

**Reproductive success and breeding ground banding of Atlantic Population
Canada Geese in northern Québec – 2009**



Atlantic Population Canada Goose recruitment study site on Qikirtajuaq Island along Ungava Bay in northern Québec. Snow melt and nest initiation by Canada Geese were over one week later than the long-term average, which had a negative effect on production. In addition to monitoring recruitment in 2009, 2930 AP geese were captured and banded.

**A Progress Report Presented to the
Atlantic Flyway Council & Migratory Bird Technical Section**

Supported by:

**Arctic Goose Joint Venture
Atlantic Flyway Council & Migratory Bird Technical Section
CWS, USFWS, Ducks Unlimited Inc.
Makivik Corporation, Nunavik HFTA**

SUMMARY

Over three-quarters of Atlantic Population Canada Geese (*Branta canadensis interior*) breed in Nunavik, northern Québec, and in 1996 an annual recruitment study was initiated to measure reproductive effort and success. In 2009, from 9 to 15 June, a nest survey was conducted at 5 sites located along the coastal lowlands of southwestern Ungava Bay. On the Ungava Peninsula in 2009, snow melt was very late (Aliva Tulugak, Puvirnituk, and Peter May, Kuujuaq, pers. comm.) and at the time of the survey most nests were in late laying-early incubation. The mean nest initiation date (average of all 5 sites) in 2009 was 5 June, which is 12 days later than in 2008 and 7 days later than the long-term average (1996-2009). The total number of nests found and the mean clutch size for all 5 sites were 62 and 3.62, respectively; for clutch size this is over an egg smaller than in 2008 and smaller than the long-term average of 3.92. At the time of the survey, 55 of the 62 nests (i.e., 89%) found were still active. Final apparent nesting success was moderate in 2009, with 53% of all nests initiated hatching. Between 2 and 13 August, three crews captured and banded a total of 2,930 Canada Geese along the coastal lowlands of Hudson Bay and Ungava Bay. Number banded along Hudson Bay was average (2,394 geese) compared with previous years but due to inclement weather banding was extremely difficult along Ungava Bay and only 536 geese were banded in that region. The ratio of goslings to adult females with brood patches (I:BP) per catch, a good productivity index, in 2009 was below the long-term average for both Hudson Bay (2.73:1 in 2009 vs. 3.43) and Ungava Bay (2.76:1 in 2009 vs. 3.38). Combining both regions, the overall immature:adult (I:A) ratio and I:BP ratios in 2009 were also below their long-term averages (I:A: 1.09:1 in 2009 vs 1.47; I:BP: 2.73 in 2009 vs. 3.43). These results all indicate that Canada Goose productivity on the Ungava Peninsula in 2009 was poor.

INTRODUCTION

After a sharp decline in the size of the Atlantic Population of Canada Geese in the early 1990s, a recruitment study was initiated in 1996 in northern Québec to measure reproductive effort and success. The study has focused on two areas of tundra habitat known to harbour the majority of the breeding population (Malecki and Trost 1990, Harvey and Rodrigue 2009): one along the northern coast of Hudson Bay between the Inuit communities of Inukjuak and Akulivik (1996-2005) and the other along Ungava Bay between Kangiqsualujjuaq and Kangirsuk (1996-ongoing). The base of operation for work along Hudson Bay was Puvirnituaq, while for Ungava Bay the work was carried out of Kuujjuaq. Every year several sites with concentrations of nesting geese are visited, once in June to locate and mark a sample of nests and again in late July-early August to check on their fate in order to calculate nesting success.

In addition to the recruitment study, a program of breeding ground banding was initiated in 1997. Large numbers of Canada Geese have been banded in the Ungava region of northern Québec in the past: 13,069 in the 1960's and 5,662 in the late 1980's. However, only about 200 of those banded in the 1980's were banded in the Hudson Bay coastal zone which harbours over half of the entire Ungava Peninsula breeding population (Harvey and Rodrigue 2009). Thus, there have not been large numbers of geese banded in the principal breeding area in over thirty years. The present program of breeding ground banding includes both the Hudson Bay and Ungava Bay portions of the breeding range. The main objective of the banding program is to create a marked population of geese from representative portions of the breeding range for studies of adult and juvenile survival, harvest rate, timing and distribution of harvest, and population delineation.

