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TIME–ACTIVITY BUDGETS OF THREE COOT SPECIES IN A RELICT OF HUMAN-MODIFIED COASTAL WETLANDS IN SOUTHEASTERN BUENOS AIRES PROVINCE

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ABSTRACT: The amount of time individuals allocate to different behavioral activities influences their survival and reproductive success. In urban wetlands and lagoons, pressure from various anthropogenic activities affects multiple components of these ecosystems, including waterbirds. This study characterized the time–activity budgets of three sympatric coot species in an anthropogenic urban lagoon environment. Although surveys were conducted at the beginning of the birds' breeding season, no breeding-related behaviors (e.g., courtship, nesting) were observed, suggesting that the studied populations may have consisted of juvenile or non-breeding individuals. A total of 636 focal observations were conducted, during which more than ten distinct behaviors were recorded. Overall, and across all three species, time allocated to foraging and swimming jointly accounted for more than 80% of the total time budget. Regarding foraging techniques, feeding both at the water surface and outside the water column (i.e., within vegetated areas) predominated. The average distribution of time allocated among activity categories varied among species and across time periods of the day. Although these results are descriptive in nature, they are consistent with those reported for other coot species inhabiting different regions. Behavioral studies provide insight into fundamental aspects of the biology of species and are a key tool for proposing management measures aimed at ensuring their conservation in urban ecosystems exposed to multiple anthropogenic impacts.

KEYWORDS: *Argentina, behavior, Buenos Aires province, Fulica sp., urban lagoons*

Wetlands are considered one of the most relevant ecosystems globally, characterized not only by supporting high biodiversity, but also by the multiple ecosystem services they provide, such as water purification, support for recreational activities, and environmental education, among others (Ghermandi et al. 2010, Ramsar 2016, Alikhani et al. 2021). Wetlands are grouped into three main categories: marine-coastal, inland, and artificial wetlands (Ramsar 2016). Within these categories, we can identify so-called urban wetlands, which are located within urban or peri-urban areas and can be of natural or artificial origin (Palta et al. 2017, Alikhani et al. 2021). These types of wetlands are often among the most affected, partly due to pressure exerted by multiple human activities that result in habitat degradation, water pollution, biodiversity loss, and the introduction of exotic or invasive species, among others (Alikhani et al. 2021). Urban wetlands, as well as other water bodies (e.g., artificial urban lagoons), are widely used by various taxa, such as fish, amphibians, reptiles, mammals, and birds (Schnack et al. 2000, De Marco et al. 2011, Hassall et al. 2014, Alikhani et al. 2021). With respect to birds, so-called waterbirds are usually the most conspicuous in these environments (e.g., families Anatidae, Rallidae, Podicipedidae; McKinney et al. 2011, Murray et al. 2013,

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Hassall 2014). This group of birds may use these water bodies permanently, as well as during some stage of their life cycle (e.g., breeding period, wintering), or they may make partial use of them during migration (Traut & Hostetler 2004, Tallei et al. 2021, Xie et al. 2022). Therefore, these water bodies function as feeding, resting, shelter, and even breeding sites for many waterbird species (Traut & Hostetler 2003, Murray et al. 2013, Alikhani et al. 2021).

Birds have a limited amount of time throughout the day to carry out their activities; the allocation of time among different activities is commonly known as a time budget (Barnard 1980). The study of time budgets devoted to daily activities provides valuable information on how individuals perform different activities in order to improve their reproductive success (Ryan & Dinsmote 1979, Stephens et al. 2007, Dunbar et al. 2009). Among the diversity of daily activities an individual may perform, feeding plays an essential role, directly influencing the time allocated to activities such as resting, preening, and even reproduction, among others (Illius et al. 2002, Dunbar et al. 2009, Rose et al. 2022, Mukherjee et al. 2023). It is crucial to emphasize that time allocation to a particular behavior can vary significantly both at hourly and seasonal scales (Mukherjee et al. 2023). At the hourly scale, for example, time allocated to feeding is usually concentrated in the early and late hours of the day. This may be because birds thereby avoid both thermal stress and human disturbance, while resting may predominate during midday (Döpfner et al. 2009). Therefore, understanding these hourly patterns makes it possible to evaluate the efficiency with which waterbirds use their habitats.

With regard to seasonal variation, during the breeding period, activities such as egg laying and chick care become more relevant, modifying time budgets (Ryan & Dinsmote 1979, Döpfner et al. 2009, Mukherjee et al. 2023). Prior to the onset of the breeding period, there is an increase in energetic needs or the accumulation of reserves, so waterbirds may increase consumption rate, select food items of higher energetic quality, invest more daily time in feeding, and/or reduce energetic expenditure (Stephens et al. 2007, Newton 2010). In contrast, during the non-breeding period, many waterbirds tend to invest more time in activities related to resting and swimming (Döpfner et al. 2009, Mukherjee et al. 2023).

