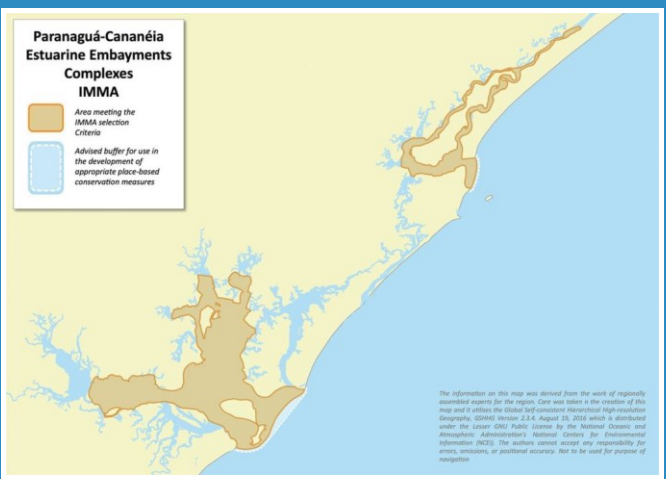

Area Size

533 km²

Qualifying Species and Criteria

Guiana Dolphin – *Sotalia guianensis*

Criterion A; B (1,2); D (1)

Other Marine Mammal Species Documented

Pontoporia blainvillei, Tursiops truncatus

Summary

The Paranaguá and Cananéia Estuarine Embayment Complex IMMA includes coastal bays with estuarine characteristics and rich ecosystem environments including sand beaches, rocky shores, mangroves, islands, and rivers. These areas share similar characteristics that are suitable for the residency and survival of the "Vulnerable" (Brazilian list of Endangered Species) and "Near Threatened" (globally) Guiana dolphins (*Sotalia guianensis*) (Secchi et al., 2018; MMA/ICMBio, 2022). This IMMA comprises four marine conservation units, one of which is inscribed on the UNESCO World Heritage List for its culture and biodiversity. Harbour activities, heavy boat traffic, chemical and noise pollution, overfishing, and bycatch are the main threats for marine mammals in this area.

Paranaguá-Cananéia Estuarine Embayments Complexes IMMA

Description:

The Paranaguá-Cananéia Estuarine Embayment Complex IMMA includes two coastal bays (Cananéia Estuarine Complex and Paranaguá Estuarine Complex) that are not connected but that share similar estuarine characteristics and rich ecosystem environments including sand beaches, rocky shores, mangroves, islands, and rivers all of which make the embayment a suitable habitat for resident Guiana dolphins. Although not connected, Guiana dolphin individuals have been reported moving from Cananéia to Paranaguá (Santos et al., 2019).

Cananéia Estuarine Complex (CEC)

The Cananéia Estuarine Complex (CEC; 25°03' S, 47°55' W) is a large mangrove-dominated estuary located along the southeast coast of Brazil (Schaeffer-Novelli et al., 1990). The availability of shelf sands and a moderate wave energy regime has led to the formation of an elongated (74 km) barrier island (Comprida Island) that encloses narrow water bodies in this estuary. Maximum water depth reaches 23 m, but the average is approximately 7 m (Santos & Rosso, 2007). Salinity varies from 35–40 ppm at the main estuary entrance to 0 ppm in the middle and northern part of the estuary, in a place named "Tombo das Águas." In that region, a deviation of a river called "Valo Grande" at the northern edge of the estuary was made in the 1850s; therefore, the surrounding area came to more closely resemble a riverine habitat rather than estuarine due to the increase of freshwater input and silting (Schaeffer-Novelli et al., 1990; Mahiques et al., 2014). The Cananéia Estuary is part of a Federal Environmental

Protected Area established in October 1984. In October 2008, a Marine Protected Area was also established along the coast of São Paulo state (Protection Environmental Area (APA-Sul), and the Cananéia estuarine connections to the sea were included for conservation purposes.

