SCIENTIFIC COMMITTEE
WORKING GROUP ON DOLPHINS

October 30 – November 2, 2023
Greenland Representation in Copenhagen, Denmark

REPORT

Presented to the 30th Meeting of the Scientific Committee as NAMMCO/SC/30/07

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NAMMCO

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EXECUTIVE SUMMARY

The NAMMCO Working Group on Dolphins (DWG) met at the Greenland Representation in Copenhagen (Denmark), from 30 October to 2 November 2023. The meeting was chaired by Philip Hammond (University of St Andrews, UK). This was the first meeting of the working group (WG), which was convened following recommendations from the WG on Harbour Porpoise (HPWG) in 2022, and initial assessments of *Lagenorhynchus* (white-beaked and white-sided) dolphins were conducted.

The *Terms of Reference* for this meeting were:

a) Conduct an assessment of the sustainability of the removals of Lagenorhynchus dolphins in the Faroe Islands, Iceland, and Greenland.

b) Review available information in other areas and identify knowledge gaps and needs for further research.

c) Assess impacts from non-hunting related anthropogenic stresses (pollution, climate change, noise etc).

NAMMCO 30 (March 2023) added a standard term of reference for all working groups conducting stock assessment, namely:

d) Recommend the suitable regularity of abundance surveys and assessments for each specific case (species/stock).

Summary of previous recommendations

The research recommendations for the Faroe Islands, Iceland, and Greenland made at the 2022 HPWG meeting were reviewed and updates on their status are provided in the main report.

Assessment of white-sided dolphins

Stock identity

Extensive genetic evidence indicates that there is no population structure across the entire Northeast Atlantic, suggesting that a highly connected (panmictic) population of white-sided dolphins inhabits the waters of the central and eastern North Atlantic. Tagging of white-sided dolphins in the Faroe Islands provides further support for this; tagged individuals from the same group separated from each other and some travelled long distances towards Iceland and Greenland. The WG therefore agreed to consider the entire central and eastern North Atlantic as a single assessment unit.

Biological parameters

Information on age, growth, and reproductive parameters of white-sided dolphins was derived from data collected from animals taken in the traditional drive hunt in the Faroe Islands over several years. Mean age was estimated at 7.4 and 8.6 years for females and males, respectively. Males were generally larger, with maximum length around 250 cm and a maximum weight of 236 kg, while females reached maxima of around 220 cm and 180 kg. Median ages at sexual maturity were 7 years for females and 5.6 years for males. The annual pregnancy rate was 0.23, giving a calving interval of 4.4 years. Parturition likely occurs shortly after midsummer. The WG noted an under-representation of young animals (up to 2 years) and older females in the dataset, which could result from underreporting, not targeting those animals during drives, or from these cohorts not being available to the drive hunt.

Abundance estimation

Abundance estimates of white-sided dolphins from recent surveys in the central and eastern North Atlantic (NASS, SCANS, CODA, ObSERVE), as well as their potential biases, are presented in detail under item 5.3. Estimates for the central and eastern North Atlantic assessment unit for 2007 and 2015/16 were generated by summing estimates from European waters from 2007 and 2015/2016 to those from Iceland and Faroes NASS in 2007 and 2015.

Removals, including by-catch

The Faroese drive hunt provides catch statistics dating back to 1872, but the WG agreed that the data cannot be considered reliable prior to 1986. Catches have increased during the last 40 years, accounting for 72% of all recorded catches. The greatest harvest occurred between 1993 and 2006, averaging 356 animals per year; subsequently, the annual average has dropped to 122 dolphins. There was one exceptional drive event in 2021 that landed 1,423 dolphins. Group size has fluctuated considerably, but most drives (74%) have recorded groups of 50 animals or fewer. High season is July–October, with drives peaking in September. However, the worse weather conditions during winter months confound any evidence of seasonal movements within and around the area.

Prior to 2021, hunting records from Greenland did not distinguish between white-sided and white-beaked dolphins, as both species had the same common name. However, given the lack of white-sided dolphin sightings during Greenlandic surveys and their almost complete absence from sampled catches, it is presumed that all or most records refer to white-beaked dolphins; these are considered under item 6.4.

By-catch of white-sided dolphins has not been documented in Icelandic fisheries (with the exception of three individuals which were identified genetically *post hoc*). In Norwegian fisheries, by-catch records seldom distinguish between the two *Lagenorhynchus* species, so it is difficult to estimate separate by-catch levels for each; however, as for Greenland, it is assumed that all or most records refer to white-beaked dolphins (see item 6.4).

Impacts from other anthropogenic stressors

There is limited information on impacts of anthropogenic stressors on white-sided dolphins. Persistent organic pollutants (POPs), including polychlorinated biphenyls (PCBs), are considered to present high toxicity risks for dolphins. POP levels measured in white-sided dolphins caught in the Faroe Islands are comparable to those found in pilot whales. It is currently difficult to predict what effect climate and environmental change will have on this species.

Population modelling and assessment

The WG used a Bayesian age-structured modelling framework to assess the sustainability of removals of white-sided dolphins. The models integrated abundance estimates for the Faroe Islands and Iceland, as well as age structure, survival, and reproductive parameters estimated from the Faroese catch data. A conservative model included only abundance estimates from NASS surveys, while a further model incorporated estimates from concurrent SCANS, CODA and ObSERVE surveys in European waters. The results of these models were validated using a time-to-event modelling approach, which resulted in similar predicted values of survival rates of younger animals and a birth rate of 0.3 needed to maintain a stable or increasing population. The conservative assessment model indicates a maximum removal of 750 animals per year in order to maintain a 70% likelihood of sustainable catches in the Faroe Islands. The WG noted that, with the exception of the unusually large catch in 2021, all recent annual drive records have been below 750 animals.

Assessment of white-beaked dolphins

Stock identity

Genomic data indicate population structure in white-beaked dolphins in the central and eastern North Atlantic, with one stock comprising animals from Iceland and northern Norway and a second stock spanning the North Sea, Britain, and Ireland. The stock identity of Greenlandic animals is unclear due to a lack of genetic or other information.

Biological parameters
There is little information available on biological parameters of white-beaked dolphins. Data from animals by-caught in Icelandic fisheries and landed in Greenlandic hunts will be processed prior to a future assessment of this species.

Abundance estimation
Observations from sighting surveys show a continuous distribution of white-beaked dolphins from Iceland to Greenland but a clear hiatus in distribution between northern Norway and Iceland (Figure 2a of the main report). Abundance estimates from aerial surveys around Greenland and Iceland were updated using a correction factor for perception and availability bias from SCANS surveys.

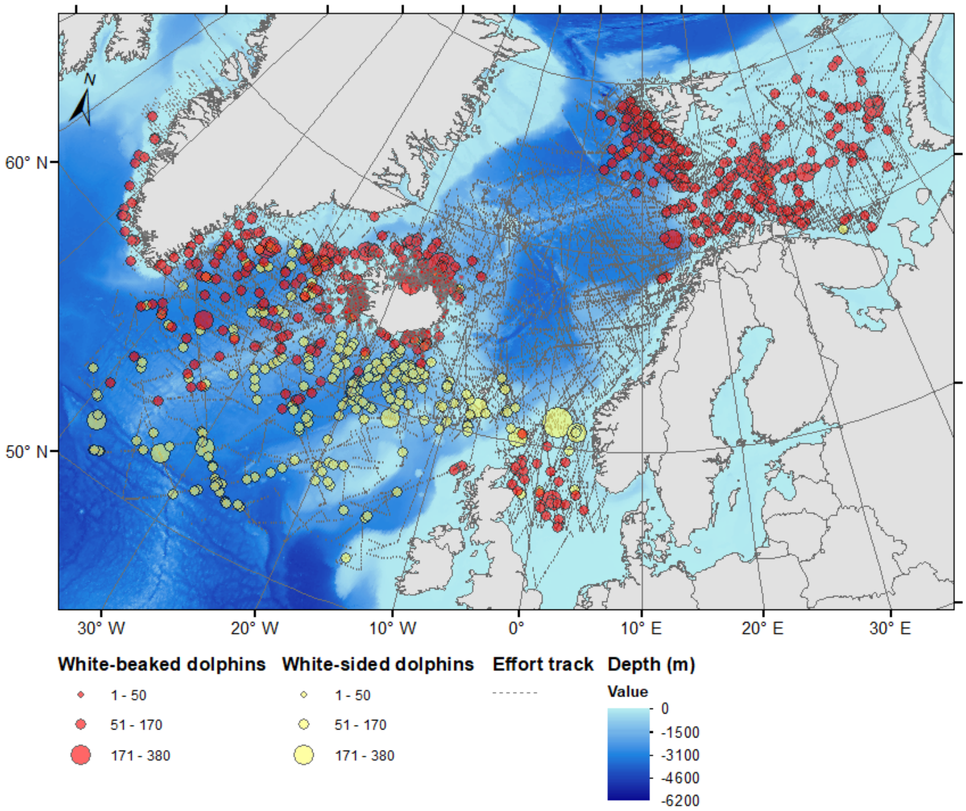

Figure 2a. Map of all sightings of white-beaked and white-sided dolphins compiled from NASS, NILS, and Greenlandic surveys from 1986 to 2016. Prepared by N. Ramirez-Martinez with data from Ramirez-Martinez (2021) and Houghton (2019).

Removals, including by-catch
Dolphin catches in Greenland fluctuate annually, ranging from tens of animals to 381 caught in 2020. The majority of catches are taken in Maniitsoq, West Greenland. Catches in Tasiilaq, Southeast Greenland have increased in recent years. There is considerable uncertainty around the total removal numbers due to unreported landings and animals that are struck and lost. For assessment purposes, and acknowledging the uncertainty around the available information, the WG corrected the reported catches by two factors: a multiplier of 2.42 for underreporting, based on a known ratio of sampled/reported catches from Tasiilaq in 2016, and a multiplier of 3.5 for struck and lost animals, estimated from a video of a hunt in Nuuk in 2020.

Data from Icelandic fisheries indicate an average annual by-catch of 18 *Lagenorhynchus*, which have consistently been recorded as white-beaked dolphins. However, in light of genetic evidence that white-sided dolphins occasionally also get by-caught in this area, these numbers should be reassessed. Data from Norwegian fisheries, dating back to 2006, indicate similarly low levels of *Lagenorhynchus* by-catch. Although these records are generally not separated by species, observations from sighting surveys suggest that all by-catches occurring in northern Norway can be assigned to white-beaked dolphins, while in southern Norway they likely pertain to both species (Figure 2a). Any issues with underreporting and drop-outs from fishing gear should be addressed before extrapolating to the entire fishing fleet.

Impacts from other anthropogenic stressors

Information on anthropogenic impacts on white-beaked dolphins is limited, but similar to that presented for white-sided dolphins.

Population modelling and assessment

Given the uncertainty around removal levels and stock identity of East and West Greenland white-beaked dolphins, the WG could not perform a full assessment, nor provide advice on sustainable removals. Instead, the WG conducted a simple preliminary assessment based on Potential Biological Removal (PBR) applied to two assessment scenarios: i) West Greenland assessed separately from East Greenland, Iceland and the Faroe Islands combined, and ii) Greenland (East and West), Iceland, and the Faroe Islands combined. In areas that included West Greenland, total estimated removals exceeded PBR; in West Greenland assessed separately, even the uncorrected reported catches exceeded PBR (Tables 4 and 5 of the main report). Acknowledging the large gaps in information, these calculations illustrate that the removals of white-beaked dolphins in Greenland may not be sustainable.

Table 5. Potential Biological Removal (PBR), and removal values in number of animals for white-beaked dolphin in Greenland (GL) and Iceland (IS). 95% confidence intervals for IS estimates in brackets. S&L is struck and lost animals.

