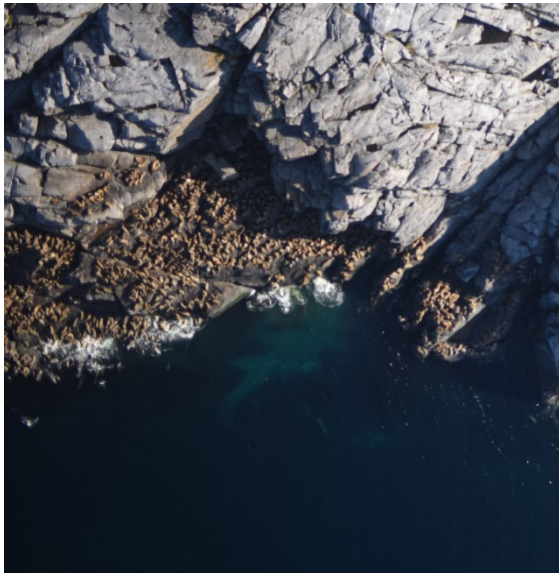




ESTIMATES OF ABUNDANCE AND TOTAL ALLOWABLE REMOVALS FOR THE HUDSON BAY-DAVIS STRAIT ATLANTIC WALRUS (*ODOBENUS ROSMARMUS ROSMARMUS*) STOCK



Aerial photo of Atlantic Walrus (*Odobenus rosmarus rosmarus*) hauled out on Walrus Island during the 2017 DFO survey. (DFO).

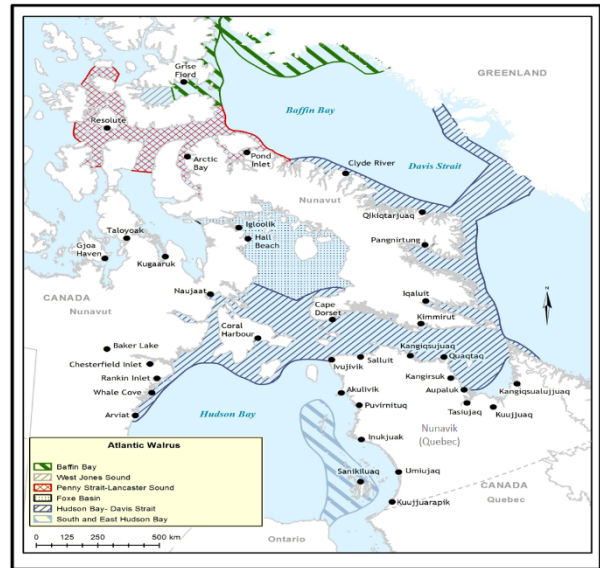


Figure 1. Location of Atlantic Walrus stocks in the eastern Canadian Arctic. The stocks are Baffin Bay, West Jones Sound, Penny Strait-Lancaster Sound, North and Central Foxe Basin stocks, and Hudson Bay-Davis Strait.

Context:

The Hudson Bay-Davis Strait stock of the Central Arctic population of Atlantic Walrus (*Odobenus rosmarus rosmarus*) encompasses a large geographical area. The stock is shared with Greenland. Walrus from this stock are harvested in Nunavut, Nunavik, and Greenland. An Integrated Fishery Management Plan (IFMP) has been approved by the Nunavut Wildlife Management Board (NWMB) and the Minister of DFO. The IFMP identifies the need for accurate and current population abundance estimates.

A survey of Hudson Bay-Davis Strait (including the east coast of Baffin Island) was undertaken in the summer of 2017. Resource Management requests an updated population abundance estimate for this stock as well as the Potential Biological Removal (PBR).