In addition to temporal variation, the coexistence or sympatry of species using the same resource, for example, an urban wetland, as in this study, may generate the need for niche differentiation (Murray et al. 2013, Mukherjee et al. 2023). In this way, it is expected that sympatric species, through behavioral segregation, minimize competition, resulting in different time budgets and resource use among species (Mukherjee et al. 2023). Therefore, quantifying and comparing time budgets of different behaviors among species is relevant for evaluating coexistence in anthropized environments (Murray et al. 2013, Hassall 2014, Rose et al. 2022, Mukherjee et al. 2023).

In Argentina, many ecosystems along the maritime coast are included within several wetland regions (e.g., Cuenca del Plata, Pampas, and Patagonian Coastal Zone; Secretaría de Ambiente y Desarrollo Sustentable de la Nación 2006). Among these, urban wetlands stand out, some of which contain water bodies permanently throughout the year. Among the most frequent and abundant waterbirds that use these environments are coots (*Fulica* sp., family Rallidae; Di Giacomo et al. 2007, González Trilla & Blanco 2017). These are waterbirds considered mostly or primarily herbivorous, but they may occasionally include aquatic insects, mollusks, and even crustaceans in their diets (Draulans & Vanherck 1987, García et al. 2008, Olguín et al. 2013, Velásquez et al. 2019). In Argentina, the genus *Fulica* is represented by six species, of which the White-winged Coot (*Fulica leucoptera*), the Red-fronted Coot (*F. rufifrons*), and the Red-gartered Coot (*F. armillata*), the focus of this study, are widely distributed along their latitudinal distribution gradient, which includes other countries such as Chile and Uruguay (Narosky & Yzurieta 2010). These species have an extended breeding period of approximately eight to ten months, which begins, with slight variation depending on the area, during the austral spring (e.g., between August and September), with egg-laying peaks in the austral summer (e.g., between December and January; Silva et al. 2011, Salvador 2012, Echevarria et al. 2022, De la Peña 2025).

In Argentina, studies of coots have focused on reproductive biology (Salvador 2012, Echevarria et al. 2022), habitat use (Heimsath et al. 1993), and trophic ecology (García et al. 2008, Olguin et al. 2013), with a strong geographic bias, as most studies were conducted in the central and northern parts of the country. It is worth noting that, despite the studies mentioned above, there are few studies aimed at evaluating the time investment that different species of the genus *Fulica* devote to their daily activities. The general objective of this study was to establish a baseline and characterize the time–activity budgets of three sympatric coot species that, during the months coinciding with the onset of the birds' breeding period, used a

highly anthropized urban lagoon environment that is part of a wetland relic in the southeast of Buenos Aires Province, Argentina. The specific objectives of the present study were to quantify and compare, descriptively, for each coot species separately and among coot species, the time invested in different behavioral activities and feeding techniques (a) among different times of day (i.e., morning, midday, afternoon), and (b) throughout the day (i.e., all time periods combined).

METHODS

Study area

The study area encompassed the Punta Mogotes lagoon complex (38°03'S, 57°32'W), located in the Partido de General Pueyrredon, in southeastern Buenos Aires Province, Argentina. The lagoon complex consists of four shallow lagoons (< 2 m) connected to each other and arranged in an arc, parallel to the coastline. With an approximate length of 2.5 km, it is bounded to the north by the Reserva Natural del Puerto Mar del Plata (RNPMdP) and the Club Atlético Aldosivi sports grounds, it is bounded to the south by Punta Cantera, and along its extension it is bounded to the west by Avenida de los Trabajadores and to the east by the Punta Mogotes beach resort complex (Fig. 1). The lagoon complex, together with the RNPMdP, is considered a relic of coastal wetlands (Richeri 2011). Given the surrounding infrastructure, both in terms of residential housing and commercial establishments, as well as the layout of the Punta Mogotes resort, the aforementioned sports club, and the port of Mar del Plata, the study area is fully urbanized, with port, industrial, commercial, and tourism activities prevailing (De Marco et al. 2005). The lagoon complex supports an important diversity of flora and fauna, where a wide variety of vertebrates coexist (i.e., fish, amphibians, reptiles, mammals, and birds), with birds being the most diverse and conspicuous group (De Marco et al. 2005). Regarding the birds using the study area, some of the most frequently observed species are the three coot species under evaluation (i.e., White-winged Coot, Red-fronted Coot, Red-gartered Coot), several grebe species (e.g., *Podiceps major*, *Rollandia rolland*), ducks (e.g., *Anas flavirostris*, *A. georgica*), gulls (e.g., *Chroicocephalus maculipennis*, *Larus dominicanus*), and the domestic Graylag Goose (*Anser anser*; De Marco et al. 2011, Berón & Seco Pon 2024). The lagoons are interconnected, allowing free movement among them by the birds that use them. Due to their location, the lagoons are similarly exposed to the impact of anthropogenic activities, from Avenida de los Trabajadores, which runs along the entire western side with constant vehicle traffic throughout the day, to the pedestrian and vehicular promenade of the beach resort complex along the eastern side, which is used for various outdoor activities such as walking, running, and resting. Due to its proximity to the RNPMdP, declared a Municipal Reserve in 1990 (Municipal Ordinance No. 7927/90) and in 2014 a Provincial Natural Reserve with Mixed Defined Objectives—Botanical, Faunal, and Educational (Provincial Law No. 14688), as well as its high environmental value, the Punta Mogotes lagoon complex is listed as a locally protected area (Municipal Ordinance No. 11038/97). In turn, the approximately 4 km stretch of coastline where the Punta Mogotes resort is located, adjacent to the study area, is considered one of the Important Bird Areas in Buenos Aires Province (IBA BA12; Di Giacomo et al. 2007).

