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INTERNATIONAL
WHALING COMMISSION

Progress report on the research and conservation of Lahille's bottlenose dolphins - 2022

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1. INTRODUCTION

This paper report progresses toward the research and conservation actions taken on Lahille's bottlenose dolphins in the year 2022. The progress report is a fundamental part of the Lahille's Bottlenose Dolphin Task Team (LBD Task Team - SC/68B/SM/10), formally approved by the Task Team Steering Group in March 2021, collaborating to unify specific information from different sites and contributing for unrevealing a broad picture on this endangered dolphin. In addition, it provides an opportunity to tackle previous recommendations made (and reiterated) by the Scientific Committee (IWC, 2019c, p.49; 2020c, p.88), suggesting:

(a) an assessment of the conservation status of the Argentina population; (b) that governments take immediate action to reduce the level of bycatch, particularly in the southern Brazil MUs; (c) a continued monitoring throughout the species range to increase knowledge of its life-history parameters, assess trends in populations abundance and document the prevalence and aetiology of chronic skin diseases; and (d) that a health assessment programme for the Lahille's bottlenose dolphin be implemented, including use of the Committees contaminants mapping tools. Based on the LBD Task Team recommendations and working plan for small cetaceans established by the Scientific Committee Report of 2021 (table 18), the Scientific Committee encouraged: (i) coordinate regional efforts among Argentina, Uruguay and Brazil to estimate and monitor populations parameters; (ii) efforts to seek ways to cooperate with fishing communities and government authorities to reduce bycatch; and (iii) efforts to explore potential synergies with the Franciscana CMP.

The present report aims at updating the Scientific Committee on the progress related to these recommendations, briefly informing about the work in progress and/or planned.

2. LBD TASK TEAM ACTIVITIES IN 2022

The LBD Task Team maintained sporadic contact and there was no formal meeting of the group in 2022. Regular research activities in each area covered by the Task Team, logistical and potential adjustments in data collection and analysis were informed and discussed via WhatsApp group. Photo-id data collection in Southern Brazil and Uruguay was regular and synchronised in different areas, as planned initially by Gephyreus Project[1] (see details below). Population parameters were estimated for all southern-Brazil and Uruguay local populations and viability analysis were conducted under a metapopulation context. Fisheries were mapped around Patos Lagoon Estuary, southern Brazil, and discussion with fishery communities was started to find ways to reduce bycatch in the area (details below). There was little progress to finalise the document listing the short/medium-term research and conservation actions for Lahille's bottlenose dolphins. The document was initially planned to be ready at the end of 2022 and has now been rescheduled for June 2023. A standard protocol for data collection and analysis was developed to assist research

[1] Gephyreus Project: a multi-institutional and transnational project established in late 2018 to estimate population parameters for the Lahille´s bottlenose dolphins in southern Brazil and Uruguay, within a metapopulation context. Photo-identification data is being collected over six sampling sites and financial support is guaranteed until the end of 2022.

groups to standardise baseline data collection procedures to estimate mark-recapture population parameters considering the movement of individuals between sampling sites. Catalogues continued to be uploaded in a shared virtual space and potential re-sightings between areas were routinely checked. Potential synergy with Franciscana CMP was discussed in the way to utilise aerial survey data currently being collected in Uruguay to estimate Franciscana abundance to support the investigation of the distribution and density of Lahille's bottlenose dolphins in the region. No progress was made by the Task Team to explore possible synergies with the bycatch mitigation initiative - BMI.

An important progress made by LBD Task Team was the participation in the IMMA Regional Workshop for the Identification of Important Marine Mammal Areas in the Southwest Atlantic Ocean Region, conducted by the Marine Mammal Protected Area Task Force of the IUCN Specialist Group. The IMMA workshop was held in Praia do Forte, Bahia, between 9-12 December 2022. A candidate area that fully covers the southern Brazil and Uruguay population of Lahille's bottlenose dolphins was proposed. The independent Review Panel concluded that the cIMMA submission has been Accepted for IMMA Status, pending Major Corrections to ensure that the IMMA can be published formally online using the IMMA e-Atlas. In brief, the candidate area "Southern Brazil and Uruguay Coastal Ecosystems" comprises a mosaic of coastal habitats (from the surf zone to the 50m isobath, including inner estuaries, islands and coastal bays) between Florianópolis, Brazil, and Santa Lucia del Este, Uruguay, fully covering key habitats for three endangered cetaceans: the entire distributional range of Southern Brazil-Uruguay subpopulation of Lahille's bottlenose dolphin and Franciscana Management Area III and a second most important breeding ground for Southern Right Whales in the Southwest Atlantic. The cIMMA polygon also includes important colonies of two pinniped species, the South American Sea Lion, and the South American Fur Seal.

3. CURRENT CONSERVATION STATUS OF LAHILLE'S BOTTLENOSE DOLPHINS

The Lahille's bottlenose dolphin is still listed as VULNERABLE (VU) under criterion D1 by the IUCN (Vermeulen et al., 2019a) and as ENDANGERED (EN) in Brazil (MMA 148, 2022) and Argentina (Vermeulen et al., 2019b). In Uruguay, it was recently listed as ENDANGERED in the first conservation status assessment of the National Red List of Threatened Species for mammals.

3.1. AN ASSESSMENT OF THE CONSERVATION STATUS OF THE ARGENTINA POPULATION

Small progress was made towards updating the current population status of Argentina Lahille's bottlenose dolphins. Several surveys have been conducted in Rada Tilly but no sighting of Tursiops was made. The area of San Antonio Bay and Bahía Blanca Estuary are still waiting for the permits to start with the surveys.