	Scenario (i)		**Scenario (ii)**
	West Greenland	**East Greenland, Iceland, Faroe Islands**	**West Greenland, East Greenland, Iceland, Faroe Islands**
Survey year	2015	2015–2016	2015–2016
PBR	**31**	**1,621**	**1,662**
GL average annual reported catch (2019–2021)	262	50	312
GL reported catch corrected for underreporting (×2.42)	634	121	755
GL reported catch corrected for S&L (×3.5)	917	175	1,092
GL total estimated annual catch (corrected for S&L and underreporting)	2,219	424	2,643
IS estimated annual by-catch (2016–2019)	NA	18 (3–44)	18 (3–44)
Total removals	**2,219**	**442**	**2,661**
Sustainable removals (<PBR)	**No**	**Yes**	**No**

General Recommendations for white-sided and white-beaked dolphins

ALL COUNTRIES

Recommendations for research

- To deploy satellite tags on both white-sided and white-beaked dolphins, preferably in areas other than the Faroe Islands, to obtain more movement and dispersion data.
- To emphasise in the NASS 2024 protocols the importance of accurate species identification and to ensure that the NASS 2024 data be analysed to provide estimates of abundance in a timely fashion for white-sided and white-beaked dolphins.
- To obtain abundance estimates for white-sided and white-beaked dolphins from all NASS surveys prior to 2007.

NORWAY

Recommendations for research

- To validate the by-catch data from the reference fleets, including estimating drop-out rates, and to estimate total by-catch for relevant fisheries.

General Recommendations for white-sided dolphins

ALL COUNTRIES

Recommendations for conservation and management

- Considering the low levels of reported catch compared to the estimated population size, a new assessment might be conducted within the standard 5-year period, integrating the 2024 abundance estimate, full catch reporting, and validated age structure information.

FAROE ISLANDS

Recommendations for research

- To investigate if there is older (i.e., 1986–1992) existing biological material from the Faroe Islands that could be processed and analysed, and to continue collecting relevant samples to investigate reproduction parameters and age structure.
- To collect eye lenses to explore alternative age-determination methods.
- To investigate temporal patterns in strandings over a wider area to better understand seasonal movement patterns.
- To collect information from stranded animals, including age, length, and sex data.
- To program satellite transmitters to collect higher resolution dive data at shallow depths to allow aerial survey availability correction factors to be estimated.

Recommendations for conservation and management

- Based on the conservative assessment model, the most cautious approach for maintaining a 70% likelihood of sustainable catches is to maintain the Faroese catch levels below 750 animals per year.
- The prerequisite to any reliable population assessment is the existence of complete, validated, and accurate removal data. Therefore, the issue of underreporting of calves must be examined and every effort be made to ensure that full catch data are systematically reported.

General Recommendations for white-beaked dolphins

GREENLAND

Recommendations for research

- To analyse existing tissue samples from East Greenland (and West Greenland, if available), and to collect and analyse new samples from West Greenland to explore genetic connectivity across the North Atlantic, including in Europe and North America.
- To collect life history and age data from Greenland.
- To estimate the accuracy of the catch reporting system, if possible, and to obtain estimates of struck-and-lost rates to improve estimates of total removals.

Recommendations for conservation and management

As a **high priority**, Greenland is strongly recommended to:

- Validate the accuracy of reported dolphin removals;
- Implement a system ensuring that underreporting is minimised and can be estimated;
- Conduct an evaluation of the struck and lost rate for the hunt of dolphins, with the aim of estimating and reducing rates.

ICELAND

Recommendations for research

- To make existing and newly collected biological data (age and reproductive information) from Iceland available for the next assessment.

MAIN REPORT

The NAMMCO Scientific Committee Working Group on Dolphins (DWG) held its 1st meeting at the Greenland Representation in Copenhagen (Denmark) from October 30 to November 2, 2023. The Working Group (WG) was chaired by Philip Hammond (University of St Andrews, UK). The meeting agenda and list of participants are available in Appendix 1 and 2, respectively.

1. WELCOME FROM THE CHAIR AND OPENING REMARKS

Hammond welcomed the participants and called for a round of introductions. He then gave the background and explained the focus of the meeting as described in the Terms of Reference (ToR) established by SC29:

a) Conduct an assessment of the sustainability of the removals of Lagenorhynchus dolphins in the Faroe Islands, Iceland and Greenland.
b) Review available information in other areas and identify knowledge gaps and needs for further research.
c) Assess impacts from non-hunting related anthropogenic stresses (pollution, climate change, noise etc).

NAMMCO 30 (March 2023) added an additional ToR to the list, as a standard term of reference for all working groups conducting stock assessment, namely:

d) Recommend the suitable regularity of abundance surveys and assessments for each specific case (species/stock).

The list of meeting documents is available in Appendix 3. The species assessed in this meeting were white-sided dolphin and white-beaked dolphin (Figure 1).

Figure 1. *Lagenorhynchus* species assessed during this DWG meeting. *Left:* white-sided dolphin. *Right:* white-beaked dolphin.

2. ADOPTION OF AGENDA

The agenda (Appendix 1) was adopted without modification, except to add the common name to the scientific name of each species.

3. APPOINTMENT OF RAPPORTEURS

NAMMCO Deputy Secretary Maria Garagouni was appointed as the primary rapporteur, with assistance from NAMMCO Deputy Secretary Naima El bani Altuna and General Secretary, Geneviève Desportes, as well as other participants as necessary. Participants were asked to submit written summaries of presentations, and interventions on agenda items as needed.

4. REVIEW OF AVAILABLE DOCUMENTS AND REPORTS

4.1. UPDATES ON RECOMMENDED RESEARCH PROGRESS FROM MEMBER COUNTRIES

NAMMCO/SC/30/DWG/04 summarises the updates on recommendations for research progress in the Faroe Islands, Greenland, and Iceland. The Chair noted that several key points of information needed for a population assessment, as identified during the NAMMCO Scientific Committee Working Group on Harbour Porpoise, had been provided by each Member country.

4.2. SUMMARY OF EXISTING DATA IN NAMMCO COUNTRIES & ADJACENT AREAS

The existing data are discussed as needed under their relevant agenda items.

5. ASSESSMENT OF WHITE-SIDED DOLPHIN (*LAGENORHYNCHUS ACUTUS*)

5.1. STOCK IDENTITY

<u>Genetic data</u>

Marc-Alexander Gose presented findings relating to stock identity of Atlantic white-sided dolphins (*L. acutus*) in the NAMMCO region and beyond.

Summary:
NAMMCO/SC/30/DWG/08 presented a brief summary of past work, emphasising some data gaps and uncertainties in previous studies, especially in relation to fine-scale structure based on mitochondrial control region sequences. Next, the size and range of the samples of the most recent population genetic assessment conducted by Gose et al. (2023) was presented, highlighting the high coverage of samples around Scotland, Ireland, and the Faroe Islands, the lower coverage around Iceland and in the western North Atlantic, as well as a lack of samples for some other regions (namely Greenland and northern Norway). Based on a reduced representation sequencing approach and a large collection of openly accessible and newly generated mitochondrial control region sequences, Atlantic white-sided dolphins analysed in this study show a lack of population structure, both between the two sides of the North Atlantic coast as well as on finer scales within the central and eastern North Atlantic. The conclusion is that *L. acutus* in the central and eastern North Atlantic, and possibly across its entire range, represents a single panmictic or near-panmictic population. The generated sequences for the 93 analysed specimens have been deposited in an openly accessible sequence archive, allowing future studies to access the raw data and build upon them, e.g., to put samples collected in previously unassessed regions into a wider context and add to the species-wide assessment of genetic structure.

Discussion:
Because of the initial aims of this project, most of the samples originated in Scotland, so there may be an uneven distribution in the sample coverage. However, with the exception of the single sample from the western Atlantic (USA), the group agreed that the total number of samples and the combination of methods used render the findings robust. This is in contrast with previous smaller-scale studies that used mitochondrial DNA data, which found evidence of fine-scale structure around the UK and Ireland. The small sample size relative to overall abundance, especially from the western North Atlantic, is insufficient to allow a conclusion about whether or not there are distinct populations in the eastern and western North Atlantic. New data can be incorporated as they become available to increase sample size; Morten Tange-Olsen pointed to existing tissue samples from East Greenland that are being processed.

The WG discussed the implications of these findings for defining management units. Tange-Olsen and Lars Witting expressed concerns about using the entire Northern Atlantic basin based on genetics alone.

Telemetry data

Bjarni Mikkelsen provided an overview of distribution and movements of white-sided dolphins based on recent telemetry studies.

Summary:
NAMMCO/SC/30/DWG/13 noted that satellite transmitters, attached to the body of a marine mammal, can provide crucial insights into individual movement and behaviour, as well as species distribution and population structure. On six different tagging occasions, 23 Atlantic white-sided dolphins (*Lagenorhynchus acutus*) were fitted with satellite transmitters in the Faroe Islands. The tracks from the tagged dolphins were mostly over the continental shelf and slope areas. However, the data highlight the capacity of Atlantic white-sided dolphins to perform long-distance migrations maintaining a relatively high migration speed. On all six tagging occasions, the tagged dolphins had separated from each other only a few days after they had been released. This separation confirms the fluid social structure of the white-sided dolphin that has been suggested from genetic studies (Gose et al. 2023). The study shows that long-term tracking is an important and valuable tool for collecting data to improve understanding species habitat preferences and distribution, and for exploring pod and stock structure.

Discussion:
Mikkelsen pointed out that the short tag longevity was comparable to similar tagging efforts on other small cetaceans. The WG discussed potential explanations for this, including increased mortality of tagged animals as a result of either stress or infection, increased drag affecting the tags because of the relatively high average swimming speed of these dolphins, removal of the tag antenna by conspecifics, and tag failure. Based on information from other telemetry studies, tag failure seems to be the most likely explanation; there is very little evidence to support the other scenarios. Both infection and physical drag require a longer time to have a noticeable effect, and the animals are unlikely to have been dangerously stressed, as they returned to normal feeding patterns very shortly after being tagged.

The group also discussed whether the tracking data indicate seasonal movement patterns. There does not appear to be any conclusive evidence to support this, although there may be an indication that individuals target prey hotspots and remain in those areas as long as there is plentiful food. Indeed, individuals that moved towards East Greenland shortly after being tagged remained in that area for a prolonged period (including one carrying a tag that is still transmitting data at the time of the meeting), while other animals remained close to the Faroe Islands shelf for a longer time before undertaking directional movement towards a different area. The group agreed, however, that further investigation of seasonality is warranted, specifically in conjunction with the spatio-temporal patterns of catch and sighting survey data.

The WG noted that the sample size for this study is very small compared to the population size, but agreed that the findings provide information on movement patterns. The WG further noted that the tracks support the mixing of white-beaked and white-sided dolphins in the waters east of Greenland and southwest of Iceland, as indicated by sightings of both species from NASS (Figure 2). This is in contrast to other areas where sightings of the two species do not overlap.

The long-distance movements and splitting of groups seen in the telemetry data support the evident lack of a stable social structure presented by Gose (DWG/08). Such movement patterns indicate a high potential for reproduction across the central and eastern North Atlantic, explaining the high genetic connectivity observed.