Data collection

During August to November 2022, coinciding with the breeding period of coots in Argentina (De la Peña 2025), we conducted weekly observations on weekdays using 5-minute focal samples (i.e., 300 seconds; Altmann 1974) on three coot species inhabiting the

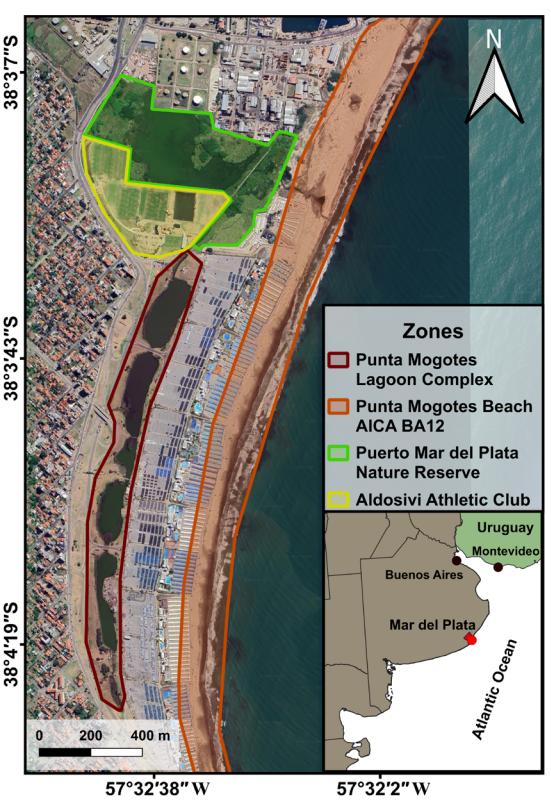

Figure 1. Study area. The study area is shown in relation to the coast of General Pueyrredón County, in the southeast of Buenos Aires Province, Argentina.

study area. Focal observations of the three coot species were distributed across three time periods (local time, GMT -3): morning (8–10 h, *n* = 255 focal observations), midday (11–13 h, *n* = 193), and afternoon (14–16 h, *n* = 188; Supplementary Material Table S1). For each time period, one of the water bodies within the lagoon complex was randomly selected. Within each, we selected a total of five individuals per species (i.e., White-winged Coot, Red-fronted Coot, Red-gartered Coot), on which focal observations were conducted, totaling 15 focal observations per species per day, evenly distributed across the three time periods considered. We conducted a total of 636 focal observations, corresponding to 53 h of recordings (White-winged Coot: *n* = 214 focal observations, total recording time = 17.84 h; Red-fronted Coot: *n* = 213, 17.75 h; Red-gartered Coot: *n* = 209, 17.41 h; Supplementary Material Table S1). To reduce the probability of observing the same individual across time periods, we randomly rotated among lagoons for each time period analyzed. Although we did not have an estimate of population size for each coot species in the study area, the total number of individuals present in the lagoons was approximately fewer than 200 individuals per species. Observations and data collection were carried out at distances that did not disturb the animals' natural behavior (> 20 m), using binoculars (8 x 40) or a monocular (8 x 60) and a digital recorder. Two of the authors (MMH and MPB) conducted all observations. To minimize potential observer-related errors in recording behaviors, we conducted a behavioral assessment trial a few weeks prior to the study. For this, observers visited the study area and jointly observed the behaviors of the three species under evaluation, thereby standardizing the recognition of behaviors to be recorded.

