

SC/68B/RP/09

CMP - Assessment of Arabian Sea
humpback whale body condition and
co-occurrence with human activities in
Oman

IWC



INTERNATIONAL
WHALING COMMISSION

PROJECT PROPOSAL REQUEST

1 . PROPOSAL TITLE

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

Assessment of Arabian Sea humpback whale body condition and co-occurrence with human activities in 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 proposal builds on existing funding and planned fieldwork to allow a more thorough assessment of the health and conservation status of endangered Arabian Sea humpback whales (ASHW), as well as more accurate assessment of human activity, including fisheries, in their core habitats in Oman. This proposal addresses recommendations made in two papers presented to SC68B by 1) conducting a desk-based study that will use spectral filtering of free sentinel imagery to map the density of human activities, including artisanal gillnet fleets (fishing dhows) in key humpback whale habitat off the coast of Oman; and 2) facilitating fieldwork in either November 2020 or March 2021 that will allow ground-truthing of the fisheries mapping exercise, as well as a second assessment of ASHW body condition. Timing of the proposed field work will be dependent on developments related to COVID19.

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 Subcommittee – this proposal directly relates to the planned CMP on Arabian Sea humpback whales
- HIM Subcommittee – the proposed work, if successful, could provide a useful methodology to map and ground-truth fishing effort in other regions where artisanal fishing fleets do not carry AIS or VMS, and to more accurately map co-occurrence of cetaceans and fisheries and thus estimate potential bycatch risk.

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.

Arabian Sea humpback whales (ASHW) have been a priority for the IWC since 2010 when the first recommendation was made to form a Comprehensive Management Plan for this population (e.g. IWC, 2016). The population is small, genetically isolated, and designated as Endangered on the IUCN Red List of Threatened Species (Minton et al., 2008; Pomilla, Amaral et al., 2014). The two core ASHW habitats identified in Oman the Gulf of Oman and the Dhofar area, (Corkeron et al., 2011; Minton et al., 2011), are both characterized by vessel traffic associated with ports, offshore oil exploration, and intense fishing effort from dhows (25m or larger traditional style vessels) that are formally classified as artisanal, and as such are not required to carry AIS or VMS. SC/68B/CMP16 reported that an estimated 67% of ASHW examined have scarring considered consistent with presumed fisheries entanglement, and a number of documented sub-lethal entanglements in Oman and Pakistan involve large-mesh gillnets, such as those deployed by the artisanal fishing dhows on both sides of the Arabian Sea.

Fieldwork conducted in Oman between 2000 and 2004 included mapping of vessels and fishing effort and crude measures of co-occurrence of human activities, including fisheries and humpback whales (Minton, 2004). However, surveys since that time have had multiple objectives, including satellite tagging, which made systematic logging of human activities difficult to include in survey protocols.

SC/68B/CMP23 presented information on the body condition of 9 individual humpback whales, of which 3 were identified as females, assessed through UAV images obtained in the Gulf of Masirah in November 2019. The body condition of the sampled whales, all identified as adults, was comparable to that of newly arrived adult humpback whales from breeding stock D off Western Australia, which suggests that the Omani whales were in good condition. The 3 females were in particularly good condition, similar to that of early lactating females from stock D. To determine the reproductive potential of the ASHW population, additional body condition sampling is needed at other times of year, to quantify the amount of energy that females can accumulate over a year, and hence their potential to recover from reproduction. Multi-year sampling of body condition is also needed to investigate annual variations in body condition resulting from variations in prey availability, which is known to fluctuate substantially in relation to seasonal upwelling (Weigmann, 1970; Smith et al., 1998). Together, this information will help determine the resilience of the ASHW population to anthropogenic disturbance, and the reproductive potential of the population.

Fieldwork has been planned with the costs of UAV components partially funded for November 2020 and March 2021. However, additional resources are required to ensure that the fieldwork can accommodate the manpower and equipment required to address the two research questions above.

(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.

This project would result in the following specific deliverables/outcomes:

- Mapping and ground truthing of human activity, including artisanal fishing in survey areas known to include core ASHW habitat off the coast of Oman.
- A second set of measurements to allow assessment of ASHW body condition in one of the two core ASHW habitats.

(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).

The proposed work would take place in two separate phases:

1) Desk-based analysis and mapping of artisanal fishing effort and ASHW co-occurrence

Preliminary investigations indicate that fishing vessels active in the Gulf of Masirah are detectable from Sentinel-2 satellite imagery and that near complete coverage of this area is acquired and archived once every 5 days during suitable daylight hours. To allow for co-occurrence analysis against the habitat utilisation of ASHWs from satellite telemetry work we will work with the archived images from a period between December 2017 to May 2018 that is concurrent with the final set of months in which satellite tags were operational off Oman (Willson et al., 2018) SC/67B/CMP13_Rev1).

