

Biological aspects of the Black-necked Swan (*Cygnus melancoryphus*) and Coscoroba Swan (*Coscoroba coscoroba*) in Rio Grande do Sul state, Brazil

João Luiz Xavier do Nascimento¹, Jussara Macedo Flores², Benedito Salvador Ataguile³, Mônica Koch⁴, Scherezino Barbosa Scherer¹ and Paulo Jorge Parreira dos Santos⁵

¹ Centro de Pesquisas para Conservação das Aves Silvestres - CEMAVE/IBAMA, Parque Nacional de Brasília, Via Epia, 70630-000, Brasília, Distrito Federal, Brazil. E-mail: cemave@ibama.gov.br

² Associação Brasileira para Conservação das Aves - PROAVES, SCLN 315, Bloco B, Sala 202, 70774-520, Brasília, Distrito Federal, Brazil. E-mail: proaves@abordo.com.br

³ Rua Alfeeiro Danardi, 2. Apto. 8, 95560-000, Torres, Rio Grande do Sul, Brazil.

⁴ IBAMA/DEVIS/DIREC - Av. L-4 Norte, SAIN, Edifício Sede, 70800-200, Brasília, Distrito Federal, Brazil.

⁵ Departamento de Zoologia, CCB, Universidade Federal de Pernambuco, 50670-420, Recife, Pernambuco, Brazil.

Abstract

Between 1991 and 1994 the Black-necked Swan (*Cygnus melancoryphus*) and the Coscoroba Swan (*Coscoroba coscoroba*) were studied with the aim of identifying their main breeding sites and periods of reproduction and moulting of remiges in Rio Grande do Sul state, Brazil, as well as of gathering more information on morphological and ethological aspects. Both species went through the moulting of remiges between March and December, especially at Lagoa da Reserva, Mostardas and Taim Ecological Station, Rio Grande. External morphological characteristics were tested and they could not be used in the differentiation of sexes for *Cygnus melancoryphus*. The discriminating analysis permitted the building of a significant function that allows differentiating the groups of individuals of different sexes based on the measurements of tarsus and total length of the head for Black-necked Swan, and culmen, nostril-tip of bill and tarsus for Coscoroba Swan.

Key words: breeding, *Coscoroba coscoroba*, *Cygnus melancoryphus*, ethology, morphology, moult.

The Black-necked Swan (*Cygnus melancoryphus*) is considered to be an "insufficiently known species of Brazilian fauna and probably in danger of extinction" (Bernardes *et al.* 1990)

and the Coscoroba Swan (*Coscoroba coscoroba*), which has the same distribution, probably faces the same conservation problems (Antas *et al.* 1996). Belton (1994) considers both species uncommon residents in Rio Grande do Sul state.

C. melancoryphus is white with black head

Received 10.08.2000

Accepted 17.10.2000

and black neck. It has red caruncle and red beak, pink feet and legs with grayish nails (Johnsgard 1978). The young have black-brownish heads and necks and gray-stained bodies. They get their adult plumage before the end of their first year (Madge and Burn, 1988).

As sexes differentiation, Palermo (1983) states that the males have caruncles with three lobes and the females with two. However, Sick (1997) mentions that the females, besides being smaller, possess only one small and flaccid caruncle and present a white stripe behind the eyes which goes to the neck.

This species occurs from Chile and Argentina (where they are abundant) up to the coast of Southern Brazil, Rio Grande do Sul state and occasionally up to the South of São Paulo state and probably in Rio de Janeiro state (Sick 1997). In Rio Grande do Sul state they occur mainly on the coastal region, with some populations in the extreme west of the state (Belton 1994, Antas *et al.* 1996, Sick 1997). They reproduce from July to March (Antas *et al.* 1996).

The plumage of *C. coscoroba* is entirely white except for the black tips of the primary remiges (flight feathers). The young can be distinguished from their parents by the greyish head and under parts; feathers with a little grey or brownish may persist mainly on the wings, till the second year (Johnsgard 1978). Both the beak and feet are red.

Coscoroba Swans occur from Patagonia and Chile to Paraguay and Brazil (Sick 1997). In Rio Grande do Sul state, they occur in swamps, lakes and open lagoons along the coastal zone (Sick 1997). They reproduce during the same period as the Black-necked Swan (Antas *et al.* 1996).

