



# Aerial Survey of Muskoxen (*Ovibos moschatus*) and Peary Caribou (*Rangifer tarandus pearyi*) on Banks Island, July and August 2019

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## ABSTRACT

A survey of Banks Island was conducted for Muskoxen (*Ovibos moschatus*) and Peary caribou (*Rangifer tarandus pearyi*) between July 24th and August 20th, 2019. Survey was conducted with two fixed-winged air craft at an average elevation of 120 m above ground and an average speed of 160 km/hr. Planned survey lines were spaced 5 km apart and a distance of 500 m on either side of the aircraft was used as “on-transect.” Due to weather and logistical issues the ground coverage was reduced from the planned 20% to 17.1%.

The survey resulted in an adult muskox population estimate of  $10,979 \pm 1,448$  (95%CI) on Banks Island. This estimate is significantly lower ( $t=2.267$ ,  $P<0.05$ ,  $df=94$ ) than the  $13,767 \pm 1,938$  estimate from 2014 with an annual rate of decline of 4.4% between the 2014 and 2019 surveys.

The adult Peary caribou population was estimated at  $1,913 \pm 406$  (95%CI) on Banks Island. This population estimate is not significantly different ( $t=2.491$ ,  $P>0.05$ ,  $df=24$ ) from the 2014 estimate of  $2,234 \pm 830$ . However, the average yearly rate of decline was 3.1% between the 2014 and 2019 point estimates.

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## INTRODUCTION

Muskoxen (*Ovibos moschatus*) and Peary caribou (*Rangifer tarandus pearyi*) are important to Canadian arctic communities as a traditional food source and are the iconic large mammal species in the region. Peary caribou were assessed by the Committee on the Status of Endangered Species of Wildlife in Canada (COSEWIC) as Endangered in Canada in May 2004 and legally listed as Endangered under the Federal *Species at Risk Act* in February 2011. Peary caribou were reassessed by COSEWIC as Threatened in 2015, however, are still legally listed as Endangered. Peary caribou were also assessed and listed under the *Species at Risk (NWT) Act* as Threatened in 2013.

This report summarizes a survey planned to determine the current population abundance estimates and trends of muskox and Peary caribou on Banks Island. The last Banks Island population survey of muskoxen and Peary caribou was in 2014 (Davison et al. 2017). The last survey showed that caribou were stable and muskox was declining. This survey was conducted to determine if those trends have continued.