The Marine Fauna Rescue Station "Indio Fidalgo" of Bahía Blanca, province of Buenos Aires, the Provincial Nature Reserve Bahía Blanca, Falsa and Verde, and Fundación Cethus are initiating a joint study on the resident population that habits this reserve. This study will employ photo-identification and acoustic techniques and will focus mainly on estimating demographic

parameters. The photographs obtained for photo-identification will be shared with other colleagues in Argentina studying the species.

Tissue and bone samples have been obtained from stranded and dead specimens and from local collections for subsequent genetic analysis, to compare them with previous studies on this species.

A proposal to list Lahille's bottlenose dolphin in Appendices I and II will be presented at CMS CoP 14 to be held in Uzbekistan.

3.2. GOVERNMENTS TO TAKE IMMEDIATE ACTION TO REDUCE BYCATCH PARTICULARLY IN THE SOUTHERN BRAZIL MU's

Patos Lagoon Estuary Management Unit

In 2022, as was in 2021, no specific surveillance actions were taken by authorities within the Lahille's bottlenose dolphin protected area covering the Patos Lagoon Estuary (PLE) and adjacent marine coast, despite several records of illegal fishing activities along the year. Only a few regular enforcement actions were taken, as surveillance focused on the pink-shrimp fisheries—a type of fishery that does not cause direct harm to Lahille's bottlenose dolphins, but it is very harmful for the trophic chain in which they are inserted. Authorities informally informed precarious conditions to work to combat illegal fisheries. The main problems reported were a low budget and an insufficient number of personnel to conduct specific actions along the protected area.

Strandings of Lahille's bottlenose dolphins on the marine coast adjacent to the PLE increased in 2022 in comparison to 2021—when no carcasses were recorded. A total of eight Lahille's bottlenose dolphins were recorded between April 2022 and March 2023 during systematic beach surveys conducted along the coastal beaches of southern Rio Grande do Sul State: 4 immatures animals (two neonates and two juvenile/subadults) and 4 adults (two males and two of unknown gender). The advanced decomposition state of the carcasses precludes a detailed examination of the *causa mortis*. However, mortality followed the pattern of artisanal fisheries in the area which is intense during late spring and summer (Fruet et al., 2012).

Despite not related to government actions, a detailed study on the characterization and mapping of fisheries activities in and around Patos Lagoon Estuary was conducted by Kaosa, a non-governmental organization based on Rio Grande city. Sixty artisanal fishers from the gillnetting fisheries fleet were interviewed. Interviews were transcribed and analyzed. Mental maps were georeferenced. Fisheries (industrial, semi-industrial and artisanal) were characterized in the field in terms of capacity, target species, net types, area covered, seasonality, overlapping with the Lahille's bottlenose dolphins protected area and socioeconomic status. All fishers interviewed declared to fish regularly within the boundaries of the protected area but affirm that their activity does not harm bottlenose dolphins. Also, declared not to now the reasons and aims of the establishment of the fishing exclusion zone. It was estimated to have 2700 fishers in the region. Interviewers reported increasing expenses to sustain fisheries due to overexploitation of stocks of commercially species. It remains clear that artisanal fisheries are undergoing the tragedy of commons and the social aspects of fishers, independent of the fishery type, is precarious. Mental maps revealed the mains areas used by fishermen, showing the high overlap between fisheries and areas used by Lahille's bottlenose dolphins. Artisanal gillnetting fishers reported that the main

responsible for the incidental captures of Lahille's bottlenose dolphins is the beach trammel and beach seine – both allowed to operate within the protected area. However, our team surveyed beach trammel in the field and indicated that the nets are very short and potentially has low power to capture Lahille's dolphins. Beach seine is known to capture and is very likely as a significant impact factor on dolphins' population's viability. Also, the artisanal gillnetting fishermen recognized the incidental capture of sea turtles and sealions, with intentional killing of the latter due to fishing net depredation. Results of this work was discussed with fishery community. A workshop was held at São José do Norte Fishers' Colony on August 5, 2022, and had the participation of 20 social and institutional actors involved in the artisanal fisheries management process.

Laguna Management Unit

In 2019, the Santa Catarina Institute of Environment (IMA) held a Workshop to define a State Action Plan to conserve the Lahille's bottlenose dolphin population in Laguna (*Portaria* Nº 214/2019). This plan aims to support efforts to: (i) reduce the gillnet bycatch events; (ii) regulate boat traffic and reduce noise pollution; (iii) monitor the dolphins' population parameters and dolphins' health conditions; (iv) monitor and propose actions to improve and guarantee the habitat quality; (v) involve society in conservation actions. The first effort to implement this Plan intensified the fishing activity enforcement actions and a better engagement of fishers to local rules. As a result, since 2020, no bycatch events have been reported in the area.

Northern Patos Lagoon Mamagement Unit

Tramandaí Inlet

Advances were observed in the Tramandaí Inlet after key management actions. Preliminary data of the Projeto Botos da Barra (CLN/CECLIMAR/UFRGS) indicates that after the implementation of a legal instrument (Lei Municipal N° 3952/2015) that ordered fishing, sports, and leisure activities in the inlet (prohibiting speedboats, jet skis and kitesurfing within the inlet), the presence of dolphins in the inlet increased 3,55 times in the summer, and 2,99 times in the autumn (Torquato, 2023). Almost ten years ago, artisanal fishers warned of these as one of the main reasons for dolphins abandoned or reduced the use of this area, threatening the human-dolphin cooperation in the area. The regulation of these anthropic activities seems to have been fundamental to improve habitat quality for the resident dolphins in the Tramandaí Inlet, which is now defined as one of three strategic areas for Lahille's bottlenose dolphin conservation in Brazil (CMA, 2021).

