

United States Department of the Interior



FISH AND WILDLIFE SERVICE

Division of Migratory Bird Management Branch of Assessment and Decision Support 11510 American Holly Drive Laurel, Maryland, 20708-4016

MEMORANDUM

TO: Mark Seamans

FROM: Joshua Dooley

DATE: 17 August 2023

SUBJECT: Atlantic Population Canada Goose Integrated Population Model 2024 Abundance Prediction

In fall 2020, the Atlantic Flyway Council adopted the use of an integrated population model (IPM) to inform harvest management decisions for Atlantic Population Canada geese (AP CAGO; Dooley 2019). The AP CAGO harvest strategy considers setting hunting regulations based on the IPM out-year prediction of breeding pairs. The AP CAGO IPM predicted 2024 median number of breeding pairs was 147,500 (95% CI = 105,000–199,000; Figure 1, Table 2).

Input data included in the AP CAGO IPM were provided in Table 1. Aerial surveys and banding operations were conducted in 2022 and 2023 after not being conducted in 2020 and 2021 due to the COVID-19 pandemic. The IPM predicted adult harvest probability for the 2023–24 hunting season was 0.055 (95% CI = 0.045–0.067; Figure 1, Table 2). The IPM predicted August 2023 juvenile:adult age ratio was 1.43 (95% CI = 1.16–1.71), which was greater than the observed 1997–2022 average (1.28). Average temperature during May 2023 at Kuujjuaq, Québec was 2.4°C ($\bar{x}_{1997-2022}$ = 1.5°C), and the proportion of snow/ice cover on the Ungava Peninsula on 15 June 2023 was 0.11 ($\bar{x}_{1997-2022}$ = 0.40). In last year's memo, the out-year (2023) median breeding pair prediction from the IPM was 180,500 (95% CI = 124,500–249,500), which was +57% higher than the observed 2023 aerial survey breeding pair estimate of 115,328 ± 12,221 (SE; Lefebvre et al. 2023).

LITERATURE CITED

Dooley, J. L. 2019. Atlantic Population Canada Goose Integrated Population Model. Unpubl. Report to Atlantic Flyway Technical Section. U. S. Fish and Wildlife Service, Laurel, MD. November 2019.

Lefebvre, J., F. St-Pierre, and R. Spangler. 2023. A breeding pair survey of Canada Geese in northern Québec - 2023. Canadian Wildlife Service, Québec Region. Report to the Atlantic Flyway Technical Section. July 2023.

Table 1. Input data included in the Atlantic Population Canada goose integrated population model and summarized band-recovery data, 1997–2023.

Survey abundance (in thousands)

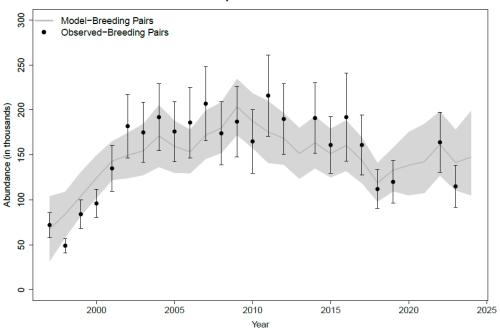
Harvest Regulations (days, bag)