WORK CONDUCTED IN 2009

Every year since 1996 a crew of biologists and wildlife technicians visit in early to mid-June several sites, most smaller than 1 km² in size, along Hudson Bay and Ungava Bay with the objective of locating all Canada Goose nests within each site. As of 2006, due to fiscal constraints, only sites along Ungava Bay are visited each year. For each nest found, the status (active, depredated, abandoned), stage (laying, incubating), and clutch size are recorded. In 2009, five sites along Ungava Bay were visited between 9 and 15 June. These sites, from north to south, were Tryon, Aupaluk, Qikirtajuaq Island, Dry Bay, and Big Island. These are 5 of the 6 sites generally visited each year; we flew over the site at Ragged Point but it was 40% snow covered and we saw very few geese so we decided to forego this site. All sites were revisited after hatch during the banding operations in early August. At this second visit each active nest that was found during the June visit was checked to determine if it hatched successfully or not.

We banded brood flocks of Canada Geese along the northern Hudson Bay coast (2 crews) and along the south and west coasts of Ungava Bay (1 crew) between 2 and 13 August. Helicopters (a Bell 206L Long Ranger and an ASTAR B2 in Hudson Bay and an ASTAR 350BA in Ungava Bay) were used to round up and help drive flightless geese toward funnel-shaped traps. When conditions were favourable, each crew conducted 4-6 catches per day.

RESULTS

BREEDING PHENOLOGY

For the 5 recruitment study sites, I used an egg density index [$DI = mass/(length \times width^2)$] to determine the number of days of incubation (Hughes et al. 2000). The mean nest initiation date was 4 June, which is 12 days later than last year (24 May) and 7 days later than the long-term average (1996-2009) for Ungava Bay (Table 1, Figure 1). Among these five sites, mean nest initiation ranged from 31 May to 7 June. The mean hatching date of all five sites was 3 July (Table 2).

NESTING EFFORT AND SUCCESS

Along Ungava Bay, 62 nests were found in June at the 5 sites visited in 2009. The average nest density of the five sites was 34 nests/km²; this is slightly higher than the long-term average for Ungava Bay of 30 nests/km² (Table 1). Excluding Big Island, nest density was similar among sites, ranging between 28 and 33 nests/km² (Table 2). Very few nests were being found on Big Island during the survey thus we searched a small nearby island to the northeast on which we found 7 nests. The mean apparent nest success of these sites, which includes nests that had already failed before the June visit, was 53% (Figure 2); this is slightly above the long-term average for 1996-2009 of 47%. Nesting success of the five sites revisited ranged from 27% to 100% (Table 2). Mean clutch size in 2009 was 3.62, which is over an egg smaller than in 2008 (4.71); this is the fourth smallest annual average clutch size since the study began in 1996 (Table 1).

Table 1. Productivity data for Atlantic Population Canada Geese in the Ungava Bay region, 1996-2009.

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Long-term Average
No. Sites Surveyed	1	2	3	4	4	5	6	5	3	5	6	5	4	5	4
No. Nests	16	28	61	113	80	181	185	225	59	116	126	64	75	62	99
Nest Density (n/km ²)	3.3	14.2	21.2	67.1	38.4	40.7	19.4	16.7	24.5	43.3	34.1	32.4	25.7	33.7	29.6
Mean Nest Initiation Date	1 June	24 May	22 May	25 May	30 May	21 May	10 June	18 May	8 June	25 May	21 May	12 June	24 May	4 June	29 May
Mean Clutch Size	3.89	4.36	4.16	4.07	3.73	4.27	3.19	4.30	3.04	4.37	3.99	3.20	4.71	3.62	3.92
Mean Hatching Date	30 June	24 June	21 June	24 June	29 June	20 June	9 July	18 June	7 July	25 June	20 June	11 July	24 June	3 July	27 June
% Nest Success	13	64	78	62	39	43	32	59	21	52	46	22	77	53	47

Table 2. Atlantic Population Canada Goose productivity data of the recruitment study sites surveyed in the Ungava Bay region in 2009.