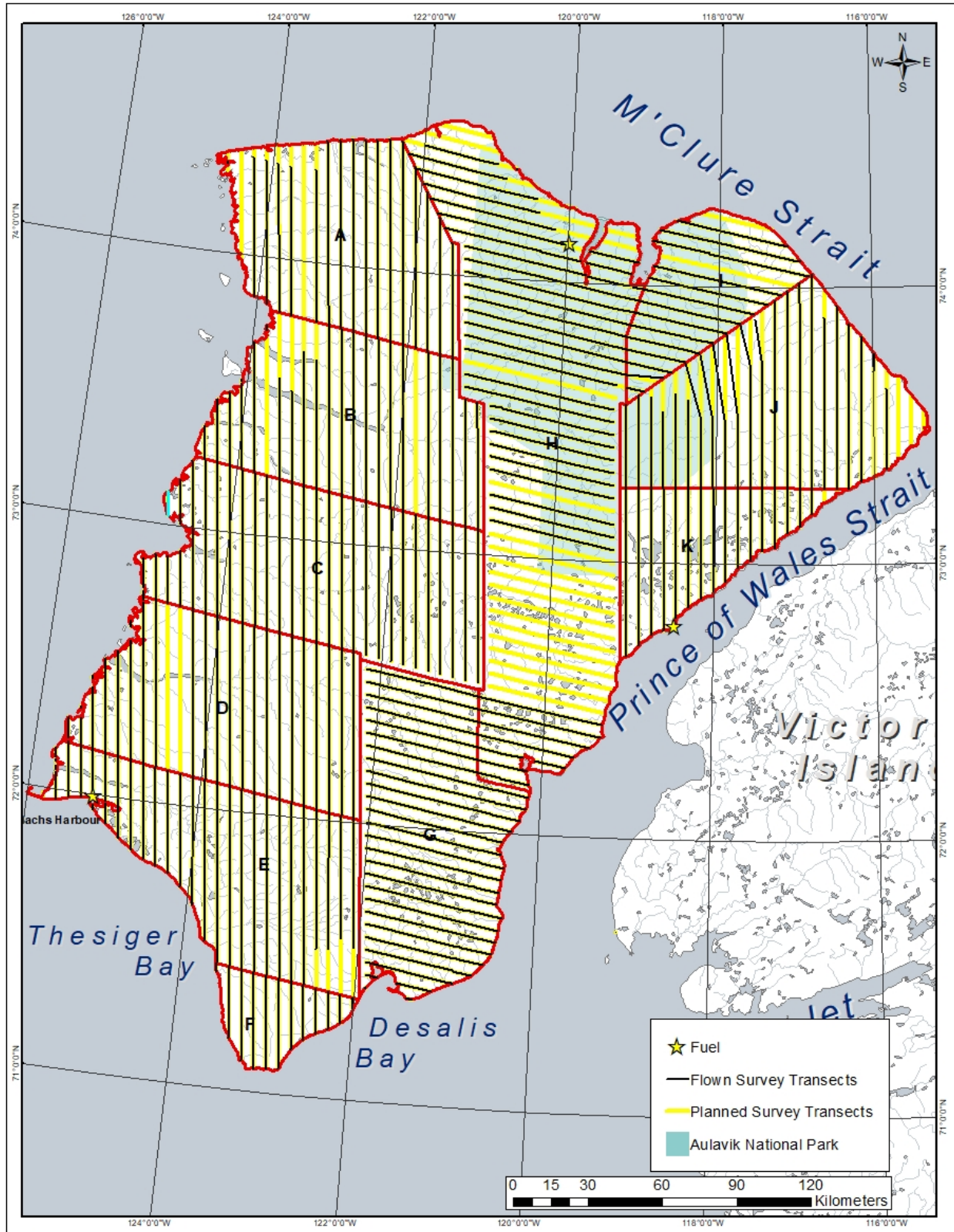
## METHODS

The survey area was broken into eleven strata, as previous surveys were (Figure 1). Survey lines were spaced 5 km apart, for planned survey coverage of 20%. The survey was flown with two fixed-wing aircrafts, a Cessna 185 based out of Polar Bear Cabin on the north end of the island and a Cessna 206 based out of the community of Sachs Harbour on the south end of the island. Each survey crew consisted of a pilot, front right-seat recorder/navigator, and two community observers seated in the back on either side of the aircraft. Peary caribou and muskoxen within a 500 m strip on each side of the aircraft were considered “on transect.” The strip width was marked by flying at survey altitude over an object measured at 500 m away on the ground and marking the aircraft windows. Observations beyond the 500 m markers were considered “off transect.” The survey was flown at an average altitude of 120 m above ground level and an average speed of 160 km/hour.

Flight lines were saved as GPS track logs and all large mammal observations, on and off transect, were marked and saved to GPS by the recorder/navigator. Muskoxen observed were classified as adults or calves. Caribou observed were classified as mature bulls, cows/young bulls, or calves. Larger groups of muskoxen or Peary caribou on transect were circled and photos taken with a small digital camera to be reviewed for an accurate count and classification.

Population estimates for adult Peary caribou and muskoxen were calculated using a ratio method for unequal-sized units sampled without replacement (Krebs 1999, Ecological Methodology, Version 7.0). Population estimates were only calculated for the adults (1+ years of age) because of the high variability of yearly productivity and higher mortality rate of animals in their first year. The adults-only population estimation is consistent with previous population estimates allowing trend determinations.

A two-tailed t-test was used to determine if the population estimates were significantly different than the 2015 estimates (Gasaway et al. 1986). Yearly growth rate ( $\lambda$ ) was calculated as  $\lambda = (N_{t2}/N_{t1})^{1/T}$  where  $N_{t1}$ =population at year one,  $N_{t2}$ =population at year two and  $T$ =number of years between population estimates. Growth rates were converted into percent change in population using the formula  $(\lambda - 1) \times 100$  (Mills 2012).



**Figure 1.** Survey strata and transects showing flown (black) and planned transects that were not flown (yellow).



## RESULTS

Survey flights were conducted between July 24<sup>th</sup> and August 20<sup>th</sup>, 2019. The survey start was delayed by weather and there were also many days when flights could not be conducted due to weather. The Cessna185 based at Polar Bear Cabin was scheduled to start surveying July 12<sup>th</sup>, with crew and survey aircraft positioning on July 11<sup>th</sup>, but weather delayed the positioning. The crew with fuel and equipment was positioned to Polar Bear Cabin by Twin Otter on July 20<sup>th</sup>, but the Cessna 185 was further delayed so the survey didn't start until July 24<sup>th</sup>. Additionally, the survey aircraft had to leave the island on August 4<sup>th</sup> due to other contracts. Due to these logistical restraints some coverage was reduced and the southern survey aircraft positioned in Sachs Harbour covered more area than initially planned. The Cessna 185 from Polar Bear Cabin was able to conduct survey flights 24-27<sup>th</sup> of July, 1<sup>st</sup>, 3<sup>rd</sup> and 4<sup>th</sup> of August. The Cessna 206 from Sachs Harbour positioned to the island on July 25<sup>th</sup> and was able to conduct survey flights 26-28<sup>th</sup> of July, 1<sup>st</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 16<sup>th</sup>, 19<sup>th</sup> and 20<sup>th</sup> of August. On the 23<sup>rd</sup> of August the survey was ended despite some coverage missing, specifically an area of strata H (Figure 1), because weather was extremely poor and not forecasted to improve.