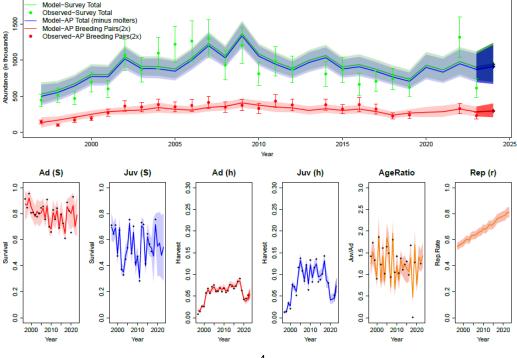
		<u>(III tilous</u>			Banding										
	Breeding Pairs To		To	tal	age ratio	Env.	Covariate	Cl	ies.	MidAt	Cana	<u>ada</u>	To	tal	
Year	Est	SE	Est	SE	Juv:Ad	MayTemp	Prop. SnowIce	đ	ь	đ	b	d	ь	d	ъ
1997	72	7	444	44	1.42	1.5	0.25	0	0	0	0	0	0	0	0
1998	49	4	513	51	1.73	2.9	0.09	0	0	0	0	0	0	0	0
1999	84	8	468	45	1.33	2.8	0.61	6	1	15	1	20	3	41	5
2000	96	8	695	71	0.90	0.8	0.83	6	1	15	1	20	3	41	5
2001	135	13	602	60	1.86	4.8	0.07	30	1	30	2	30	5	90	8
2002	182	18	1,069	108	1.23	-1.1	0.65	45	1	45	2	45	5	135	8
2003	175	17	864	87	1.61	4.7	0.18	45	1	45	2	45	5	135	8
2004	192	19	1,096	112	1.02	-0.6	0.76	45	1.5	45	3	45	5	135	9.5
2005	176	17	1,219	126	1.64	4.7	0.08	45	2	45	3	45	5	135	10
2006	186	20	1,263	141	1.49	5.3	0.26	45	2	45	3	45	5	135	10
2007	207	21	1,297	132	0.94	-1.7	0.84	45	2	45	3	45	5	135	10
2008	174	18	934	104	1.80	5.5	0.09	45	2	45	3	45	5	135	10
2009	187	20	1,203	128	1.05	-1.9	0.90	45	2	45	3	45	5	135	10
2010	165	18	811	82	1.42	1.2	0.28	45	2	45	3	60	5	150	10
2011	216	23	980	104	1.03	-1.0	0.46	45	2	45	3	60	5	150	10
2012	190	20	871	93	1.37	1.9	0.10	50	2	50	3	60	5	160	10
2013	_	_	_	_	1.11	0.8	0.28	50	2	50	3	60	5	160	10
2014	191	20	808	87	1.23	1.7	0.13	50	2	50	3	60	5	160	10
2015	161	16	864	89	1.30	1.5	0.34	50	2	50	3	60	5	160	10
2016	192	25	663	80	0.99	0.9	0.45	50	2	50	3	60	5	160	10
2017	161	17	706	73	1.67	2.1	0.18	50	2	50	3	60	5	160	10
2018	112	11	739	77	0.01	-5.1	0.99	50	2	50	3	60	5	160	10
2019	120	12	622	64	1.28	4.3	0.18	30	1	30	2	60	5	120	8
2020	_	_	_	_	_	-0.8	0.94	30	1	30	2	30	3	90	6
2021	_	_	_	_	_	3.4	0.42	30	1	30	1	30	3	90	5
2022	164	17	1,316	142	1.25	1.3	0.12	30	1	30	1	30	3	90	5
2023	115	12	612	65	_	2.4	0.11	45	2	45	3	30	3	120	8