Paranaguá Estuarine Complex (PEC)

Paranaguá Estuarine Complex (PEC) located in the north-central portion of the Paraná coast has a surface area of approximately 600 km², consisting of two main axes: the N-S, which includes Laranjeiras Bay, Pinheiros Bay and Guaraqueçaba Bay and connects with Pinheiros Bay and Superagui Channel and the E-W axis, including the bay of Antonina and Paranaguá (Lana et al., 2001). The E-W axis, corresponding to the bays of Antonina and Paranaguá receiving 70% of the drainage of the Atlantic Hydrographic Basin (Knoppers et al., 1987; Mantovanelli, 1999). In this axis, there is saline stratification, with euhaline sectors (downstream of the Antonina Bay), polyhaline and intense mixing of waters from the adjacent platform and drainage basins, and mesohaline sectors (Lana et al., 2001). The average depth of these areas is less than 10 m, with a maximum of 20 m in the channels, however islands and submerged rocky outcrops are frequent in the area between "Ilha das Cobras" and "Ilha dos Gererês" (Ângulo et al., 2006). In this zone between the islands, there is a zone of maximum turbidity (ZMT), in which there is an increase in primary productivity due to the trapping of fine sediments from the drainage basins located in the "Serra do Mar", in addition to having a heterogeneous bottom with areas shallow and deep and submerged rocks, which influence hydrodynamics driven by tidal currents (Cattani & Lamour, 2015). The natural channels located in the central portion of these bays undergo frequent dredging works (Lamour & Soares, 2008). On the N-S axis is one of the most conserved areas of Atlantic Forest in Brazil which has high biodiversity, supporting Federal and State Conservation Units, such as the Guaraqueçaba Ecological Station and the Superagui National Park (UNESCO 1999, IAP 2011, IBAMA, Lamour et al. 2004, Góes & Lorenzo 2012ab).

The PEC is composed of several habitats that harbour a wide diversity of marine species, including at least 213 species of fish, an important shelter, feeding and reproduction area for different species of terrestrial and marine fauna (Lana et al., 2001; Passos et al., 2012).

Criterion A: Species or Population Vulnerability

Guiana dolphin (*Sotalia guianensis*) is classified "near threatened" by IUCN (Secchi et al., 2018) and "vulnerable" on the Brazilian Endangered Species National List (MMA/ICMBio, 2022).

Figure 1: Guiana dolphin (*Sotalia guianensis*) sighted in Cananéia. Photo credit: Marcos Santos

Figure 2: Guiana dolphins (*Sotalia guianensis*) sighted in Paranaguá. Photo credit: Laboratório de Ecologia e Conservação (LEC_UFPR)

Criterion B: Distribution and Abundance Sub-criterion B1: Small and Resident Populations

Cananéia Estuarine Complex (CEC) has been one of the most studied areas for Guiana dolphins along its distribution. Santos et al. (2001), after analyzing 4 years of data, found that the individuals of this population show high fidelity to the site, in what appears to be a closed or at least semi-closed population. This is a small resident population that was estimated by mark-recapture photo-identification at 414 (95% CI 392 – 438) individuals in the summer of 2016 (Mello et al., 2019). CEC area corresponds to a breeding area of Guiana dolphin where, in addition to observing calves, it was also possible to estimate the birth intervals for some females (Mello et al., 2019). In the CEC, several individuals of the local population of Guiana dolphin have been observed foraging and feeding (Santos, 2010; Tannure et al., 2020). The main prey items found in stomachs of stranded animals were the banded croaker (*Paralonchurus brasiliensis*) and the cephalopod (*Doryteuthis plei*). The prey most found in the stomach of individuals stranded or captured in the estuary was *Stellifer rastrifer* (Lopes et al., 2012).

