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BUREAU OF WILDLIFE MANAGEMENT
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TITLE: Waterfowl Population Monitoring

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COOPERATING AGENCIES: U. S. Fish and Wildlife Service, Division of Migratory Bird Management; Cooperating Atlantic Flyway States

WORK LOCATION(S): Statewide

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ABSTRACT The objectives of this project are to monitor the status of breeding and wintering populations of waterfowl in Pennsylvania and the Atlantic Flyway (AF), and to assess the effects of harvest regulation changes on the waterfowl resource. Pennsylvania duck hunting seasons for both 2015-16 and 2016-17 were 60 days with a daily bag limit of 6 birds, similar to those offered in 2014-15, except that canvasback daily bag limit was increased from 1 to 2 in 2015-16, and eider and long-tailed duck bag limits decreased from 6 to 4 in 2016-17. The Atlantic brant daily bag limit increased from 1 to 2, and season length increased from 30 to 60 days in 2016-17. U.S. Fish and Wildlife Service (USFWS) Harvest Information Program estimated active duck and goose hunters in Pennsylvania during 2015-16 were 19,400 and 22,600, down 27% and 33% respectively from the 1999 to 2015 averages. Pennsylvania's 2015-16 total duck harvest estimate was 69,400, down 51% from average. Pennsylvania's 2015-16 estimated Canada goose harvest was 74,000, down 55% from average. Canada goose harvest timing was 29% during September and 71% during the regular season. Pennsylvania's estimated regular season snow goose harvest of 2,300 in 2015-16 was down 70% from average. In the 2017 light goose conservation season, a minimum of 1,852 snow geese were harvested in Pennsylvania. During the 2017 AF Midwinter Waterfowl Survey conducted in January, 223 tundra swans were recorded in Pennsylvania and 115,425 tundra swans (as well as 161,661 Atlantic brant) were counted in the flyway. State-level results are not comparable to previous years due to a narrower geographic and species focus; flyway-level totals for both species were well above 2007-2016 averages. In the Pennsylvania portion of the 2017 AF Breeding Waterfowl Survey, mallard pairs (47,196) were down 46% from the 1993-2016 average of 87,306. There were 62,684 wood duck breeding pairs estimated in 2017 which was 18% above the LTA 53,328. Estimates of total hooded mergansers (9,179) and common merganser (20,176)

were 37% and 6% above average respectively. The Canada goose breeding pair (99,892) and total spring population (244,908) estimates were 8% above and 7% below LTA. For the Northeastern U.S. survey area, the 2017 total population estimate for mallards (448,467) was 38% below LTA and the lowest since the survey began in 1993. American black ducks (31,176) was 48% below average. The estimates for wood ducks (396,376) was similar to LTA and Atlantic Flyway Resident Population Canada geese (933,321) was 10% below LTA. For 2016, waterfowl populations in the Eastern survey area of Canada were near average for mallards, black ducks, mergansers, and green-winged teal. Goldeneye (common and Barrow's combined) was 14% below LTA. Habitat conditions on the traditional survey area during 2016 were poorer than 2015. Breeding duck populations on the traditional survey area in the mid-continent of North America were significantly above (38%) the long-term average for 2016. Pond counts and habitat conditions in the U.S. and Canadian prairies were similar to LTA. Spring 2016 production was predicted to be slightly below average for Atlantic Population and Southern James Bay Population Canada geese; Atlantic Population breeding pair estimates have been relatively stable over the past 10 years, while Southern James Bay Population has now been merged into a larger Mississippi Flyway Interior Population for monitoring which will make long-term trend analysis difficult until additional years of data are accumulated. For greater snow geese, no significant population trend has been observed over the past 10 years and fair breeding conditions existed in 2016. An average fall flight was expected in 2016.

OBJECTIVE

To determine the status of breeding and wintering waterfowl populations in Pennsylvania and the Atlantic Flyway, and assess the effects of hunting regulation changes on the waterfowl resource.

