SC/68B/RP/01 Rev1

SH - Pygmy blue whale pre-assessments

IWC

INTERNATIONAL
WHALING COMMISSION

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PROJECT PROPOSAL REQUEST

1. PROPOSAL TITLE

Finalizing catch time series for pygmy blue whale populations using songs

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 point to list outcomes. Be succinct and clear as this may be used to summarise your project for the report.

The following projects are proposed to assist in pre-assessments of pygmy blue whale populations. Five pygmy blue whale populations are considered, in the north-west Indian Ocean (Oman, NWIO), central Indian Ocean (Sri Lanka, CIO), south-west Indian Ocean (Madagascar, SWIO), south-east Indian Ocean (Australia/Indonesia, SEIO), and south-west Pacific Ocean (New Zealand, SWPO)

- Monthly or seasonal models of pygmy distribution based on a greatly expanded collation of acoustic data and ongoing collaboration with Microsoft's AI for Earth program.
- Catch time series for pygmy populations including uncertainty through bootstrapping.

3. RELEVANT IWC SCIENTIFIC COMMITTEE GROUPS OR SUB-GROUPS

List all the IWC Scientific Committee groups or sub-groups 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.

The SH sub-committee is preparing for in-depth assessments of populations of Southern Hemisphere blue whales. Assessments have previously been conducted by the PI and others for Antarctic blue whales (Branch et al. 2004, Branch 2008b) and Chilean blue whales (Williams et al. 2011).

For the five pygmy blue whale populations in this proposal, the proposal would provide crucial catch separation data required for the planned in-depth assessments. Preliminary results were planned for May 2020, but unavoidable increases in teaching load to prepare online lectures due to covid-19, the identification of a fifth population (NWIO/Oman), and in-progress work on new acoustic data for the Indian Ocean through a collaboration with Microsoft's AI for Earth, have delayed the results.

4. TYPE OF PROJECT (PLEASE TICK)

Research project	X
Modelling	X
Workshop/meeting	
Database creation/maintenance	
Compilation work/editing *(e.g. on whalewatching 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 Scientific Committee identified priorities. Clearly identify the most relevant and recent Scientific Committee recommendations.

The Scientific Committee initiated an in-depth assessment of Southern Hemisphere (and northern Indian Ocean) blue whale populations 14 years ago. Stock assessments have been previously provided for Antarctic blue whales (Branch et al. 2004, Branch 2008b), and Chilean blue whales (Williams et al. 2011, Jackson 2016), but not for the five pygmy blue whale populations (NWIO, CIO, SWIO, SEIO, SWPO).

Spatial catch separation models

Over the past two years the PI led a project developing spatial models fitted to acoustic data, to separate historical catches of pygmy blue whales (Branch et al. 2018, Branch et al. 2019). The hypothesized region inhabited by various blue whale subspecies and populations is outlined in Figure 1.

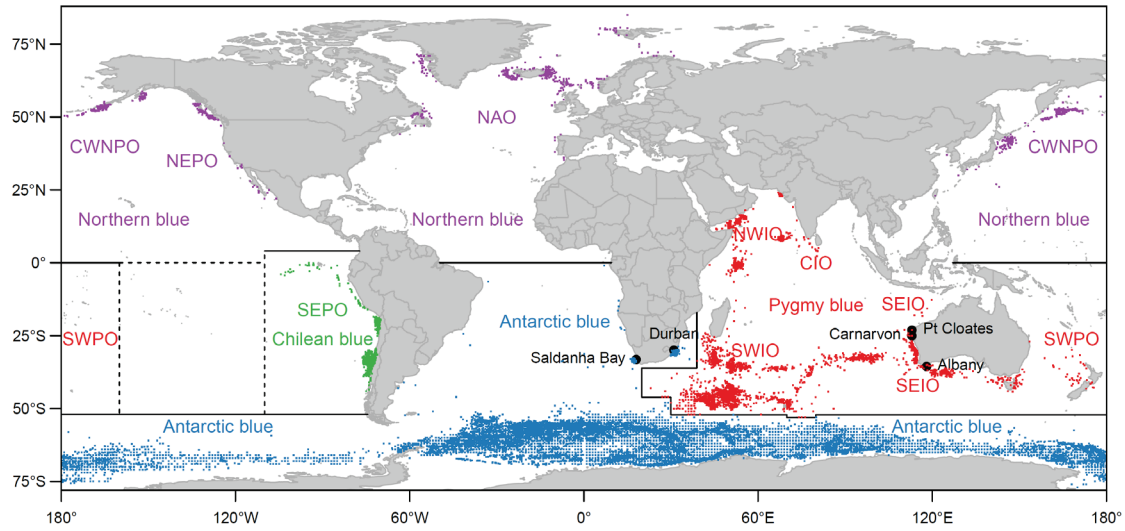

Fig. 1: regions inhabited by different blue whale subspecies (colors) and populations (3-5 letter codes), including NWIO, CIO, SWIO, SEIO, and SWPO pygmy blue whales.

