



# SCIENTIFIC COMMITTEE WORKING GROUP ON ABUNDANCE ESTIMATES

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*Online*

## REPORT

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## REPORT

The Working Group on Abundance Estimates (AEWG) held an online meeting on 16 September 2026, chaired by Daniel Pike. The aim of the meeting was to prepare for the upcoming AEWG meeting on 26–27 October in Copenhagen, including receiving updates on the identification of duplicate records and resightings in non-target species data from the North Atlantic Sightings Surveys (NASS) 2024 project.

### 1 REVIEW OF DUPLICATE IDENTIFICATION PROCEDURES FOR NON-TARGET SPECIES

Philip Hammond provided the background for the work and Stine Petersen presented the algorithmic approach developed. The development of an automated approach to identifying observations as duplicates or resightings had been proposed several times in the context of NASS 2024. During the processing of pilot whale data from the Faroese and Icelandic shipboard surveys in 2025, some of the duplicate/resighting allocations required checking and correction. Doing this manually was feasible, as there was a limited number of pilot whale observations. In the context of non-target species, with a considerably higher number of observations, the work focused on developing an algorithmic approach applied to the available data to assign resightings and duplicates prior to the calculation of abundance estimates. Feedback was requested on the methodology. The potential application of this approach to data for other species was also raised for consideration.

#### *Summary*

To help maximise the ability to determine duplicates accurately for double-platform ship line transect surveys, an algorithm was developed that compares the data for each pair of sightings and predicts whether they are unique sightings, duplicates (sightings of the same group from different observation platforms) or resightings (sightings of the same group from the same observation platform). Error was incorporated by constructing an ellipse around each position using angle error on one axis and radial distance error on the other. The protocol tested angle errors of  $\pm 10^\circ$ ,  $20^\circ$ , and  $30^\circ$  and radial distance errors of  $\pm 20\%$ ,  $40\%$ ,  $60\%$ , and  $80\%$ , giving 12 error combinations. The amount of overlap between pairs of ellipses indicated the likelihood that two sightings represented the same group:  $\geq 25\%$  classified as P (probably the same group),  $>0\%$  but  $<25\%$  as U (unlikely), and  $0\%$  as NA (definitely not the same group). All Probable (P) duplicates and resightings were accepted and clusters were constructed to identify sightings with multiple resightings (including duplicates). Only sightings of the same species group, same transect (sample.label), on the same date, and within 30 minutes of each other were compared.

The protocol was run for two species to illustrate the results of the method: northern bottlenose whale and humpback whale. For northern bottlenose whale, uncorrected abundance varied little across scenarios (32,657–37,140), while corrected estimates were substantially higher for all 20% radial distance errors and for  $10^\circ/40\%$  errors (211,000–463,000) than for other combinations (80,000–116,000). Effective  $g(0)$  was higher for lower corrected estimates, with values of 0.31–0.39 for the larger error combinations. For humpback whale, uncorrected estimates were generally similar (9,283–10,892), except for the  $80\%$  radial distance and  $20^\circ/30^\circ$  angle with  $60\%$  radial distance scenarios (5,323–8,190). Corrected estimates were highest for all 20% radial distance errors (78,000–94,000), intermediate for 40% radial distance errors and the  $10^\circ/60\%$  combination (40,000–57,000), and lowest for larger error combinations (22,000–29,000). Effective  $g(0)$  was generally higher for lower estimates, with values of 0.27–0.31 for the lowest estimates from larger error combinations, except for the  $30^\circ/80\%$  scenario (0.19).

## Discussion

The WG thanked Petersen and Hammond for undertaking this substantial body of work and for their continued efforts to adapt the analyses. The WG recognised the significance of developing an automated approach to duplicate identification, following discussions of this objective over several years.

The choice of the 30-minute window within which to identify potential duplicate sightings was discussed. The threshold was introduced as a precautionary measure, rather than being based on a specific theoretical value. Sightings occurring approximately one hour apart had been identified as unlikely to represent resightings, given vessel movement during the intervening period. Members of the WG pointed out that the movement capacity of some species may allow animals to travel considerable distances over relatively short periods. The extent to which random animal movement should be incorporated into the uncertainty or error associated with the method was therefore raised as a consideration. At present, time was not incorporated into the methodology, as it has generally been considered of limited relevance when conducting this identification manually, including with previous NASS datasets.

