Ontario Species at Risk Evaluation Report for

Polar Bear

Ours polaire

Nanook

(*Ursus maritimus*)

Committee on the Status of Species at Risk in Ontario (COSSARO)

Assessed by COSSARO as Threatened

February 2021

Ours polaire (Ursus maritimus)

L'ours polaire (*Ursus maritimus)* est classé dans la catégorie des espèces menacées en Ontario par le CDSEPO.

L'ours polaire est largement reconnu comme l'espèce emblématique des questions de protection de la nature et de changements climatiques à l'échelle mondiale. Sa présence est saisonnière en Ontario, quand il se déplace vers la terre ferme après la dislocation de la glace saisonnière dans la baie d'Hudson et dans la baie James. La répartition de l'espèce en Ontario se limite à la côte de ces deux baies. La population mondiale de l'ours polaire occupe toute la région arctique et est divisée en 19 unités de gestion, selon la dynamique démographique de l'ours.

La population d'ours de l'Ontario se compose de deux unités de gestion : celle du sud de la baie d'Hudson et celle de l'ouest de la baie d'Hudson. Ces unités de gestion empiètent également sur le territoire des administrations voisines, à savoir le Québec, le Manitoba et le Nunavut. Bien qu'elles soient considérées comme des unités séparées, le mélange d'ours membres de l'une et de l'autre a été observé, mais les mouvements entre ces deux unités et d'autres unités de gestion sont rares.

Étant donné cette dynamique démographique, la zone englobant les sous-unités du sud de la baie d'Hudson et de l'ouest de la baie d'Hudson est considérée comme l'aire de répartition plus vaste pertinente sur le plan biologique pour les ours polaires de l'Ontario. Ces unités de gestion sont parmi les populations d'ours polaires situées les plus au sud, où les menaces liées au changement climatique sont les plus sérieuses, et semblent connaître un déclin quasiment uniforme. L'ours polaire est principalement menacé par le changement climatique et par la perte de glace de mer qui lui est associée, qui nuit à son accès aux proies, ce qui entraîne la détérioration de son état corporel, de son taux de reproduction et de son abondance. Les ours polaires subissent également la menace de la mortalité causée par les êtres humains et des contaminants environnementaux, bien que l'incidence de ces menaces soit estimée faible.

L'ours polaire est classé dans la catégorie des espèces menacées en Ontario par le CDSEPO, en raison de sa population petite et en baisse. D'après les données des relevés récents, moins de 1 000 ours polaires se trouvent en Ontario et le déclin de la taille de la population a été observé entre les deux derniers relevés. Ce statut, qui tient compte de la taille plus petite de la population de l'Ontario et de la hausse de ses menaces, diffère de celui du COSEPAC, qui le classe dans la catégorie des espèces préoccupantes.

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Executive summary

Polar Bear is a widely recognized species emblematic of global conservation and climate change issues. It is a seasonal resident of Ontario, moving to land in the summer after the break-up of seasonal sea ice in Hudson Bay and James Bay. The species' distribution in Ontario is limited to the shorelines of the two bays. The global population of Polar Bear extends across the artic region and is divided into 19 management units based upon the bear's population dynamics. Ontario's population consists of bears from two management units, Southern Hudson Bay and Western Hudson Bay. These management units also overlap neighboring jurisdictions including Quebec, Mantioba and Nunavut. Although these are considered separate units, bears have been observed mixing between them, however movements between these two units and other management units are rare. Due to these population dynamics, the combined area of the Southern Hudson Bay and Western Hudson Bay subunits is considered to be the broader biologically relevant range for Ontario's Polar Bears. These management units are among the most southerly Polar Bear populations, where threats from climate change are most acute, and appear to be undergoing a near uniform decline. Polar Bear are primarily threatened by climate change, and the associated loss of sea ice. Reductions in sea ice reduced the bears' ability to access their prey, leading to declines in body condition, reproductive success and abundancy. Polar Bears also face threat from human caused mortality and environmental contaminants, although these threats are considered low impact.

Polar Bear is classified by COSSARO as Threatened, due to a small and declining population. Recent census data indicates that there are fewer than 1000 Polar Bears in Ontario and a decline in population size was observed between the two most recent censuses. This status differs from the COSEWIC status of Special Concern, reflecting the smaller size and increased threats for the Ontario population.

1. Eligibility for Ontario status assessment

1.1. Eligibility conditions

1.1.1. Taxonomic distinctness

Polar Bear was first described in western science by Phipps (1774), and has been classified as *Ursus maritumus* since 1960s (Wilson and Reader 2005). Aboriginal Traditional Knowledge holders recognize two types of bear, with differing ecology and body shapes (Wilson and Reader 2005; Department of Fisheries and Oceans Canada 2011, p.73; Slavik 2013; Joint Secretariat 2015). Further study is required to elucidate these differences. At the current time, Wildlife Management Boards and COSEWIC recognize a single species (COSEWIC 2018), and Polar Bear is considered as such in this assessment.

1.1.2. Designatable units

COSEWIC (2018) currently considers all Polar Bears in Ontario to be a single designatable unit.

