Ornithology Research
https://doi.org/10.1007/s43388-021-00042-5

ORIGINAL ARTICLE

Breeding biology of the American Oystercatcher *Haematopus palliatus* on a key site for conservation in southern Brazil

Bruno de Andrade Linhares[1,2,3] · Juçara Bordin[1] · Guilherme Tavares Nunes[2] · Paulo Henrique Ott[1,4]

Received: 21 August 2020 / Revised: 9 March 2021 / Accepted: 12 March 2021

Abstract

The American Oystercatcher, *Haematopus palliatus*, is a widespread shorebird in both North and South America. Despite its large distribution along the Brazilian coast, there is a paucity of breeding information about the species across this vast region. Herein, we monitored the breeding biology of the species during three consecutive breeding seasons on three sandy beaches in southern Brazil. The nesting season extended from July to January with a mode clutch size of two eggs (mean ± SD = 1.9 ± 0.6, n = 63). The majority of the nests recorded were found in the sandy dunes habitat adjacent to the beachfront, with a low cover of herbaceous native vegetation, reinforcing the importance of this habitat for the conservation of the species.

Keywords Flagship species · Nesting · Reproduction · Sandy beaches · Shorebird

Introduction

The American Oystercatcher (*Haematopus palliatus* Temminck, 1820) is a widespread shorebird along the Atlantic and Pacific coasts from North to South America (Hockey 1996; Simons 2017). The species is generally resident across most of its range, and its distribution is restricted to coastal habitats, where it breeds most commonly on sandy beaches (Hockey 1996; Clay et al. 2014). Due to widespread human use of coastal zones and increased pressure on sandy beaches and associated ecosystems (Defeo et al. 2009), the American Oystercatcher has emerged as a focal species for coastal conservation efforts in North America, where most information on breeding populations came from (e.g., Clay et al. 2014; Simons 2017). However, in tropical and subtropical South America, monitoring programs of the species are incipient and information about resident breeding populations is still scarce (Clay et al. 2014; Vega-Ruiz et al. 2019).

Along the Brazilian coast, no accurate population estimates exist for the species. Nevertheless, based on ground-based nest surveys along a small stretch of the coast during the 2006–2007 breeding season (Canabarro and Fedrizzi 2010), around 2000 individuals were estimated for the entire Rio Grande do Sul state coast (hereafter RS; ~620 km long), in the southernmost region of Brazil (Clay et al. 2014). Taking into account this estimate and the supposed lower abundance of the species in other Brazilian regions, the coastline of RS was classified as a key site for the conservation of oystercatchers in South America, regarded as "globally important" (Clay et al. 2014).

However, information on the breeding biology of American Oystercatchers in Brazil is scarce, despite the importance of this data for the monitoring and assessment of populations within its vast range. Among the scant information of oystercatchers breeding in Brazil, Vooren and Chiaradia (1990) mentioned the occurrence of chicks and first-summer juveniles on Cassino beach (RS) in November and from January to March, respectively. Almost two decades

Communicated by Eduardo Santos

✉ Bruno de Andrade Linhares
brunolinhares.bio@gmail.com

[1] Laboratório de Biodiversidade e Conservação (LABeC), Universidade Estadual do Rio Grande do Sul (UERGS), Osório, Rio Grande do Sul, Brazil

[2] Centro de Estudos Costeiros, Limnológicos e Marinhos (CECLIMAR), Universidade Federal do Rio Grande do Sul (UFRGS), Imbé, Rio Grande do Sul, Brazil

[3] Present address: Laboratório de Aves Aquáticas e Tartarugas Marinhas (LAATM), Instituto de Ciências Biológicas; Programa de Pós-Graduação em Oceanografia Biológica, Instituto de Oceanografia, Universidade Federal do Rio Grande (FURG), Rio Grande, Rio Grande do Sul, Brazil

[4] Grupo de Estudos de Mamíferos Aquáticos do Rio Grande do Sul (GEMARS), Torres, Rio Grande do Sul, Brazil

Published online: 23 March 2021

later, Barbieri and Delchiaro (2009) recorded nests and chicks in October and November, respectively, in São Paulo state, southeastern Brazil. Afterwards, Canabarro and Fedrizzi (2010) reported nests and chicks between December and February, along 10 km of coastline on Hermenegildo Beach (RS), close to the Uruguayan border. The last two studies recorded nests in vegetated parts of the beach or sandy dunes and, despite the relatively low sample size, provided the first morphometric measures for eggs and chicks of the species along the Brazilian coast.

