

SEASONAL RICHNESS AND ABUNDANCE OF ANATIDAES IN THE FLOODED PLAIN, IN THE BRAZILIAN PAMPA

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Abstract: The study was carried out in a flooded plain in the Vacacaí River floodplain, in the municipality of Santa Margarida do Sul, located in the South Center of the state of Rio Grande do Sul. Monitoring took place in two periods, determined as the hot season, between the months of October 2020 and March 2021, and as the cold season, between the months of May and September 2021. A total of 13 species of the Anatidae family were recorded, totaling 61.9% of the species of the family recorded in the state of Rio Grande do Sul. These species belong to 3 subfamilies of 10 different genera, with the subfamily Anatinae being the richest in species and the subfamily Dendrocygninae the most abundant. The species of the genus correspond to this subfamily: *Dendrocygna*, which presented itself as the richest genus with three species, followed by the genus *Anas*, with two species. Thus, the relevant number of species recorded, the expressive abundance and the seasonal movement of the species, show that the wetlands of the Vacacaí River floodplain are an important ecoregion for the Anatidae family, as they offer resources throughout the year for the resident species, as well as presenting important resting areas for species that arrive from migration, as well as for rare and uncommon species in Rio Grande do Sul, being a fundamental area for the conservation of these birds in the Brazilian Pampa.

Keywords: Seasonality, Marrecas, Vacacaí River, Rio Grande do Sul.

INTRODUCTION

Aquatic environments are among the most productive ecosystems, constituting the habitats of numerous plant and animal species, and in these wetlands water is the main controlling factor of the landscape and associated biota (FRAZIER, 1996). These areas are of great importance due to the various environmental services they provide,

including: water storage and cleaning, groundwater recharge, climate regulation and biogeochemical cycles, carbon storage, in addition to serving as a habitat for numerous species. (JUNK et al., 2011).

Floodplains and other wetlands are important habitats for waterfowl, being used as a place for breeding, chick care, feeding, resting between migrations and shelter. Waterfowl are increasingly threatened with extinction and the successes achieved by conservation measures are being offset by the negative response to habitat loss (PASZKOWSKI, 2000). Changes in species composition and abundance of planktonic communities are reported, which greatly affect the production of organic matter in the aquatic environment and, consequently, the maintenance of resources for other trophic levels, leading to a consequent reduction in biodiversity (RODRIGUES et al., 2006). Despite the growing pressure to preserve the integrity of wetlands in the tropics, the biodiversity associated with these environments is still poorly understood (JUNK et al., 2006).

The Anatidae Family is cosmopolitan and occupies a wide variety of aquatic environments across the globe, with the exception of the Antarctic region. With 165 species, greater richness and abundance are observed in the extratropical regions of temperate climate, both southern and northern (CARBONERAS, 1992; SICK, 1997). Most species that depend on wetlands live in populations maintained through occasional or seasonal movements. In many cases with very precise routes and landing sites, mainly due to climatic seasonality, the levels of water bodies or even for trophic, reproductive reasons or even the search for safe places for drainage (CARBONERAS, 1992; SICK, 1997); ACORDI, 2003).

Thus, the study aimed to show the relative importance of the floodplains of the Vacacaí

river floodplains for the Anatidae family, providing, through the results, important data for the conversation of these birds and this type of environment in the Brazilian Pampa.

MATERIAL AND METHODS

The study was carried out in a flooded plain in the Vacacaí River floodplain, 30°12'30"S 54°06'54" with about 250 m², in the municipality of Santa Margarida do Sul, located in the South Center of the state of Rio Grande do Sul. southern. The climate of the region is subtropical temperate, classified as humid mesothermal and the altitude is around 90 m.

Monitoring took place at two times of the year, determined as the hot season: between the months of October 2020 and March 2021, and as the cold season: between the months of May and September 2021. The area where the sampling took place was selected after years of experience in the region, as it is the most used by the Anatidae family in the surroundings, for feeding, resting, building nests and raising young, in addition to being on the migratory route of some species and serving as a resting point.