Sub-criterion B2: Aggregations

In the Paranaguá Estuarine Complex (PEC), abundance of the Guiana dolphin was studied between 2012 and 2013. Boat line transects and distance sampling methods were used by Miranda (2017), resulting in an estimated population of 1,811 individuals (95% CI = 1,371-2,393) and density estimates by sector ranged from 2.42 to 9.33 individuals/km^2. On the coast of Paraná, the bays of the Estuarine PEC gather throughout the year groups

of Guiana dolphins composed of adults and calves (Filla & Monteiro-Filho, 2009; Moura et al., 2021). Feeding behaviours have been reported for the PEC area, where the main prey of the Guiana dolphin corresponds to *Chloroscombrus chrysurus, Pellona harroweri, Sardinella brasiliensis* and *Cetengraulis edentulus* (Barros et al., 1997; Zanellatto, 2001; Domit 2010; Daura-Jorge et al., 2011; Araújo, 2012; Moura et al., 2021).

Criterion D: Special Attributes
Sub-Criterion D1: Distinctiveness

In CEC Guiana dolphins display a different hunting strategy in comparison to other Guiana dolphin populations, the 'beach hunting'. This strategy is based on the use of the sloping beach for feeding purposes, showing at least two different strategies to catch their prey (Santos, 2010). Consequently, it is likely that these unique foraging behaviours displayed by Guiana dolphins represent further proof of cultural transmission in cetacean societies.

Figure 3: Guiana dolphins (*Sotalia guianensis*) sighted near the beach in Paranaguá. Photo credit: Stephane Moura

Supporting Information

Ângulo, R.J., Lessa, G.C. and Souza, M.C. 2006. 'A critical review of mid-to late-Holocene sea-level fluctuations on the eastern Brazilian coastline'. Quaternary Science Reviews 25: 486-506.

Araújo, A.C.P.S. 2012. Dieta do boto-cinza (*Sotalia guianensis* Van Benédén, 1864) (Cetacea: Delphinidae) na Baía de Sepetiba (RJ). 2012. Dissertação (Mestrado em Oceanografia) – Universidade do Estado do Rio de Janeiro, Rio de Janeiro.

Barros, N.B., Barbosa, L.A. and Gasparini, J.L. 1997. Distribuição e biologia de mamíferos marinhos no litoral do Espírito Santo, Brasil. In: IX ENCONTRO DE ZOOLOGIA DO NORDESTE, 1997, Fortaleza. Anais... Fortaleza.

Cattani, P.E. and Marcelo R.L. 2016. "Considerations regarding sedimentation rates along the EW axis of the Paranaguá Estuarine Complex, Brazil: a bathymetric approach." Journal of Coastal Research 32.3: 619-628.

Daura-Jorge, F.G., Wedekin, L.L. and Simões-Lopes, P.C. 2011. Feeding habits of the Guiana dolphin, *Sotalia guianensis* (Cetacea: Delphinidae), in Norte Bay, southern Brazil. Scientia Marina(Barcelona), 75(1), 163-169.

Domit, C. 2010. Ecologia comportamental do boto-cinza, *Sotalia guianensis* (van Bénéden, 1864), no estado do Paraná, Brasil. PhD thesis, Universidade Federal do Paraná.

Domit, C., Caballero, S., Miranda, A.V., Fruet, P., Torres-Florez, J.P., Cunha, H.A., Farro, A.P., Azevedo, A.F., Bisi, T., Briseno, Y., Cremer, M.J., Tardin, R., Barreto, A.S., Bertozzi, C.P., Laislson-Brito, J., Barrios-Garrido, H., Belleghen, T.V., May-Collado, L.J., Tullio, J., Bracarense, A.P., Cantor, M., and Andriolo, A. 2021. Report of the *Sotalia guianensis* Pre-Assessment Workshop: Main Results and Status of Current Knowledge. THE JOURNAL OF CETACEAN RESEARCH AND MANAGEMENT, v. 22, p. 333-378, 2021.

Filla, G.F. and Monteiro-Filho, E.L.A. 2009. 'Monitoring tourism schooners observing estuarine dolphins (*Sotalia guianensis*) in the Estuarine Complex of Cananéia, south-east Brazil'. Aquatic Conservation: Marine and Freshwater Ecosystems 19: 772-778.

Góes, C.G. and Lorenzo, M.P. 2012a. Estação Ecológica de Guaraqueçaba. In: Unidades de Conservação do Paraná. Disponível em: . Acesso em: (29/10/2022).