The activities recorded during focal observations included: (a) 'self-maintenance', which included preening behaviors such as feather and/or bill cleaning and bathing; (b) 'resting', when the individual was observed stationary either in or out of the water; (c) 'swimming', when the individual was observed moving within the water; (d) 'paddling', when the individual moved across the water surface while flapping wings and legs; (e) 'flying'; (f) 'agonistic', any type of aggressive interaction with or without contact directed toward or by the focal individual; and (g) 'feeding'. Within this latter activity, feeding techniques were distinguished as follows: (1) 'surface feeding', defined as the ingestion and handling of food obtained from the water surface; (2) 'head–neck submerged', when the individual partially or totally submerges the head and neck; (3) 'diving', defined as total submersion of the focal individual, broken down into total time submerged and, when observed, time spent ingesting food obtained through this technique; (4) 'up-ending', a behavior in which the individual submerges half of the body, remaining upside down with legs extended vertically in the air (similarly to 'diving', this behavior was broken down into time submerged and, when observed, time spent ingesting food obtained through this technique); and (5) 'feeding outside the water body', defined as the ingestion and handling of food obtained from vegetated ground (i.e., outside the water body), following the criteria of Draulans & Vanherck (1987) and Ryma & Mouloud (2018).

Data analysis

To characterize the time allocated by each coot species to different behaviors (recorded activities) and feeding techniques, we analyzed the recordings and quantified the total time (in seconds) devoted to each behavior during the 5-minute focal sampling period (i.e., 300 s), both at the daily scale (combined time periods) and intra-daily scale (i.e., morning, midday, afternoon). To account for the potential issue of pseudoreplication due to the unknown identity of sampled individuals, we used a data randomization protocol proposed by Garamszegi (2016). To implement this protocol, we randomly assigned an identity to each sample in the dataset (i.e., focal observation). This step assumes that the activity is highly repeatable and that coots consistently exhibit these activities. We repeated this process 1000 times and, in each simulation, calculated an overall mean for each activity category. We calculated this mean for each coot species, both for each time period analyzed and for the combination of them (Garamszegi 2016, Hernandez et al. 2021). To evaluate differences in daily activity budgets and feeding techniques both within and among species, we calculated, based on the simulations for each time period and their combination, an Overlap Index between the empirical distributions of the means of each behavioral category (see Pastore & Calcagní 2019, Hernandez et al. 2021). The Overlap Index (η) ranges between 0 and 1, where η = 0 indicates that empirical distributions are completely separate, whereas η = 1 indicates that empirical distributions are exactly the same. High values of the Overlap Index are interpreted as similarity in the probability distribution of time invested in a given activity or feeding technique, whereas low values indicate activities that differ in terms of time invested. Data management and statistical analyses were performed using R, version 4.3.0 (R Development Core

Team 2023). Simulations followed the supplementary material associated with Garamszegi (2016), while the Overlap Index was calculated using the '*Overlapping*' package version 2.2 (Pastore 2025).

RESULTS

Daily activity budgets

In general, throughout the entire study period and for the three species evaluated, the time invested in daily activities related to feeding and swimming together accounted for more than 80% of their time budgets. For White-winged Coots and Red-fronted Coots, unlike Red-gartered Coots, the percentage of time invested in feeding activities was greater than that invested in swimming (Fig. 2; Supplementary Material Table S2). Activities related to self-maintenance and resting together accounted for approximately 18% of the total time for the three coot species. The percentage of time invested in both activities was similar for Red-gartered Coots, whereas Red-fronted Coots invested a greater percentage of time in resting

