

## Attitudes of Nunavut Inuit toward Killer Whales (*Orcinus orca*)

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**ABSTRACT.** Killer whale (*Orcinus orca*) sightings are increasing throughout the eastern Canadian Arctic, and residents of Nunavut are concerned about the possible impact of killer whale predation on other marine mammals that are of socio-economic and cultural importance to Inuit. We analyzed the attitudes of Inuit towards killer whales, drawing on 105 semi-directed interviews conducted in 11 eastern Nunavut communities (Kivalliq and Qikiqtaaluk regions) between 2007 and 2010. Information gathered included interviewees' firsthand knowledge, as well as knowledge they had gained through oral history. Interviews provided data on interactions between Inuit and killer whales, physical descriptions and nature of killer whales in this region, overall opinion of interviewees with respect to killer whales, historical use of the animal, opinions regarding research on killer whales and effects of killer whales on other species, particularly the whales and seals harvested for Inuit subsistence. Interviewees described killer whales as their helpers more often than as their competitors, but also as feared and dangerous. Overall, negative opinions were more common than positive opinions, and some interviewees also had a conflicted attitude towards killer whales. More participants viewed killer whales as smart and fast than as beautiful and playful. Inuit attitudes toward killer whales did not vary significantly with sex, age, hunter status, or experience with killer whales, but did vary somewhat across regions. Inuit knowledge and perspectives play a critical role in wildlife management, especially in a changing Arctic. Conservation and management of species that are important to the Inuit subsistence harvest in Nunavut must take into consideration killer whale predation, Inuit knowledge, and Inuit views and attitudes towards killer whales.

**Key words:** killer whale, traditional ecological knowledge, Inuit hunting, predation, wildlife management

**RÉSUMÉ.** Les observations d'épaulards (*Orcinus orca*) augmentent dans l'est de l'Arctique canadien, et les habitants du Nunavut s'inquiètent des effets possibles de la prédation des épaulards à l'égard d'autres mammifères marins qui revêtent une importance socioéconomique et culturelle pour les Inuits. Nous avons analysé les attitudes des Inuits vis-à-vis des épaulards, nous appuyant ainsi sur 105 entrevues semi-dirigées réalisées dans 11 collectivités de l'est du Nunavut (les régions de Kivalliq et de Qikiqtaaluk) entre 2007 et 2010. Les connaissances directes des personnes interviewées font partie des renseignements qui ont été recueillis, de même que les connaissances obtenues par le biais de l'histoire orale. Les entrevues ont ainsi permis d'obtenir des données sur les interactions entre les Inuits et les épaulards, sur les descriptions physiques et sur la nature des épaulards de cette région, en plus de recueillir l'opinion générale des personnes interviewées au sujet des épaulards, l'utilisation historique de cet animal, les opinions en matière de recherche sur les épaulards et les effets des épaulards sur d'autres espèces, plus particulièrement les baleines et les phoques capturés pour la subsistance des Inuits. Selon les personnes interviewées, les épaulards leur viennent davantage en aide au lieu d'entrer en concurrence avec elles, mais cela dit, elles les craignent et les trouvent dangereux. Dans l'ensemble, il y avait plus d'opinions négatives que d'opinions positives, et certaines personnes interviewées avaient même une attitude conflictuelle à l'égard des épaulards. Plus nombreux étaient les participants qui considéraient les épaulards comme intelligents et rapides que comme beaux et enjoués. Les attitudes des Inuits envers les épaulards ne variaient pas beaucoup en fonction du sexe, de l'âge, du type de chasseur ou de l'expérience qu'ils possédaient avec les épaulards, mais ils variaient quelque peu d'une région à l'autre. Les connaissances et les perspectives des Inuits jouent un rôle critique dans la gestion de la faune, surtout dans l'Arctique en pleine évolution. La conservation et la gestion des espèces qui revêtent de l'importance dans les récoltes de subsistance des Inuits au Nunavut doivent tenir compte de la prédation par les épaulards, des connaissances des Inuits de même que des points de vue et des attitudes des Inuits vis-à-vis des épaulards.

**Mots clés :** épaulard, connaissances écologiques traditionnelles, chasse par les Inuits, prédation, gestion de la faune

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## INTRODUCTION

Available evidence suggests that sightings of the killer whale, *Orcinus orca* (or *aarluk* in Inuktitut), are becoming more frequent throughout the eastern Canadian Arctic (Higdon et al., 2011). Sighting reports have increased in Baffin Bay and Lancaster Sound, where killer whales were historically known (Reeves and Mitchell, 1988), as well as in the Hudson Bay area, where the species was not known to occur regularly until recent decades (Degerbøl and Freuchen, 1935; Higdon and Ferguson, 2009; Ferguson et al., 2010). Many of the sightings come from Inuit hunters in Nunavut, Canada, who generally report an increase in killer whales throughout the territory (Gonzalez, 2001; Higdon, 2007). Killer whales in the eastern Arctic consume a variety of marine mammal prey (Higdon et al., 2011; Ferguson et al., 2012b), including species of cultural and socio-economic importance to local Inuit. Hunters have expressed concern about the effects of increased killer whale presence on marine mammals such as ringed seals (*Pusa hispida*), belugas (*Delphinapterus leucas*), and narwhals (*Monodon monoceros*), known in Inuktitut as *netsiak*, *qulilugaq*, and *tugaliik*.

Inuit of Nunavut have a complex relationship with killer whales, although they are generally a non-harvested species (see below for rare exceptions). Killer whales are sometimes disliked because they drive other marine mammals away (Higdon, 2007) and blamed for declines in harvested species (e.g., Wilkinson et al., 1995), and they are cited as a concern when a harvested species population is small (Shelden et al., 2003). Conversely, killer whales sometimes make hunting easier for Inuit by triggering avoidance behaviour in prey (Gonzalez, 2001; Higdon, 2007; Ferguson et al., 2012b): Arctic seals and whales typically avoid killer whale predation by moving into shallow water along shorelines. This behaviour, which is well known to Canadian Inuit, is called *aarlirijuk* ('fear of killer whales') in the South Baffin dialect of Inuktitut (NWMB, 2000) or alternatively spelled *ardlingayuq* (Finley, 1990), *ardlungaijuq*, or *aarlungajut* (Finley, 2001). This behaviour provides hunters with easy prey and occasionally results in high harvests (e.g., the 1998 and 1999 narwhal harvests in Repulse Bay, DFO, 1998; Gonzalez, 2001). Increased presence of killer whales is therefore also relevant to co-management of subsistence harvests.

