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ABUNDANCE AND POTENTIAL BIOLOGICAL REMOVAL (PBR) ESTIMATES FOR CANADA'S HIGH ARCTIC ATLANTIC WALRUS MANAGEMENT STOCKS, SUMMER 2022

*Aerial photo of Atlantic walrus (*Odobenus rosmarus rosmarus*) hauled out on Houston-Stewart Island during the August 2022 DFO survey.*

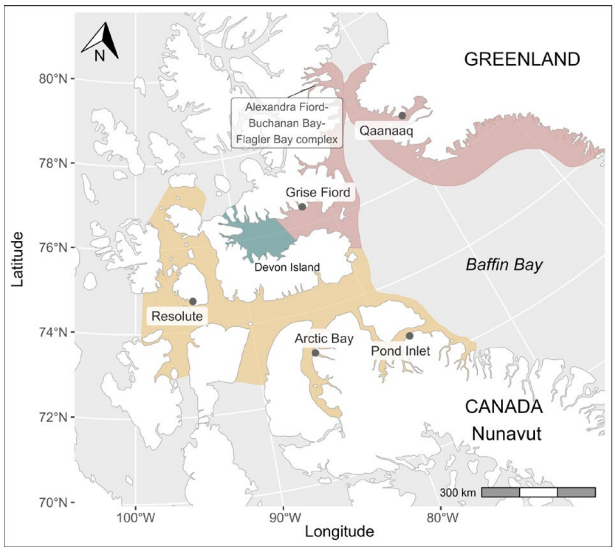

Figure 1. Distribution of the three Atlantic walrus (Odobenus rosmarus rosmarus) *management stocks (Baffin Bay [pink], West Jones Sound [blue], Penny Strait-Lancaster Sound [yellow]) surveyed during August 2022.*

CONTEXT

The High Arctic Atlantic walrus (*Odobenus rosmarus rosmarus*) population comprises walrus distributed from the Canadian Archipelago to west Greenland and is divided into three management stocks: Penny Strait-Lancaster Sound (PS-LS), West Jones Sound (WJS), and Baffin Bay (BB). All three High Arctic walrus stocks are hunted by Inuit in Canada and are managed according to applicable federal acts and regulations, as well as relevant land claims agreements. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has assessed the High Arctic Atlantic Walrus population as Special Concern in Canada. The species is currently under consideration for listing on Schedule 1 of the *Species at Risk Act* (species of *Special Concern*).

The three High Arctic walrus stocks were last surveyed in 2009, and associated abundance and Potential Biological Removal (PBR) estimates are considered outdated. A new aerial survey of the PS-LS, WJS, and BB walrus stocks was completed in August 2022 to provide updated abundance and PBR estimates requested by Fisheries and Oceans Canada (DFO) Fisheries Management. Updated abundance estimates and Science advice on sustainable hunt levels will

also be used by the Nunavut Wildlife Management Board (NWMB), Inuit organizations, and other stakeholders in the management of walrus. It may also be used internationally by the North Atlantic Marine Mammal Commission (NAMMCO), where shared walrus stocks are hunted in both Canada and Greenland.

This Science Advisory Report is from the January 28-29, 2025, regional peer review on the Abundance and Potential Biological Removal (PBR) Estimates for the High Arctic Atlantic Walrus (*Odobenus rosmarus rosmarus*) Management Stocks. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

SUMMARY

- The High Arctic Atlantic walrus (*Odobenus rosmarus rosmarus*) population in the eastern Canadian Arctic comprises three management stocks: Penny Strait-Lancaster Sound (PS-LS), West Jones Sound (WJS), and Baffin Bay (BB).
- Photographic aerial surveys of haulout sites and adjoining coastline were flown during August 2022 to update stock abundances last estimated in 2009. The areas that were surveyed included most of the known distributions of the PS-LS and WJS stocks and focused on the summer core-use area of the BB stock.
- Two surveys of both the PS-LS (August 13-16 and 24-27) and WJS (August 17-18 and August 22) stocks were completed, while the summer core-use area of the BB stock was surveyed three times (August 7, 16, and 26).
- Abundance estimates from the first survey replicates of each stock were used as the basis for scientific advice due to uncertainty regarding walrus movements between subsequent surveys.
- Abundance estimates accounted for animals at sea during the survey using the average proportion of time hauled-out (P = 0.3) and correlated walrus haulout behaviour.
- First survey abundance estimates were 887 (95% confidence interval [CI] = 475–1,653) for the PS-LS stock; 1,157 (95% CI = 618–2,166) for the WJS stock, and 847 (95% CI = 254*–3,286) for the BB stock.
- Potential Biological Removal (PBR) estimates based on the first surveys of each stock are 6.8 walruses for the PS-LS stock, 8.8 for the WJS stock, and 4.7 for the BB stock. PBR estimates were calculated using a recovery factor (R_F) of 0.25. PBR estimates are heavily dependent on the selected R_F value and updated PBR estimates may differ from previous estimates largely due to this term in the calculation.
- Reported Canadian hunts from each of the three High Arctic management stocks are generally lower than PBR estimates. However, the winter hunt of walruses in Greenland exceeds the PBR estimate for the shared BB stock.