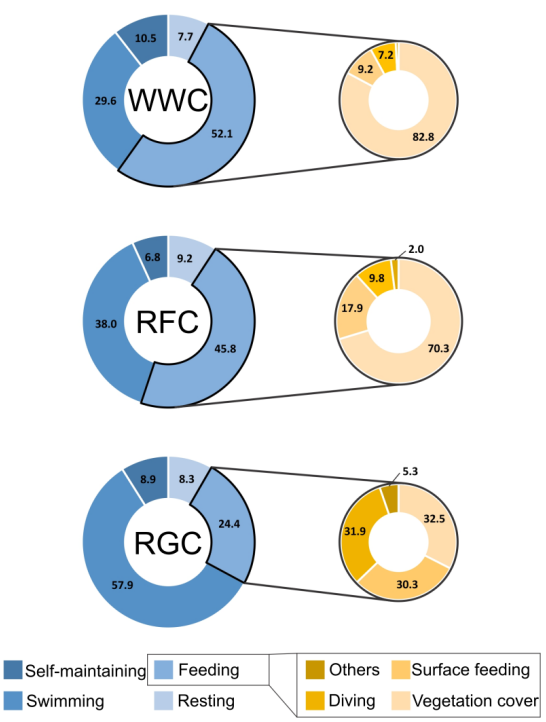

Figure 2. Percentage of time spent by the White-winged Coot (*Fulica leucoptera*, WWC), Red-fronted Coot (*F. rufifrons*, RFC), and Red-gartered Coot (*F. armillata*, RGC) in the main daily activity categories, and percentage of time spent (out of total feeding time) using the different feeding techniques, for the entire study period (i.e., August to November 2022) and combined time periods (i.e., morning, midday, and afternoon). The category 'Others' includes the feeding techniques 'head-neck submerged' and 'up-ending'. The percentage of time spent in the behaviors 'Agonistic interaction', 'Foot-paddling', and 'Flying' is not shown in the figure (together < 0.5% for each coot species).

activities and White-winged Coots in self-maintenance activities (Fig. 2; Supplementary Material Table 2). For all species under study, agonistic interactions represented less than 0.5% of the time budget; these were generally non-contact interactions in which individuals were displaced a few meters without pursuit. On the other hand, behaviors such as flying and paddling were almost nonexistent (Supplementary Material Table 2). Regarding the different feeding techniques, and throughout the entire study period, both White-winged Coots and Red-fronted Coots invested a greater percentage of time consuming items at the surface outside the water (i.e., surface vegetation), followed by feeding at the water surface and consuming items obtained by diving. In the case of Red-gartered Coots, the percentage of time invested in the three feeding techniques mentioned above was similar (Fig. 2; Supplementary Material Table 3). The time invested in acquiring food through partial body immersion and head–neck submergence techniques was low and, combined and for all species, accounted for less than 5% of the total time devoted to foraging activities (Supplementary Material Table 3). The average time spent per diving event (mean ± standard deviation) was estimated at 5.12 ± 0.85 s, 5.11 ± 1.09 s, and 4.87 ± 1.11 s for Red-gartered Coots, Red-fronted Coots, and White-winged Coots, respectively.

Considering that the Overlap Index ranges between zero and one, high values (close to one) are interpreted as strong similarity in the mean time invested among the behaviors evaluated. The evaluation of the level of overlap for each activity among species, for the entire study period, showed very low and even null values for activities related to self-maintenance, swimming, feeding, and agonistic interactions (Fig. 3, Table 1). In contrast, for resting activities, this index yielded intermediate and low overlap values between White-winged and Red-gartered Coots and between Red-fronted and Red-gartered Coots, respectively (Fig. 3, Table 1). The analysis of the different feeding techniques used by these species throughout the study period showed low and null overlap values for almost all feeding techniques considered, except for food acquisition through head–neck submergence, where high values of the Overlap Index were observed between Red-fronted and Red-gartered Coots (Fig. 4, Table 1).

Intra-daily activity budgets

The mean distribution of time allocated among activity categories for each time period differed among the species studied (Supplementary Material Figs. 1–6). In general terms, Overlap Index values were low

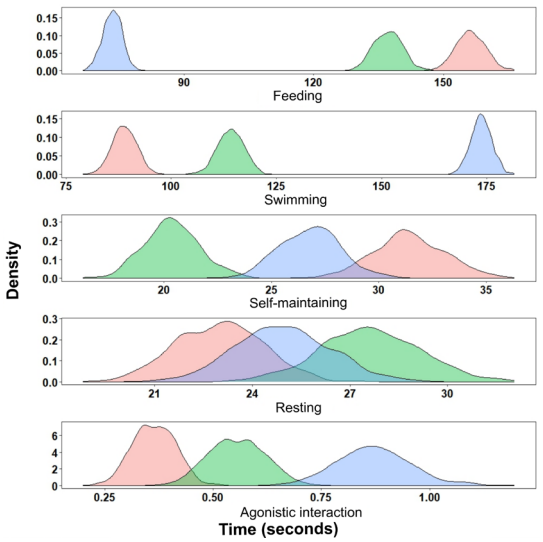

Figure 3. Distribution of the means of each daily activity category for the White-winged Coot (*Fulica leucoptera*, red), Red-fronted Coot (*F. rufifrons*, green), and Red-gartered Coot (*F. armillata*, blue), calculated from 1000 simulations for the entire study period (i.e., August to November 2022) and combined time periods (i.e., morning, midday, and afternoon). The *y*-axis represents the estimated kernel density of the distribution of the means for each behavior. The *x*-axis represents time, in seconds, allocated to each behavior.

