# Annex L
# Report of the Subcommittee on *Implementation Simulation Trials*

**Participants:** Allison, Angliss, Banga, Bell, Bickham, Biuw, Brandon, Brownell, Buss, Butterworth, Cipriano, Cisternino, Citta, Collier, de Moor, Doniol-Valcroze, Donovan, Double, Evangelista, Ferguson, Fyfe, Givens, Hielscher, Hikari, Iida, Iñíguez, Isoda, Joon Park, Katara, Kelly, Kema, Kim, Kitakado, Lang, Leal, K. Lee, Lundquist, Lysenko, Mallette, Matsuoka, Nelson, O'Loughlin, Øien, Palka, Pampoulie, Porter, Punt, Reeves, S, Robson, Rojas Urrego, Schubert, Scordino, Sigurðsson, Solvang, Staniland, Suydam, Tiedemann, Wade, Walløe, Warrie, Webster, Weller, Wilberg, Witting, Woo Han, Zerbini.

## 1. INTRODUCTORY ITEMS

### 1.1 Welcoming remarks

Donovan welcomed the participants. The primary task this year was to provide management advice for all AWMP stocks (apart from St Vincent and The Grenadines – see Annex E). Additionally, modifications to the West Greenland fin whale model that had been previously requested were discussed. Both topics have been the subject of intense intersessional work at one small technical meeting in Cambridge in January 2024. He also reminded participants of the need to provide a two-year workplan and budget.

On behalf of the Subcommittee, Donovan thanked Katara, Allison, Punt, and Wilberg who provided computing assistance, as well as Witting, Givens, Brandão, and Ferguson who provided substantial assistance in providing additional information about *SLA* programs.

### 1.2 Election of Chair

Donovan and Wilberg were elected as Co-Chairs.

### 1.3 Appointment of rapporteurs

Donovan and Wilberg served as rapporteurs with assistance from the authors of the working papers.

### 1.4 Adoption of Agenda

The agenda was adopted. See Appendix 1.

### 1.5 Documents available

SC/69B/IST01. Working papers relating to *SLA*s and associated data have been appended to the report.

## 2. GENERAL ASSESSMENT AND MODELLING ISSUES

The Subcommittee had no matters to discuss under this Item.

### 2.1 Progress on previous recommendations

There were no outstanding items under this Item.

### 2.2 Workplan

At present, no topics have been referred to the Subcommittee under this item.

## 3. PROVISION OF ADVICE USING AGREED SLAs

This year the focus is on the provision of advice to the Commission. The Subcommittee was informed that no changes to the ASW strike limits in the Schedule are proposed, apart from any modifications due to block length (the existing Schedule has a seven-year block whereas the new one will revert to six years, i.e., 2026-31).

For each hunt, the Subcommittee considered any new information discussed earlier in the week by other relevant sub-groups (e.g., ASW, ASI, SDDNA, NH) and then discussed for each hunt whether the new information would cause a change in the manner of providing management advice from previous years (i.e., whether the existing *SLA*s remain appropriate). In each case, the input data were reviewed and agreement was reached on the series of abundance estimates and removals data to be used and the rationale for any updates from previous years documented. As the strike limit advice is for the period 2026-31, it has been assumed that the number of strikes for the 'bridge period' (i.e. between the most recent strike data and the start of the new six-year block) is the strike limit. The report below presents a concise overview and the Appendices (2-8) document for each hunt the *SLA*s agreed by the Committee and endorsed by the Commission, the agreed abundance estimates and the strike data (if appropriate) used to run the *SLA*s. The Subcommittee noted that the GitHub repositories for the *SLA*s are:

1. https://github.com/intwhcom/Greenland-SLAs
2. https://github.com/intwhcom/ENP-gray-whales-SLA
3. https://github.com/intwhcom/BCB-Bowheads-SLA

The code for some *SLA*s required updating to ensure they worked with current compilers. The dates of *SLA* approval and completed *Implementation Reviews*, as well as the projected future *Implementation Reviews* are provided in Table 1 that is discussed under Item 6.

### 3.1 Eastern Canada/West Greenland bowhead whales (Appendix 2)

*3.1.1 New information*

The Subcommittee received no new information to suggest that the present *SLA* was no longer the best way to provide management advice. Appendix 2 summarises information on the *WG Bowhead Whale SLA* and the abundance estimates needed to run it. The *SLA* code was updated as required, and all abundance estimates were reviewed as to their inclusion in the *SLA.* The **agreed** abundance estimates and to be used in the *SLA* are tabulated in Appendix 2.

*3.1.2 Provision of advice*

The Subcommittee **agreed** that the *WG Bowhead Whale SLA* remains the best way to provide management advice for this stock and it confirms that the limit of up to two whales struck annually for the years 2026-31 will not harm the stock. The general carryover provisions agreed in the AWS apply.

### 3.2 Bering-Chukchi-Beaufort Seas bowhead whales (Appendix 3)

*3.2.1 New information*

The Subcommittee received no new information to suggest that the present *SLA* was no longer the best way to provide management advice. Appendix 3 summarises information on the *Bowhead Whale SLA*, and the removals and abundance estimates needed to run it. The *SLA* code was updated as needed and described in Appendix 3, and all abundance estimates and removals data were reviewed as to their inclusion in the *SLA.* The **agreed** abundance estimates and removals to be used in the *SLA* are tabulated in Appendix 3.

*3.2.2 Provision of advice*

The Subcommittee **agreed** that the *BCB Bowhead Whale SLA* remains the best way to provide management advice for this stock. It confirms that a total number of landed bowhead whales of up to 336 in the six-year block 2026-31 will not harm the stock (the annual number struck shall not exceed 67 except the general carryover provisions agreed in the AWS apply).

**3.3 North Pacific gray whales (Appendix 4)**

*3.3.1 New information*

Last year, the Subcommittee had discussed new information on the recent gray whale unusual mortality event (UME) and abundance estimates (Annex L, Item 4), in the light of the applicability of the *Gray Whale SLA* which had been tested with a lower frequency of such events. At that time, the Subcommittee examined the results of a selection of trials to provide insight into the implications of the UME and recent abundance estimates (SC/69A/IST01). It had agreed that the set of projections reported suggested that the performances of the *Gray Whale SLA* and the Makah Management Plan are robust to a broader set of scenarios related to episodic events such as UMEs than previously considered. It established a small intersessional group to examine whether further trials were needed to provide advice on the suitability of the advice for the 2026-31 and had noted the need for the US to provide the most recent abundance estimates to ASI for review (see Annex D).

The Subcommittee **agreed** that no new trials were required at this meeting before advice can be provided in the light of: (a) the results in SC/69A/IST01 with respect to robustness; (b) the new agreed abundance estimates showing that the decline had been arrested (see Appendix 4); (c) the declaration under US legislation that the UME had ceased (see Annex E); and (d) the start of the *Implementation Review* after this meeting (see Item 6).

Appendix 4 summarises information on the *Gray Whale SLA*, and the removals and abundance estimates needed to run it. The *SLA* code was updated as needed and all abundance estimates and removals data were reviewed as to their inclusion in the *SLA.* The **agreed** abundance estimates and removals to be used in the *SLA* are tabulated in Appendix 4.

*3.3.2 Provision of advice*

The Subcommittee **agreed** that the *Gray Whale SLA* remains the best way to provide management advice for this stock. It confirms that a total number of landed gray whales of up to 840 in the six-year block 2026-31 will not harm the stock (the annual number struck shall not exceed 140). The general carryover provisions agreed in the AWS apply. The Subcommittee advises that the Makah Management Plan (IWC 2018) is also in accord with the Commission's conservation and management objectives.

**3.4 Common minke whale stocks off East Greenland (and see Appendix 5)**

*3.4.1 New information*

The Subcommittee received no new information to suggest that the present *SLA* was no longer the best way to provide management advice. Appendix 5 summarises information on the *Greenland Minke Whale SLA* and the abundance estimates needed to run it. The *SLA* code was updated as needed, and all abundance estimates were reviewed as to their inclusion in the *SLA.* The **agreed** abundance estimates to be used in the *SLA* are tabulated in Appendix 5.

*3.4.2 Provision of advice*

The Subcommittee **agreed** that the *Greenland Minke Whale SLA* remains the best way to provide management advice for this stock and it confirms that the limit of up to 20 whales struck annually for the years 2026-31 will not harm the stock. The general carryover provisions agreed in the AWS apply.

**3.5 Common minke whale stocks off West Greenland (Appendix 6)**

*3.5.1 New information*

The Subcommittee received no new information to suggest that the present *SLA* was no longer the best way to provide management advice. Appendix 6 summarises information on the *Greenland Minke Whale SLA* and the abundance estimates needed to run it. The *SLA* code was updated needed, and all abundance estimates were reviewed as to their inclusion in the *SLA.* The **agreed** abundance estimates to be used in the *SLA* are tabulated in Appendix 6.

*3.5.2 Provision of advice*

The Subcommittee **agreed** that the *Greenland Minke Whale SLA* remains the best way to provide management advice for this stock and it confirms that the limit of up to 164 whales struck annually for the years 2026-31 will not harm the stock. The general carryover provisions agreed in the AWS apply.

**3.6 Fin whales off West Greenland (Appendix 7)**

*3.6.1 New information*

The Subcommittee received no new information to suggest that the present *SLA* was no longer the best way to provide management advice. Appendix 7 summarises information on the *Fin Whale SLA* and the abundance estimates needed to run it. The *SLA* code was updated as needed, and all abundance estimates were reviewed as to their inclusion in the *SLA.* The **agreed** abundance estimates to be used in the *SLA* are tabulated in Appendix 7.