Here we report new information on American Oystercatchers' breeding biology gathered across three consecutive years in a key site region in southern Brazil, providing the most comprehensive data on the reproduction of the species along the Brazilian coast to date.

Methods

During three breeding seasons (2017–2018, 2018–2019, and 2019–2020), we monitored nesting sites in southern Brazil. The sampling area has 6.1 km of coastline and included three sandy beaches with different degrees of human occupation: (i) Parque Estadual de Itapeva (PEVA; 29°20′S; 49°43′W), a protected area with limited access to people; (ii) Praia Grande (PG; 29°22′S; 49°44.6′W), an urban beach intensely used for human recreation (Esteves et al. 2003) and located in the front (ca. 2 km) of a small rocky island (ca. 1.70 ha) classified as a marine protected area—the Wildlife Refuge of Ilha dos Lobos (Engel et al. 2014); and (iii) Balneário Miratorres (BM; 29°18.3′S; 49°42′W), a sparsely populated beach (Fig. 1a). The PEVA is the only area that vehicles are completely forbidden on the beach, although people can access the beach section on foot; in PG, although restrictions to vehicles also exist, law enforcement is weak and cars are allowed to supply the beach kiosks during summer (December to March), and, in BM, no control exists over vehicles.

These three beach sections have the typical morphology of the southern Brazil coastline, as they are wave exposed, dissipative beaches that present very fine sand and are episodically altered by high-energy storm waves that may reach and erode the foredunes (Gianuca 1983; Tomazelli 1994; Tomazelli et al. 1998). Notwithstanding, these sites were chosen to survey because they present well-established vegetated coastal dunes adjacent to the beachfront (Tomazelli 1994), which are acknowledged as a main nesting habitat for oystercatchers in southern Brazil (Canabarro and Fedrizzi 2010; Sanabria 2012). Sandy dunes in the region are mainly colonized by herbaceous plants and are mosaics of dry, scarcely vegetated "fixed" dunes (including foredune ridges) interspersed with deflation zones and/or interdunes (i.e., generally flat and low areas), which can be wet and densely vegetated (Seeliger 1992; Tomazelli 1994; Martinho 2008). The size of the surveyed dunes area varies between the three sites, with BM being the largest (in width and area), PEVA presenting the lowest width, and PG the lowest area (Table 1), although PEVA also has a large area (up to 780 m wide) of unvegetated mobile dunes (i.e., dunefield) separated from the sampled coastal dunes by a moist and vegetated deflation plain (Fig. 1a; Tomazelli et al. 2008). However, no evidence exists that oystercatchers use this innermost area for nesting.

From July to February, monthly surveys (one to four times per month) were conducted in PG across the three breeding seasons, for a total of 53 surveys. The two other beaches were surveyed more opportunistically: BM was surveyed between September and December in the 2018–2019 and 2019–2020 breeding seasons (n = 8 surveys), whereas PEVA was surveyed in October 2018 and from August to March in the 2019–2020 breeding season (n = 7 surveys). In each locality, the beachfront and the adjacent sandy dunes areas were carefully surveyed on foot by one to three observers in search of nests and chicks of oystercatchers. During the surveys, pairs of individuals observed nesting (i.e., associated with a nest or chick) or performing nesting behavior (e.g., alarm calling, false incubating, aggressive attacks) were counted to infer the number of breeding pairs and used as indicators of potential sites to search for nests (Hostetter et al. 2015; Schulte and Simons 2015). The information recorded on the breeding biology in these areas included the number of breeding pairs, size of eggs and nests, clutch size, chick occurrence, vegetation surrounding nests, and nesting habitat (i.e., dunes or beachfront). The vegetation surrounding nests was sampled using a vegetation parcel method (Mueller-Dombois and Ellenberg 1974), with a square-quadrat (1 m × 1 m) divided into a grid of 25 squares centered on the nest location, similarly to the sampling method applied by Grant et al. (2019) to characterize the substrate of nests of the species in New Jersey, USA. The plant species inside the square-quadrat were identified and the percentage of vegetation cover was measured visually (Braun-Blanquet 1979). The importance of each plant species was defined based on its frequency of occurrence among all nests. The coordinates of each nest were recorded by a hand-held GPS device. Nest spacing was assessed by measuring the straight-line distance to the nearest neighboring active nest in a given breeding season, using the "ruler" tool in Google Earth Pro. Breeding habitat measures, including the approximate area of sandy dunes surveyed in each site, were obtained manually with the Google Earth Pro. Throughout the text, measured mean values are shown with the standard deviations (± SD).