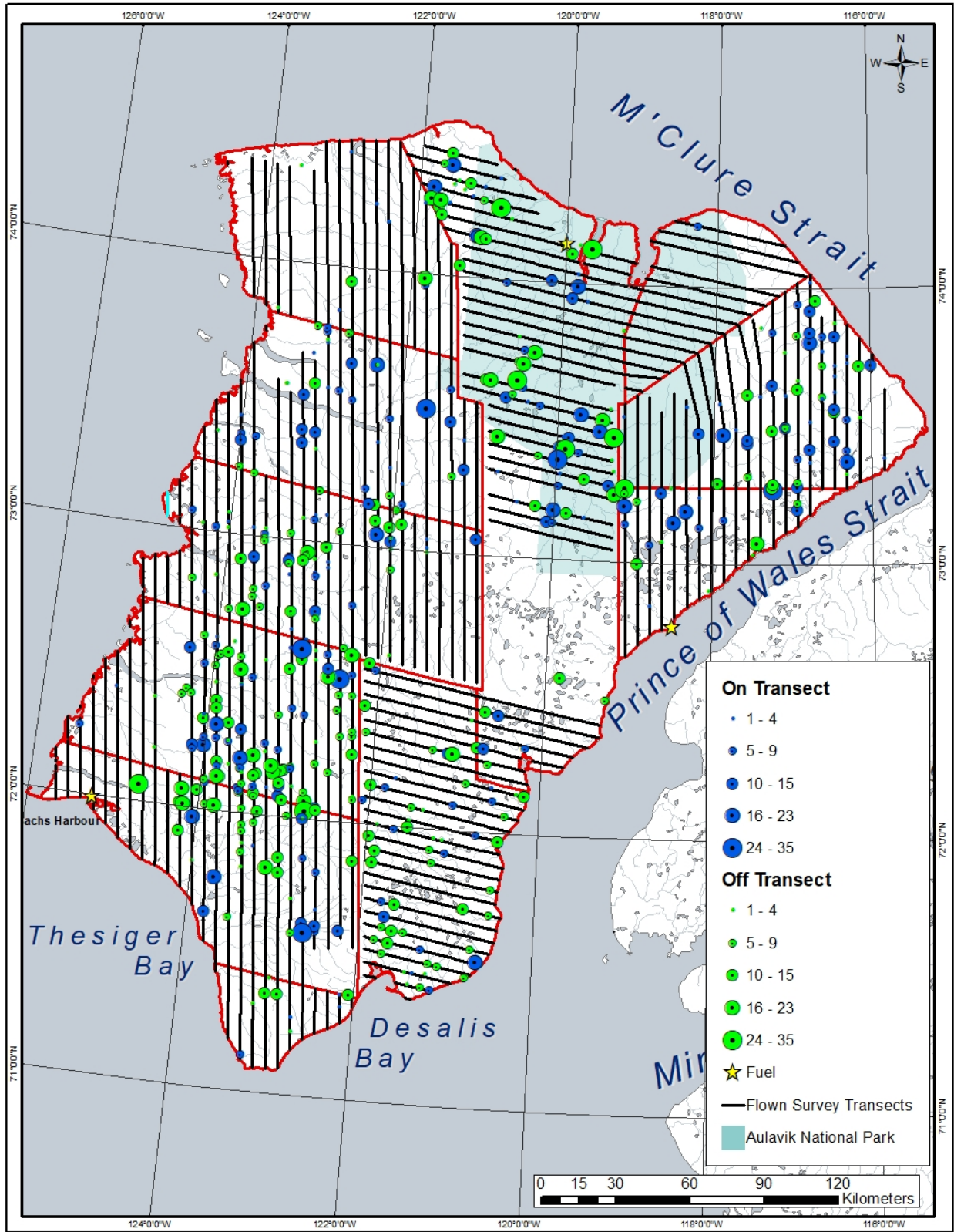
The total flight time during the survey, including ferry flights, was 107.9 hours (65.9 hours on-transect). Survey strata and transect lines flown are indicated in Figure 1. The actual survey coverage over the entire island was reduced from the planned 20% coverage to 17.1% due to weather/logistical issues, with the coverage by strata ranging from block H with lowest coverage of 12.5% to block C with coverage of 19.8% (Table 1). Some transect lines were completely dropped and other transects were partially completed or not completed due to fog or low clouds (Figure 1).