*3.6.2 Provision of advice*

The Subcommittee **agreed** that the *Fin Whale SLA* remains the best way to provide management advice for this stock and it confirms that the limit of up to 19 whales struck annually for the years 2026-31 will not harm the stock. The general carryover provisions agreed in the AWS apply.

**3.7 Humpback whales off West Greenland (Appendix 8)**

*3.7.1 New information*

The Subcommittee received no new information to suggest that the present *SLA* was no longer the best way to provide management advice. Appendix 8 summarises information on the *Humpback Whale SLA* and the abundance estimates needed to run it. The *SLA* code was updated as needed, and all abundance estimates were reviewed as to their inclusion in the *SLA.* The **agreed** abundance estimates to be used in the *SLA* are tabulated in Appendix 8.

The Subcommittee reiterated its previous agreement (IWC, 2021) that the *Implementation Review* for this *SLA* should occur in the context of the In-depth Assessment of humpback whales in the whole North Atlantic. Plans for this are discussed under Item 6.

*3.7.2 Provision of advice*

The Subcommittee **agreed** that the *Humpback Whale SLA* remains the best way to provide management advice for this stock and it confirms that the limit of up to 10 whales struck annually for the years 2026-31 will not harm the stock. The general carryover provisions agreed in the AWS apply.

***Attention**: C, CG, ASW*

*The Subcommittee has reviewed the available information for all the ASW hunts with an agreed SLA. It was informed that no changes to the ASW strike limits in the Schedule are proposed, apart from any*

*modifications due to block length (the existing Schedule has a seven-year block whereas the new one will revert to six years, i.e., 2026-31).*

*Noting that, funding permitting, the next Implementation Review for gray whales will begin with a workshop in 2025 and work on developing a modelling framework for North Atlantic humpbacks will begin in early 2026, the Subcommittee* ***recommends*** *that the best way to provide management advice for the hunts above is to use the agreed SLAs and that these SLAs have confirmed that the present strike limits in the Schedule (adjusted for the change from a seven to a six-year block) will not harm the stocks.*

## 4. PROGRESS ON PREVIOUS RECOMMENDATIONS

There were no formal previous recommendations to address apart from one from last year (Recommendation no).

The four recommendations made by the Scientific Committee related to North Atlantic fin whale trials were addressed in SC/69B/IST01:

1. incorporate the *SLA* into the control program to set the aboriginal catch in West Greenland;
2. revise the control program to be able to run it using different compilers;
3. consider how stochastic mixing can be incorporated to mimic fluctuations in abundance in the West Greenland sub-area; and
4. replicate the most recent methods to run the trials.

An updated version of the control program is available at the Secretariat. The paper focussed on the changes to the operating model used to implement stochastic mixing in the western part of the distribution (the East Canada and West Greenland sub-areas).

The Subcommittee welcomed the thorough and prompt response to this recommendation, noting that it was a product of the small meeting of the computing group in January 2024. It **stresses** the value of this work to enable future *Implementation Reviews* and contribute to the 'legacy' work of the Committee; it **encourages** future such meetings (see Item 6). It **agrees** that this recommendation can be considered closed.

## 5. BIENNIAL/LONG-TERM WORKPLAN, BUDGET REQUESTS

The highest priority of the IST workplan is the gray whale *Implementation Review*. Additionally, work has begun towards the North Atlantic humpback whale In-depth Assessment with a planned data workshop for 2025 (which has already been funded) and a request for a modelling meeting prior to the SC70 meeting which is directly relevant to this Subcommittee. The in-depth assessment will provide the modelling framework for the *Implementation Review* of the West Greenland humpback whale hunt and allow for the development of an *SLA* for the St. Vincent and the Grenadines hunt.

### 5.1 Implications of biennial meetings

The Aboriginal Whaling Scheme (AWS, IWC, 2019 – developed by the Committee and endorsed by the Commission), the Scientific Committee Handbook (see Item); and the Commission's Rules of Procedure and the Schedule to the International Convention for the Regulation of Whaling impose requirements on: (1) ASW governments and thus hunter organisations seeking aboriginal subsistence whaling (ASW) quotas; and (2) how and when the Scientific Committee provides advice on ASW catch limits.

These requirements were developed when Committee meetings were held annually.

At IWC68 in October 2022, the Commission agreed that Committee meetings would occur in 2023, 2024, and biennially thereafter. In light of this change, the Commission directed the Committee to prioritize topics related to ASW such that the Committee can provide advice in years when strike limits are reviewed.

The Subcommittee and Committee have spent considerable time discussing the implications of the Commission's decision for ASW/IST-related work since then (e.g. ref to last year). Building upon those discussions, the Subcommittee provides the following conclusions and recommendations for its workplan.

*Abundance estimates*

A successful abundance survey is not considered to have 'occurred' until the resulting abundance estimate is endorsed by the Committee via ASI. Upon endorsement, the 10-year time window starts with the time of the survey itself. If a survey occurs at the end of the 10-year interval (e.g., 2024 as for West Greenland) but the analyses are only ready in a non-full Committee year (likely 2025 in this case), in principle the 'grace period' provision can be invoked for one year until the estimate can be approved at a full Committee meeting but this is purely a result of a change in meeting timing. The Subcommittee discussed several potential approaches but **agrees** that the simplest solution is for the Committee to determine a mechanism to handle such issues when they arise by establishing a mechanism for intersessional approval.

*Implementation Reviews (IRs) are required 'normally' every 5 to 6 years under the AWS.*

For practical reasons, the Committee tries to work on only one IR at a time (although in cases of shared areas, an AWMP and an RMP IR are combined). An IR 'normally' requires one or two Committee meetings (usually with at least one intersessional workshop) to complete, although complex IRs (e.g., if new stock structure hypotheses need to be developed and trials run) may take much longer. In addition, if a *Special Implementation Review* is deemed necessary, this will interfere with the timing of other IRs. The Workplan below assumes funding for adequate intersessional activity. The Subcommittee **stresses** that without adequate funding for intersessional activity and in-person workshops (e.g. see Item 6.1), the robustness of advice guaranteed by the *Implementation Review* component of the ASW will be lost since IRs will only be able to be completed with 12- and 14-year intervals (or longer) as discussed last year (ref).

Table 1

Proposed workplan and **potential** timings of *Implementation Reviews* under the assumptions of: (a) adequate intersessional funding; and (b) lengths of time required. Note: The full Committee can endorse the results of IRs only during even years. Green shading indicates common analytical frameworks.

| Species/stock | *Implementation* (and subsequent IRs) completed | Next planned IR subject to sufficient resources |
|---|---|---|
| WG humpback whales (AWMP) | 2014 | Start 2026 after in-depth assessment |
| St Vincent and The Grenadines humpbacks (SLA development) | n/a | Start 2026 after in-depth assessment |
| Eastern North Pacific gray whales (AWMP) | 2004 (2010, 2013, 2020) | Start 2025, complete ~2026 |
| BCB bowhead whales (AWMP) | 2000 (2007, 2012, 2018) | Start 2027 |
| West Greenland bowhead whales (AWMP) | 2015 (2022) | Start 2028 |
| Common minke whales off Greenland (AWMP) | 2019, 2022 | Start 2029 |
| North Atlantic common minke whales (RMP) | 1993 (2003, 2008, 2017, 2022) | |
| North Atlantic fin whales (AWMP, RMP) | 2009 (2016, 2023) | Start 2030 |
| North Atlantic fin whales (AWMP, RMP | 2009 (2016, 2023) | |

## 5.2 Budget requests

The Subcommittee ranks all the budget proposals it is involved in as **equal High Priority** if it is to meet its workplan and continue to provide the most robust advice on strike limits to the Commission. Some of these are in collaboration with other Subcommittee work, due to common subject matter and/or personnel. Every effort has been made to minimise costs, the venue is free and it has been assumed that

national delegates will fund themselves. The text below summarises only those parts directly relevant to the IST and the provision of ASW advice.

(1) *Implementation Review* of gray whales (SC/69B/RP05): the workshop to begin the *Implementation Review* of gray whales following AWS guidelines will take place in May/June 2025. The complexity of the subject matter requires an in-person meeting. The outcome will be submitted to the 2026 Committee meeting. It is not possible at this stage to determine whether the review can be completed at SC70 but that would be the ideal. This work also contributes to ensuring the future ability of the Committee to provide advice as part of the succession planning process discussed by the Committee.

(2) In-depth Assessment of North Atlantic humpback whales (SC/69B/RP23): this is needed urgently to agree upon a common modelling framework to complete an *Implementation Review* for the Greenland hunt and to develop an *SLA* for the St Vincent and The Grenadines hunt. Collaborating with IA will ensure that the modelling framework meets both IA and IST needs and ultimately provides the most robust advice on strike limits to the Commission. It is not possible at this stage to determine whether the review can be completed at SC70 but that would be the ideal. This work also contributes to ensuring the future ability of the Committee to provide advice as part of the succession planning process discussed by the Committee.

(3) Computing resources (SC/69B/RP16): the provision of robust scientific advice on strike limits requires efficient and effective computing resources (financial and personnel). The proposal to hold a small group meeting of the relevant persons whilst developed under IA with respect to common minke whales of the western North Pacific will also support work under IST with respect to *Implementation Reviews* and the development of a new *SLA* for St. Vincent and The Grenadines. A similar meeting allowed the completion of the fin whale work discussed under Item 5, the documentation and coding required to provide the ASW advice at this meeting, and the documentation to ensure that advice can be provided in 2030 for the next quota block.

Although a document is not yet available to the Subcommittee for detailed comments, it **strongly supports** the concept of succession planning for the computing, modelling and assessment capabilities of the Committee. Without this, provision of the most robust scientific advice on ASW hunts in the future will become increasingly difficult.