SUMMARY

- Aerial surveys of terrestrial haul-out sites and adjoining coastline were flown during September 2017 to determine abundance of Walrus belonging to the Hudson Bay-Davis Strait (HBDS) stock.
- The survey covered northern Hudson Bay, southern Foxe Basin, Hudson Strait, and southeastern Baffin Island.
- Uncorrected counts of hauled out Walrus in the surveyed area totaled 13,400.
- These counts were adjusted to account for animals at sea during the survey. The adjusted aerial survey estimate for the HBDS stock is 44,600 (95% CI = 19,500–102,000; rounded to the nearest 100).
- A survey of the northern Hudson Bay-Hudson Strait component of the HBDS stock flown in 2014 produced an adjusted abundance estimate of 7,100 (95% CI = 2,500–20,400). In 2017, there were an estimated 38,500 (95% CI = 15,100–98,300) Walrus for the same area.
- The difference between the two estimates is greater than what would be expected from population growth alone. The higher 2017 count may have resulted from a greater proportion of animals hauled out than assumed, particularly at Walrus Island in northern Hudson Bay. Another possibility is movement of Walrus from other areas (e.g., Foxe Basin) into northern Hudson Bay, or a combination of the two factors. However, there were no reports of unusual Walrus movements in 2017.
- A population model fitted to the survey data and Canadian harvest data estimated a total abundance of 8,200 (95% CI = 5,800–19,700) for the northern Hudson Bay-Hudson Strait component of the HBDS stock. Adding in the estimated abundance for Walrus along the east coast of Baffin Island (3,900; 95% CI = 2,200–7,200) results in a total abundance of 12,100 (95% CI = 7,000–20,800) for the HBDS stock.
- The Potential Biological Removal estimate for the HBDS stock is 360, assuming a Recovery Factor of 1.
- Reported harvest levels by Canadian communities harvesting from this stock have declined from a high of 604 in 1954 to an annual estimated average of 95 animals over the last five years. Assuming a combined struck and loss (S&L) and non-reporting rate of 44% derived from a population model results in an estimated total annual removal of 137.

INTRODUCTION

Walrus in the Canadian Arctic are divided into two populations and seven stocks (Figure 1) based on genetic, isotope, satellite telemetry, and trace element analysis. The Hudson Bay-Davis Strait (HBDS) Walrus stock is part of the central Arctic population. It occurs along the east coast of Baffin Island, Hudson Strait and northern Hudson Bay. There is also some exchange of animals between Greenland and eastern Baffin Island in winter.

Walrus are widely distributed in the eastern Canadian Arctic and are often found in aggregations of tens to thousands. During summer months, groups of Walrus often haul-out on ice floes or, if no ice is available, at terrestrial sites. The practice of using haul-out counts to estimate stock size for Walrus is thought to be an appropriate survey method. Data from satellite tags are used

to adjust the haul-out counts to account for those animals missed by the survey because they are at sea.

Owing to limited survey effort, Walrus stocks are considered data-poor with respect to the assessment of population status. DFO has used the Potential Biological Removal (PBR) method to develop advice about sustainable removals for marine mammals considered data-poor.

PBR refers to all human-caused mortality. Estimating a Total Allowable Removal (TAR) or a Total Allowable Take (TAT) with this method must consider removals from all human-caused mortalities.

ASSESSMENT

Survey

A photographic aerial survey was flown in September 2017 to estimate abundance of the HBDS Walrus stock using three deHavilland Twin Otter 300 aircraft. The survey covered the east coast of Baffin Island, the Hudson Strait and the northwestern part of Hudson Bay (Figure 2).

The surveys produced a count of 13,400 animals (rounded to the nearest 100; Figure 3). Counts at haul-out sites were adjusted to account for the proportion of animals in the water during the survey, assuming an average haul-out proportion of 0.3. This results in an adjusted aerial survey estimate of 44,600 (95% CI = 19,500–102,000) for the HBDS stock.