Recruitment Site	No. Nests Found	Area Searched (km ²)	Nest Density (n/km ²)		Clutch Size		Nest Initiation Date		Hatching Date		Apparent Nest Success (%)	
			2009	Long-term	2009	Long-term	2009	Long-term	2009	Long-term	2009	Long-term
Tryon	15	0.45	33.3	30.8	3.82	3.87	7 June	27 May	6 July	26 June	33	49
Aupaluk	22	0.77	28.7	42.2	3.58	3.93	6 June	28 May	5 July	27 June	59	62
Qikirtajuaq Island	11	0.39	28.4	41.2	3.38	3.95	2 June	29 May	1 July	28 June	27	47
Dry Bay	3	0.10	31.0	32.6	4.33	4.08	31 May	29 May	1 July	28 June	100	59
Big Island ¹	11	0.15	47.0	27.4	3.00	3.89	6 June	29 May	5 July	28 June	45	37

¹ Four nests found on the main island and seven on a small adjacent island; nest density calculated for only the small island

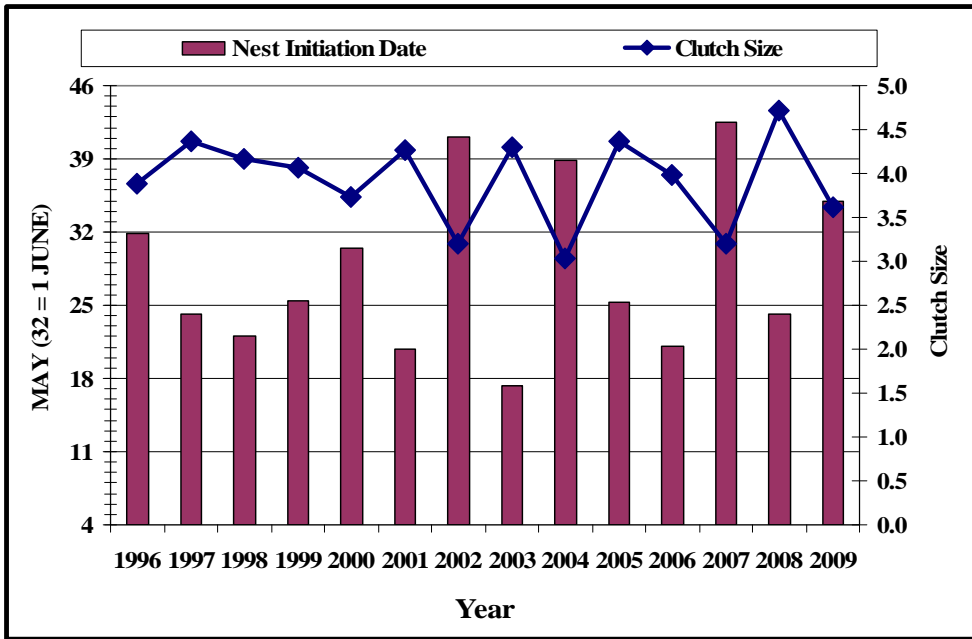


Figure 1. Annual mean nest initiation date and clutch size of AP Canada Geese in the Ungava Bay region, 1996-2009.

