

# Distribution and abundance of the Grey-headed Gull *Chroicocephalus cirrocephalus* (Vieillot, 1818) in Rio de Janeiro, Southeastern Brazilian coast

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**ABSTRACT:** The distribution and movements of the Grey-headed Gull in the Brazilian coast are poorly known. Here, we provide records and data on this species in the environments it uses more frequently, either polluted or non-polluted, in the “Região dos Lagos” and northern Rio de Janeiro state. Counts were carried out during monthly systematic surveys from October 2011 to November 2012 and supplementary observations between February 2009 and October 2011. In total, 76 *C. cirrocephalus* records were made, with mean and maximum numbers of  $74.9 \pm 145$  and 1,500 gulls, respectively. The difference in abundance between “Região dos Lagos” and northern Rio de Janeiro was not significant (Student’s test,  $P = 0.51$ ). In northern Rio de Janeiro, greater numbers were recorded during the dry season ( $116 \pm 220.8$ ) than in the rainy season ( $16.5 \pm 31.6$ ) (Student’s t test,  $P = 0.04$ ). Coastal lagoons and deactivated salt ponds were the most extensively used environments (Tukey test,  $P < 0.04$ ). On the other hand, large flocks were recorded in environments polluted with sewage. In addition, we present the first documented evidence that *C. cirrocephalus* breeds in northern Rio de Janeiro, which indicates that the species is expanding its range in Rio de Janeiro as in other areas in Brazil.

**KEY-WORDS:** geographic expansion, habitat use, northern Rio de Janeiro, “Região dos Lagos”, Restinga de Jurubatiba.

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## INTRODUCTION

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The Grey-headed Gull *Chroicocephalus cirrocephalus* (Vieillot 1818) inhabits coastal environments in Africa and South America (Harrison 1983, Burger & Gochfeld 1996, Brooke *et al.* 1999). In Brazil, relatively few records have been obtained for the species, which makes it difficult to assess *C. cirrocephalus* range and movements. To date, the species is known to occur along the coast of northern and northeastern Brazil, in the states of Pará, Maranhão, Ceará, Rio Grande do Norte, Alagoas and Pernambuco, as well as irregularly in south and southeastern Brazil, in the states of Rio de Janeiro, São Paulo, Santa Catarina, Paraná and Rio Grande do Sul (Sick 1997, Ruschel & Costa 2003, Azevedo-Júnior *et al.* 2004, Votto *et al.* 2006, Rodrigues *et al.* 2010, Scherer-Neto & Straube 2011, Leal *et al.* 2013, Tavares & Siciliano 2013a). However, the specialized literature cites only one occurrence for the state of São Paulo, which means that, in the southeastern Brazilian coast, the species might be restricted to Rio de Janeiro State (Pacheco & Bauer 2001, Barbieri *et al.* 2010, Tavares *et al.* 2012).

In Rio de Janeiro State, the Grey-headed Gull has been recorded to occur in the central coast by Sick & Pabst (1968) and Pacheco (1988), and in the state’s northern coast by Aguirre & Aldrighi (1983), Sick (1997) and Tavares & Siciliano (2013a). Also, only two specimens were collected in the state. The first is the type-specimen, collected at an unspecified location in Rio de Janeiro State, by Pierre Antoine Delalande, as early as 1816. The second specimen was collected in Cabo de São Tomé, on the state’s northern coast, and currently it is housed in the Museu Nacional do Rio de Janeiro (Aguirre & Aldrighi 1983). It should be emphasized that although *C. cirrocephalus* is considered probably threatened in the State, there is no previous abundance information for the species, which is an obstacle to the accurate evaluation of its conservation status, as well as with other birds in Rio de Janeiro (Alves *et al.* 2000, Tavares & Siciliano 2013b).