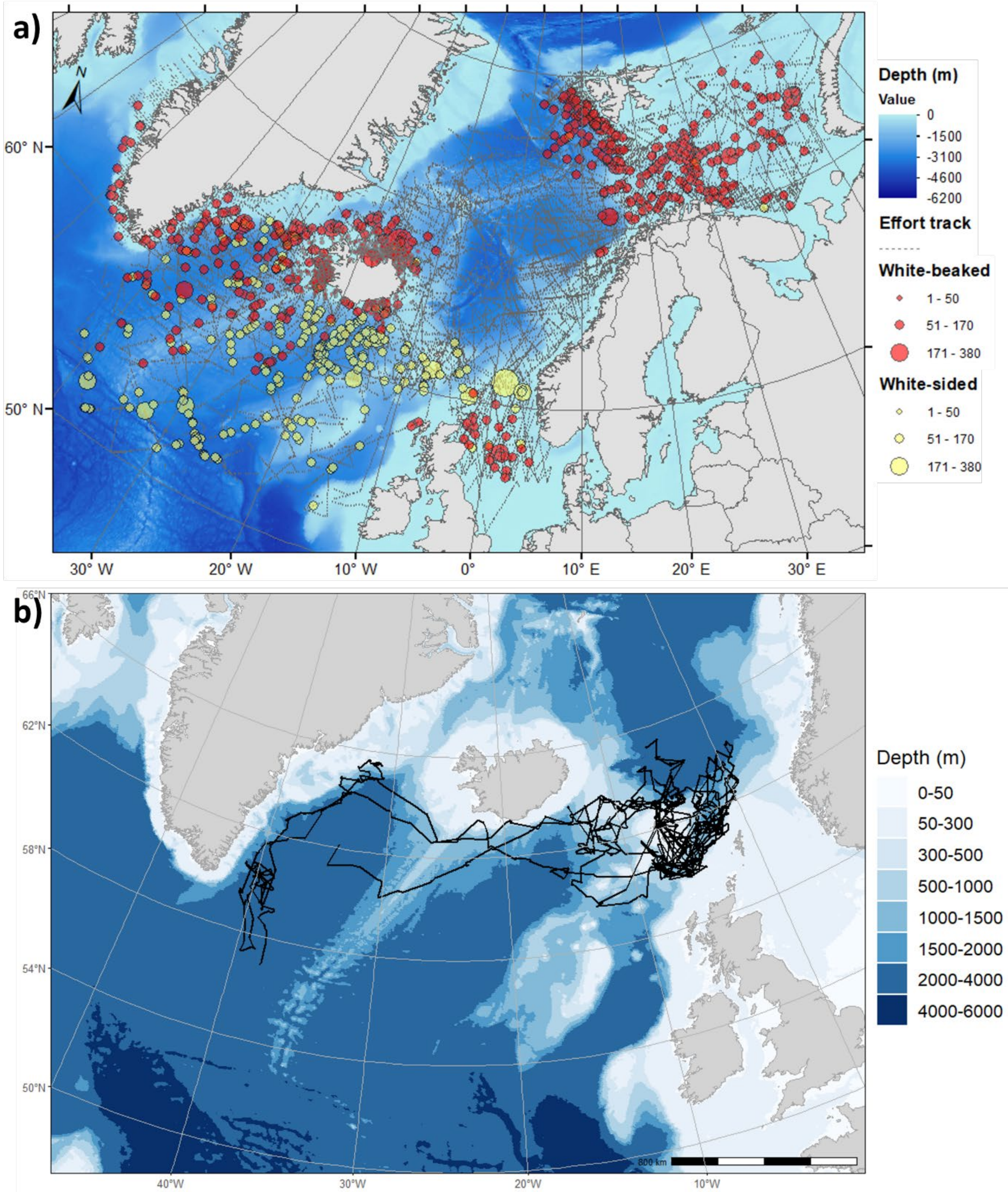

Figure 2. a) Map of all sightings of white-beaked and white-sided dolphins compiled from NASS, NILS, and Greenlandic surveys from 1986 to 2016. Prepared by N. Ramirez-Martinez with data from Ramirez-Martinez (2021) and Houghton (2019). **b)** Satellite tracks of 21 white-sided dolphins tagged in the Faroe Islands between 2009 and 2023.

Conclusion:

The genetic data presented showed no population structure across the central and eastern North Atlantic. This was further supported by the telemetry data presented.

5.2. BIOLOGICAL PARAMETERS

Mikkelsen summarised available information on biological parameters estimated from samples taken from the Faroese dolphin catches.

Summary:
NAMMCO/SC/30/DWG/12 presented data on age, growth, and reproductive parameters of Atlantic white-sided dolphins taken in the traditional drive hunt in the Faroe Islands. Most of the biological material was collected in August and September, when the hunt also peaks. Age was estimated from growth layer groups in the teeth, and was available for 208 females and 257 males, collected in 2001–2006 and 2021. From the age distribution it was evident that females aged 0 and 1 year were underrepresented in the aged material, that younger males were also underrepresented, and that age groups 15+ had small sample sizes. The underrepresentation of age groups 0 and 1 might be partly explained by the fact that the calves are harvested but not systematically integrated into the officially evaluated catch, due to their small size and meat value. From the official catch statistics, from 1996 to 2023, length data were available for 5562 white-sided dolphins, while weight data were recorded by the Faroe Marine Research Institute for 347 individuals. Female reproductive samples (143 animals) were examined for evidence of pregnancy and lactation, ovaries were weighed, and the number of *corpora* determined. Attainment of sexual maturity (A_{50}) for females was estimated to occur at an average age of 5.6 years, and at a body length and weight of 206 cm and 120 kg, respectively. Male age at sexual maturity (A_{50}) was estimated as 5.6 years, and at a body length and weight of 221 cm and 131 kg, respectively. The oldest female in the sample was 27 years, and maximum measured body sizes from the biological samples were 244 cm (from the official data 298 cm) and 180 kg. Ovulation rate was estimated to 0.37 year^{-1}. The total number of *corpora* increased with age. Estimated annual pregnancy rate was 0.23 (based on a gestation period from literature of 11 months) resulting in a calving interval of 4.4 years. Tiny and near-term foetuses were present in August and September; this indicates that parturition occurs in late summer, and also that breeding may occur in Faroese waters.

Discussion:
The WG noted that most animals in the dataset were mature by 10 years old, but that there were few dolphins older than 15 years old (Figure 3). Although the average age at sexual maturity was estimated to be 5–6 years, if these data are representative of the population, this would result in a narrow reproductive window for these animals. The WG noted that there were some data available on females with only one corpus in the ovary, indicating that these animals had only just become sexually mature. The age range for the first-time ovulators was 5–12 years, with a median of 7 years.

Despite having a fairly large sample size, the dataset appears to be missing some segments of the population. A possible explanation for the apparent lack of older animals could be limitations in the age-reading using teeth. The WG **recommends** that eye lenses be collected to provide samples to explore an alternative ageing method for white-sided dolphins, which may be able to verify whether the absence of older individuals in the sample was an artefact of the ageing technique.

An underreporting of calves in the first two years of life is suspected from the large catch of 2021. It is important to examine whether this was an exceptional event, perhaps due to the unusually large catch, or whether this is a systematic issue. The WG **recommends** that underreporting be examined and that every step be taken to ensure that full catch data are systematically reported. An alternative possible explanation for the lack of younger animals in the dataset could be the absence of those cohorts from the area. This might be linked to the lack of older females in the age data.

It was not possible to infer seasonality of movements; although the samples were not evenly spread across the year, the hunts do not occur as frequently in winter months. While some shore-based observations indicate that there may be fewer white-sided dolphins in the area in winter, there is no information on their winter movement patterns within and beyond Faroese waters.

Regarding the length and weight distribution of the measured individuals, males were longer and heavier than females of the same age. This marked sexual dimorphism is unusual for pelagic dolphins and raised questions about its underlying causes.

The apparent lack of older females in the age data could be due to these animals avoiding the drives or to females with calves staying away from Faroese waters (as the age data could suggest). Older research has suggested Ireland as a breeding area (Berrow & Rogan 1997), which could be consistent with the missing cohorts in the Faroese data. Strandings data from the UK and Ireland could be used to explore whether the missing age classes are found in habitats south of the Faroe Islands.

Another reason for the imbalanced age data could be that the data are skewed because they are exclusively derived from the hunt, which targets larger groups. If older female dolphins (and their calves) are more likely to occur in smaller groups, this could lead to their underrepresentation in the data. The atypical male biased sex ratio of 1.43:1 is consistent with the underrepresentation of older females in the dataset.

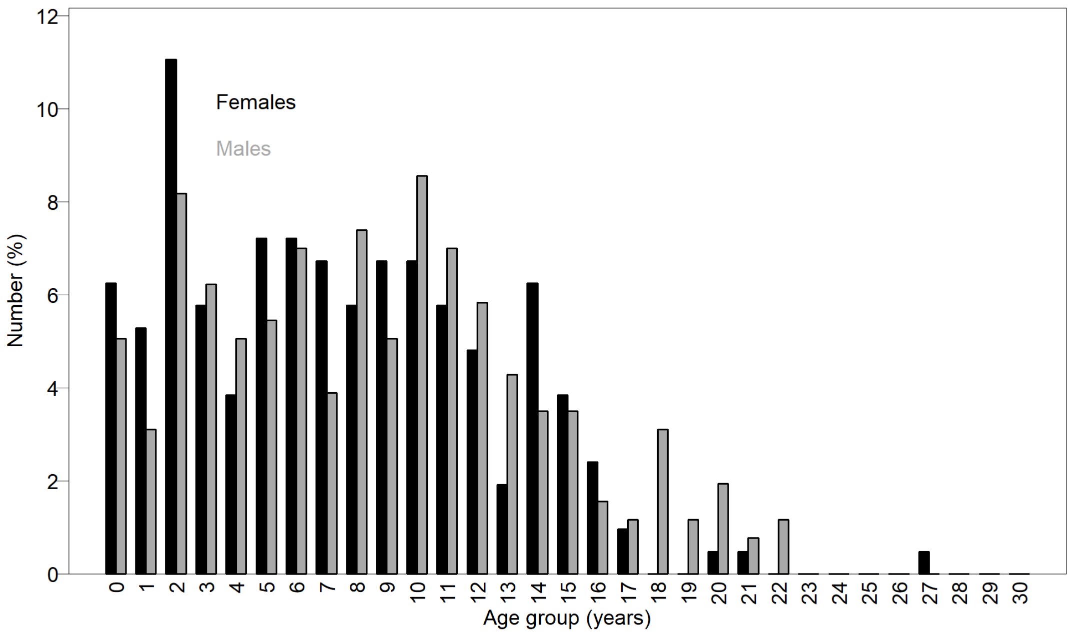

Figure 3. Age distribution by sex of white-sided dolphins caught in the Faroese drive hunt (N=208 females, 257 males).

The estimated average age at which females reach maturity was 5.6 years. The WG discussed that this estimate may vary depending on the chosen model. Matthieu Authier offered to explore alternative models to estimate age at maturity (discussed under item 5.6).

One in four mature females in the dataset was pregnant (a lower rate than expected based on the literature) and the proportion of pregnant-and-lactating females was unexpectedly high. This suggests that these dolphins may not undergo a resting period between calving events. However, the WG noted that the sample size for pregnant females was too small to draw robust conclusions about the reproductive cycle.

Conclusion:

The work presented provided estimates of the main biological parameters needed for assessment but there are concerns about the representativeness of the data relating to missing cohorts, temporal gaps, and skewed or small samples.

5.3. ABUNDANCE ESTIMATION

Abundance estimates in NAMMCO areas

Daniel Pike presented an overview of sightings surveys conducted by NAMMCO countries.

Summary:
NAMMCO/SC/30/DWG/06 summarised some recent surveys in the Central and Eastern North Atlantic, paying particular attention to the biases affecting the abundance estimates for both white-sided and white-beaked dolphins. The estimates (summarised in Table 1 of DWG/06) are published in NAMMCO Scientific Publications Vol. 11 (Hansen et al. 2019; Leonard and Øien 2019a, 2019b; Pike et al. 2020; Pike et al. 2019a; Pike et al. 2019b). Dolphins were a low priority for these surveys, and this influenced the amount of effort dedicated to species identification and obtaining accurate group sizes. White-sided and white-beaked dolphins can be difficult to differentiate at sea from ships, and the data from all surveys contain a relatively high proportion of uncertain species identification, with some sightings identified to the generic level only. For the Norwegian surveys, this means that only generic level estimates have been developed, while generic sightings were allocated to species by observed proportion in some Icelandic and Faroese ship surveys. While this may not necessarily introduce bias, it is an unaccounted source of variance. In most areas, the distribution of the two species is distinct, with white-beaked dolphins being more common in coastal and northern areas, and white-sided dolphins being more pelagic. Availability bias, which is the proportion of individuals or groups that are submerged and therefore invisible to observers, is expected to be small for both species for ship surveys, because dive times are relatively short compared to the period in which the animals are visible to observers. However, it is more important for aerial surveys (see item 6.3). Negative bias in distance estimation has been detected in some ship surveys, but the magnitude of its effect on abundance estimation is unclear. Responsive movement by *Lagenorhynchus* spp. dolphins to ships was not detected when it was assessed for the NASS 2007 survey, and other surveys have found responsive movement to be absent or equivocal for these species. Mosaic surveys conducted by Norway (NILS) are covered over a 5–6-year period, but the additional variance due to distributional change during this period has not been estimated for dolphins. Trends in abundance in the Norwegian and central NASS survey areas have not been observed between 2002–2018 and 2007–2015 respectively. Summing recent survey estimates for the North Atlantic east of Greenland suggests a minimum population of at least 200,000 white-sided dolphins in the North Atlantic. Coastal aerial surveys conducted off East and West Greenland and around Iceland did not detect white-sided dolphins (further discussed under item 6.3).