In its discussions of these proposals, the Subcommittee noted the difficulty of predicting the results and hence the timetable of the necessary iterative approach to completing *Implementation Reviews*, hence the tentative dates assigned to the workplan outlined in Table 1. The ability to fulfil the need for regular *Implementation Reviews* may depend on unexpected work, in addition to that predicted in developing the biennial budget, with associated financial implications.

***Attention**: SC, BSC, ASW, C*

*The Committee noted that the only guidance provided by the Commission on the priorities for the Committee's workplan at its last meeting related to high priority for ASW and related essential work on* Implementation Reviews *and related simulation trials. This work is critical to the provision of advice under the Schedule. Whilst the Committee must of course, fully justify requests for intersessional workshops related to IRs and the provision of ASW advice, such as those in this report, it **reiterates** its recommendation that the Commission should consider carefully developing an approach that, under a biennial regime, ensures the necessary ASW work can be funded in a prompt manner if unforeseen situations arise that require additional work to resolve.*

## 6. INFORMAL ADVICE ON ADDITIONAL METHODS FOR PROVIDING ADVICE TO THE COMMISSION IN LIGHT OF THE SC COMMUNICATIONS INITIATIVE

The co-chairs will work with the Secretariat on this issue.

## 7. ADOPTION OF REPORT

The Chair and co-chair thanked the Subcommittee for its commitment to provide the Commission with the best management advice, not only for the next (2026-31) block but into the future. The extensive intersessional work undertaken by Katara and the advisory group detailed in the Appendices has provided a strong, documented baseline for future work.

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**Appendix 1**

**Agenda**

**1. INTRODUCTORY ITEMS**

**1.1 Welcoming remarks**

**1.2 Election of Chair**

**1.3 Appointment of rapporteurs**

**1.4 Adoption of Agenda**

**1.5 Documents available**

**2. GENERAL ASSESSMENT AND MODELLING ISSUES**

**2.1 Progress on previous recommendations**

**2.2 Workplan**

**3. PROVISION OF ADVICE USING AGREED SLAS**

**3.1 Eastern Canada/West Greenland bowhead whales**

*3.1.1 New information*

*3.1.2 Provision of advice*

**3.2 Bering-Chukchi-Beaufort Seas bowhead whales**

*3.2.1 New information*

*3.2.2 Provision of advice*

**3.3 North Pacific gray whales**

*3.3.1 New information*

*3.3.2 Provision of advice*

**3.4 Common minke whale stocks off East Greenland**

*3.4.1 New information*

*3.4.2 Provision of advice*

**3.5 Common minke whale stocks off West Greenland**

*3.5.1 New information*

*3.5.2 Provision of advice*

**3.6 Fin whales off West Greenland**

*3.6.1 New information*

*3.6.2 Provision of advice*

**3.7 Humpback whales off West Greenland**

*3.7.1 New information*

*3.7.2 Provision of advice*

**5. PROGRESS ON PREVIOUS RECOMMENDATIONS**

**6. BIENNIAL/LONG-TERM WORKPLAN, BUDGET REQUESTS**

**7. INFORMAL ADVICE ON ADDITIONAL METHODS FOR PROVIDING ADVICE TO THE COMMISSION IN LIGHT OF THE SC COMMUNICATIONS INITIATIVE**

**8. ADOPTION OF REPORT**

## Appendix 2

### Eastern Canada/West Greenland bowhead whales

The code and input data used in the 2024 application of the *Greenland Bowhead SLA* can be found in a restricted-access *GitHub repository*. The *SLA* uses the total need and a time series of agreed estimates of abundance. The time series of catches are provided for information and as a legacy feature because the control program allowed for the possibility that the *SLA*s might use catch data.

Separate *SLA*s were developed for the West Greenland bowhead whales by Brandão (Brandão, 2017a; Brandão and Butterworth, 2013; 2014; 2015a) and Witting (Witting, 2013a; 2014a; 2015b), the latter is dated 02/03/2015. The outputs of the two algorithms are averaged to derive the final strike limit. The *SLA* by Brandão is used when the last year of catches is <=2019, the two SLAs are averaged when the last year of catches is between 2026 and 2031, and the *SLA* by Witting is used for all other cases. Given that the last year of catches is 2023, the strike limit will be calculated using the Witting *SLA*. Minor changes were made to output more information and to ensure the C++ code could be compiled by multiple (current) compilers.

The need for West Greenland is 2 strikes per year for a block of 6 years (2026-2031).

Historical abundance estimates listed in the IWC abundance tables and used in the SLA are shown in Table 1. The inverse variance average of the two 2012 abundance estimates is used in the SLA (average: 1,132; CV: 0.115).

The data on historical removals (Table 2) include direct caches from the IWC catch database. Individuals of unknown sex are equally divided between males and females. Bycatch and ship strikes were unknown in the previous iteration of the algorithms and noted as -1 in the input data (i.e., are ignored when applying the *SLA*s).

Table 1
Abundance estimates for bowhead whales off West Greenland, from the IWC-endorsed abundances table, used in the 2024 SLA application

| Subarea | Category | Year | Abundance | CV | Ref | Notes |
|---|---|---|---|---|---|---|
| WG | 1A | 2006 | 1,229 | 0.47 | Heide-Jørgensen *et al.*, 2007a | The estimate does not reflect total population size but is representative of the number of whales off W. Greenland in winter (April survey). Estimate adjusted by a time-in-view factor of 0.8975 gives 1,103 used in conditioning in some trials (Year 2007 in some reports |
| WG | 1A | 2012 | 744 | 0.34 | Rekdal *et al.*, 2015 | LT. Agreed for use in conditioning (IWC 2015 p436) as changing to an MR approach might compromise the completion of SLA development work. Estimate = 829 excluding time-in-view correction. |
| WG | 1A | 2012 | 1,274 | 0.12 | Rekdal *et al.*, 2015; IWC, 2015a; 2015b | Genetic mark-recapture estimate. SC agreed this provides the best estimate of no. of whales visiting West Greenland. |
| | | 2012 | 1132 | 0,115 | | Combined from the two 2019 estimates |
| WG feeding area | 1A | 2022 | 888 | 0.46 | Hansen, 2023 | LT. |

Table 2
Direct catches of bowhead whales off West Greenland since 1928. If sex unknown allocated equally between the sexes.

| Year | Male | Female | Year | Male | Female |
|---|---|---|---|---|---|
| 1928 | 0.5 | 0.5 | 2008 | 0 | 0 |
| 1929 | 0 | 0 | 2009 | 1 | 2 |
| … | 0 | 0 | 2010 | 0 | 3 |
| 1955 | 0 | 0 | 2011 | 0 | 1 |
| 1956 | 0.5 | 0.5 | 2012 | 0 | 0 |
| 1957 | 0 | 0 | 2013 | 0 | 0 |
| … | 0 | 0 | 2014 | 0 | 0 |

| | | | | | |
|---|---|---|---|---|---|
| 1972 | 0 | 0 | 2015 | 0 | 1 |
| 1973 | 0.5 | 0.5 | 2016 | 0 | 0 |
| 1974 | 0 | 0 | … | 0 | 0 |
| … | 0 | 0 | 2021 | 0 | 0 |
| | | | 2022 | 0 | 1 |
| | | | 2023 | 0 | 0 |

## Appendix 3

## Bering-Chukchi-Beaufort Seas bowhead whales

The outputs from two strike limit algorithms (*SLA*s) are combined to calculate a strike limit for the Bering-Chukchi-Beaufort (BCB) bowheads. The original subroutines (*SLC*s) were developed by (Givens, 2001; Givens et al., 2015) - dated May 2001, G-G SLC hereafter) and by Dereksdóttir and Magnússon (Dereksdóttir and Magnússon, 2003), dated January 2002; D-M SLC hereafter). Allison expanded and altered versions of the original code for both SLAs (dated April 2002) and combined them as the 'Grand Unified Procedure' (GUP). The procedure combines the two SLAs, ignoring their 'snap-to-need' features, applied after averaging the two strike limits (IWC, 2003). The G-G SLC maintains the features of variability dampening and protection levels - the latter was described as a feature applied after the 'snap-to-need', which is 'switched off' in the code. The D-M SLC imposes a maximum of 20% change in strike limits, also described as a feature applied after the 'snap-to-need'. Allison provided code to run GUP (January 2024), along with older versions of the SLAs and GUP. Punt revised the code to ensure the continuity between periods of quota allocation that the G-G SLC requires; the algorithm uses stock size estimators (denoted as $\bar{\bar{P}}t$ in Givens (2003) from previous applications of the G-G GLS as input for subsequent applications and previously set strike limits.

The final versions of GUP and its dependencies (the G-G and D-M SLAs) can be found in a restricted access GitHub repository.

### Inputs

A total of up to 336 bowhead whales were requested as a 'need' for the period 2026-31 (six years), with no more than 67 whales struck in any year. The 1st year to which the strike limit (the 'current year') applies is 2024.

The NeedBlk – a variable referring to the annual quota imposed the years before the 'current year' and used in the D-M SLC to impose the maximum of a 20% change in strike limits – is 67 whales per year for the years 2019-25.

### Catches

A time series of removals based on direct catches was produced by a small group (Allison, Citta, Suydam) and can be found in Adjunct Table 3A.1. Different methods were used in different periods to estimate the number of struck and lost whales and the number of those whales assumed dead because reporting and acquired information changed in time (see Adjunct for details).

The total estimated killed whales was used as input in the SLA; it was divided equally between the two sexes because the population models, on which the G-G and D-M SLCs are based, are not sex-structured.

### Abundance estimates

Table 1 lists the abundance estimates for North Pacific bowhead whales recorded in the IWC abundances tables and used in the SLA. If two or more abundance estimates are available for the same year the inverse variance weighted mean is calculated and used as input to the *SLA*.