The moulting of remiges are synchronized in these species, making the birds temporarily unable to fly and, consequently, more susceptible to human predation. This phenomenon needs to be monitored, espe-

cially as a measure to prevent the birds from being poached and captured to supply the illegal bird market.

Between 1991 and 1994 the Black-necked Swan and the Coscoroba Swan were studied with the aim of identifying the main sites and periods of reproduction and moulting of remiges in Rio Grande do Sul state, Brazil. Part of these results has previously been published (Antas *et al.* 1996). We also summarized morphological and ethological aspects of both species including a literature review of the characteristics considered useful for the identification of the sexual dimorphism of *C. melancoryphus*.

Material and Methods

The lagoons and wetlands in coastal and Central Rio Grande do Sul state were surveyed on land in search of concentrations of Black-necked Swans and Coscoroba Swans. Birds were captured and measured at Taim Ecological Station and the surrounding areas, municipalities of Rio Grande and Santa Vitória do Palmar (32°20'S - 52°30'W), Mostardas (30°50'S - 50°40'W), Uruguaiana (30°20'S - 56°20'W) and Barra do Quaraí (29°00'S - 56°40'W).

For field observations we used 10 X 50 binoculars and a 15 X - 60 X 60 mm telescope.

Swans were captured by hand during the moulting period with the help of a 9.9 hp motorboat (Figure 1). Some young were manually chased and captured on land. A hand-net and a snare were sometimes used.

The birds were sexed through cloacal inspection (Figures 2 and 3).

For *C. melancoryphus* a caliper (precision of 0.01 mm) was used for the measurements of total length of head (occipital - tip of the bill), bill, nostril, tarsus (length and width) and also caruncle. The measurements of the wings and eighth remige were taken with the help of a ruler marked in millimeters during the process of moult in order to determine the



Figure 1 - Capture during the moulting period of *Cygnus melancoryphus*.

feather growth period and consequently the changes in wing length.

Avoiding observer variation, only one technician was responsible for collecting biometrical data and for determining the individuals' sexes.

For individual identification, as well as for survival and movement studies, the birds were ringed by CEMAVE-IBAMA (*Centro de Pesquisas para Conservação das Aves Silvestres - Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis*).

In order to score the stage of damage of the remiges it was used the manual of bird-banding (IBAMA 1994). The feathers were classified as worn-out when excessively used, corresponding to code 5, and new when the tips appeared perfect, code 0.

The following categories were used to assess the stage of the feather growth: absent,

present inside the shaft, grown half the length, and beyond half the length.

A standardized discriminating analysis was carried out with the Stat Graphics 5.1 computer program to assess the effectiveness of the determination of the sexes through the use of functions based on biometric data. The level of significance used for the functions was 0.05 and the normality of the variables was checked before the analysis.

Results and Discussion

During this study 261 individuals of *C. coscoroba* were banded. Through the examination of the cloaca, 26 males and 93 females were identified. One hundred and fourteen out of 397 *C. melancoryphus* were males and 96 females.

Sexual characteristics reported in the

literature (Palermo 1983, Sick 1997), like a flaccid caruncle, yellowish stripe behind the eyes extending to the occipital bone in the females, and caruncle with three lobes in the males and two in the females for *C. melancoryphus* were not confirmed by cloacal examination, as it can be seen in Tables 1 and 2.

The discriminating analysis built a significant function (Chi-square, $x^2 = 89.4$; $df = 3$; $P < 0.001$), which permits the differentiation of Black-necked Swans of different sexes based on the measurement of tarsus, total length of head (TLH) and culmen (Table 3):

$$x = (\text{tarsus} \times 0.14960) + (\text{TLH} \times 0.08578) + (\text{culmen} \times 0.06512) - 27.6965.$$

This function permits the determination of sex with maximum error of 28.4% for females and 10.5% for males, ascribing the lower rates of -0.80 to females and the higher ones of 0.67 to males.

For *C. coscoroba* (Table 3) the discriminating analysis made use of culmen, nostril (nostril-tip of bill) and tarsus, resulting in a

significant function ($x^2 = 33.4$; $df = 3$; $P < 0.001$):

$$x = (\text{culmen} \times 0.25332) + (\text{nostril} \times 0.09356) + (\text{tarsus} \times 0.02322) - 24.1160.$$

The anticipated maximum error in the determination of the sexes is 19.2% for males and 23.9% for females, ascribing the rates above 1.08 to males and below -0.30 to females.