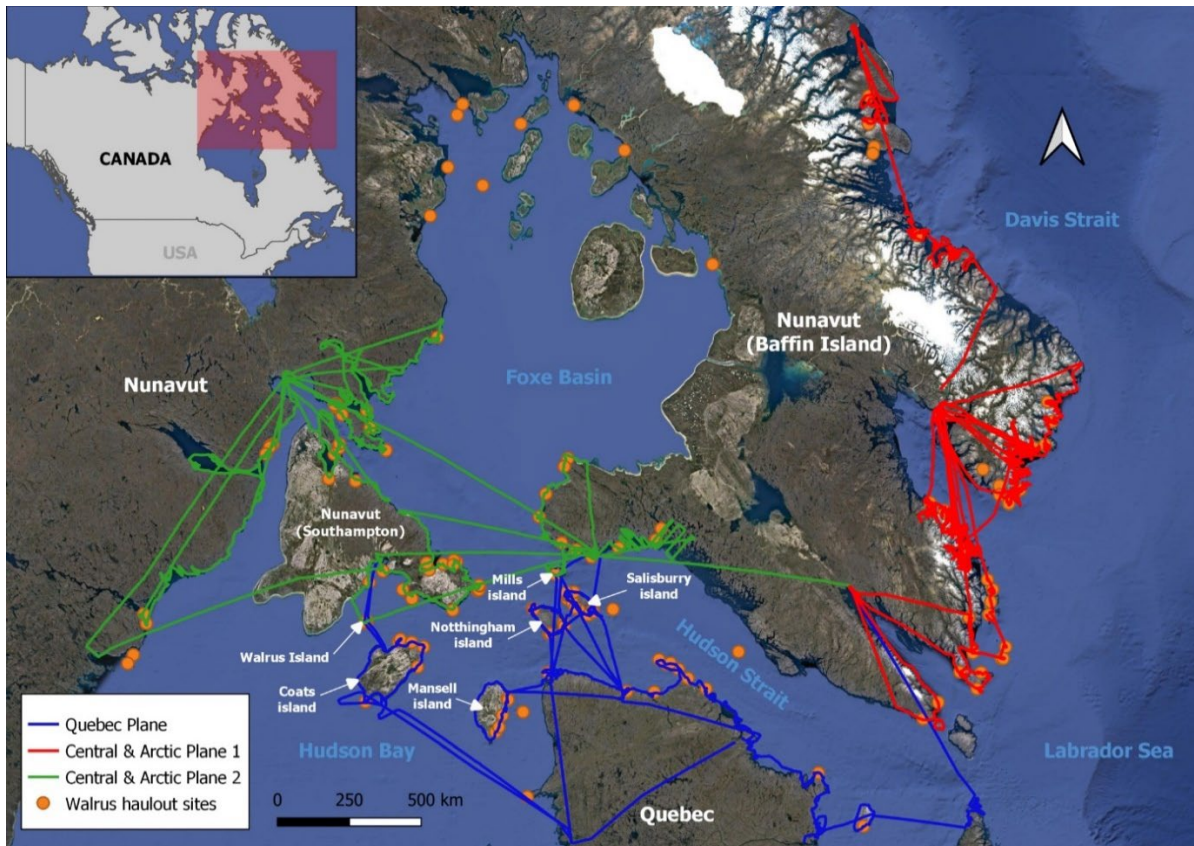


Figure 2. Survey tracks flown by the three aircraft during September 2017, along with locations of known Walrus haul-out sites obtained from previous surveys and discussions with Inuit hunters.

