

# SC/69B/O/07

**Sub-committees/working group name: O**

**‘Satellites to Study Whales’ - Report of the Intersessional Correspondence Group (ICG)  
2023/2024**

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# 'Satellites to Study Whales'

## Report of the Intersessional Correspondence Group (ICG) 2023/2024

### Summary

Since SC69A, the 'Satellites to Study Whales' Intersessional Correspondence Group (ICG) has begun working towards fulfilling recommendations endorsed at the SC69A meeting in 2023 (IWC, 2023).

The ICG devised a number of sub-groups with the following aims and outputs:

**Database sub-group:** to publish a summary table on the IWC webpage, containing links to where annotated datasets of whales in satellite imagery are stored. The group devised the following options; to use MEDIN, a data standard, to create xml files hosted on an IWC webpage (requiring a budget proposal and IWC support), or create a table with a list of all known datasets uploaded on an IWC webpage. Discussions between the sub-group, the IWC, and Adhoc Working Group on Databases (GDR) are ongoing.

**Priority Places sub-group:** to finalise the list of important candidate areas, before presenting to satellite image providers (page 21, Annex T; IWC, 2023) to; (1) rank the locations in order of priority; and (2) consider if further locations need to be added. For equitability and global conservation efforts, the sub-group emphasised the need for concerted efforts to distribute the locations more equally around the globe. The group commented on the original table presented at the SC69A, and in the upcoming year, will detail actions and assign those actions to volunteers to improve the table.

**Satellites image providers sub-group:** to establish nominated direct contacts of satellite image providers (nationally/internationally) for the Satellites to Study Whales community (page 21, Annex T; IWC, 2023). The group concluded that contacting the generic sales email will be the best option to escalate communication to the appropriate contact.

**Letter to satellite image providers sub-group:** to send a letter to satellite image providers, requesting support in; facilitating access to satellite imagery; developing licensing agreements to facilitate data sharing; using unique image identifiers to enable multiple groups to access the same image; and detailing collective research questions and a list of candidate areas for speculative tasking, particularly over open ocean areas (page 21, Annex T; IWC, 2023). A previous satellite image provider employee reviewed a draft letter, and advised the group review their approach. This recommendation will be reviewed collectively at the ICG's next workshop to evaluate and agree on an approach.

**Best practice: SMM workshop sub-group:** to continue to refine the use of very high-resolution satellite imagery to study whales, by holding a best practice workshop. The co-convenors submitted an abstract to SMM (awaiting news of acceptance). To ensure diverse voices and those actively engaged in using satellites to study whales are present in the best practice discussion, the co-convenors are exploring funding opportunities and seek the IWC's support.

The ICG requests that it may be re-established so that it may continue its work in the 2024-26 biennium.

## Introduction

The 'Satellites to Study Whales' ICG's main objectives are:

- coordination of information, data, and code sharing among research groups conducting active research on the use of optical satellite images to monitor whales;
- facilitating the development of automated methods;
- avoiding duplication of effort; and
- negotiating better tasking opportunities with satellite imagery providers.

Following a virtual meeting, convened on the 20-21 March 2023, the ICG proposed several recommendations targeted at; the Secretariat (S); the Scientific Committee (SC); the SH workplan (via the ICG Satellites to Study Whales); satellite image providers (I); and National Governments (NG); presented and endorsed at the SC69A meeting in 2023 (IWC, 2023).

## Update

Since SC69A, the ICG has begun working towards fulfilling these recommendations including; compiling links to datasets; prioritising candidate areas; drafting a letter to satellite image providers for support; and planning a workshop to develop best practices.

### 1. 'Database' sub-group

Accessible datasets will be vital to support international collaboration and to transform the development of automation techniques necessary for scaling up the application of satellites to study whales. As the field progresses, it is important from the outset that the group establish a standardised approach to publishing data, which centralises multiple international data repositories. A sub-group was created to focus on the recommendation requesting, 'the Secretariat's and Adhoc Working Group on Databases (GDR) support, for the IWC to publish a summary table on the IWC webpage, containing links to where annotated datasets of whales in satellite imagery are stored' (page 23, Annex T; IWC, 2023). The sub-group met online several times and devised the following options:

- 1) encourage holders of datasets to submit their metadata to MEDIN (<https://medin.org.uk/>), and export an xml file that could be linked to a webpage on the IWC website. MEDIN is a data standard and well established. However, to proceed with this option, it may require a budget proposal and IWC support, to create the webpage to host all the xml files. Furthermore, additional clarity is needed on how such xml files would be linked to an IWC webpage.
- 2) the sub-group create a table with a list of all the datasets they are aware of, which would be uploaded on an IWC webpage (see Table 1 for an example), similar to the catch data table (<https://iwc.int/management-and-conservation/whaling/total-catches>). This option would be faster and more cost effective, as there are currently less than ten such datasets. However, in the long term as more datasets are created, this option might not be suitable, as searching such a table may become inefficient.