3.3. CONTINUED MONITORING THROUGHOUT ITS RANGE TO INCREASE KNOWLEDGE OF LIFE HISTORY PARAMETERS, ASSESS TRENDS IN ABUNDANCE AND DOCUMENT THE PREVALENCE AND AETIOLOGY OF CHRONIC SKIN DISEASE

Southern Brazil

Patos Lagoon Estuary Management Unit

A satisfactory survey effort for collecting photo-identification data and biopsy samples was obtained in 2022 (32 surveys and 145 photo-identified individuals; four biopsy samples were collected).

Significant progress was made to evaluate trends in abundance, population parameters and the effectiveness of the protected area established at Patos Lagoon estuary and surrounding areas to reduce bycatch in 2014. Sixteen years of mark-recapture data were analysed. Models were built under the Pollock's Robust Design framework to estimate key population parameters stratified by sex and subpopulation (coastal and estuarine). Preliminary results suggest that survival is higher in females regardless of habitat, and for both males and females, estuarine and coastal, a subtle increase in survival after the establishment of the protected area was detected (for coastal females: +0.72% from the survival values before the norm; estuarine females: +0.61%; coastal males: +1.9%; estuarine males: +1.5%). Abundance fluctuates with a slight temporal increase in coastal dolphins (perhaps an effect of survey effort) and a slight decline in estuarine males. Capture probabilities were constant over time. Conclusive results from this analysis should be available at the end of 2023 and a detailed report for SM regarding this work is expected to be presented in the next SC meeting.

A study was initiated in late 2020 to assess the impact of persistent organic pollutants (POPs) on population viability. The investigation has progressed well in 2022. Data is being analysed and a PVA model is underway. A piece of this work, reporting on temporal trends of POPs concentration in adult male dolphins from PLE, can be found in Manhães et al. (2023). In brief, it was found an increasing temporal trend in PCBs and DDTs. It was also found high ΣPCB concentrations (median: 79 $\mu g.g^{-1}$ lw) that are much above the thresholds established in the literature regarding PCB toxicity, which are: 1.3 $\mu g.g^{-1}$ lw for endocrine disruption (Mos et al., 2010), 10 $\mu g.g^{-1}$ lw for risk of decline in population growth rates (Hall et al., 2006), and 17 $\mu g.g^{-1}$ lw in cetaceans' blubber for physiological effects (Kannan et al., 2000).

It is expected to update information on this issue in the next SC meeting and provide a report regarding the impact of POPs on population viability.

No progress was made on studies to evaluate the prevalence and aetiology of chronic skin disease.

Laguna Management Unit

During 2021 and 2022, 28 photo-identification surveys were carried out (also following WHO standards protocols) and three biopsy samples were collected. With the new data collected, population parameters such as abundance and survival were estimated within the scope of the Gephyreus Project (see below).

Recent research used static acoustic monitoring stations to better understand the habitat use and ranging behaviour of the dolphin population. This effort aimed to better assess the effectiveness of the recent fisheries restrictions and propose complementary measures for reducing bycatch events, if needed. The results of this passive acoustic monitoring confirmed the distribution, home range, and habitat use patterns previously described via photo-identification data (Romeu 2022). Also, they suggested no variation in spatial behaviour between days. Therefore, these results indicate that the area designated for fishing restrictions seems well-designed and adequate to protect the core area used by dolphins.

Another research summarises the long-term monitoring effort carried out in Laguna in the last 16 years (Cantor et al., 2023). It described how dolphins and net-casting fishers interact cooperatively

in this area, what mechanisms explain this cooperation, and its potential consequences for the dolphin population. One of the main findings suggests that dolphins that tend to cooperate with fishers have a 13% higher survival probability than dolphins that typically forage independently. Based on this result, the study simulates scenarios in which the interaction between dolphins and fishers becomes less frequent, primarily due to reductions in resource availability. These scenarios indicate a marked decrease in the dolphin population or its extinction in case of decline or extinction of the cooperative tactic with fishers. New population models have also been built to predict population dynamics, accounting for the effects of the foraging tactic used by a subset of dolphins specialised in cooperating with fishers, and results will be available mid-2023.
During 2022, the population monitoring effort continued, integrated with the effort carried out in the other MU's (see details below). These data were used to update the prevalence of lesions of Lobomycosis-like disease (LLD) in recent years. In 2011, the prevalence of LLD was 9% for this population. However, it increased significantly in recent years, reaching ~19% in 2022 (Bezamat, *in prep*).

In 2021, a Long-Term Ecological Research Program (*PELD-SELA: Projeto Ecológico de Longa Duração - Sistema Estuarino de Laguna e Adjacências*) initiated new efforts to estimate multiple biological, social and economic components in Laguna, emphasising fishing activities. In addition to the effort of investigating the behavioral mechanisms of the dolphin-fisher cooperation and its influence on the dynamics of the dolphin population and the artisanal fisheries, this new program considers the social, cultural and economic contexts by evaluating the implications of the population dynamics of dolphins and fishers for the ecological and economic systems in which they are inserted. Specifically, the goals are twofold. From a survey of the abundance and biomass of the main biological components of the ecosystem, its trophic interactions, and of the resulting fishery production, an ecosystem model will be parametrized to predict the resilience of the dolphin-fisher interaction in different scenarios of ecosystem changes. Then, a bioeconomic model will be developed to define artisanal fisheries management strategies that reduce negative effects and maximize economic and social gains. This way, it is expected that this proposal will be able to design fishing management scenarios that are both profitable and sustainable. The first results are expected for 2024 and maybe a reference approach to be applied in other MU's.