METHODS

Hunter activity and total waterfowl harvest are estimated from the U.S. Fish and Wildlife Service (USFWS) Harvest Information Program (HIP) (Raftovich et al. 2016). The species, age, sex, geographical, and temporal distribution of the total harvest are obtained from the USFWS Parts Collection Survey (PCS). This survey samples a number of HIP-registered migratory bird hunters who record the date and location for each bird they harvest, and send in a wing from each duck and a tail fan and primary tips from each goose from which species, sex, and age are determined.

To estimate harvest and hunter participation during the 2017 light goose conservation season, hunters were required to obtain a free Snow Goose Conservation Permit either online or by mail. Along with the permit, hunters were required to possess a general hunting license, migratory game bird license and a federal duck stamp (for those 16 or older). Mandatory reporting of harvest and hunter activity was required of all hunters even if they did not hunt, and harvest reports were due within 30 days of the close of the snow goose conservation season. In an effort to boost reporting rates, which had been declining from 2009-2012, we have used e-mail reminders since 2013. In 2017, a single reminder was sent in late May to those permit holders for whom we had an e-mail address on file and who had not responded as required within the 30-day reporting period following the close of the season. Those permit holders for whom we did not have an e-

mail address in our license database (approximately 22% of permit holders in 2017) were not sent a reminder. Flyway-level conservation season data is obtained from the Snow Goose, Brant, and Swan Committee of the Atlantic Flyway Migratory Game Bird Technical Section.

Historically, data on the population size and distribution of wintering waterfowl was obtained through the Atlantic Flyway Midwinter Waterfowl Survey (MWS). Because population estimates used to set most waterfowl hunting seasons are now obtained from breeding ground surveys, the MWS has been reduced in scope to prioritize collection of data for tundra swans and Atlantic brant, the 2 species for which MWS counts are still the primary metric to inform harvest management. Although a few states still collect data for additional species, the Pennsylvania Game Commission is surveying tundra swans only, on segments where this species has historically occurred (Atlantic brant do not commonly occur in Pennsylvania).

Information on breeding population size of mallards, black ducks, wood ducks, Canada geese, and other waterfowl was obtained from the Atlantic Flyway (AF) Breeding Waterfowl Plot Survey. This survey has been conducted annually since 1989 in Pennsylvania and other AF states from Virginia to New Hampshire. Survey participants included biologists from the Game Management and Wildlife Diversity Divisions of the Bureau of Wildlife Management and Game Commission Region biologists and Wildlife Management Supervisors. A total of 346 1-km² plots were part of this survey across 6 physiographic regions (Fig. 1) of Pennsylvania using a stratified random design. Of these, 90 plots were not field checked because they did not contain habitat for breeding waterfowl. Surveys were conducted from 13 April to 5 May 2017. Breeding pair units are determined from the presence of pairs, lone drakes, and groups of drakes. Total population estimates presented for Canada geese utilize an equation initiated in 2003 that accounts for geese observed as singles, but assumed to be part of a breeding pair. These estimates averaged 8% higher each year from 2003 to 2010 than the old method of calculating total population. Breeding pair estimates show large 95% confidence intervals on the state level; the survey is designed to yield $\leq 20\%$ coefficient of variation on the mean over the entire Northeast United States region. Therefore, breeding pair trends over several years are more useful to follow than individual year estimates for Pennsylvania. Breeding population and breeding pair estimates for this year were compared with estimates from the long-term (1993-2016) averages. Additional breeding survey data for areas not covered by the AF Breeding Waterfowl Plot Survey is provided by the USFWS.

RESULTS

Hunter Activity and Harvest

Duck season length in both 2015-16 and 2016-17 was 60 days with outside framework dates of the Saturday nearest to 24 September (26 September in 2015 and 24 September in 2016) and the last Sunday in January (which due to state-level Sunday hunting closure equates to last Saturday in January for Pennsylvania: 30 January in 2016 and 28 January in 2017). Duck seasons selected for Pennsylvania in both years included split seasons in 3 of 4 zones with the first split opening in October and the second split closing between late December and mid-January; and non-split seasons opening in late October and closing in early January for the Lake Erie zone (Appendices 1 and 2). The aggregate daily duck bag limit remained at 6 birds. The daily bag limit for individual species regulations remained the same in 2015-16 and 2016-17 as in 2014-15, except canvasback daily bag limit was increased from 1 to 2 per day in 2015-16 and remained at 2 for the 2016-17 season; and eiders and long-tailed ducks decreased from 6 to 4 birds in 2016-17.