There were a total of 1,877 adult muskox (and 234 calves) seen on-transect in 233 groups of muskox with herd size ranging from 1-35 muskoxen. The average group size on transect was nine muskox. The on-transect observations resulted in a population estimate of  $10,979 \pm 1,448$  (95%CI) adult muskox on Banks Island. The annual rate of decline was 4.4% between the 2014 and 2019 surveys. Summaries of muskoxen observed by stratum are in Table 1. Location of muskox observations are indicated in Figure 2.

There were a total of 327 adult Peary caribou (and 37 calves) seen on-transect in 95 groups with group size ranging from 1-12 caribou. The average group size on transect was four caribou. The on-transect observations resulted in a population estimate of  $1,913 \pm 406$  (95%CI) adult Peary caribou on Banks Island. The average yearly rate of decline was 3.1% between the 2014 and 2019 surveys. Caribou observed by stratum are summarized in Table 2. Location of caribou observations are indicated in Figure 3.

**Table 1.** Summary of number of muskox observed on transect during the Banks Island survey 2019, and resulting population estimates by survey stratum.

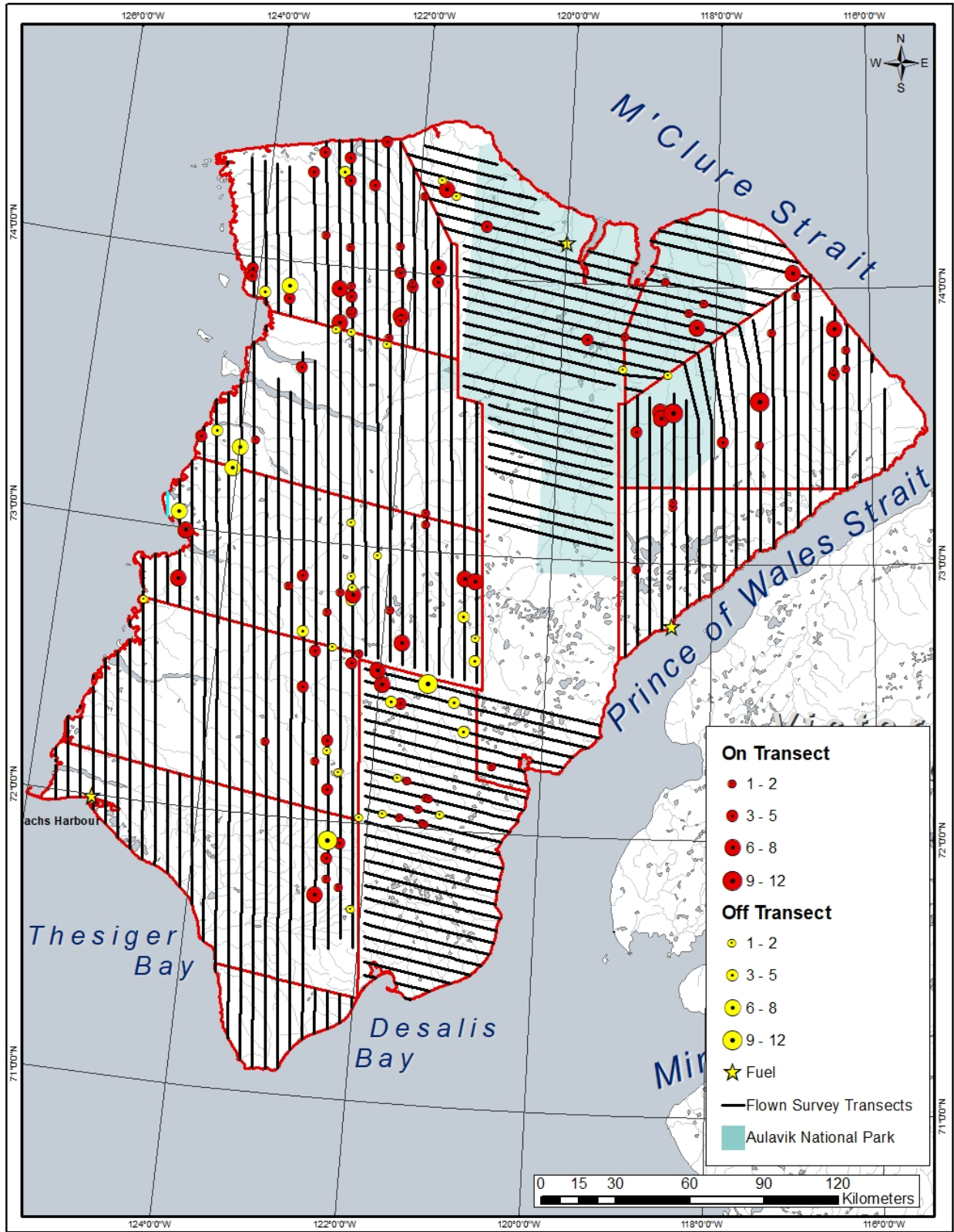
Strat	Area (Km <sup>2</sup> )	Transect sampled	Possible transects	On Transect		Off Transect		% Area Sampled	Adult Population Estimate	95% Confident Interval	Density
				Adult	Calf	Adult	Calf				
<b>A</b>	6249.1	18	96	13	1	52	4	17.37	<b>75</b>	74	0.0120
<b>B</b>	6627.1	24	114	232	34	68	4	16.85	<b>1377</b>	380	0.2078
<b>C</b>	8012.3	32	138	190	24	265	7	19.77	<b>961</b>	423	0.1199
<b>D</b>	6930.6	29	117	347	41	412	26	18.13	<b>1914</b>	482	0.2762
<b>E</b>	6605.5	33	129	168	12	186	13	18.92	<b>888</b>	443	0.1344
<b>F</b>	1405.2	12	57	9	0	47	2	19.88	<b>45</b>	55	0.0322
<b>G</b>	6768.3	28	129	128	15	304	22	19.01	<b>673</b>	261	0.0995
<b>H</b>	14759.1	46	255	368	46	515	21	12.53	<b>2936</b>	675	0.1989
<b>I</b>	3047.3	14	84	7	0	0	0	17.29	<b>40</b>	81	0.0133
<b>J</b>	6966.0	22	123	255	42	179	6	17.26	<b>1478</b>	642	0.2121
<b>K</b>	3209.3	17	92	160	19	83	5	19.59	<b>817</b>	455	0.2545
Whole Island	<b>70579.7</b>	<b>275</b>	<b>1334</b>	<b>1877</b>	<b>234</b>	<b>2111</b>	<b>110</b>	<b>17.10</b>	<b>10979</b>	<b>1448</b>	<b>0.1556</b>