Northern Patos Lagoon Mamagement Unit

Tramandaí Inlet

During 2021 and 2022, 24 photo-identification surveys were carried out, mostly inside the Inlet. Ten adults and two juvenile dolphins were identified as resident and cooperate with net-casting fishers. A strong association is observed between these likely family-related individuals, with four adults been photo-identified for more than three decades. The last two photo-identified calves were born in 2019. Although resident dolphins have been monitored only from land in the past two years, it is known from previous boat-based surveys that more dolphins inhabit adjacent waters of the Tramandaí Inlet. A mark-recapture approach indicated 23 individuals in the area, including these resident individuals (Gephyreus project).

Four strandings of Tursiops sp. were reported between January 2022 and January 2023, over the long-term megafauna standings program dataset continued by the Museu de Ciências Naturais (MUCIN/CECLIMAR/UFRGS) since 2008. Until now one of these is confirmed as Lahille's bottlenose dolphin, while the biological material of the others is still being processed. By analysing

the dorsal fin shape and marks it was concluded that this individual (MM275, male, 2.92 m) does not belong to the group of resident dolphins. However, one individual of this resident group (born in 2005) has lobomycosis-like-disease (LLD). The progress of the skin lesion in this individual has been monitored for at least three years and it was possible to notice an advanced of the lesion from the dorsal to the lateral of the animal body.

Since March 2022, an ongoing research project (Projeto Botos da Barra) supported by FBPN (Fundação Grupo O Boticário de Proteção à Natureza) has been systematically monitoring the resident dolphins, the human activities and the fishing productivity of the net-casting fishers that cooperate with dolphins in the Tramandaí inlet. This project also carried out environmental education activities, reaching more than 1000 people by visiting local schools and offering workshops on how to promote responsible tourism. The main objective of these actions is to involve the local community, promote the value of the dolphin-fisher cooperation as a local cultural heritage and enable society to get involved in local conservation actions related to safeguard the Lahille's bottlenose dolphins and "cooperative fishing".

Torres (Mampituba River)

The population monitoring effort continued in the coastal waters adjacent to the Mampituba river (Torres/Passo de Torres), during 2021-2022. A total of 22 photo-identification surveys were carried out during this period, resulting in the identification of 16 dolphins. An adult animal was recorded with LLD, a skin disease not recorded in the dolphins of this area since 2004 (Van Bressem et al., 2015).

In addition to photo-identification studies, a systematic monitoring program of bycatch of marine mammals in artisanal fishery has been conducted in the region by Grupo de Estudos de Mamíferos Aquáticos do Rio Grande do Sul (GEMARS). From November 2020 to December 2022, two bottlenose dolphins (Tursiops sp.) were incidentally caught in coastal gillnets (~15m depth) during 108 monitored fishing trips (see Sucunza et al., 2023; SC/69A/HIM/01). Although the taxonomic identity of the bottlenose dolphins incidentally caught could not be fully assigned, the captures occurred close to shore (< 1,700m) and near the mouth of the estuary, in an area potentially used by Lahille's bottlenose dolphins.

Southern Patos Lagoon and Uruguay Management Unit

Since late 2019, Lahille's bottlenose dolphin photo-identification surveys have been continued along Rocha Department coast in Uruguay, as part of the Gephyreus Project and Toninas Project of Yaqu Pacha Uruguay civil association. A total of 20 surveys were carried out in 2022.

Preliminary results show a new abundance estimate of 35 individuals (CI:95%: 21-49) for Rocha department in 2022, smaller than the first one estimated in 2008 (63 individuals, 95% CI = 54–74 - Laporta et al., 2016). It is important to note that the study area for both estimates are different, being the last one in La Coronilla-Cerro Verde and the current one in Cabo Polonio-Punta del Diablo. In addition, at least five new matches of identified individuals were recorded between southern Brazil (Patos Lagoon Estuary and surrounding coastal areas) and Uruguayan coastal waters to add to those 21 previously reported (Laporta et al., 2017).

Citizens have continued recording Lahille's bottlenose dolphins along La Plata River Estuary and the oceanic coast of Uruguay through a digital form created by Franca Austral Project and Yaqu Pacha Uruguay, as well as by a Telegram group created by Fauna Marina Uruguay and WhatsApp group created by Aguara Pope organization. During 2022, at least 124 sightings of Lahille's bottlenose dolphins were recorded, (91 in 2021), 25% of them in La Plata River Estuary, an area where their sighting frequency has been decreasing in the last 40 years.

On March 12, 2021, we observed a dolphin without the entire tail fin, possibly due to artisanal fishery interaction. This animal was observed at least eight times, moving along the Rocha department coast. On January 3, 2023, we observed another dolphin with injuries in the peduncle, also possible to artisanal fishery interaction. During the field surveys of 2022, it seems to be more common to observe fishing nets in the first 300m of the coast, although the national regulations do not permit any kind of nets in that zone between October and April. We communicated this situation to the National Direction of Aquatic Resources, but measures still need to be taken. We will continue working to ensure a year-round exclusion zone of 1km from the coastline, following the measures taken on the coast of Rio Grande do Sul, Brazil.

During 2022, no records of stranded Lahille's bottlenose dolphin were reported in coastal Uruguayan waters.

Argentina

A project planned to initiate in March 2020 in Bahía Blanca Estuary, southwestern coast of the Province of Buenos Aires, is still wating for permits to run surveys and data collection is now planned to start during 2023. For these reasons, no further survey effort was conducted at Rio Negro as well. A regular survey program focusing on the better-studied population at Bahía San Antonio is still required. Surveys have not been carried out in the area since 2012. No dedicated surveys for Lahille's bottlenose dolphins were conducted in Bahía Engaño. Several surveys have been conducted in Rada Tilly but no sighting of Tursiops was made.

