Zoo Yearbook , 24/25, 240-243.
- Brown C. & King C. (2005). Flamingo Husbandry Guidelines. A Joint Effort of the AZA and EAZA in Cooperation With WWT. Dallas: Dallas Zoo.
- Franchin M. (2013/2014). Analisi del benessere durante la stagione riproduttiva di una colonia di fenicotteri rosa in ambiente controllato. Tesi di Laurea Magistrale in Medicina Veterinaria. Università degli Studi di Padova
- Milesi A. (2018). Comportamento riproduttivo di una colonia di fenicotteri rosa (*Phoenicopterus roseus* PALLAS, 1811) in ambiente controllato e valutazione del benessere. Tesi di Laurea Magistrale in Scienze della Natura. Università degli Studi di Milano.