Discussions between the sub-group, the IWC, and Adhoc Working Group on Databases (GDR) are ongoing to decide which option to choose.

### 2. 'Priority Places' sub-group

In its initial meeting, the ICG identified several challenges to studying whales in satellite imagery including; the costs of purchasing satellite imagery; the limited archival data available over open oceans and for specific events in space and time for strandings; and the lack of training data to achieve machine learning. The ICG compiled a list of candidate areas, for both live and stranded

cetacean monitoring, to share with satellite image providers (Table 1, Annex T; IWC, 2024) for speculative tasking (proactively collecting imagery of an area of interest for a future project, ahead of financial exchange), with the aim of increasing available archival repositories. The ICG recommended further work be actioned to finalise the list of important candidate areas, before presenting to satellite image providers (page 21, Annex T; IWC, 2023). A 'Priority Places' sub-group was established with the objective of reviewing the list of places developed in the first workshop to; (1) rank the locations in order of priority (acknowledging that satellite image providers may only be able to accept a limited number of locations); and (2) consider if further locations need to be added.

To facilitate the participation of sub-group members across various time zones, two initial meetings were held on the 7<sup>th</sup> and 11<sup>th</sup> December 2023. Members discussed the original table, identifying a bias in the proposed locations, which sees areas around the globe with little to no representation, while other areas had several proposed sites. For equitability and global conservation efforts, the sub-group emphasised the need for concerted efforts to distribute the locations more equally around the globe. Moreover, the sub-group identified that some locations were missing information such as; an area of interest (AOI) shapefile; the value of the area; and a reference. The sub-group considered it a priority to ensure the table was complete before considering the exercise to prioritise locations. To prioritise the list, the members proposed it would be valuable to discuss each location and how its study could benefit different areas of interest across the research community. For example; monitoring known populations; informing policy to address threats such as collisions; discovering new calving/breeding and feeding grounds or migration routes; improving automated detection workflows; and monitoring stranding events. The sub-group identified additional guiding criteria, which they aim to give further consideration to in the prioritisation exercise, which include incorporating; the IWC's objectives; and identifying Important Marine Mammal Areas (IMMAs). In view of these observations, the sub-group organised its work in three steps:

- 1) making improvements to the table, by commenting on; which fields could be changed, added, or removed; and other observations on the table itself;
- 2) with the table improved, add locations where particular deficiencies were noticed including; locations aligned with IWC priorities; IMMAs; and areas of the world without representation, etc.;
- 3) reaching a consensus on a method for ranking locations and performing the ranking exercise.

The sub-group has been working towards step one and the period for adding comments to the table has now finished. In the upcoming year, the sub-group will review the comments to detail actions and assign those actions to volunteers to improve the table. The sub-group resolved to continue its immediate work via email, after step 1 is complete, the sub-group will proceed with steps 2 and 3.

### 3. 'Satellite Image Providers' sub-group

To negotiate better tasking opportunities with satellite image providers and to encourage equitable access to imagery the group must build relationships with satellite image providers. The 'Satellite Image Providers' sub-group was created to address the recommendation to establish nominated direct contacts of satellite image providers (nationally/internationally) for the Satellites to Study Whales community (page 21, Annex T; IWC, 2023). Following an initial meeting held 11<sup>th</sup> January 2024, the group identified the need to list prior known contacts within the ICG, detail the contact information of the representatives of the satellite image providers in attendance at the ICG's first workshop, and check the literature for upcoming satellite providers. After consultation with a previous satellite provider employee and further deliberation of the dynamic nature of employment

at these companies and different national level contacts, the group concluded that contacting the generic sales email will be the best option to escalate communication to the appropriate contact.