**Figure 2.** Location of muskox observed on and off transect during the survey.

**Table 2.** Summary of number of Peary caribou observed on transect during the Banks Island survey 2019, and resulting population estimates by survey stratum.

Strat	Area (Km <sup>2</sup> )	Transect sampled	Possible transects	On Transect		Off Transect		% Area Sampled	Adult Population Estimate	95% Confidence Interval	Density
				Adult	Calf	Adult	Calf				
<b>A</b>	6249.1	18	96	102	18	13	0	17.37	<b>589</b>	250	0.0943
<b>B</b>	6627.1	24	114	9	0	19	0	16.85	<b>53</b>	45	0.0081
<b>C</b>	8012.3	32	138	48	9	32	2	19.77	<b>243</b>	114	0.0303
<b>D</b>	6930.6	29	117	18	0	3	0	18.13	<b>99</b>	56	0.0143
<b>E</b>	6605.5	33	129	17	1	13	0	18.92	<b>90</b>	64	0.0136
<b>F</b>	1405.2	12	57	0	0	0	0		--	--	--
<b>G</b>	6768.3	28	129	30	0	24	1	19.01	<b>158</b>	100	0.0233
<b>H</b>	14759.1	46	255	15	3	4	0	12.53	<b>120</b>	89	0.0081
<b>I</b>	3047.3	14	84	21	1	1	0	17.29	<b>121</b>	101	0.3980
<b>J</b>	6966.0	22	123	62	5	2	0	17.26	<b>359</b>	246	0.0516
<b>K</b>	3209.3	17	92	5	0	0	0	19.59	<b>26</b>	34	0.0080
Whole Island	<b>70579.7</b>	<b>275</b>	<b>1334</b>	<b>327</b>	<b>37</b>	<b>111</b>	<b>3</b>	<b>17.10</b>	<b>1913</b>	<b>406</b>	<b>0.0271</b>



**Figure 3.** Location Peary caribou observed on and off transect during the survey.



Eight wolves were observed during the survey. Other wildlife observed included Arctic hare, foxes and seals. The locations of the wolf and other mammal observations are indicated in Figure 4.