Discussion:
The spatial segregation of the two *Lagenorhynchus* species was evident in many but not all areas, with both species being observed between Iceland and East Greenland (Figure 2). For NAMMCO ship surveys, while availability and perception bias have largely been accounted for, species identification remains problematic. The two species are difficult to distinguish from a ship, and dolphins have not been a target species group for NAMMCO surveys, so less effort has been devoted to obtaining positive species identifications. Some species identification problems could result from lack of observer experience, i.e., observers in strata where white-sided dolphins rarely occur are not necessarily able/likely to identify a *Lagenorhynchus* sighting as *L. acutus.* Some survey protocols included levels of uncertainty around each observation and allowed generic identification when species-level identification was not possible. Species identification was not as severe a problem during aerial surveys because the two species are more easily distinguished when seen from above.

While there has been analysis of the possible underestimation of distance to cetacean sightings, as well as the possibility of responsive movement towards or away from the survey vessel, these issues were reviewed by Pike et al. (2020) where it was concluded that no corrections were warranted

The WG **agreed** that the available estimates of abundance were acceptable for use in assessment. It further **recommended** that abundance be estimated from all NASS surveys prior to 2007, back to 1987. Several abundance estimates could be generated, for both species separately, for both species together, and with unidentified *Lagenorhynchus* sp. The possibilities of apportioning the unidentified *Lagenorhynchus* sp. to each species should be explored. This would create a longer time-series and provide information on trends in abundance.

Abundance estimates in European Atlantic waters

Hammond presented a summary of information on sightings and abundance estimates from the SCANS (1994), SCANS-II (2005), CODA (2007), SCANS-III (2016), ObSERVE (2015-16) and SCANS-IV (2022) surveys in European Atlantic waters. Information is not yet available from the ObSERVE2 (2021-22) survey.

Summary:
NAMMCO/SC/30/DWG/09 summarised that for white-sided dolphin, no sightings were made in SCANS and SCANS-II. In CODA, 13 sightings were made from the ship primary platform in the northernmost block 1 (west of Scotland, northwest of Ireland and adjacent to the T-NASS 2007 Faroes survey blocks) but abundance estimates have not been made from these data.

From SCANS-III, there are estimates of white-sided dolphin abundance from three aerial survey blocks and the ship survey block 8, west of Scotland and adjacent to the NASS 2015 Faroes survey blocks. There are also estimates from the three offshore survey blocks from the ObSERVE aerial survey. SCANS-IV did not conduct a ship survey in offshore waters west of Scotland, but there are white-sided dolphin abundance estimates from five of the aerial survey blocks.

Discussion:
All the surveys revealed a clear spatial segregation between white-sided dolphin and white-beaked dolphin, with white-sided dolphin being present in offshore areas and white-beaked dolphin over the continental shelf. The double-platform survey protocols, with tracking for the ship surveys and a circle-back approach for the aerial surveys, allowed for the correction of availability and perception bias; the estimates are therefore considered robust. It was noted that group sizes recorded by sighting surveys are typically small, while those reported during the Faroese drives are usually much larger (as is also the case for pilot whales).

The low number of white-sided dolphin sightings prevented the calculation of abundance estimates in several survey blocks. However, the WG agreed that it would be useful to calculate an estimate of abundance for CODA block 1, either using an independent analysis of these data or, if that was not possible, using an estimate of detection probability from the SCANS-III ship survey in this area. Hammond and Anita Gilles were assigned this task, to be completed during the present meeting in order to be incorporated into the estimate used in assessment (see item 5.6).

Conclusion:
In addition to estimates of abundance for the Iceland/Faroes NASS, the WG **agreed** to add estimates of white-sided dolphin abundance from European waters from 2007 and 2015/2016 for these years to generate abundance for a wider area compatible with conclusions on stock identity (see item 5.1).

5.4. REMOVALS, INCLUDING BYCATCH

Mikkelsen summarised information on catch data from the Faroe Islands.

Summary:
NAMMCO/SC/30/DWG/10 provided an overview of the catches of Atlantic white-sided dolphins from the traditional drive hunt in the Faroe Islands. Catch statistics exist back to 1872, but the numbers were probably underreported up until the 1980s. The recorded catch data include about 11,890 white-sided dolphins taken in 178 drives, giving an average annual harvest of 67 dolphins and 1.2 groups. For the 65 years with catches, the average was 183 dolphins and 2.7 drives. The harvest increased significantly during the last 40 years, with 8,604 animals, or 72% of the total recorded catches, taken in this period. Harvest was most significant during the period 1993–2006 with annual average catches of 356 animals, whereas for the latest 10 years the average hunt dropped to 222 dolphins per year. Group size ranged from 1 to 1,423 animals; however, 74% of the drives consisted of groups of less than 50 animals. 71% of all catches were taken in August and September.

Discussion:
White-sided dolphins were not included in catch statistics prior to 1872 because—unlike pilot whales, for which uninterrupted data are available since 1709—dolphin catches were not subjected to taxes. The data presented in DWG/10 comprise publicly available catch numbers (Figure 4). In 1992, the white-sided dolphin catch data became more reliable due to the introduction of new regulations, which obliged hunters to report additional biological parameters such as length and weight of all individuals in the catches. However, see item 5.2 regarding issues of underreporting of calves.

Desportes argued that, due to the focus on data collection concurrent with the start of an extensive project on the effect of the drive fishery on the pilot whale population, catch data collected since 1986 for any caught species should be considered reliable. The WG **agreed** to set 1986 as a starting year for reliable data.

The WG noted an exceptionally high catch in 2021. Typically, the size of driven groups averages around 50 individuals, with smaller group sizes occurring as low as a few individuals. Peak catches occur in August and September, likely due to seasonal movement of the animals. However, the increase in recreational fishing activities during the summer months, compared to the winter, due to better weather conditions, also increases the likelihood of any group present to be observed. Catches are higher in the southernmost island. Catches can also be limited by local temporary restrictions; therefore, catch numbers do not necessarily reflect the relative abundance of the species around the islands.

Guðjón Már Sigurðsson inquired whether it would be feasible to use fishing effort as a proxy for sighting effort. This was not considered applicable, because the initial sightings of dolphin (and pilot whale) groups prior to a drive are generally made by recreational fishing boats, which do not report fishing effort. A proportion of initial sightings is also made from land.

There is no estimate of by-catch from the Faroe Islands, where it is considered to be insignificant (one by-catch event in 2021; ICES, 2022) because there are no gillnet fisheries in shallow waters. By-catch has not been reported by trawlers; the WG underlined, however, that logbook reporting is not considered reliable for reporting by-catch.

Removals of white-sided dolphins in areas besides the Faroes are likely low (see also item 6.4). Prior to 2021, hunting records from Greenland did not distinguish between white-sided and white-beaked dolphins, as the same common name was used for both species. However, given the absence of white-sided dolphin sightings during Greenlandic surveys, it is presumed that all or most records refer to white-beaked dolphins. Similarly, by-catch of white-sided dolphins has not been documented in

Icelandic fisheries (with the exception of three individuals which were identified genetically *post hoc*). In Norwegian fisheries, by-catch records seldom distinguish between the two *Lagenorhynchus* species, so it is difficult to estimate separate by-catch levels for each; however, by-catch events in northern Norway are presumed to involve white-beaked dolphins only.

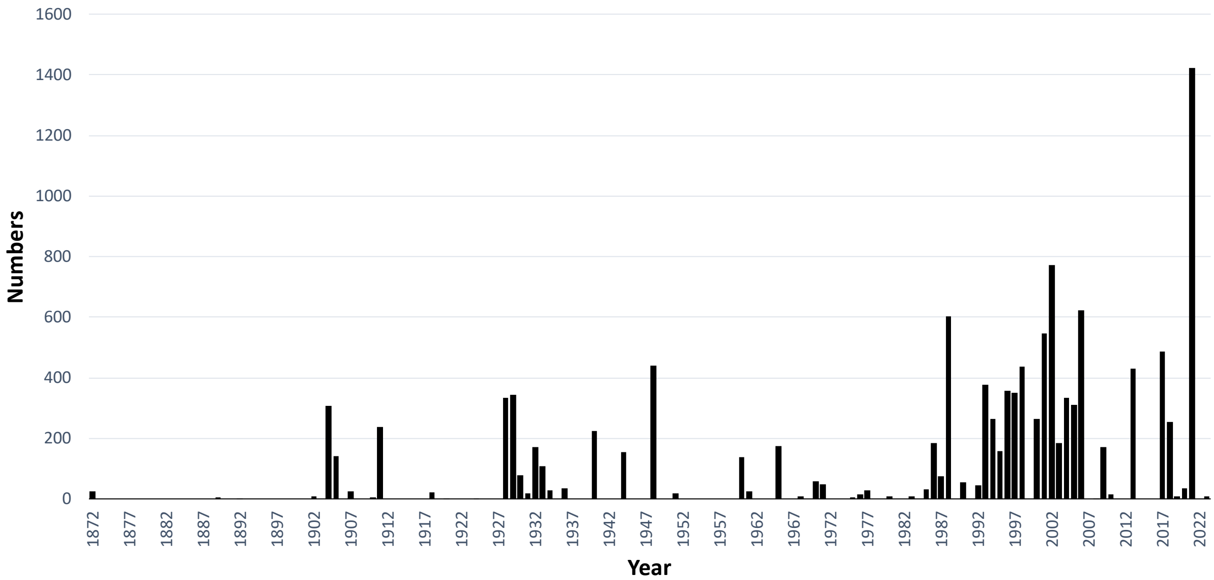

Figure 4. Annual catch statistics of white-sided dolphins taken in the Faroese drive hunt.

Conclusion:
The WG **agreed** to use 1986 as the starting year for Faroese catch data, and not to consider by-catch for the assessment.

5.5. IMPACTS FROM OTHER ANTHROPOGENIC STRESSORS

The WG considered the limited knowledge on impacts from anthropogenic stressors on white-sided dolphins, apart from some information on pollutant loads. McKenzie et al. (1997) showed that organic pollutant loads in Irish & Scottish white-sided dolphins show varying patterns, depending on age, sex, and reproductive condition. Mikkelsen provided some more recent insights from the Faroese Environmental Agency monitoring scheme, which has measured Persistent Organic Pollutant (POP) levels in white-sided dolphins caught in the Faroe Islands. Average POP concentrations for the species are comparable to those found in pilot whales, and they appear higher in males than females. No inferences have been made on the potential impacts of such POP levels on reproductive cycles or other aspects of life history for white-sided dolphins.

In OSPAR's Quality Status Report 2023, the pilot assessment of “Status and Trends of Persistent Chemicals in Marine Mammals” concluded that Polychlorinated biphenyls (PCBs) are present in marine mammals living in all five OSPAR Regions, including Region I (Arctic Waters). The functional group of marine mammals most at risk of high toxicity from legacy pollutants are small toothed cetaceans, as well as some subpopulations of pinnipeds for which moderate to high ranges of PCB concentrations were reported, often surpassing the estimated toxicity thresholds for the onset of reproductive incapacity, followed by deep-diving toothed cetaceans and baleen whales (Pinzone et al. 2022).

It is currently difficult to predict the impact, positive or negative, that the current rates of climate and environmental change will have on this offshore, mostly pelagic species.

Conclusion:
Although some studies exist on the level of different pollutants in white-sided dolphins, the effects of these and other anthropogenic pressures at the individual or population level have not been investigated.

5.6. POPULATION MODELLING & ASSESSMENT

Assessment runs

Witting presented the results of the preliminary assessment for white-sided dolphins based on a population dynamics model used for other small cetaceans in NAMMCO. Following the discussions under previous agenda items, and debate within the WG about the most appropriate way to incorporate data as model priors, further models were run. The summary and relevant discussion and decisions regarding model structure are presented together.

Summary and discussion:
NAMMCO/SC/30/DWG/11 presented the results of runs of assessment models for white-sided dolphins in the central North Atlantic, based on abundance estimates from the Faroese/Icelandic component of the NASS, the catch data from the Faroe Islands (DWG/10 with no losses assumed), and the age structure data from DWG/12 lumped into two distributions, one for 2003 and one for 2021.

These models use the latest version of the Bayesian age-structured framework that has been developed continuously for assessments of narwhal, beluga, walrus, and harbour porpoises in NAMMCO over more than two decades (model details in the appendix of DWG/11). The priors of the models were adjusted for white-sided dolphins. As age class zero survival and reproduction are confounded in the model, the birth rate was initially fixed at 0.5 to reflect mature females that give birth every other year. A symmetrical humped prior from 6 to 13 years of age was used for reproductive maturity, and annual adult survival was centred on a point estimate of 0.91, covering the range from 0.86 to 0.96. Age class zero survival was set to fractions from 0.5 to 0.9 of annual adult survival. There are abundance estimates available for two years, with the point estimate of the 2015 survey being about 60% higher than the point estimate of the 2007 survey. As this difference may reflect the lack of precision of the surveys, the trend cannot reasonably be used to estimate the growth rate in the model. Most models were thus fitted to the geometric mean of the two abundance estimates, with information on the growth rate being subtracted from the age structure data.