Our method will select those tiles of suitable quality (accounting for clouds, seastate and sunlight glint) from each five day pass and stitch them together as a complete raster surface of the area. Land features will be extracted from all images, and a grid prepared for overlay as a surface within which to innumerate counts of vessels. The resolution of sentinel 2 imagery is 10 m² and the vessels of interest generally over >15 m overall length. We intend to enhance the process of image identification by applying the Normalised Difference Water Index filter to each raster and automating the process of pixel counting for those pixels that present a verified spectral signature for the vessels. Manual checking will also be performed on these images. It is our intention that the data collected on the location of vessels during fieldwork (see component 2) will provide an opportunity for ground truthing and verification of the spectral signature of vessels in the area. For ground truthing to work the locations of observed vessels will require referencing against satellite imagery taken within the same approximate time frame (within minutes). Therefore satellite footprint and overpass schedule will be required prior to the survey to account for the location and timing of transects.

The gridded vessel count surface from each 5 day period will be stacked and averaged for each month and also for the entire 6 month period. The output will provide density-based index maps of relative fishing vessel presence with the area. Detection of vessels at known landing sites will be filtered against those vessels further offshore to provide relative reference values for those engaged or not engaged in fishing activities. Finally, the fishing vessel density index rasters will be overlaid with satellite telemetry habitat utilisation maps for ASHW, using the same grid system providing a final mapped surface presenting as a co-occurrence index.

2) Fieldwork to ground truth fisheries mapping and to implement next phase of body-condition assessment

Ground-truthing of fisheries effort will be conducted during modified line transect surveys in core ASHW habitat in the Gulf of Masirah (November) or Dhofar (March), depending on logistics and permitting and easing of COVID 19 restrictions. Systematic transects would be navigated using a 6.5m rigid-hulled inflatable. During transects, the following data would be collected using a purpose-designed tablet-based data collection App:

- All observations of cetaceans, which would also be approached for confirmation of species, group size, behaviour, and photo-identification where possible and practical;
- Additional data collected for ASHWs will include images suitable for photo-identification (including photos of the caudal peduncle for entanglement scarring analysis).
- Location of all observed vessels, using clearly defined categories for vessels and observed gear, and distinguishing between those actively fishing, or those in transit and/or idle. (Note that unpublished fisheries interviews and observations during fieldwork in Oman indicate that dhows set their nets predominantly at night, retrieve them in the morning, and then remain idle in the same location for much of the following day. As such, the position of idle fishing vessels during calm weather conditions is likely to reflect the location of fishing effort from the previous evening).

During encounters with humpback whales, UAV/drone images will be collected for body condition assessment. A laser range finder, attached to the drone, will be used to measure the altitude of the drone above the whales, to allow scaling of images (convert pixels to meters). Biopsy sampling will also be conducted to determine sex and pregnancy status of the measured whales¹.

Data analysis

Digitised fishing vessel location data collected from the field survey will be projected in GIS. A raster presenting the vessel encounter rate will be produced from two composite layers; one of an enumerated gridded surface of vessel counts within each cell and the other the distance traveled through each cell as extracted from GPS vessel track data. A similar co-occurrence analysis with ASHW habitat utilisation will be performed for this visual survey vessel data as it is described for the layers of fishing density derived from Sentinel 2 satellite imagery.

For the body condition assessment, body length and width (at 5% increments) will be measured from the UAV/drone photographs. From these, the body volume will be estimated and the body condition of the whales will be calculated as the residual of the relationship between body volume and length. Inter- and intra-seasonal changes in body condition will then be determined from body condition measurements collected at the same time (i.e. Nov) between years, and from measurements collected at different times (i.e. March and Nov) within the same year. By contrasting these to body condition data from the migratory stock D population of Western Australia, we will be able to calculate the amount of energy reserves (BC) a female whale would need to be able to produce and wean a viable offspring, as well as the amount of disturbance needed to compromise this.

¹ Note that the PIs hope to work with Susan Bengtson Nash from Griffith University, Australia on hormone analysis, and FC has collaborated with her on previous studies, but we have not yet been able to approach her in relation to this proposal.

(D) SUGGESTION S FO R 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.