Conflict between large predators and humans, whether competing to obtain resources, space, or safety, or to conserve them, is well documented around the globe (Woodroffe, 2000; Packer et al., 2005; Mattson et al., 2006; Sandström et al., 2009). Conservation programs generally focus on the ecological and behavioural aspects of species and ecosystems, but there is increasing recognition that wildlife management includes an understanding of people (Decker et al., 1992) and that success will be determined largely by political, social, and cultural factors (Clark et al., 1996, 2005; Decker et al., 2006; Bruskotter et al., 2010). Considerable research supports the idea that management

and conservation of large predators require an integration of social science research on the human dimensions with the study of ecosystems and other scientific research (Mascia et al., 2003; Treves and Karanth, 2003; Bruskotter and Shelby, 2010; Kotierk, 2010). In fact, experts generally agree that the human dimension of wildlife management has greater weight than biological factors in making management decisions that affect stakeholders (Decker and Richmond, 1995). In large carnivore conservation, the human dimension is often the most difficult to control (Jacobson and McDuff, 1998; Treves and Karanth, 2003). For conservation and co-management of Arctic marine resources, the human dimension includes the stakeholders' attitudes, perceptions, and knowledge of predator management issues (Decker and Chase, 1997). Without an understanding of attitudes and perceptions towards large predators such as killer whales, we are not in a good position to make wildlife management decisions. Integrating human dimensions into wildlife management decisions is not simple, as attitudes and perceptions are affected by interactions, species knowledge, and change over time (Kellert et al., 1996; Enck and Decker, 1997). However, gathering a baseline of data is critical for creating future management steps that garner public support.

Here, we describe Inuit attitudes toward and opinions of killer whales in Nunavut collected using semi-directed interviews. The human dimension information presented here was collected as part of a larger study on Inuit knowledge of killer whale distribution, seasonality, and ecology in the eastern Canadian Arctic (Higdon et al., 2011; Ferguson et al., 2010, 2012a, b).

## METHODS

We used semi-directed (or semi-structured) interviews to document information on killer whales provided by Inuit hunters and elders in two regions of Nunavut: Qikiqtaaluk, which includes Baffin Island and Foxe Basin, and Kivalliq, western Hudson Bay (see Fig. 1). The semi-directed interview method was chosen for its effectiveness in other projects involving Traditional Ecological Knowledge (TEK) and wildlife and for its flexibility and ability to promote dialogue (Huntington, 1998, 2000). Structure was provided by a list of questions developed in advance, but no set order of questions was required for comparison (Ferguson et al., 2012b: Appendix 1). Questions were open-ended, allowing interviewees to elaborate on topics they had interest in or were knowledgeable about. With this guidance by the interviewees, not every question or topic of interest was addressed in every interview.

Selection of communities for this study was based on geographic location, logistics, and past killer whale sighting reports (Higdon, 2007; Higdon et al., 2011). Interviewees were identified using reputational and snowball sampling (Goodman, 1961; Stewart et al., 1995), starting from a list of potential interviewees provided by the local Hunters and