Preliminary results include a compilation of acoustic data, fitting of spatial models, and the separation of catches among the four previously identified populations (Fig. 2, Branch et al. 2019), including tables of catches for each population.

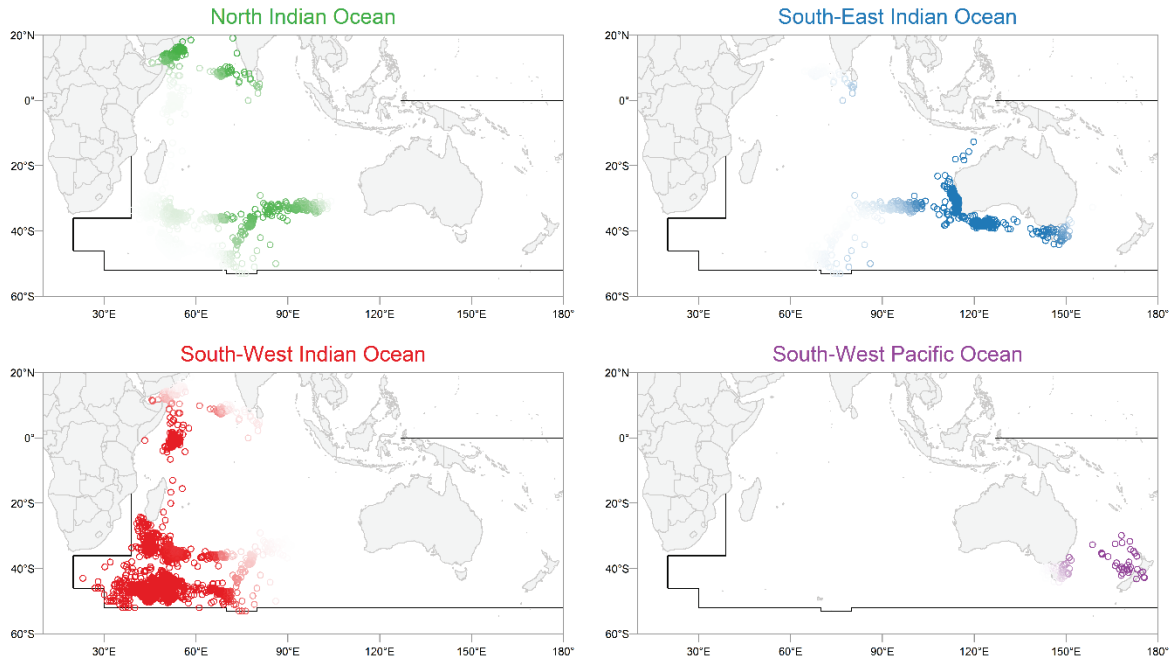

Fig. 2. Previous results estimating the probability of catches belonging to northern Indian Ocean (now split into NWIO and CIO), NEIO, SWIO, and SWPO pygmy blue whale populations (Branch et al. 2019). Bright colors in each panel represent probability near 100% that a catch belongs to a population, which fades from bright to white as the probability declines to 0%.

Since the 2019 SC meeting, several new developments have taken place that will greatly advance the catch separation portion of this project: (1) The confirmation that there is a fifth population of pygmy blue whales termed the "Oman" or NWIO population that occurs off NW Madagascar, Oman, and Diego Garcia (Cerchio et al. 2018, Cerchio et al. submitted); (2) Additional acoustic data have been obtained and compiled, expanding the collaboration to 30 coauthors. (3) A new collaboration between Microsoft's AI for Earth program through Ming Zhong, Maelle Torterotot, Kate Stafford and the PI is nearing completion and will provide long-term acoustic data in the south-central Indian in the core area of overlap between the CIO, SWIO, and SEIO populations. (4) Additional satellite tag data are available for the SEIO population (manuscript in prep.).

Adding these components to the spatial model will greatly improve the accuracy of the catch separation analysis.

Separation of pygmy and Antarctic blue whales

Prior work includes the PI involved using lengths of mature females to separate Antarctic, pygmy, and Chilean blue whales (Branch et al. 2007a), leading to the designation of Chilean blue whales as a putative subspecies; demonstrating that pygmy blue whales comprise no more than 0.1% of blue whales south of 52°S using ovarian corpora vs. length data (Branch et al. 2009); and finding that pygmy blue whales in the northern Indian Ocean have slightly shorter length at maturity (by 0.5-0.6 m) than other pygmy blue whale populations (Branch and Mikhalev 2008). In addition, a large-scale compilation of catch, stranding, sighting, and acoustic data for blue whales in the region provides additional background and context for population assignments (Branch et al. 2007b).

