



135 Station Road, Impington, Cambridge, UK, CB24 9NP;  
Tel: +44 1223 233397 - Fax: +44 1223 232876  
E-mail: secretariat@iwc.int

## PROJECT PROPOSAL REQUEST

### 1. PROPOSAL TITLE

Please provide the title of the project or the name of the workshop/meeting.

Assessing movement rates of Southwest Atlantic southern right whales between Argentina and Brazil

### 2. BRIEF OVERVIEW OF THE PROPOSAL AND ITS EXPECTED OUTCOME

Give a very brief overview (max 150 words) on your proposal and its expected outcomes. Use bullet points to list outcomes. Be succinct and clear as this may be used to summarise your project for the report.

In 2020, the SH sub-committee highlighted the need to have a multistate capture-recapture and population dynamic analysis of Brazil-Argentina right whale photo-ID data to assess movement rates between calving grounds in the SW Atlantic. Data from the long-term individual-based studies of SRW population carried out by the Right Whale Program (*Instituto de Conservación de Ballenas – Ocean Alliance*) at Península Valdés (PV), Argentina since 1971, by ProFRANCA (*Instituto Australis*) in Brazil since 1987, the 124 matches between both calving grounds reported by Rowntree et al., 2020 (SC/68B/CMP/20) and a subsequent update (in prep.), will be used to perform the analysis. Multi-states mark-recapture models with a Bayesian approach will be applied to the data expecting the following outcomes:

- Movement rates between breeding grounds over the years.
- Region-specific survival and recapture probability.
- Influence of micropredation by Kelp Gulls, calf mortality and density-dependence processes at PV on movement probabilities.

### 3. RELEVANT IWC SCIENTIFIC COMMITTEE GROUPS OR SUB-GROUPS

List all the IWC Scientific Committee groups or subgroups that the outcomes of this work would be relevant to and provide a brief (1-2 lines) explanation of how it would contribute more widely to their ongoing programmes of work. Where possible, do not simply list only the sub-committee within which or for which the project proposal was generated.

**Sub-Committee on the other Southern Hemisphere whale stocks (SH):** the analysis was recommended by SH for a regional population assessment. Methodology outcomes can be applied in future assessments to estimate movement rates between other breeding grounds of SRW including Australia. Information will be relevant for the Intersessional Working Group “Multi-ocean assessment of southern right whale (SRW) demographic parameters and environmental correlates.”

**Sub-Committee on Conservation Management Plans (CMP):** results from this analysis are a **high priority** for SWA-SRW CMP in order to accomplish the research action established at the plan: RES-01: Determine movements, migration routes and location of feeding ground(s) as well as a monitoring action: MON-01: Ensure long-term monitoring of abundance, trends, and biological parameters.

**Standing Working Group on Abundance estimates (ASI):** outcomes can be used to feed population models to estimate abundance, population trends and recovery.

**Ah hoc Working Group on Photo-ID (PH):** the analysis highlights the importance of mark-recapture data for assessing population parameters. Outcomes will encourage new comparison of photo-ID catalogues for regional assessment.

### 4. TYPE OF PROJECT (PLEASE TICK)

Research project	
Modelling	X
Workshop/meeting	
Database creation/maintenance	
Compilation work/editing (e.g. on whale watching regulations, SOCER, etc.)	
Other (please specify below)	

## 5. BRIEF DESCRIPTION OF THE PROPOSAL AND ITS CONNECTION WITH SCIENTIFIC COMMITTEE RECOMMENDATIONS (DO NOT EXCEED 1500 WORDS)

### (A) BACKGROUND, RATIONALE, AND RELEVANCE TO THE PRIORITIES IDENTIFIED BY THE IWC SCIENTIFIC COMMITTEE:

Provide a clear explanation of the background and rationale for the proposal and its relevance to the Scientific Committee identified priorities. Clearly identify the most relevant and recent Scientific Committee recommendations.

#### Background

Southwest Atlantic southern right whales (SWA-SRW, *Eubalaena australis*) gather every winter along the coasts of Argentina, Brazil, and Uruguay (Costa et al., 2005; Groch et al., 2005; Simões-Lopes et al., 1992; Whitehead and Payne, 1981). Península Valdés in Argentina and Santa Catarina in Southern Brazil are the largest breeding grounds for SWA-SRW, and despite being part of the same population (Carroll et al., 2020; Oliveira et al., 2011; Ott et al., 2011), assessments on population dynamics have been conducted separately for each region.