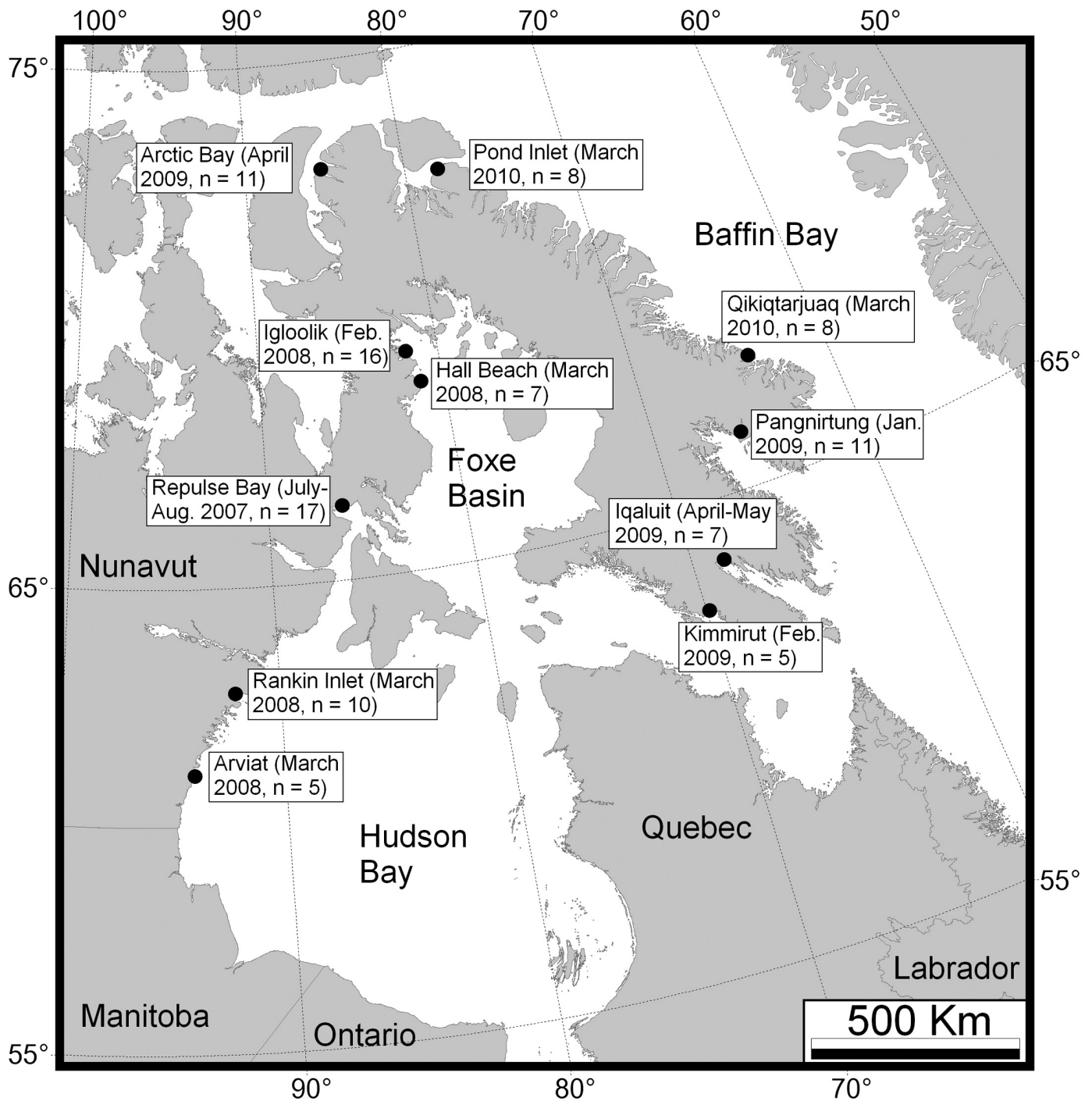


FIG. 1. Map of eastern Nunavut Territory, Canada, showing locations of communities where interviews were conducted, month and year, and total number of interviews (also see Ferguson et al., 2012b). Communities were grouped into four geographic regions: Hudson Bay (Arviat, Rankin Inlet, Repulse Bay), Foxe Basin (Igloolik, Hall Beach), southern Baffin Island (Kimmirut, Iqaluit, Pangnirtung), and northern Baffin Island (Qikiqtarjuaq, Pond Inlet, Arctic Bay).

Trappers Organization (HTO). Interviews were conducted in each community with the aid of a local interpreter, and most were conducted in Inuktitut. The interview process was approved by the Office of Research Services, University of Manitoba, the Nunavut Research Institute (NRI), and the local HTO in each community. Further details are available in Ferguson et al. (2012b).

Information was indexed manually by subject and analyzed using an interpretive approach to connect ideas and

categorize results (Kitchin and Tate, 2000). Results were grouped into related categories (e.g., all mentions of uses of killer whales were put together, all discussion of hunting events were another category) and then summarized within and between communities, across different regions (see Table 1), and for Nunavut as a whole. Killer whale information was divided into three broad (and sometimes overlapping) categories: (1) ecological factors such as abundance, distribution, and seasonality (Higdon et al., in press); (2)

predation on other species (Ferguson et al., 2012b); and (3) human dimensions of killer whale management and conservation (this paper).

Human dimension information was subdivided into the following categories based on grouping of results:

- Information known via oral history
- Hunting of killer whales, including recollections of past harvesting events
- Descriptions of killer whales (dangerous, fast, intelligent, etc.)
- Danger of killer whales: including whether or not the interviewee was scared of killer whales and their interactions with Inuit boats
- Human interaction: killer whales as helpers or competitors in subsistence harvest of other species
- Uses of killer whales for subsistence (food and energy) and economy (e.g., crafts)
- Opinions regarding scientific research on killer whales
- Effects of killer whales on other species, including wastage of prey items

For statistical analyses of factors influencing attitude, each interviewee's overall opinion of killer whales was categorized as negative, neutral, conflicted, or positive. Neutral opinions included statements such as "I don't bother them and they don't bother me" or that an interviewee "did not bother to watch them." Positive opinions included statements that hunters like killer whales because they make it easier to catch other marine mammals, that killer whales are beautiful, that they would like to see more, and that they are pleased when *maqtaq* (skin and outer blubber layer) from other marine mammals is available as a result of killer whale predation. Negative opinions included statements about an interviewee not liking to see killer whales, or not liking them because they eat other mammals. Interviewees with a mix of statements (at least two of positive, neutral, or negative) were scored as "conflicted."

We analyzed a mix of nominal and ordinal explanatory variables to explain patterns in attitude (a nominal response variable). Explanatory variables examined were interviewee age (birth decade) and sex, harvester status (full-time hunter, part-time hunter, former full-time hunter), and experience with killer whales. Experience with killer whales was given a categorical ranking based on interviewee statements on how usual sightings were or how often they saw killer whales. A total of 29 interviewees indicated the total number of sightings made in their lives, including three with no sightings, 20 who had seen killer whales only once, three who had seen them twice, two who had seen killer whales on three occasions, and one who reported five sightings. One additional interviewee reported that he had seen them 5–10 times. The remaining 75 interviewees gave qualitative descriptions such as "some," "a few," or "many" sightings. Interviewee responses were ranked on a four-point scale for experience with killer whales: 1) none,

2) little (one or two sightings in their lifetime), 3) some (3 to 5 sightings, plus qualitative descriptions of "a few" and "some" sightings), and 4) much (the one interviewee with 5–10 sightings, plus those with "many" sightings). For statistical analyses, the categories "none" ( $n = 3$ ) and "little" ( $n = 15$ ) were combined.

Relationships between attitude and the various explanatory variables were examined using contingency tables. We calculated the chi-square statistic for each contingency table, but with one exception, there were many expected frequency values under 5, which is problematic for the test in question (Zar, 1999). We therefore used Williams' correction for chi-square tests with small samples (Williams, 1976; Fleis et al., 2003). Fisher's exact test was also used for comparisons with nominal explanatory variables (region, sex, and status) (McDonald, 2009). We also calculated Cramer's V (Cramér, 1999) for all variables (both ordinal and nominal). Cramer's V statistic provides a quantitative measure of the strength of the association between the two variables in a contingency table. The statistic ranges from 0 to 1, with 0 indicating no relationship and 1 indicating a perfect association. *P*-values for Cramer's V are calculated in the same manner as they are for the chi-square statistic (or corrected test statistic as necessary). The magnitude of association measured by Cramer's V was interpreted following guidelines in Rea and Parker (1992).