Polar Bears have a very large geographic range, likely facing spatial differences in their conservation needs and status (COSEWIC 2018). There is evidence for genetic distinctiveness among Polar Bear in Canada (Paetkau *et al.* 1999; Malenfant *et al.* 2016), and genetic clusters of Polar Bear do occur in distinct ecoregions (COSEWIC 2018). However, because the genetic differences among Polar Bear groups are small, and the species has a continuous distribution across its historical Canadian range, it does not meet the criteria for significant difference between groups, and is not recognized to have multiple designatable units at this time.

1.1.3. Native status

Polar bear is native to Ontario (COSEWIC 2018).

1.1.4. Occurrence

Polar bear occurs in Ontario (COSEWIC 2018; Obbard 2018).

1.2. Eligibility results

Polar Bear (*Ursus maritimus*) is eligible for status assessment in Ontario.

2. Background information

2.1. Current designations

- o GRANK: G3 (NatureServe 2020)
- o IUCN: Vulnerable (2015)
- o NRANK Canada: N3
- o COSEWIC: Special Concern (November 2018)
- o SARA: Special Concern (Schedule 1)
- o ESA 2007: Threatened (September 2009)
- o SRANK: S3 (ranked in 2009)

2.2. Distribution in Ontario

Polar Bear are frequently observed along Ontario's northern coastline. This use is seasonal: bears only retreat to land after sea-ice concentrations drop (COSEWIC 2018). They occur along Ontario's Hudson Bay shoreline, from the border the Manitoba border in the West. Their range continues south along Ontario's shoreline with James Bay, as far south as Attawapiskat. Ontario's Natural Heritage Information Centre (NHIC) records 1588 observations since 2000, producing an EOO of 74 845 km^2 and AOO of 2 312 km^2 (figure 1). The number of locations is not known but is assumed to exceed 10. NHIC considers Polar Bear records in Ontario to constitute a single Element Occurrence (EO), although they note that cooling pits, maternal dens and some diggings could potentially be considered as separate EOs and further investigation is required.

2.3. Distribution, status and the broader biologically relevant geographic range outside Ontario

Polar Bear are distributed throughout the Arctic, and occur in Canada, U.S.A., Russia, Norway and Greenland (COSEWIC 2018). The distribution is closely linked to the distribution of suitable sea-ice, ocean bathymetry and prey availability (Ferguson *et al*. 2000; Durner *et al*. 2009; McCall *et al*. 2016). Changes in Polar Bear distribution are associated with loss and changes in sea-ice, for example: their prehistoric distribution included areas further south in Denmark and Sweden, and extirpation in these regions is thought to relate to the loss of sea-ice (COSWEIC 2018). Polar Bear have a GRANK of G3, and were assessed by the IUCN as Vulnerable in 2015.

Polar Bear were previously considered to be a single homogeneous population ranging throughout the entire artic (Pedersen 1945). However, extensive evidence has subsequently demonstrated that bears have seasonal fidelity local areas (Born et al. 1997; Mauritzen *et al*. 2001; Taylor *et al*. 2001; Amstrup *et al*. 2004; Cherry *et al*. 2013; McCall *et al*. 2015; Sahanatien *et al*. 2015). Contemporary authorities consider the global population of Polar Bear to be comprised of 19 management units (IUCN/SSC Polar Bear Specialist Group. 2017; COSEWIC 2018). Management units are defined upon local population dynamics and foraging behavior, associated with local environment conditions, harvest activity and management. Accordingly, while some sources refer to these units as subpopulations (e.g. IUCN/SSC Polar Bear Specialist

Group. 2017), COSWEIC (2018) preferred the term 'management units', to distinguish from discrete demographic entities. Work to further delineate subpopulations is ongoing. Genetic studies to date indicate that Polar Bears in James Bay form a unique cluster district from others, and bears in the Hudson Bay complex (Peacock et al. 2015; Malenfant et al. 2016; Viengkone et al. 2016), however the significance of these differences has not been established.

Ontario's Polar Bear population includes bears from two management units: South Hudson Bay (Jonkel *et al.* 1976; Kolenosky and Prevett 1983; Kolenosky *et al.* 1992; Obbard and Middel 2012; Middel 2014), which covers the majority of the species' range in Ontario, along with southwestern Quebec and Hudson Bay and James Bay islands; and Western Hudson Bay (Stirling *et al.* 1977; Derocher and Stirling 1990; Cherry *et a*l. 2013; Stapleton *et al.* 2014; Lunn et al. 2016), which covers Ontario's extreme northwest Hudson Bay coastline, Manitoba's entire Hudson Bay coastline, and a portion of Nunavut's Hudson Bay coastline (IUCN/SSC Polar Bear Specialist Group. 2017). Although currently listed as separate management units, there is strong evidence that bears mix between Southern Hudson Bay and Western Hudson Bay: bears from the units mix on the Hudson Bay ice overwinter, and recoveries of tagged bears by hunters demonstrate the movement of individuals between the two (J. Northrup pers. comm. 2020). Bears in Southern Hudson Bay and Western Hudson Bay inhabit the same seasonal sea-ice ecotype, and face similar threats due to the current and projected losses of seasonal sea-ice due to climate change (J. Northrup pers. comm. 2020).