The mapping products derived from the satellite imagery and vessel survey investigation of fishing vessel density in our study area will be made available to support IWC outreach activities after approval from the permitting authorities in Oman.

Further, both videos and still imagery taken of the vessel surveys (including UAV footage) will be available as supporting media to accompany a press styled write up on the activities, highlighting the importance of projects funding through the IWC SC.

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)
Preliminary desk-based analysis of fishing effort in core humpback whale habitats using satellite imagery, including ground truthing from vessel surveys.	Andrew Willson	10/2020	05/2021
Fieldwork to ground truth mapped fishing effort and conduct body condition assessments	Andrew Willson, Fredrik Christiansen, Robert Baldwin	11/2020	04/2021
Processing of field-based fisheries observations	Andrew Willson	12/2020	05/2021
Co-occurrence analysis of satellite imagery and field based of fisheries work with ASHW telemetry data	Andrew Willson	05/2020	10/2021
Processing of photo-identification data to support body condition assessments	Gianna Minton	12/2020	05/2021

Expected outputs	Completion date (mm/yy)
Preliminary report of fishing vessel density mapping	05/2021
Preliminary report of body condition assessment work	05/2021
Final report of processed analysis	05/2022
Submission to a peer reviewed journal	07/2022

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
Andrew Willson	Five Oceans Environmental Services, LLC (5OES)	None
Fredrik Christiansen	Aarhus University	None
Robert Baldwin	Five Oceans Environmental Services, LLC (5OES)	None
Gianna Minton	Independent Researcher	Contracts with IWC, but not related to this work

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.

Part 1; Desk based analysis and mapping of artisanal fisheries

Type	Detailed description	Cost in GB pounds
(1) Salaries (by person)	Remote sensing fisheries mapping: Project manager and co-PI. Andrew Willson. Management and reporting (12 days) Remote sensing specialist Jayanthi Walgamage (5 days) GIS support staff (5 days) Subtotal	4665 864 540 6069
(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	Co-occurrence mapping of fisheries with ASHW satellite telemetry data: Project manager and co-PI. Andrew Willson. Management and reporting (6 days) GIS support staff (2.5 days) Subtotal	2332 270 2602
(9) Other		
Total requested from IWC		6069
Total including co-funding		8671

Part 2; Fieldwork to ground truth fisheries mapping and to implement next phase of body-condition assessment

Type	Detailed description	Cost in GB pounds
(1) Salaries (by person)	Gianna Minton Photo ID processing (5days)	1944
(2) Travel/subsistence (by person or est. total for IPs)	Fred Christiansen. Copenhagen to Muscat Team transport Muscat to Field station.	972 324
(3) Services (by item)	Drone flight permit licensing Administration for processing of visas, survey and flight permits (4 days)	864 691
(4) Reusable equipment		
(5) Consumables	Survey vessel fuel and consumables Vehicle fuel Field food supplies	900 216 388
(6) Shipping (by Item)	Drone shipping and import tax	457
(7) Insurance (by item)		
(8) Co-funding	5OES - Vessel hire 5OES - 4WD Car hire	2592 1209

	SOES - Camping supplies	324
	SOES – Salary for senior scientist; Robert Baldwin	3888
	SOES – Salary for project manager co-PI; Andrew Willson (19 days)	6637
	Aarhus – Drone costs and servicing	1512
	Aarhus – Salary for UAV/ body condition, field and reporting senior scientist; Fred Christiansen	7560
	Subtotal	23,722
(9) Other		
Total requested from IWC		6,756
Total including co-funding		30,478
Both components:		
Grand Total requested from/IWC		12,825
Grand Total including co-funding		39,149

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 on body condition can be made publicly available after an agreed period of time for publication of papers, while data on human activity, including fishing effort in Oman can only be shared subject to permissions from the necessary authorities.

10 . PERMITS (PLEASE TICK)

Do you have the necessary permits to carry out the field work and have animal welfare considerations been appropriately considered?	SOES and collaborating institutions have been granted permits for field surveys since 2001 and UAV work since 2017.
Do you have the appropriate permits (e.g. CITES) for the import/export of any samples?	Not required

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

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
<i>Relevance to Scientific Committee priorities</i>			
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	
<p><u>Note:</u> 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.</p>			
<i>Approach and methodology</i>			
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		
<p><u>Note:</u> 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.</p>				
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		

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G. Minton, A. Zerbini, and M. J. Witt. 2018. Update on satellite telemetry studies and first unoccupied aerial vehicle assisted health assessment studies of Arabian Sea humpback whales off the coast of Oman., IWC, Bled.