In 2019, the Committee encouraged and funded the matching of Argentinian and Brazilian photo-identification catalogues which was completed by 2020 (SC/68B/CMP20). By comparing both catalogues, 124 matches were found (Rowntree et al., 2020, SC/68b/CMP/20). An update of this analysis is underway at present (Rowntree et al., in prep.). Most of the whales photographed in both regions were first identified at PV and later in Brazil (n=65), followed by individuals first identified in Brazil and later seen at PV (n=37). The remaining individuals (n=22) switched between the two regions on more than one occasion. Within the “Multi-ocean assessment of southern right whale demographic parameters and environmental correlates” project framework, efforts are underway to develop theoretical models for population growth and abundance assessment including data from both regions (SC/68C/SH/06). To better understand regional patterns of SWA-SRW movements, the SH sub-committee highlighted the need and recommended to have a “multi-state mark-recapture and population dynamic analysis of Brazil-Argentina photo-ID data to assess movement rates between regions” in the SW Atlantic (IWC, 2020).

High mortality events were observed in Argentina, with peaks in 2008 and 2012. In Península Valdés (PV), 855 dead whales were found between 2003 and 2021, 763 were newborn calves (Donini et al., 2021). Studies provided evidence that the physiological stress from lesions due to Kelp Gull harassment could be a contributing factor to calf deaths (Fernández Ajó et al., 2020). By analysing 25-years of gull attack frequency on mother-calf pairs, evidence of a relationship between gull harassment and local calf mortality during the first three months of their lives was found (Piotto et al., in prep.). A recent study applied capture-recapture methods to analyse the effect of gull harassment on calf survival. By analysing 36-years, the results showed that calves with more kelp gull wounds have lower survival (Agrelo et al., in prep). Both studies provide new evidence that gull harassment may have a key impact in SWA-SRW population parameters. In Brazil, 42 whales have been found dead since 2002, most of them were calves. Pathologic findings and causes of death were investigated and the main causes of death were neonatal respiratory distress syndrome and trauma of unknown origin (Groch et al., 2019a).

Due to the high calf mortality events observed at PV and the link with gull harassment and other proposed hypotheses to explain the mortalities, a Conservation Management Plan (CMP) was implemented in 2012 for the SWA-SRW

population. The CMP aims to protect whales by monitoring attributes of the population, identifying and minimising anthropogenic threats and maximising the likelihood of recovering to healthy levels (Iñíguez et al., 2012; Iñíguez, 2018). Apart from gull harassment, other threats such as entanglement in fishing gear, habitat degradation, microplastic and global warming may have an impact on population recovery (Agrelo et al., 2021a; Alzugaray et al., 2020; Leaper et al., 2006; Marón et al., in prep.). Therefore, the CMP encourages the comparison of the reference catalogues from all the calving grounds used by this population to provide accurate information for regional population assessment.

#### Relevance to the IWC SC priorities

IWC, 2019, Annex H: Report of the Sub-Committee on Other Southern Hemisphere Whale Stocks, item 5.3 Progress towards population assessment

The sub-committee identified that the most urgent task at present was to reconcile the Brazilian and Argentinian photo-identification catalogues, a significant data gap as the southwest Atlantic wintering ground (spanning Brazil, Argentina, and Uruguay) is likely to represent a single, expanding population, and is currently being monitored via two separate national datasets.

*To better understand patterns of right whale population dynamics around the Southern Hemisphere, and further the work on updated assessments ... The Committee also **encouraged** the matching of photo- identification catalogues between Brazil and Argentina in order to progress regional assessment of the recovery of the southwest Atlantic southern right whale population.*

IWC, 2020, item 8.2.3.5 Progress Towards an In-Depth Assessment

In 2019 (IWC, 2020a, p.28, item 9.2.4.5), the Committee funded the matching of photo-IDs from Brazil and Argentina to progress the pre-assessment of southwest Atlantic right whales (SC/68B/CMP/20)

*The Committee noted the importance of this matching effort towards a better understanding of connectivity and recent growth in the southwest Atlantic right whale calving grounds and **encouraged** 'multi-state' mark-recapture modelling to estimate movement rates between Argentina and Brazil compared to resight rates within regions.*

IWC, 2021, item 8.2 Potential new assessments: progress on previous recommendations and prioritised work plan (SH and NH), item 8.2.3.5 Southwest Atlantic

In 2019 the Committee identified the reconciliation of photo-identification catalogues from Brazil and Argentina as a high priority, recognising that these two calving grounds are likely to represent a single expanding population, but are currently being monitored separately (Item 5.2.4, IWC, 2020a). The result of that matching was reported in 2020 (SC/68B/CMP20)

*...The Committee **encourages** mark-recapture analysis of right whale connectivity between Brazil and Argentina, for informing the regional population assessment of southwest Atlantic southern right whales...*

...Subsequent work **recommended** was to conduct a multi-strata mark recapture analysis to estimate movement rates between Brazil and Argentina and to compare these to resighting rates within countries (Item 8.2.3.5, IWC, 2021). SC/68C/SH/16 provides more details of the planned work, which will measure movement probabilities, and region-specific apparent survival and recapture probabilities. This work will also investigate the influence of Kelp Gull micropredation, calving failure and density-dependent processes at Península Valdés on movement rates from Argentina to Brazil.