The inverse variance weighted average will be used for 2011 (average 17,042.66, CV 0.05076). The variance for the 2019 estimate of 14,025 is given as 10,257,486 (Givens *et al.* 2021b). The variance for the 2019 estimate of 17,175 is derived from the CV and equals 16,568,767 (M. Ferguson personal communication). The inverse-variance weigh ted average is 15,229 (CV = 0.165)

Table 1.
Abundance estimates of BCB bowheads from the IWC-endorsed abundances tables used in the SLA.

| Category | Year | Abundance | CV | Reference | Notes |
|---|---|---|---|---|---|
| 1A | 1978 | **4,765** | **0.305** | (Zeh and Punt, 2005) | Updated 1978-2001 abundance estimates using data from various sources |
| 1A | 1980 | **3,885** | **0.343** | | |
| 1A | 1981 | **4,467** | **0.273** | | |
| 1A | 1982 | **7,395** | **0.281** | | |
| 1A | 1983 | **6,573** | **0.345** | | |

| | | | | | |
|---|---|---|---|---|---|
| 1A | 1985 | **5,762** | **0.253** | | |
| 1A | 1986 | **8,917** | **0.215** | | |
| 1A | 1987 | **5,298** | **0.327** | | |
| 1A | 1988 | **6,928** | **0.12** | | |
| 1A | 1993 | **8,167** | **0.071** | | |
| 1A | 2001 | **10,545** | **0.128** | | |
| 1A | 2004 | **12,631** | **0.2442** | (Koski *et al.*, 2010) | Revised from estimate 11,800 (cv 0.255) |
| 1A | 2011 | 16,820 | 0.052 | (Givens *et al.*, 2016) | Uses a Horvitz-Thompson type estimator, based on counts at ice-based visual observation stations. |
| 1A | 2011 | 27,133 | 0.217 | (Givens *et al.*, 2018a; 2018b) | Photo-ID data from the 2011 aerial survey. |
| | **2011** | **17,042** | **0.051** | | Combined from the two 2011 estimates |
| 1A | 2019 | 14,025 | 0.228 | SC68C; Givens *et al.*, 2021a; 2021b | Updated to take account of some sources of bias associated with a 12,505 estimate due to: missed survey effort, unusual ice conditions & more frequent use of motor-powered skiffs by hunters |
| 1A | 2019 | 17,175 | 0.237 | Ferguson *et al.*, 2022; SC68D | The survey in 2019 missed a small number of whales |
| | **2019** | **15,229** | **0.165** | | Combined from the two 2019 estimates |

## Adjunct

### Historical catches for the Bering-Chukchi-Beaufort Seas stock of bowhead whales

A small group (Allison, Citta, Suydam) was tasked with reconciling the catch information used in the Bering-Chukchi-Beaufort bowhead whale *SLA*. The difference between the previously used estimates in the SLA and the ones in the IWC database were because the removal estimates previously used for testing the SLA were estimated kills that included a proportion of struck whales based on their reported dispositions. The best estimates are provided in Table 3A.1.

*Table 3A.1. Catches of bowhead whales. For the years 1848-1969, 100% of struck and lost were assumed dead and struck and lost were estimated as 50% of landed whales. For the years 1970-1980, 50% of struck and lost whales were assumed dead and estimates of struck and lost estimates were provided by NMFS, whaling captains and AEWC. For years 1981-2023, hunters report the number of struck and lost whales and assess their chance of survival as died= d, p=poor, f=fair, g=good, e=excellent, u=unknown; Total estimated kill = whales that died (d) + poor chance of survival (p) + proportion of unknown (u) that died. landed + estimated mortality (kill) of whales with unknown fate = [(d+p)/(d+p+f+g+e)] x u. Further details on the data sources and the 3 methods used to estimate killed whales can be found in here the relevant GitHub repository (access granted after request to the Secretariat.). PK: Pelagic Kill; SK: Shore Kill; UnK: unrecoverable or abandoned kill; EK: Estimated kill*

| Year | Total PK | Alaskan SK (UnK) | Canadian SK | Russian SK | Total SK | Shore S&L[1] | EK of shore S&L | Total EK | Total Strikes[2] |
|---|---|---|---|---|---|---|---|---|---|
| 1848 | 18 | 0(-) | 0 | 0 | 0 | 0 | 0 | 18 | |
| 1849 | 571 | 0(-) | 0 | 1 | 1 | 1 | 1 | 573 | |
| 1850 | 2067 | 0(-) | 0 | 0 | 0 | 0 | 0 | 2067 | |
| 1851 | 896 | 0(-) | 0 | 1 | 1 | 1 | 1 | 898 | |
| 1852 | 2682 | 17(-) | 0 | 1 | 18 | 9 | 9 | 2709 | |