This paper aims to (i) assess *C. cirrocephalus* occurrence patterns in coastal wetlands of “Região dos Lagos” and northern Rio de Janeiro; (ii) identify the most widely used environments by this species; and (iii) test if

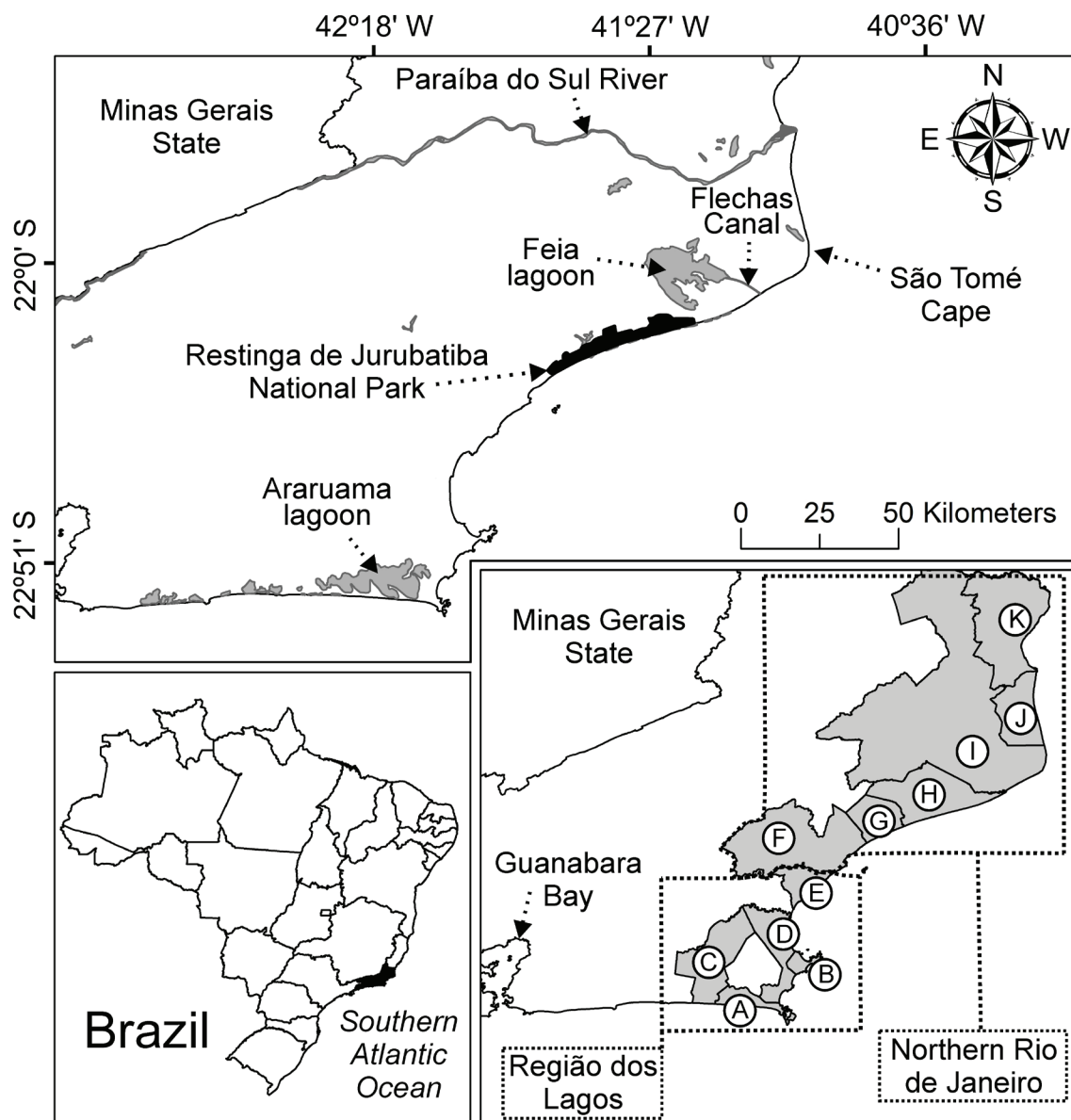
it uses polluted water bodies to the same extent as non-polluted environments.