## RESULTS

A total of 105 interviews were conducted in 11 Nunavut communities from 2007 to 2010 (Fig. 1). Interviewees were predominantly male (94%,  $n = 99$ ) and most were older (71 of 89 interviewees who provided age information were born in the 1950s or earlier). Interviewees were mainly active hunters, and all had spent considerable time on the water in their lifetimes. Most interviewees (97%,  $n = 102$ ) had seen at least one killer whale in the eastern Arctic over the course of their lives.

The majority of these interviewees, 87%, included at least some information on human attitudes and opinions towards killer whales, with representation from all 11 communities (Table 1). A total of 43 interviewees (all 11 communities, range one to eight per community) noted that they learned about killer whales through oral history, with 19 mentioning knowledge provided by family members (parents, grandparents, uncles) and 15 indicating stories from elders or shamans (*Angakkuq*, as spelled in Tungilik and Uyarasuk, 1999). The types of information reported as coming from elders and family members, all discussed in further detail below, included killer whale fear of walrus (*Odobenus rosmarus rosmarus*), the dangers of killer whale attacks on boats, and the fact that killer whales have a good memory and will take their revenge on anyone who has harmed a whale in the past.



TABLE 1. Summary of interviewee statements regarding killer whales, by community and region.

Interview statements about killer whales	Region and community											Sum
	Hudson Bay			Foxe Basin			South Baffin			North Baffin		
	Arviat	Rankin Inlet	Repulse Bay	Hall Beach	Igloolik	Iqaluit	Kimmirut	Pangnirtung	Arctic Bay	Pond Inlet	Qikiqtarjuaq	
Strong, huge		1	1		1		2				1	6
Fast	1	1		1		1				3		8
Smart, wise, aware	2	2	1			1		1		1		8
Beautiful, pretty		1					1					2
Curious, playful											1	2
Respected							1					1
Dangerous, deadly			1		1		1			2	1	7
Aggressive, furious	1 <sup>1</sup>											3
Fearsome, feared					1		2			1		4
Not afraid of people, show no fear		1		1			1					2
Can attack or disrupt boats				1	2		1			1		6
Hunters flee to land	1			1			1					3
Scared of them, scary	1	-- <sup>2</sup>		1	2		2			2	1	10
Afraid of them				1	1		1					3
Wary of them				1	1							2
Avoided, not bothered				1	1							2
Okay when calm				1								1
Help hunters by pushing animals to shore		2	1	1	3		1			4	1	17
Compete with hunters for food	1	1	1		2		3			1		9

<sup>1</sup> Another interviewee felt that it was a myth that killer whales were overly aggressive.

<sup>2</sup> One interviewee noted that he was no longer scared of killer whales.

*Descriptions*

Fifty-three interviewees (ca. half the total) described killer whales in specific terms, some of which were positive, some negative, and others neutral. Descriptors used by interviewees to describe killer whales included “strong” or “huge”; “fast,” “smart,” “wise,” or “aware”; “beautiful” or “pretty”; and “curious” or “playful” (Table 1). Five interviewees from Repulse Bay (n = 2) and Igloolik (n = 3) referred to killer whales as wolves of the sea or as being wolf-like in their behaviour (also see Ferguson et al., 2012b). Some interviewees (n = 12) also noted that there are different types of killer whales, smaller and larger ones.

An Igloolik interviewee reported a story from his grandfather: when a killer whale’s fin is bent, it means it is hungry, because the fin is made from blood, and when the fin is bent it means the whale is skinny and starving. A Pond Inlet interviewee reported that he once saw a killer whale with a bent dorsal fin, and on a different occasion, he saw another one with a broken fin that was hanging off.

*Interviewees’ Overall Opinion of Killer Whales*

Given the nature of the semi-directed interview process, not all interviewees provided information that could be scored for attitude towards killer whales. Data were available for 79 (71 male) of the 105 interviewees (75%) (Table 2). The majority of these interviewees (41 of 79, or 52%) had a negative opinion of killer whales, 16 (20%) had positive attitudes, 12 (15%) were conflicted, and 10 (13%) were neutral. While positive attitudes were more prevalent than conflicted or neutral attitudes, there were still more than twice as many negative opinions as positive. The most common positive statements related to killer whales’ making the harvest of narwhal, beluga, and bowhead (*Balaena mysticetus*) whales and seals easier by driving them to shore out of fear, or by leaving portions of a kill available for Inuit to pick up after the killer whales were gone. Most common negative comments concerned fear and unhappiness related to the killer whales’ chasing away and consuming of Inuit subsistence harvest animals. Conflicted statements generally combined viewing killer whales as competition for food resources and considering them helpful, in that it is easier to catch other whales and seals when killer whales are around.

Interviewee age (birth decade) was available for most (69) of those who provided information on attitude. Information on experience with killer whales was available for all interviewees, and harvester status was available for 92 (88%) of the total 105 interviewees, including 49 of those with attitude

TABLE 2. Summary of interviewee attitudes toward killer whales, by community.

Region	Community (n)	No data	Positive	Neutral	Negative	Conflicted
Hudson Bay	Repulse Bay (17)	6	4	2	4	1
	Rankin Inlet (10)	1	4	1	4	0
	Arviat (5)	0	1	0	4	0
Foxe Basin	Igloolik (16)	2	2	2	8	2
	Hall Beach (7)	4	1	1	1	0
North Baffin Island	Arctic Bay (11)	2	2	2	4	1
	Pond Inlet (8)	1	1	0	3	3
	Qikiqtarjuaq (8)	3	0	1	3	1
South Baffin Island	Kimmirut (5)	1	0	0	3	1
	Iqaluit (7)	4	1	1	1	0
	Pangnirtung (11)	2	0	0	6	3
Total		26	16	10	41	12

information. This group included 15 active full-time hunters, five active part-time hunters, 11 active part-time hunters who were formerly full-time hunters, 16 no longer active but formerly full-time harvesters (generally elders), and two who identified themselves as active hunters but did not specify full-time or part-time.