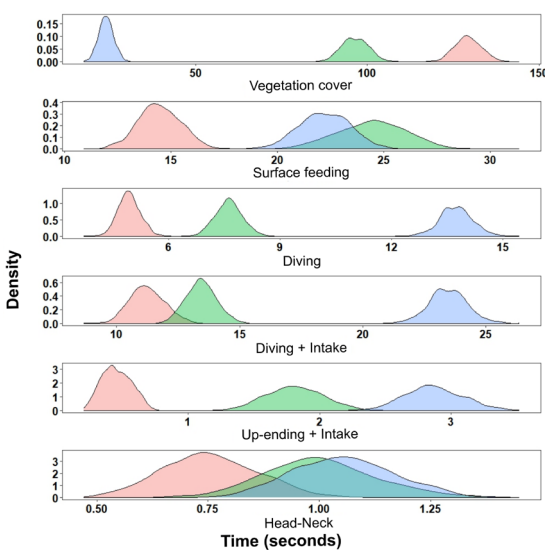

Figure 4. Distribution of the means of each feeding technique for the White-winged Coot (*Fulica leucoptera*, red), Red-fronted Coot (*F. rufifrons*, green), and Red-gartered Coot (*F. armillata*, blue), calculated from 1000 simulations for the entire study period (i.e., August to November 2022) and combined time periods (i.e., morning, midday, and afternoon). The *y*-axis represents the estimated kernel density of the distribution of the means for each behavior. The *x*-axis represents time, in seconds, allocated to each behavior. 'Vegetation cover': Feeding in areas outside the water column. 'Surface': Feeding at the surface of the water column. 'Diving + Intake' or 'Up-ending + Intake': Represents the sum of the time spent on the food acquisition technique plus the time spent ingesting the obtained food.

or null for most activities considered (Supplementary Material Tables 4–6), reflecting, for each species, differential time investment in each activity among time periods. White-winged Coots invested, similarly during the morning and midday periods, a greater proportion of their time in feeding activities, followed by activities related to searching (i.e., swimming; Supplementary Material Fig. 1, Tables 2 & 4); both activities had similar time investment for this species during the afternoon period (Supplementary Material Table 2). Although to a lesser extent, activities related to resting were mostly represented, similarly, during midday and afternoon periods, whereas White-winged Coots invested more time in self-maintenance activities during the afternoon period (Supplementary Material Fig. 1, Tables 2 & 4). Red-fronted Coots invested more time in feeding activities during morning hours, followed by swimming, whereas during midday and afternoon periods the time devoted to both behaviors was similar (Supplementary Material Fig. 3, Tables 2 & 5). For this species, resting was the third activity accumulating the most time during midday and afternoon periods, followed by preening, which was similar, in terms of time invested, to resting during morning hours (Supplementary Material Fig. 3, Tables 2 & 5). Regarding Red-gartered Coots, activities related to food searching dominated the proportion of time invested by the species across the three time periods, being higher during the morning (Supplementary Material Fig. 5, Tables 2 & 6), followed by feeding, which showed its highest values during the midday period. Resting activities for this species were higher during midday and self-maintenance was highest during the afternoon (Supplementary Material Fig. 5, Tables 2 & 6).

Regarding the different feeding techniques, those performed outside the water body (i.e., in surface vegetation) largely dominated the time budget invested across the three time periods for both White-winged and Red-fronted Coots, being higher in both cases during morning hours (Table 1; Supplementary Material Figs. 2 & 4, Tables 2 & 3). In the case of Red-gartered Coots, surface feeding and feeding outside the water body dominated feeding time during the afternoon and midday periods, respectively, whereas during morning hours feeding outside the water body as well as diving techniques accounted for the greatest amount of time (Supplementary Material Fig. 6, Tables 3 & 6).

DISCUSSION

The present study is the first to address the time invested in daily activities by three coot species oc-

curring in sympatry in highly anthropized coastal wetlands in southeastern Buenos Aires Province. The protocol implemented in this study does not rely on an inferential statistical model but rather follows an exploratory and descriptive approach. Therefore, its results and comparisons with other studies discussed in this section should be interpreted with caution. On the other hand, for a better interpretation of the results obtained, it is important to note that although the sampling period of the present study (i.e., August–November) coincides with the breeding period of these species in other regions of the country (De la Peña 2025), we did not observe individuals exhibiting behaviors related to reproduction (e.g., courtship, copulation, egg laying), nor did we record eggs or chicks. This apparent absence of reproductive activity represents a limitation when comparing and generalizing the results. For this reason, and because time investment in different behaviors is affected by the stage of the breeding period, in the present section we have compared our results with other studies conducted during both the breeding and non-breeding periods. In addition, we have considered other scenarios such as the presence of non-breeding individuals. Among the possible scenarios that could explain the results obtained here, it is possible that birds reproduced before or after the sampling period, or even at other sites not surveyed (e.g., Reserva Natural del Puerto Mar del Plata). Another possible explanation is that during 2022 (the year of data collection) adverse climatic events may have occurred that affected reproduction. However, we do not rule out the possibility that some of these species may have been breeding during the evaluated period, given that in other years coot chicks have been observed in the lagoons studied (JPSP, MPB, pers. obs.). We also do not rule out the possibility that individuals present in these lagoons were juveniles or non-breeders. In Buenos Aires Province, the reproductive biology of these species has not yet been studied, and such studies are scarce even at the regional level (see Salvador 2012, Echevarria et al. 2022). Although in other parts of Argentina the breeding period of the species studied occurs between August and April, peak egg laying has been identified during December and January (Salvador 2012, Echevarria et al. 2022). The possibility that the populations of the three coot species using the study area during the evaluated period consisted of juveniles and/or non-breeding individuals should be considered when comparing our results with other studies at both regional and global scales.

