



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 Kuujuaq, Québec was 2.4°C ($\bar{x}_{1997-2022} = 1.5^\circ\text{C}$), 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 $115,328 \pm 12,221$ (SE; Lefebvre et al. 2023).

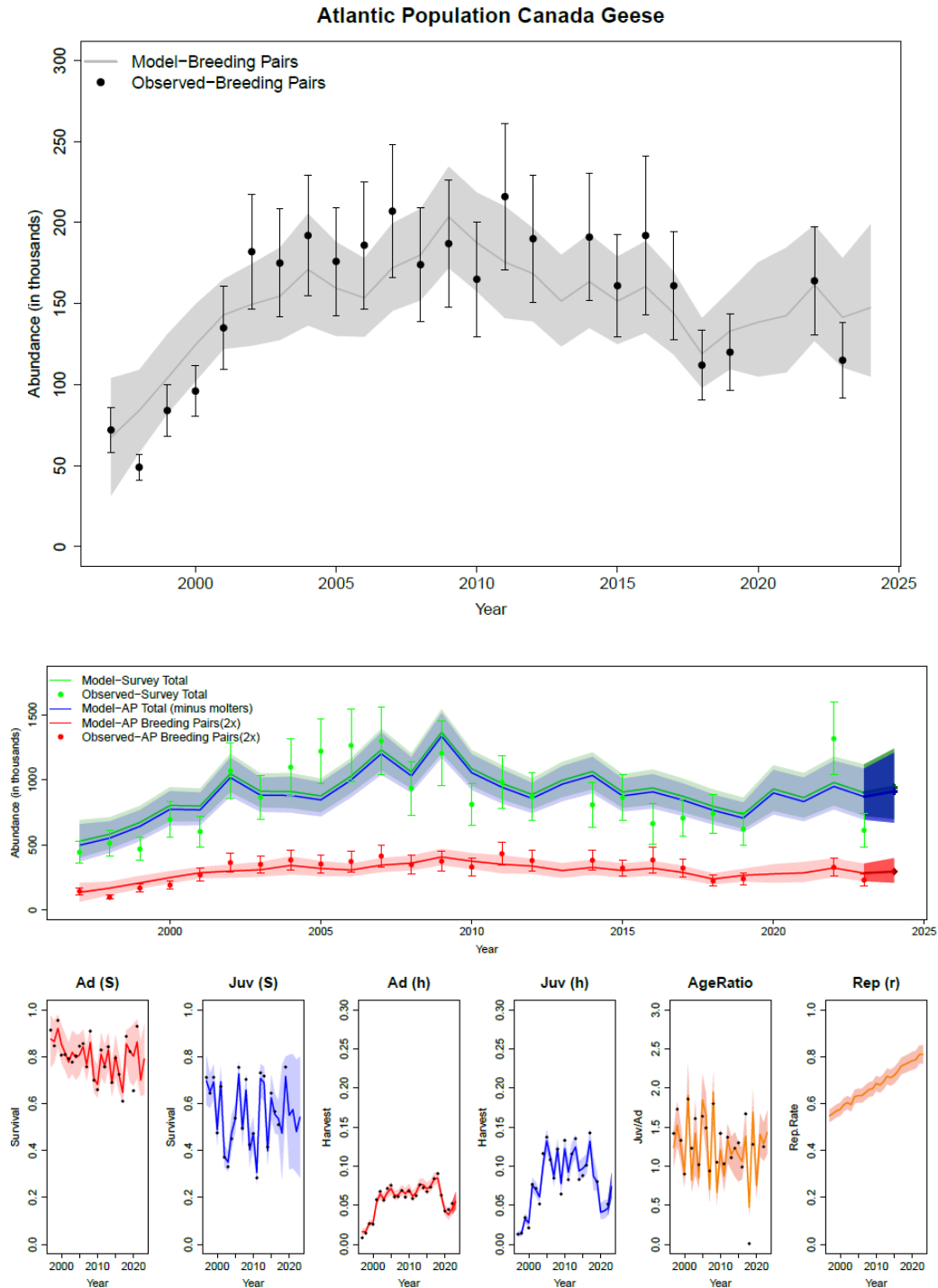
LITERATURE CITED

- 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.