Góes, C.G. and Lorenzo, M.P. 2012b. Parque Nacional Superagui. In: Unidades de Conservação do Paraná. Disponível em: . Acesso em: (29/10/2022).

IAP. Unidades de Conservação Abertas à Visitação. 2011. Disponível em: http://www.uc.pr.gov.br/arquivos/File/...Ucs/Abertas_a_visitacao_17_02_11.pdf. Acesso em: (29/10/2022).

IBAMA. Parque Nacional do Superagui. Disponível em: http://www.guaraquecaba.com/superagui.asp. Acesso em: (29/10/2022).

Knoppers, B.A., Brandini, F.P. and Thamn, C.A. 1987. 'Ecological studies in the bay of Paranaguá. II. Some physical and chemical characteristics'. Nerítica, Curitiba (2): 1-36.

Lana, P.C., Marone, E., Lopes, R.M., and Machado, E.C. 2001. 'The subtropical estuarine complex of Paranaguá Bay, Brazil'. 2000. In: Seeliger, U.; Lacerda, L.D.; Kjerfve, B. (Ed.), Coastal Marine Ecosystems of Latin America. Basel: Springer Verlag p 131-145.

Lamour, M.R., Soares, C.R. and Carrilho, J.C. 2004. 'Mapas dos parâmetros texturais dos sedimentoss de fundo do Complexo Estuarino de Paranaguá – Pr'. Bolet. Paraná. De Geociências 55:77-82.

Lamour, M.R. and Soares, C.R.A. 2008. "Barra de Paranaguá" e a Evolução Batimétrica do delta de maré vazante na desembocadura do Complexo Estuarino de Paranaguá (PR). In E. B. Boldrini, C. R. Soares, & E. V. D. Paula (Eds.), Dragagens portuárias no Brasil: Engenharia, Tecnologia e Meio Ambiente p 69-87. Antonina: ADEMADAN/UNIBEM/Secretaria de Ciência e tecnologia para Inclusão social.

Lopes, X.M., da Silva, E., Bassoi, M., dos Santos, R.A. and Santos, M.C.O. 2012. 'Feeding habits of Guiana dolphins, *Sotalia guianensis*, from the Brazilian south-eastern: new items and knowledge review'. Journal of of the Marine Biological Association of the United Kingdom (Print), 8: 1723-1733.

Mahiques, M.M., Figueira, R.C., Alves, D.P., Italiani, D.M., Martins, C.C., and Dias, J. 2014. 'Coastline changes and sedimentation related with the opening of an artificial channel: the Valo Grande Delta, SE Brazil'. Anais da Academia Brasileira de Ciências, 86, 1597-1607.

Mantovanelli, A. 1999. Caracterização da dinâmica hídrica e do material particulado em suspensão na Baía de Paranaguá e em sua bacia de drenagem. Curitiba, 152 f. Dissertação (Mestrado em Geologia Ambiental) – Setor de Ciências da Terra, Universidade Federal do Paraná.

Mello, A.B., Molina, J., Kajin, M., and Santos, M.C.O. 2019. 'Abundance Estimates of Guiana Dolphins (*Sotalia guianensis*; Van Bénéden, 1864) Inhabiting an Estuarine System in Southeastern Brazil'. Aquatic Mammals, 45(1).

Miranda, A.V. 2017. Estimativa de densidade e tamanho populacional de botos-cinza, *Sotalia guianensis* (Van Beneden, 1864) no complexo estuarino de Paranaguá, Paraná. Dissertação (Mestrado em Sistemas Costeiros e Oceânicos), Universidade Federal do Paraná, Pontal do Sul, PR. Master thesis.

Moura, S.P., Cantor, M., Broadhurst, M.K., and Domit, C. 2021. 'Environmental and behavioral factors influencing individual variation in spatial use by Guiana dolphins (*Sotalia guianensis*)'. Journal of Mammalogy, 102(4), 1009-1019.