Abundance estimates for pygmy blue whales

NWIO: no abundance or trend estimates; little likelihood of obtaining estimates.
CIO: abundance estimate of 270 applies to small area off Sri Lanka (Priyadarshana et al. 2016); no trend data. There is a possibility of a mark-recapture estimate in the future.
SWIO: abundance estimate of 424 from small region south of Madagascar (Best et al. 2003);

no trend data.
SEIO: line-transect estimate of 671 in a small area (Kato et al. 2007); mark-recapture estimate of 791 (Jenner et al. 2008); passive acoustics estimate of 1,100 (95% CI 662-1559) (McCauley and Jenner 2010). Increase rates of 4.3% per year have been inferred from acoustic call trends (McCauley et al. 2018).
SWPO: a mark-recapture estimate of 718 considered conservative (Barlow et al. 2018); no trend data.

(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.

Objectives

1. Catch separation of pygmy blue whale populations.

Deliverables

1. Peer reviewed paper of catch separation.

(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 pre-requisites 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).

Catch separation methods

The underlying assumptions for catch separation is that songs made by pygmy blue whales are distinctive to each population, and that the current distribution of each population is the same as the distribution during the 1958–1973 when the majority of catches were taken. Data have been collated from 40 different published and unpublished sources comprising more than 4000 rows of data (year/month combinations plus locations from satellite tags). Data are either available for every day or for every hour; and are recorded, for example, as the number of hours examined in a month and the number of hours with calls detected in that month. A conversion model has been developed to convert monthly data into daily equivalents using datasets that can be coerced into either hourly or daily format, as outlined in Branch et al. (2019).

Spatial smoother models are fit to the data separately for each population using beta-binomial likelihoods as outlined in Branch et al. (2019); fits are vastly better than for binomial likelihoods since the latter do not sufficiently account for overdispersion, and hence binomial models will no longer be considered. The models estimate the probability of detecting a particular song type at each location in the pygmy blue whale region (Fig. 1). From these separate probabilities, an overall probability at each location of hearing each of the five song types is obtained, and then applied to the pelagic catch locations.

Catch separation is complicated by the many ways in which catch data were recorded on each expedition (either pelagic or land station). Annual totals are the most reliable for total catch, since individual catch locations are not always available for every individual caught. Where no positional data are available, the best information available is used to infer locations (e.g. Soviet trip records, land station locations). Where positions are available for most but not all catches, the catch separation method is applied to the available data to

find proportions for each population, and then these proportions are multiplied by the annual total for that expedition code.

Uncertainty in catch separation will be assessed using a bootstrapping method developed by Monnahan et al. (2014) that repeatedly resamples recorder locations, fits surfaces, and calculates time series, to obtain means and 95% intervals for catches for each population. Technical issues with convergence when fitting large numbers of spatial surfaces may complicate this plan, however, based on preliminary model fitting attempts.

(D) SUGGESTIONS FOR OUTREACH

The PI teaches a course called "Beautiful Graphics in R" and will produce graphics that can be used by the Secretariat for dissemination and outreach, such as those included here.

Social media: The PI runs a Twitter account called @BlueWhaleNews with 4,700 followers, that tweets about every published blue whale paper (3,073 tweets; viewed 921,000 times in 2018-19). Additional tweets from @TrevorABranch with 12,300 followers will be used to amplify outreach (tweets from this account were viewed 11,719,000 times in 2018-19).

Links to broader research community: extensive collaborations have already been formed with other scientists in (1) obtaining acoustic records in the right format (30 coauthors and data contributors so far), (2) obtaining abundance and trend estimates (Barlow, de Vos, Jenner, McCauley), (3) catch data (Allison, Ivashchenko), and (4) analytical methods (Monnahan). Additional extensive use will be made of blue whale connections from the past 17 years, including with the 42 coauthors of Branch et al. (2007b).

6. TIMETABLE FOR ACTIVITIES AND OUTPUTS

Specify the timetable for project activities and expected out puts 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)
Finalised catch separation publication	Branch	06/20	05/21

Expected outputs	Completion date (mm/yy)
SC document on catch separation	05/21
Publication on catch separation, Marine Mammal Science	10/21

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
Trevor Branch	University of Washington	None

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.

Type	Detailed description	Cost in GB pounds
(1) Salaries (by person)	PI Branch: 1 mo of salary and benefits (24.5%) in Year 1. No institutional indirect costs (overheads) are included.	£14,117 (Year 1)
(2) Travel/subsistence (by person or est. total for IPs)		
(3) Services (by item)		
(4) Reusable equipment		
(5) Consumables		
(6) Shipping (by Item)		
(7) Insurance (by item)		
(8) Co-funding		
(9) Other		
Total		£14,117

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).