[1] excludes known killed whales
[2] Including Russian strikes

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1853 | 796 | 7(-) | 0 | 0 | 7 | 4 | 4 | 807 | |
| 1854 | 130 | 24(-) | 0 | 0 | 24 | 12 | 12 | 166 | |
| 1855 | 2 | 0(-) | 0 | 0 | 0 | 0 | 0 | 2 | |
| 1856 | 0 | 0(-) | 0 | 0 | 0 | 0 | 0 | 0 | |
| 1857 | 78 | 0(-) | 0 | 0 | 0 | 0 | 0 | 78 | |
| 1858 | 459 | 1(-) | 0 | 0 | 1 | 1 | 1 | 461 | |
| 1859 | 366 | 0(-) | 0 | 4 | 4 | 2 | 2 | 372 | |
| 1860 | 221 | 0(-) | 0 | 0 | 0 | 0 | 0 | 221 | |
| 1861 | 306 | 0(-) | 0 | 0 | 0 | 0 | 0 | 306 | |
| 1862 | 157 | 0(-) | 0 | 0 | 0 | 0 | 0 | 157 | |
| 1863 | 303 | 0(-) | 0 | 0 | 0 | 0 | 0 | 303 | |
| 1864 | 434 | 0(-) | 0 | 0 | 0 | 0 | 0 | 434 | |
| 1865 | 588 | 0(-) | 0 | 1 | 1 | 1 | 1 | 590 | |
| 1866 | 540 | 0(-) | 0 | 9 | 9 | 5 | 5 | 554 | |
| 1867 | 599 | 0(-) | 0 | 0 | 0 | 0 | 0 | 599 | |
| 1868 | 516 | 0(-) | 0 | 0 | 0 | 0 | 0 | 516 | |
| 1869 | 370 | 5(-) | 1 | 2 | 8 | 4 | 4 | 382 | |
| 1870 | 620 | 5(-) | 0 | 6 | 11 | 6 | 6 | 637 | |
| 1871 | 133 | 0(-) | 0 | 3 | 3 | 2 | 2 | 138 | |
| 1872 | 194 | 4(-) | 0 | 0 | 4 | 2 | 2 | 200 | |
| 1873 | 147 | 0(-) | 0 | 0 | 0 | 0 | 0 | 147 | |
| 1874 | 95 | 0(-) | 0 | 0 | 0 | 0 | 0 | 95 | |
| 1875 | 200 | 0(-) | 0 | 0 | 0 | 0 | 0 | 200 | |
| 1876 | 76 | 0(-) | 0 | 0 | 0 | 0 | 0 | 76 | |
| 1877 | 262 | 0(-) | 0 | 5 | 5 | 3 | 3 | 270 | |
| 1878 | 80 | 0(-) | 0 | 0 | 0 | 0 | 0 | 80 | |
| 1879 | 261 | 3(-) | 0 | 0 | 3 | 2 | 2 | 266 | |
| 1880 | 460 | 12(-) | 0 | 1 | 13 | 7 | 7 | 480 | |
| 1881 | 418 | 11(-) | 0 | 0 | 11 | 6 | 6 | 435 | |
| 1882 | 240 | 1(-) | 0 | 0 | 1 | 1 | 1 | 242 | |
| 1883 | 39 | 2(-) | 0 | 0 | 2 | 1 | 1 | 42 | |
| 1884 | 133 | 13(-) | 0 | 5 | 18 | 9 | 9 | 160 | |
| 1885 | 287 | 41(-) | 0 | 19 | 60 | 30 | 30 | 377 | |
| 1886 | 133 | 13(-) | 0 | 10 | 23 | 12 | 12 | 168 | |
| 1887 | 204 | 23(-) | 0 | 1 | 24 | 12 | 12 | 240 | |
| 1888 | 133 | 17(-) | 1 | 0 | 18 | 9 | 9 | 160 | |
| 1889 | 53 | 49(-) | 0 | 0 | 49 | 25 | 25 | 127 | |
| 1890 | 127 | 6(-) | 0 | 0 | 6 | 3 | 3 | 136 | |
| 1891 | 234 | 33(-) | 0 | 0 | 33 | 17 | 17 | 284 | |
| 1892 | 317 | 19(-) | 0 | 0 | 19 | 10 | 10 | 346 | |
| 1893 | 141 | 26(-) | 0 | 0 | 26 | 13 | 13 | 180 | |
| 1894 | 151 | 52(-) | 0 | 3 | 55 | 28 | 28 | 234 | |
| 1895 | 94 | 10(-) | 0 | 5 | 15 | 8 | 8 | 117 | |
| 1896 | 58 | 40(-) | 0 | 0 | 40 | 20 | 20 | 118 | |
| 1897 | 73 | 38(-) | 0 | 0 | 38 | 19 | 19 | 130 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1898 | 228 | 44(-) | 1 | 9 | 54 | 27 | 27 | 309 | |
| 1899 | 208 | 14(-) | 0 | 3 | 17 | 9 | 9 | 234 | |
| 1900 | 112 | 21(-) | 0 | 3 | 24 | 12 | 12 | 148 | |
| 1901 | 29 | 17(-) | 0 | 0 | 17 | 9 | 9 | 55 | |
| 1902 | 132 | 18(-) | 0 | 2 | 20 | 10 | 10 | 162 | |
| 1903 | 95 | 13(-) | 0 | 1 | 14 | 7 | 7 | 116 | |
| 1904 | 74 | 8(-) | 0 | 0 | 8 | 4 | 4 | 86 | |
| 1905 | 93 | 8(-) | 0 | 0 | 8 | 4 | 4 | 105 | |
| 1906 | 36 | 19(-) | 0 | 3 | 22 | 11 | 11 | 69 | |
| 1907 | 70 | 15(-) | 0 | 2 | 17 | 9 | 9 | 96 | |
| 1908 | 33 | 49(-) | 0 | 11 | 60 | 30 | 30 | 123 | |
| 1909 | 10 | 28(-) | 0 | 6 | 34 | 17 | 17 | 61 | |
| 1910 | 16 | 14(-) | 0 | 0 | 14 | 7 | 7 | 37 | |
| 1911 | 30 | 12(-) | 0 | 0 | 12 | 6 | 6 | 48 | |
| 1912 | 0 | 26(-) | 0 | 0 | 26 | 13 | 13 | 39 | |
| 1913 | 0 | 15(-) | 0 | 0 | 15 | 8 | 8 | 23 | |
| 1914 | 40 | 14(-) | 0 | 0 | 14 | 7 | 7 | 61 | |
| 1915 | 0 | 14(-) | 1 | 0 | 15 | 8 | 8 | 23 | |
| 1916 | 0 | 15(-) | 0 | 0 | 15 | 8 | 8 | 23 | |
| 1917 | 0 | 23(-) | 0 | 0 | 23 | 12 | 12 | 35 | |
| 1918 | 0 | 17(-) | 1 | 0 | 18 | 9 | 9 | 27 | |
| 1919 | 16 | 11(-) | 0 | 0 | 11 | 6 | 6 | 33 | |
| 1920 | 0 | 17(-) | 0 | 5 | 22 | 11 | 11 | 33 | |
| 1921 | 0 | 6(-) | 0 | 0 | 6 | 3 | 3 | 9 | |
| 1922 | 0 | 25(-) | 1 | 0 | 26 | 13 | 13 | 39 | |
| 1923 | 0 | 7(-) | 0 | 1 | 8 | 4 | 4 | 12 | |
| 1924 | 0 | 25(-) | 0 | 2 | 27 | 14 | 14 | 41 | |
| 1925 | 0 | 33(-) | 0 | 2 | 35 | 18 | 18 | 53 | |
| 1926 | 0 | 21(-) | 0 | 2 | 23 | 12 | 12 | 35 | |
| 1927 | 0 | 7(-) | 0 | 2 | 9 | 5 | 5 | 14 | |
| 1928 | 0 | 16(-) | 0 | 4 | 20 | 10 | 10 | 30 | |
| 1929 | 0 | 17(-) | 0 | 3 | 20 | 10 | 10 | 30 | |
| 1930 | 0 | 8(-) | 0 | 3 | 11 | 6 | 6 | 17 | |
| 1931 | 0 | 19(-) | 0 | 2 | 21 | 11 | 11 | 32 | |
| 1932 | 0 | 9(-) | 0 | 9 | 18 | 9 | 9 | 27 | |
| 1933 | 0 | 5(-) | 0 | 9 | 14 | 7 | 7 | 21 | |
| 1934 | 0 | 6(-) | 0 | 8 | 14 | 7 | 7 | 21 | |
| 1935 | 0 | 8(-) | 0 | 2 | 10 | 5 | 5 | 15 | |
| 1936 | 0 | 11(-) | 0 | 5 | 16 | 8 | 8 | 24 | |
| 1937 | 0 | 32(-) | 0 | 3 | 35 | 18 | 18 | 53 | |
| 1938 | 0 | 22(-) | 0 | 2 | 24 | 12 | 12 | 36 | |
| 1939 | 0 | 12(-) | 0 | 0 | 12 | 6 | 6 | 18 | |
| 1940 | 0 | 13(-) | 0 | 0 | 13 | 7 | 7 | 20 | |
| 1941 | 0 | 23(-) | 0 | 2 | 25 | 13 | 13 | 38 | |
| 1942 | 0 | 14(-) | 0 | 3 | 17 | 9 | 9 | 26 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1943 | 0 | 7(-) | 0 | 2 | 9 | 5 | 5 | 14 | |
| 1944 | 0 | 5(-) | 0 | 0 | 5 | 3 | 3 | 8 | |
| 1945 | 0 | 12(-) | 0 | 3 | 15 | 8 | 8 | 23 | |
| 1946 | 0 | 12(-) | 0 | 1 | 13 | 7 | 7 | 20 | |
| 1947 | 0 | 14(-) | 0 | 0 | 14 | 7 | 7 | 21 | |
| 1948 | 0 | 5(-) | 0 | 0 | 5 | 3 | 3 | 8 | |
| 1949 | 0 | 7(-) | 0 | 0 | 7 | 4 | 4 | 11 | |
| 1950 | 0 | 15(-) | 0 | 0 | 15 | 8 | 8 | 23 | |
| 1951 | 0 | 15(-) | 0 | 0 | 15 | 8 | 8 | 23 | |
| 1952 | 0 | 7(-) | 0 | 0 | 7 | 4 | 4 | 11 | |
| 1953 | 0 | 27(-) | 0 | 0 | 27 | 14 | 14 | 41 | |
| 1954 | 0 | 6(-) | 0 | 0 | 6 | 3 | 3 | 9 | |
| 1955 | 0 | 24(-) | 0 | 0 | 24 | 12 | 12 | 36 | |
| 1956 | 0 | 7(-) | 0 | 0 | 7 | 4 | 4 | 11 | |
| 1957 | 0 | 3(-) | 0 | 0 | 3 | 2 | 2 | 5 | |
| 1958 | 0 | 2(-) | 0 | 1 | 3 | 2 | 2 | 5 | |
| 1959 | 0 | 1(-) | 0 | 0 | 1 | 1 | 1 | 2 | |
| 1960 | 0 | 22(-) | 0 | 0 | 22 | 11 | 11 | 33 | |
| 1961 | 0 | 11(-) | 0 | 0 | 11 | 6 | 6 | 17 | |
| 1962 | 0 | 13(-) | 0 | 0 | 13 | 7 | 7 | 20 | |
| 1963 | 0 | 10(-) | 0 | 0 | 10 | 5 | 5 | 15 | |
| 1964 | 0 | 16(-) | 0 | 0 | 16 | 8 | 8 | 24 | |
| 1965 | 0 | 9(-) | 0 | 0 | 9 | 5 | 5 | 14 | |
| 1966 | 0 | 16(-) | 0 | 0 | 16 | 8 | 8 | 24 | |
| 1967 | 0 | 8(-) | 0 | 0 | 8 | 4 | 4 | 12 | |
| 1968 | 0 | 18(-) | 0 | 0 | 18 | 9 | 9 | 27 | |
| 1969 | 0 | 21(-) | 0 | 0 | 21 | 11 | 11 | 32 | |
| 1970 | 0 | 29(-) | 0 | 0 | 29 | 37 | 19 | 48 | |
| 1971 | 0 | 23(-) | 0 | 0 | 23 | 3 | 2 | 25 | |
| 1972 | 0 | 41(-) | 0 | 1 | 42 | 3 | 2 | 44 | |
| 1973 | 0 | 39(0) | 0 | 2 | 41 | 20 | 10 | 51 | |
| 1974 | 0 | 20(3) | 0 | 3 | 26 | 32 | 16 | 42 | |
| 1975 | 0 | 15(2) | 0 | 2 | 19 | 26 | 13 | 32 | |
| 1976 | 0 | 48(8) | 0 | 0 | 56 | 35 | 18 | 74 | |
| 1977 | 0 | 29(3) | 0 | 0 | 32 | 79 | 40 | 72 | |
| 1978 | 0 | 12(0) | 0 | 0 | 12 | 6 | 3 | 15 | |
| 1979 | 0 | 12(0) | 0 | 0 | 12 | 15 | 8 | 20 | |
| 1980 | 0 | 16(3) | 0 | 0 | 19 | 25 | 13 | 32 | |
| 1981 | 0 | 17(2) | 0 | 0 | 19 | 9 | 7 | 26 | |
| 1982 | 0 | 8(0) | 0 | 0 | 8 | 11 | 6 | 14 | |
| 1983 | 0 | 9(0) | 0 | 0 | 9 | 9 | 7 | 16 | |
| 1984 | 0 | 12(0) | 0 | 0 | 12 | 13 | 4 | 16 | |
| 1985 | 0 | 11(1) | 0 | 0 | 12 | 5 | 2 | 14 | |
| 1986 | 0 | 20(0) | 0 | 0 | 20 | 8 | 2 | 22 | |
| 1987 | 0 | 22(0) | 0 | 0 | 22 | 8 | 7 | 29 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1988 | 0 | 23(0) | 0 | 0 | 23 | 6 | 5 | 28 | |
| 1989 | 0 | 18(0) | 0 | 0 | 18 | 3 | 7 | 25 | |
| 1990 | 0 | 30(0) | 0 | 0 | 30 | 14 | 11 | 41 | |
| 1991 | 0 | 28(0) | 1 | 0 | 29 | 19 | 18 | 47 | |
| 1992 | 0 | 38(0) | 0 | 0 | 38 | 12 | 8 | 46 | |
| 1993 | 0 | 41(0) | 0 | 0 | 41 | 11 | 10 | 51 | |
| 1994 | 0 | 34(0) | 0 | 0 | 34 | 12 | 4 | 38 | |
| 1995 | 0 | 44(0) | 0 | 0 | 44 | 13 | 13 | 57 | |
| 1996 | 0 | 38(0) | 1 | 0 | 39 | 5 | 5 | 44 | |
| 1997 | 0 | 48(0) | 0 | 0 | 48 | 18 | 14 | 62 | 66 |
| 1998 | 0 | 41(1) | 0 | 1 | 43 | 12 | 7 | 50 | 55 |
| 1999 | 0 | 42(0) | 0 | 1 | 43 | 5 | 5 | 48 | 48 |
| 2000 | 0 | 35(0) | 0 | 1 | 36 | 12 | 7 | 43 | 48 |
| 2001 | 0 | 49(0) | 0 | 1 | 50 | 26 | 16 | 66 | 76 |
| 2002 | 0 | 39(2) | 0 | 2 | 43 | 10 | 4 | 47 | 53 |
| 2003 | 0 | 35(0) | 0 | 3 | 38 | 6 | 2 | 40 | 44 |
| 2004 | 0 | 37(0) | 0 | 1 | 38 | 7 | 7 | 45 | 45 |
| 2005 | 0 | 54(1) | 0 | 2 | 57 | 13 | 9 | 66 | 70 |
| 2006 | 0 | 31(0) | 0 | 3 | 34 | 8 | 8 | 42 | 42 |
| 2007 | 0 | 41(0) | 0 | 0 | 41 | 22 | 16 | 57 | 63 |
| 2008 | 0 | 38(0) | 0 | 2 | 40 | 12 | 7 | 47 | 52 |
| 2009 | 0 | 31(0) | 0 | 0 | 31 | 7 | 4 | 35 | 38 |
| 2010 | 0 | 45(0) | 0 | 2 | 47 | 26 | 19 | 66 | 73 |
| 2011 | 0 | 38(0) | 0 | 0 | 38 | 13 | 11 | 49 | 51 |
| 2012 | 0 | 55(0) | 0 | 0 | 55 | 14 | 11 | 66 | 69 |
| 2013 | 0 | 46(0) | 0 | 1 | 47 | 11 | 6 | 53 | 58 |
| 2014 | 0 | 38(0) | 0 | 0 | 38 | 15 | 12 | 50 | 53 |
| 2015 | 0 | 39(0) | 0 | 0 | 39 | 10 | 6 | 45 | 49 |
| 2016 | 0 | 47(0) | 0 | 2 | 49 | 12 | 12 | 61 | 61 |
| 2017 | 0 | 50(0) | 0 | 1 | 51 | 7 | 5 | 56 | 58 |
| 2018 | 0 | 47(0) | 0 | 0 | 47 | 21 | 17 | 64 | 68 |
| 2019 | 0 | 30(0) | 0 | 1 | 31 | 6 | 4 | 35 | 37 |
| 2020 | 0 | 54(0) | 0 | 0 | 54 | 15 | 13 | 67 | 69 |
| 2021 | 0 | 57(0) | 0 | 0 | 57 | 13 | 9 | 66 | 70 |
| 2022 | 0 | 53(0) | 0 | 0 | 53 | 15 | 11 | 64 | 68 |
| 2023 | 0 | 45(0) | 0 | 1 | 46 | 10 | 6 | 52 | 56 |