There were 15 samplings in the cold period and 15 in the hot period, making a total of 30 samplings, being carried out 3 each month. Sampling took place alternately at two different points in the area, where a complete view of the floodplain could be obtained, since one point was carried out in the early hours of the morning, one hour after sunrise and another close to the end of the afternoon, one hour after sunrise. before sunset. Individuals were counted using a 60x telescope on a tripod, 10x42 binoculars and a field worksheet.

Each sampling was divided into two parts: in the first, a sweep was carried out throughout the area, using binoculars and a telescope, performing the identification of the species and the counting of the individuals that

occupied the area. After the end of this scan, a fixed point of 30 minutes was carried out to collect data on new species and individuals that arrived in the area. All individuals who used the area in some way, whether resting, foraging or flying over the site were counted.

RESULTS AND DISCUSSION

Thirteen species of the Anatidae family were recorded, totaling 61.9% of the species of the family recorded in the state of Rio Grande do Sul. These species are divided into 3 subfamilies of 10 different genera. The subfamily Anatinae being the richest in species and the subfamily Dendrocygnae the most abundant. This subfamily includes the species of the genus *Dendrocygna*, which presented itself as the richest genus, with three species, followed by the genus *Anas*, with two species. Included in the genre *Dendrocygna*, the species: *Dendrocygna viduata* with 70.5% it was the most abundant species in the study. (Table 1).

When comparing the richness and abundance of the recorded species between the two seasons, the cold season was the most representative in number of species, with all 13 species recorded in the study being present in this season (Figure 2), while in the warm season 9 species were recorded. In terms of abundance, the cold season also presented a greater number of individuals, a total of 3,007, while in the hot season a record of 1,832 individuals was obtained. These data demonstrate that the cold season concentrates 39.0% more individuals than during the hot season (Figure 3), which shows a trend of greater occurrence of anatids in the cold season, both in the number of species and in the number of individuals.

These data may be related to the low water level in the wetlands of the region at the height of the hot season, which reduced the number of species and individuals, since some species

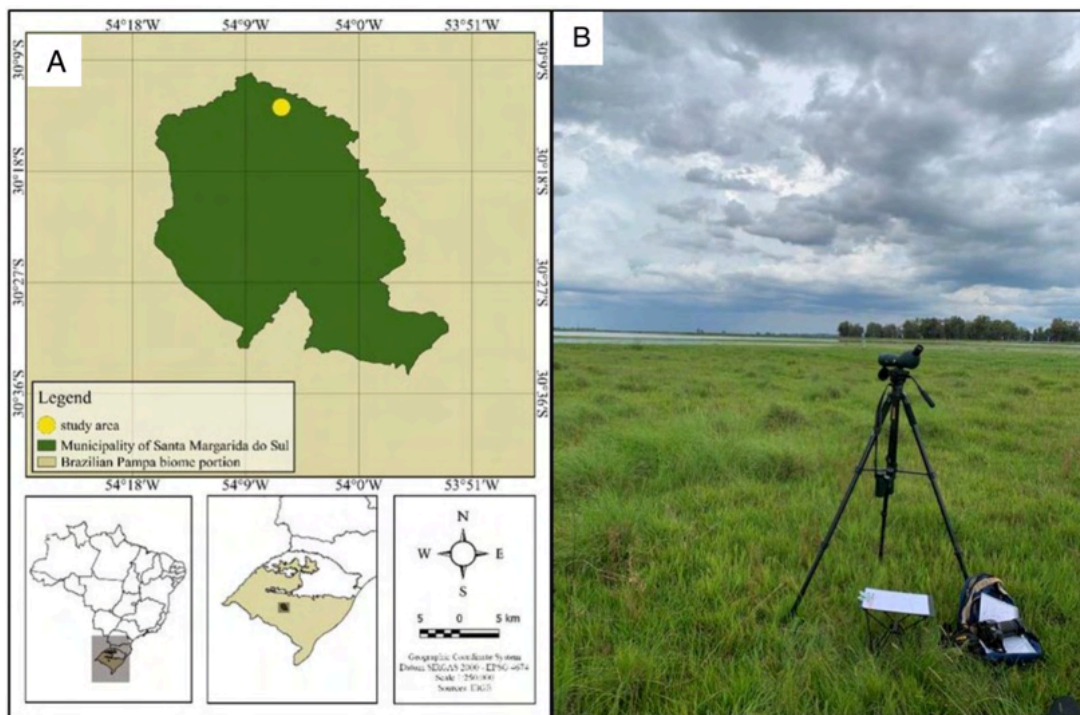


Figure 1: Study area map (A). Landscape of the flooded plain where the samplings were carried out (B).