The potential inclusion of vessel speed in the model was discussed, as the current approach uses only the vessel's location and bearing at the time of each observation. It was noted that fluctuations in vessel speed should have limited influence when applying the 30-minute cutoff threshold.

The algorithm in its current form used fixed levels of uncertainty around angle and distance measurements. The WG agreed, based on experience, that a fixed error level (of 20° or lower) is suitable for angle measurements. However, distance errors can vary considerably between observers, sea state, and the distance itself. Leaper et al. (2010) showed that measurement error does not necessarily vary in a linear fashion with distance, as might perhaps be expected; that is, more distant sightings may be more accurately recorded than sightings at a medium distance. It would be of interest to *investigate such differences and the appropriateness of different error thresholds in a dataset such as SCANS*, where the observer platforms are not independent and duplicates are assessed in the field by a dedicated observer. The commonly used manual approach to identifying duplicates and resightings does not employ fixed thresholds, but an ad hoc assessment for each record. The algorithmic approach is much more standardised, by comparison: it is based solely on the data and the application of user-determined levels of allowable error in angle and radial distance, and a threshold in overlap of error ellipses in space. As such, it should be considered for application to other datasets. The importance of *documenting the procedure used for manual identification of duplicate sightings* was also highlighted, to ensure that the approach is clearly described.

It was noted that, particularly in the Icelandic data, a substantial proportion of the effort did not follow the original survey design, and that some clusters of humpback whale sightings may have been associated with the ice edge near Greenland. It was clarified that all sightings were included to calculate detection functions, but, as for the pilot whale data (NAMMCO 2025), the irregular effort was excluded from the estimation of abundance.

The algorithmic approach resulted in relatively low effective  $g(0)$  values (corrected abundance divided by uncorrected abundance) for humpback whales (max. 0.31) compared to higher values (~0.7) reported from previous NASS. It was noted that the low number of duplicates was also evident in the manual identification of duplicates and therefore was not considered to result solely from the algorithm.

No clear data characteristics, such as observer-related factors, were identified to explain disparity between manually identified duplicates and those assigned by the algorithm. Some records appeared similar (in angle and distance) in the tabulated data, although their error ellipses did not necessarily overlap. Frequency plots of the Euclidean distance between duplicates could perhaps reveal underlying patterns. *Further discussion is required on how to assess differences between sets of duplicates/resightings assigned by the algorithm and those assigned manually in the original data.*

With regard to the impact of duplicate/resighting assignment by the algorithm on the resulting abundance estimates, a larger assumed error in angle and distance data tends to result in more duplicates and, consequently, lower corrected abundance estimates. However, such conservative estimates would not necessarily be more accurate, because the level of error is not known. It was suggested that abundance estimates could be calculated using both the algorithm-based and manually identified duplicate datasets, allowing comparison between the two approaches and with previous analyses.

The potential application of the same algorithm to the fin and minke whale datasets for the Faroe Islands and Iceland was proposed, given that both target and non-target species analyses will be reviewed at the upcoming in-person AEWG meeting. The WG **agreed** but, due to the work still needed to analyse all non-target species, algorithm-derived estimates may not be available for the upcoming meeting.

During this discussion, *several issues in the underlying dataset were mentioned, which require the original data holders to check and resolve*. This is particularly important to investigate for observations marked *D* or *R* (duplicate or resighting) but which have with no linked pair in the dataset. It was stressed that the original dataset should not be corrected beyond such obvious errors, so that the manual identification of duplicates/resightings is not influenced post hoc. *Copies of the original (uncorrected) datasets should always be retained, and corrected ones should be accompanied by clear annotations as to the changes made.*

As an immediate next step, it was agreed that Petersen should flag any obvious issues identified in the Icelandic data for review by Guðjón Már Sigurðsson (Icelandic data holder), given the limited time available to assess the full datasets. Bjarni Mikkelsen (Faroese data holder) will assess the full Faroese datasets. Petersen will also run the algorithm on the pilot whale data and compare the resulting abundance estimate with the previously endorsed estimate.