**Appendix 4**

**North Pacific gray whales**

The outputs from two strike limit algorithms (*SLA*s) are combined to calculate a strike limit for the Eastern North Pacific gray whales ('Grand Unified Procedure-2' GUP2; IWC, 2005). The original subroutines (SLCs) were developed by Johnston and Butterworth (2004) and Dereksdóttir and Magnússon (2004). The code for GUP2 differs from the original code for the *SLA*s by integrating the tuning parameters into the code rather than being read in from input files.

The final versions of GUP2 and its dependencies (the J-B and D-M SLAs) can be found in a restricted access GitHub repository. The input data for the *SLA* are a time-series of catches from 1930 onwards (nominally allocated to sex, but the *SLA*s are based on catches aggregated across sex) and the estimates of absolute abundance based on the counts off California (and their CVs)

A total of up to 840 gray whales can be landed in the period 2026 – 2031 (6 years), with a strike limit of 140 whales per year. The 1st year to which the strike limit (the "current year") applies is 2024. Table 4.1 lists the updated catches from (IWC, 2019)[3] and Table 4.2 lists the abundance estimates. There are two estimates of abundance for 2007. Both estimates use the same data but apply different methods. The inverse variance average of the 2 estimates was used for the SLA (average: 19,858; CV: 0.049).

Table 1.
Catches of eastern North Pacific gray whales since 1930

| Year | Catch | Year | Catch | Year | Catch |
|---|---|---|---|---|---|
| 1930 | 47 | 1962 | 151 | 1994 | 44 |
| 1931 | 10 | 1963 | 180 | 1995 | 92 |
| 1932 | 20 | 1964 | 219 | 1996 | 43 |
| 1933 | 75 | 1965 | 181 | 1997 | 79 |
| 1934 | 126 | 1966 | 220 | 1998 | 125 |
| 1935 | 154 | 1967 | 374 | 1999 | 124 |
| 1936 | 198 | 1968 | 201 | 2000 | 115 |
| 1937 | 24 | 1969 | 214 | 2001 | 112 |
| 1938 | 64 | 1970 | 151 | 2002 | 131 |
| 1939 | 39 | 1971 | 153 | 2003 | 128 |
| 1940 | 125 | 1972 | 182 | 2004 | 111 |
| 1941 | 77 | 1973 | 178 | 2005 | 124 |
| 1942 | 121 | 1974 | 184 | 2006 | 134 |
| 1943 | 119 | 1975 | 171 | 2007 | 132 |
| 1944 | 6 | 1976 | 165 | 2008 | 130 |
| 1945 | 58 | 1977 | 187 | 2009 | 116 |
| 1946 | 30 | 1978 | 184 | 2010 | 118 |
| 1947 | 31 | 1979 | 183 | 2011 | 130 |
| 1948 | 19 | 1980 | 182 | 2012 | 143 |
| 1949 | 26 | 1981 | 136 | 2013 | 127 |
| 1950 | 11 | 1982 | 168 | 2014 | 124 |
| 1951 | 14 | 1983 | 171 | 2015 | 125 |
| 1952 | 44 | 1984 | 169 | 2016 | 120 |
| 1953 | 48 | 1985 | 170 | 2017 | 120 |
| 1954 | 39 | 1986 | 171 | 2018 | 108 |
| 1955 | 59 | 1987 | 159 | 2019 | 137 |
| 1956 | 122 | 1988 | 151 | 2020 | 136 |
| 1957 | 96 | 1989 | 180 | 2021 | 127 |
| 1958 | 148 | 1990 | 162 | 2022 | 124 |
| 1959 | 196 | 1991 | 169 | 2023 | 130 |
| 1960 | 156 | 1992 | 0 | | |
| 1961 | 208 | 1993 | 0 | | |

[3] The 1930-2016 is presented in (IWC, 2019)

Table 2

The abundance estimates and their standard errors. This time series of abundances is based on shore-based surveys. SBC: Shore-based counts. NMM: N mixture modelling. All listed estimates were used in the *SLA*, except for the 2007 estimates for which the inverse variance average was used.

| Category | Year | Estimate | SE | Method | Reference | Notes |
|---|---|---|---|---|---|---|
| 1A | 1968 | 13,426 | 0.094 | SBC | IWC 2011 p19; Laake *et al,* 2012; SC69A; Eguchi et al., 2022 | Method: J.L. Laake |
| 1A | 1969 | 14,548 | 0.08 | | | |
| 1A | 1970 | 14,553 | 0.083 | | | |
| 1A | 1971 | 12,771 | 0.081 | | | |
| 1A | 1972 | 11,079 | 0.093 | | | |
| 1A | 1973 | 17,365 | 0.080 | | | |
| 1A | 1974 | 17,375 | 0.082 | | | |
| 1A | 1975 | 15,290 | 0.084 | | | |
| 1A | 1976 | 17,564 | 0.086 | | | |
| 1A | 1977 | 18,377 | 0.08 | | | |
| 1A | 1978 | 19,538 | 0.088 | | | |
| 1A | 1979 | 15,384 | 0.08 | | | |
| 1A | 1980 | 19,763 | 0.083 | | | |
| 1A | 1985 | 23,499 | 0.089 | | | |
| 1A | 1986 | 22,921 | 0.082 | | | |
| 1A | 1988 | 26,916 | 0.058 | | | |
| 1A | 1993 | 15,762 | 0.068 | | | |
| 1A | 1994 | 20,103 | 0.055 | | | |
| 1A | 1996 | 20,944 | 0.061 | | | |
| 1A | 1998 | 21,135 | 0.068 | | | |
| 1A | 2001 | 16,369 | 0.061 | | | |
| 1A | 2002 | 16,033 | 0.069 | | | |
| 1A | 2007 | 19,126 | 0.071 | | | |
| 1A | 2007 | 20,640 | 0.068 | SBC-NMM | Eguchi *et al*., 2024, ASI annex 2023 | Method: Durban. N-mixture modelling uses all data from 2006/2007 to 2023/2024 |
| 1A | 2008 | 18,450 | 0.070 | | | |
| 1A | 2010 | 20,960 | 0.047 | | | |
| 1A | 2011 | 20,820 | 0.045 | | | |
| 1A | 2015 | 23,440 | 0.052 | | | |
| 1A | 2016 | 27,450 | 0.049 | | | |
| 1A | 2020 | 20,630 | 0.047 | | | |
| 1A | 2022 | 17,430 | 0.050 | | | |
| 1A | 2023 | 14,530 | 0.048 | | | |
| 1A | 2024 | 19,260 | 0.051 | | | |

## Appendix 5

## Common minke whale stocks off East Greenland

The code and input data used in the 2024 application of the *Greenland minke whale SLA* (also see Appendix 6) can be found in a restricted-access *GitHub repository*. The *SLA* uses the total need and a time series of agreed estimates of abundance. The time series of catches are provided for information and as a legacy feature because the control program allowed for the possibility that the *SLA*s might use catch data.