Taxon	Abundance/Relative Frequency			Seasonality
	Cold temp. (n=3.007)	Hot temp. (n=1.832)	Accumulated (n=4.839)	
ANSERIFORMS				
Anatidae				
Dendrocygninae				
<i>Dendrocygna bicolor</i> (Vieillot, 1816)	374 (12,45)	131 (16,97)	505 (14,15)	Res
<i>Dendrocygna viduata</i> (Linnaeus, 1786)	2.082 (69,23)	1.332 (72,70)	3.414 (70,55)	Res
<i>Dendrocygna autumnalis</i> (Linnaeus, 1758)	16 (0,53)	-	16 (0,33)	Ind
Anserinae				
<i>Coscoroba coscoroba</i> (Molina, 1782)	6 (0,01)	1 (0,05)	7 (0,14)	Vis
Anatinae				
<i>Cairina moschata</i> (Linnaeus, 1758)	1 (0,01)	-	1 (0,02)	Ind
<i>Sarkidiornis sylvicola</i> (Ihering & Ihering, 1907)	1 (0,01)	4 (0,21)	5 (0,10)	Ind
<i>Callonetta leucophrys</i> (Vieillot, 1816)	27 (0,89)	57 (3,11)	84 (1,73)	Res
<i>Amazonetta brasilienses</i> (Gmelin, 1789)	99 (3,29)	55 (3,00)	152 (3,18)	Res
<i>Mareca sibilatrix</i> (Poeppig, 1819)	1 (0,01)	-	1 (0,02)	Vis
<i>Anas flavirostris</i> (Vieillot, 1816)	21 (0,69)	11 (0,60)	32 (0,66)	Res
<i>Anas georgica</i> (Gmelin, 1789)	3 (0,09)	-	3 (0,06)	Pr
<i>Spatula versicolor</i> (Vieillot, 1816)	17 (0,56)	8 (0,04)	25 (0,51)	Pr
<i>Netta peposaca</i> (Vieillot, 1816)	331 (11,90)	53 (2,89)	384 (8,49)	Vis

Table 1: Accumulated records of the Anatidae family and their respective proportions (in parentheses) between the cold and warm seasons. Seasonal presence: resident (Res), probable resident (Pr), visitor (Vis), undetermined (Ind).