Boundaries of Pennsylvania's 3 Canada goose harvest zones (Resident Canada Goose [RP], Southern James Bay Population [SJB], and Atlantic Population [AP]) are presented in Appendices 1 and 2. An early Canada goose season (1-25 September in 2015, 1-24 September in 2016 when 25 September was a Sunday) was again held statewide in both 2015 and 2016, except for State Game Land (SGL) 214 (Pymatuning Wildlife Management Area [WMA]) in Crawford County and SGL 46, the Middle Creek WMA in Lebanon and Lancaster counties. The daily bag limit was again 8 birds, 24 in possession statewide except the SJB zone (3 per day) and the areas surrounding Pymatuning WMA and Middle Creek WMA (see Appendices 1 and 2; daily bag limit of 1 bird in these areas to limit harvest on the resident flocks at each WMA). Regular Canada goose season lengths (AP Zone - 50 days, SJB Zone - 78 days, RP Zone - 80 days), daily bag limits (AP and SJB Zones - 3, RP Zone - 5), and framework dates were the same as 2014-15 in all 3 zones for both 2015-16 and 2016-17. Atlantic Brant season length (30 days to 60) and daily bag limit (1 bird to 2) increased from the 2015-16 to the 2016-17 season.

At the time of preparation of this report, data was not yet available from the USFWS on hunter effort, total harvest, or harvest composition (species and age ratios) for the 2016-17 hunting season. For the 2015-16 season, the estimates (Roberts 2016) of active duck and goose hunters in Pennsylvania from HIP were 19,400 and 22,600 respectively and were second highest and highest, respectively in the AF (Table 1). Both estimates were slightly above those for 2014-15 but remained 27% and 33% below the 1999-2015 averages. The HIP estimate of days hunted for ducks in 2015-16 was down 35% from the long-term average (LTA) while the number of goose hunter days was down 48% from average. These trends are related to the decline in hunter numbers noted above, but the reflected fewer days hunted are also likely related to budget and time constraints identified by hunters as reasons limiting waterfowl hunting participation (Jacobs et al. 2012). The 2015-16 HIP estimate of total Pennsylvania duck harvest (69,400) was down 51% from average. Harvest Information Program Canada goose harvest estimate in Pennsylvania for 2015-16 was 74,000 and was 55% below average. Pennsylvania ranked third in the AF for total Canada goose harvest after New York and Maryland. The September season continues to account for a substantial proportion (29%) of the Canada goose harvest while the regular season (early October to late February) harvest accounted for 71% of the total. Estimated snow goose harvest during the 2015-16 regular season in Pennsylvania was 2,300 birds, 70% below average.

We issued 1,632 permits to hunters to participate in the 2017 Light Goose Conservation Season. This included 35 nonresident hunters. We received 475 reports by May 25 (29.1% initial reporting rate), and an additional 93 reports following distribution of the e-mail reminder to non-respondents for a total of 568 harvest reports (34.8% overall reporting rate).

Of the 568 reports received, 351 (61.8% of respondents or 21.5% of all permit holders, if non-respondents were assumed to be non-participants) indicated hunting during the conservation season. Their grand total retrieved harvest was 1,852 (Table 2). Total hunter days were 1,043 and the number of geese bagged per hunter day was 1.78. Data on harvest attributable to additional hunting methods of extended hours, electronic calls, and electronic decoys was not collected, as this information is no longer required by the U. S. Fish and Wildlife Service for states to participate in the conservation season. From 2009-15, electronic calls were used for approximately 34% of snow geese taken in the Pennsylvania conservation order and from 2012-15, electronic decoys

were used for approximately 27% of geese taken. Extended hunting hours had less effect, with approximately 12% of the total geese taken after sunset between 2009-15. (It should be noted that these expanded methods categories are not mutually exclusive; for example, a goose taken after sunset while using both electronic calls and electronic decoys would be recorded as harvested under all 3 methods, although only counted once in the grand total retrieved harvest).