INTRODUCTION

The High Arctic Atlantic walrus (*Odobenus rosmarus rosmarus*) population is distributed across Baffin Bay and the Canadian Arctic Archipelago. In Canada, the High Arctic population is

* Actual count, which exceeds the estimated lower 95% confidence limit.

currently subdivided into three management stocks based on genetic or distribution differences inferred from telemetry and tissue microchemistry: the West Jones Sound (WJS) stock, the Penny Strait-Lancaster Sound (PS-LS) stock, and the Baffin Bay (BB) stock, which is shared with Greenland (Figure 1). Walruses from all three stocks are hunted by Inuit in Canada, while walruses from the BB stock are also hunted during winter in the Qaanaaq area of West Greenland.

Fisheries and Oceans Canada's (DFO) last assessment of all three High Arctic walrus stocks based on aerial surveys in 2009 produced abundance estimates of 727 (623–831) walruses in the PS-LS stock, 470 (95% confidence limit [CL] 297–1,732) walruses in the WJS stock, and 1,251 (571–2,477) walruses in the BB stock (Stewart et al. 2014a,b). Following well-established 'colony count' methods for estimating pinniped population sizes, a new coastal photographic aerial survey of all three stocks was conducted in August 2022. Counts of walruses hauled out on land (and ice, when observed) were adjusted for availability bias to estimate stock abundance and PBR. Secondary objectives included updating terrestrial walrus haulout locations to inform the management plan and zoning framework of the Tallurutiup Imanga National Marine Conservation Area (NMCA), the spatial extent of which encompasses the PS-LS and BB stocks.

ASSESSMENT

Survey

Surveyed coastlines of Ellesmere, Devon, Cornwallis, and Bathurst islands encompassed almost all previously identified terrestrial haulout sites of the PS-LS and WJS walrus stocks, as well as summer core-use areas of the BB stock. Two De Havilland Twin Otter DHC-6 aircraft were flown at an altitude of 1,000 feet (305 m) and a speed of 100 knots (185 km/h). Each aircraft was fitted with a ventral camera port that allowed the land/water surface directly below the aircraft to be photographed using two vertically mounted Nikon D850 cameras fitted with either a 35 mm or 55 mm Zeiss lens. Observers seated at bubble windows ensured all observed walruses were photographed in geo-referenced images saved directly to a laptop hard drive.

First surveys of the WJS and PS-LS stocks during August 17-18 and August 13-16, 2022, respectively, covered all haulouts and intervening coastlines. The second surveys (August 22 and August 24-27, respectively) prioritized haulout sites and were flown in a more direct manner. The Alexandra Fiord/Buchanan Bay/Flagler Bay complex (i.e., the summer core-use area) of the BB stock was surveyed three times (August 7, 16, and 26).

Analysis

Walruses hauled out on land, and ice, when observed, were counted in photographs. Walruses that had been clearly hauled out on land or ice but were startled into the water by the survey aircraft, which was usually evident from trails of disturbed sediment and/or feces, were included in the haulout count. Total counts for the first and second surveys of the PS-LS stock were 266 and 495, and 347 and 656 for the WJS stock, respectively. Total counts for the three surveys of the Alexandra Fiord/Buchanan Bay/Flagler Bay complex (BB stock) on August 7, 16, and 26, respectively, were 254 (all on land), 3 (on ice only), and 6 (on ice only).

Total haulout counts were divided by the estimated proportion hauled out (0.3) to account for the proportion of animals at sea during the survey following Doniol-Valcroze et al. (2016), whose calculations also account for correlated haulout behaviour among individuals. Summing adjusted haulout counts produced stock abundance estimates of 887 (95% CI = 475–1,653) and

1,650 (95% CI = 696–3,909) for the PS-LS stock; 1,157 (95% CI = 618–2,166) and 2187 (95% CI = 1,132–4,224) for the WJS stock, and 847 (95% CI = 254*–3,286), 10 (95% CI = 3*–44), and 20 (95% CI = 6*–83) for the BB stock (Table 1).