Although movements regularly occur between the Southern Hudson Bay and Western Hudson Bay management units, the movement of bears between these, and the next nearest units to Ontario—Foxe Basin in northern Hudson Bay and Davis Strait, encompassing the Labrador Sea and surrounding coastline—occurs much less frequently, if at all (J. Northrup pers. comm. 2020). Additionally, while the Foxe Basin and Davis Strait management units encompass the same seasonal sea-ice ecotype occupied by the Southern Hudson Bay and Western Hudson Bay units, the 500–1000 km difference in latitude means that the regions face very different near-term projections for sea-ice change, which differentiates the bear's threats and habitat between the southern and northern units (J. Northrup pers. comm. 2020).

Accordingly, for the purpose of this COSSARO assessment, the BBRGR for Polar Bears in Ontario is considered to be the extent of the Southern Hudson Bay and Western Hudson Bay management units. Despite Southern Hudson Bay and Western Hudson Bay being among the best surveyed of management units, the challenges of surveying Polar Bears mean that long-term data are limited and population trends and condition are difficult to determine.

Western scientific knowledge, largely based upon aerial censuses, suggests an overall decline in the population. A 2016 census of Southern Hudson Bay, the most recent available data, estimated a population of 780 bears with the majority of sightings located on the Ontario coastline, and a smaller proportion on islands in James Bay or eastern Hudson Bay (Obbard *et al.* 2018), a 17% decline was from the previous 2011/2012 census (Obbard *et al.* 2015). In Western Hudson Bay, the most recent population estimate is 842 bears, of which the vast majority occur in Manitoba (Dyck *et al.* 2017),

representing a not statistically significant 18% decline since 2011.

Aboriginal Traditional Knowledge (ATK) suggests an uncertain or increasing population. Polar Bear are notable for their significance in Indigenous culture throughout the bears' artic range, and extensive ATK has been documented for this species. In Southern Hudson Bay, ATK includes: increased Polar Bear abundance along coasts and near communities (COSEWIC 2008; Laforest et al. 2018; NMRWB 2018); increases on offshore islands and around Inukjuak (McDonald et al. 1997); high numbers near Twin Islands in James bay (Crête *et al.* 1991); and still increasing populations in the James Bay and southern Hudson Bay region (Laforest *et al*. 2018; NMRWB 2018). In Western Hudson Bay, local ATK similarly suggests an increasing population, with greater numbers of bears reported in and near communities (Obbard et al. 2015; Nirlungayuk and Lee 2009; Brown and Fast 2012).

Table 1. Condition of the Species in Adjacent Jurisdictions and Broader Biologically Relevant Geographic Range

Adjacent Jurisdictions	Biologically Relevant to Ontario (n/a, yes, no)	Condition	Notes & Sources
Quebec	Partially: the portion of Quebec within the Southern Hudson Bay management unit only	S3	Vulnerable. Quebec's Polar Bear population encompasses bears from three management units / subpopulations. The IUCN Polar Bear Specialist Group considers the South Hudson Bay unit to have 'very likely declined' over the past three generations, while the Foxe Basin unit is considered to be 'stable' and the Davis Strait unit is data deficient, but 'stable' over a shorter time period (IUCN/SSC Polar Bear Specialist Group. 2017).
Manitoba	Partially: the portion of Manitoba within the Western Hudson Bay management unit only	S2	Threatened. Manitoba's entire Polar Bear population falls within the Western Hudson Bay management unit / subpopulation, which is considered to have 'very likely decreased' in the past three generations (IUCN/SSC Polar Bear Specialist Group. 2017)
Michigan	NA		
Minnesota	NA		
Nunavut	Partially: the portion of Nunavut within the	S3	Nunavut's Polar Bear population encompasses multiple management units / subpopulations. Western Hudson Bay is the southernmost unit,

Adjacent Jurisdictions	Biologically Relevant to Ontario (n/a, yes, no)	Condition	Notes & Sources
	Western Hudson Bay management unit only		and is considered to have 'very likely decreased' in the past three generations, while the more northern units in Nunavut as listed as either stable or data deficient (IUCN/SSC Polar Bear Specialist Group. 2017).
New York	NA		
Ohio	NA		
Pennsylvania	NA		
Wisconsin	NA		
South Hudson Bay management unit	Yes	Likely qualifies as Threatened, if considered as a unit for evaluation	Encompasses the majority of Polar Bear range in Ontario, and a portion of the range in Quebec, with the majority of bears using the Ontario shoreline
Western Hudson Bay management unit	Yes	Likely qualifies as Threatened, if considered as a unit for evaluation	Includes the northwestern tip of Ontario's Polar Bear range, but the majority of bears observations are in Manitoba

2.4. Ontario conservation responsibility

Large scale estimates for Polar Bear population are inherently challenging due to a combination of irregular, inconsistent and often outdated survey data, and large confidence intervals on the data that do exist (COSEWIC 2018). Global population estimates range from 20 000 and 26 000 (IUCN/SSC Polar Bear Specialist Group 2014). However, the authors of these studies do not support the use of these estimates for population assessment, due to their well-known limitations (COSEWIC 2018). For the purpose of their 2018 assessment, COSEWIC derived a minimum population estimate for Canada of 10 448 bears of all ages. COSEWIC and COSSARO assessments only count adult individuals for population assessments, and COSEWIC amended their 2018 estimate to 7209 adults.

Ontario's Polar Bear population are among the best surveyed in recent years, and the total population is likely less than 1000 individuals. Accordingly, Ontario's population likely represents approximately < 5% of the global population, and < 10% of the Canadian population, though these figures should be treated with appropriate caution.