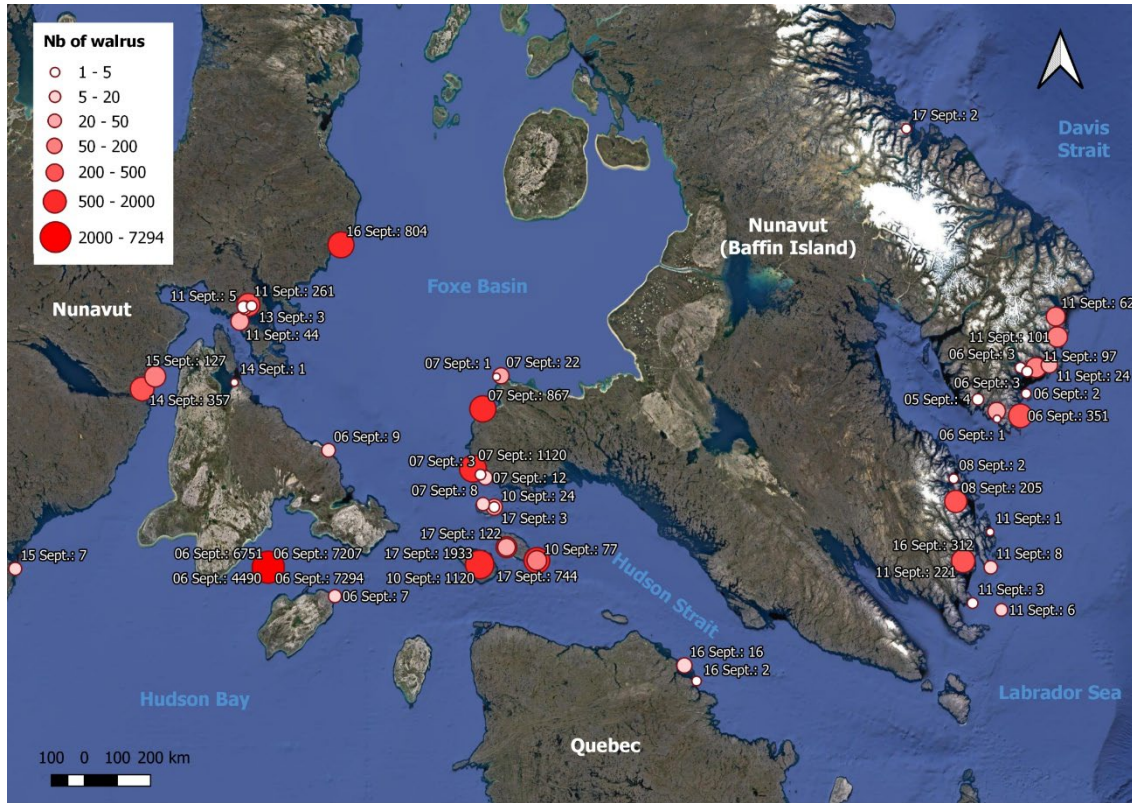


Figure 3. Counts of Walrus obtained from photos taken during the September 2017 Walrus survey.

Analysis

An aerial survey of the northern Hudson Bay-Hudson Strait component of the HBDS stock was flown in 2014 using a similar design, producing an abundance estimate of 7,100 animals (95% CI = 2,500–20,400; Table 1). The same area in 2017 was estimated to have 38,500 Walruses (95% CL = 15,100–98,300; Table 1). Previous surveys in the 1950s, 1970s, and 1980s covered the Nottingham-Salisbury and southern Southampton-Coats-Walrus Island complexes, which together account for over 85% and 70% of observations in the 2014 and 2017 surveys, respectively. Finally, additional estimates from two strip-transect surveys flown during the spring of 2012 in Hudson Strait are available (Table 1). Together, these estimates form a five-decade time series of abundance estimates that were used in a population model of the northern Hudson Bay-Hudson Strait component of the HBDS stock.

Table 1. Abundance estimates for the northern Hudson Bay-Hudson Strait (HBHS) component of the HBDS Walrus stock from various surveys conducted from 1954 to 2017 (rounded to the nearest 100).

Year	HBHS Estimate	95% CI
1954	9,700	2,500–37,300
1961	8,800	2,300–34,100
1976	2,700	700–10,500
1977	2,700	700–10,400
1988	2,800	700–10,900
1989	4,400	1,100–17,100
1990	6,100	1,600–23,600
2012	5,300	1,400–20,300
2014	7,100	2,500–20,400
2017	38,500	15,100–98,300

Walrus are harvested in Nunavut and Nunavik (Figure 4). For the years for which harvest data were unavailable, we used the average harvest of the most recent five years as a proxy. Reported catches have declined from over 450 animals in the 1950s to an estimated annual average of 76 animals over the last five years. Hunters from Nunavik report that Walrus hunting has declined because there are fewer dog teams to feed. There is also concern about trichinosis, particularly in the southern portion of the Walrus range.