#### 4. 'Letter to satellite image providers' sub-group

The ICG requested the Secretariat send a letter to satellite image providers, requesting support in; facilitating access to satellite imagery; developing licensing agreements to facilitate data sharing; using unique image identifiers to enable multiple groups to access the same image; and detailing collective research questions and a list of candidate areas for speculative tasking, particularly over open ocean areas (page 21, Annex T; IWC, 2023). Following the draft of a letter, the ICG co-convenors met with a previous satellite image provider employee to review and advise on the letter. The contact identified the letters current approach of colonial science and equitability to directly criticise commercial satellite image providers business models. Such an approach may lead to damaged relationships and uncooperativeness. While satellite image providers will support ethical projects, there needs to be short or long-term financial gain for providers to encourage cooperation. The contact encouraged the ICG to revise its approach and agree on the aims of the letter. While the group may consider continuing with the equitability narrative with the aim to encourage discussion of a company's business model, the contact suggested three alternative approaches the group may wish to consider:

1. approach providers with clearly defined quotes, framing it as market research with the aim of buying a service, to encourage competing companies to lower their prices;
2. ask providers to create a server to analyse imagery on the community's behalf. Whereby the community shares its models for the companies to run analyses and in return the companies support the group with free/facilitated cost imagery;
3. developing a proposal to build a 'satellite to study whales' satellite or purpose-built sensors (like a cubesat) that works for the ICG's scientific questions.

Several grant applications and initiatives like Airbus's 'Connected Conservation: Satellites for Biodiversity' form a framework that could benefit the community. The group could encourage the providers to develop similar initiatives welcoming proposals from this group. This recommendation will be reviewed collectively at the ICG's next workshop to evaluate and agree on our approach.

#### 5. Best practice: SMM workshop

To continue to refine the use of very high-resolution satellite imagery to study whales, the group is working towards the recommendation to hold a best practice workshop (summarised in a published guidance paper made available on the IWC website) to establish:

- standardised protocols for the data format required for training data;
- what information to include at publication;
- standardised definitions of each certainty category;
- standardised development (annotating whales and environmental conditions in satellite imagery) and sharing of training data;
- common code to automate the detection of whales in satellite imagery;
- standardised AI performance terminology, translated for non-AI specialists;
- the level of accuracy required for AI models compared to a manual observer; and
- decision matrix to assist the community in determining whether satellites, aerial, or vessel surveys are most appropriate to a research question and region of interest.

The ICG co-convenors met with the Scientific Committee (SC) Vice Chair to discuss funding opportunities to host a best practice workshop and to ensure diverse participation. To follow on from the work of the ICG's first workshop, the co-convenors proposed to the group to hold a best practice workshop at the upcoming Society of Marine Mammalogy (SMM) Conference 2024, in

Perth, Australia. The co-convenors met to discuss the workshop concept, corresponded with SMM on the costs of hosting a workshop and submitted an abstract to SMM (now awaiting news of acceptance). To ensure diverse voices and those actively engaged in using satellites to study whales are present in the best practice discussion, the co-convenors continue to explore funding opportunities.

#### 6. References

IWC 2023. 2023 Scientific Committee Report: Annex T Report of the Intersessional Correspondence Group 'Satellites to Study Whales'.

1 Table 1. Example of a table listing all existing datasets with whale annotations that may be useful for training automated detection system