Analyses conducted in 2013 and 2014 of the per capita hunting activity and harvests of permit holders reporting after the distribution of reminders compared to those of earlier respondents showed that assuming non-respondents to be non-participants is probably inaccurate. However, we have not attempted to introduce correction factors. Thus, the overall percentage of permit holders participating in the season is likely somewhere between the calculations of 22% based on all permit holders and the 62% based on reports actually received, and the harvest totals presented herein should be considered minimum estimates that may not be completely comparable between years. We will continue to investigate options to improve our harvest estimates and/or revise previous estimates.

At the flyway level, results for 2017 for the 7 states (Delaware, Maryland, New Jersey, New York, Pennsylvania, Vermont and Virginia) participating in the conservation season were not available at the time of preparation of this report. For the 2016 conservation season, an estimated 5,303 hunters harvested a total of 38,460 snow geese in the Atlantic Flyway; harvest was 56% lower than the 2015 estimate and 26% lower than the previous 7-year average (Snow Goose, Brant, and Swan Committee of the Atlantic Flyway Council, unpublished data). The conservation season in the U.S. has been reasonably successful in providing additional harvest of greater snow (for example, estimates of average total snow goose harvest (HIP regular season estimate plus Pennsylvania Game Commission conservation season minimum estimate) in Pennsylvania for the first 8 years with a conservation season are 56% higher than those for the 8 years prior to initiation of the conservation season). Also, the lack of a statistically significant trend in spring estimates of greater snow goose abundance over the past 10 years suggests that increased harvests may be stabilizing this overabundant population (U.S. Fish and Wildlife Service 2016).

The 6 most commonly harvested duck and merganser species in Pennsylvania were mallard, wood duck, American black duck, bufflehead, American green-winged teal and common merganser (Table 3). The 2015-16 harvests of most major duck and merganser species were below the 1999-2015 average: mallard (-58%), wood duck (-47%), American black duck (-50%), bufflehead (-13%) American green-winged teal (-56%), common merganser (-6%), hooded merganser (-16%), ring-necked duck (-30%), gadwall (-63%), mallard/black duck hybrid (-37%), lesser scaup (-81%), American wigeon (-80%) and greater scaup (-80%). The below average harvest was most likely related to the 35% lower than long-term average hunter participation (as measured by days hunted) but also the relatively mild weather conditions experienced during the fall and winter 2015-16.

The number of juveniles per adult in the 2015-16 AF harvest (Table 4) was near the 1996-2015 average for black duck (-1%) and green-wing teal (-3%), and slightly above average for mallard (+8%), and wood duck (+9%) Above average were bufflehead (+18%), common merganser (+48%), ring-necked duck (+65%), and greater scaup (+52%). Slightly below average were hooded merganser (-13%), gadwall (-10%), American wigeon (-9%), greater snow goose (-

8%), and Canada goose (-13%).

Midwinter Waterfowl Survey

Pennsylvania's reduced-scope MWS was conducted in early January at Presque Isle State Park, Pymatuning WMA, Conneaut Lake, and Middle Creek WMA. Participants recorded 223 total tundra swans. With the lack of comparability between results from 2017 and prior years, no summary tables are included with this report. As additional years of data are accumulated under the new survey design, we will resume providing summary information.

For the entire AF, 115,425 tundra swans (highest on record for this species and 22% above the previous 10-year average) and 161,661 Atlantic brant (highest since 2003 and 14% above the previous 10-year average) were recorded in the 2017 MWS (Appendix 3).

Breeding Waterfowl Surveys

Survey results from the Pennsylvania portion of the 2017 Atlantic Flyway Breeding Waterfowl Survey are presented in Tables 5 and 6. Please note that breeding pair estimates presented have large confidence intervals on the strata and state level; the survey is designed to yield $\leq 20\%$ coefficient of variation on the mean over the entire Northeast United States region. In most instances, breeding pair trends over several years are more useful to follow than individual year estimates. Table 5 summarizes complete 2017 survey results with comparison to the 1993 to 2016 long-term average (LTA) for ducks, mergansers and Canada goose pairs. The Canada goose total is averaged from 2003 to 2016 due to a methods change in recording and calculating total birds observed.