3.4 THE CONSERVATION STATUS OF THE SUBSPECIES BE PRIORITISED FOR ASSESSMENT IN THE FUTURE

The Gephyreus Project—an international research initiative coordinating simultaneous photo-identification sampling effort at six sites along the distribution range of the Lahille's bottlenose dolphin to understand the southern Brazil/Uruguay ESU from a metapopulation dynamics perspective — has been generating some preliminary, but important results. Mark-recapture models in a Robust Design and Multistate frameworks (Kendall et al., 1997; Brownie et al., 1993) were fitted to data from five sampled sites in southern Brazil and Uruguay, collected during five to seven periods of sampling effort between 2019 and 2022. These models estimated apparent survival probabilities of 0.70 (CI95%: 0.50-0.83) for North Bay, 0.96 (CI95%: 0.92-0.98) for Laguna, 0.82 (CI95%: 0.70-0.90) for Tramandaí, 0.68 (CI95%: 0.48-0.82) for Torres, 0.97 (CI95%: 0.94-0.98) for Patos Lagoon and 0.97 (CI95%: 0.94-0.98) for Uruguay. The estimated survivals for Laguna and Patos Lagoon probably better represent the real survival probabilities for the species. For the other areas, the estimated survivals seem not to reflect only mortality but also the non-occurrence in the area during the sampling effort. In other words, the low estimates observed, especially in North Bay and Torres, reflects the occasional use of these areas by transient

individuals. The model that considers survival constant over time and between areas, for example, suggests a survival for all areas of 0.925 (95%CI: 0.88-0.94).

These models also estimated abundance for each area per period of sampling effort. Abundances ranged from 53 (CI95%: 50-57) to 62 (CI95%: 48-76) in Laguna; from 127 (CI95%: 80-174) to 252 (CI95%: 143-361) in Patos Lagoon estuary and adjacent marine coast; from 20 (CI95%: 11-30) to 29 (CI95%: 16-41) in Tramandaí; from 4 (CI95%: 3-8) to 47 (CI95%: 37-57) in Torres; from 8 (CI95%: 3-12) to 24 (CI95%: 4-12) in North Bay; from 10 (CI95%: 7-14) to 38 (CI95%: 21-55) in Uruguay. Combining these estimates from all areas, the total estimate of Lahille's bottlenose dolphins ranged from 246 (CI95%: 183-309) in the first period of sampling effort to 398 (CI95%: 245-550) in the sixth period of sampling effort. Assuming the current effort is satisfactory to assess the total number of individuals in the area covered, we sum the average estimates of each population unit over all cycles to estimate a regional population size (metapopulation) of 316 individuals, along southern Brazil and Uruguay.

A population viability analysis was run in Vortex software (version 10; Lacy, 1993; Lacy, 2000) under a metapopulation context to estimate the extinction probabilities of each local unit and the entire Southern Brazil-Uruguay regional population. A combination of parameters specifically estimated from each local population complemented with parameters available from the literature was used to model the population's trajectories. Six scenarios were built considering variations in bycatch and habitat conditions in the face of success or failure of management actions. For each projection, 1000 iterations were performed, in a time interval of 100 years, including uncertainties in some parameters to incorporate the effect of demographic and environmental stochasticity. In summary, to ensure the viability of all local populations and thus the metapopulation, it is necessary to reduce bycatch-related mortality events to zero and ensure the quality of the habitat. The scenario that would represent the current condition does not seem sustainable in the long-term, predicting the extinction of some local populations and a dramatic reduction of the metapopulation.

Using the mark-recapture data generated for the entire Southern Brazil-Uruguay subpopulation and the PVA results, we evaluated the extinction risk of Lahille's bottlenose dolphins in the region against Criteria C and D of the IUCN. This preliminary evaluation suggests that Lahille's bottlenose dolphins from Southern Brazil-Uruguay are Critically Endangered by sub-criteria C1 (i.e. number of mature individuals <250 individuals and a continued decline of 25% projected for the regional population in three generations) and C2ai (i.e. continued decline projected for the regional population and less than 50 mature individuals in each local population); Endangered by criteria D (<250 mature individuals). This would downgrade the conservation status of Lahille's bottlenose dolphins from Endangered to Critically Endangered in the National Red List of Threatened Species in Brazil.

4. CONSERVATION CONCERNS

A new source of concern regarding Lahille's dolphins (and other cetaceans) conservation in southern Brazil is the future installation of nearshore and offshore wind farms for renewable energy production. In November 2020, the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA) launched the Standard Term of Reference (TR) for the Environmental Impact Study and Environmental Impact Report (EIA/Rima) of Offshore Wind Complexes. Updated

information obtained in March 2023 from the Licensing Board of the IBAMA revealed more than 70 environmental licencing processes opened for offshore wind farms. Projects are expected to occur in specific areas along the Northeast, Southeast and South Brazilian coast (see IBAMA's map of environmental licencing processes in annex I). Some projects target the surrounding areas of the Tramandaí Inlet, where occur one of the last remaining cases of dolphin-fisher cooperation (Van der Wall et al., 2022), and the Patos Lagoon Estuary, where inhabits one of the most abundant Lahille's bottlenose dolphin population.

Regarding the bridge planned to be built in the Tramandaí Inlet (Fruet et al., 2021), it was announced that the polygonal of the project matched exactly where dolphins and fishers cooperate, generating a lot of concern in the local community (Camargo, 2019; UFRGS, 2021). However, through legal strategies and political pressure, a public hearing was held on August 10, 2022, mobilizing the local community and public opinion to discuss the project and its potential impacts. A judicial representation was also filed with the Federal Public Ministry, requiring that all legal decisions for the current process are based on an Environmental Impact Study conducted at the federal level.