Results and discussion

In total, 63 nests were recorded in the study area (PG = 43, PEVA = 10, BM = 10) throughout the study period. The nests

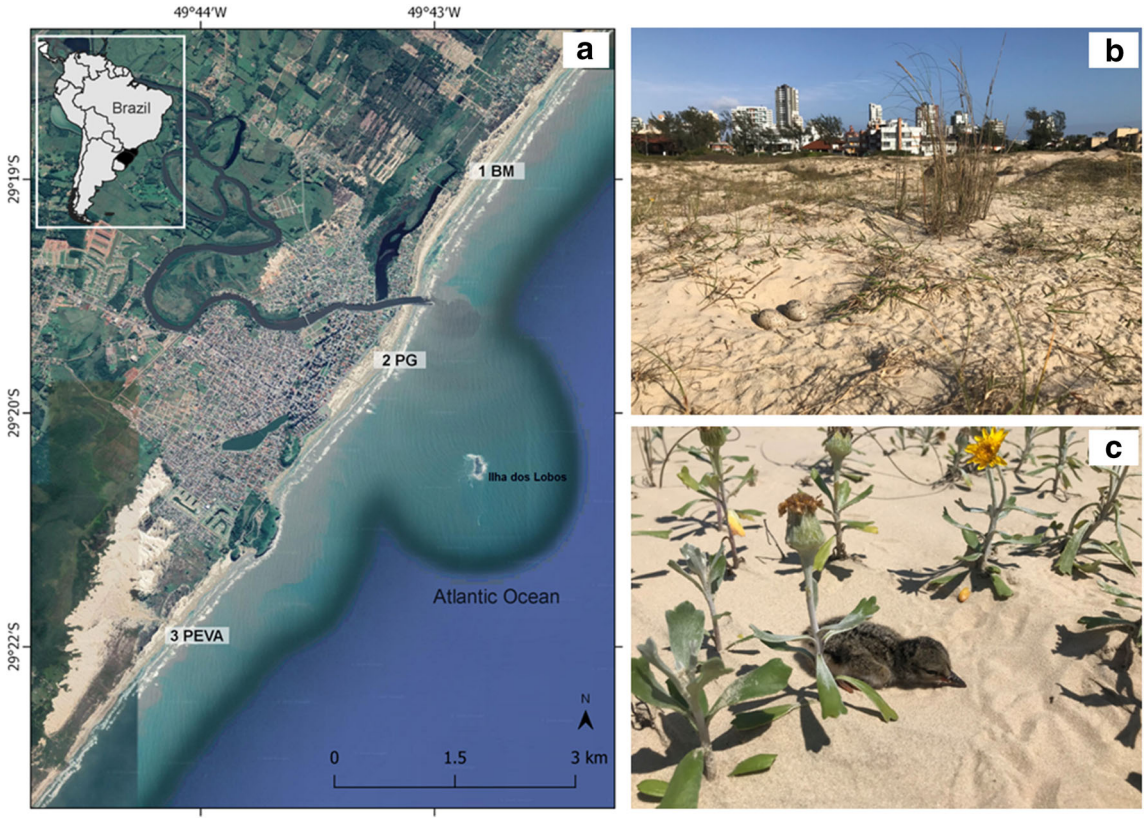

Fig. 1 **a**) Study area indicating the three sandy beaches surveyed in southern Brazil and the marine protected island Ilha dos Lobos: 1, Balneário Miratorres (BM); 2, Praia Grande (PG); and 3, Parque Estadual de Itapeva (PEVA); **b**) nest of the American Oystercatcher, *Haematopus palliatus*, surrounded by sandy dune vegetation, *Panicum racemosum*, in the urban beach of Praia Grande; **c**) American Oystercatcher chick surrounded by sand dune vegetation, *Senecio crassiflorus*, in Balneário Miratorres. Photos: Paulo H. Ott

were found seasonally between July and January. Most of the recorded nests occurred in the coastal dunes habitat, in dry areas with the presence of herbaceous, sparse native vegetation. However, four nests were recorded on the beachfront, on the exposed sand with no vegetation cover, and a few meters above the high-tide mark. American Oystercatchers typically nested in solitary pairs and the distances between the nearest neighbor nests in a given breeding season ranged from 15 to 430 m (mean = 113.4 ± 105.8 m, n = 39). Nests consisted of irregular shallow scrapes on the ground (Fig. 1b) with 21.0 ± 3.9 cm of diameter and 4.3 ± 0.8 cm of depth (n = 21). Around the nesting site, multiple scrapes could be found, probably a result of nest building by the male before a specific site was chosen by the female (Hockey 1996).