Several models were run to explore the influence of the age data and to understand the limitations of the models. A single density regulated model was run from 1955 to examine the influence of the historical catches, while the remaining models were exponential (with no density regulation) because such models have no structural constraints on the growth rate and are better suited to capture the information content of the age structure data.

The density regulated model estimated hardly any depletion (a current depletion ratio of 0.92, 90% CI:0.82-0.96) reflecting historical catches that are low compared to the estimates of absolute abundance. This implied a very low growth rate, in agreement with point estimates of the growth rate around 1% for the exponential models with age data.

The age data have an apparent underrepresentation of younger animals (up to about 5 and 8 years of age for the 2021 and 2003 data). This is not uncommon in age data from catches, and two approaches were used to address the problem. One model fitted a selection function against younger animals separately for the two data sets, and another model used only the age data above 5 and 8 years of age (for the 2021 and 2003 data, respectively) in the fitting. Both models gave essentially the same results, with the model that used only the older age classes being preferred to avoid a compromising fitting issue between the selection function and the growth/survival information of the age data.

Relative to the priors, all exponential models with age data estimated a high age class zero survival and a low age of reproductive maturity, indicating that the age data might inform a higher growth rate than expected. This was confirmed by a model that allowed for an unrealistically high birth rate, indicating that there seems to be a progressive underrepresentation of older animals in the age data. Given a lack of independent information on adult survival, a model that solved adult survival from a growth rate that was fixed at 1% was introduced, to reflect a somewhat realistic growth rate given the exploitation history of the population. Following the life history discussion in the current WG meeting, it was agreed to extend the model to also fit a maturity curve from the available data on age at maturity, and to extend the prior on the birth rate to allow for a birth interval of up to four years (reflecting the estimate from DWG/12). This model was run for the Faroese/Icelandic components of the 2007 T-NASS and 2015 NASS (rs model), and for an extended survey area that also included the CODA 2007, SCANS-III 2016, and OBSERVE 2015/2016 surveys (rl model). The abundance estimates used in the rs and rl models are given in Table 1.

Table 1. Abundance estimates (CV given in brackets) used in the assessment models for white-sided dolphins in the Faroe Islands and Iceland (rs) and the extended survey area (rl).

Survey year & data	rs	rl
2007 (T-NASS|T-NASS/CODA)	81,008 (54%)	107,139 (46.3%)
2015/2016 (NASS|NASS/SCANS-III/ObSERVE)	131,022 (73%)	148,453 (64.9%)

The posterior estimates of the final agreed model included a median age of reproductive maturity of 7.97 (90% CI:7.62-8.47) years, with the first females becoming mature at 6.67 (90% CI:6.24-6.89) years of age. Additional estimates from this model were 0.47 (90% CI:0.39—0.50) for the annual birth rate, and 0.92 (90% CI:0.92-0.93) for annual adult survival, with age class zero survival being 0.85 (90% CI:0.70-0.89) of adult survival.

A trade-off table between the total annual removals and the probability that the exploited stock will increase from 2024 to 2029 was generated for both models (Table 2). A 70% chance of increase reflects total annual removals of 750 and 953 animals for the Faroese/ Icelandic and extended surveys areas, respectively. The WG **agreed** that it is precautionary to conclude that it is sustainable to remove on average 750 individuals annually for the next five years.

Table 2. Catch objective trade-off per stock. The annual total removals per stock that meet given probabilities (*P*) of meeting management objectives. The simulated period is from 2024 to 2029, and *F* is the assumed fraction of females in the catch. Model rs was run only for the Faroese/Icelandic area covered by the two NASS surveys; model rl included an extended area covered by non-NASS surveys.

P	*F*	0.50	0.55	0.60	0.65	**0.70**	0.75	0.80	0.85	0.90	0.95
rs	0.50	1121	1020	923	836	**750**	666	599	530	439	336
rl	0.50	1285	1187	1109	1031	**953**	875	790	704	615	483

Time-to-event models

Authier presented a piece-wise modelling approach to compare with Witting's assessment model outputs, using the newly compiled information from the Faroe Islands to estimate survivorship of white-sided dolphins.

Summary:
In NAMMCO/SC/30/DWG/15, data on age of Atlantic white-sided dolphins (*Lagenorhynchus acutus*) taken in the traditional drive hunt in the Faroe Islands (DWG/12) were analysed using time-to-event methods to estimate age-specific vital rates (survival and female maturity). Survivorship was estimated from age-at-death with the parametric method described in Rouby et al. (2021): model fit was good for both males and females when compared to a non-parametric estimate (Kaplan & Meier 1958). Female and male survival rates were high (0.9) in early life and decreased with age. Female survival was, however, lower than that of males, suggesting sample selection issues and a deficit of old females in the sample. Female maturity was estimated with time-to-event methods (the so-called Accelerated Failure Time model) taking into account left-censoring (females that matured before being taken) and right-censoring (females that would have matured later had they not been taken). This approach relaxes the symmetry assumption intrinsic to the logistic model classically used. There was a weak signal in the data that age at maturity changed from 5.6 years (80% highest probability density interval: 5.1 – 6.2) in the 2000s to 5.2 years (80% HPDI: 4.4 - 5.8) in the 2020s. Assuming that estimated age-specific survival and maturity rates were accurate, a simple age-structured matrix model was built to investigate birth rate values compatible with an asymptotic growth rate larger than 1 (i.e. an increasing population). An annual birth rate larger than approx. 0.30 was identified as sufficient. The implied population growth rate for birth rate between 0.30 and 0.5 was further used as an input for a simple Population Viability Analysis, projecting the population forward in time for 100 years under different scenarios of constant anthropogenic removals and environmental stochasticity to investigate long-term viability.

Discussion:
Both modelling approaches resulted in similar estimates of several life history parameters, such as high survival rates of younger animals, and a birth rate of approximately 0.3 needed to maintain a stable population. The WG agreed that this was an encouraging result, which validated the assessment modelling approach.

The piece-wise modelling approach resulted in higher predicted survival rates for males than females, across all age classes; this was flagged as reflecting the lack of older females in the underlying dataset. It would be theoretically possible to weight the model in a way that accounts for that lack of information, but it was agreed that this was impractical at the current meeting.

The WG expressed interest in the long-term predictions which incorporated environmental stochasticity and different levels of removals. Forward projections of population size are commonly used in other fora, even if not directly applicable to short-term management schemes. However, it would be a good exercise to a) validate the predictions based on the earlier time-period in the dataset using known parameters of the more recent period, b) limit projections to realistic levels of stochasticity and removal rates, and c) incorporate predicted trajectories of environmental change—and associated demographic stochasticity— directly in the model, in order to predict how climate change might affect this species in the eastern and central North Atlantic. The WG discussed caveats that would need to be considered before using such a model for management recommendations, such as the obvious data gaps, and the uncertainty around the level of direct impacts of environmental change on this dolphin species. This further highlighted the need for more representative datasets that could be used to improve either modelling approach, particularly with regard to age structure.

Conclusion:
Based on the conservative assessment model, the most cautious approach for achieving a 70% likelihood of sustainable catches is to maintain the Faroese catch levels below 750 animals per year. The WG notes that all recent catch records have been well below 750 individuals per year, with the exception of the unusually large catch in 2021. The WG also noted the possible issue of underreporting

of calves and reiterated that complete, validated, and accurate removal data should be made available for the next assessment.

6. ASSESSMENT OF WHITE-BEAKED DOLPHIN (*LAGENORHYNCHUS ALBIROSTRIS*)

6.1. STOCK IDENTITY

Genetic data

Gose presented findings relating to stock identity of white-beaked dolphins in the NAMMCO region and beyond.

Summary:
Referring again to DWG/08, methods to analyse white-beaked dolphin data used a similar approach as for Atlantic white-sided dolphin discussed under item 5.1, but no mitochondrial control region data were used for white-beaked dolphin. The range and coverage of the samples shows a high density of samples around Britain but low sample size for the Canadian Atlantic. Greenland was excluded from the analysis due to the lack of samples from this region. The results showed evidence of substantial genetic structure across the range of the species. The Canadian Atlantic samples were differentiated from all other regions in the Principal Component Analysis (PCA), but not in the Admixture analysis, which is prone to bias arising from low sample sizes and high gene flow from other regions. A larger sample size is needed from this region. Apart from this discrepancy, in the other regions the PCA and Admixture results detected the same pattern of structure.

Within the central and eastern North Atlantic, samples from Iceland and northern Norway showed differentiation from samples from around Britain and Ireland, including the North Sea. Northern Norway and Iceland were highly connected. In the southern range of the species, there was substructure detected between individuals sampled in the North Sea and individuals sampled in western Scotland and Ireland.

The data suggest that although northern Norway and Iceland are spatially separated, a continuous genetic exchange driven by a few individuals per generation maintains genetic connectivity between these two regions. Similarly, although there is a lack of samples from southern Norway, it is likely that white-beaked dolphins from southern Norway are associated with the North Sea cluster, which would mean that Norwegian waters are inhabited by two distinct populations, one in the south connected to the North Sea population and one in the north connected to the Icelandic population.

Discussion:
The WG noted that the genomic data showed very clear clusters, with at least two genetically distinct populations of white-beaked dolphins in the central and eastern North Atlantic. In northern waters, there is a population spanning Iceland, the Barents Sea, and the western Svalbard margin. In European waters, there is a population inhabiting the North Sea and waters west of Britain and Ireland. Although there is no evidence of spatial segregation, the slight degree of genetic separation observed between the North Sea and west of Britain and Ireland suggests the possibility that two genetically distinct groups live in close proximity in this region.

The WG noted that a few samples were seemingly assigned to "incorrect" genetic clusters, deviating from the expectations based on their collection locations. This discrepancy may arise from human error in the lab, or from carcass drift.

Regarding the stock identity of Greenland, the WG emphasized the need to collect samples from both eastern and western Greenland and to include them in genetic analysis. In this regard, Tange-Olsen mentioned 17 white-beaked dolphin samples that are currently being processed by his research group. More samples are available from East Greenland, and at least one from West Greenland. The public availability of raw sequence data was noted, enabling straightforward incorporation of further samples into the current stock identity assessment.

Conclusion:
The group concluded that there were at least two distinct populations in the Northeast Atlantic, one in the north (Barents Sea, western Svalbard and Iceland) and another in the south (North Sea, Britain and Ireland). However, the absence of information from Greenland precludes consideration of stock identity in this region based on genetics.

The WG agreed that incorporating samples from Greenland in genetic analysis is essential. The WG **recommends** that samples are obtained from West Greenland in particular to address the genetic uncertainties associated with that white-beaked dolphin stock.

6.2. BIOLOGICAL PARAMETERS

There is little available information on biological parameters of white-beaked dolphins. Samples from by-caught animals in Iceland (n=92) provide some information on length, weight, age, sex, and maturity. Sigurðsson showed a brief overview of these age (range: 0–47 years) and maturity data, and agreed to provide a more detailed description prior to a new assessment. Hunters in Greenland have also collected measurements and samples that could be processed in the near future, but these are mostly from males. The SMASS (Scottish Marine Animal Stranding Scheme) dataset may include relevant information but may not be directly available.

Conclusion:
The WG concluded that more data on biological parameters were needed before conducting a full population assessment. The strong genetic evidence that animals in the North Sea, Britain and Ireland are distinct from those sampled to the north (Iceland and Norway), and the lack of information from Greenland, means that the emphasis should be on organising the available Icelandic data and, especially, on data collection and processing from Greenland.

6.3. ABUNDANCE ESTIMATION

Aerial surveys in Iceland

Summary:
Pike revisited DWG/06, noting that the aerial survey series around Iceland and coastal Greenland had detected almost solely white-beaked dolphins. After some discussion in the meeting, it was concluded that white-beaked and white-sided dolphins were easily discriminated from the air, and that species identification was therefore reliable. The 30-year timespan of the Icelandic series (1986–2016) provided an opportunity to investigate trends in distribution and abundance over that period. After an initial decline from 1986–1987, uncorrected line transect density has shown a general increase from 1987 to 2016 in the entire survey area, with a shift in distribution from southern to northern strata, where these dolphins are now concentrated in the summer. This shift may be related to changes in the distribution of forage fish observed over that period.