Table 1. Overlap Index between the empirical distributions of the means of each activity category and feeding techniques among the study species, calculated from 1000 simulations, for the entire study period (i.e., August to November 2022) and combined time periods (i.e., morning, midday, and afternoon). 'Vegetation cover': Feeding in areas outside the water column. 'Surface': Feeding at the surface of the water column. 'Diving + Intake' or 'Up-ending + Intake': Represents the sum of the time spent on the food acquisition technique plus the time spent ingesting the obtained food.

	White-winged Coot – Red-fronted Coot	**White-winged Coot – Red-gartered Coot**	**Red-fronted Coot – Red-gartered Coot**
Activity			
Feeding	0.01	0.00	0.00
Swimming	0.00	0.00	0.00
Self-maintenance	0.00	0.14	0.02
Resting	0.12	0.51	0.39
Foot-paddling	0.68	0.14	0.11
Flight	0.62	0.53	0.39
Agonistic interaction	0.10	0.00	0.04
Feeding technique			
Vegetation cover	0.00	0.00	0.00
Surface	0.00	0.00	0.43
Diving	0.00	0.00	0.00
Diving + Intake	0.11	0.00	0.00
Up-ending	0.00	0.00	0.00
Up-ending + Intake	0.00	0.00	0.02
Head-neck submerged	0.31	0.20	0.82

In the study area, during the months of August to November, the three coot species studied invested the greatest proportion of their time in activities related to searching for and obtaining food. For White-winged and Red-fronted Coots, our results are consistent with those reported during the breeding period for other coot species inhabiting the Northern Hemisphere (i.e., North America; Ryan & Dinsmore 1979). Time budget studies conducted during the breeding period in the American Coot (*F. americana*) showed that this species invests from 50–70% of its time in feeding activities, while activities related to resting and self-maintenance ranged from 6–10% and 8–15%, respectively (Ryan & Dinsmore 1979). On the other hand, studies conducted on the Eurasian Coot (*F. atra*) during the non-breeding period in other regions (i.e., Algeria, Belgium, Ireland, India) showed diverse and contrasting values of time investment (Draulans & Vanherck 1987, Irwin & O'Halloran 1997, Baaziz & Samraoui 2008, Ryma & Mouloud 2018, Mukherjee et al. 2023). Baaziz & Samraoui (2008) and Ryma & Mouloud (2018) observed that the Eurasian Coot invested 75–80% of its time feeding, 15% in activities related to food searching, and less than 5% combined in resting and self-maintenance activities. For this species, Draulans & Vanherck (1987) reported that feeding and food searching accounted for approximately 55% and 30% of the time invested throughout the day, respectively, while self-maintenance accounted for around 11%, and no resting activities were observed. Irwin & O'Halloran (1997) determined that the Eurasian Coot invested similar amounts of time swimming and feeding, at 38% and 36%, respectively, and approximately 7% and 5% in resting and self-maintenance activities, respectively. Mukherjee et al. (2023), on the other hand, recorded food searching as the main activity at approximately 40%, followed by resting at 30%, and third, feeding activities at around 18%. Variation among regions in time budgets for the Eurasian Coot was mainly attributed to variability in trophic resource diversity and availability, and to environmental variability (Draulans & Vanherck 1987, Irwin & O'Halloran 1997, Ryma & Mouloud 2018). In our study, the Red-gartered Coot showed time budgets that differed from the other species evaluated, mainly in relation to feeding activities, with only the time invested in food searching being similar to that recorded during the non-breeding period for the Eurasian Coot (Mukherjee et al. 2023). Regarding agonistic interactions and other behaviors such as flying, our results are consistent with those previously reported (< 1%; Ryan & Dinsmore 1979, Draulans & Vanherck 1987, Irwin & O'Halloran 1997, Ryma & Mouloud 2018, Mukherjee et al. 2023).