2.5. Direct threats

Polar Bears in Ontario are primarily threatened by sea-ice loss due to climate change, which is considered a high impact threat by COSWIC (2018). Sea-ice data for Canadian waters as a whole declined at a rate of 7% per decade between 1968 and 2018, while sea-ice in Hudson Bay declined 9.5% in the same period (Environment and Climate Change Canada 2019).

Loss of sea-ice affects the bears' body condition, reproduction, abundance, and distribution by reducing prey availability and the number of days the bears are able to hunt in each season. Reduced body condition is determined as an index of combined mass of fat and skeletal muscle to body length (Obbard et al. 2016). Bears require sufficient fat reserves to survive their fasting period during the summer ice-free season, and for pregnant females fat reserves are required to support winter denning and lactation (Ramsay and Stirling 1988; Derocher et al. 1993; Atkinson and Ramsay 1995; Derocher and Stirling 1995; Atkinson et al. 1996; Polischuk et al. 2002). Reduced body condition and lower reproductive success have been observed in Southern Hudson Bay (Obbard et al. 2016; Rode et al. 2012) and Western Hudson Bay (Stirling et al. 1999; Sciullo et al. 2016) management units.

Sea-ice is predicted to decline significantly in the coming decades (Stern and Laidre 2016). One modelling exercise concluded a medium 71% probability of a > 30% decline in bears in the next three generations (IUCN 2015), however there is substantial uncertainty due to the unclear relationship between bear populations and sea-ice which limits the applicability of this projection. Some ATK, suggests Polar Bears may be better adaptable to change (Canadian Wildlife Service 2009; Joint Secretariat 2015), while other ATK does not (Kotierk 2010; Slavik 2013; Joint Secretariat 2015; York et al. 2016). Empirical analyses suggests that terrestrial foods will be inadequate to replace the value of prey associated with sea-ice, with the result that Polar Bear populations will decline with melting sea-ice (Ramsay and Hobson 1991; Hobson and Stirling 1997; Hobson et al. 2009).

Low impact threats to Polar Bears include human caused mortality and contaminants. The threat from human caused mortality includes overhunting and defensive kills, and is considered low impact due to Canada's regulated system of Polar Bear hunting (Peakcock *et al*. 2011) and the practice of subtracting defensive kills from the total allowable harvest in most units (COSEWIC 2018). Contaminants and pollution pose a risk to Polar Bears due to their potential to bioaccumulate in the marine food web in which the bears are apex predators. Some correlative studies have found individual relationships between a biological process in Polar Bears and pollution levels (e.g. Sonne 2010), however it has been difficult to prove population declines caused by pollutants (Jenssen *et al.* 2015)

Displacement and disturbance of Polar Bears resulting from industrial development, recreation, and ship traffic is of notable concern and interest, but is currently considered a negligible impact threat (COSEWIC 2018).

2.6. Specialized life history or habitat use characteristics

Polar Bears are highly specialized predators of marine mammals, with slow growth the reproductive rates. They rely on sea-ice to access their prey, preferring annual ice cover over multi-year ice, due to the higher density of seal and other prey. Sea-ice concentration is the primary factor determining Polar Bear habitat selection. Polar Bears prefer sea-ice for foraging during the spring, and move to land when ice concentration declines. Female bears excavate maternity dens while on land, using permafrost or snow, while other bears may segregate by sex and reproductive status.

3. Ontario status assessment

3.1. Application of endangered/threatened status in Ontario

3.1.1. Criterion A – Decline in total number of mature individuals

Does not apply.

Although there is emerging evidence of declines in Ontario populations of Polar Bear (e.g. Obbard *et al* 2015; Obbard *et al.* 2018; COSEWIC 2018; IUCN Polar Bear Specialist Group 2020), the available data supporting to support this cover a relatively short and recent time (2011–2016), much less than three generations, and earlier data suggest the population to have been previously stable (IUCN Polar Bear Specialist Group 2016a). In addition, the declines observed to date do not meet any thresholds for this criterion. Population trend modelling for Polar Bear as a whole, not limited to Ontario, suggests a 71% chance of a greater than 30% decline, and a 7% chance of a greater than 50% decline (IUCN 2015). This level of decline could meet the threshold for threatened under this criteria, however there is considerable uncertainty about the accuracy of these projections.

3.1.2. Criterion B – Small distribution range and decline or fluctuation

Does not apply.

The extent of occurrence for Polar Bear Ontario, derived from contemporary NHIC observations (see section 2.2) greatly exceeds thresholds for this criterion. The index of area of occupancy calculated from contemporary NHIC observations (2312 km^2; see section 2.2) is close to the threshold for Threatened under B2, however Polar Bear does not meet the required two subcriteria: it meets subcriterion b, but does not meet a or c.

3.1.3. Criterion C – Small and declining number of mature individuals

Threatened C1, C2a(i).