Three explanatory variables were examined using two different classifications. Region was examined first using the original four categories and then using only two categories, Hudson Bay combined with Foxe Basin and north Baffin Island combined with south Baffin Island. Age was examined using two categories (20s to 50s, 60s to 90s) and three categories (40s or younger, 50s or 60s, and 70s or older). Harvester status was also examined using two and three categories (active full-time, active part time, no longer active). For the two-category tests, full-time and no longer active categories were combined, as these were all elders who were formerly full-time harvesters (or women married to former full-time harvesters).

Statistical analyses of contingency tables were hampered by small sample sizes (Table 3). Only one chi-square test was valid (region using two categories). The other chi-square tests were therefore corrected using Williams' correction. Cramer's V statistics suggested that attitude had a moderate to strong association with region, weak to moderate associations with age and sex, and moderate to relatively strong associations with harvester status and experience with killer whales. None of the tests were significant at 0.05, however, although the analysis of region using two categories was significant at a reduced  $\alpha = 0.10$ . *P*-values calculated using Fisher's exact tests (nominal variables only) were similar to those calculated for the chi-square test statistics.

Sample sizes are limited, but the results indicate that Inuit attitudes towards killer whales do not vary significantly by sex, age, hunter status, or experience with killer whales, but do vary somewhat across regions (Table 3). The majority of interviewees with a conflicted opinion of killer whales were found in the Baffin regions (9 of 12, 5 in North Baffin, 4 in South Baffin), whereas the majority of interviewees with a positive opinion were in the Foxe Basin and Hudson Bay regions (12 of 16, including 9 from Hudson Bay). Negative opinions were evenly distributed in all four

regions, ranging from 9 to 12 per region (21 and 20 in the combined analysis), and neutral opinions, while generally rare, were evenly distributed in all regions ( $n = 3$ ) except south Baffin ( $n = 1$ ).

#### *Danger of Killer Whales*

A total of 38 interviewees stated that Inuit were scared of killer whales. Some made personal statements (e.g., "I was scared," "I am afraid") others made general statements (e.g., "Inuit are afraid," "we fear them"), and some reported both personal and general fears (Table 1). Three Rankin Inlet interviewees noted that Inuit generally fear killer whales, but that they did not personally share this fear. One noted that he didn't see the danger in seeing killer whales, and another had heard stories as a teen that they were dangerous but was not scared anymore. The third said he used to be scared of killer whales before seeing them in the 1950s, but then he was no longer scared.

Eighteen interviewees (in eight communities) noted that killer whales have good memories and will carry a grudge and take revenge against any person who harms or kills one of their own. Eight reported that they heard this from elders, two from older family members, and two from shamans. One interviewee from Rankin Inlet said he no longer believed that killer whales would carry a grudge and avenge the killing or harming of another, and thought it was just told to scare people from hunting them. Six interviewees (two from Igloolik, one each from Hall Beach, Pangnirtung, Pond Inlet, and Rankin Inlet) noted that killer whales can attack, disrupt, or capsize boats. Three interviewees (from Arviat, Igloolik, and Kimmirut) observed that in the past people would go to shore if they saw killer whales, and one interviewee (from Pangnirtung) noted that people were scared if they encountered killer whales while boating. Three others (from Arctic Bay, Iqaluit, and Pond Inlet) said that killer whales will closely approach boats sometimes, possibly being curious or playful ( $n = 2$ ).

Interviewees also noted that killer whales fear walrus. Thirty-two interviewees in nine communities (excluding Repulse Bay and Qikiqtarjuaq) noted that killer whales were afraid of walrus, and 29 of these stated that a white item like a coffee cup or a walrus tusk could be used to

TABLE 3. Results for statistical analyses of contingency tables comparing association between Inuit attitudes regarding killer whales (four nominal categories) and four nominal or ordinal explanatory variables (two different classification schemes for three variables, described in footnotes). All chi-square values were corrected using Williams' correction for small samples, with one exception (see footnote). Cramer's V and associated *p*-values were calculated using corrected chi-square statistics where necessary. Associated *p*-values for Fisher's exact tests are shown for comparison (nominal variables only).

Variable (categories)	Type	R × C	N	df	χ <sup>2</sup>	Cramer's V	<i>p</i>	<i>p</i> (Fisher's)	Strength of association <sup>6</sup>
Region (4) <sup>1</sup>	Nominal	4 × 4	79	9	10.635	0.635	0.302	0.312	Strong
Region (2) <sup>1</sup>	Nominal	2 × 4	79	3	7.137 <sup>2</sup>	0.300	0.068	0.069	Moderate
Age (3) <sup>2</sup>	Ordinal	3 × 4	69	6	5.117	0.385	0.529	n/a	Moderate
Age (2) <sup>2</sup>	Ordinal	2 × 4	69	3	1.910	0.166	0.591	n/a	Weak
Sex (2)	Nominal	2 × 4	79	3	1.017	0.113	0.797	0.705	Weak
Harvester status (3) <sup>3</sup>	Nominal	3 × 4	49	6	6.451	0.513	0.375	0.374	Relatively strong
Harvester status (2) <sup>3</sup>	Nominal	2 × 4	49	3	6.195	0.356	0.102	0.104	Moderate
Experience (3) <sup>4</sup>	Ordinal	3 × 4	79	6	8.862	0.474	0.181	n/a	Relatively strong

<sup>1</sup> Two different classifications: 1) all four regions included as categories, 2) Hudson Bay and Foxe Basin regions combined and same for the two Baffin regions.

<sup>2</sup> Two different classifications: 1) three categories (70s or older, 50s or 60s, 40s or younger), 2) two categories (20s to 50s, 60s to 90s). Ten records with no data removed from analyses.

<sup>3</sup> Two different classifications: 1) three categories (active full-time, active part-time (including former full-time, plus 2 "active"), no longer active), 2) two categories (full-time (those who identified themselves as current FT, active PT but formerly FT, and no longer active but formerly FT) and part-time hunters (six self-identified as part-time hunters, plus two who simply identified themselves as "active"). Thirty records with no information removed from analyses.