## MATERIAL AND METHODS

### Study site

This study was carried out in coastal wetlands of two regions of Rio de Janeiro State, “Região dos Lagos” and northern Rio de Janeiro (22°54’S; 42°24’W and 21°37’S; 41°05’W) (Figure 1). “Região dos Lagos” is characterized by active and deactivated salt ponds, mudflats and marshes surrounding the Araruama lagoon, one of the largest hypersaline lagoons in the world (Kjerfve 1986). This lagoon covers 20,000 ha of flooded

areas and communicates with the sea by Itajuru Canal, which receives sewage discharges in different points along its course. Northern Rio de Janeiro state comprises numerous coastal lagoons, marshes, mudflats, and the Feia lagoon, the second largest lagoon of Brazil, with 22,000 ha of permanent flooded areas, which communicates with the sea by Flechas Canal. The water levels of most water bodies in the region are regulated mainly (or only) by rainfall regimes, which change drastically between two periods, the dry season (April – September) and the rainy season (October – March) (Carmouze *et al.* 1991, Esteves 1998, Macedo-Soares *et al.* 2010). In addition, the federal protected area which includes coastal lagoons and associated environments is the Restinga de Jurubatiba National Park, located between the municipalities of Macaé and Quissamã (Figure 1).



**FIGURE 1.** Location of the study area, with indication of surveyed municipalities and the most representative water bodies along the coast of Rio de Janeiro. Only environments located within 3 kilometers from the shoreline were visited. Surveyed municipalities: (A) Arraial do Cabo, (B) Armação dos Búzios, (C) Araruama, (D) Cabo Frio, (E) Rio das Ostras, (F) Macaé, (G) Carapebus, (H) Quissamã, (I) Campos dos Goytacazes, (J) São João da Barra, (K) São Francisco de Itabapoana.

## Data collection

In total, a 380-h sighting effort was conducted between February 2009 and November 2012. Scheduled monthly excursions were carried out between the municipalities of Araruama (“Região dos Lagos”) and São Francisco de Itabapoana (northern Rio de Janeiro), from October 2011 to November 2012 (312-h) (Figure 1). However, the municipalities of Arraial do Cabo and Armação dos Búzios were surveyed only opportunistically (23 h) as well as all the other areas, before October 2011 (45 h). Semi-random points spaced at least 300 m apart were covered in a motor vehicle, along the margins of wetlands located up to 3 km from the shoreline, according to logistics and better use of time (Bibby *et al.* 2000, Accordi 2010). Birds were recorded using 8x42 binoculars and a 20-60x80 spotting scope. When large flocks occurred, the counts were made based on photographs taken using 300 mm *teleobjective* lens. The presence of pollution was evaluated based on the detection of domestic sewage sources. Additionally, surveyed environments were classified into eight groups, according to physiognomy: coastal lagoons, deactivated salt ponds, marshes, mudflats, canals, coastal marine waters, beaches and estuaries (Kjerfve 1986, Esteves 1998).

## Data Analysis

The differences in *C. cirrocephalus* abundance between “Região dos Lagos” and northern Rio de Janeiro as well as the difference between dry and rainy seasons and between polluted and non-polluted environments were tested using the Student’s t test (Fisher 1939, Sokal & Rohlf 2011). Also, variation in abundance among types of environments was tested using the 1-way analysis of variance (ANOVA) and the post hoc Tukey test for multiple comparisons (Fisher 1936, 1938, Sokal & Rohlf 2011). We used the Box–Cox transformation to find the best transformation of data (Vernables & Ripley 2002). Results were considered significant at  $P < 0.05$ . Statistical analyses were performed considering only systematic surveys, using the R software version 3.0.0 (Ihaka & Gentleman 1996).

## RESULTS

Between February 2009 and October 2012, 76 records of the Grey-headed Gull were obtained in the surveyed localities (Figure 2A-F), with mean number of  $74.9 \pm 145$  gulls. The numbers of *C. cirrocephalus* were greater in northern Rio de Janeiro ( $95.9 \pm 180$ ) than in “Região dos Lagos” ( $44.6 \pm 75.7$ ) (Figure 3), but this difference was not significant (Student’s t test,  $t = -0.67$ ,  $P = 0.51$ ). Besides that, the maximum number (1,500 gulls)

was recorded in the municipality of Quissamã on 27 April 2012 in lagoons inside the Restinga de Jurubatiba National Park. Also, on 3 June 2012, 733 grey-headed gulls were counted in the same locality.