The *SLA* for common minke whales off West and East Greenland was developed by Witting (Witting, 2004; 2006; 2018b) and the available version date is 22/5/2019. Recent updates to the code involve minor changes to ensure that the input data are read correctly and more outputs are printed and to ensure the C++ code can be compiled by multiple compilers.

The need for East Greenland is 20 minke whales per year for a block of 6 years (2026-31).

Historical abundance estimates listed in the IWC abundance tables and used in the SLA are shown in Table 1.

The data on historical removals (Table 2) include direct caches from the IWC catch database. Individuals of unknown sex are divided equally between males and females.

Table 1

Abundance estimates for minke whales off East Greenland, from the IWC-endorsed abundances table, used in the 2024 SLA application. The 2015 values are summed to cover the whole area (sum: 5368, CV 0.349). All abundances are based on line-transect estimates.

| Subarea | Category | Year | Abundance | CV | Ref | Notes |
|---|---|---|---|---|---|---|
| CG | 1A | 1987 | 1,555 | 0.26 | IWC, 1993b, p66,128-9 | To be used as a minimum estimate: no g(0) correction |
| CG | 1A | 2001 | 7,990 | 0.29 | Pike *et al*., 2009 | Blocks Bii (5,856; CV 0.358)+ Wii (2,134; CV 0.469). |
| CG | 1A | 2007 | 1,048 | 0.60 | Pike *et al*., 2010 | The estimate is not given in, but it is derived from, Pike *et al*. (2010.) |
| CG exc EG | 1A | 2015 | 2,606 | 0.52 | Pike *et al.*, 2016; 2019 | Part of the Icelandic estimate accepted at SC2016. Excludes overlap with EG. Estimates inc. & exc. overlap are reported. |
| CG:EG | 1A | 2015 | 2,672 | 0.47 | Hansen *et al*., 2018a | P = 0.97 (cv 0.04), A = 0.19 (cv 0.27) |
| CG | | 2015 | 5,368 | 0.349 | | Sum of the 2015 estimates |

Table 2

Direct catches of common minke whales off East Greenland. If sex unknown allocated equally amongst males and females.

| Year | Male | Female | Year | Male | Female |
|---|---|---|---|---|---|
| 1955 | 1 | 5 | 1991 | 2.5 | 4.5 |
| 1956 | 0 | 0 | 1992 | 1.5 | 9.5 |
| 1957 | 0 | 0 | 1993 | 3.5 | 5.5 |
| 1958 | 0 | 0 | 1994 | 0 | 50 |
| 1959 | 9 | 5 | 1995 | 3.5 | 5.5 |
| 1960 | 4 | 8 | 1996 | 00 | 120 |
| 1961 | 3 | 0 | 1997 | 2.5 | 11.5 |
| 1962 | 4 | 0 | 1998 | 1 | 9 |
| 1963 | 9 | 1 | 1999 | 1.5 | 12.5 |
| 1964 | 5 | 3 | 2000 | 2 | 8 |
| 1965 | 0 | 0 | 2001 | 1.5 | 15.5 |
| 1966 | 69 | 18 | 2002 | 0 | 10 |
| 1967 | 108 | 35 | 2003 | 2 | 12 |
| 1968 | 106.5 | 104.5 | 2004 | 4 | 7 |
| 1969 | 64 | 30 | 2005 | 3 | 1 |
| 1970 | 91 | 68 | 2006 | 2.5 | 0.5 |
| 1971 | 23 | 6 | 2007 | 0.5 | 1.5 |
| 1972 | 74 | 65 | 2008 | 0 | 1 |
| 1973 | 159.5 | 62.5 | 2009 | 3 | 1 |
| 1974 | 73.5 | 28.5 | 2010 | 5.5 | 3.5 |
| 1975 | 84.5 | 132.5 | 2011 | 0.5 | 9.5 |
| 1976 | 57.5 | 23.5 | 2012 | 0 | 4 |
| 1977 | 0.5 | 0.5 | 2013 | 2 | 4 |
| 1978 | 72 | 58 | 2014 | 1.5 | 9.5 |
| 1979 | 75.5 | 43.5 | 2015 | 0 | 6 |
| 1980 | 78.5 | 40.5 | 2016 | 3 | 12 |
| 1981 | 10 | 35 | 2017 | 3.5 | 6.5 |
| 1982 | 84.5 | 24.5 | 2018 | 1 | 1 |
| 1983 | 55.5 | 42.5 | 2019 | 2 | 9 |
| 1984 | 11.5 | 13.5 | 2020 | 5 | 15 |
| 1985 | 22 | 22 | 2021 | 8.5 | 12.5 |
| 1986 | 1 | 1 | 2022 | 7 | 10 |
| 1987 | 0 | 4 | 2023 | 5 | 13 |
| 1988 | 3.5 | 6.5 | | | |
| 1989 | 4.5 | 5.5 | | | |

## Appendix 6

## Common minke whale stocks off West Greenland

The code and input data used in the 2024 application of the *Greenland minke whale SLA* (and see Appendix 5) can be found in a restricted-access *GitHub repository*. The *SLA* uses the total need and a time series of agreed estimates of abundance. The time series of catches are provided for information and as a legacy feature because the control program allowed for the possibility that the *SLA*s might use catch data.

The *SLA* for common minke whales off West and East Greenland was developed by Witting (Witting, 2004; 2006; 2018b) and the available version date is 22.5.2019. Recent updates to the code involve minor changes to ensure that the input data are read correctly and more outputs are printed and to ensure the C++ code can be compiled by multiple compilers.

Historical abundance estimates listed in the IWC abundance tables and used in the SLA are shown in Table 1. The data on historical removals (Table 2) include direct caches from the IWC catch database and bycatches reported either directly to the Statistics Department or through National Progress Reports. Individuals of unknown sex are divided between males and females using a sex ratio based on the direct catch data (Males = 0.26; Females = 0.74).

Table 1
Abundance estimates for minke whales off West Greenland (subarea WG), from the IWC-endorsed abundances table, used in the 2024 SLA application

| Category | Year | Abundance | CV | Ref | Notes |
|---|---|---|---|---|---|
| 2 | 1988 | 3,266 | 0.31 | IWC, 2009b, p135; IWC, 1990, p43 | Line transect. Partial coverage of the area |
| 2 | 2005 | 10,792 | 0.59 | Heide-Jørgensen *et al.*, 2008a | Line transect. Known not to cover all of the population. |
| 1A | 2007 | 9,066 | 0.39 | Hansen *et al.*, 2018a;2018b | Strip Census. P = 0.98 (cv 0.02), A = 0.21 (cv 0.25) |
| 1A | 2015 | 5,095 | 0.46 | Hansen *et al.*, 2018a;2018b | Strip Census. P = 0.96 (cv 0.06), A = 0.19 (cv 0.27). |

Table 2
Direct catches of common minke whales off West Greenland. If sex unknown allocated as Males = 0.26; Females = 0.74 (see text).

| Year | Male | Female | Year | Male | Female |
|---|---|---|---|---|---|
| 1948 | 1.04 | 2.96 | 1988 | 22.94 | 86.06 |
| 1949 | 1.30 | 3.70 | 1989 | 19.38 | 43.62 |
| 1950 | 2.34 | 6.66 | 1990 | 17.38 | 71.62 |
| 1951 | 4.16 | 11.84 | 1991 | 26.02 | 82.98 |
| 1952 | 8.32 | 23.68 | 1992 | 22.42 | 87.58 |
| 1953 | 8.32 | 23.68 | 1993 | 29.42 | 83.58 |
| 1954 | 5.72 | 16.28 | 1994 | 21.82 | 82.18 |
| 1955 | 8.82 | 13.18 | 1995 | 47.04 | 107.96 |
| 1956 | 5.52 | 16.48 | 1996 | 38.82 | 131.18 |
| 1957 | 6.00 | 18.00 | 1997 | 43.04 | 104.96 |
| 1958 | 9.94 | 20.06 | 1998 | 42.04 | 126.96 |
| 1959 | 11.36 | 43.64 | 1999 | 36.04 | 135.96 |
| 1960 | 12.88 | 43.12 | 2000 | 38.82 | 108.18 |
| 1961 | 11.94 | 23.06 | 2001 | 36.16 | 102.84 |
| 1962 | 20.86 | 51.14 | 2002 | 35.60 | 104.40 |
| 1963 | 54.62 | 111.38 | 2003 | 59.60 | 125.40 |
| 1964 | 51.74 | 110.26 | 2004 | 45.56 | 133.44 |
| 1965 | 57.22 | 138.78 | 2005 | 35.82 | 140.18 |
| 1966 | 63.52 | 161.48 | 2006 | 46.60 | 134.40 |
| 1967 | 57.70 | 186.30 | 2007 | 40.08 | 126.92 |

| | | | | | |
|---|---|---|---|---|---|
| 1968 | 77.08 | 237.92 | 2008 | 58.12 | 95.88 |
| 1969 | 69.38 | 199.62 | 2009 | 49.86 | 115.14 |
| 1970 | 57.50 | 149.50 | 2010 | 57.86 | 129.14 |
| 1971 | 48.90 | 147.10 | 2011 | 40.08 | 138.92 |
| 1972 | 34.60 | 121.40 | 2012 | 35.56 | 112.44 |
| 1973 | 67.54 | 208.46 | 2013 | 39.86 | 135.14 |
| 1974 | 52.02 | 164.98 | 2014 | 28.04 | 117.96 |
| 1975 | 54.04 | 167.96 | 2015 | 27.56 | 105.44 |
| 1976 | 45.94 | 145.06 | 2016 | 35.78 | 112.22 |
| 1977 | 75.06 | 209.94 | 2017 | 34.30 | 98.70 |
| 1978 | 44.90 | 135.10 | 2018 | 22.04 | 93.96 |
| 1979 | 64.74 | 185.26 | 2019 | 38.08 | 121.92 |
| 1980 | 67.08 | 190.92 | 2020 | 27.82 | 134.18 |
| 1981 | 53.52 | 150.48 | 2021 | 32.60 | 144.40 |
| 1982 | 65.00 | 185.00 | 2022 | 38.60 | 110.40 |
| 1983 | 69.68 | 198.32 | 2023 | 34.04 | 129.96 |
| 1984 | 61.10 | 173.90 | | | |
| 1985 | 57.72 | 164.28 | | | |
| 1986 | 37.70 | 107.30 | | | |
| 1987 | 25.18 | 60.82 | | | |