<sup>4</sup> Three categories only, since two of the original four categories, "none" and "little," were merged.

<sup>5</sup> The only chi-square statistic not corrected using William's correction for small samples (the only test in which fewer than 20% of expected values were less than 5).

<sup>6</sup> Strength of association (Cramer's V) interpreted following guidelines in Rea and Parker (1992).

scare killer whales away. The most information on this subject came from the two Foxe Basin communities, with six interviewees from Hall Beach and 12 from Igloolik. Four interviewees noted that they had learned this technique from elders, and another was told by her husband. Four interviewees (three in Igloolik, one in Pangnirtung) also reported first-hand experience with using this technique to scare killer whales away. Four interviewees (two from Rankin Inlet, one each from Arviat and Iqaluit) reported dead killer whales that had been killed by walruses. One story involved an event that occurred prior to 1921 in the Coral Harbour area, where a walrus stuck its tusks into a killer whale and both animals died. Two others reported a similar story with no additional details, and the final interviewee reported another event that was specifically noted to be different from the Coral Harbour story.

#### *Killer Whales as Helpers vs. Competitors*

Some interviewees (*n* = 17, in nine communities) noted that killer whales can have a positive impact by helping hunters catch marine mammal prey. Killer whales drive or push belugas, narwhals, or seals close to shore, moving them into locations where they have less vertical space in the water column to move and escape. Inuit have also been able to secure products (blubber, oil, baleen, and ivory) from animals killed by killer whales (belugas, narwhals, and bowhead whales) (four interviewees). Nine interviewees (six communities) indicated the opposite: they dislike

killer whales because they are competitors for food; they scare off or drive away wildlife, reducing the abundance of prey animals. Positive and negative opinions were reported in all four regions, with an even distribution for all except North Baffin, where the number of positive opinions vastly outweighed the negative (Fig. 2). Two interviewees (Qikiqtarjuaq and Arctic Bay) noted both sides of the issue, that killer whales sometimes help hunters catch other marine mammals, but also compete with hunters for food.

#### *Uses of Killer Whale Products*

Eleven interviewees from seven communities mentioned uses of killer whale products or their lack of usefulness. Three noted that killer whales were not eaten, and two more stated that they had no use. One of these interviewees suggested that the teeth could be good for carving, and another noted that if dead killer whales were found, they would be used for dog food or as a site to trap foxes. Another suggested that killer whales, if they were to be hunted, could possibly be good for dog food. An elder from Arctic Bay recalled people carving killer whale bones when she was young and said that people used the bones for *qamutik* (dog sled) runners. One Hall Beach elder had eaten killer whale before, and another had heard that the *maqtaq* was good, like beluga *maqtaq*, but thinner. Another interviewee from Hall Beach recalled her grandfather giving her *maqtaq* as well as blubber from a killer whale harvested in the Foxe Basin ice entrapment event. The blubber was white and was