Input data is held by the Secretariat and the PI. Resulting R code and outputs will be submitted to the Secretariat, published in peer-reviewed papers, or available on request from the author, as required.

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:

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Appendix 2 – DRAFT SCORING SHEET

If a project presents multiple primary objectives which are achieved using sub-projects, a sheet should be used to evaluate each single sub-project. Note that not all criteria are equally applicable depending on the nature of the project (e.g. field work versus workshops).

IWC SCIENTIFIC COMMITTEE PROPOSALS FOR FUNDING - REVIEW CRITERIA - TEST				
TITLE OF THE PROJECT/sub-projects:				
PRINCIPAL INVESTIGATOR:				
Key criteria		**Explanation of scoring**	**Score**	**Supporting Remarks**
Relevance to Scientific Committee priorities				
1	How well aligned are the scientific outcomes of the project/activity with the current SC priority areas?	1 - Not aligned/poorly aligned (e.g. too vague or generic reference to general SC priorities) 2 - Reasonably aligned (e.g. some aspects may be vague or links are not clear) 3 - Well aligned (e.g. outcomes clearly deliver in the most part on priority areas, may also address longer term or potential future issues). 4 – Closely aligned (e.g. of interest for multiple sub-groups or delivers on specific SC high priority topics/recommendations in the immediate or short term).		
2	To what extent will the outcomes of the project/activity contribute to improvements in the conservation and management of cetaceans?	1 - Not at all 2 - Poorly 3 - Reasonably or over the longer term 4 - Well or over the medium term 5 - Excellently or to almost immediate effect		
Note: if in each of the two above key criteria under this section the project does not score singularly at least 2 points, do not proceed in further evaluation. Of course, proposals within a sub-group would only be developed if in their estimation scores were of 4 or above.				
Approach and methodology				
3	What degree of scientific merit/value is there in carrying out the work?	1 - Not demonstrated or of low scientific value 2 - Useful/basic scientific value 3 - Very good scientific value 4 - Excellent/innovative scientific value		
4	Is the proposed methodology scientifically sound and feasible in terms of field and analytical methods?	1 - Feasibility unrealistic & poor methodology or not properly addressed 2 - Feasibility & methodology acceptable but would benefit from some substantial amendments		

		3 - Feasibility & methodology good, some small changes beneficial 4 - Feasibility & methodology excellent or a highly promising innovative approach to an important question facing the Committee		
5	What is the likelihood of success based on the proposed overall approach and methodology?	1 – No chance of success 2 - Low chance of success/better approaches available 3 - Medium chance of success/some changes to the approach necessary 4 - High chance of success/little or no changes to the approach necessary		
5a	Are objectives of the research likely to be achieved within the proposed time-frame?	1 – No or unlikely 2 – Partially or potentially ambitious 3 - Yes with some minor suggestions 4 – Yes		
5b	Are any proposed intermediary targets timely and achievable?	1 – No or unlikely 2 – Partially 3 - Probably 4 - Yes		
5c	Is the proposed time-frame/work necessary (e.g. can the project produce results in a shorter time period)?	1 – No or unlikely 2 – Partially 3 - Probably 4 - Yes		
5d	Is the sample size adequate to achieve the stated objectives?	1 – Not demonstrated/not properly addressed 2 – No or unlikely (too low/too high) 3 – Probably (additional analysis needed) 4 - Yes		
6	Is the project likely to affect adversely the population(s) involved?	1 - Not properly addressed/ unknown 2 - Yes severely 3 – Possibly at a low level 4 - No		
6a	**IF YES**, are analyses provided on simulations of the effects using different time-frames for the project if applicable?	1 – No 2 – Partially 3 - Yes		
Note: if in each of the above key criteria under this section the project does not score singularly at least 2 points, do not proceed in further evaluation. Of course, proposals within a sub-group would only be developed if in their estimation scores were of 3 or above.				
Project team and Project management				

7	To what extent does the team have the relevant expertise, experience, and balance?	1 – Poor or not demonstrated 2 – Sufficient 3 - Very good 4 - Excellent		
8	Contingency plan: To what extent have potential problems/risks been considered and appropriate mitigation proposed?	1 – Poor or not demonstrated 2 – Sufficient but could be improved 3 - Fully or requiring only minor suggestions or not applicable		
Value for Money				
10	Does the project represent good value for money?	1 – No or significant amendments would be needed 2 – Yes but with some minor amendments 3 – Yes		
11	Have sufficient links been made to the wider research community/other organisations/capacity building.	1 – No 2 – Some but significant amendments needed 3 – Yes but with some minor additions 4 – Yes or not applicable		