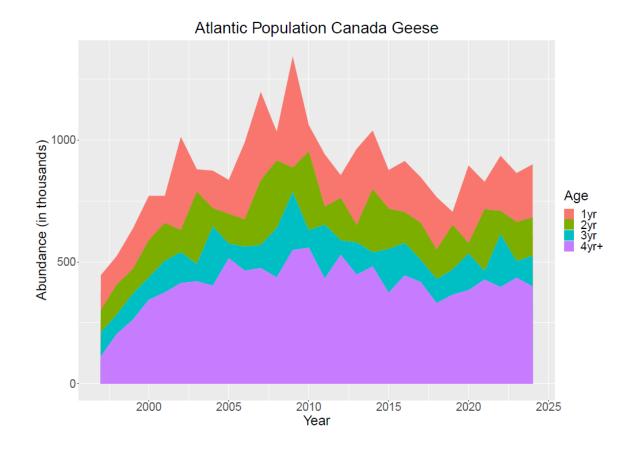
ADULT																											
Year	Bandings		1998	1999								2007		2009								2017	2018	2019	2020	2021	2022
1997	1299	6	6	14	15	28	29	16	19	17	14	7	6	8	5	1	2	0	2	0	3	1	0	0	0	0	0
1998	1981	0	17	21	25	44	47	18	33	36	11	14	9	11	14	8	6	3	1	3	0	1	0	0	0	0	0
1999	2987	0	0	43	45	97	65	60	48	40	38	18	27	19	11	8	5	6	2	5	4	2	0	1	1	0	0
2000 2001	2312 2706	0	0	0	34 0	69 79	63 83	42 72	39 61	37 56	24 37	19 24	16 28	21	13 15	9	5 10	15	3	2	3	0	2	0	0	0	0
2001	3098	0	0	0	0	79	137	98	80	67	49	35	30	33	23	18 12	19	18	14	3	4	6	1	1	0	0	0
2003	2064	0	0	0	0	0	0	71	73	57	42	32	40	23	21	13	11	9	9	5	8	2	3	2	1	1	1
2004	1119	0	0	0	0	0	0	0	55	43	25	20	26	16	26	7	7	2	8	2	5	3	0	1	ō	o	ō
2005	1127	0	0	0	0	o	0	o	0	61	34	30	28	23	18	6	12	8	6	6	5	4	4	ō	0	o	1
2006	2911	0	0	0	0	0	0	0	0	0	121	84	92	59	52	32	25	31	23	24	16	7	8	6	2	3	3
2007	2106	0	0	0	0	0	0	0	0	0	0	97	64	56	44	23	20	18	19	17	14	13	4	6	3	1	2
2008	2187	0	0	0	0	0	0	0	0	0	0	0	116	59	71	24	45	31	26	13	14	19	7	5	3	1	1
2009	1412	0	0	0	0	0	0	0	0	0	0	0	0	63	39	27	25	21	18	13	7	7	4	7	3	2	2
2010	1825	0	0	0	0	0	0	0	0	0	0	0	0	0	98	34	32	44	42	22	23	13	6	5	7	7	1
2011	1018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	36	30	25	22	10	14	13	6	4	3	2
2012	1416	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	72	49	45	25	26	25	12	10	13	3	5
2013	1720	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	104	68	54	39	31	24	19	9	6	4
2014 2015	1773 1317	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	96 0	49 72	53 50	43 40	22	27 30	14 12	9 13	11 10
2015	1928	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	112	75	60	27	24	15	26
2017	1502	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	107	45	30	27	23	20
2018	3723	o	o	0	0	ō	0	o	o	0	o	o	0	ō	ō	o	o	o	o	ō	o	0	276	163	75	58	66
2019	1332	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48	40	33	33
2020	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2022	1267	0	0	0	0	0	0	0	0	0	0	0	0	0	_	0	0	0	0	0	0	0	0	0	0	0	53
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Figure 1 and Table 2. Atlantic Population Canada goose IPM posterior estimates (median/95% CI [line/shading]) of breeding pairs (top plot), total and breeding abundance indices (with 2024 out-year prediction in darker shading), other model parameters (middle plot; ad=adult; juv=juvenile; S=survival; h=harvest rate; AgeRatio=juvenile:adult at banding; r=reporting rate), and abundance indices by age class (bottom plot). Observed data (abundance, age ratios) and estimates of survival and harvest rates from other band-recovery analyses (i.e., fitting a global model in Program MARK) were included as points (bars=95% CL).