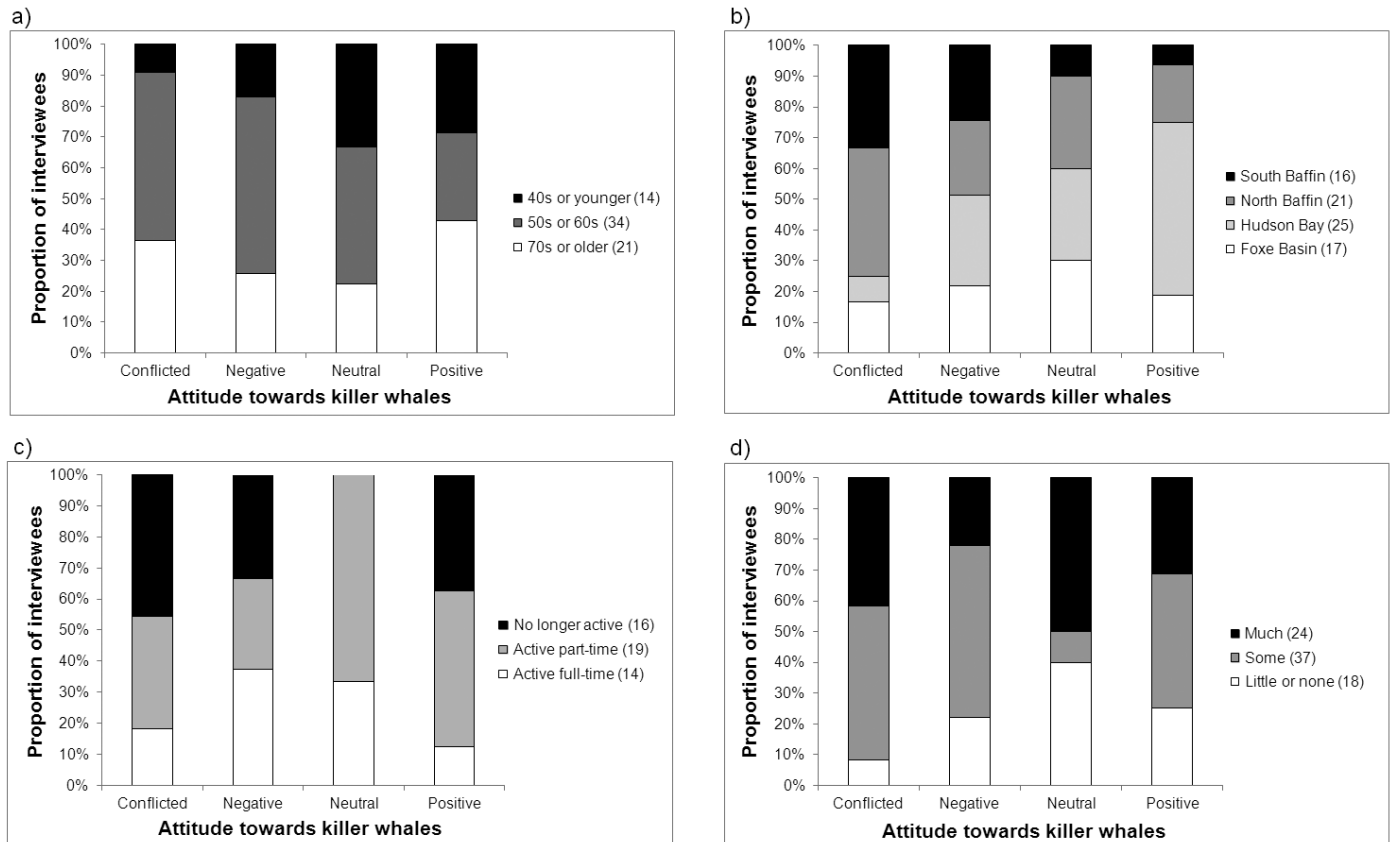


FIG. 2. Patterns in attitude examined by a) interviewee age, b) region, c) harvester status (full-time hunters, part-time hunters, former full-time hunters, and d) experience with killer whales.

used for fuel in their *kudluk* (oil lamp). The fat was considered very good, as it did not produce smoke and burned bright without a large flame.

### Research on Killer Whales

Six interviewees, four in Rankin Inlet and two in Pond Inlet, discussed scientific research on killer whales. Four, all from Rankin Inlet, indicated that they would like to see killer whales satellite-tagged so their movements could be tracked (e.g., Matthews et al., 2011). One also noted that increasing killer whale predation was causing a decline in the beluga population and wanted Fisheries and Oceans Canada to allow some form of predator control. A Pond Inlet interviewee noted that Inuit were starting to pay more attention to sightings of killer whales and other marine mammals, and he thought that having a baseline of sightings was a good idea. Another recounted seeing killer whales while his father was working with marine mammal biologists (Ford et al., 1986; Ford, 2002).

### Effects on Other Species

Five interviewees (two in Igloolik, one each in Arctic Bay, Pangnirtung, and Pond Inlet) noted that killer whales drive or scare the other marine mammals away. Eight hunters from Foxe Basin (six in Igloolik, two in Hall Beach)

suggested that killer whale predation was not extensive enough to cause prey species declines (four general statements, four specific to bowhead whales). Conversely, six other Foxe Basin interviewees (five from Igloolik) suggested that killer whale predation was causing declines in the numbers of bowhead ( $n = 4$ ), narwhal ( $n = 1$ ), and beluga ( $n = 1$ ). An Arviat interviewee maintained that killer whales were reducing the populations of belugas and seals. One additional Foxe Basin interviewee indicated he was unsure whether killer whales were causing reductions in prey numbers, and another hypothesized that bowhead numbers might be declining because of predation.

Eleven interviewees in four communities (four in Igloolik, one in Pond Inlet, three in Rankin Inlet, and three in Repulse Bay) discussed killer whale wastage of prey (beluga, 4; bowhead, 3; narwhal, 1). Eight noted that killer whales sometimes kill for fun, kill without eating, or play with wildlife. One of these eight noted observing two killer whales in 2008 throwing a ringed seal that was still alive around in the air before consuming it. Three interviewees described wastage in a positive manner because Inuit get products from whales killed by killer whales but not completely eaten, while five comments were decidedly negative. Three interviewees also noted that killer whales appear to prefer meat to blubber, as floating blubber is often seen in large square pieces (and sometimes collected for human use) (Ferguson et al., 2012b).



### *Hunting Events – Inuit Hunting Killer Whales*

Killer whales have occasionally been killed by Canadian Inuit since the 1950s (summarized in Reeves and Mitchell, 1988), and three of these events were mentioned by interviewees (31 interviewees in total, with some reporting two of the three events). Nine mentioned a Foxe Basin ice entrapment that occurred in December 1956 (Blackadar, 1964; Higdon, 2007), and two of these also reported the killing of a male by Baker Lake residents in 1978 (Kayuryuk and Innakatsik, 1982). Seventeen hunters, including one who also mentioned Baker Lake, discussed the Pangiirtung killing of 14 killer whales in Cumberland Sound in 1977 (Reeves and Mitchell, 1988). Five additional interviewees reported the event at Baker Lake, making a total of eight reports of this event. Most of the interviewees who reported the killing in Cumberland Sound were from Pangiirtung ( $n = 10$ ), with others from (or currently residing in) Qikiqtarjuaq ( $n = 3$ ) and Arviat, Igloodik, Kimmirut, and Pond Inlet ( $n = 1$  each). Of the eight interviewees who mentioned the kill in Baker Lake, four were from Igloodik, two from Rankin Inlet, and one each from Qikiqtarjuaq and Repulse Bay. The Foxe Basin event was reported by six elders in Igloodik, two in Hall Beach, and an elder currently residing in Pond Inlet, who was present during the event as a child.

Interviewees did not provide any information on additional, previously unknown hunting events, but some gave accounts of shots taken at killer whales. One interviewee from Iqaluit told of someone shooting a killer whale in the dorsal fin out of fear in the local area around 2004. A killer whale reportedly washed up a few days later, but it is not known if it was the same animal. Shooting of killer whales was also noted by interviewees in Kimmirut, Pangiirtung, and Arviat, and one elder reported shooting a killer whale himself with a rifle. One interviewee in Rankin Inlet also fired a gun off in the presence of killer whales, but only to scare them away.

## DISCUSSION

The majority of interviewees had a negative opinion of killer whales. We did not find that opinion was related to age, sex, hunter status, or experience with killer whales. The experience score measured first-hand experience only and did not address the amount of information gathered through oral history. Many interviewees, for example, noted that their parents were afraid of killer whales and had told them so. We did find, however, that attitude could be broadly linked to region. Could this fact be related to oral history and attitudes and experience passed down about killer whales? With predicted changes in Arctic sea ice, unknown responses of marine mammals to environmental change, and potential for increases of killer whales in the eastern Canadian Arctic, it is likely that conflict between killer whales and humans may escalate in the future.

Potential wildlife management conflicts relate to the Inuit subsistence harvest of key species preferred by both killer whales and humans, mainly bowhead, beluga, and narwhal.