With respect to the feeding techniques observed, the results obtained in this study differed from those reported for these and other coot species. Our results indicate that White-winged and Red-fronted Coots select areas outside the water body to feed, especially during morning hours. In contrast, Red-gartered Coots invested a greater proportion of their time obtaining food within the water body, both at the surface and through diving techniques. Although coots include a wide diversity of seeds and arthropods in their trophic spectrum, feeding mainly on vegetation at the water surface has been recognized by other authors as the main feeding mechanism in these birds (Draulans & Vanherck 1987, Irwin & O'Halloran 1997, Baaziz & Samraoui 2008, Olguín et al. 2013, Ryma & Mouloud 2018). However, a single study reported diving as the technique accounting for the greatest amount of feeding time in the Eurasian Coot, followed by feeding at the water surface (Mukherjee et al. 2023). The proportion of time invested in other feeding techniques by the coots analyzed in our study, such as those in which individuals submerge the head, neck, or part of the body, fell within the ranges reported in other studies focused on coots (Draulans & Vanherck 1987, Irwin & O'Halloran 1997, Mukherjee et al. 2023). Regarding diving times, the three coot species evaluated invested a similar amount of time (~ 5 s) in each diving event. These results differ from those reported for other species such as the American Coot, whose average times ranged from 2–3 s (Batulis & Bongiorno 1972). In the case of the Red-gartered Coot, diving time was shorter than previously reported for the species in the region (~ 8.5 s). It should be considered that previous reports involved individuals feeding on crabs (García et al. 2008), whereas in the present study individuals fed on vegetation. In waterbirds such as coots, water depth and the diversity and abundance of submerged vegetation are some of the factors that determine dive duration (Batulis & Bongiorno 1972).

It has been shown that increased human activity in coastal environments negatively affects the richness and abundance of coots and other waterbirds, and it also generates avoidance behavior or displacement away from shoreline areas, which are in turn subject to greater anthropogenic pressure (Cardoni et al. 2008, Chávez-Villavicencio et al. 2015). Several authors have highlighted the importance of these behavioral changes, suggesting that individuals that are more alert to potential predators or threats may invest less time in feeding and resting activities, which may directly affect reproductive success (Beale & Monaghan 2004, Cardoni et al. 2008, Borgmann 2011). In

our study, we characterized time budgets invested in daily activities in three coot species under natural conditions. However, these were recorded during weekdays, when visitor presence is lower. Likewise, the study period, which extended until December, did not include the summer months, when visitor numbers increase considerably due to the use not only of the Punta Mogotes beach resort complex but also the surrounding green spaces around all the lagoons in the complex (Bouvet et al. 2005, De Marco et al. 2005, Richeri 2011). For this reason, our study did not include comparisons of behavioral changes resulting from external stressors such as visitor presence and/or tourist activities. We consider it important to develop studies that allow for a better understanding of this issue in the study area, given that, due to its intrinsic characteristics, port, industrial, commercial, and tourism activities predominate in the surrounding area, with the potential to impact the avifauna present, as well as other local fauna (De Marco et al. 2005).

On the other hand, future studies should aim to obtain information on the physical characteristics of the study area, such as depth, as well as the vegetation present. This information would allow a better understanding of trophic behavior, dive times, energetic return (Batulis & Bongiorno 1972), as well as differential use of sectors of the water bodies (Heimsath et al. 1993). It should be noted that vegetation present in water bodies such as the lagoons evaluated is not only used as a food resource by a wide diversity of birds, but also functions as shelter (Traut & Hostetler 2003, Murray et al. 2013, Alikhani et al. 2021), where individuals can protect themselves from threats present in the area, such as unsupervised dogs (Berón & Seco Pon 2024) and feral dogs, some of which were observed entering the water with the intention of capturing birds (MH, pers. obs.). Given that the behaviors exhibited by an individual may be affected by the presence of other individuals both at the conspecific and heterospecific levels (Yasué 2005, Gil et al. 2018, Mukherjee et al. 2023), it would be relevant for future studies to evaluate the effect of group size as well as assemblage composition.

Finally, it is essential to know and understand basic aspects of the biology of waterbird species that use these urban ecosystems, as they are exposed to various anthropogenic impacts. For this purpose, baseline behavioral studies play a fundamental role in understanding the spatial and temporal use that waterbirds make of these urban lagoons. This will make it possible to recommend potential management measures to ensure the conservation of the avifauna using the area, considering that it is not only part of a relic of coastal wetlands, but is also designated as a locally protected area and is adjacent to the Reserva Natural del Puerto Mar del Plata and an Important Bird Area (IBA BA12; Di Giacomo et al. 2007).

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SUPPLEMENTARY MATERIAL

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