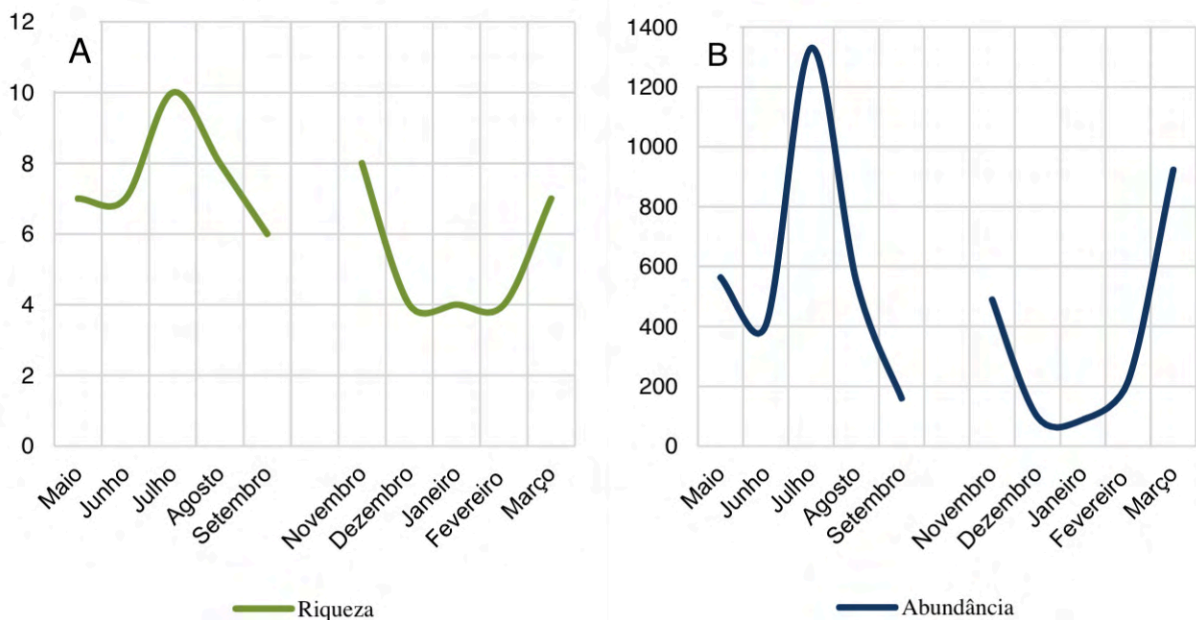


Figure 2: Line graph showing the general richness (A) and abundance (B) curves of species and individuals during the cold (left) and warm (right) seasons).

of Anatidae can perform local displacements caused by the variation in water availability, usually a few hundred kilometers away (CARBONERAS, 1992). In the months of December and January, high of the hot season, only four species were recorded: *Dendrocyna bicolor*, *Dendrocygna viduata*, *Calloneta leucopherys* and *Amazonetta brasilienses*, while at the beginning of the hot season, in November, eight species were recorded.

The species just mentioned were present in the study area throughout the year, but in the hot season they presented below normal abundance, especially: *Dendrocygna viduata*, which presented a population reduction of 94.2% in relation to March, the end of the hot season and its period with greater abundance in the study area. However, one of the reasons for this population difference may be related to reports of reproduction during the summer period, when flocks disperse into couples (BRITTO, 1950; REITZ et al., 1982; BELTON, 1994; NASCIMENTO

& ANTAS, 1995). Despite the low number of individuals of the species, 13 pairs of *Dendrocygna viduata* with nestlings, during the hot season. The same situation occurs for *Anas flavirostris* for which Antas et al. (1996) observed slight population increases along the coast at this time of year. The authors suggest, however, that success in reproduction would not be the only source of this increase, but an increase in individuals coming from the marshes of Uruguay or Argentina.

At the beginning of the cold season, a couple of *Dendrocygna autumnalis*, species that was described for the first time in Rio Grande do Sul by Guadagni et al. (1995), with seven other puppies. At the end of the same season, this couple was already observed with five juveniles. Today, the species seems to be already established in the state, with several well-distributed records, but with data on its ecology still poorly known for Pampa and Rio Grande do Sul biomes.

As mentioned above, in the cold season there was a greater number of species than in the hot season, including the presence of all species recorded in the work. This may be related to the concentration of rainfall in the region, which causes an increase in the volume of water in the ponds and, consequently, in the resources needed by anatids. This result also seems to be related to the time when some species arrive in migration to the region, such as *Coscoroba coscoroba* (CALABUIG 2010) and *Netta peposaca* (NASCIMENTO *et al.*, 2000) and also those that can use these bodies of water only as resting points during the trajectory. In addition to the species recorded in the present study, Dias and Teixeira (2021) recorded three species of anatids in this same location, at the height of the cold season, which were not recorded during this study, and which could also be using the wetland as a resting point, since two of them have migratory habits during the winter: *Heteronetta atricapila* and *Oxyura vitatta*, in addition to the registration of *Anas bahamensis* that could be expanding its distribution to the central region of the State, in search of resources.

This migratory behavior is similar to that recorded for *Mareca sibilatrix*, migrant species coming from the Southern Cone of the continent (Bencke, 2001), which during work was observed only in the cold season. This indicates that their migratory movements reach the central region of the Brazilian Pampa during the winter, when they move to lower latitudes, fleeing the harsh Patagonian winters in search of resources, staying until the time to return in migration to the southern region of the continent.