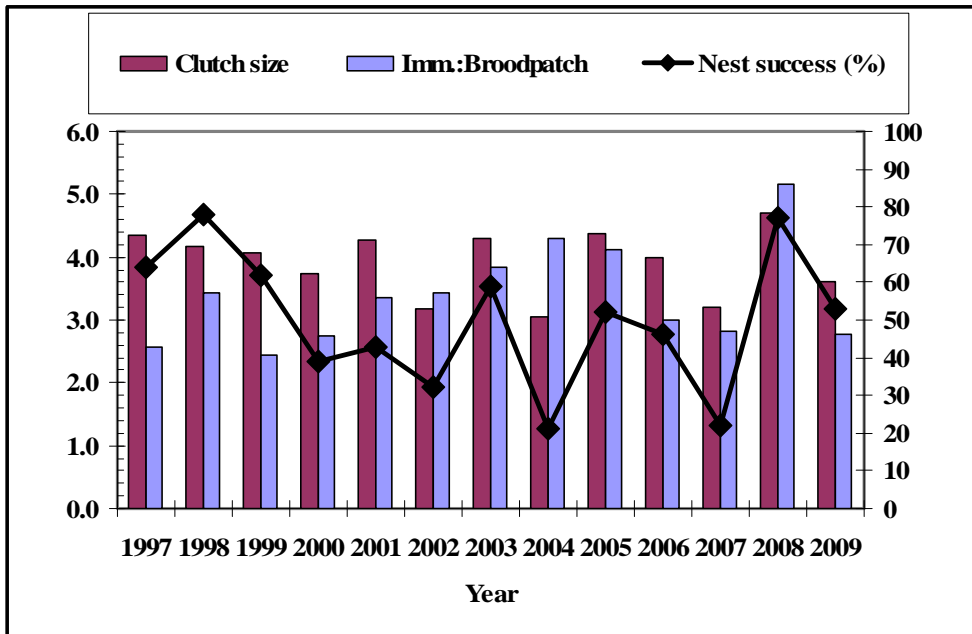


Figure 2. Comparison of annual mean clutch size and ratio of immature (goslings) to adult female with brood patch (left axis) with nesting success (right axis) of AP Canada Geese in the Ungava Bay region, 1997-2009.

BANDING

In 2009 three crews captured and banded a total of 2930 Canada Geese, 8 adult Cackling Geese (in 3 different catches), and 39 Lesser Snow Geese (22 adults and 17 goslings) on the Ungava Peninsula in northern Québec. This brings the total number of AP Canada Geese banded since the current program in northern Québec started in 1997 to 78,662 birds (Table 3).

Hudson Bay

Between 5 and 13 August 2,394 Canada Geese were banded along the Hudson Bay coast (Table 3). Of this total, 1,113 were adults and 1,281 were goslings (54% of total); the pre-season objective of a minimum of 2,000 adults was, therefore, not met. From 1998 to 2008, the total number of birds banded by two crews along Hudson Bay varied between 2,259 (2007) and 5,948 (2001). In addition to the adults that were captured and banded in 2009, there were 61 recaptures of which all but two were originally banded between 1997 and 2008 in northern Québec (the two exceptions were banded in New York [June 25, 2008] and New Hampshire [June 30, 2004]). A total of 78 catches were made by the two banding crews, with an average, including recaptures, of 31 geese (range: 3-71) per catch (Table 3). All catches contained goslings.

All catches were made in an area extending approximately 165 km along the Hudson Bay coast and extending 40 km inland. Specifically, banding sites extended from the Sorehead River (situated 30 km south of Akulivik) in the north to just south of the Mariet River (75 km north of Inukjuak) in the south.

Weather conditions were generally poor over the banding period. with intermittent rain most days. Temperatures were generally cool (maximum 12-17 °C).

Table 3. Atlantic Population Canada Geese banded in northern Québec, 1997-2009.