5. LEGISLATION

The legal process of recognize the dolphin-fisher cooperative interaction—that occurs in the Laguna Estuary and in the Tramandaí Inlet—as a national intangible heritage advanced in the Brazilian Institute of National Historical and Artistic heritage (IPHAN), and a final decision should be made still in 2023 (Nº 790/2021/DPI-IPHAN; SEI/IPHAN, 2718925).

Considering that the Lahille's bottlenose dolphins is an emblematic species for the cities bordering the lower Patos Lagoon estuary and that it is responsible for important regulatory and cultural/aesthetic ecosystem services, Rio Grande City has declared Lahille's bottlenose dolphins as Natural Heritage in 2022 (Municipal Law 8.820, June 8, 2022).

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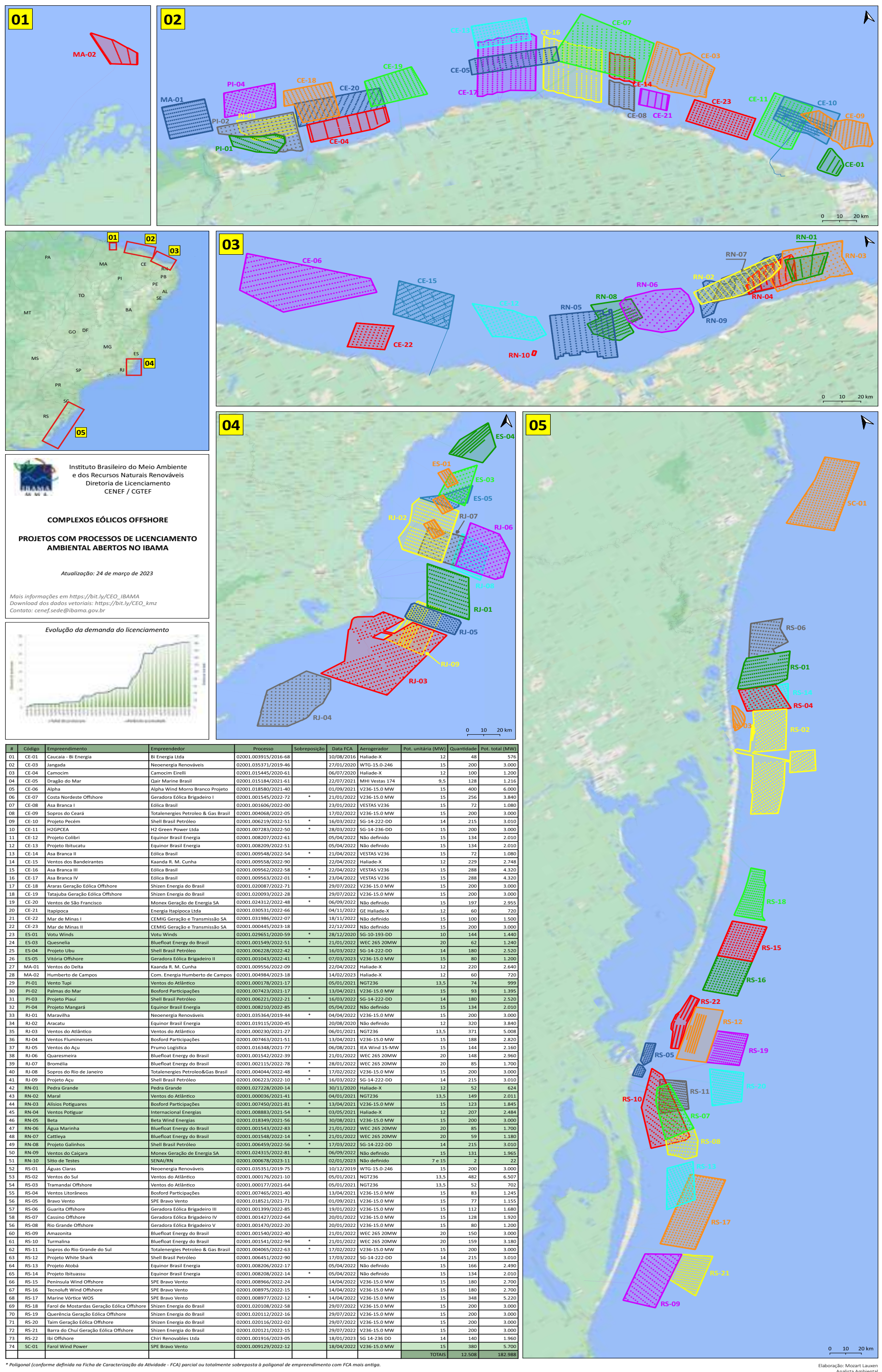
ANNEX I
OFFSHORE WIND COMPLEXES
PROJECTS WITH ENVIRONMENTAL LICENSING PROCESSES OPEN AT IBAMA
(UPDATED ON MARCH 24 2023)