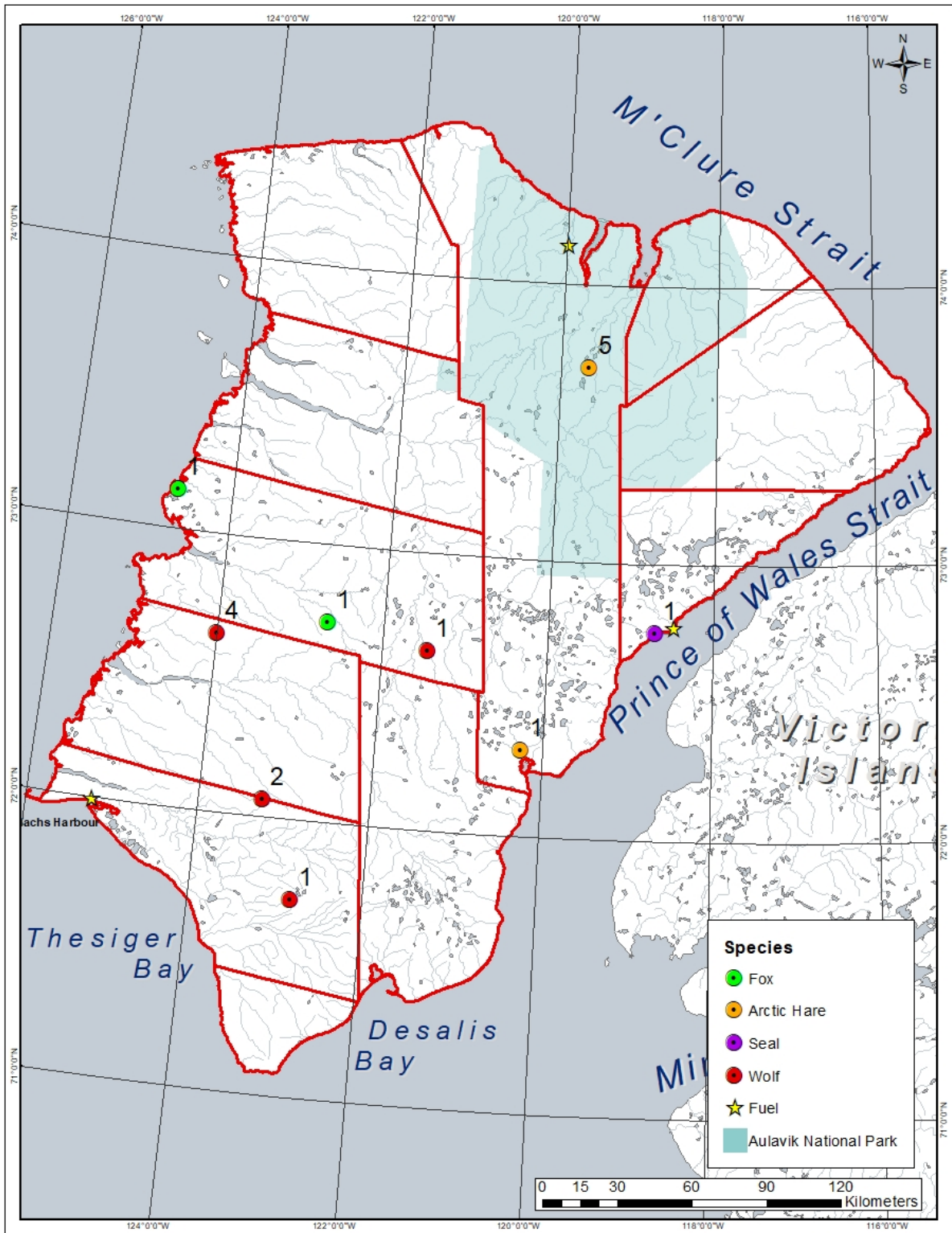
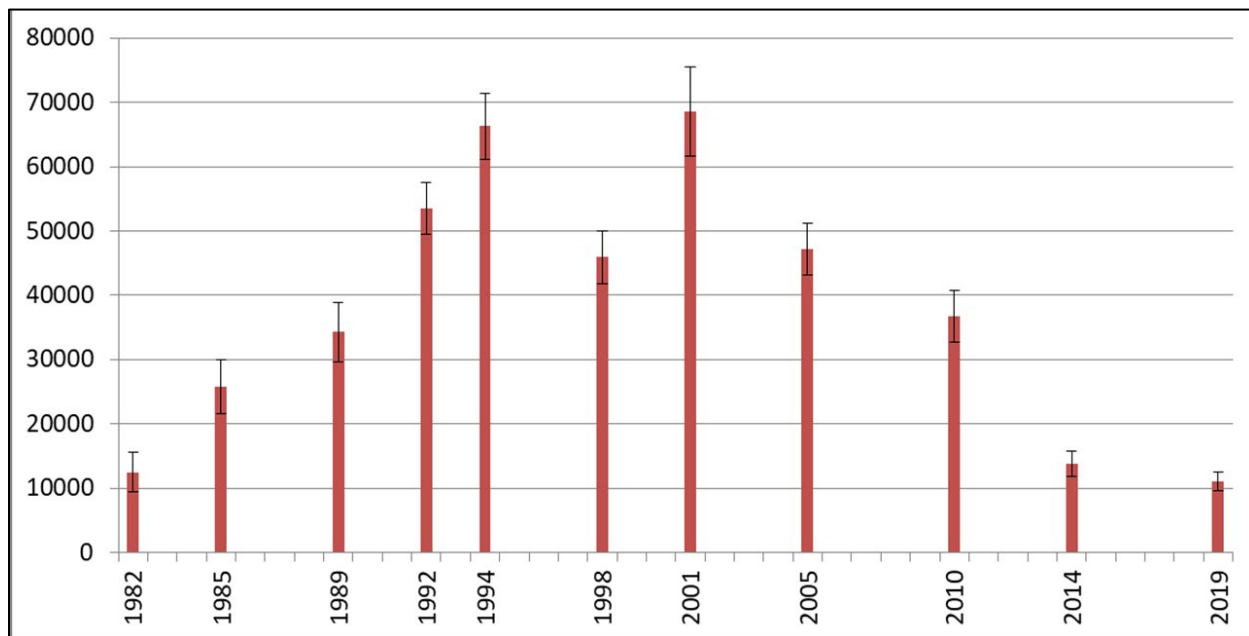