Aerial surveys in GL

Rikke Guldborg Hansen presented information on white-beaked dolphin abundance estimated from aerial surveys in West and East Greenland (NAMMCO/SC/30/DWG/07).

Summary:
In West Greenland, abundance, corrected for perception bias but uncorrected for availability, was estimated as 9,827 (CV=0.19) animals in 2007 and 2,747 (CV=0.41) animals in 2015, with dolphins being distributed farther north in 2007. The survey conducted off East Greenland in 2015 provided the first

estimate of abundance for that area. Abundance “at-surface” (corrected for perception bias) was corrected for availability using data from a single white-beaked dolphin tagged in Iceland, giving dive data between 0 and 2 m depth for 18 hours after tagging. The data showed an average time spent at 0–2m depth of 18% with a CV of 0 (due to a single individual with one day of tagging data). Estimates shown in Table 3 are not corrected for time-in-view, i.e., abundance is corrected for instantaneous availability. Only those observations where the species was identified with certainty as white-beaked dolphin were included in the generation of abundance estimates.

Table 3. Total number of sightings of *Lagenorhynchus sp.* obtained from aerial surveys in West Greenland (2005, 2007, 2015) and East Greenland (2015). *WBD* is white-beaked dolphin; *WSD* is white-sided dolphin; *UD* is unknown dolphin species; *Abundance* is fully corrected abundance using an availability correction factor of 18% (CV=0) for white-beaked dolphin with coefficient of variation in parenthesis; *95% CI* is confidence intervals; *At surface* is abundance of white-beaked dolphin corrected for perception bias.

Region	Year	No. of sightings	WBD	WSD	UD	Abundance WBD	95% CI	At-surface
West Greenland	2005	59	12	3	44	*na*	*na*	*na*
	2007	53	49	1	3	54,594 (0.19)	37,744-78,967	9827 (0.19)
	2015	30	28	0	2	15,261 (0.41)	7048-33,046	2747 (0.41)
East Greenland	2015	24	22	0	2	9827 (0.50)	4710-30,008	2140 (0.50)

Discussion:
Outi Tervo inquired whether spatial distribution analyses have been conducted that would support the idea of white-beaked dolphins being a strictly coastal/shelf species; if so, that could provide information concerning whether to consider animals around Greenland as an assessment unit separate from Iceland. Repeated sighting surveys show that dolphins are not always confined to the continental shelf.

All the sighting surveys in Norwegian waters indicate a hiatus in white-beaked dolphin distribution between northern Norway and more southern and western regions. Nils Øien noted that ecosystem surveys confirm the same pattern, although these are lacking information from winter months.

The WG discussed the marked difference in the patterns shown by the genetic and sighting data, i.e., distinct genetic stocks contrasting with continuous survey observations. Gose explained that gene flow is susceptible to even low migration rates per generation, and the chances of the latter increase with large population sizes.

Hansen flagged the availability correction factor used for the Greenlandic aerial surveys (only 18% of time spent at the surface from one day from a single tagged individual), suggesting that the availability-corrected estimates should not be used for assessment.

The WG agreed that the availability correction factor of 18% was not robust, and that a different approach should be explored. Possibilities included i) using information from the literature or ship-based survey observations, ii) using dive cycle data from white-sided dolphins tagged in the Faroe Islands, and iii) using a g(0) value estimated for delphinid species from SCANS, which accounts for both perception and availability bias. The WG considered that, despite the differences in survey platforms, the most supportable approach was iii), applied to the at-surface abundance estimates (Table 3).

Conclusion:
The WG agreed to use the at-surface estimates from Greenlandic surveys, corrected by the SCANS g(0) factor (using the average of good and moderate sighting conditions).

Surveys in European Atlantic waters

Hammond briefly presented the abundance estimate results for white-beaked dolphins from the SCANS, CODA and ObSERVE surveys (NAMMCO/SC/DWG/09). However, since this population is genetically distinct from the stocks within the NAMMCO region, these estimates were not informative for assessment.

6.4. REMOVALS, INCLUDING BYCATCH

Catch data from Greenland

Outi Tervo presented information on catch data of white-beaked dolphins in Greenland.

Summary:
DWG/07 summarised *Lagenorhynchus* spp. catches in Greenland from 2003 to 2021, inclusive, from the National Catch Reporting System "Piniarneq", offering insights into exploitation and the species' temporal distribution in West and East Greenland. While catch of *Lagenorhynchus* is officially recorded from 2003, it is likely that hunting began earlier, possibly post-1970s with the introduction of outboard engines, but no relevant records exist. Currently, there are no catch quotas for *Lagenorhynchus* spp. Data from Piniarneq are detailed by month, region, and settlement, but not separated out for the two *Lagenorhynchus* species caught in Greenland. Annual catches have fluctuated, ranging from tens to a peak of 381 in 2020. Most catches occur in West Greenland, followed by East and South Greenland (Figure 5). The majority of Greenland's annual catches take place in Maniitsoq in West Greenland. Catches in Tasiilaq, Southeast Greenland, have increased in recent years. Potential underreporting in Greenland, however, raises uncertainty about the number of catches. As an example, in 2016, 48 animals were reported landed in Tasiilaq, whereas biological sample collection in that same year in Tasiilaq documents a minimum landed catch of 116 individuals. The unverified catch data highlight the need for validation to draw accurate conclusions about catch distribution changes.

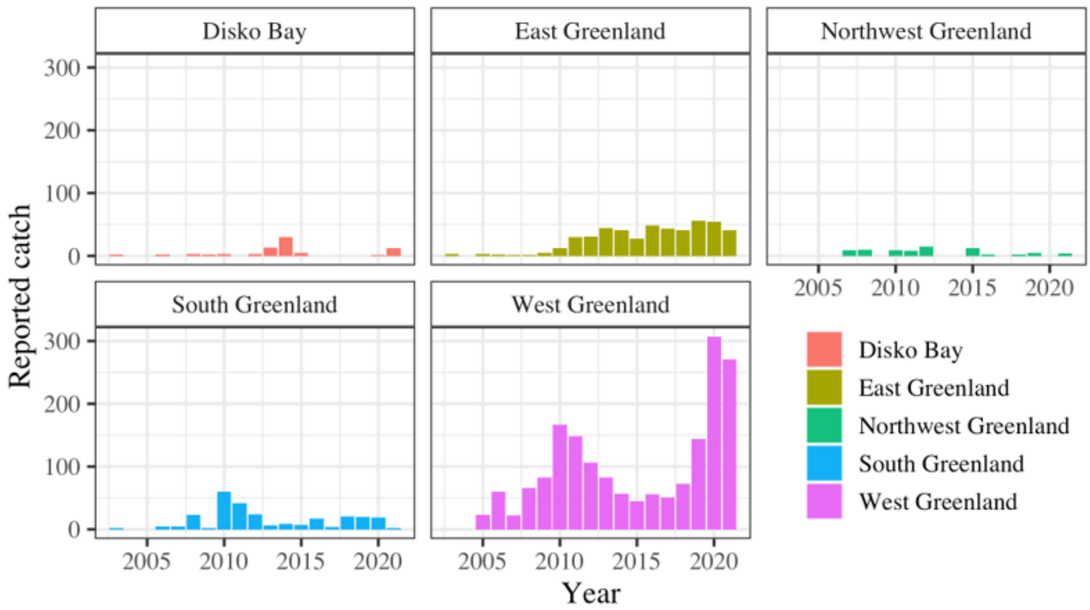

Figure 5. Annual catch of *Lagenorhynchus* spp. in different hunting regions in Greenland between 2003 and 2021.

Struck and lost rates in Greenlandic hunts

Witting presented information on struck and lost animals in open-water rifle hunts.

Summary:
The dolphin hunt in Greenland is mainly an open water hunt from small boats and, as such, it is likely to have a relatively large struck and lost rate. NAMMCO/SC/30/DWG/14 attempted to estimate a minimum struck and lost rate for a particular instance of this hunt from a half hour–long YouTube video of a hunt on a group of white-beaked dolphins close to Nuuk in April 2020.

This hunt was a drive-like hunt that involved several boats and ended up in a small bay. Based on the length and intensity of the hunt, and the cornering of the dolphin group in the small bay, it was judged likely that almost all, if not all of, the animals in the group were at least struck. The video also indicates that at least 3–4 dolphins were retrieved from the hunt. But this may be an underestimate, and the total number of dolphins reported landed in Nuuk in Apil 2020 (which is nine) was thus used to calculate a minimum loss/underreporting rate for this particular hunt.

Before knowing the total number of reported landings, four persons made independent assessment/judgement of the minimum number of dolphins in the group. The assessment methods were somewhat different, resulting in minimum estimates of 12, 15–20, 24, and 25–30, with a resulting mean estimate of 20 for the minimum number of dolphins in the group. Based on the reported landings, this indicates that at least two dolphins are struck for each dolphin that is reported landed. The actual number of struck animals per landing may be higher, with an estimate of five if only four dolphins were retrieved from the April hunt in 2020. It is important to note that it is unclear how this particular hunt relates to the overall hunt of dolphins in Greenland, except that the overall loss rates of this hunt are expected to be large.

Discussion:
Given that a) all of the 116 dolphins that were sampled in Tasiilaq in 2016 were white-beaked dolphins and b) almost all observations of *Lagenorhynchus* spp. from sighting surveys are recorded as white-beaked dolphins, the WG agreed that it was appropriate to treat the catches of unspecified dolphins in Greenland as catches of white-beaked dolphins.

The WG discussed the uncertainty of the Greenland catch data. Given the presented information on struck and lost and underreporting, the WG agreed that the official catch statistics for dolphins from Greenland may be very inaccurate. In the single case presented, it was possible to obtain samples from 116 landed dolphins when only 48 were reported landed. This suggests an underreporting of 140%, which is much higher than the estimate that about 30% of the harbour porpoise catches in Maniitsoq are not reported (NAMMCO 2019). The estimate, however, is only from Tasiilaq in 2016, and it is thus not appropriate to correct the overall Greenlandic catches for underreporting, or to convert a potential recommendation on landed catches into actual catches.

Given the struck and lost information in DWG/14, and personal observations by other members of the WG, the overall struck and lost rate is also likely to be high. The average estimate from DWG/14 based on a single hunt from Nuuk, that one out of 3.5 struck animals is landed, may not be applicable to the overall hunt. A struck and lost multiplier of 3.5 is much higher than the 1.44 that has been observed for four narwhal hunts in East Greenland (9 out of 13 struck animals retrieved; Tervo et al, 2021). Nevertheless, the WG agreed that a loss rate of 3.5 is not unrealistically high for open water hunts of dolphins with rifles. A struck and lost rate for dolphins is reported by the hunters in the reporting system, and these estimates are forwarded to NAMMCO together with the official catch data. Since 2003, however, only 11 animals have been reported struck and lost in the Greenland dolphin hunt (NAMMCO Catch database). The WG agreed that these numbers are unrealistically low and cannot be trusted as an estimate of struck and lost rates. In this context, the group **recommended** that all catch data should undergo validation.

The WG considered the use of the information on catches in assessment given the associated uncertainties. Pike questioned the feasibility of conducting a full population assessment based on the limited and uncertain information on stock identity and removal rates. The WG agreed that assessment of sustainability in this case could more appropriately be achieved by calculating Potential Biological Removal (PBR) or considering a specified conservative rate of removals as a percentage of estimated population size. The WG agreed to postpone a full population assessment until more accurate catch data can be provided to inform model priors.

By-catch data from Iceland

Sigurðsson discussed the by-catch estimates for white-beaked dolphins in Icelandic waters.

Summary:
NAMMCO/SC/30/DWG/16 presented estimates of by-catch based on onboard inspector and survey data, which are then extrapolated to total fishing effort. The estimated annual by-catch was 18 animals, (95% CI: 3–44). This roughly corresponds with numbers from an older study between 1992 and 1994, when by-caught dolphins were bought, and between 13 and 25 dolphins were paid for annually. Furthermore, some biological information from the older study, including age and maturity data (mentioned under item 6.2) will be available for future assessments.