#	Código	Empreendimento	Empreendedor	Processo	Sobreposição	Data FCA	Aerogerador	Pot. unitária (MW)	Quantidade	Pot. total (MW)
01	CE-01	Caucaia - Bi Energia	Bi Energia Ltda	02001.003915/2016-68		10/08/2016	Haliade-X	12	48	576
02	CE-03	Jangada	Neoenergia Renováveis	02001.035371/2019-46		27/01/2020	WTG-15.0-246	15	200	3.000
03	CE-04	Camocim	Camocim Eirelli	02001.015445/2020-61		06/07/2020	Haliade-X	12	100	1.200
04	CE-05	Dragão do Mar	Qair Marine Brasil	02001.015184/2021-61		22/07/2021	MHI Vestas 174	9,5	128	1.216
05	CE-06	Alpha	Alpha Wind Morro Branco Projeto	02001.018580/2021-40		01/09/2021	V236-15.0 MW	15	400	6.000
06	CE-07	Costa Nordeste Offshore	Geradora Eólica Brigadeiro I	02001.001545/2022-72	*	21/01/2022	V236-15.0 MW	15	256	3.840
07	CE-08	Asa Branca I	Eólica Brasil	02001.001606/2022-00		23/01/2022	VESTAS V236	15	72	1.080
08	CE-09	Sopros do Ceará	Totalenergies Petroleo & Gas Brasil	02001.004068/2022-05		17/02/2022	V236-15.0 MW	15	200	3.000
09	CE-10	Projeto Pecém	Shell Brasil Petróleo	02001.006219/2022-51	*	16/03/2022	SG-14-222-DD	14	215	3.010
10	CE-11	H2GPCEA	H2 Green Power Ltda	02001.007283/2022-50	*	28/03/2022	SG-14-236-DD	15	200	3.000
11	CE-12	Projeto Colibri	Equinor Brasil Energia	02001.008207/2022-61		05/04/2022	Não definido	15	134	2.010
12	CE-13	Projeto Ibitucatu	Equinor Brasil Energia	02001.008209/2022-51		05/04/2022	Não definido	15	134	2.010
13	CE-14	Asa Branca II	Eólica Brasil	02001.009548/2022-54	*	21/04/2022	VESTAS V236	15	72	1.080
14	CE-15	Ventos dos Bandeirantes	Kaanda R. M. Cunha	02001.009558/2022-90		22/04/2022	Haliade-X	12	229	2.748
15	CE-16	Asa Branca III	Eólica Brasil	02001.009562/2022-58	*	22/04/2022	VESTAS V236	15	288	4.320
16	CE-17	Asa Branca IV	Eólica Brasil	02001.009563/2022-01	*	23/04/2022	VESTAS V236	15	288	4.320
17	CE-18	Araras Geração Eólica Offshore	Shizen Energia do Brasil	02001.020087/2022-71		29/07/2022	V236-15.0 MW	15	200	3.000
18	CE-19	Tatajuba Geração Eólica Offshore	Shizen Energia do Brasil	02001.020093/2022-28		29/07/2022	V236-15.0 MW	15	200	3.000
19	CE-20	Ventos de São Francisco	Monex Geração de Energia SA	02001.024312/2022-48	*	06/09/2022	Não definido	15	197	2.955
20	CE-21	Itapipoca	Energia Itapipoca Ltda	02001.030531/2022-66		04/11/2022	GE Haliade-X	12	60	720
21	CE-22	Mar de Minas I	CEMIG Geração e Transmissão SA	02001.031986/2022-07		18/11/2022	Não definido	15	100	1.500
22	CE-23	Mar de Minas II	CEMIG Geração e Transmissão SA	02001.000445/2023-18		22/12/2022	Não definido	15	200	3.000
23	ES-01	Votu Winds	Votu Winds	02001.029651/2020-59	*	28/12/2020	SG-10-193-DD	10	144	1.440
24	ES-03	Quesnelia	Bluefloat Energy do Brasil	02001.001549/2022-51	*	21/01/2022	WEC 265 20MW	20	62	1.240
25	ES-04	Projeto Ubu	Shell Brasil Petróleo	02001.006228/2022-42		16/03/2022	SG-14-222-DD	14	180	2.520
26	ES-05	Vitória Offshore	Geradora Eólica Brigadeiro II	02001.001043/2022-41	*	07/03/2023	V236-15.0 MW	15	80	1.200
27	MA-01	Ventos do Delta	Kaanda R. M. Cunha	02001.009556/2022-09		22/04/2022	Haliade-X	12	220	2.640
28	MA-02	Humberto de Campos	Com. Energia Humberto de Campos	02001.004984/2023-18		14/02/2023	Haliade-X	12	60	720
29	PI-01	Vento Tupi	Ventos do Atlântico	02001.000178/2021-17		05/01/2021	NGT236	13,5	74	999
30	PI-02	Palmas do Mar	Bosford Participações	02001.007423/2021-17		13/04/2021	V236-15.0 MW	15	93	1.395
31	PI-03	Projeto Piauí	Shell Brasil Petróleo	02001.006221/2022-21	*	16/03/2022	SG-14-222-DD	14	180	2.520
32	PI-04	Projeto Mangará	Equinor Brasil Energia	02001.008210/2022-85		05/04/2022	Não definido	15	134	2.010
33	RJ-01	Maravilha	Neoenergia Renováveis	02001.035364/2019-44	*	04/04/2022	V236-15.0 MW	15	200	3.000
34	RJ-02	Aracatu	Equinor Brasil Energia	02001.019115/2020-45		20/08/2020	Não definido	12	320	3.840
35	RJ-03	Ventos do Atlântico	Ventos do Atlântico	02001.000230/2021-27		06/01/2021	NGT236	13,5	371	5.008
36	RJ-04	Ventos Fluminenses	Bosford Participações	02001.007463/2021-51		13/04/2021	V236-15.0 MW	15	188	2.820
37	RJ-05	Ventos do Açu	Prumo Logística	02001.016348/2021-77		06/08/2021	IEA Wind 15-MW	15	144	2.160
38	RJ-06	Quaresmeira	Bluefloat Energy do Brasil	02001.001542/2022-39		21/01/2022	WEC 265 20MW	20	148	2.960