Vegetation surrounding nests (1 m^2) was recorded for 21 nests, and 22 species of plants were identified (Table 2). The percentage of vegetation cover in each quadrat ranged from 10 to 60% (mean = 26.2 ± 13.2%). The most frequent surrounding plant species were *Panicum racemosum* (P. Beauv.) Spreng., *Senecio crassiflorus* (Poir.) DC., and *Hydrocotyle*

Table 1 Habitat measures and breeding pair (BP) estimates for the American Oystercatchers, *Haematopus palliatus*, across the three sandy beaches surveyed in southern Brazil: Parque Estadual de Itapeva (PEVA), Praia Grande (PG), and Balneário Miratorres (BM)

	PEVA	PG	BM
Coordinates	29°20′S; 49°43′W	29°22′S; 49°44.6′W	29°18.3′S; 49°42′W
Dunes' width (m)	67. 9 ± 32.4 (27–148)*	122 ± 29.6 (70–154)*	138.2 ± 47.6 (77–217)*
Surveyed dunes' area (ha)	24.5	19.2	26.0
Surveyed coastline (km)	3.0	1.5	1.6
BP abundance (number of pairs)	11.0	12.0	8 .0
BP encounter rate (pairs/km)	3.7	8.0	5.0
BP density (pairs/ha)	0.4	0.6	0.3
Total performed surveys	7	53	8

*The range of values of the dunes' width is shown between parentheses

Table 2 Plant species recorded around (1 m^2) nests (n = 26) of American Oystercatchers, *Haematopus palliatus*, in coastal dune ecosystems of southern Brazil. *FO*, frequency of occurrence (%)

Species	FO%
Panicum racemosum (P. Beauv.) Spreng.	95.2
Senecio crassiflorus (Poir.) DC.	33.3
Hydrocotyle bonariensis Lam.	28.6
Noticastrum psammophilum (Klatt) Cuatrec.	28.6
Paspalum sp.	28.6
Polygala cyparissias A.St.-Hil. & Moq.	23.8
Panicum repens L.	19.0
Baccharis gnaphalioides Spreng.	19.0
Conyza sumatrensis (Retz.) E. Walker	19.0
Gamochaeta americana (Mill.) Wedd.	19.0
Oxypetalum tomentosum Wight ex Hook. & Arn.	14.3
Digitaria eriantha Steud.	9.5
Plantago australis Lam.	9.5
Pterocaulon lorentzii Malme	9.5
Achyrocline satureioides (Lam.) DC.	4.8
Ambrosia elatior L.	4.8
Andropogon arenarius Hack.	4.8
Blutaparon portulacoides (A. St.-Hil.) Mears	4.8
Cenchrus incertus M.A. Curtis	4.8
Chascolytrum subaristatum (Lam.) Desv.	4.8
Oenothera mollissima L.	4.8
Ipomoea pes-caprae (L.) R. Br.	4.8

bonariensis Lam. (Table 2). The species recorded are common in sandy dunes in southern Brazil (Dewes et al. 2021) and stand out for their high sand binding and dune fixation capacities (Waechter 1985; Seeliger 1992; Tomazelli 1994), reducing wind erosion of oystercatcher nests and providing a cryptic environment for nests and chicks (Fig. 1c).

Clutch size of two eggs was recorded in 68.3% (n = 43) of nests, whereas 22.2% (n = 14) contained one egg and 9.5% (n = 6) three eggs. This follows the pattern of oystercatchers from the southern hemisphere, with a modal clutch size of two eggs, while oystercatchers from the northern hemisphere have generally clutch size of three eggs (Hockey 1996). The length of the eggs recorded ranged from 52 to 61.4 mm (mean = 56.3 ± 2.0, n = 91) and the width from 35.9 to 40.5 mm (mean = 38.2 ± 1.0, n = 91). Egg lengths were slightly larger than recorded for breeding American Oystercatchers in São Paulo state, in southeastern Brazil (i.e., means = 51.3 to 52.8 mm; Barbieri and Delchiaro 2009) but similar to another study on RS state (mean = 54.4 mm; Canabarro and Fedrizzi 2010) and in the USA (means = 56.6 to 56.7; Nol et al. 1984).