The number of mallard breeding pairs (47,196) was 46% below the LTA of 87,306 pairs (Table 5). This is consistent with other indices of statewide mallard abundance (North American Breeding Bird Survey and the number of pre-season-banded mallards). Stratum 22 in southwestern Pennsylvania had the highest density of breeding mallards (0.77 pairs/km²). American black ducks were not observed in 2017, resulting in a statewide estimate of 0 pairs. Breeding black ducks have been observed at very low densities since the survey was initiated in 1989 and there is evidence of declining statewide abundance and distribution. Numbers of black ducks banded pre-season in Pennsylvania has been declining since the mid-1990s and results from the Pennsylvania Breeding Bird Atlas have confirmed the declining occurrence of statewide breeding black ducks. There were 62,684 wood duck breeding pairs estimated in 2017, which was 18% above the LTA 53,328 pairs. Trends in wood duck abundance have indicated slightly increasing populations across all years of the survey. Wood duck densities were highest in northwestern Pennsylvania with 1.29 pairs/km². The estimate of total blue-winged teal (1,480) was 72% below average in 2017, while the American green-winged teal estimate (2,262) was 57% below average. Annual teal estimates can vary widely by weather related effects on teal migration, and teal estimates are not indicative of true breeding populations of teal in Pennsylvania as many migrating teal are encountered during the survey period. The estimate of total hooded mergansers (9,179) was 37% above average, while common mergansers (20,176) were 6% above average. Populations of both breeding merganser species have increased significantly across Pennsylvania since 1993 and are confirmed by Breeding Bird Atlas results.

The 2017 Pennsylvania Canada goose breeding pairs was estimated at 99,892 which is statistically similar to the average of 92,638. Pair densities were highest in the southwest (2.0

pairs/km²), northwest (1.8 pairs/km²) and southeast (1.1 pairs/km²) portions of the Commonwealth. The 2017 total population estimate of 244,908 was 7% below the recent 2003-2016 average of 262,612 geese (Table 6). As expected, the highest densities of total geese were observed in southwestern (4.3 geese/km²), northwestern (4.0 geese/km²) and southeastern (2.4 geese/km²) portions of Pennsylvania. This population remains well above the Atlantic Flyway Resident Population management plan goal of 150,000 spring birds in the Commonwealth (Atlantic Flyway Council 2011). We continue to support harvest policies to achieve the management plan goal through reduced densities in southeastern and southwestern Pennsylvania, while maintaining stable populations in other portions of the Commonwealth.

Survey results for the entire AF Breeding Waterfowl Plot Survey for 2017 (U.S Fish and Wildlife Service 2017, Appendix 4) included a mallard total population estimate of 448,467 which was the lowest observed population since the survey began in 1993, and 38% below LTA (statistically significant). The American black duck estimate (31,176) was the second lowest observed population estimate since 1993, and down 48% (statistically significant) from LTA. There has been a declining trend in mallard and black duck abundance over the last 15 years of this survey. The wood duck estimate (396,376) was 8% below last year but similar to LTA. Wood duck trends appear stable over the long-term. The Atlantic Flyway Resident Population (AFRP) of Canada geese breeds locally throughout the AF extending into southern Ontario, Québec, and the maritime provinces. The total population estimate for AFRP Canada geese was 933,321, which was similar to 2016 and slightly below (statistically significant) the LTA. This population remains well above the Atlantic Flyway management goal of 700,000 birds (Atlantic Flyway Council 2011). The Northeastern states experienced a mild winter in 2016-17. However, March temperatures were near average. Spring phenology in the northeast U.S. was near average. Some states experienced above average spring rains that were predicted to reduce waterfowl nesting in some areas of the northeastern states (U.S. Fish and Wildlife Service 2017).