Ontario's Polar Bear popuation is comfortably less than 1000 (Dyck *et al*. 2017, Obbard *et al.* 2018, M. Obbard pers. comm. 2020, J. Northrup pers. comm. 2020), meeting the thresholds for both Endangered and Threatened under criterion C. Census data collected in 2011/2012 (Obbard *et al.* 2015), and 2016 (Obbard *et al.* 2018) suggests a decline of 17% within five years, meeting subcriterion C1. Although considerably less than three generations for this species, this management unit / subpopulation is considered to have 'very likely decreased' over three generations (1986–2016) by the IUCN Polar Bear Specialist Group (2020), and declines are projeted to continue in the future as sea-ice decreases due to the ongoing climate crisis (COSWIC 2018). Ontario's Polar Bear popualtion further meeets subcriteiron C2a(i) because no subpopuation is estimated to contain more than 1000 mature individuals.

3.1.4. Criterion D – Very small or restricted total population

Threatened D1.

Ontario's Polar Bear popuation is comfortably less than 1000 (Dyck *et al*. 2017, Obbard *et al.* 2018, M. Obbard pers. comm. 2020, J. Northrup pers. comm. 2020), meeting sub criteria D1 for Threatened.

3.1.5. Criterion E – Quantitative analysis

Does not apply.

Insufficient information.

3.2. Application of Special Concern in Ontario

Does not apply.

3.3. Status category modifiers

3.3.1. Ontario's conservation responsibility

Does not apply. The species is considered globally at risk (G3), however Ontario has less than 25% of the global population and range – see section 2.4 for additional details.

3.3.2. Status modification based on rescue effect or level of risk in broader biologically relevant geographic range

Status modification due to recue effect does not apply.

Relevant populations outside Ontario which could provide bears are facing similar declines to those observed inside Ontario. Ontario's bears are likely declining due to a reduction in sea-ice caused by climate change, and Ontario is among the most acutely affected areas of the Polar Bear's range due to its relatively southern latitude.

Status modification due to BBRGR does not apply.

As described in section 2.3, the BBRGR for Ontario's Polar Bear population is most aptly defined as the extent of the two management units overlapping the province: Southern Hudson Bay which covers most of Ontario, and western Quebec; and Western Hudson Bay, which includes the Hudson Bay coastline in northwestern Ontario, Manitoba and part of Nunavut. Bears regularly move between these two management units, but are clearly delineated from more northernly units. Southern Hudson Bay and Western Hudson Bay are among the best surveyed and understood Polar Bear management units, and in both cases surveys strongly indicate small and declining populations and would likely be assessed as Threatened if considered as assessment units. Polar Bear are ranked as S2 in Manitoba, reflecting these threats. Both Quebec and Nunavut rank Polar Bear as S3, however these provincial assessments include

bears from other, separate, management units that are further north, are not so well studied, and do not show such clear evidence of decline.

3.4. Other status categories

3.4.1. Data deficient

Does not apply.

3.4.2. Extinct or extirpated

Does not apply.

3.4.3. Not at risk

Does not apply.

4. Summary of Ontario status

Polar Bear (*Ursus maritimus*) is classified as Threatened in Ontario based on meeting criterion C1, C2a(i), D1 This status differs from the COSEWIC status of Special Concern, reflecting the smaller size and increased threats for the Ontario population.

This status of this species is consistent with the definition of Threatened under the Endangered Species Act, 2007.

5. Information sources

Amstrup, S.C., T.L. McDonald, and G.M. Durner. 2004. Using satellite radiotelemetry data to delineate and manage wildlife populations. Wildlife Society Bulletin 32:661- 679.

Atkinson, S.N. and M.A. Ramsay. 1995. The effects of prolonged fasting of the body composition and reproductive success of female polar bears (*Ursus maritimus*). Functional Ecology 9:559-567.

Atkinson, S.N., R.A. Nelson, and M.A. Ramsay. 1996. Changes in the body composition of fasting polar bears (*Ursus maritimus*): The effect of relative fatness on protein conservation. Physiological Zoology 69:304-316.

Born, E.W., Ø. Wiig, and J. Thomassen. 1997. Seasonal and annual movements of radio-collared polar bears (*Ursus maritimus*) in northeast Greenland. Journal of Marine Systems 10:67-77.

Brown, L. and H. Fast. 2012. An overview of important ecological and biological marine feataures in Nunavut based on local knowledge. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2976. Fisheries and Oceans Canada, Winnipeg, MB.

Canadian Wildlife Service. 2009. Consultations on the proposed listing of the polar bear as special concern under the Species at Risk Act. Conducted February – April 2009. Canadian Wildlife Service, Iqaluit, Nunavut.

Cherry, S.G., A.E. Derocher, G.W. Thiemann, and N.J. Lunn. 2013. Migration phenology and seasonal fidelity of an Arctic marine predator in relation to sea-ice dynamics. Journal of Animal Ecology 82:912-921.

COSEWIC. 2008. COSEWIC assessment and update status report on the polar bear *Ursus maritimus* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa. vii + 75 pp.

COSEWIC. 2018. COSEWIC assessment and status report on the Polar Bear Ursus maritimus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xv + 113 pp. (http://www.registrelep-sararegistry.gc.ca/default.asp?lang=en&n=24F7211B-1).

Crête, M., D. Vandal, L.P. Rivest, and F. Potvin. 1991. Double counts in aerial surveys to estimate polar bear numbers in the ice free season. Arctic 44:275-278.

Department of Fisheries and Oceans Canada. 2011. Conversations with Nunavut communities on areas of ecological importance. DFO Freshwater Institute. Winnipeg, MB.