Chicks and juveniles (i.e., post-fledge chicks) were first recorded in the study area in September and October, respectively. Based on the peak counts of each locality (see Davis et al. 2001), we estimated that 12 breeding pairs utilize PG for reproduction, whereas 11 were estimated in PEVA and eight in BM. This data generates the breeding pair abundance per coastline length (i.e., encounter rate) of 8.0 pairs/km in PG, 3.7 pairs/km in PEVA, and 5.0 pairs/km in BM (Table 1). In this sense, the highest numbers of breeding pairs observed in the urban beach of PG were quite unexpected, as the human disturbance is recognized as a major threat to coastal birds, especially breeding shorebirds (Defeo et al. 2009). Although the higher sampling effort in PG is a potential source of bias in our results, these findings may suggest that underlying factors are driving breeding pair abundance along shores, besides the effect of human disturbance, such as differences in nesting habitat quality, predator abundance, or food availability. In this way, the Wildlife Refuge of Ilha dos Lobos in front of PG holds large aggregations of the brown mussel *Perna perna* Linnaeus, 1758, which is an important food resource for the species in the locality (Linhares 2018). Notwithstanding, the encounter rates reported here are higher than previously estimated for the RS coast (1.1 pairs/km; Clay et al. 2014), and in the case of PG, the abundance is similar to the high values reported in nesting river islands (10.6 pairs/km) in the USA (McGowan et al. 2005; Clay et al. 2014). Thus, our results clearly indicate that the abundance of breeding pairs in southern Brazil can vary greatly among different sites, probably depending on habitat suitability for nesting and foraging.

Our results also highlight the species dependence on the coastal dune ecosystem to breed in the sampled region. These results reinforce previous findings that sandy dunes are the major nesting habitat of American Oystercatchers in southern Brazil (Canabarro and Fedrizzi 2010; Sanabria 2012), where the occurrence of the species seems to be largely associated with the presence of large dune fields (Sanabria 2012). However, in the region, sandy dunes are often fragmented, completely modified, or entirely removed in urban areas to give place to human infrastructure (Esteves et al. 2003), resulting in habitat degradation and loss for nesting oystercatchers (Sanabria 2012). Nonetheless, whereas the species feeds primarily in the marine intertidal zone, adjacent vegetated sandy dunes provide an adequate nesting habitat and refuge to nests and chicks. Moreover, despite the greater distance from the intertidal foraging habitat, nesting in the dunes may be advantageous to birds, to avoid both flooding from storm tides (e.g., Lauro and Burger 1989) and the high human disturbance on the beachfront.

Due to its biological attributes and ecological requirements, the American Oystercatcher has been considered a good umbrella and flagship species for the conservation of coastal species and habitats (Clay et al. 2014; Maslo et al. 2016; Simons 2017). Taking into account that the species is resident and abundant across sandy beaches in southern Brazil, relying on these shores as a globally important site, we suggest that

it should also be considered a representative candidate for a conservation symbol and umbrella species of coastal ecosystems in this region.

Acknowledgments We are thankful to all colleagues and students from Universidade Estadual do Rio Grande do Sul (UERGS), Universidade Federal do Rio Grande do Sul (UFRGS), Grupo de Estudos de Mamíferos Aquáticos do Rio Grande do Sul (GEMARS), and Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio – Refúgio de Vida Silvestre da Ilha dos Lobos) that helped in the field expeditions during the three years of the study. We would also like to thank the staff of the Parque Estadual de Itapeva and Refúgio de Vida Silvestre da Ilha dos Lobos for support during the field work; Natalia Berchieri for preparing the map of the study area; this study was performed under permits from the federal agency SISBIO and Secretaria do Meio Ambiente e Infraestrutura do Rio Grande do Sul (SEMA-RS).

Availability of data and material Not applicable.

Code availability Not applicable.