*Table 1. Walrus abundance estimates ($\widehat{N}$), and associated variance (var($\widehat{N}$)), standard error (SE) and 95% confidence interval (CI) for each survey completed of each management stock (Penny Strait-Lancaster Sound [PS-LS], West Jones Sound [WJS], and Baffin Bay [BB]). *Denotes number of walruses counted, which exceeded the estimated lower 95% confidence limit.*

Stock	Survey	Date	$\widehat{N}$	var($\widehat{N}$)	SE	95% CI
PS-LS	1	Aug 13-16	887	83,617	289	475–1,653
	2	Aug 24-27	1,650	581,784	763	696–3,909
WJS	1	Aug 17-18	1,157	144,258	380	618–2,166
	2	Aug 22	2,187	571,092	756	1,132–4,224
BB	1	Aug 7	847	440,081	663	254*–3,286
	2	Aug 16	10	78	9	3*–44
	3	Aug 26	20	279	17	6*–83

Potential Biological Removal

Potential Biological Removal (PBR) is defined as the maximum number of animals that can be removed, excluding natural mortality, while allowing the stock to attain or maintain its optimal sustainable size. PBR is DFO's default method to estimate sustainable hunt levels for 'data-poor' stocks. PBR was calculated using a maximum rate of population increase (R_{max}) of 0.08, consistent with other recent DFO walrus stock assessments, and a recovery factor (R_F) of 0.25, in accordance with DFO guidelines for stocks whose abundance with respect to carrying capacity/historical size and growth trend are unknown. PBR estimates based on the first surveys of each stock are 6.8 walruses for the PS-LS stock, 8.8 for the WJS stock, and 4.7 for the BB stock.

Sources of Uncertainty

- Walruses are a challenging species to enumerate owing to their aggregated distribution and correlated haulout behaviour, resulting in highly variable numbers of animals hauled out at one time. This uncertainty has an important impact on adjusted abundance estimates.
- While three management stocks (PS-LS, WJS, and BB) have been identified within the High Arctic walrus population, little is known about walrus movements among the identified stock ranges. In particular, directed movements of walruses from the range of the BB stock southward across the purported boundaries of the PS-LS and WJS stocks have been observed in previous summers but could not be independently evaluated during the 2022 survey. Potential directed movement among surveyed areas adds uncertainty, and the first replicates were used for management advice for this reason.
- Surveys are timed to coincide with the maximum number of walruses at terrestrial haulout sites. The presence of sea ice – a preferred haulout platform – and its melting may have influenced the numbers of walruses at terrestrial sites during the survey period. Movements of walruses from melting sea ice to terrestrial sites could not be evaluated.

- The Alexandra Fiord/Buchanan Bay/Flagler Bay complex is a summer core-use area of the BB stock, and the 2022 survey coverage is consistent with previous DFO surveys. However, the coastline to the north and south of this area where walruses occur with less frequency, along with abandoned haulout sites along the coast of west Greenland recently observed to be re-occupied by walruses, were not surveyed due to fuel shortages, which may have negatively biased BB stock abundance estimates.
- PBR estimates encompass all anthropogenic mortality, including walruses that are landed as well as those that are struck and lost. Reported Canadian hunts from each of the High Arctic walrus stocks are below PBR estimates. However, there is uncertainty associated with hunt reporting and associated struck and lost rates have not been quantified.

CONCLUSIONS

The first surveys of the PS-LS and WJS and the first and second surveys of the BB stock can all be considered independent, having taken place within a sufficiently short period in mid-August to have prevented walrus movements among stocks. The second surveys of both the PS-LS and WJS stocks and the third survey of the BB stock during the last week of August can similarly be considered independent based on the same rationale. However, the period separating the mid- and late-August surveys was sufficiently long enough to have allowed potential movements of walruses between stocks. Movements of walruses from the BB stock across purported PS-LS and WJS stock boundaries, in particular, could account for the lower BB and higher PS-LS and WJS stock counts in late August, but unfortunately, this possibility cannot be assessed with available data.

Using abundance estimates from the first surveys of each stock, rather than the last surveys or an average of surveys, as the basis for science advice avoids any potential bias due to movements among stocks. The adjusted estimates from the first surveys of each stock were 887 (95% CI = 475–1,653) for the PS-LS stock, 1,157 (95% CI = 618–2,166) for the WJS stock, and 847 (95% CI = 254*–3,286) for the BB stock. Associated PBR estimates are 6.8 walruses for the PS-LS stock, 8.8 for the WJS stock, and 4.7 for the BB stock, assuming a recovery factor of 0.25. These PBR estimates are generally higher than recent Canadian hunts from each of the three stocks, although hunts are inconsistently reported, and the proportion of walruses that are struck and lost has not been quantified. Greenland harvests, however, from the BB stock during winter are higher than the estimated PBR for that stock.

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SOURCES OF INFORMATION

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