The Grey-headed Gull was present along the whole year in “Região dos Lagos” and northern Rio de Janeiro. However, in the latter, greater numbers were recorded during the dry season ( $116 \pm 220.8$ ) than in the rainy season ( $16.5 \pm 31.6$ ) (Student’s t test,  $t = -2.1$ ,  $P = 0.04$ ). In fact, during the rainy season, gulls disperse from lagoons inside the Restinga de Jurubatiba National Park to other areas of the State (Figure 4). In “Região dos Lagos”, numbers did not differ significantly between the dry ( $66.4 \pm 110.8$ ) and rainy seasons ( $52.1 \pm 52.5$ ) (Student’s test,  $t = 0.97$ ,  $P = 0.34$ ).

The number of the Grey-headed Gull varied significantly among different types of environments (ANOVA,  $F = 9.99$ ,  $P = 2.1 \times 10^{-9}$ ) (Figure 5A). More specifically, gulls’ abundance was significantly greater in coastal lagoons than on beaches, coastal marine waters, marshes and mudflats (Tukey test,  $P < 0.04$ ). Besides that, *C. cirrocephalus* was more abundant in environments polluted with domestic sewage ( $105.5 \pm 169$ ) than in non-polluted sites ( $26 \pm 75.5$ ) (Student’s t test,  $t = -2.39$ ,  $P = 0.02$ ) (Figure 5B).

Additionally, during an opportunistic survey on 28 September 2008, we found eight fledgling chicks in a marsh near the heliport of São Tomé Beach, Campos dos Goytacazes ( $22^{\circ}02'18''S; 41^{\circ}03'10''W$ ) (Figure 6). This is the first documented evidence that *C. cirrocephalus* breeds in northern Rio de Janeiro.

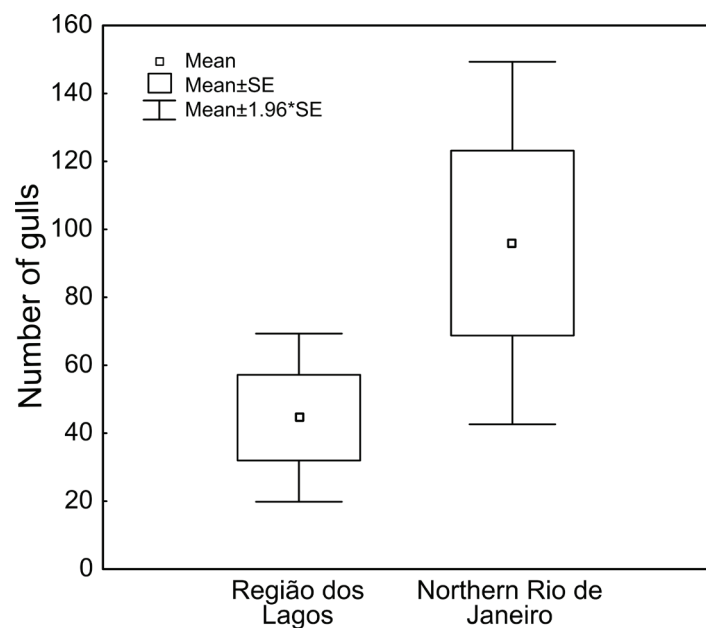
## DISCUSSION

The Grey-headed gull is expanding its geographic range along the Brazilian coast. In the State of Rio Grande do Sul, only 12 records were reported in the 1980’s and 1990’s (Belton 1984, Maurício & Dias 1996). However, recent studies indicate that the species is becoming more common along the whole coast of the State (Pacheco & Fonseca 2002, Ruschel & Costa 2003, Votto *et al.* 2006, Petersen & Petry 2011, Accordi & Hartz 2013). In May 2006, Scherer *et al.* (2011) recorded 30 individuals in the municipality of Triunfo, Rio Grande do Sul. Besides that, *C. cirrocephalus* was successively recorded for the first time in the States of São Paulo (April 2009), Alagoas (March 2010) and Pernambuco (October 2011) (Barbieri *et al.* 2010, Leal *et al.* 2013). In Rio de Janeiro State, several previous studies conducted on coastal environments did not list *C. cirrocephalus* (Nacinovic 1982, Maciel 1984, Antas *et al.* 1986, Alves *et al.* 1997, Alves & Pereira 1998, Alves *et al.* 2004a, Alves *et al.* 2004b, Mallet-Rodrigues *et al.* 2008). Given the above, the present records of large flocks and a new breeding site in the northern coast of