Atlantic Population Canada Geese







		Abundance						Sur	vival			Harvest				Juv:Adult		
Year	<u>B</u>	Breeding Pairs		eding Pairs (2X)		<u>Total</u>		<u>Adult</u>		<u>luvenile</u>		<u>Adult</u>	:	<u>Juvenile</u>	Ag	e Ratio		
	median	95% CI	median	95% CI	median	95% CI	median	95% CI	median	95% CI	median	95% CI	median	95% CI	mediar	95% CI		
1997	67,500	(31,500-104,000)	135,000	(63,000-208,000)	528,000	(402,000-691,000)	0.876	(0.755-0.977)	0.698	(0.596-0.804)	0.016	(0.012-0.021)	0.013	(0.010-0.017)	1.24	(1.00-1.47)		
1998	84,000	(58,000-109,000)	168,000	(116,000-218,000)	582,000	(470,000-712,000)	0.865	(0.776-0.954)	0.650	(0.581-0.725)	0.016	(0.013-0.021)	0.014	(0.011-0.018)	1.53	(1.26-1.82)		
1999	104,000	(82,000-131,000)	208,000	(164,000-262,000)	672,000	(561,000-799,000)	0.922	(0.842-0.980)	0.693	(0.623-0.768)	0.027	(0.023-0.031)	0.033	(0.028-0.039)	1.25	(1.06-1.52)		
2000	124,500	(102,000-149,500)	249,000	(204,000-299,000)	803,000	(682,000-943,000)	0.853	(0.773-0.936)	0.489	(0.422-0.564)	0.027	(0.024-0.031)	0.027	(0.022-0.034)	0.92	(0.74-1.09)		
2001	143,000	(122,000-165,000)	286,000	(244,000-330,000)	799,000	(682,000-933,000)	0.817	(0.742-0.898)	0.694	(0.632-0.758)	0.054	(0.048-0.060)	0.076	(0.067-0.085)	1.91	(1.66-2.30)		
2002	149,500	(124,000-174,500)	299,000	(248,000-349,000)	1,046,000	(908,000-1,200,000)	0.777	(0.704-0.859)	0.374	(0.330-0.426)	0.065	(0.059-0.071)	0.070	(0.062-0.079)	0.82	(0.68-0.99)		
2003	154,500	(127,500-184,500)	309,000	(255,000-369,000)	911,000	(788,000-1,049,000)	0.820	(0.728-0.912)	0.351	(0.312-0.396)	0.058	(0.052-0.064)	0.061	(0.054-0.069)	1.43	(0.89-1.84)		
2004	171,000	(136,500-205,500)	342,000	(273,000-411,000)	910,000	(783,000-1,052,000)	0.796	(0.702-0.896)	0.476	(0.409-0.553)	0.066	(0.060-0.074)	0.102	(0.089-0.115)	0.85	(0.72-1.07)		
2005	159,500	(130,000-188,000)	319,000	(260,000-376,000)	876,000	(751,000-1,009,000)	0.808	(0.721-0.896)	0.535	(0.480-0.596)	0.072	(0.064-0.080)	0.133	(0.119-0.147)	1.85	(1.57-2.16)		
2006	153,500	(129,500-178,000)	307,000	(259,000-356,000)	1,028,000	(900,000-1,165,000)	0.844	(0.768-0.916)	0.727	(0.667-0.780)	0.063	(0.057-0.069)	0.111	(0.100-0.123)	1.65	(1.18-1.93)		
2007	172,000	(145,500-199,500)	344,000	(291,000-399,000)	1,230,000	(1,074,000-1,391,000)	0.765	(0.698-0.844)	0.490	(0.423-0.566)	0.063	(0.057-0.069)	0.087	(0.075-0.101)	0.70	(0.55-0.83)		
2008	180,000	(152,000-208,500)	360,000	(304,000-417,000)	1,060,000	(933,000-1,203,000)	0.861	(0.776-0.924)	0.658	(0.586-0.728)	0.069	(0.063-0.076)	0.122	(0.110-0.135)	1.95	(1.56-2.21)		
2009	203,500	(172,000-234,500)	407,000	(344,000-469,000)	1,365,000	(1,204,000-1,542,000)	0.709	(0.648-0.790)	0.402	(0.334-0.481)	0.065	(0.059-0.072)	0.078	(0.065-0.092)	0.67	(0.52-0.78)		