Discussion:
In this dataset, there were no reported white-sided dolphins among the by-caught animals. However, Gose noted that three samples labelled as white-beaked dolphin taken as bycatch in Iceland were genetically assigned as white-sided dolphins.

Sigurðsson agreed to compile the by-catch data separately for each species and to present this information to NAMMCO's Working Group on By-Catch (BYCWG). The WG **recommended** that the tissue from by-catches from Iceland be used in genetic analysis and subsequently integrated into Gose's dataset.

By-catch data from Norway

André Moan presented a summary of available information on by-catches of *Lagenorhynchus* dolphins in Norwegian fisheries.

Summary:
NAMMCO/SC/30/DWG/05 described that *Lagenorhynchus* by-catch is not reported by most fishers, but data from a reference fleet and fishery data from electronic catch logbooks in Norway contained records of 25 by-catch events, involving a total of 33 bycaught *Lagenorhynchus* dolphins. These data were collected over 18 years, from 2006 to 2023, but there were no reports of by-catch in 2006–2009 or in 2011–2017. It is not clear whether these gaps are a consequence of the sampling/observation process or reflect very small by-catch probabilities. By-catches occurred in a variety of Norwegian fisheries (including gillnets, trawls, seines, and even hook lines) and on both coastal (<15m length overall) and offshore vessels (≥15m length overall). Most of the by-catch data specify only the generic dolphin name, so it is mostly not possible to distinguish white-beaked and Atlantic white-sided dolphins in the data. By-catch locations were mostly clustered either in the northern Norwegian and Barents Sea or in the North Sea, with few by-catch events in between. It is reasonable to expect that by-catch rates derived from these data will be biased low due to unobserved drop-outs, as has been demonstrated with harbour porpoise by-catch.

Discussion:
Although the by-caught dolphins were mostly not identified to species, based on the information available to the meeting, the WG agreed that animals caught in the northern region are very likely white-beaked dolphin, whereas those caught in the southern region could be either species (Figure 6).

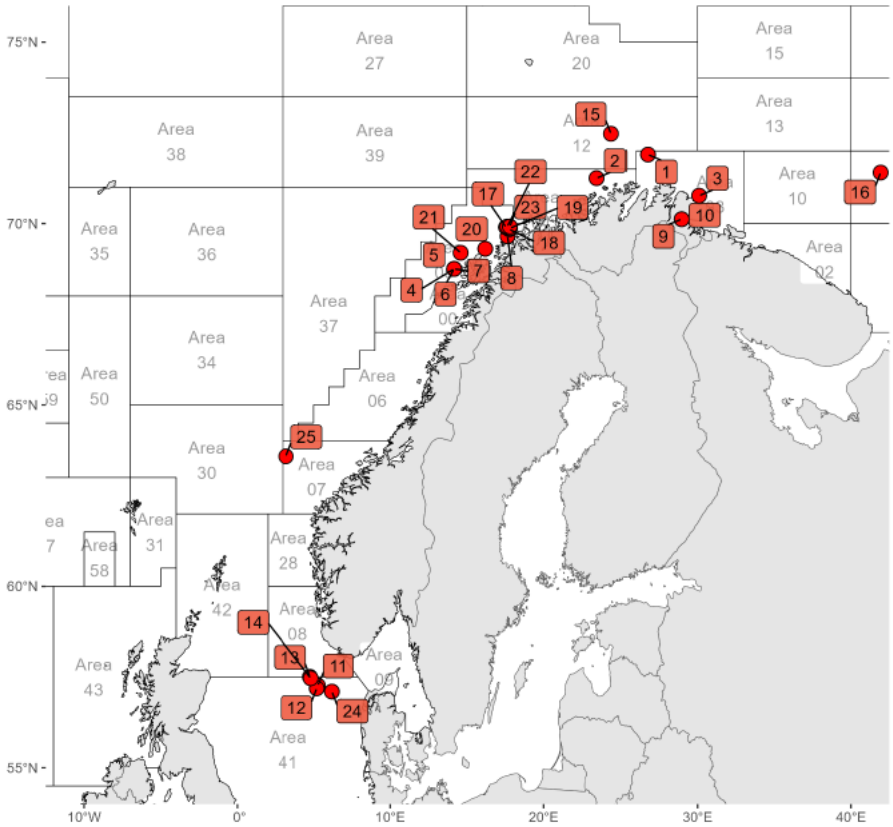

Figure 6. Spatial distribution of *Lagenorhynchus* by-catches. Red circles indicate the locations of by-catch events registered in electronic logbook data between 2011 and 2022, as well as in reference fleet data between 2006 and 2022. The numbers in red boxes refer to the chronological order of the events. The Area polygons indicate the fishery statistics blocks used by the Norwegian Directorate of Fisheries since 2018.

Over the course of 18 years, the recorded by-catch consistently remained at low levels, although it was noted that these data represent only a fraction of the entire fishing fleet. The WG discussed the capture of some animals on hook lines, which is highly unusual for delphinids. The WG recommended that Moan investigate this unusual phenomenon and also explore possible explanations for the data gap between 2011 and 2017.

The WG **recommended** calculating a combined *Lagenorhynchus* by-catch estimate for Norwegian waters, accounting for drop-out rates, and distinguishing between the northern area (likely corresponding to white-beaked dolphins) and the southern area (potentially a mix of both species). Assessing removals in Norwegian waters was not a focus of the current WG ToRs; this information should be presented at the upcoming BYCWG meeting for further consideration.

Conclusion:
Both direct catches and incidental by-catches are underrepresented in the currently available data. Obtaining more accurate removals data is a crucial prerequisite to conducting a model-based assessment.

6.5. IMPACTS FROM OTHER ANTHROPOGENIC STRESSORS

There is little information available on pollutant levels and their impacts on white-beaked dolphins. The conclusions of the OSPAR Quality Status Report cited under item 5.5 are also relevant to white-beaked dolphins.

6.6. POPULATION MODELLING & ASSESSMENT

Assessment units

The WG agreed that the clear hiatus in white-beaked dolphin distribution observed between northern Norway and Iceland (Figure 2, item 5.3) means that the eastern North Atlantic should not be included in assessment of the sustainability of white-beaked dolphin removals in the Faroe Islands, Iceland, and Greenland. No assessment is required for Norway.

There was no consensus on whether or not to assess Greenland separately from Iceland and the Faroe Islands. Support for assessing Greenland separately was based on white-beaked dolphins being primarily coastal, (e.g., as illustrated by the coastal affinity of a white-beaked dolphin tagged for 200 days off Iceland – Rasmussen 2013). Conversely, sighting surveys indicate no obvious gap in white-beaked dolphin distribution between Greenland and Iceland (Figure 2).

There was further discussion concerning whether or not East and West Greenland should be assessed separately. Support for combining them was based on distribution data (Figure 7). However, the separation in genetic analysis between samples from Canada and Iceland (DWG/08) could indicate that animals in West Greenland may be more closely linked to Canada than to East Greenland, in which case the most cautious approach would be to assess West and East Greenland separately.

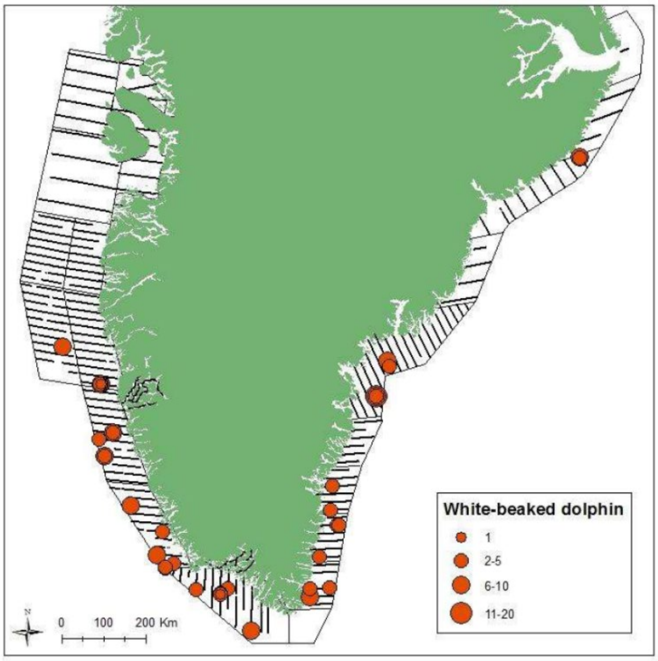

Figure 7. Sightings of white-beaked dolphins from aerial surveys of East and West Greenland in 2015 (Hansen et al. 2018).

Furthermore, catches are apparently smaller in East Greenland than in West Greenland (item 6.4. and DWG/07), which could lead to incorrect conclusions regarding the sustainability of removals if these two areas were combined in assessment.

In conclusion, the WG agreed that the most precautionary approach was to assess West and East Greenland separately.

Assessment method

Given the considerable uncertainty about the removals of white-beaked dolphins in Greenland and the lack of information on stock identity, the WG agreed that it could not conduct a full assessment nor, therefore, make management recommendations on sustainable removal levels. Instead, the WG agreed to provide a simple preliminary assessment based on calculating Potential Biological Removal (PBR) – see below.

The WG agreed to conduct preliminary assessments for two scenarios: i) West Greenland assessed separately from East Greenland, Iceland, and the Faroe Islands combined (the least precautionary approach for East Greenland/Iceland/Faroe Islands because most removals are from West Greenland, and ii) Greenland (East and West), Iceland, and the Faroe Islands combined.

Preliminary assessment for two scenarios

The Potential Biological Removal method was developed by Wade (1998) to compute limits to removals below which the conservation objectives of the U.S. Marine Mammal Protection Act would be met. In simulation testing, annual removals no greater than PBR allow a population to recover to or be maintained at or above 50% of carrying capacity with 95% probability in 100 years, which is the U.S. MMPA definition of an Optimum Sustainable Population.

The PBR equation requires:

- an estimate of minimum population size, N_{min}, defined as the 20$^{\text{th}}$ percentile of the error distribution of the best available abundance estimate;
- a value for the maximum rate of increase of the population[1], R_{max}; and
- a recovery factor, F_r.

Abundance estimates from the most recent surveys: NASS 2015 (Pike et al. 2019a), Iceland aerial survey 2016 (Pike et al. 2020), and East and West Greenland 2015 (DWG/07) were used to calculate N_{min} values to input to the PBR equation for the areas specified in the two preliminary assessment scenarios. Abundance estimates were used as previously reported, except that the uncorrected estimates from the aerial surveys in Iceland and Greenland were corrected for perception and availability bias by applying the g(0) (for dolphins) from the SCANS-III survey (Hammond et al. 2021; NAMMCO/SC/30/DWG/FI06), because estimates from Iceland and Greenland could not be corrected for availability bias using the limited tagging data available (see also item 6.3).

In the absence of information, a recovery factor (F_r) of 0.5 was chosen, which is recommended for populations under no immediate threat or of uncertain status according to the guidelines under the U.S. Marine Mammal Protection Act (NMFS 2023).

Using the above information, PBR was computed as: PBR = $0.5 \times N_{\text{min}} \times R_{\text{max}} \times F_r$ for the areas specified in the two scenarios defined above (NAMMCO/SC/30/DWG/17 and Table 4).

To compare removals with the calculated values of PBR, the WG group discussed the best approach for generating the best estimates of removals, given the uncertainties in the data (see item 6.4). For Iceland, by-catch data from 2016 to 2019 were used. For Greenland, the WG agreed to correct the reported catch records in two ways. To correct for struck and lost animals, a multiplier of 3.5 (the mean of the estimates that span from 2 to 5) was applied. To correct for underreported catches, a multiplier of 2.42 (the 116/48 ratio of samples to reported catches from Tasiilaq in 2016) was used.

The results are presented in Table 4. For West Greenland assessed alone and for West and East Greenland, Iceland and the Faroe Islands assessed together, total corrected estimated removals exceeded PBR. For East Greenland, Iceland and the Faroe Islands assessed together (excluding West Greenland), total corrected estimated removals were less than PBR.

[1] In the absence of life-history information specific to white-sided dolphins, R_{max} was set at the default value for cetaceans of 4%.

Acknowledging the large gaps in information, these calculations illustrate that the removals of white-beaked dolphins in Greenland may not be sustainable. Due to the large uncertainties associated with estimated removals, the WG refrained from making management recommendations regarding sustainable removal levels. Nonetheless, given these preliminary results, the WG **recommended** that a full assessment be carried out as soon as possible.