At the time of preparation of this report, results for the 2017 breeding season were not available for the eastern surveyed areas of Canada and Maine, the traditional mid-continent survey area, or Arctic-nesting goose populations (Atlantic [AP] and Southern James Bay [SJBP] Populations of Canada geese, greater snow geese). Monitoring results for these populations from the 2016 breeding season were reported by the USFWS (2016) and are summarized below.

In the eastern surveyed areas of Canada and Maine, 2016 abundance estimates for American black was 600,000, 13% higher than 2015 and similar to the LTA. Mallards (400,000) and mergansers (400,000) were similar to the 2015 estimate and their LTA. Abundance of ring-necked ducks (600,000) and green-winged teal (200,000) were similar to 2015 for both species, and similar to the LTA. The estimate of combined goldeneye (common and Barrow's) was 400,000, similar to 2015 but 14% below LTA.

The number of ducks counted in the traditional mid-continent survey area in May 2016 was 48.4 million. This was 38% above the 1955-2015 LTA. Mallard abundance was 11.8 million birds, 51% above the LTA of 7.8 million. Blue-winged teal (6.7 million birds, 34% above LTA), green-winged teal (4.3 million, highest estimate on record and 104% above LTA), gadwall (3.7 million, 90% above LTA), American wigeon (3.4 million, 31% above LTA), northern shovelers (4.0 million, 56% above LTA), redheads (1.3 million, 82% above LTA), and canvasbacks (0.7

million, 26% above LTA), were all above their LTA in 2016. Estimated abundance of combined greater and lesser scaup (5.0 million) were similar to the LTA. Northern pintails (2.6 million) were 34% below LTA. The Canadian and U.S. prairies experienced early spring phenology. However, overall habitat condition was poorer than 2015 because of below average precipitation. Most regions were at best fair for waterfowl production. Areas comprising of semi-permanent and permanent wetlands were considered good conditions. The total pond estimate (prairie Canada and U.S. combined) was 5.0 million, 21% below the 2015 estimate and similar to the LTA of 5.2 million. The projected mid-continent mallard fall flight index was 13.5 million birds, similar to 2015.

Atlantic Population Canada geese nest across a broad area of Northern Québec with highest densities occurring in the Ungava Peninsula and along the Hudson Bay coast. The estimated number of breeding pairs in 2016 was 191,500, statistically similar to the 2015 estimate and the LTA. The total population estimate was 663,500, which was also similar to the 2015 estimate. Over the past 10 years, breeding pair estimates have been relatively stable while total populations have decreased approximately 5% per year. The total population declines may be related to earlier survey timing in recent years resulting in fewer molt migrants being counted, or several consecutive years of below-average production that will become evident in breeding pair estimates in future years as these cohorts reach reproductive maturity (Canada Goose Committee of the Atlantic Flyway Council, unpublished report). Spring phenology was later than average in northern and central Quebec with habitat conditions appearing to be below average. Overall, a slightly below average production is expected. The SJBP is the predominant migratory goose population in northwest Pennsylvania, contributing approximately 5% of the overall harvest in the SJBP zone (the balance being resident geese). In 2016, biologists modified the monitoring surveys of 3 populations (SJBP, Mississippi Valley Population (MPP), and Eastern Prairie Population (EPP)) previously surveyed and managed separately into a combined survey along the southern and western portions of the Hudson and James bays and indices from this combined survey are reported for what is now referred to as the Mississippi Flyway Interior Population of Canada Geese. Indices from the new survey are not directly comparable to the prior SJBP, MVP, and EPP estimates because the survey design changed. The total spring breeding population in the new combined survey was 65,100 for the mainland and 4,600 for Akimiski Island. Additional years of data will need to be accumulated under the new survey design for trends to become evident. In 2016, spring phenology along the western Hudson and James Bay was average, with a lower than average snow pack throughout most of the Hudson Bay Lowlands. Poor weather and high levels of precipitation occurred during nest initiation and hatching, which may have affected productivity. Greater snow geese nest principally on Bylot, Axel Heiberg, Ellesmere, and Baffin Islands in the Canadian Arctic, and in Greenland. The 2016 estimate was 915,000 geese, similar to 2015. Greater snow goose estimates have shown no trend over the past 10 years. An average fall flight was expected for greater snow geese in 2016.