Derocher, A.E., and Stirling, I. 1990. Distribution of polar bears (Ursus maritimus) during the ice-free period in western Hudson Bay. Canadian Journal of Zoology 68:1395–1403.

Derocher, A.E., D. Andriashek, and J.P.Y. Arnould. 1993. Aspects of milk composition and lactation in polar bears. Canadian Journal of Zoology 71:561-567.

Derocher, A.E. and I. Stirling. 1995. Estimation of polar bear population size and survival in western Hudson Bay. Journal of Wildlife Management 59:215-221.

Durner, G.M., (and 16 co-authors). 2009. Predicting 21st-century Polar Bear habitat distribution from global climate models. Ecological Monographs 79:25-58.

Dyck, M., (and 4 co-authors). 2017. 2016 Aerial survey of the Western Hudson Bay polar bear subpopulation. Nunavut Department of Environment, Wildlife Research Section, Igloolik, NU. 82 pp.

Environment and Climate Change Canada (2019) Canadian Environmental Sustainability Indicators: Sea ice in Canada. Consulted on Month day, year. Available at: www.canada.ca/en/environment-climate-change/services/environmental-indicators/sea- ice.html.

Ferguson, S.H., M.K. Taylor, and F. Messier. 2000. Influence of sea-ice dynamics on habitat selection by polar bears. Ecology 81:761-772.

Hobson, K.A. and I. Stirling. 1997. Low variation in blood delta C-13 among Hudson Bay polar bears: Implications for metabolism and tracing terrestrial foraging. Marine Mammal Science 13:359-367.

Hobson, K.A., I. Stirling, and D.S. Andriashek. 2009. Isotopic homogeneity of breath CO_2 from fasting and berry-eating Polar Bears: Implications for tracing reliance on terrestrial foods in a changing Arctic. Canadian Journal of Zoology 87:50-55.

IUCN. 2015. Supplemental material for Ursus maritimus red list assessment. 16 pp. [http://www.iucnredlist.org/details/22823/0].

IUCN/SSC Polar Bear Specialist Group. 2014. [Global polar bear population estimates](). [Website accessed January 17 2021]

IUCN/SSC Polar Bear Specialist Group. 2016a. [Southern Hudson Bay (SH)](). [Website accessed January 17 2021]

IUCN/SSC Polar Bear Specialist Group. 2016b. [Western Hudson Bay (WH)](). [Website accessed January 17 2021]

IUCN/SSC Polar Bear Specialist Group. 2017. [Polar bear population map](). [Website accessed January 17 2021]

Jenssen, B.M., (and 7 co-authors). 2015. Anthropogenic flank attack on polar bears: interacting consequences of climate warming and pollutant exposure. Frontiers in Ecology and Evolution 3: Article 16.

Joint Secretariat. 2015. Inuvialuit and Nanuq: A polar bear traditional knowledge study. Joint Secretariat, Inuvialuit Settlement Region, Inuvik, NT.

Jonkel, C., P. Smith, I. Stirling, and G.B. Kolenosky. 1976. The present status of the polar bear in the James Bay and Belcher Islands area. Canadian Wildlife Service Occasional Paper 26:1-40.

Kolenosky, G.B. and J.P. Prevett. 1983. Productivity and maternity denning of polar bears in Ontario. International Conference on Bear Biology and Management 5:238-245.

Kolenosky, G.B., Abraham, K.F., and Greenwood, C.J. 1992. Polar bears of southern Hudson Bay. Polar bear project, 1984-88. Final Report. Ontario Ministry of Natural Resources, Maple, Ontario, Canada, 107 pp.

Kotierk, M. 2010. The documentation of Inuit and public knowledge of Davis Strait polar bears, climate change, Inuit knowledge and environmental management using public opinion polls. Department of Environment, Government of Nunavut, Iqaluit, NU.

Laforest, B., J. Hebert, M. Obbard, and G. Thiemann. 2018. Traditional ecological knowledge of polar bears in the Northern Eeyou Marine Region, Québec, Canada. Arctic 71:40-58.

Lunn, N.J., Servanty, S., Regehr, E.V., Converse, S.J., Richardson, E., and Stirling, I. 2016. Demography of an apex predator at the edge of its range – impacts of changing sea ice on polar bears in Hudson Bay. Ecological Applications 26:1302–1320.

Malenfant, R.M., C.S. Davis, C.I. Cullingham, and D.W. Coltman. 2016. Circumpolar genetic structure and recent gene flow of polar bears: A re-analysis. PLoS One 11:e0148967.

Mauritzen, M., A.E. Derocher, and Ø. Wiig. 2001. Space-use strategies of female polar bears in a dynamic sea-ice habitat. Canadian Journal of Zoology 79:1704-1713.

McCall, A.G., A.E. Derocher, and N.J. Lunn. 2015. Home range distribution of polar bears in western Hudson Bay. Polar Biology 38:343-355.

McCall, A.G., N.W. Pilfold, A.E. Derocher, and N.J. Lunn. 2016. Seasonal habitat selection by adult female polar bears in western Hudson Bay. Population Ecology 58:407–419.

McDonald, M., L. Arragutainaq, and Z. Novalinga. 1997. Voices from the Bay: traditional ecological knowledge of Inuit and Cree in the Hudson Bay bioregion. Canadian Arctic Resources Committee, Ottawa, Canada.