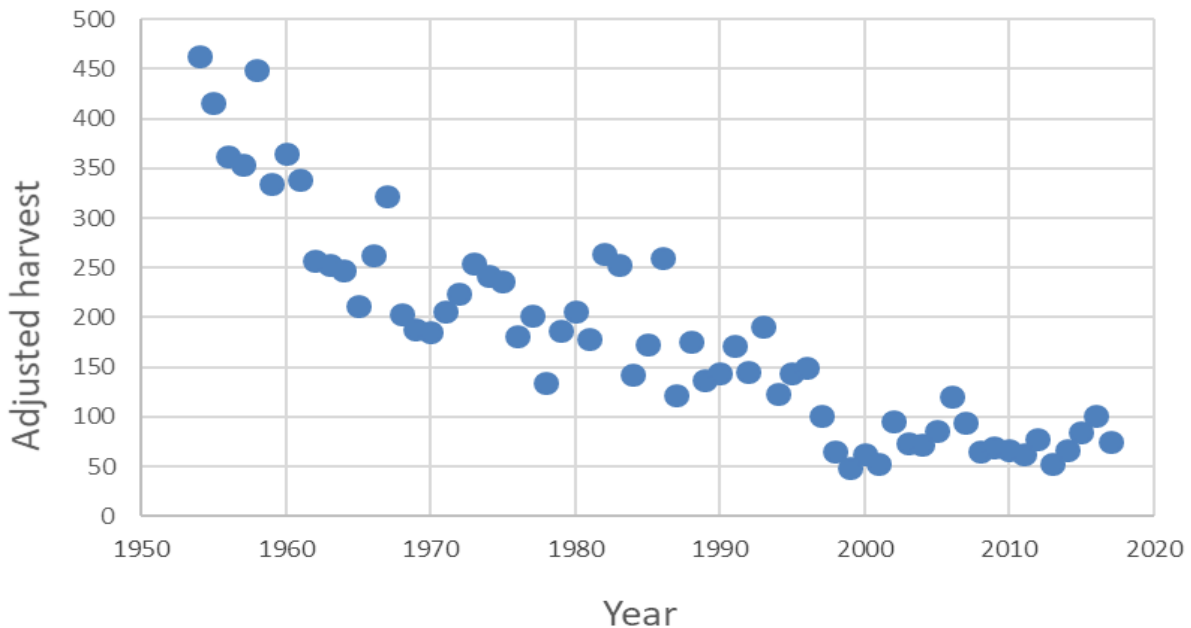


Figure 4. Adjusted reported harvest from communities in Canada harvesting from the HBDS stock.

A population model was fitted to the adjusted survey time series and Canadian harvest data (1954-2017) to estimate abundance of the northern Hudson Bay-Hudson Strait component of the HBDS stock. The model fit to the 2017 survey estimate (for the same area) was poor (Figure

5), largely due to very high counts on Walrus Island compared to previous surveys from 1954–2014 (7,300 vs. 1,400–2,900 Walruses, respectively). The 2017 aerial survey estimate is much larger than would be expected given Walrus population dynamics. This may reflect a larger proportion of the population hauled out than the assumed mean of 0.3, or movement of Walrus from other areas (e.g., Foxe Basin) into the HBDS stock range. The model provided an abundance estimate of 8,200 (95% CI = 5,800–19,700) for the northern Hudson Bay-Hudson Strait component of the stock. Adding in the 2017 aerial survey estimate from the east coast of Baffin Island of 3,900 (95% CI = 2,200–7,200) results in a total stock abundance estimate of 12,100 (95% CI = 7,000–20,800).