IWC, 2021, item 9.1.2 SW Atlantic southern right whales (CMP, SH), Table 9: Summary of future work required, MON-01 Ensure long-term monitoring of abundance, trends, and biological parameters.

*... (iv) Regional population assessments should be conducted.*

#### (B) SPECIFIC OBJECTIVES OR TOR AND DELIVERABLES/OUTCOMES:

*Provide the specific objectives and the expected deliverables. In the case of workshops and meetings, include the Terms of Reference (ToR) and expected outcomes.*

Data from photo-identification catalogues of SWA-SRW off Península Valdés (1971-2018) and Brazil (1987-2018), and the matching between both regions, bring an exceptional opportunity to increase our knowledge on SWA-SRW movement rates. Considering the data available and applying multi-state capture-recapture methods within a Bayesian approach, this study aims to:

- Estimate movement probabilities between calving grounds in Argentina and Brazil.
- Estimate region-specific survival and recapture probabilities.
- In case of time-varying movement rates, the influence of biological processes in PV – such as gull harassment, calf mortality and density-dependence – on movement probabilities.
- Encourage the use of this methodology for future assessment of SRW population parameters.

#### (C) METHODOLOGICAL APPROACH/WORK PLAN/ADMINISTRATIVE DETAILS

*Specify the methods to be applied (novel methods require more explanation than standard ones) and the broad workplan – the detailed timetable appears under Item 5 below.*

*In the case of workshops and meetings, include the broad work plan including any prerequisites for the workshop/meeting to take place (apart from funding, e.g., completed analyses, papers etc.) and administrative details (e.g., location, dates, number of participants).*

Available individual-based data up to 2017 from Península Valdés (N=3,813), Brazil (N=1,021) and the matching between both region (N=124) will be analysed by applying multi-states capture-recapture models (Nichols and Kendall, 1995). Sighting histories will be pooled by years and individual encounter histories of the combined Argentina-Brazil database will be organised in a present-absent matrix. The matrix will comprise individuals only seen off Argentina, only seen off Brazil, and seen off both regions. Besides estimating movement probabilities from Argentina to Brazil and from Brazil to Argentina, the model allows to estimate region-specific survival and recapture probabilities. Goodness of fit (GOF) test will be performed, and models will be fitting considering transient and trap-dependence effects when required. Data will include females, males and individuals of unknown sex, and survival for each region will be estimated based on the sex-specific results from Agrelo et al. (in prep). After model selection, the influence of biological processes at PV such as gull harassment, calf mortality and density-dependence will be addressed on the probability of moving from Argentina to Brazil. Model selection will be assessed by Akaike's information criterion (AIC, Burnham & Anderson 1998).

Models will be performed within a Bayesian framework implemented with Markov chain Monte Carlo methods (MCMC) in R within a framework for hierarchical statistical models and algorithms called NIMBLE (Numerical Inference for statistical Models using Bayesian and Likelihood Estimation, de Valpine et al., 2017). Package R2ucare (Gimenez et al 2018) will be used to perform GOF tests.

#### (D) SUGGESTIONS FOR OUTREACH

*Please, note that successful proponents will be requested to produce ad hoc material that will be used by the IWC Secretariat for dissemination and outreach.*

Besides a technical report to be presented at the IWC Scientific Committee meeting in 2023, outreach opportunities include:

- A peer-reviewed publication
- Presentation of the results at international conferences
- Press releases and communication via newspapers, radio, tv, social media and interviews. Social networks of the Instituto de Conservación de Ballenas in Argentina have 70,000 subscribers, and its website is a regular source of information for environmental journalists in South America. [www.ballenas.org.ar](http://www.ballenas.org.ar)

## 6. TIMETABLE FOR ACTIVITIES AND OUTPUTS

*Specify the timetable for project activities and expected outputs separately. For projects with multiple distinct elements please indicate interim goals and timeframes. Add as many rows as you need to the tables below. If publications are an expected output please note whether you will submit the manuscript to the IWC's Journal of Cetacean Research and Management.*

Activity to be undertaken	Key person(s)	Start(mm/yy)	Finish (mm/yy)
Península Valdés database management	Victoria Rowntree and Florencia Vilches	10/2022	10/2022
Brazil database management	Karina Groch and Eduardo P. Renault-Braga	10/2022	10/2022
Data preparing and modelling: Multistate analysis	Macarena Agrelo and Olivier Gimenez	10/2022	01/2023
Data preparing and modelling: Addressing biological hypothesis (gull micropredation, calf mortality and density-dependence at Península Valdés)	Macarena Agrelo, Carina Marón and Justin Cooke	02/2022	03/2022