Middel, K.R. 2014. Movement parameters and space use for the Southern Hudson Bay polar bear subpopulation in the face of a changing climate. M.Sc. thesis, Trent University, Peterborough, Ontario, Canada, xi + 131 pp.

Nirlungayuk, G. and D. Lee. 2009. A Nunavut Inuit perspective on Western Hudson Bay polar bear management and the consequences for conservation hunting. Pp. 135- 142 *in* M. Freeman and A.L. Foote, (eds.). Inuit, Polar Bears, and Sustainable Use CCI Press, Edmonton, Alberta

Nunavik Marine Regional Wildlife Board. 2018: Nunavik Inuit Knowledge and Observations of Polar Bears: Polar bears of the Southern Hudson Bay sub- population.

Obbard, M.E., and Middel, K.R. 2012. Bounding the Southern Hudson Bay polar bear subpopulation. Ursus 23:134–144.

Obbard, M.E., Stapleton, S., Middel, K.R., Thibault, I., Brodeur, V., and Jutras, C. 2015. Estimating the abundance of the Southern Hudson Bay polar bear subpopulation with aerial surveys. Polar Biology 38:1713–1725.

Obbard, M.E., (and 7 co-authors). 2016. Trends in body condition in polar bears (*Ursus maritimus*) from the Southern Hudson Bay subpopulation in relation to changes in sea-ice. Arctic Science 2:15-32.

Obbard, M.E., (and 5 co-authors). 2018. Re-assessing abundance of Southern Hudson Bay polar bears by aerial survey: effects of climate change at the southern edge of the range. Arctic Science. doi.org/10.1139/AS-2018-0004.

Paetkau, D., (and 10 co-authors). 1999. Genetic structure of the world's polar bear populations. Molecular Ecology 8:1571-1584.

Peacock, E., A.E. Derocher, G.W. Thiemann, and I. Stirling. 2011. Conservation and management of Canada's polar bears (*Ursus maritimus*) in a changing Arctic. Canadian Journal of Zoology 89:371-385.

Peacock, E., (and 22 co-authors). 2015. Implications of the circumpolar genetic structure of polar bears for their conservation in a rapidly warming Arctic. PLoS ONE 10:e112021.

Pedersen, A. 1945. Der eisbar (*Thalarctos maritimus* Phipps): verbreitung und lebensweise. Aktieselskabet E. Bruun and Co., Copenhagen.

Phipps, C.J. 1774. A voyage to the North Pole undertaken by His Majesty's command, 1773. Nourse, London.

Polischuk, S.C., R.J. Norstrom, and M.A. Ramsay. 2002. Body burdens and tissue concentrations of organochlorines in polar bears (*Ursus maritimus*) vary during seasonal fasts. Environmental Pollution 118:29-39.

Ramsay, M.A. and I. Stirling. 1988. Reproductive biology and ecology of female polar bears (*Ursus maritimus*). Journal of Zoology 214:601-634.

Ramsay, M.A. and K.A. Hobson. 1991. Polar bears make little use of terrestrial food webs: evidence from stable-carbon isotope analysis. Oecologia 86:598-600.

Rode, K.D., (and 6 co-authors). 2012. A tale of two polar bear populations: ice habitat, harvest, and body condition. Population Ecology 54:3-18.

Sahanatien, V., E. Peacock, and A.E. Derocher. 2015. Population substructure and space use of Foxe Basin polar bears. Ecology and Evolution 5:2851-2864.

Sciullo, L., G.W. Thiemann, and N.J. Lunn. 2016. Comparative assessment of metrics for monitoring the body condition of polar bears in western Hudson Bay. Journal of Zoology 300:45-58.

Slavik, D. 2013. Knowing Nanuut: Banks Islanders knowledge and indicators of Polar Bear population health. University of Alberta, Edmonton, Alberta.

Sonne, C. 2010. Health effects from long-range transported contaminants in Arctic top predators: An integrated review based on studies of polar bears and relevant model species. Environment International 36:461-491.

Stapleton, S., Atkinson, S., Hedman, D., and Garshelis, D. 2014. Revisiting Western Hudson Bay: Using aerial surveys to update polar bear abundance in a sentinel population. Biological Conservation 170:38–47.

Stirling, I., Jonkel, C., Smith, P., Robertson, R., and Cross, D. 1977. The ecology of the polar bear (Ursus maritimus) along the western coast of Hudson Bay. Canadian Wildlife Service Occasional Paper No. 33, 64 pp.

Stirling, I., N.J. Lunn, and J. Iacozza. 1999. Long-term trends in the population ecology of polar bears in western Hudson Bay in relation to climatic change. Arctic 52:294- 306.

Taylor, M.K., (and 11 co-authors). 2001. Delineating Canadian and Greenland polar bear (*Ursus maritimus*) populations by cluster analysis of movements. Canadian Journal of Zoology 79:690-709.

Viengkone, M., (and 9 co-authors). 2016. Assessing polar bear (*Ursus maritimus*) population structure in the Hudson Bay region using SNPs. Ecology and Evolution 6:8474-8484.

Wiig, Ø., (and 7 co-authors). 2015 *Ursus maritimus.* The IUCN Red List of Threatened Species 2015: e.T22823A14871490. http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T22823A14871490.en Web site: [accessed July 28, 2016].