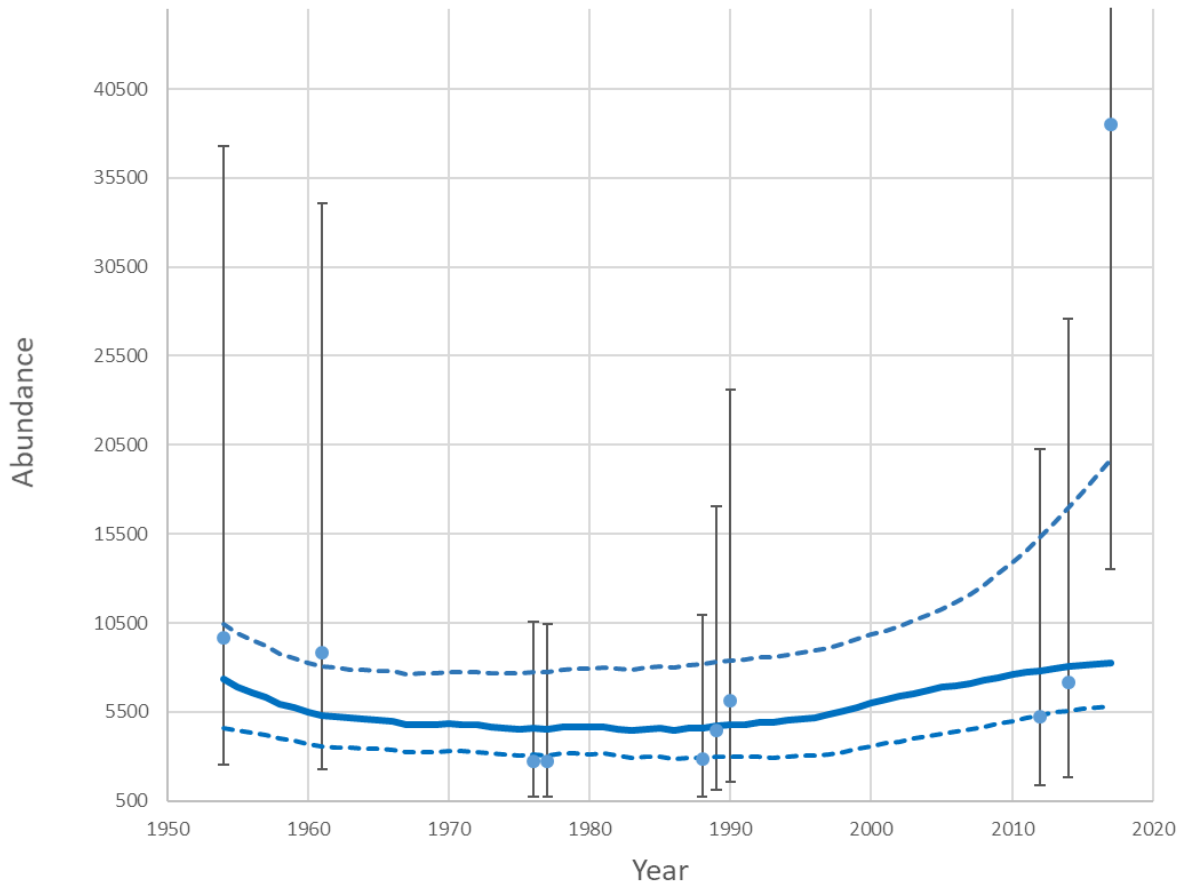


Figure 5. Aerial survey (\pm 95% CI), and model estimates of Walrus abundance (solid line) and 95% CI (dotted lines).

PBR

PBR was estimated separately for the northern Hudson Bay-Hudson Strait and east Baffin Island components assuming an $R_{\max} = 0.08$ (United States Federal Register 2013) and a recovery factor (F_R) of 1. The overall PBR for the stock was 360 animals (Table 2).