**FIGURE 2.** Records of *Chroicocephalus cirrocephalus* at “Região dos Lagos” and northern Rio de Janeiro, southeastern Brazil. (A) Mixed flock with *Ardea alba* and *Egretta thula* in a coastal lagoon in Carapebus; (B) Mixed flock with *Rynchops niger* in a deactivated salt pond in Região dos Lagos; (C) Flock in a polluted coastal lagoon in Região dos Lagos; (D-E) High numbers recorded inside the Restinga de Jurubatiba National Park; (F) Individual resting on the sand beach. (Photos: D. C. T. and J.F. M.).



**FIGURE 3.** Mean numbers of *Chroicocephalus cirrocephalus* in two coastal regions in Rio de Janeiro.

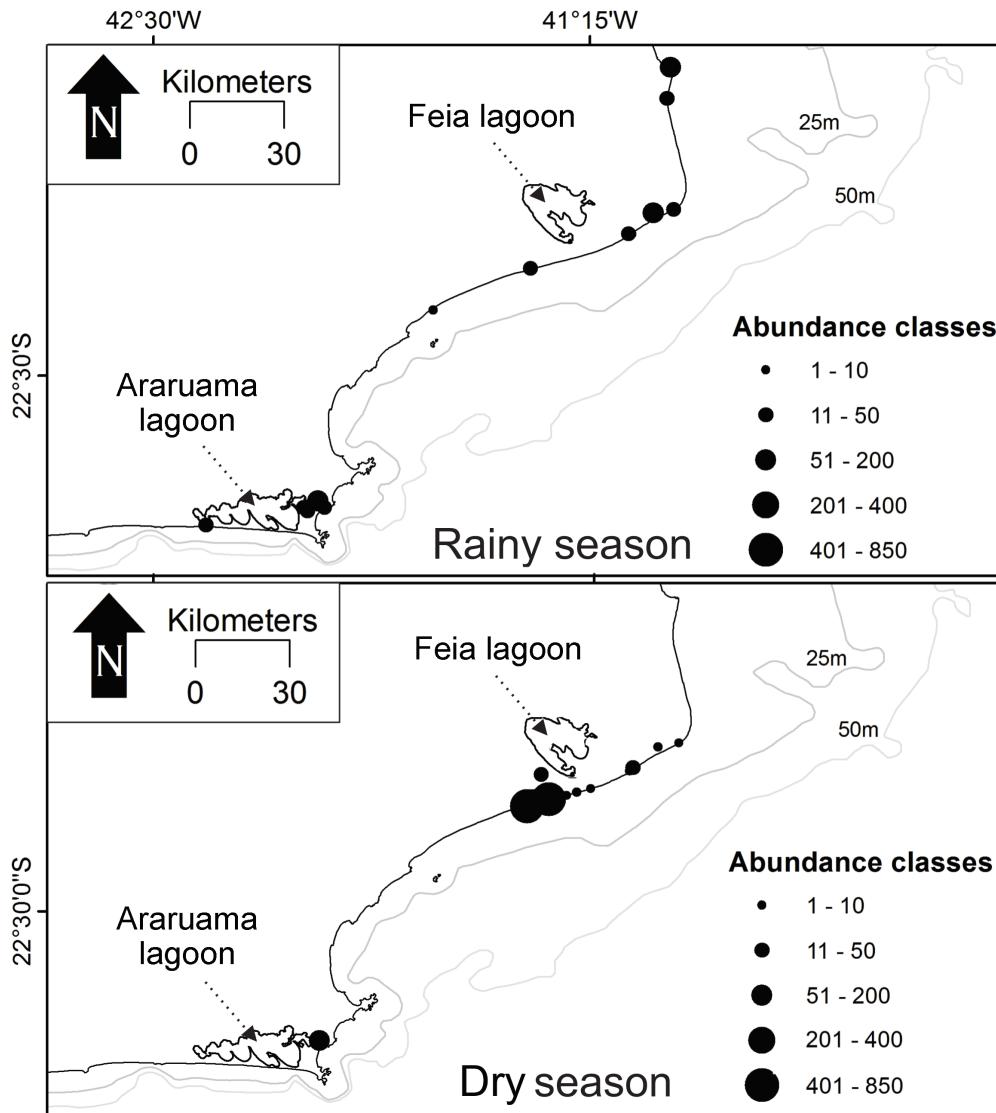


FIGURE 4. Distribution and abundance of *Chroicocephalus cirrocephalus* in Rio de Janeiro, during dry and rainy seasons, between October 2011 and November 2012.