**Appendix 7**

**Fin whales off West Greenland**

The code and input data used in the 2024 application of the *Fin whale SLA* can be found in a restricted-access *GitHub repository*. The *SLA* uses the total need and a time series of agreed estimates of abundance. The time series of catches are provided for information and as a legacy feature because the control program allowed for the possibility that the *SLA*s might use catch data.

Separate *SLA*s were developed for West Greenland fin whales by Brandão (Brandão, 2017b; 2018; Brandão and Butterworth, 2015b; 2015c) and Witting (Witting, 2015a; 2015c; 2017a; 2017b; 2018a; 2018c), the latter is dated 22/5/2019. The outputs of the two algorithms are averaged to derive the final strike limit. Minor changes have been made to the code for the SLAs to derive more outputs and check inputs are 'read' correctly. The inputs to both SLAs are estimates of abundance.

Historical abundance estimates listed in the IWC abundance tables and used in the SLA are shown in Table 1.

The need for West Greenland is 19 fin whales per year for a block of 6 years (2026-31).

The data on historical removals (Table 2 include direct caches from the IWC catch database. Individuals of unknown sex are equally divided between males and females. Bycatch and ship strikes were unknown in the previous iteration of the algorithms and noted as -1 in the input data file (i.e., are ignored when applying the *SLA*s).

Table 1
Abundance estimates for fin whales off West Greenland (subarea WG), from the IWC-endorsed abundances table, used in the 2024 SLA application.

| Category | Year | Abundance | CV | Ref | Notes |
|---|---|---|---|---|---|
| A | 1987 | 1,096 | 0.35 | IWC, 1993a, p75 | Cue Counts. Modified from (IWC, 1992) p70-1,200 and (Hiby et al., 1989), using revised blow rate estimate |
| 1A | 2005 | 9,800 | 0.62 | Hansen *et al*, 2018b | Line Transect. P=0.51 (cv 0.21), A = 0.33 (cv 0.43). Supersedes 3,234 (Heide-Jørgensen et al., 2008a). |
| 1A | 2007 | 15,957 | 0.72 | Hansen et al, 2018b | Line Transect. P=0.86 (cv 0.09), A = 0.28 (cv 0.22). Supersedes 4,359 (Heide-Jørgensen et al., 2010) |
| 1A | 2015 | 2,215 | 0.41 | Hansen *et al*, 2018b | Line Transect. P=0.99 (cv 0.007), A = 0.21 (cv 0.22). |

Table 2

Direct catches of fin whales off West Greenland. If sex unknown allocated equally amongst males and females.

| Year | Male | Female | Year | Male | Female |
|---|---|---|---|---|---|
| 1922 | 7 | 7 | 1973 | 1 | 1 |
| 1923 | 10 | 10 | 1974 | 2.5 | 2.5 |
| 1924 | 48 | 46 | 1975 | 0.5 | 0.5 |
| 1925 | 15 | 15 | 1976 | 4.5 | 4.5 |
| 1926 | 12 | 12 | 1977 | 6.5 | 6.5 |
| 1927 | 8 | 14 | 1978 | 4.5 | 3.5 |
| 1928 | 12 | 12 | 1979 | 3.5 | 3.5 |
| 1929 | 10 | 14 | 1980 | 6.5 | 6.5 |
| 1930 | 12 | 15 | 1981 | 3.5 | 3.5 |
| 1931 | 19 | -3 | 1982 | 4.5 | 4.5 |
| 1932 | 11.5 | 13.5 | 1983 | 4 | 4 |
| 1933 | 9.5 | 7.5 | 1984 | 5 | 5 |
| 1934 | 11.5 | 11.5 | 1985 | 4 | 5 |
| 1935 | 9 | 14 | 1986 | 5 | 4 |
| 1936 | 6 | 9 | 1987 | 4 | 5 |
| 1937 | 2 | 7 | 1988 | 4 | 5 |
| 1938 | 4 | 3 | 1989 | 7 | 7 |
| 1939 | 1 | 2 | 1990 | 11 | 8 |
| 1940 | 0 | 0 | 1991 | 8.5 | 9.5 |
| 1941 | 0 | 0 | 1992 | 8.5 | 13.5 |
| 1942 | 0 | 0 | 1993 | 2.5 | 11.5 |
| 1943 | 0 | 0 | 1994 | 11 | 11 |
| 1944 | 0 | 0 | 1995 | 9 | 3 |
| 1945 | 0 | 0 | 1996 | 8.5 | 10.5 |
| 1946 | 26 | 21 | 1997 | 6.5 | 6.5 |
| 1947 | 29 | 22 | 1998 | 2 | 9 |
| 1948 | 10 | 11 | 1999 | 4 | 5 |
| 1949 | 5 | 16 | 2000 | 3.5 | 3.5 |
| 1950 | 18 | 18 | 2001 | 3.5 | 4.5 |
| 1951 | 8 | 7 | 2002 | 5 | 8 |
| 1952 | 4 | 12 | 2003 | 3.5 | 5.5 |
| 1953 | 6 | 9 | 2004 | 6 | 7 |
| 1954 | 17 | 5 | 2005 | 1.5 | 11.5 |
| 1955 | 14 | 8 | 2006 | 3 | 7 |
| 1956 | 17 | 11 | 2007 | 7 | 5 |
| 1957 | 11 | 10 | 2008 | 9.5 | 4.5 |
| 1958 | 2 | 6 | 2009 | 2 | 8 |
| 1959 | 0 | 0 | 2010 | 0.5 | 5.5 |
| 1960 | 0 | 0 | 2011 | 0 | 5 |
| 1961 | 0 | 0 | 2012 | 0.5 | 4.5 |
| 1962 | 0 | 0 | 2013 | 3.5 | 5.5 |
| 1963 | 0 | 0 | 2014 | 6 | 6 |
| 1964 | 0.5 | 0.5 | 2015 | 3 | 9 |
| 1965 | 0.5 | 0.5 | 2016 | 4.5 | 4.5 |
| 1966 | 0 | 0 | 2017 | 2.5 | 5.5 |
| 1967 | 0 | 0 | 2018 | 3.5 | 3.5 |
| 1968 | 1.5 | 1.5 | 2019 | 3.5 | 4.5 |
| 1969 | 0 | 0 | 2020 | 2 | 1 |
| 1970 | 0 | 0 | 2021 | 1 | 1 |
| 1971 | 0 | 0 | 2022 | 1 | 3 |
| 1972 | 0.5 | 0.5 | 2023 | 1 | 1 |

## Appendix 8

## Humpback whales off West Greenland

The code and input data used in the 2024 application of the *Greenland humpback SLA* can be found in a restricted-access *GitHub repository*. The *SLA* uses the total need and a time series of agreed estimates of abundance.

Witting developed an *SLA* was for West Greenland humpback whales (Witting, 2013b; 2014b; 2015c; 2017a), dated 23/5/2014. Minor changes were made to the code to provide more outputs and to ensure the C++ code can be compiled by multiple (current) compilers.

Historical abundance estimates listed in the IWC abundance tables and used in the SLA are shown in Table 8.1.

The need for West Greenland is 10 strikes of humpback whales per year for a block of 6 years (2026-31).

The data on historical removals (Table 2) include direct caches from the IWC catch database. Individuals of unknown sex are equally divided between males and females. Bycatch and ship strikes were unknown in the previous iteration of the algorithms and noted as -1 in the input data. (i.e., are ignored when applying the *SLA*s).

Table 1
Abundance estimates for humpback whales off West Greenland (subarea WG), from the IWC-endorsed abundances table, used in the 2024 SLA application.

| Category | Year | Abundance | CV | Ref | Notes |
|---|---|---|---|---|---|
| 1A | 2005 | 1,158 | 0.35 | Heide-Jørgensen *et al.*, 2008b | The combined estimate of line transect (LT) and strip census analyses was agreed to be acceptable for use in assessments. LT estimate of 1,218, 95%CI 423-3,508 also given. |
| 1A | 2007 | 2,704 | 0.34 | Heide-Jørgensen and Lairdre, 2015 | Strip census. Original estimate was 3,039 cv 0.45 (Heide-Jørgensen *et al.*, 2012). This estimate, based on improved data on diving behaviour, is accepted as the best estimate |
| 1A | 2015 | 993 | 0.44 | Hansen *et al.*, 2018a; 2018b | Line transect. P=0.98 (cv 0.02), A = 0.43 (cv 0.27) |