Table 2. Estimate, minimum population estimate (N_{min}), coefficient of variation (CV), and Potential Biological Removal (PBR) for the northern Hudson Bay-Hudson Strait (HBHS) and east Baffin Island components of the Hudson Bay Davis Strait Walrus stock. PBR was calculated using a maximum rate of increase of 0.08 and a recovery factor of 1. PBR estimates from the last assessment are also presented.

Area	Estimate	N_{min}	CV	PBR
East Baffin Island (2017)	3,900	3,000	0.31	121
HBHS (2017)	8,200	6,000	0.39	239
Total	-	-	-	360
East Baffin Island (2013)	-	-	-	88
HBHS (2014)	-	-	-	228

Reported harvests underestimate the number of Walruses killed because of animals wounded or killed but not recovered, as well as non-reporting. The estimated annual average reported Canadian harvest over the last 5 years in the HBDS stock area is 95 animals. The model estimated a median struck-and-loss and non-reporting rate combined of 0.44. Adjusting the reported catch by the estimated proportion of animals that are struck-and-lost and not reported resulted in a total estimated removal of 137 animals, which is much less than the current PBR. This estimate of total removals does not include other possible human-induced mortality (e.g., ship strikes).

Sources of Uncertainty

Walruses are a challenging species to enumerate owing to their aggregated distribution and correlated haul-out behavior, resulting in highly variable numbers of animals hauled out at one time. This uncertainty has an important impact on the adjusted abundance estimates.

Little is known of Walrus movements between the management stock areas. The survey may therefore have counted Walruses not considered to be part of the HBDS stock, but that occurred within the survey area in 2017.

Walrus from the HBDS stock are also harvested by Greenland. The amount of exchange between Hudson Strait and east Baffin, and between east Baffin and Greenland, is not well understood. Greenland harvests have not been included in this analysis. This may affect the model estimates of abundance and output parameters (e.g., S&L).

Stock-specific information on struck-and-loss is very limited, and the completeness of the harvest records is not known. Uncertain harvest data have an important impact on the results of the model and our understanding of population trends.

Other sources of human-caused mortality (e.g., ship strikes, net entanglements), which are included in the estimated PBR, have not been quantified.

CONCLUSIONS AND ADVICE

Using estimates of abundance obtained from the population model, rather than the most recent survey estimate, as the basis for advice is preferred as all available information on abundance and harvest data are incorporated in the model. The model-estimated total abundance is 8,200 (95% CI = 5,800–19,700) Walrus for the Hudson Strait and northern Hudson Bay component of the HBDS stock. Adding in the estimated abundance for Walruses along the east coast of Baffin Island (3,900; 95% CI = 2,200–7,200) results in a total HBDS stock abundance estimate of 12,100 (95% CI = 7,000–20,800).

The difference between the two estimates is greater than what would be expected from population growth alone. The higher 2017 count may have resulted from a greater proportion of hauled out animals than assumed, particularly at Walrus Island, in northern Hudson Bay. Another possibility is movement of Walrus from other areas (e.g., Foxe Basin) into northern Hudson Bay, or a combination of the two factors.

The PBR estimate for the HBDS stock is 360, assuming a Recovery Factor of 1. Current Canadian reported harvests of 95 (137 taking into account struck-and-loss and non-reporting) animals are below the estimated PBR.

The eastern Baffin Island portion of the stock is shared with Greenland. A better understanding of Walrus movement patterns and total hunting mortality is required to ascertain the sustainability of the cumulative harvest in both countries. The suggested quota for West Greenland from this stock was 74 Walruses (NAMMCO 2018).

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SOURCES OF INFORMATION

This Science Advisory Report is from the February 17–22, 2020 National Peer Review on the Hudson Bay-Davis Strait Atlantic Walrus abundance estimate. Additional publications from this meeting will be posted on the [Fisheries and Oceans Canada \(DFO\) Science Advisory Schedule](#) as they become available.

NAMMCO [North Atlantic Marine Mammal Commission]. 2018. Report of the NAMMCO Scientific Working Group on Walrus, October 2018. North Atlantic Marine Mammal Commission, Copenhagen, Denmark. 22 p.