Figure 4. Location of wolves and other animals observed during the survey.

## DISCUSSION

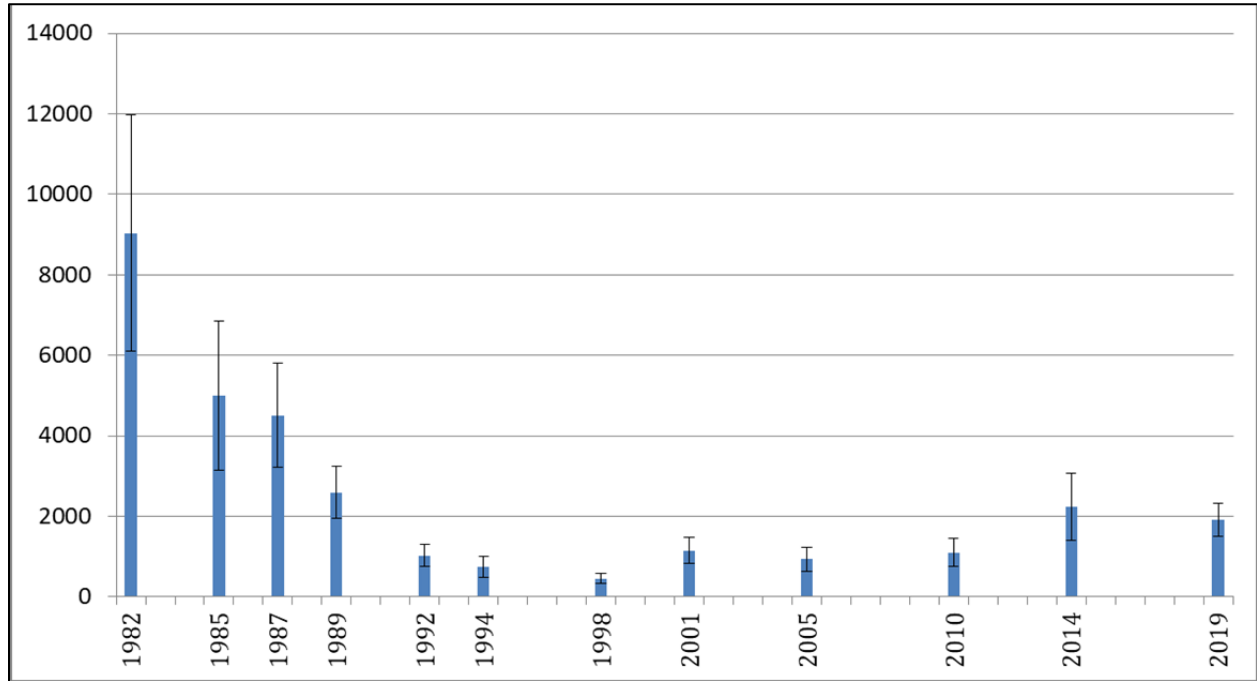
The population estimate for muskoxen on Banks Island in 2019 is significantly lower ( $t=2.267$ ,  $P<0.05$ ,  $df=94$ ) than the  $13,767\pm 1,938$  estimate from 2014 (Davison et al. 2017). The muskox population has declined since the peak in 2001 of  $68,585\pm 6,997$  (Nagy et al. 2006). The annual rate of decrease between the 2014 survey and 2019 survey was 4.4%, which is lower than seen in the past. The rate of decline between 2010 and 2014, which was linked to a die-off due to disease (Kutz et al. 2015), was 21.7% and higher than the 6.7% annual decline observed between 2001 and 2010 (Davison et al. 2017). The population estimates between 1982 and 2019 are shown in Figure 5. The proportion of all muskoxen on-transect observed that were calves (10.1%) in 2018 was similar to the percentage observed during the 2014 survey of 10.8%. The percentage of calves in the last surveys (2005-2014) tended to be lower than in earlier surveys (1982-2001), but calf percentage appears to be variable (Table 3).