2010	187,500	(157,500-218,500)	375,000	(315,000-437,000)	1,084,000	(955,000-1,227,000)	0.682	(0.625-0.764)	0.471	(0.408 - 0.543)	0.070	(0.064-0.077)	0.122	(0.110-0.137)	1.21	(1.03-1.48)		
2011	175,500	(141,000-210,000)	351,000	(282,000-420,000)	972,000	(849,000-1,112,000)	0.811	(0.718-0.903)	0.306	(0.256-0.367)	0.061	(0.055-0.068)	0.092	(0.079-0.107)	0.87	(0.68-1.02)		
2012	168,500	(139,000-196,500)	337,000	(278,000-393,000)	887,000	(774,975-1,010,000)	0.760	(0.684-0.848)	0.708	(0.633-0.770)	0.066	(0.060-0.074)	0.115	(0.102-0.130)	1.34	(1.05-1.54)		
2013	151,500	(123,500-180,000)	303,000	(247,000-360,000)	996,000	(867,000-1,138,000)	0.831	(0.747-0.903)	0.690	(0.608-0.757)	0.077	(0.070-0.084)	0.125	(0.111-0.140)	1.15	(0.96-1.37)		
2014	163,500	(135,000-193,000)	327,000	(270,000-386,000)	1,063,000	(928,000-1,210,000)	0.690	(0.630-0.776)	0.399	(0.339-0.468)	0.076	(0.069-0.084)	0.094	(0.082-0.107)	1.24	(0.87-1.44)		
2015	151,500	(125,000-179,000)	303,000	(250,000-358,000)	906,000	(785,000-1,043,000)	0.804	(0.711-0.893)	0.626	(0.537-0.722)	0.071	(0.064-0.079)	0.097	(0.085-0.111)	1.14	(0.81-1.31)		
2016	160,500	(132,000-188,500)	321,000	(264,000-377,000)	937,000	(809,000-1,079,000)	0.722	(0.651-0.808)	0.555	(0.475-0.644)	0.075	(0.067-0.083)	0.102	(0.090-0.116)	1.06	(0.83-1.24)		
2017	144,000	(118,500-169,500)	288,000	(237,000-339,000)	873,000	(752,000-1,009,000)	0.648	(0.603-0.713)	0.536	(0.467-0.613)	0.083	(0.075-0.092)	0.132	(0.118-0.147)	1.39	(1.19-1.70)		
2018	119,000	(98,000-141,000)	238,000	(196,000-282,000)	796,000	(685,000-925,000)	0.855	(0.769-0.915)	0.474	(0.278 - 0.764)	0.085	(0.078-0.093)	0.087	(0.069-0.110)	0.47	(0.38-0.57)		
2019	133,000	(109,500-158,000)	266,000	(219,000-316,000)	736,000	(625,000-863,000)	0.824	(0.693-0.924)	0.717	(0.587-0.801)	0.062	(0.055-0.069)	0.080	(0.069-0.092)	1.69	(1.39-1.97)		
2020	138,500	(105,000-175,500)	277,000	(210,000-351,000)	929,000	(762,000-1,111,000)	0.802	(0.676-0.939)	0.550	(0.320 - 0.808)	0.043	(0.037-0.050)	0.041	(0.032-0.052)	0.75	(0.60-0.90)		
2021	142,500	(107,500-184,500)	285,000	(215,000-369,000)	863,000	(709,000-1,052,000)	0.864	(0.710-0.961)	0.575	(0.325-0.812)	0.038	(0.032-0.045)	0.043	(0.033-0.057)	1.41	(1.13-1.67)		
2022	161,500	(127,000-198,500)	323,000	(254,000-397,000)	979,000	(803,000-1,178,000)	0.700	(0.633-0.864)	0.481	(0.307-0.788)	0.046	(0.039-0.054)	0.046	(0.037-0.056)	1.29	(1.07-1.55)		
2023	141,500	(110,500-178,000)	283,000	(221,000-356,000)	901,000	(723,000-1,118,000)	0.791	(0.638-0.940)	0.543	(0.285-0.802)	0.055	(0.045-0.067)	0.074	(0.059-0.092)	1.43	(1.16-1.71)		
2024	147,500	(105,000-199,000)	295,000	(210,000-398,000)	943,000	(699,000-1,239,000)												