Table 4. Abundance estimates (AE), Potential Biological Removal (PBR), and estimated removals of white-beaked dolphins in Greenland (GL) and Iceland (IS). CV is the coefficient of variation of the AE, $N_{\min}$ is the minimum population size, F_r is the recovery factor, and $R_{\max}$ is the maximum population increase rate used to calculate PBR. S&L is struck and lost animals.

	Scenario (i)		**Scenario (ii)**
	West Greenland	**East Greenland, Iceland, Faroe Islands**	**West Greenland, East Greenland, Iceland, Faroe Islands**
Survey year	2015	2015–2016	2015–2016
AE	4,503	232,849	237,352
CV	48.1%	45.1%	44.3%
$N_{\min}$	3,067	162,107	166,241
F_r	0.5	0.5	0.5
$R_{\max}$	0.04	0.04	0.04
PBR	**31**	**1,621**	**1,662**
GL average annual reported catch (2019–2021)	262	50	312
GL reported catch corrected for underreporting (×2.42)	634	121	755
GL reported catch corrected for S&L (×3.5)	917	175	1,092
GL total estimated annual catch (corrected for S&L and underreporting)	2,219	424	2,643
IS estimated annual by-catch (2016–2019)	NA	18	18
95% Confidence interval for IS by-catch	NA	3-44	3-44
Total removals	**2,219**	**442**	**2,661**

7. RECOMMENDATIONS

7.1. RECOMMENDATIONS FOR RESEARCH

7.1.1. RECOMMENDATIONS FOR RESEARCH FOR WHITE-SIDED DOLPHINS

Recommendations for the Faroe Islands

- To investigate if there is older (i.e., 1986–1992) existing biological material from the Faroe Islands that could be processed and analysed, and to continue collecting relevant samples to investigate reproduction parameters and age structure.
- To collect eye lenses to explore alternative age-determination methods.
- To investigate temporal patterns in strandings over a wider area to better understand seasonal movement patterns.
- To collect information from stranded animals, including age, length, and sex data.
- To program satellite transmitters to collect higher resolution dive data at shallow depths to allow aerial survey availability correction factors to be estimated.

7.1.2. RECOMMENDATIONS FOR RESEARCH FOR WHITE-BEAKED DOLPHINS

Recommendations for Greenland

- To analyse existing tissue samples from East Greenland (and West Greenland, if available), and to collect and analyse new samples from West Greenland to explore genetic connectivity across the North Atlantic, including in Europe and North America.
- To collect life history and age data from Greenland.
- To estimate the accuracy of the catch reporting system, if possible, and to obtain estimates of struck-and-lost rates to improve estimates of total removals.

Recommendations for Iceland

- To make existing and newly collected biological data (age and reproductive information) from Iceland available for the next assessment.

7.1.3. RECOMMENDATIONS FOR RESEARCH FOR BOTH SPECIES

Recommendations for Norway

- To validate the by-catch data from the reference fleets, including estimating drop-out rates, and to estimate the total by-catch for relevant fisheries.

Recommendations for all Member countries

- To deploy satellite tags on both white-sided and white-beaked dolphins, preferably in areas other than the Faroe Islands, to obtain more movement and dispersion data.
- To emphasise in the NASS 2024 protocols the importance of accurate species identification and to ensure that the NASS 2024 data be analysed to provide estimates of abundance in a timely fashion for white-sided and white-beaked dolphins.
- To obtain abundance estimates for white-sided and white-beaked dolphins from all NASS surveys prior to 2007.

7.2. RECOMMENDATIONS FOR CONSERVATION & MANAGEMENT

7.2.1. RECOMMENDATIONS FOR CONSERVATION & MANAGEMENT FOR WHITE-SIDED DOLPHINS

Recommendations for the Faroe Islands:

- Based on the conservative assessment model, the most cautious approach for maintaining a 70% likelihood of sustainable catches is to maintain the Faroese catch levels below 750 animals per year.
- The prerequisite to any reliable population assessment is the existence of complete, validated, and accurate removal data. Therefore, the issue of underreporting of calves must be examined and every effort be made to ensure that full catch data are systematically reported.

Recommendations for all Member countries

- Considering the low levels of reported catch compared to the estimated population size, a new assessment could be conducted within the standard 5-year period, integrating the 2024 abundance estimate, full catch reporting, and validated age structure information.

7.2.2. RECOMMENDATIONS FOR CONSERVATION & MANAGEMENT FOR WHITE-BEAKED DOLPHINS

High priority recommendation for conducting an assessment

The preliminary assessment of white-beaked dolphins revealed that catches in Greenland may not be sustainable (item 6.6, Table 5).

Table 5. Potential Biological Removal (PBR), and removal values in number of animals for white-beaked dolphin in Greenland (GL) and Iceland (IS). 95% confidence intervals for IS estimates in brackets. S&L is struck and lost animals.

	Scenario (i)		**Scenario (ii)**
	West Greenland	**East Greenland, Iceland, Faroe Islands**	**West Greenland, East Greenland, Iceland, Faroe Islands**
Survey year	2015	2015–2016	2015–2016
PBR	**31**	**1,621**	**1,662**
GL average annual reported catch (2019–2021)	262	50	312
GL reported catch corrected for underreporting (×2.42)	634	121	755
GL reported catch corrected for S&L (×3.5)	917	175	1,092
GL total estimated annual catch (corrected for S&L and underreporting)	2,219	424	2,643
IS estimated annual by-catch (2016–2019)	NA	18 (3–44)	18 (3–44)
Total removals	**2,219**	**442**	**2,661**
Sustainable removals (<PBR)	**No**	**Yes**	**No**

In light of the uncertainties described above, high priority should be given to conducting a full assessment of this species based on accurate and reliable data, as a matter of urgency.

Recommendations for Greenland

The prerequisite to any reliable population assessment is the existence of complete, validated, accurate removal data, including direct removals, struck and lost rates, and by-catch. Anomalies in the catch data strongly suggest that they are not accurate. A severe underreporting has been documented (e.g., approximately 40% of the landed catches reported in Tasiilaq in 2016). Struck and lost rates from the hunt appear to be very high (e.g., a hunt from Nuuk showing 2 to 5 animals struck per landed animal), but are not sufficiently documented.

Therefore, as a high priority, Greenland is strongly recommended to:

- Validate the accuracy of reported dolphin removals;
- Implement a system ensuring that underreporting is minimised and can be estimated;
- Conduct an evaluation of the struck and lost rate for the hunt of dolphins, with the aim of estimating and reducing rates.

8. OTHER BUSINESS

The WG agreed that based on the currently available information and the precautionary approach adopted by NAMMCO in 2023, the survey frequency for both white-sided and white-beaked dolphins should be 5 years.

9. ACCEPTANCE OF REPORT

A preliminary draft of the report was approved by the WG on November 2. The final report was recirculated and accepted by the group on November 20.

10. CLOSING REMARKS

The Chair thanked the WG members for their contributions to a fruitful discussion, remarking on the significant progress made in this first meeting and looking forward to the next. The group thanked Hammond for his commendable chairing, as well as the rapporteurs for ably documenting the deliberations.

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APPENDIX 1: DRAFT AGENDA

1. Chair welcome and opening remarks

2. Adoption of agenda

3. Appointment of rapporteurs

4. Review of available documents and reports

4.1. Updates on recommended research progress FO, GL, IS

4.2. Summary of existing data in NAMMCO countries & adjacent areas

5. Assessment of white-sided dolphin *(Lagenorhynchus acutus)*

5.1. Stock identity

5.2. Biological parameters

5.3. Abundance estimation

5.4. Removals, including bycatch

5.5. Impacts from other anthropogenic stressors

5.6. Population modelling & assessment

6. Assessment of white-beaked dolphin *(Lagenorhynchus albirostris)*

6.1. Stock identity

6.2. Biological parameters

6.3. Abundance estimation

6.4. Removals, including bycatch

6.5. Impacts from other anthropogenic stressors

6.6. Population modelling & assessment

7. Recommendations

7.1. Recommendations for research

7.2. Recommendations for conservation & management

8. Other business

9. Acceptance of report

10. Closing remarks

For information:

Terms of Reference of the DWG, as established by SC 29:
a) Conduct an assessment of the sustainability of the removals of Lagenorhynchus dolphins in the Faroe Islands, Iceland and Greenland.
b) To review available information in other areas and identify knowledge gaps and needs for further research.
c) Assess impacts from non-hunting related anthropogenic stresses (pollution, climate change, noise etc).

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APPENDIX 3: LIST OF DOCUMENTS

Working Documents

Doc. No.	Title	Agenda item
SC/30/DWG/01	Draft Agenda	2
SC/30/DWG/02	Draft List of Participants	1
SC/30/DWG/03	Draft List of Documents	Several
SC/30/DWG/04	Research updates from Member countries	Several
SC/30/DWG/05	Norwegian By-catch data	5.4, 6.4
SC/30/DWG/06	Recent Abundance estimates from NAMMCO countries	5.3, 6.3
SC/30/DWG/07	Greenlandic Catch statistics of dolphins	5.4, 6.4
SC/30/DWG/08	Overview of *Lagenorhynchus* Genetic structure	5.1, 6.1
SC/30/DWG/09	Recent Abundance estimates from non-NAMMCO countries	5.3, 6.3
SC/30/DWG/10	Faroe Islands Catch statistics of white-sided dolphins	5.4
SC/30/DWG/11	Assessment runs for white-sided dolphins in the Central North Atlantic – 2023	5.6
SC/30/DWG/12	Age, growth, and reproduction of white-sided dolphins in the Faroe Islands	5.2
SC/30/DWG/13	Movements of white-sided dolphins tagged in the Faroe Islands	5.1
SC/30/DWG/14	Note on struck and lost white-beaked dolphins in the Greenland hunt	6.4
SC/30/DWG/15	Life history (time-to-event) models for white-sided dolphins	5.6
SC/30/DWG/16	By-catch and age data on white-beaked dolphins in Iceland	6.2, 6.4
SC/30/DWG/17	Calculation of Potential Biological Removal for white-beaked dolphins in the Faroe Islands, Greenland, and Iceland	6.6

For Information Documents

Doc. No.	Title	Agenda item
SC/30/DWG/FI01	Pike et al. (2019) NASS 2015 Cetacean abundance in Iceland & Faroes	5.3, 6.3
SC/30/DWG/FI02	Pike et al. (2019) TNASS 2007 Cetacean abundance in Iceland & Faroes	5.3, 6.3
SC/30/DWG/FI03	Pike et al. (2019) 30 years of Cetacean abundance trends in Iceland	5.3, 6.3
SC/30/DWG/FI04	Leonard & Øien (2019) Norwegian surveys 2014–2018	5.3, 6.3
SC/30/DWG/FI05	Leonard & Øien (2019) Norwegian surveys 2002–2013	5.3, 6.3

SC/30/DWG/FI06	Hammond et al. (2017) SCANS III estimates	5.3, 6.3
SC/30/DWG/FI07	Hammond et al. (2013) SCANS II estimates	5.3, 6.3
SC/30/DWG/FI08	Gilles et al. (2023) SCANS IV estimates	5.3, 6.3
SC/30/DWG/FI09	Vollmer et al. (2019) Taxonomic revision	5.1, 6.1
SC/30/DWG/FI10	Mirimin et al. (2011) White-sided dolphins in Ireland	5.1, 6.1
SC/30/DWG/FI11	Fernandez et al. (2016) Genomewide catalogue of SNPs	5.1, 6.1
SC/30/DWG/FI12	Banguera-Hinestroza (2014) Phylogeography of white-sided dolphins	5.1, 6.1
SC/30/DWG/FI13	Banguera-Hinestroza (2010) Phylogeography of white-beaked dolphins	5.1, 6.1
SC/30/DWG/FI14	Hansen et al. (2018) Cetacean abundance in Greenland 2015	5.3, 6.3
SC/30/DWG/FI15	Hansen & Heide-Jørgensen (2013) Trends in cetacean abundance in West Greenland	5.3, 6.3
SC/30/DWG/FI16	Gose et al. (2023) Genetic connectivity of white-sided dolphins	5.1
SC/30/DWG/FI17	McKenzie et al. (1997) Contaminant levels in Irish & Scottish white-sided dolphins	5.5
SC/30/DWG/FI18	Rasmussen (2013) Tagging of white-beaked dolphins in Iceland	6.6