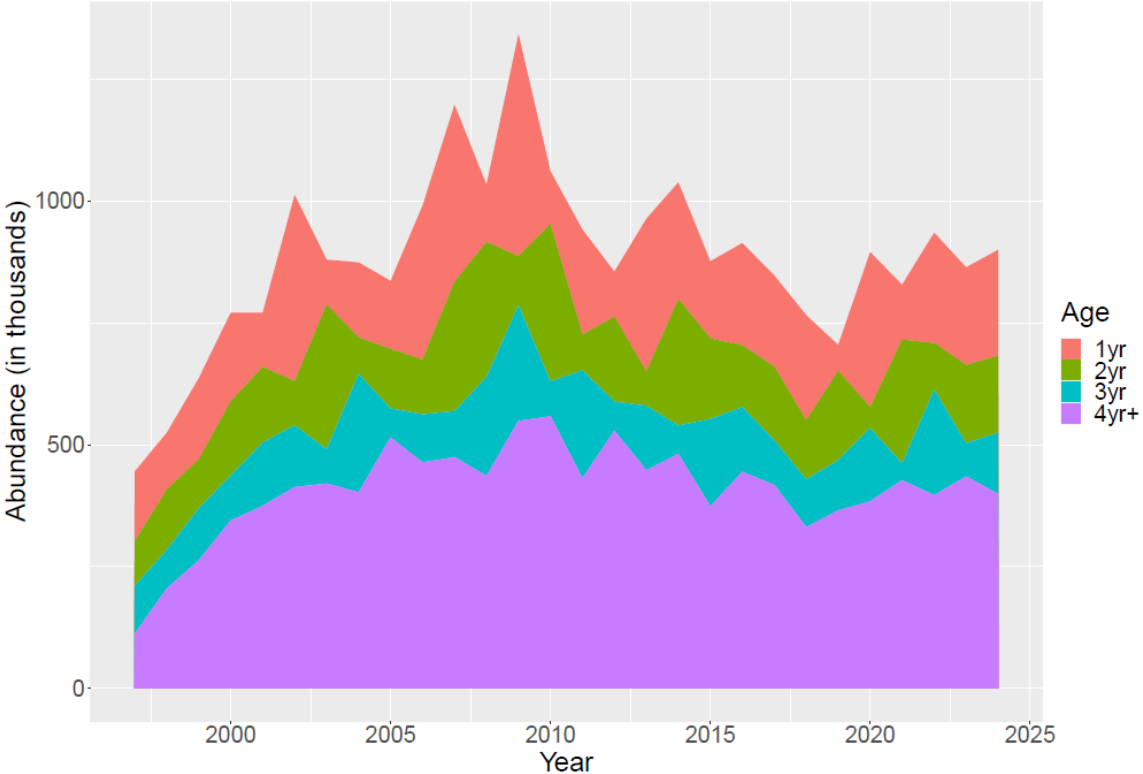
Table 1. Input data included in the Atlantic Population Canada goose integrated population model and summarized band-recovery data, 1997–2023.

Year	Survey abundance (in thousands)					Banding age ratio Juv:Ad	Env. Covariate		Harvest Regulations (days, bag)							
	Breeding Pairs		Total		MayTemp		Prop.	SnowIce	Ches.		MidAtl/NE		Canada		Total	
	Est	SE	Est	SE					d	b	d	b	d	b	d	b
1997	72	7	444	44	1.42	1.5	0.25	0	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	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	

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



Year	Abundance						Survival				Harvest				Juv:Adult	
	<u>Breeding Pairs</u>		<u>Breeding Pairs (2X)</u>		<u>Total</u>		<u>Adult</u>		<u>Juvenile</u>		<u>Adult</u>		<u>Juvenile</u>		<u>Age Ratio</u>	
	median	95% CI	median	95% CI	median	95% CI	median	95% CI	median	95% CI	median	95% CI	median	95% CI	median	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)										