INTERNATIONAL WHALING COMMISSION

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PROJECT PROPOSAL REQUEST

1 . PROPOSAL TITLE

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

Enhancement and continuation of Passive Acoustic Monitoring for Blue whales and other baleen whales off Oman

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 status and population identity of blue whales in the Arabian Sea are poorly understood, and recent acoustic evidence indicates that the whales off Oman belong to an acoustic population that has not been previously described. This implies the existence of a population in the Northwest Indian Ocean that is distinct from the Sri Lanka / Central Indian Ocean stock, with which it has been historically conflated. Consequently, illegal Soviet whaling in the 1960's depleted this stock, potentially severely. This project proposes to build on IWC SC funded passive acoustic monitoring (PAM) in deep water off the coast of Oman in 2020 by deploying 3 units off the Arabian Sea coast of Omanwith the following objectives:

- Continue a dedicated research program for NIO blue whales in the waters of Oman, in accordance with previous IWC recommendations
- Describe seasonal variation in presence of blue whales and how this relates to what is known about other IO populations
- Collect acoustic data on Arabian Sea humpback and Bryde's whales and other cetaceans

This submission is proposed as an extension to the 2020 proposal, but with a focus on increasing the number of units deployed off the coast of Oman to provide enhanced spatiotemporal coverage of the western Arabian Sea and redundancy in case of unit failure.

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.

CMP – This work will provide data for the status assessment of NIO blue whales as a stock that can be considered for a CMP, and specifically address the question of which stock(s) were reduced by illegal Soviet whaling and may be threatened and in need of conservation action. This work will also provide data on the spatiotemporal distribution Arabian Sea Humpback whales off Oman.

SH –This work will fill data gaps identified in the context of the population assessments of non-Antarctic blue whales, and thereby inform catch allocations for the North Indian Ocean

Populations, describing occurrence of an Oman acoustic population and assessing whether other acoustic populations may be present in the western Arabian Sea.

4 . TYPE OF PROJECT (PLEASE TICK)

Research project	X
Modelling	
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.

Blue whales in the Indian Ocean (IO) comprise two or three subspecies (Antarctic, *Balaenoptera musculus intermedia*; pygmy, *B. m. brevicauda*; and North Indian Ocean, NIO, *B. m. indica*) (Rice 1998). The classification of a NIO population as a separate subspecies, *B. m. indica*, as opposed to a population of pygmy blue whale, is debated and without scientific consensus (Rice 1998, Branch and Mikhalev 2008). Irrespective of taxonomic classification, a population reportedly resides year round in the northern Indian Ocean, ranging from the Arabian Peninsula in the west, to at least Sri Lanka in the east, and south at least to the Maldives (Baldwin 2003, Branch et al. 2007b, Branch and Mikhalev 2008, Anderson et al. 2012, Ilangakoon and Sathasivam 2012, de Vos et al. 2014, Willson et al. 2019).

Populations of IO blue whales are thought to be defined by diagnostic song-types (McDonald et al. 2006). Antarctic blue whales are characterized by their own song-type, whereas pygmy blue whales are thought to be structured into at least 4 populations each with a diagnostic and spatially overlapping song-type: Southwest IO pygmy ("Madagascar" song), Southeast IO pygmy ("West Australia" song), Northwest IO ("Oman" song), and Central IO ("Sri Lanka" song). Recent long-term PAM studies indicate a new putative blue whale song-type off Oman in the Arabian Sea (Cerchio et al. 2020) and off Diego Garcia (Leroy et al. 2021). Elsewhere within the NIO acoustic data are limited to boat-based recordings off eastern Sri Lanka, which first documented the Sri Lanka song-type (Alling and Payne 1987). Through the use of long-term PAM, the Sri Lanka song-type has been more extensively documented throughout the Central Indian Ocean from equatorial Chagos Archipelago, as far south as the Amsterdam Island (43°S) and Crozet Island (46°S) basins (Samaran et al. 2010, 2013, Stafford et al. 2011, Leroy et al. 2018). Despite limited evidence in the NIO, the Sri Lanka acoustic population has been assumed to be contiguous with the northern Indian Ocean population, or subspecies (Branch et al. 2017b, Anderson et al. 2012). However, there is an apparent incongruence between the concept of a resident NIO population/subspecies and the documentation of its putative song-type well into the temperate latitudes of the Southern Hemisphere.