Author contributions B.A.L., P.H.O., and G.T.N. designed the study. B.A.L. and P.H.O. performed most of the fieldwork and analyzed the data. J.B. performed the analysis of plant communities around nests. B.A.L. wrote the original draft and all authors contributed to the final version of the manuscript.

Funding The study was supported by the Universidade Estadual do Rio Grande do Sul (UERGS), Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), and Fundação Grupo Boticário de Proteção à Natureza. This is a contribution of the research group "Observa Litoral" (UERGS/CNPq).

Declarations

Ethics approval The study was performed under the permits from Instituto Chico Mendes de Conservação da Biodiversidade (SISBIO 64234-1), Secretaria do Meio Ambiente e Infraestrutura do Rio Grande do Sul (SEMA-RS; DUC 685), and approval of the Animal Ethics Committee of the Universidade Federal do Rio Grande do Sul.

Consent to participate All the authors consent to participate in this study.

Consent for publication All the authors consent to publish this study.

Conflict of interest The authors declare no conflict of interest.

References

Barbieri E, Delchiaro RTC (2009) Reprodução da ave Piru-piru (*Haematopus palliatus*, Temminck 1820, Haematopodidae) no litoral sul do Estado de São Paulo, Brasil. Biota Neotrop 9:285–288. https://doi.org/10.1590/S1676-06032009000400033

Braun-Blanquet J (1979) Fitosociologia: bases para el estúdio de las comunidades vegetales, 3rd edn. Blume, Madrid

Canabarro PL, Fedrizzi CE (2010) Aspectos da reprodução do Piru-piru *Haematopus palliatus* (Charadriiformes: Haematopodidae) na Praia do Hermenegildo, Rio Grande do Sul, Brasil. Rev Bras Ornitol 18: 249–255

Clay RP, Lesterhuis AJ, Schulte S, Brown S, Reynolds D, Simons TR (2014) A global assessment of the conservation status of the American Oystercatcher *Haematopus palliatus*. Int Wader Stud 20:62–82

Davis MB, Simons TR, Groom MJ, Weaver JL, Jeff R (2001) The breeding status of the American Oystercatcher on the East Coast of North America and breeding success in North Carolina. Waterbirds 24: 195–202. https://doi.org/10.2307/1522030

Defeo O, McLachlan A, Schoeman DS, Schlacher TA, Dugan J, Jones A, Lastra M, Scapini F (2009) Threats to sandy beach ecosystems: a review. Estuar Coast Shelf Sci 81:1–12. https://doi.org/10.1016/j.ecss.2008.09.022

Dewes TS, Pelisser A, Gonzatti F, Bordin J (2021) Riqueza e fitossociologia de plantas vasculares em dunas costeiras de Torres, Rio Grande do Sul, Brasil. Iheringia, Ser Bot 76:e2021001. https://doi.org/10.21826/2446-82312021v76e2021001

Engel MT, Marchini S, Pont AC, Machado R, Oliveira LR (2014) Perceptions and attitudes of stakeholders towards the wildlife refuge of Ilha dos Lobos, a marine protected area in Brazil. Mar Policy 45: 45–51. https://doi.org/10.1016/j.marpol.2013.11.012

Esteves LS, Silva ARP, Arejano TB, Pivel MAG, Vranjac MP (2003) Coastal development and human impacts along the Rio Grande do Sul beaches, Brazil. J Coast Res 35:548–556

Gianuca NM (1983) A preliminary account of the ecology of sandy beaches in southern Brazil. In: McLachlan A, Erasmus T (eds) Sandy beaches as ecosystems. Developments in Hydrobiology, 1st edn. Springer, Dordrecht, pp 413–419. https://doi.org/10.1007/978-94-017-2938-3_29

Grant DM, Cohen JB, Stantial ML, Linhart RC (2019) Substrate-level nest site selection of sympatric Piping Plovers (*Charadrius melodus*) and American Oystercatchers (*Haematopus palliatus*) in New Jersey, USA. Waterbirds 42:272–281. https://doi.org/10.1675/063.042.0303

Hockey PA (1996) Family Haemotopodidae (Oystercatchers). In: del Hoyo J, Elliott A, Sargatal J (eds) Handbook of the birds of the world, vol. 4 (sandgrouse to cuckoos). Lynx Editions, Barcelona, pp 308–325