The need to progress towards *reliable* abundance estimates was emphasised, even if this requires additional time. Algorithm-derived abundance estimates for all non-target species should be prepared for the October meeting. If the underlying data issues cannot be resolved in time, these estimates will be subject to some error; however, uncorrected estimates should be affected less than corrected estimates. The choice of threshold for the percentage overlap in error ellipses for sighting pairs should be investigated with a *sensitivity analysis* and discussed further at the in-person AEWG meeting.

## 2 STATUS OF THE FAROESE-ICELANDIC FIN AND MINKE WHALES ANALYSIS

The minke whale analysis of the Faroese and Icelandic NASS 2024 components was reported as completed, with the fin whale analysis expected to be ready for the upcoming meeting. It was noted that *some adjustments to the datasets may be required and Sigurðsson should be informed.*

## 3 CONSIDERATIONS FOR THE NEXT WG MEETING

The agenda for the upcoming meeting of the AEWG on 26–27 October was discussed. Abundance estimates for several non-target species should be available for review, based on the Faroese-Icelandic datasets, and following the discussion above (Item 1). Non-target species observations from the Norwegian survey components are being analysed separately and may not be reviewed by the AEWG at this meeting.

## 4 REPORT ADOPTION AND MEETING CLOSE

The Chair thanked participants for their contributions, especially Petersen and Hammond for their significant work, and looked forward to the next meeting. Garagouni and Rappin were thanked for rapporteuring, and Pike was commended for his able chairing.

The report was adopted by correspondence on 14 October 2026.

## 5 REFERENCES

- Leaper, R., Burt, L., Gillespie, D. Macleod, K. (2010). Comparisons of measured and estimated distances and angles from sightings surveys. *Journal of Cetacean Research and Management*, 11(3), 229–237. <https://doi.org/10.47536/jcrm.v11i3.602>
- NAMMCO (2025). *Report of the Working Group on Abundance Estimates* (NAMMCO/SC/AEWG/2025-03). NAMMCO-North Atlantic Marine Mammal Commission. Tromsø. Norway. 29 pp. [https://nammco.no/wp-content/uploads/2025/11/report\\_aewg\\_2025-03.pdf](https://nammco.no/wp-content/uploads/2025/11/report_aewg_2025-03.pdf)

## **APPENDIX 1: AGENDA**

### **1. Welcome from the Chair**

- 1.1. Adoption of agenda
- 1.2. Appointment of rapporteurs
- 1.3. Review of available documents

### **2. Review of algorithmic approach developed to identify duplicate sightings**

### **3. Status of the analysis of the Icelandic and Faroese fin and minke whales NASS data**

### **4. Considerations for the meeting of the WG on 26-27 October in Copenhagen**

- 4.1. IS&FO non-target species to be analysed by S&P
- 4.2. Status of NO non-target species
- 4.3. Review of October agenda, incl. list of non-target species to be reviewed
- 4.4. Any other issues

### **5. Meeting close**

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## APPENDIX 3: LIST OF DOCUMENTS

| Document Reference       | Title                                                                                                  | Agenda Item |
|--------------------------|--------------------------------------------------------------------------------------------------------|-------------|
| <b>Working Documents</b> |                                                                                                        |             |
| SC/33/AEWG/2026-01/01a   | Draft Agenda                                                                                           | 1           |
| SC/33/AEWG/2026-01/01b   | Draft List of Participants                                                                             | 1           |
| SC/33/AEWG/2026-01/01c   | Draft List of Documents                                                                                | 1           |
| SC/33/AEWG/2026-01/02    | Testing a methodology to determine duplicate sightings from NASS-24 Icelandic and Faroese ship surveys | 2           |
| SC/33/AEWG/2026-01/03    | Sighting data and the classification information for each scenario for Northern bottlenose whale       | 2           |
| SC/33/AEWG/2026-01/04    | Sighting data and the classification information for each scenario for Humpback whale                  | 2           |
| SC/33/AEWG/2026-01/05    | Minke whale abundance from Iceland-Faroes NASS 2024                                                    | 3           |
| SC/33/AEWG/2026-01/06    | Proposed Agenda for October AEWG meeting                                                               | 4           |