Wilson, D.E. and D.M. Reader. 2005. Mammal Species of the World: A Taxonomic and Geographic Reference. Johns Hopkings University Press, Baltimore, U.S.A.

York, J., (and 4 co-authors). 2016. Demographic and traditional knowledge perspectives on the current status of Canadian polar bear subpopulations. Ecology and Evolution 6:2897.

A change in the classification of a species during reassessment by COSSARO may be for genuine or non-genuine reasons. Genuine reasons may include a reduction in threats to a species such that status of the species has improved, or the continuation of threats to the species such that the status of the species has further deteriorated. Non-genuine reasons may include new information on population size or threats that was not available during a previous assessment, the use of previous COSSARO criteria that may have yielded a different result or, taxonomic revisions that result in changes in range, population sizes or designatable units.

Appendix 1: Technical summary for Ontario

Species: Polar Bear (*Ursus maritimus*)

Demographic information

Demographic attribute	Value
Generation time. Based on average age of breeding adult: age at first breeding = X year; average life span = Y years.	11.5 years
Is there an observed, inferred, or projected continuing decline in number of mature individuals?	Yes based on observation
Estimated percent of continuing decline in total number of mature individuals within 5 years or 2 generations.	17% decline in less than 2 generations
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over the last 10 years or 3 generations.	17% decline in less than three generations
Projected or suspected percent reduction or increase in total number of mature individuals over the next 10 years or 3 generations.	Unknown, but projected to further decrease
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over any 10 years, or 3 generations, over a time period including both the past and the future.	17% reduction over recent five years
Are the causes of the decline (a) clearly reversible, and (b) understood, and (c) ceased?	a. Unknown b. Partially c. No
Are there extreme fluctuations in number of mature individuals?	No

Extent and occupancy information in Ontario

Extent and occupancy attributes	Value
Estimated extent of occurrence (EOO). *If value in COSEWIC status report is not applicable, then use geocat.kew.org. State source of estimate.*	74 845 km^2
Index of area of occupancy (IAO). *If value in COSEWIC status report is not applicable, then use geocat.kew.org. State source of estimate.*	2 312 km^2
Is the total population severely fragmented? i.e., is >50% of its total area of occupancy is in habitat patches that are: (a) smaller than would be required to support a viable population, and	a. No b. No

Extent and occupancy attributes	Value
(b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	
Number of locations. *See Definitions and Abbreviations on COSEWIC and IUCN websites for more information on the term "location". Use plausible range to reflect uncertainty if appropriate.*	> 10
Number of NHIC Element Occurrences	1
Is there an observed, inferred, or projected continuing decline in extent of occurrence?	Unknown
Is there an observed, inferred, or projected continuing decline in index of area of occupancy?	Unknown
Is there an observed, inferred, or projected continuing decline in number of sub-populations or EOs?	Unknown
Is there an observed, inferred, or projected continuing decline in number of locations?	Unknown
Is there an observed, inferred, or projected continuing decline in [area, extent and/or quality] of habitat?	Yes
Are there extreme fluctuations in number of populations?	No
Are there extreme fluctuations in number of locations?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of mature individuals in each sub-population or total population (if known)

Sub-population (or total population)	Number of mature individuals
Total	< 1000

Quantitative analysis (population viability analysis conducted)

Probability of extinction in the wild is unknown.

Threats

A threats calculator was completed as part of the most recent COSEWIC assessment (2018). Assigned overall threat impact: **high**, based on the following impacts:

- High:
  - o Climate change and severe weather (habitat shifting and alteration)
- Low:
  - o Pollution (air-borne pollutants)

o   Biological resource use (hunting and collecting terrestrial animals)

Rescue effect

Rescue effect attribute	Value
Does the broader biologically relevant geographic range for this species extend beyond Ontario?	Yes
Status of outside population(s) most likely to provide immigrants to Ontario	S3, Quebec; S2, Manitoba
Is immigration of individuals and/or propagules between Ontario and outside populations known or possible?	Yes
Would immigrants be adapted to survive in Ontario?	Probably
Is there sufficient suitable habitat for immigrants in Ontario?	Possibly
Are conditions deteriorating in Ontario?	Yes
Is the species of conservation concern in bordering jurisdictions?	Yes
Is the Ontario population considered to be a sink?	Unknown
Is rescue from outside populations likely?	Unknown.

Sensitive species

This species in not sensitive.

Acronyms

COSEWIC: Committee on the Status of Endangered Wildlife in Canada
COSSARO: Committee on the Status of Species at Risk in Ontario
ESA: Endangered Species Act
EO: Element occurrence (as defined by NHIC)
EOO: extent of occurrence
GRANK: global conservation status assessments
IAO: index of area of occupancy
IUCN: International Union for Conservation of Nature and Natural Resources
MNRF: Ministry of Natural Resources and Forestry
NHIC: Natural Heritage Information Centre
NNR: Unranked
NRANK: National conservation status assessment
SARA: Species at Risk Act
SNR: unranked
SRANK: subnational conservation status assessment
S1: Critically Imperiled
S2: Imperiled
S3: Vulnerable
S4: Apparently Secure
S5: Secure
IUCN: International Union for Conservation of Nature and Natural Resources
CDSEPO: Le Comité de détermination du statut des espèces en péril en Ontario