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
<u>HUDSON BAY</u>														
Young	793	2461	3314	1334	4103	2547	3736	1662	2022	3296	1216	2066	1281	29831
Adults	355	1360	2018	1285	1845	2011	2092	1226	1209	1675	1043	1169	1113	18401
<i>Subtotal</i>	1148	3821	5332	2619	5948	4560 ¹	5828	2888	3231	4971	2259	3235	2394	48234
Imm:Adult ^{2,3}	1.94	1.72	1.45	1.00	1.89	1.21	1.71	1.23	1.34	1.65	1.14	1.67	1.09	1.47
Imm:BP ^{3,4}	4.14	4.15	3.66	2.26	3.50	2.88	3.79	3.66	3.23	4.03	2.75	3.77	2.73	3.43
Brood size ^{3,5}	3.14	3.62	3.45	3.03	3.38	3.17	3.27	2.93	3.28	3.10	2.54	3.17	2.58	3.13
Recaptures ⁶	6	69	146	90	232	141	283	139	76	123	82	98	61	1546
Banding Dates	28/07 -9/08	29/07 -8/08	30/07 -9/08	5/08 -15/08	1/08 -11/08	7/08 -18/08	2/08 -11/08	6/08 -15/08	1/08 -11/08	31/07 -13/08	6/08 -14/08	2/08 -9/08	5/08 -13/08	28/07 -18/08
No. catches	32	63	133	80	83	110	88	68	91	96	82	67	78	1071
Mean no. geese/catch ³	36	62	41	34	74	43	69	45	36	53	29	50	31	46
<u>UNGAVA BAY</u>														
Young	1081	1332	1200	896	1568	1541	2713	766	1888	1377	918	2223	259	17762
Adults	917	675	1039	1032	943	1103	1451	928	1006	1234	1050	1011	277	12666
<i>Subtotal</i>	1998	2007	2239	1928	2511	2644	4164	1694	2894	2611	1968	3234	536	30428
Imm:Adult ^{2,3}	1.17	1.67	1.15	1.16	1.88	1.40	1.77	1.08	1.94	1.40	1.46	2.39	1.05	1.50
Imm:BP ^{3,4}	2.56	3.43	2.43	2.75	3.35	3.42	3.85	4.30	4.11	3.00	2.83	5.15	2.76	3.38
Recaptures ⁶	44	84	185	67	35	61	182	98	90	96	101	106	22	1171
Banding Dates	30/07 -5/08	26/07 -3/08	27/07 -5/08	28/07 -5/08	31/07 -10/08	30/07 -8/08	29/07 -8/08	29/07 -8/08	1/08 -11/08	27/08 -5/08	31/07 -10/08	1/08 8/08	2/08 -6/08	26/07 -11/08
No. catches	22	23	28	37	43	37	49	31	34	37	27	41	11	420
Mean no. geese/catch ³	93	91	87	54	59	73	89	58	88	73	77	81	51	75

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
TOTAL BANDED														
Young	1874	3793	4514	2230	5671	4088	6449	2428	3910	4673	2134	4289	1539	47593
Adults	1272	2035	3057	2317	2788	3114	3543	2154	2215	2909	2093	2180	1391	31067
TOTAL	3146	5828	7571	4547	8459	7204 ¹	9992	4582	6125	7582	4227	6469	2930	78662
Imm:Adult ^{2,3}	1.53	1.71	1.40	1.05	1.89	1.26	1.73	1.19	1.58	1.58	1.21	1.95	1.09	1.47
± SE	0.13	0.08	0.04	0.05	0.09	0.04	0.07	0.05	0.08	0.06	0.06	0.13	0.04	0.83
Imm:BP ^{3,4}	3.28	3.96	3.44	2.69	3.44	3.02	3.81	3.86	3.57	3.74	2.77	4.31	2.73	3.43
± SE	0.28	0.21	0.17	0.22	0.22	0.13	0.17	0.32	0.19	0.17	0.12	0.26	0.10	0.14

¹ Includes 2 whose age were not recorded.

² Immature (gosling) to adult ratio at time of banding drive (capture), including birds not banded.

³ In the "Total" column, the average across years is presented.

⁴ Immature (gosling) to adult female with brood patch ratio.

⁵ Size of individual broods observed from helicopter during searches for brood flocks for banding.

⁶ Includes birds fitted with a new band (ie, old band replaced).