In addition to the greater number of species in the cold season, an increase in the abundance of some of them was noted at this time of year. as was the case with *Dendrocygna bicolor*, which, despite being

present throughout the year, showed an abundance increase of 600% in the high of the cold season, in relation to the high of the hot season. The species prefers large ponds and swamps, being rarely found in small lakes and ponds (BELTON, 1994), which would explain the increase in its abundance, due to the increase in water volume during the cold season. Something similar happened with *Anas flavirostris*, which despite the few records in the study, had a 190% increase in its abundance during the cold season. the species *Amazonetta brasiliensis* and *Callonetta leucophrys*, that were recorded in all months of the study, follow a similar pattern, with abundance increases of 198% and 211%, respectively, in the cold season, in relation to the warm season. In a study in Asunción Bay, Paraguay (Hayes 1996), *Amazonetta brasiliensis* showed population peaks contrary to this study, with peaks of abundance in the hot season and absence of individuals in the cold season. However, both data coincide, if we take into account the highest water levels recorded in the area, showing little dependence of this species on the temperature variables in the year, but a greater dependence on water levels. The data also show that, even behaving as a resident species, some individuals of the species can carry out regional displacements in search of resources.

Coimbra-Filho (1965) and Carborenas (1992), described something similar for the duck: *Cairina moschata*, mentioning small displacements, mainly due to the availability of water and food. In the present study, only one sporadic record was obtained at the end of the cold season, indicating that it is an uncommon species in the State of Rio Grande do Sul, as mentioned by Belton (1994), which is related to the elimination of forest habitats and with intensive hunting, and also corroborating with Silva (2006), who obtained irregular numbers

of *Cairina moschata* throughout the period of your study.

Another species of duck that was recorded during the study and obtained inconclusive data was *Sarkidiornis sylvicola*, which is considered a scarce species in the State of Rio Grande do Sul and is usually found in pairs during all seasons of the year, being apparently resident (Belton, 1994). However, in this study it was recorded on two occasions. In one, at the beginning of the hot season, four females were seen together with a group of *Dendrocygna bicolor* and *Dendrocygna viduata*. On another occasion, at the height of the cold season, a male was recorded among a mixed flock of hundreds of *Dendrocygna bicolor* and *Dendrocygna viduata*. This may indicate that, despite being a resident, *Sarkidiornis sylvicola* can carry out regional displacements following the large flocks of anatids in search of resources.

Some winter migratory species were also recorded during the study, especially those that move from Argentine provinces to Rio Grande do Sul (BELTON, 1994). Although some of them also breed in the state or are considered residents, as is the case with the species: *Spatula versicolor* and *Anas georgica*. Carbonera (1992) states that *Spatula versicolor* is a partial winter migrant in the extreme south of Brazil and that *Anas georgica* is considered partially migratory, with flocks from the extreme south of South America arriving in southern Brazil. In this study, *Spatula versicolor* was recorded in low numbers when compared to the most common species in the work, and was present in both seasons, but not at the top of the hot season. In the same way, it is considered as one of the most common Anatidae in Argentina and Uruguay. (Cuello e Gerzenstein 1962; Carboneras 1992). In Silva's statement (1987), *Anas georgica* presents an east-west movement of Rio

Grande do Sul, after the drainage at the mouth of Arroio Taim, between January and March. In this study, the species was present in the region only during the height of the cold season, probably using the resting area between its migratory movements through Rio Grande do Sul.

The species: *Coscoroba Coscoroba*, presents movements between southern Brazil and the lower Paraná River valley and Santiago del Estero, as proposed by Olrog (1968). Individuals arriving in southern Brazil can perform movements of up to 1700 km in a straight line (CALABUIG et al., 2010). In this work, individuals from *Coscoroba Coscoroba* were recorded, for the most part, during the cold season in the region. Studies suggest that these movements at this time of year are a return to the location of creation and/or moulting of feathers in southern Brazil, strengthening a migration model already presented for other waterfowl species (NASCIMENTO et al., 2000; MENEGHETTI, 2007). There was also a record of the species at the end of the hot season, which suggests that these individuals are migrating from Brazil to Argentina after having nested or molted. From what we can observe, the displacement area of the individuals of *Coscoroba coscoroba* arriving in Rio Grande do Sul, includes a large swath of northern Argentina and parts of the Provinces of Corrientes, Santa Fe, Buenos Aires and Chubut (CALABUIG et al., 2010).