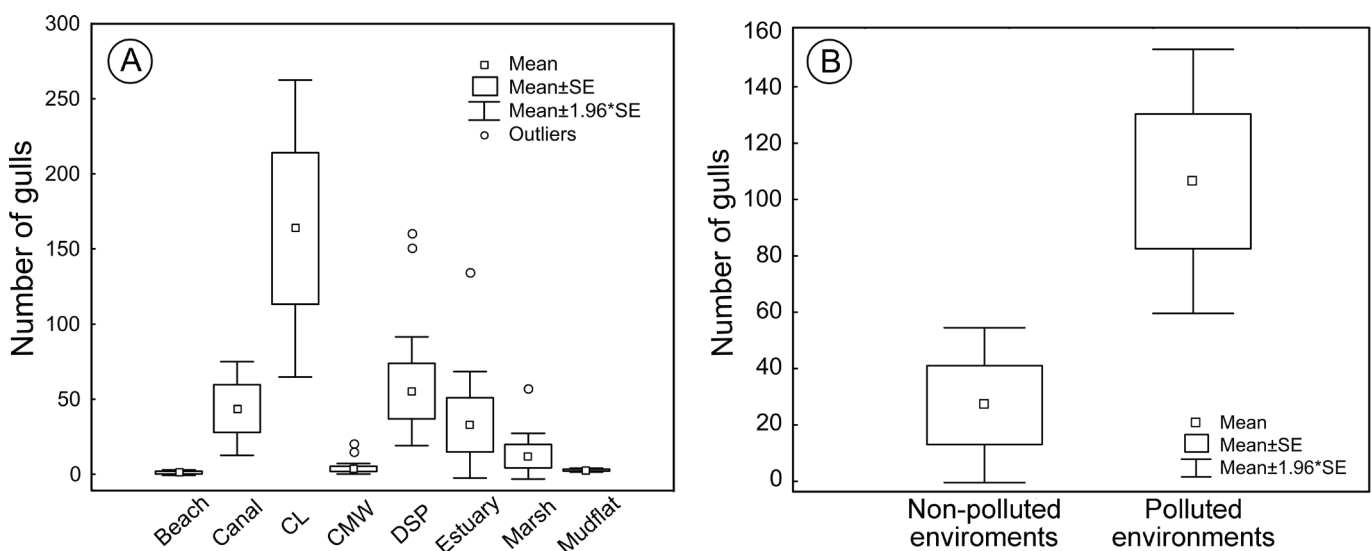


FIGURE 5. (A) - Mean numbers of *Chroicocephalus cirrocephalus* in different types of environments in Rio de Janeiro. CL = coastal lagoons; CMW = coastal marine waters; DSP = Deactivated salt ponds. (B) - Mean numbers of *Chroicocephalus cirrocephalus* in environments polluted and non-polluted with sewage in Rio de Janeiro.





FIGURE 6. *Chroicocephalus cirrocephalus* fledgling chick (arrow), recorded in the northern coast of Rio de Janeiro, on 28 September 2008. (Photo: S. S.).

the Rio de Janeiro suggests that the Grey-headed Gull is expanding its geographic distribution in the State, as observed in other sites along the Brazilian coast.