Ungava Bay

Between 2 and 6 August 2009, 536 Canada Geese were banded in the Ungava Bay region of northern Québec, of which 259 were goslings (48% of total) and 277 were adults (Table 3). Each year the pre-season banding objectives are 1,000 individuals for each age cohort. This year marked the lowest number of banded birds from the Ungava Bay region. Abnormally cold and wet weather seriously impeded our banding program; we were able to band on 4 partial days only whereas we had scheduled for 8 full days (as in previous years). Total bandings prior to this year have ranged from 1,694 (2004) to 4,164 (2003) birds. An additional 22 previously banded adults were captured, of which all were originally banded between 1997 and 2008 in northern Québec. Only 11 catches were made (compared with 41 in 2008), for a mean of 51 geese (new and recaptures) trapped per catch (range: 25-87 geese) (Table 3). All captured flocks contained goslings, and few non-breeding geese were captured.

All work was done by helicopter out of Kuujjuaq. All catches were made between the LeFroy River (between Aupaluk and Kangirsuk) and Big Island, but mainly in the Aupaluk area. We flew north of Lefroy River to Virgin Lake (north of Kangirsuk) but we did not observe any brood flocks. As expected, plumage characteristics suggested that goslings hatched very late; most goslings were class 2A (19-27 days) and some were class 1C (14-18 days). We observed what appeared to be more flying adults than in previous years, which suggests that these adults molted early and were nonbreeders or failed breeders.

PRODUCTIVITY

I examined the Immature:Adult (I:A) ratio in the flocks we captured to evaluate productivity. In several cases, a few birds in a flock escaped capture. When the number of escaped adults and goslings were known, they were included in the totals for the catch; otherwise, these flocks were excluded from the analysis. Flocks containing no goslings (captures and escapees; there were none in 2009) were also excluded. The mean I:A ratio at the time of banding was 1.09:1 for Hudson Bay flocks ($n=74$) and 1.05:1 for Ungava Bay flocks ($n=11$) (Table 3); the ratio was not significantly different between the two regions ($t=-0.326$, $df=83$, $P=0.75$). Although only flocks with goslings were captured, a number of non-breeding adult geese were included in most flocks. In order to correct for this potential source of bias, we differentiated between breeding and non-breeding females by the presence or absence of a brood patch (BP). By comparing the number of young to the number of BP-females (I:BP), we were able to obtain a relatively un-biased estimate of productivity at the time of banding. However to do this, all of the adult females in a flock had to be examined. Thus, flocks in which any number of adult geese escaped capture (except those able to fly which were assumed to be sub-adults or moult-migrants) were excluded. The mean I:BP ratio at Hudson Bay was 2.73:1 ($n=68$ flocks) and at Ungava Bay, 2.76:1 ($n=11$) (Table 3, Figure 2); the ratio was not significantly different between the two regions ($t=0.0996$, $df=77$, $P=0.92$). Additional observations from along the Hudson Bay coastal plain were obtained from the helicopter during flights searching for brood flocks to band between 5 and 13 August; the mean brood size from those observations was 2.58 ($n=65$), which is lower than the long-term average of 3.13 (Table 3).

BAND RETURNS

Since 1997, 78,662 adult and juvenile Canada Geese have been captured and banded on the Ungava Peninsula breeding grounds in northern Québec. Of these, as of 11 December 2009, 9322 geese, or 11.9%, (Table 4) have been shot and reported by hunters. Regular hunting seasons were closed in 1995 in known migration corridors and wintering areas of migrant AP Canada Geese. From 1997 to 1999, some geese were harvested during early (September) Resident goose seasons or during regular and late seasons in areas not thought to be frequented by wintering migrant geese. A small number of banded birds were also shot and reported by Aboriginal subsistence hunters in northern Canada. Limited regular hunting seasons were re-instated in most Atlantic Flyway jurisdictions in 1999-2000 and in all jurisdictions in 2001-2002. Recoveries of hunter-shot birds have steadily increased as regular seasons have been re-instated and hunting regulations have been liberalised. Since 2001 direct recovery rates have been relatively stable, about 4-6% and 2-6% for adults and juveniles, respectively, in the United States, and about 1-2% for both adults and juveniles in Canada (excluding aboriginal harvest; Table 4).