DATASET NAME	ACCESS	SPECIES	ANNOTATION TYPE	ANNOTATION FORMAT	IMAGERY TYPE	SPATIAL RESOLUTION	RELATED REFERENCE
Unnamed	Contact corresponding author: saakshikpr28@gmail.com		Unknown	Unknown	Aerial and satellite	≤ 50 cm	Kapoor, S., Kumar, M., & Kaushal, M. (2023) Deep learning based whale detection from satellite imagery. <i>Sustainable Computing: Informatics and Systems</i> <b>38</b> : 100858. <a href="https://doi.org/10.1016/j.suscom.2023.100858">https://doi.org/10.1016/j.suscom.2023.100858</a>
Whales from Space Database	<a href="https://data.bas.ac.uk/full-record.php?id=GB/NERC/BAS/PDC/01482">https://data.bas.ac.uk/full-record.php?id=GB/NERC/BAS/PDC/01482</a>	<i>Megaptera novaeangliae</i> ; <i>Eubalaena australis</i> ; <i>Balaenoptera physalus</i> ; <i>Eschrichtius robustus</i>	Point and box shapefiles	.shp	Satellite	30 and 50 cm	Cubaynes, H.C., Fretwell, P.T. (2022) Whales from space dataset, an annotated satellite image dataset of whales for training machine learning models. <i>Scientific Data</i> <b>9</b> , 245. <a href="https://doi.org/10.1038/s41597-022-01377-4">https://doi.org/10.1038/s41597-022-01377-4</a>
Whales from Space Database: Image chips	<a href="https://data.bas.ac.uk/full-record.php?id=GB/NERC/BAS/PDC/01592">https://data.bas.ac.uk/full-record.php?id=GB/NERC/BAS/PDC/01592</a>	<i>Megaptera novaeangliae</i> ; <i>Eubalaena australis</i> ; <i>Balaenoptera physalus</i> ; <i>Eschrichtius robustus</i>	Images chips	.png	Satellite	30 and 50 cm	Cubaynes, H.C., Fretwell, P.T. (2022) Whales from space dataset, an annotated satellite image dataset of whales for training machine learning models. <i>Scientific Data</i> <b>9</b> , 245. <a href="https://doi.org/10.1038/s41597-022-01377-4">https://doi.org/10.1038/s41597-022-01377-4</a>
S1 Database	<a href="https://doi.org/10.1371/journal.pone.0254380.s002">https://doi.org/10.1371/journal.pone.0254380.s002</a>	<i>Delphinapterus leucas</i>	Table with coordinates	.csv	Satellite	30 cm	Charry, B., Tissier, E., Iacozza, J., Marcoux, M., Watt, C.A. (2021) Mapping Arctic cetaceans from space: A case study for beluga and narwhal. <i>PLOS ONE</i> <b>16</b> (8): e0254380. <a href="https://doi.org/10.1371/journal.pone.0254380">https://doi.org/10.1371/journal.pone.0254380</a>
S2 Database	<a href="https://doi.org/10.1371/journal.pone.0254380.s003">https://doi.org/10.1371/journal.pone.0254380.s003</a>	<i>Monodon monoceros</i>	Table with coordinates	.csv	Satellite	30 cm	Charry, B., Tissier, E., Iacozza, J., Marcoux, M., Watt, C.A. (2021) Mapping Arctic cetaceans from space: A case study for beluga and narwhal. <i>PLoS ONE</i> <b>16</b> (8): e0254380. <a href="https://doi.org/10.1371/journal.pone.0254380">https://doi.org/10.1371/journal.pone.0254380</a>
31cmAerialImagery.zip	<a href="https://zenodo.org/records/3356970">https://zenodo.org/records/3356970</a>	<i>Balaenoptera acutorostrata</i>	Image chips	.png	Aerial	30 cm	Borowicz, A., Le, H., Humphries, G., Nehls, G., Höschle, C., Kosarev, V., et al. (2019) Aerial-trained deep learning networks for surveying cetaceans from satellite imagery.

*PLoS ONE* **14**(10): e0212532.  
<https://doi.org/10.1371/journal.pone.0212532>

Supplementary dataset 3	<a href="https://static-content.springer.com/esm/art%3A10.1038%2Fs41598-019-50795-9/MediaObjects/41598_2019_50795_MOESM4_ESM.csv">https://static-content.springer.com/esm/art%3A10.1038%2Fs41598-019-50795-9/MediaObjects/41598_2019_50795_MOESM4_ESM.csv</a>	Unknown	Table with coordinates	.csv	Aerial and satellite	≤ 50 cm	Guirado, E., Tabik, S., Rivas, M.L. <i>et al.</i> (2019) Whale counting in satellite and aerial images with deep learning. <i>Scientific Report</i> <b>9</b> , 14259. <a href="https://doi.org/10.1038/s41598-019-50795-9">https://doi.org/10.1038/s41598-019-50795-9</a>
Supplementary dataset 5 (A, S)	<a href="https://static-content.springer.com/esm/art%3A10.1038%2Fs41598-019-50795-9/MediaObjects/41598_2019_50795_MOESM6_ESM.csv">https://static-content.springer.com/esm/art%3A10.1038%2Fs41598-019-50795-9/MediaObjects/41598_2019_50795_MOESM6_ESM.csv</a>	Unknown	Table with coordinates	.csv	Aerial and satellite	≤ 50 cm	Guirado, E., Tabik, S., Rivas, M.L. <i>et al.</i> (2019) Whale counting in satellite and aerial images with deep learning. <i>Scientific Report</i> <b>9</b> , 14259. <a href="https://doi.org/10.1038/s41598-019-50795-9">https://doi.org/10.1038/s41598-019-50795-9</a>