The recent description of a distinct Northwest Indian Ocean (NWIO) song-type came from PAM detections off the coast of off Oman, off the western Chagos Archipelago, and off Madagascar in the (Cerchio et al. 2020). The recordings from Oman that contributed to the identification of the new song type (Cerchio et al. 2020) were made from a shallow water recorder perched on the edge of the shelf-break, and consequently were limited in detection range and provided song occurrences that were degraded due to propagation loss associated with the shelf. Through funding from IWC SC in 2020, and a loan of equipment, additional PAM effort was applied in the deep water (~250m) on the shelf slope off Oman in March 2020. Recovered on 14th March 2021 after 373 days in the water the unit yielded 214

days of data, having stopped collecting data earlier than expected due to hydrophone element failure (CMP04). Despite the premature cessation of recording, the seven months of archived data is expected to provide higher quality data than previous shallow water deployments, greater detection range, better description of temporal distribution, and an better assessment of the presence/absence of other song types of large whales in the area.

Of particular relevance to discovery of the NWIO song-type, a period of illegal whaling by the Soviet Union during 1963-1967 captured 1,294 blue whales in the northwestern IO (Mikhalev 1996, 2000). The largest numbers of catches in the Arabian Sea was in the Gulf of Aden and the Arabian Peninsula (ca. 10º-17ºN, 45º-55ºE), with additional smaller clusters in the central-eastern Arabian Sea off Lakshadweep/Maldives/western Sri Lanka (ca. 5º-10ºN, 65º-80ºE) and the Indus Canyon in the northeastern Arabian Sea (ca. 22º-24ºN, 66º-68ºE). These catches are generally allocated to the Sri Lanka acoustic population (Branch et al. 2007a, 2019, Anderson et al. 2012). However, timing of presence of the NWIO song-type off Oman suggests that the Soviet whaling targeted this population, as opposed to the more widely spread Sri Lanka acoustic population. Moreover, based upon geographic distribution and potential aseasonal reproduction found in the Soviet catch data, Cerchio et al. (2020) suggest that if there is a northern Indian Ocean subspecies, it is likely this acoustic population. Furthermore, the potentially restricted range, intensive historic whaling, and the fact that the song-type has been previously undetected, suggests a small population that is in critical need of status assessment and conservation action.

The proposed work has particular relevance to the priorities of the CMP and SH subcommittees. In the context of the ongoing population assessments of non-Antarctic blue whales, the identification of a new population, and definition of a new IO song-type, the results of this study will provide critical new information for current efforts to assign catch allocations to IO populations (SC/68C/SH/17). The new data from the NIO has a profound effect on these allocation models and the resultant conclusions regarding status of IO populations. In addition, the work is of relevance to the CMP subcommittee, specifically addressing the question of which stock(s) were reduced by illegal Soviet whaling and may be threatened and in need of conservation action. Given the large number of blue whales taken in the Arabian Sea, it is likely that this NWIO blue whale population may be as threatened as the Arabian Sea humpback whale (which was taken by the Soviet whalers in far fewer numbers; Mikhalev 1997; Mikhalev 2000), and thus should also be considered for a CMP.

Specifically, this project addresses component (2) of recommendation SC2063, made by the SH subcommittee for northern and western Indian Ocean blue whales during IWC SC 68B:

Reiterating its advice that the distribution and population isolation of blue whales is poorly understood in the northern and western Indian Ocean (IWC 2019b:21), the sub-committee encourages researchers and range states to address the following research priorities:
(1) continued photo-identification and genetic sampling of blue whales off Oman, ***(2) passive acoustic monitoring to determine seasonal presence, population abundance and trends;***

(3) comparison of blue whale photographic catalogues with other blue whale catalogues in Oman, India, Sri Lanka and any others available in the Indian Ocean (and possibly the Antarctic);
(4) collection and analysis of tissue samples, to better understand the taxonomy and stock structure of Arabian Sea blue whales.

It is the intention of the research team that this acoustic work will be embedded in concerted efforts to ensure that research in Oman addresses blue whale conservation management needs, as well as humpback whales, addressing all of the recommendations above.