This migration pattern is similar to that observed for *Netta peposaca*, which uses as an entry and exit route from Brazil to Argentina, the natural corridor of rivers, small lagoons and swamps of the Central Depression of Rio Grande do Sul, formed by the floodplains of the Ibicuí, Butuí, Santa Maria, Vacacaí and Jacuí rivers, which constitute paths to reach the coastal region of the State (CALABUIG et al., 2010). In the present study, individuals

from *Netta peposaca* began appearing in the area at the start of the cold season, with a flock of six adults and one juvenile, the only one found at work. Belton (1994) also registered nestlings in Rio Grande do Sul at the same time of year. The species had its population peak, 331 individuals, at the height of the cold season, that is, during the month of July, which shows an increase of 4,728% in its abundance compared to the hot season. This corroborates data from Calabuig et al. (2010), who cite the Vacacaí river corridor, formed by its floodplains, as one of the migratory routes of the species in Rio Grande do Sul. This population increase is also mentioned by Nascimento et al. (2000) who also found a peak of individuals of *Netta peposaca* in migration to Rio Grande do Sul, at the height of the cold season. During the warm season, the species returns in migration to Argentina to reproduce (CUELLO & GERZENSTEIN, 1962; CARBONERAS, 1992).

FINAL CONSIDERATIONS

Subtropical regions undergo seasonal changes in the composition of fauna and flora over an annual cycle. Considering such seasonalities, it is relevant to carry out studies on the structure of the avifauna throughout the seasons, since knowing the movement patterns of birds is of great interest in their conservation (ACCORDI, 2003). Due to the importance of the areas that make up the bird migration corridor between Brazil and Argentina, the wetlands and lagoons of the central depression of Rio Grande do Sul need protection considering the extreme pressure to which they are subjected by human activities (MENEGHETI, 2007).

In addition to the 13 species recorded in the present study, the area where this was carried out has the record of another 5 anatids, observed on occasions outside the sampling period. Besides: *Anas bahamensis*,

Heteronetta atricapilla and *Oxyura vittata* (Dias & Teixeira, 2021), *Nomonyx dominicus* was registered at the site in 2012 and 2015 and *Spatula platalea* in 2018, making a total of 18 species of anatids, which reinforces the importance of the Vacacaí river floodplains for the conservation of this group, which has great richness and considerable abundance in the region. Thus, the relevant number of species recorded, the expressive abundance and the observation of the seasonal movement of several species, show that the floodplains of the Vacacaí River floodplain are an important ecoregion for the Anatidae family, as they offer resources throughout the year for resident species, as well as important resting areas for species that arrive from migration, as well as for rare and uncommon species in Rio Grande do Sul, in addition to being a fundamental area for the conservation of these birds in the Brazilian Pampa.