The moulting period of both species in Rio Grande do Sul state occurs between March and December (Table 4), mainly at Lagoa da Reserva, Mostardas and at Taim Ecological Station. These are priority areas for the conservation of those species in Brazil.

During the captures it was observed that not all individuals in each population underwent moult, since some flew away. It may be due to the species' adaptive strategy, taking into consideration the vulnerability they are exposed to at this phase.

The growth of the eighth remige in *C. melancoryphus* (Table 5) takes longer than

Table 1 - Morphological variation of the caruncle in males and females of *Cygnus melancoryphus* in Rio Grande do Sul state, Brazil

	Males (n = 57)	Females (n = 34)
Smooth caruncle	17	19
Caruncle with 1 incision	16	11
Caruncle with 2 incisions	18	03
Caruncle with 3 incisions	06	01

n = number of analyzed individuals

Table 2 - Variation between males and females of *Cygnus melancoryphus* in relation to the closing up of the spot behind the eyes on the occipital bone

	Closes on the occipital bone	Does not close on the occipital bone
Males (n = 93)	39	54
Females (n = 87)	39	48

n = number of analyzed individuals

thirty days, the period estimated for the wing to be reconstituted. It is estimated that the process of complete moult takes about two months, as the coverts fall out about two weeks before the remiges fall out, which makes it impossible for the birds to fly.

At a reservoir at Barra do Quaraí and at the dam *Barragem de Sanchuri*, both in the

municipality of Uruguaiana, swans were found with partially or totally mutilated feet caused by carnivorous fish known locally as "palometas" (*Serrasalmus spilopleura*).

However, this problem does not seem to be a limiting factor for the birds' staying at these places, since mutilated species were also observed reproducing. This strengthens

Table 3 - Biometric data for *Cygnus melancoryphus* and *Coscoroba coscoroba* captured from October to December 1994 in Rio Grande do Sul state, Brazil.

m = males, f = females, n = sample size, TLH = total length of head.

Measurements	<i>Cygnus melancoryphus</i>			<i>Coscoroba coscoroba</i>		
	Sex (n) Amplitude (mm)	Medium (mm)	Standard deviation (mm)	Sex (n) Amplitude (mm)	Medium (mm)	Standard deviation (mm)
TLH	m (114) 125.0 - 154.5	136.9	4.1	m (26) 134.0 - 148.0	139.2	3.7
	f (96) 84.0 - 143.0	129.7	7.4	f (93) 124.0 - 146.3	133.3	4.6
Culmen	m (114) 40.1 - 52.8	47.7	2.2	m (26) 63.3 - 74.0	70.1	2.8
	f (96) 40.6 - 52.0	45.2	2.8	f (92) 53.0 - 73.0	66.2	2.9
Nostril	m (114) 37.9 - 53.5	48.5	2.5	m (26) 49.0 - 56.0	52.1	1.8
	f (96) 38.0 - 52.0	46.1	2.8	f (93) 45.2 - 55.0	49.8	1.2
Tarsus	m (114) 81.0 - 99.0	90.4	3.0	m (26) 98.5 - 126.0	110.2	10.0
	f (95) 70.0 - 96.5	85.6	4.6	f (93) 84.0 - 127.5	102.7	9.7
Width of tarsus	m (18) 6.5 - 8.5	7.6	0.5	m (9) 9.2 - 10.2	9.7	0.4
	f (23) 6.9 - 8.4	7.7	0.4	f (24) 8.0 - 10.2	9.1	0.6
Occipital- caruncle	m (19) 71.0 - 102.2	88.1	9.0	-	-	-
	f (22) 70.5 - 91.5	84.0	4.6	-	-	-
Length of caruncle	m (18) 27.9 - 39.0	32.1	2.7	-	-	-
	f (21) 24.0 - 35.0	29.2	2.4	-	-	-
Wing	m (7) 190.0 - 430.0	345.3	77.0	m (5) 375.0 - 390.0	381.0	5.5
	f (5) 310.0 - 391.0	345.2	29.1	f (4) 350.0 - 358.0	354.5	3.3

the swan populations faithfulness to the place of moult (Antas *et al.* 1996). Another hypothesis is that the mutilations would have had an effect on the ability of moving, causing, in a certain way, their confinement to more restricted distribution areas.