**Figure 5.** Population estimates for muskox on Banks Island over time.

The population estimate for Peary caribou on Banks Island in 2019 is not significantly different ( $t=2.491$ ,  $P>0.05$ ,  $df=24$ ) than the 2014 estimate of  $2,234\pm 830$  (Davison et al. 2017). The population estimates between 1982 and 2019 are shown in Figure 6. Peary caribou on Banks Island are recovering from a low of  $451\pm 123$  adult caribou estimated in 1998. Although the results of this survey were not found to be significantly different than the 2014 population estimate, using the point estimates, the

results indicate an annual rate of decline of 3.1%. The annual growth rate of the population between the 2010 survey and the 2014 survey was 19.5%. Group sizes were smaller in 2019 survey than the 2014 survey. In 2014 the largest group seen was 75 caribou compared to 12 in this survey.



**Figure 6.** Population estimates for Peary caribou on Banks Island over time.

The proportion of caribou calves observed both on and off transect ranged from 28.8% to 16.9% between 1987 and 2014 (Table 3), with the exception of the 1994 survey, with the lowest percentage of calves where only 7.5% was recorded (Davison et al. 2017, Nagy et al. 2009a-c, 2013a, 2013b). The percentage of calves found in this survey is the second lowest recorded during a survey at 11.1%.

There were eight wolves observed in this survey, which is less than the number seen in the previous six island muskox and Peary caribou surveys. During the 1992 survey only two wolves were seen which is the last survey when fewer wolves were seen (Nagy et al. 2009a). Previous wolf observations are summarized in Table 3, however, this survey is not a wolf survey and sightings may not indicate anything about population size. This survey also had less flying time than previous island wide surveys because of the lower coverage.



**Table 3.** Survey results from 1992-2019.

Year	Dates	Muskox				Caribou				Wolves
		Adult Population Estimate	95% Confidence Interval	AAGR <sup>a</sup>	% calves	Adult Population Estimate	95% Confidence Interval	AAGR <sup>a</sup>	% calves	
2019 <sup>1</sup>	24 July - 20 August	10,979	1,448	-4.4	10.1%	1,913	406	-3.1	11.1%	8
2014 <sup>2</sup>	8-18 July	13,767	1,938	-21.7	10.8%	2,234	830	19.5	16.9%	16
2010 <sup>3</sup>	17-26 July	36,676	4,031	-4.9	%	1,097	343	3.4	%	28
2005 <sup>4</sup>	24 July-1 August	47,209	3,997	-8.9	9.5%	929	289	-5.0	19.4%	28
2001 <sup>5</sup>	7-15 July	68,585	6,972	14.3	14.6%	1,142	324	36.3	26.3%	40
1998 <sup>6</sup>	Early July	45,922	4,097	-8.8	18.7%	451	123	-11.7	18.9%	26
1994 <sup>7</sup>	Early July	66,297	5,106	11.3	10.2%	742	269	-14.6	7.5%	23
1992 <sup>8</sup>	21-30 August	53,526	4,032	16.0	17.5%	1,018	270	-26.8	28.8%	2
1989 <sup>9</sup>	22-28 July	34,266	4,623	7.5	12.7%	2,593	654	-24.1	25.5%	13
1987 <sup>10</sup>	26-30 June	--	--	--	--	4,500	1,293	-5.1	22.6	--
1985 <sup>11</sup>	6-14 July	25,700	4,222	27.2	11.8%	5,000	1,858	-17.9	15.3%	12
1982 <sup>12</sup>	2-10 July	12,482	3,047	--	--	9,038	2,928	--	--	--

<sup>a</sup> Average annual growth rate from previous survey

<sup>1</sup> This survey; <sup>2</sup> Davison et al. 2017; <sup>3</sup> Davison et. al. 2013, <sup>4</sup> Nagy et. al. 2009b; <sup>5</sup> Nagy et. al. 2006; <sup>6</sup> Nagy et al 2013b; <sup>7</sup> Nagy et al 2013a; <sup>8</sup> Nagy et al 2009a; <sup>9</sup> Mclean and Fraser 1992; <sup>10</sup> Mclean 1992; <sup>11</sup> McLean et. al. 1986; <sup>12</sup> Nagy et. al. 2009c

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