Table 4. Direct recoveries and direct recovery rate (%) of Canada Geese banded in northern Québec, 1997-2009¹
(recoveries as of 11 December 2009).

Year	ADULTS							JUVENILES						
	n banded	Direct Recoveries						n banded	Direct Recoveries					
		Canada		USA		Total			Canada		USA		Total	
	n	(%)	n	(%)	n	(%)		n	(%)	n	(%)	n	(%)	
1997-1998	1272	0	0.00	4	0.31	4	0.31	1874	2	0.11	6	0.32	8	0.43
1998-1999	2035	1	0.05	9	0.44	10	0.49	3793	4	0.11	18	0.47	22	0.58
1999-2000	3057	10	0.33	21	0.69	31	1.01	4514	41	0.91	29	0.64	70	1.55
2000-2001	2317	12	0.52	19	0.82	31	1.34	2230	12	0.54	15	0.67	27	1.21
2001-2002	2788	10	0.36	67	2.40	77	2.76	5671	47	0.83	194	3.42	241	4.25
2002-2003	3114	28	0.90	103	3.31	131	4.21	4088	47	1.15	126	3.08	173	4.23
2003-2004	3543	45	1.27	115	3.25	160	4.52	6449	75	1.16	114	1.77	189	2.93
2004-2005	2154	38	1.76	98	4.55	136	6.31	2428	35	1.44	133	5.48	168	6.92
2005-2006	2215	31	1.40	92	4.15	123	5.55	3910	95	2.43	231	5.91	326	8.34
2006-2007	2909	35	1.20	82	2.82	117	4.02	4673	86	1.84	232	4.96	318	6.81
2007-2008	2093	24	1.15	69	3.30	93	4.44	2134	29	1.36	88	4.12	117	5.48
2008-2009	2180	27	1.24	84	3.85	111	5.09	4289	84	1.96	243	5.67	327	7.62
2009-2010	1391	13	0.93	12	0.86	25	1.80	1539	12	0.78	10	0.65	22	1.43

¹ Table excludes native harvest from northern Québec, northern Ontario, Labrador, and Nunavut.

² Data for 2009/2010 hunting season are incomplete.

CONCLUSIONS AND PLANS FOR 2010

Our data from the recruitment study and banding program in 2009 indicate that nesting effort and production (late nest initiation and small clutches) was poor along both Hudson Bay and Ungava Bay in 2009 (Table 5).

Table 5. Summary of reproductive parameters of AP Canada Geese in northern Québec in 2009 and the long-term averages.

<i>Variable</i>	<u>Ungava Bay</u>		<u>Hudson Bay</u>		Long-term Average ¹
	2009	Long-term Average ¹	2009	1997-2005	
<u>Breeding Pair Survey</u> (Harvey and Rodrigue 2009) number of breeding pairs	176,118 ²	175,143 ²			
<u>Recruitment Study</u> (this report) nest density (n/km ²)	33.7	29.6	–	89.3	–
nest initiation date	4 June	29 May	–	29 May	–
clutch size	3.62	3.92	–	4.09	–
nesting success (%)	53	47	–	77	–
<u>Banding Program</u> (this report) immature:adult ratio	1.05	1.50	1.09	–	1.47
immature:brood patch female	2.76	3.38	2.73	–	3.43
mean no. geese per catch	51	75	31	–	46

¹ breeding pair survey: 5-year running average (ie., 2004-2008); recruitment study: 1996-2009;
banding program: 1997-2009

² fixed-winged survey estimate for the entire Ungava Peninsula

Our knowledge of this population has expanded dramatically since the work began in 1996 and in the past six field seasons we've witnessed two years of low recruitment and four years with moderate or good productivity. In addition to our studies of recruitment, we also conducted breeding ground banding over the past twelve years, including participating in a band return-rate study for AP Canada Geese in 2003-2005. The banding program has been very successful with over 78,600 AP geese banded to date. The banding operations and reproductive studies have neatly dove-tailed enabling us to reduce costs and to obtain data on productivity over a broad geographic area.