The proposed project also addresses the draft recommendation made by the CMP subcommittee during SC68C to ensure that research includes:

continuous and simultaneous passive acoustic monitoring in identified ASHW habitat in both the western Arabian Sea (different parts of Oman's waters) and eastern Arabian Sea (Pakistan, India and Sri Lanka) to better understand the population's spatiotemporal distribution and potential connectivity across a larger area of suspected range, as well as to understand if range or distribution shifts begin to emerge as a result of climate change and other threats.

(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. Collect one year of PAM data from 3 locations off the continental slope waters of the western Arabian Sea. This effort is viewed by the P.I.s as an extension of an on-going effort to assess blue whales in the western Arabian Sea.
2. Collect acoustic data on Arabian Sea humpback whales, Bryde's whales and other cetaceans (e.g., Sperm whales, delphinids), to be analysed under separate funding.
3. Validate data in preparation for assessment of blue whale and humpback whale presence on multiple temporal scales (monthly, daily, hourly). Detailed analysis to be conducted under separate funding to be sought for 2023.

Deliverables

1. Report to the IWC Scientific Committee on results of blue whale song assessment.
2. Peer-reviewed publication submission, following analysis.

(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).

PAM data collection has already commenced off Dhofar, Oman, with the deployment of an Ocean Instruments SoundTrap 500-STD autonomous archival recorder (oceaninstruments.co.nz) at 260m depth in the Hallaniyats Bay on March 6, 2020. The unit was recovered on 14th March 2021. Redeployment of this unit at the same location is awaiting receipt of repaired hydrophones from the manufacturer. A second unit has already been acquired, and a third unit is proposed herein, with the intention to deploy these units in two deployments of 6 months from October 2021 to October 2022, with recovery and redeployment in March 2022. Instrument '1' will be redeployed off the shelf break in the Hallaniyats Bay at a position 17.38°N, 55.31°E, at a bottom depth of 300. Instrument '2' will be deployed at a similar depth approximately 250 km to the west of Salalah at approximately 16.55°N, 53.5°E, with the intention to monitor as close as possible to the eastern most distribution of Soviet whale catches from the Gulf of Aden (Mikhalev 2000). Instrument '3' will be deployed approximately 450 km to the north east of the first unit off the shelf break to the east of the Gulf of Masirah at approximately 20.00°N, 58.60°E. This spatial configuration will also monitor a large portion of the habitat of Arabian Sea humpback whales off Oman, as indicated by Soviet whaling records (Mikhalev 2000, and IWC Catch records), vessel-based survey data (e.g. Minton 2011), and satellite telemetry data (Willson et al. 2017)

Vemco Ascent acoustic release units will be tethered beneath the SoundTrap units and suspended above the anchor. These rigs will be recovered using the Vemco VR100 surface communication station. The SoundTrap recorder has a flat response from 20Hz-60kHz (+/- 3dB) with a 34dB re 1V µPa-1 noise floor and a full scale response of 174.1 dB re 1V µPa-1 including system gain.

Recording parameters will be set for 50% duty cycle (30min every 60min) and 24kHz sample rate; at this parameter setting the expected recording endurance is approximately 270 days. This provides some precaution with the target deployment duration scheduled for 180 days.

The resulting sound files will be down-sampled to 2kHz to reduce size and increase manageability of the data set for low-frequency analysis. After acquisition of funding for analysis during 2023, manual evaluation of spectrograms will be conducted in Raven Pro 1.5 for review of baleen whale vocalizations and logging for hourly presence as conducted for Cerchio et al. (2020). During the manual browse, presence of the NWIO blue whale song-type will be logged for each hour, and the number of singing individuals estimated based upon overlapping sequences of song units. Other low frequency (in the 10-100Hz frequency range) baleen whale vocalizations, including any other blue whale song-types (e.g., Sir Lanka song-type), potential Bryde's whale vocalizations, and LF downsweeps (potentially attributed to blue whales) will also be logged. Results will be collated and reported as the number of hours per day with NWIO song-type presence, and coded for estimated number of singers (as in Cerchio et al. 2020).

(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.