39	RJ-07	Bromélia	Bluefloat Energy do Brasil	02001.002115/2022-78	*	28/01/2022	WEC 265 20MW	20	85	1.700
40	RJ-08	Sopros do Rio de Janeiro	Totalenergies Petroleo&Gas Brasil	02001.004044/2022-48	*	17/02/2022	V236-15.0 MW	15	200	3.000
41	RJ-09	Projeto Açu	Shell Brasil Petróleo	02001.006223/2022-10	*	16/03/2022	SG-14-222-DD	14	215	3.010
42	RN-01	Pedra Grande	Pedra Grande	02001.027228/2020-14		30/11/2020	Haliade-X	12	52	624
43	RN-02	Maral	Ventos do Atlântico	02001.000036/2021-41		04/01/2021	NGT236	13,5	149	2.011
44	RN-03	Alísios Potiguares	Bosford Participações	02001.007450/2021-81	*	13/04/2021	V236-15.0 MW	15	123	1.845
45	RN-04	Ventos Potiguar	Internacional Energias	02001.008883/2021-54	*	03/05/2021	Haliade-X	12	207	2.484
46	RN-05	Beta	Beta Wind Energias	02001.018349/2021-56		30/08/2021	V236-15.0 MW	15	200	3.000
47	RN-06	Água Marinha	Bluefloat Energy do Brasil	02001.001543/2022-83		21/01/2022	WEC 265 20MW	20	85	1.700
48	RN-07	Cattleya	Bluefloat Energy do Brasil	02001.001548/2022-14	*	21/01/2022	WEC 265 20MW	20	59	1.180
49	RN-08	Projeto Galinhos	Shell Brasil Petróleo	02001.006459/2022-56	*	17/03/2022	SG-14-222-DD	14	215	3.010
50	RN-09	Ventos do Caiçara	Monex Geração de Energia SA	02001.024315/2022-81	*	06/09/2022	Não definido	15	131	1.965
51	RN-10	Sítio de Testes	SENAI/RN	02001.000678/2023-11		02/01/2023	Não definido	7 e 15	2	22
52	RS-01	Águas Claras	Neoenergia Renováveis	02001.035351/2019-75		10/12/2019	WTG-15.0-246	15	200	3.000
53	RS-02	Ventos do Sul	Ventos do Atlântico	02001.000176/2021-10		05/01/2021	NGT236	13,5	482	6.507
54	RS-03	Tramandaí Offshore	Ventos do Atlântico	02001.000177/2021-64		05/01/2021	NGT236	13,5	52	702
55	RS-04	Ventos Litorâneos	Bosford Participações	02001.007465/2021-40		13/04/2021	V236-15.0 MW	15	83	1.245
56	RS-05	Bravo Vento	SPE Bravo Vento	02001.018521/2021-71		01/09/2021	V236-15.0 MW	15	77	1.155
57	RS-06	Guarita Offshore	Geradora Eólica Brigadeiro III	02001.001399/2022-85		19/01/2022	V236-15.0 MW	15	112	1.680
58	RS-07	Cassino Offshore	Geradora Eólica Brigadeiro IV	02001.001427/2022-64		20/01/2022	V236-15.0 MW	15	128	1.920
56	RS-08	Rio Grande Offshore	Geradora Eólica Brigadeiro V	02001.001470/2022-20		20/01/2022	V236-15.0 MW	15	80	1.200
60	RS-09	Amazonita	Bluefloat Energy do Brasil	02001.001540/2022-40		21/01/2022	WEC 265 20MW	20	150	3.000
61	RS-10	Turmalina	Bluefloat Energy do Brasil	02001.001541/2022-94	*	21/01/2022	WEC 265 20MW	20	159	3.180
62	RS-11	Sopros do Rio Grande do Sul	Totalenergies Petroleo & Gas Brasil	02001.004065/2022-63	*	17/02/2022	V236-15.0 MW	15	200	3.000
63	RS-12	Projeto White Shark	Shell Brasil Petróleo	02001.006451/2022-90		17/03/2022	SG-14-222-DD	14	215	3.010
64	RS-13	Projeto Atobá	Equinor Brasil Energia	02001.008206/2022-17		05/04/2022	Não definido	15	166	2.490
65	RS-14	Projeto Ibituassu	Equinor Brasil Energia	02001.008208/2022-14	*	05/04/2022	Não definido	15	134	2.010
66	RS-15	Península Wind Offshore	SPE Bravo Vento	02001.008966/2022-24		14/04/2022	V236-15.0 MW	15	180	2.700
67	RS-16	Tecnoluft Wind Offshore	SPE Bravo Vento	02001.008975/2022-15		14/04/2022	V236-15.0 MW	15	180	2.700
68	RS-17	Marine Vórtice WOS	SPE Bravo Vento	02001.008977/2022-12	*	14/04/2022	V236-15.0 MW	15	348	5.220
69	RS-18	Farol de Mostardas Geração Eólica Offshore	Shizen Energia do Brasil	02001.020108/2022-58		29/07/2022	V236-15.0 MW	15	200	3.000
70	RS-19	Querência Geração Eólica Offshore	Shizen Energia do Brasil	02001.020112/2022-16		29/07/2022	V236-15.0 MW	15	200	3.000
71	RS-20	Taim Geração Eólica Offshore	Shizen Energia do Brasil	02001.020116/2022-02		29/07/2022	V236-15.0 MW	15	200	3.000
72	RS-21	Barra do Chuí Geração Eólica Offshore	Shizen Energia do Brasil	02001.020121/2022-15		29/07/2022	V236-15.0 MW	15	200	3.000
73	RS-22	Ibi Offshore	Chiri Renovables Ltda	02001.001916/2023-05		18/01/2023	SG 14-236 DD	14	140	1.960
74	SC-01	Farol Wind Power	SPE Bravo Vento	02001.009129/2022-12		18/04/2022	V236-15.0 MW	15	380	5.700
								TOTAIS	12.508	182.988

** Poligonal (conforme definida na Ficha de Caracterização da Atividade - FCA) parcial ou totalmente sobreposta à poligonal de empreendimento com FCA mais antiga.*