The flocks recorded during the dry seasons in coastal lagoons of the Restinga de Jurubatiba National Park are much larger than those reported for other Brazilian regions and important bird sites in South America, especially those located in Peru, Ecuador and Uruguay (Blanco & Carbonell 2001, De Luca *et al.* 2006, Menegheti 2006, Alfaro & Sarroca 2009, Iannacone *et al.* 2010, Alava & Haase 2011). Indeed, when compared to other environments in which the species was recorded in this study, the coastal lagoons surveyed show far greater biological productivity (Kjerfve 1994, Knoppers 1994). During the dry season, these environments become shallower, concentrating greater abundance of food resources that can be easily captured (Macedo-Soares *et al.* 2010, Lisboa *et al.* 2011). Similarly, 13,705 Grey-headed Gulls were reported for the Río Xanáes estuary, on the coast of Argentina, an environment with high productivity (Serra 2009).

The greater abundance of *C. cirrocephalus* during the dry season (winter) in northern Rio de Janeiro coincides with the pre-reproductive period of the species and the period of higher availability of prey in coastal lagoons inside Jurubatiba National Park (Olsen & Larsson 2004, Macedo-Soares *et al.* 2010). On the other hand, lower numbers of gulls were recorded during the rainy season

(summer), the breeding season of *C. cirrocephalus*, which was confirmed by the present record of fledglings in September 2008. During this period coastal lagoons become a less suitable feeding environment due to the considerable increase in water levels. So, it is quite possible that the species moves from coastal lagoons inside the Jurubatiba National Park to northern areas to breed, during the rainy season. This is in accordance with the species' habits of dispersing along short distances before and after the reproductive period (Olsen & Larsson 2004, Mata *et al.* 2006). In addition, the non-significant difference in *C. cirrocephalus* abundance in "Região dos Lagos" between the dry and rainy seasons occurred because a resident population remains in the region throughout the year (Sick 1997).

Aggregations of the Grey-headed gull were greater in polluted than in non-polluted environments. Under certain circumstances, organic waste inputs in water bodies may trigger an increase availability of food resources for gulls (O'Connor 1974, Green *et al.* 1993). However, these food sources could change natural patterns of dispersion of individuals, which may choose to feed in polluted environments, where it could be easier to obtain nourishment, as opposed to natural sources, during periods of food shortage (Raven & Coulson 2001). Besides that, by feeding in waters contaminated with sewage, gulls become pathogen reservoirs, which

may have a negative impact in these species' populations (Alderisio & DeLuca 1999, Ferns & Mudge 2000, Moura *et al.* 2012). In the worst scenario, infected gulls can contaminate non-polluted water bodies, as well as waters used by humans and other species (Benton *et al.* 1983). In fact, other birds, including threatened species in the state of Rio de Janeiro, were sighted feeding in the same places with Grey-headed Gulls, such as *Egretta caerulea* (Linnaeus, 1758); *Egretta thula* (Molina, 1782); *Platalea ajaja* Linnaeus, 1758; *Tringa melanoleuca* (Gmelin, 1789); *Thalasseus acufavidus* (Cabot, 1847); *Charadrius semipalmatus* Bonaparte, 1825; *Rynchops niger* Linnaeus, 1758; *Ardea alba* Linnaeus, 1758; *Pluvialis squatarola* (Linnaeus, 1758); *Himantopus melanurus* Vieillot, 1817; *Larus dominicanus* Lichtenstein, 1823 and *Leucophaeus atricilla* (Linnaeus, 1758).

Finally, based on the 76 sightings of *C. cirrocephalus* recorded in this study, including flocks of up to 842 individuals in northern Rio de Janeiro, and considering the absence of records in previous works conducted in the region, we concluded that the species is expanding its range in the State. However, this expansion could be linked with degradation of natural wetlands due to sewage discharges. It should be stressed that coastal lagoons exposed to the imminent risk of disappearing due to anthropogenic pressure were the environments that the species used most intensely. So, studies focused on restoring and managing habitat conditions at regional level may provide critical information to preserve suitable sites for the Grey-headed Gull and other waterbirds.

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