Results of the proposed work will be highlighted and publicised by the Environment Society of Oman, Five Oceans Environmental Services, Future Seas and the African Aquatic Conservation Fund, each having outreach capacity that ranges from their local region to global in scope. Materials will be made available for to the IWC Secretariat to disseminate and use for outreach.

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)
Deployment of ST500 & ST600 recorders off 3 deployment sites in Oman.	A. Willson, S. Cerchio	10/21	11/21
Recovery and redeployment of ST500 & ST600 recorders after first deployment[1]	A. Willson, S. Cerchio	04/22	04/22
Validation of first six months of data	S. Cerchio	04/22	05/22
Final recovery of ST500 & ST600 recorders	A. Willson, S. Cerchio	10/22	11/22
Validation of second six months of data	S. Cerchio	11/22	12/22
Preparation of final report of deployment summary	A. Willson, S. Cerchio	01/23	02/23
Analysis of data (under separate funding)	S. Cerchio	01/23	10/23

Expected outputs	Completion date (mm/yy)
Progress Report to IWC Scientific Committee, SC 69A	05/22
Final Report to IWC Scientific Committee	05/23
Submission to peer-reviewed journal	11/23

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
Salvatore Cerchio, P.I.	African Aquatic Conservation Fund (AACF)	None
Andrew Willson, P.I.	Future Seas Global SPC (FSG)	None
Danielle Cholewiak	NOAA Northeast Fisheries Science Center (NEFSC)	Convenor of E

8 TOTAL BUDGET

PROJECT BUDGET								
						Please indicate when funds will be needed		
	Description	**Cost per unit**	**Number of units**	**Total Cost £GBP**		**2022**	**2023 +**	**Co-funding**
(1) Salaries (by person)	Andrew Willson - PM (prep and deployments) Sal Cerchio - Project supervision, data validation Assistant	£342 /day £342 /day £190 /day	9 days (+3 co-funded) 3 days (+3 co-funded) 9 days (+3 co-funded)	£3,078 £1,026 £1,710		£3,078 £1,026 £1,710		1026 1026 741
(2) Travel/subsistence (by person or est. total for IPs)	Field team expenses (food) Boat fuel Boat hire Car rental Car fuel	£15 /day £38 /day £143 /day £67 /day £143 /trip	18 man days 6 days (+2 co-funded) 6 days (+2 co-funded) 12 days (co-funded) 3 trips	£274 £228 £855 £428		£274 £228 £855 £428		 76 285 798
(3) Services (by item)	n/a							
(4) Reusable equipment	Vemco VR100 suface station Vemco Ascent Acoustic release SoundTrap ST600 PAM recorder for deep water Deep water depth sounder	£6,574 £3,122 £4,256 £589	1 (co-funded) 1 (+2 co-funded) 1 (+2 co-funded) 1	 £3,122 (see memo) £4,256 (see memo) £589		 £3,122 £4,256 £589		6920 6243 8512
(5) Consumables	Batteries Mooring	£24 £57	6 6	£143 £342		£143 £342		
(6) Shipping & Customs (by Item)	Shipping and import tax for acoustic gear	£855	1	£855		£855		
(7) Insurance (by item)								
(8) Other								
			TOTAL	**£16,904**		£16,904		£25,627

Co-funding Memo: If the entire requested amount (£16,904) cannot be funded, separate co-funding will be sought for either the Vemco Ascent (£3,122) and/or the SoundTrap ST600 (£4,256)

Source	**Purpose of Funding**	**Amount**		**Secured/Tentative?**
Future Seas	In kind coverage of salary and field expenses	£2,926		Secured
AACF	In kind coverage of salary	£1,026		Secured
NOAA Fisheries	Loan of equipment (Vemco VR 100, 2 Vemco Ascents, and 2 SoundTrap 500s)	£21,675		Secured
	TOTAL	£25,627		

Total value of project:	**£GBP**
Funds requested from IWC	£16,904
Co-funding	£25,627
TOTAL	£42,532

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).

Data will be archived by the African Aquatic Conservation Fund and Future Seas, with a backup copy maintained by NOAA Northeast Fisheries Science Center, and requests for further sharing agreements can be made to the project PI's.

10 . PERMITS (PLEASE TICK)

Do you have the necessary permits to carry out the field work and have animal welfare considerations been appropriately considered?	Yes
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:

References

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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		