MMA/ICMBio. 2022. Lista Nacional de Espécies Ameaçadas. Ministério do Meio Ambiente. Accessed in: 12-06-2022.

Passos, A.C.D., Contente, R.F., Araujo, C.C.V.D., Daros, F.A.L.D.M., Spach, H.L., Abilhôa, V., and Fávaro, L.F. 2012. 'Fishes of Paranaguá Estuarine Complex, South West Atlantic'. Biota Neotropica 12(3): 226-238.

Santos, M.C.O., Acuña, L.B. and Rosso, S. 2001. 'Insights on site fidelity and calving intervals of the marine tucuxi dolphin (*Sotalia fluviatilis*) in south-eastern Brazil'. Journal of the marine Biological Association of the United Kingdom, 81(6), 1049-1052.

Santos, M.C.O. and Rosso. S. 2007. 'Ecological aspects of marine tucuxi dolphins (*Sotalia guianensis*) based on group size and composition in the Cananéia estuary, southeastern Brazil'. Latin American Journal of Aquatic Mammals, 71-82.

Santos, M.C.O., Oshima, J.E.F. and Silva, E. 2009. 'Sightings of franciscana dolphins (*Pontoporia blainvillei*): the discovery of a population in the Paranaguá Estuarine Complex, Southern Brasil'. Brazilian Journal.

Santos, M.C.O., Oshima, J.E.D.F., Pacífico, E.D.S. and Silva, E.D. 2010. 'Guiana dolphins, *Sotalia guianensis* (Cetacea: Delphinidae), in the Paranaguá Estuarine Complex: insights on the use of area based on the photo-identification technique'. Zoologia (Curitiba), 27, 324-330.

Santos, M.C.O., Laílson-Brito, J., Flach, L., Oshima, J.E., Figueiredo, G.C., Carvalho, R.R., and Azevedo, A.F. 2019. Cetacean movements in coastal waters of the southwestern Atlantic ocean. Biota Neotropica, 19.

Schaeffer-Novelli, Y., Mesquita, H.D.S.L., and Cintrón-Molero, G. 1990. The Cananéia lagoon estuarine system, São Paulo, Brazil. Estuaries, 13(2), 193-203.

Secchi, E., Santos, M.C.O. and Reeves, R. 2018. 'S*otalia guianensis* (errata version published in 2019)'. The IUCN Red List of Threatened Species 2018: e.T181359A144232542. https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T181359A144232542.en.

Tannure, N.C., Barbosa, F.S., Barcellos, D.D., Mattiuzzo, B., Martinelli, A., Campos, L.B., and Santos, M.C.O. 2020. 'Acoustic Description of Beach-Hunting Guiana Dolphins (*Sotalia guianensis*) in the Cananéia Estuary, Southeastern Brazil'. Aquatic Mammals, 46(1), 11-20.

Zanelatto, R.C. 2001. Dieta do boto-cinza, *Sotalia fluviatilis* (Cetacea, Delphinidae), no complexo estuarino da baía de Paranaguá e sua relação com a ictiofauna estuarina. 2001. Dissertação (Mestrado em Engenharia Florestal) – Universidade Federal do Paraná, Curitiba.

Acknowledgements

We would like to thank the participants of the 2023 hybrid IMMA Regional Expert Workshop for the identification of IMMAs in the South West Atlantic Ocean. Funding for the identification of this IMMA was provided by the Global Ocean Biodiversity Initiative funded by the German government's International Climate Initiative (IKI). Additional funds were provided by OceanCare and the Animal Welfare Institute. Local support and hosting for the workshop was provided by the Instituto Baleia Jubarte. Support to the IMMA programme is provided by Whale and Dolphin Conservation, and the Tethys Research Institute.

Suggested Citation: IUCN-MMPATF (2023) Paranaguá-Cananéia Estuarine Embayments Complexes IMMA Factsheet. IUCN Joint SSC/WCPA Marine Mammal Protected Areas Task Force, 2023.

PDF made available for download at ***https://www.marinemammalhabitat.org/portfolio-item/paranagua-cananeia-estuarine-embayments-complexes-imma/***