Hostetter NJ, Gardner B, Schweitzer SH, Boettcher R, Wilke AL, Addison L, Swilling WR, Pollock KH, Simons TR (2015) Repeated count surveys help standardize multi-agency estimates of American Oystercatcher (*Haematopus palliatus*) abundance. Condor 117:354–363. https://doi.org/10.1650/CONDOR-14-185.1

Lauro B, Burger J (1989) Nest-site selection of American Oystercatchers (*Haematopus palliatus*) in salt marshes. Auk 106:185–192. https://doi.org/10.1093/auk/106.2.185

Linhares BA (2018) Biologia reprodutiva, dieta e ocorrência sazonal do Piru-piru, *Haematopus palliatus* Temminck, 1820, nas dunas da Praia Grande, Torres, Rio Grande do Sul. BSc thesis, Universidade Federal do Rio Grande do Sul

Martinho CT (2008) Morfodinâmica e evolução de campos de dunas transgressivos quaternários do litoral do Rio Grande do Sul. PhD Thesis, Universidade Federal do Rio Grande do Sul

Maslo B, Leu K, Faillace C, Weston MA, Pover T, Schlacher TA (2016) Selecting umbrella species for conservation: a test of habitat models and niche overlap for beach-nesting birds. Biol Conserv 203:233–242. https://doi.org/10.1016/j.biocon.2016.09.012

McGowan CP, Simons TR, Golder W, Cordes J (2005) A comparison of American Oystercatcher reproductive success on barrier beach and river island habitats in coastal North Carolina. Waterbirds 28:150–155. https://doi.org/10.1675/1524-4695(2005)028[0150:ACOAOR]2.0.CO;2

Mueller-Dombois D, Ellenberg H (1974) Aims and methods of vegetation ecology. Wiley, New York

Nol E, Baker AJ, Cadman MD (1984) Clutch initiation dates, clutch size, and egg size of the American Oystercatcher in Virginia. Auk 101: 855–867. https://doi.org/10.2307/4086913

Sanabria JAF (2012) Abundância, distribuição espacial, uso de hábitat e conservação do Piru-piru *Haematopus palliatus* (Aves: Haematopodidae) no litoral norte e médio do Rio Grande do Sul, Brasil. MSc dissertation, Universidade Federal do Rio Grande do Sul

Schulte SA, Simons TR (2015) Factors affecting the reproductive success of American Oystercatchers *Haematopus palliatus* on the outer banks of North Carolina. Mar Ornithol 43:37–47. https://www.marineornithology.org/content/get.cgi?rn=1099

Seeliger U (1992) Coastal foredunes of southern Brazil: physiography, habitats, and vegetation. In: Seeliger U (ed) Coastal plant communities of Latin America. Academic Press, San Diego, pp 367–381

Simons TR (2017) The American Oystercatcher (*Haematopus palliatus*) Working Group: 15 years of collaborative focal species research and management. Waterbirds 40:1–9. https://doi.org/10.1675/063.040.sp102

Tomazelli LJ (1994) Morfologia, organização e evolução do campo eólico costeiro do Litoral Norte do Rio Grande do Sul, Brasil. Pesq Geoci 21:64–71. https://doi.org/10.22456/1807-9806.21252

Tomazelli LJ, Dillenburg SR, Barboza EG, Rosa ML (2008) Geomorfologia e potencial de preservação dos campos de dunas transgressivos de Cidreira e Itapeva, litoral norte do Rio Grande do Sul, Brasil. Pesq Geoci 35:47–55. https://doi.org/10.22456/1807-9806.17936

Tomazelli LJ, Villwock JA, Dillenburg SR, Bachi FA, Dehnhardt BA (1998) Significance of present-day coastal erosion and marine transgression, Rio Grande do Sul, southern Brazil. An Acad Bras Cienc 70:221–230

Vega-Ruiz II, Castillo-Guerrero JA, Palacios E, Fernandez G (2019) Breeding population size and trends of American Oystercatchers on small islands of Bahía Santa María-La Reforma, Sinaloa, Mexico. J Field Ornithol 90:325–334. https://doi.org/10.1111/jofo.12315

Vooren CM, Chiaradia A (1990) Seasonal abundance and behaviour of coastal birds on Cassino Beach - Brazil. Ornitol Neotrop 1:9–24

Waechter JL (1985) Aspectos ecológicos da vegetação da restinga no Rio Grande do Sul, Brasil. Comun Mus Cienc PUCRS, Ser Bot 33:49–68