With the 2001 season, we completed the five years of intensive studies on reproductive success that were called for in the Atlantic Flyway Council's original Co-operative Research Program for Atlantic Population Canada Geese. At the end of 2001, a new five-year research and monitoring program was approved by the Atlantic Flyway Council and called for continued full funding for the intensive recruitment study for two additional years (2002/03 and 2003/04) as well as funding for the following 3 years (2004 through to the 2006 field season) for the recruitment surveys and the banding program. The recruitment and banding programs were renewed in 2007 for an additional five years by the Atlantic Flyway Council (2007-2011). In 2009 we successfully carried out the recruitment surveys as well as the banding program, and in 2010 we will repeat the recruitment surveys (visit the same sites along Ungava Bay) and continue with the banding program (three crews) along both Hudson and Ungava Bays.

ACKNOWLEDGEMENTS

Financial support was provided by the Canadian Wildlife Service (mainly through the Arctic Goose Joint Venture), the U.S. Fish and Wildlife Service, the states of the Atlantic Flyway, Ducks Unlimited Inc., and from Pennsylvania the Blue Mountain Conservation Fund, the Lancaster County Chapter-Waterfowl USA, Lehigh Valley Chapter Safari Club, and Susquehanna River Wetlands Trust. The Wildlife Management Institute facilitated financial administration. The Nunavik Hunting, Fishing and Trapping Association again showed strong support for the study. Bill Doidge of Makivik Corporation also showed strong support and provided considerable logistical help out of Kuujjuaq, as did Québec's Ministère des Ressources naturelles et de la Faune (Benoit Champoux) in Kuujjuaq and Aliva Tulugak in Puvirnituk. Special thanks to Paul Castelli (NJ) for finding volunteers to participate in the recruitment and banding operations, and to Pierre Brousseau for assisting with the recruitment and banding summaries for Ungava Bay.

Nest searches of the recruitment study sites were carried out by Richard Cotter (CWS), Paul Castelli (NJ), Michael Castelli, Sheldon May, and Makivik Corporation (Nunavik Research Centre) wildlife technicians Sandy Suppa and Peter May. At Hudson Bay, banding in 2009 was undertaken by two crews. The Coast Guard helicopter (Bell 206 Long Ranger) pilot was Serge Arsenault and the banding crew was comprised of Richard Cotter, Shirley Orichefsky, Vincent Carignan, and Stéphane Turgeon (all 4 from CWS). The Ontario Ministry of Natural Resources helicopter (A-Star B2) banding crew consisted of Doug Holtby (OMNR; pilot and recorder), Kevin Jacobs (PA), Tom Bidrowski (VA), and Benoit Audet (CWS). At Ungava Bay, the banding crew was comprised of Pierre Brousseau (CWS), Peter May (Makivik), Jim Bennett (MD), and Kate Guerena (DE), and the Nunavik Rotor's A-Star BA helicopter was piloted by Peter Duncan.

REFERENCES

- Harvey, W.F. and J. Rodrigue. 2009. A breeding pair survey of Canada Geese in northern Québec - 2009. Maryland Department of Natural Resources and Canadian Wildlife Service, Québec Region.
- Hughes, R.J., A. Reed, L. Rancourt and R. Bergeron. 2000. Breeding ecology of Canada Geese near the Laforge-1 hydroelectric reservoir in north-central Québec. Pages 99-107 in Dickson, K.M. (ed.). Towards conservation of the diversity of Canada Geese (*Branta canadensis*). Canadian Wildlife Service Occasional Paper No. 103.
- Malecki, R.A. and R.E. Trost. 1990. A breeding ground survey of Atlantic Flyway Canada Geese, *Branta canadensis*, in northern Québec. Canadian Field-Naturalist 104:575-578.