In other regions of Canada, reductions in human harvests of targeted species have resulted in calls for culls of predator species. Two examples are the proposed cull of the Atlantic grey seal to assist in the recovery of the cod population (Swain and Sinclair, 2000; O'Boyle and Sinclair, 2012) and the Yukon debate over the cull of wolves to protect ungulate populations for hunters and trappers (Musiani and Paquet, 2004). This study points to the importance of the perceived increase in killer whale populations (Higdon et al., 2011), and the perceived competition between killer whales and Inuit for resources in the changing Arctic environment, which could lead Inuit to call for a killer whale cull.

Killer whales have been hunted in Canada on several occasions, in unique situations, though none more recent than the late 1970s (see Reeves and Mitchell, 1988; Higdon, 2007). Interviewees described three hunting events between the 1950s and 1970s, and in all cases, the whales were trapped in ice or a saltwater lake. Inuit oral history indicates that killer whales are dangerous to kayaks and other small boats (Brody, 1976; Aqatsiaq, 1996; Kappianaq, 2000), and the animals themselves were feared (e.g., Qipanniq, 1991). They are the only Arctic marine mammal not hunted in the open sea, but they could be hunted when frozen in or trapped (Irnigaut, 1990; Aqatsiaq, 1996). In older times, hunters would typically head to shore when killer whales were sighted, and they could also imitate walruses, which are feared by killer whales, to drive the whales away (Brody, 1976; Qipanniq, 1991; Higdon, 2007).

Historically, killer whales have been disliked and feared in some areas as large predators that competed for resources (Ford et al., 2000; NFMS, 2008). For example, in a 1954 article about large numbers of killer whales off the coast of Iceland causing problems for the fishing industry, *Time* magazine referred to killer whales as "savage sea cannibals" (Anon., 1954). Prior to the early 1980s, killer whales were hunted in large numbers by Norway, Greenland, and Russia (Heide-Jørgensen, 1988; Ford et al., 2000). The United States and Canada also used lethal control measures to protect resources in the 1950s and 1960s (Hoyt, 1990; Ford et al., 2000). Killer whales are currently harvested in smaller numbers in Japan, Indonesia, and Greenland (Reeves et al., 2003), although some reports suggest that harvest levels have increased in recent years in Greenland (Higdon, 2007). Intentional shooting may also occur in locations where killer whales are interacting with fishermen and longline fishing operations. Depredation on longlines by killer whales, though relatively new, is occurring in many regions around the globe (Taylor et al., 2011). In addition to the killing of whales by fishermen in retaliation, this depredation has caused requests for management measures such as culls (Reeves et al., 2003).

Global attitudes towards killer whales, however, are different today than in the 1950s. The change began with the introduction of the species to aquariums in the late 1960s.

Killer whales began to be viewed as smart, inquisitive, and interesting, and by 1980, the first killer whale watching operation was running on the west coast of Canada (Ford et al., 2000). Worldwide, attitudes towards killer whales have varied by region and over time: these whales have been viewed as a threat, as competitors for resources, and more recently, as a tourist attraction. Information gathered suggests that attitudes and perceptions of Inuit with respect to killer whales are also not static and vary within and across communities in the Eastern Arctic. Changes in numbers and distribution of killer whales could affect attitudes in the future. Inuit attitudes toward and perceptions of killer whales and the relationship between killer whales and other species that are part of the subsistence harvest will continue to play a role in conservation and co-management of the marine ecosystem.

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#### APPENDIX 1

We thank the following people for sharing their knowledge with us and facilitating the research (communities and interviewees are in alphabetical order):

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- Arviat:** L. Angalik Sr., J. Kaludjak, P. Kaludjak, J. Karetak, and Rev. J. Muckpah (interviewees); Frank Nutarasungnik (interpreter), Arviat HTO
- Hall Beach:** A. Allianaq, S. Arnardjuak, D. Iqittuq, D. Issigaitok, S. Kaernerik, P. Pikuyak, and R. Siakuluk (interviewees); L. Ningmalik (interpreter); Hall Beach HTA
- Igloodik:** S. Allurut, S. Ammaq, A. Arnatsiaq, M. Arnatsiaq, E. Ipkarnak, D. Inrgaut, H. Ittuksarjuat, A. Ivalu, J. Kopak, E. Kunuk, L. Makkik, C. Piugattuk, S. Qammanirq, A. Qrunnut, A. Ulayuruluk, and L. Uttak (interviewees); J. Kopak (interpreter); Igloodik HTA
- Iqaluit:** I. Adamie, J. Adamie, C. Erkidguk, I. Inookee, A. Inookie, J. Kownirk, and A. Sata (interviewees); Adamie Inookie (interpreter); Amarak HTO
- Kimmirut:** S. Akavak, T. Akavak, S. Aqqik, E. Padluq, and Q. Pudlat (interviewees); S. Aqqik (interpreter); Mayukalik HTA
- Pangnirtung:** M. Batty, J. Keakee, S. Keenainak, O. Kilabuk, P. Kilabuk, M. Kisa, E. Nashalik, P. Nauyuk, M. Noah, P. Quappik, and D. Veevee (interviewees); L. Kanayuk (interpreter); Pangnirtung HTA
- Pond Inlet:** P. Enoogak, L. Kadloo, P. Komangapik, T. Maktar, J. Muckpa, C. Nutorak, E. Panipakoocho, and J. Simonee (interviewees); T. Arnakallak and R. Soucie (interpreters); Mittimatalik HTA
- Qikiqtarjuaq:** L. Alikatuktuk, J. Alookie, J. Keyooktak, I. Kokseak, J. Newkingngak, T. Newkingnak, A. Kooneeliusie, and L. Nutaralak (interviewees); H. Olookie (interpreter); Nattivak HTA
- Rankin Inlet:** M. Innuksuk, P. Ipkorneak, H. Ittinuar, O. Ittinuar, J. Kabvitok, F. Kaput, N. Makayak, M. Tarpanti, J. Tattuinee, and R. Tatty (interviewees); Norman Ford (interpreter); Kangiqliniq HTA

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