The capture of young *C. melancoryphus* and the observation of their nests between September and December confirmed the reproductive period of the species in the state, as previously published (Antas *et al.* 1996).

During the capturing and banding activities at the Taim Ecological Station in August 1992, four Coscoroba Swan nests in different stages were recorded. Two were in the building stage, with one egg in one of them.

The others, already in the incubation stage, had six and seven eggs. The nest with seven eggs was observed and only one parent was observed incubating for 529 minutes.

A nest of Black-necked Swan with six eggs was closely observed in September 1992 at Barra do Quaraí. In a total of 482 consecutive minutes of observation, only one of the parents incubated the eggs, while the other stayed around the nest, keeping away other species which approached it, such as White-winged Coots *Fulica leucoptera* and Coyopus *Myocastor coipus*.

As Sick (1997) noted for Coscoroba Swan, a species without sexual dimorphism, both parents take care of the young. In a potentially

Table 4 - Distribution by months of the year of the stages of the wear of the moults of remiges in *Cygnus melancoryphus* (X) and *Coscoroba coscoroba* (Y), captured between 1991 and 1994.

Stage of wear/moult	March	July	August	September	October	November	December
Worn	Y	X	X	XY	X	XY	X
Absent/inside the shaft	X	X	XY	XY	XY	XY	X
Growth to half the size/beyond half the size	X	XY	XY	XY	XY	X	Y
New	Y	X			XY	XY	X

Table 5 - Data of the flight feathers growth and measurements of the eighth primary in *Cygnus melancoryphus*, collected in Rio Grande do Sul state, Brazil.

Individual	Capture		Recapture		
	Date	Stage of remiges	Date	Stage of remiges	Measurement 8 th primary (mm)
1	16/11/94	Inside the shaft	15/12/94	Beyond half the size	180
2	16/11/94	Absent	15/12/94	Beyond half the size	155
3	16/11/94	Absent	15/12/94	Beyond half the size	170
4	16/11/94	Absent	15/12/94	Up to half the size	140
5	16/11/94	Absent	15/12/94	Up to half the size	125
6	16/11/94	Absent	15/12/94	Up to half the size	145



Figure 2 - Cloacal examination of a male *Cygnus melancoryphus*.



Figure 3 - Cloacal examination of a female *Cygnus melancoryphus*.

dangerous situation for the young, one of the parents approached the observer, pretending to be hurt, while the other escapes with the young in the opposite direction.

The results of the discriminating analysis show that external morphological characteristics are not completely effective to separate sexes. Then, cloacal examination is a safer method to sex both species of swans.

However, in cases where this method cannot be used due to lack of experience in the technique, the functions presented here represent an alternative, with a margin of error, to be used in sexual proportion studies.

Acknowledgements

We are grateful to IBAMA/CEMAVE for financial support; the teams of the Lagoa do Peixe National Park and Taim Ecological Station, for the support during the field work; the Associação Brasileira para Conservação das Aves – PROAVES for making the studies possible and the Fundação O Boticário de Proteção à Natureza for financial support. ♣

References

- Antas, P. T. Z., J. L. X. Nascimento, B. S. Ataguile, M. Koch and S. B. Scherer. 1996. Monitoring Anatidae populations in Rio Grande do Sul State, South Brazil. *Gibier Faune Sauvage, Game Wildl.* 13:513-530.
- Belton, W. 1994. *Aves do Rio Grande do Sul: distribuição e biologia*. Editora da Universidade do Vale do Rio dos Sinos. São Leopoldo.
- Bernardes, A. T., A. B. M. Machado and A. B. Rylands. 1990. *Fauna brasileira ameaçada de extinção*. Fundação Biodiversitas. Belo Horizonte.
- IBAMA. 1994. *Manual de anilhamento de aves silvestres*. Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis. Brasília.
- Johnsgard, P. A. 1978. *Ducks, geese, and swans of the world*. University of Nebraska Press. Nebraska.
- Madge, S. and H. Burn. 1988. *Waterfowl - an identification guide to the ducks, geese and swans of the world*. Houghton Mifflin Company. Boston.
- Palermo, M. A. 1983. *Fauna Argentina 17 - el cisne de cuello negro*. Centro Editorial de America Latina S/A. Buenos Aires.
- Sick, H. 1997. *Ornitologia Brasileira*. Editora Nova Fronteira. Rio de Janeiro.