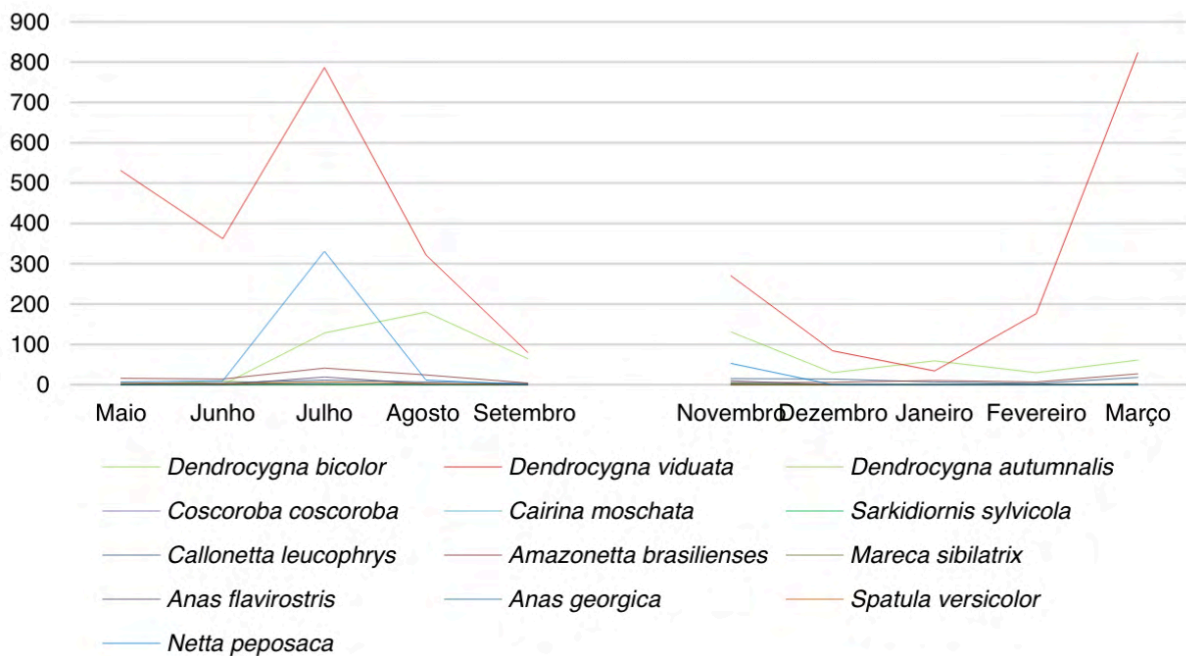


Figure 2: Line graph showing the seasonal movement of individuals of Anatidae species during the cold season (left) and warm season (right) months).

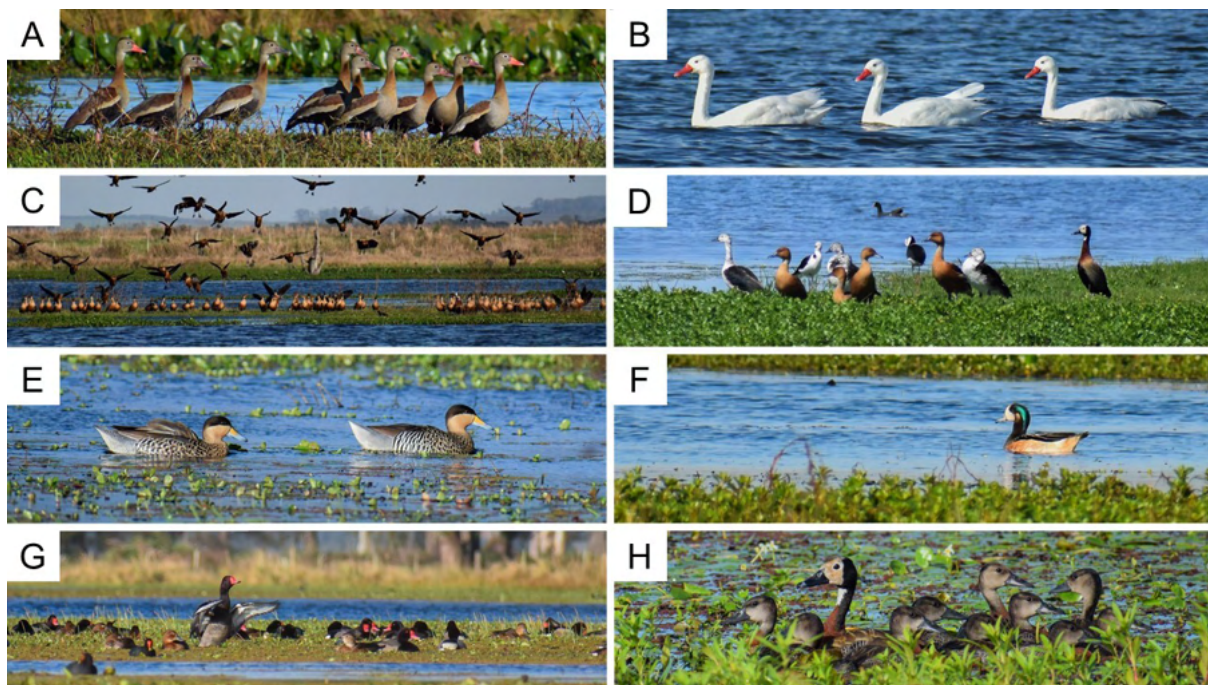


Figure 3: Some of the species of the family Anatidae recorded with a photo during the study: *Dendrocygna autumnalis* (A), *Coscoroba coscoroba* (B), *Dendrocygna bicolor* (C), *Sarkidiornis sylvicola* (D), *Spatula versicolor* (E), *Mareca sibilatrix* (F), *Netta peposaca* (G) and *Dendrocygna viduata* (H).

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