Expected outputs	Completion date (mm/yy)
SC-IWC report writing	03/2023
Report presentation at SC 2023 meeting outlining methods and results	04/2023
Peer-reviewed paper writing and submission	05/2023

## 7. RESEARCHERS' (OR STEERING GROUP) NAME(S) AND AFFILIATION

Please, also specify if the project team has any direct connection (e.g. same research group or institute, collaborator on common project) with people involved or likely to be involved in taking the funding decision (e.g. IWC SC heads of delegations, SC convenors, etc.). Add as many rows as you need to the table below.

Name	Affiliation	Connection with decision
Macarena Agrelo	Instituto de Conservación de Ballenas, Argentina	Modelling – RWP researcher
Mariano Sironi	Instituto de Conservación de Ballenas, Argentina	RWP Scientific Director in Argentina
Victoria Rowntree	Ocean Alliance, USA	RWP curator and coordinator in Argentina and USA
Florencia Vilches	Instituto de Conservación de Ballenas, Argentina	RWP PhotoID coordinator
Karina Groch	Instituto Australis, Brazil	ProFRANCA curator and coordinator in Brazil
Carina Marón	Instituto de Conservación de Ballenas, ARG	PhotoID and data preparing contributor
Justin Cooke	Centre for Ecosystem Management Studies, DE	Modelling contributor
Olivier Gimenez	Centre d'Ecologie Fonctionnelle et Evolutive, FR	Modelling contributor
Eduardo P. Renault-Braga	Instituto Australis, Brazil	Contributor
Juan Pablo Torrez-Florez	ICMBio/CMA, Brazil	SWA-SRW CMP coordinator

## 8. TOTAL BUDGET

Breakdown into: (1) salaries/wages (include name/position of each individual and breakdown of time and duties i; (2) travel/subsistence expenses (breakdown by person and justification) unless for IPs for workshops where a total estimate based on an average for the total number of IPs is acceptable; (3) services (e.g. aircraft/vessel time, consultancy fees, ARGOS fees, etc.); (4) reusable capital equipment (e.g. reusable equipment such as a hydrophone, cameras, etc. Note that this equipment will have to be registered at the IWC Secretariat and will remain property of the IWC at the end of the project), (5) expendable capital equipment (e.g. consumables, tags, stationery), (6) shipping costs, (7) insurance costs, (8) in kind co-funding (specify whether other funding is available for personnel/name, equipment, venues, etc.). Note that "Overheads" are not admissible. Add as many rows as you need to the table below.

PROJECT BUDGET						
	Description	Cost per hour	Cost per month	Number of months	Total Cost £GBP	Co-funding £GBP
(1) Salaries (by person)	Data preparing and modelling (Macarena Agrelo, PI)	5,5	968	6	5808	
(2) Travel/subsistence (by person or est. total for IPs)						

PROJECT BUDGET						
	Description	Cost per hour	Cost per month	Number of months	Total Cost £GBP	Co-funding £GBP
(3) Services (by item)	Computer cluster			3		500
(4) Reusable equipment						
(5) Consumables						
(6) Shipping & Customs (by Item)						
(7) Insurance (by item)						
(8) Other	Working space			6		350
	Photo identification cross matching					2000*
	Publication fees					1600
<b>TOTAL</b>					<b>5808</b>	<b>4450</b>

\* This proposal will use data from the reconciliation of photo-identification catalogues from Argentina and Brazil which was previously partially funded by the IWC. Photo-ID analysis and catalogue maintenance mentioned in the Total Budget section as co-fundings are funds already awarded and executed.

<b>Total value of project:</b>	<b>£GBP</b>
<b>Funds requested from IWC</b>	<b>5808</b>
Co-funding	4450
<b>TOTAL</b>	<b>10258</b>

## 9. DATA ARCHIVING/SHARING

Please state your plans for data archiving and sharing. Note that data collected primarily under IWC grants are considered publicly available after an agreed period of time for publication of papers, usually about two years. The work of the IWC depends on the voluntary contribution of data to the various databases and catalogues IWC supports. Please consult the Secretariat ([secretariat@iwc.int](mailto:secretariat@iwc.int))

## 10. PERMITS (PLEASE TICK)

Do you have the necessary permits to carry out the field work and have animal welfare considerations been appropriately considered?	N/A
Do you have the appropriate permits (e.g. CITES) for the import/export of any samples?	N/A

If 'Yes' please provide further details and enclose copies where appropriate