RECOMMENDATION

Continue waterfowl breeding and wintering survey efforts during Fiscal Year 2017-18 to provide annual information on waterfowl population status.

LITERATURE CITED

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Table 1. 2015-16 waterfowl hunting season activity and harvest in Pennsylvania and percentage change as estimated by U.S. Fish and Wildlife Service Harvest Information Program Survey (HIP).

	2015-16^a	2014-15	% Change from 2014-15	1999-2015 Average	% Change from Average
Ducks					
HIP Hunters	19,400	17,300	+12	26,650	-27
HIP Hunter Days	88,900	71,700	+24	136,456	-35
HIP Harvest	69,400	72,800	-5	142,331	-51
Canada goose					
HIP Hunters	22,600	20,900	+8	33,775	-33
HIP Hunter Days	95,000	102,300	-7	181,394	-48
HIP Harvest	74,000	106,900	-31	162,906	-55
Snow goose					
HIP Harvest	2,300	2,300	0	7,719	-70

^a Preliminary.

Table 2. Number of permits issued, reports received, hunter days and number of geese taken by hunting method during the 2009 to 2017 Light Goose Conservation Season in Pennsylvania.

Year	Permits Issued	No. Hunted	% Hunted based on all permits	% Hunted based on reports submitted	Days Hunted	Grand Total Geese Bagged	Grand Total Geese Lost	After Sunset	W/ e^a calls	W/ e^a decoys
2009 ^b	3,276	1,724	53	59	3,840	5,903	317	736	1,522	- ^f
2010 ^c	3,107	668	21	50	2,409	2,985	141	330	1,101	- ^f
2011 ^c	3,401	900	26	69	2,959	5,197	259	475	1,845	Unknown ^g
2012 ^c	2,649	568	21	62	2,123	3,420	134	542	1,356	1,091
2013 ^d	2,606	578	22	59	2,051	3,162	162	457	1,049	739
2014 ^e	2,741	773	28	66	2,011	3,433	155	521	1,336	1,027
2015 ^e	2,661	806	30	66	2,260	4,684	147	475	1,452	1,130
2016 ^d	2,000	501	25	63	1,311	1,953	78	Unknown ^g	Unknown ^g	Unknown ^g
2017 ^d	1,632	351	22	62	1,043	1,852	62	Unknown ^g	Unknown ^g	Unknown ^g

^a e = electronic

^b Reporting reminder postcard sent; 89% reporting rate by permit holders

^c No reminders used; reporting rates by permit holders varied between 35-43%

^d Reporting reminder sent to non-respondents for whom we had an e-mail address; overall 35-40% reporting rate by permit holders

^e One reporting reminder sent to all permit holders for whom we had an e-mail address at the close of the season, and a second reporting reminder sent after the close of the mandatory reporting period to non-respondents for whom we had an e-mail address; overall 43-46% reporting rate by permit holders

^f Method prohibited by state regulation

^g No data collected on this method

Table 3. U.S. Fish and Wildlife Service Harvest Information Program Survey (USFWS HIP) harvest estimates for major duck and merganser species in Pennsylvania, 1999-2016.

Species	2015-16^a	2014-15	% Change from 2014-15	1999-2015 Average	% Change from Avg.
Mallard	28,900	28,700	+1	69,556	-58
Wood duck	18,100	19,000	-5	34,069	-47
Black duck	4,000	4,000	0	7,944	-50
Bufflehead	3,900	5,400	-28	4,506	-13
Green-winged teal	3,000	2,500	+20	6,800	-56
Common merganser	3,000	800	+275	3,119	-4
Hooded merganser	2,300	2,100	+10	2,725	-16
Ring-necked duck	1,100	2,000	-45	1,563	-30
Gadwall	700	1,400	-50	1,888	-63
Mallard/black Hybrid	600	100	+500	956	-37
Lesser scaup	400	1,700	-76	2,056	-81
American wigeon	200	400	-50	981	-80
Greater scaup	200	900	-78	1,025	-80

^a Preliminary.

Table 4. Age ratios (Immature/Adult) of the 10 most commonly harvested duck species, Canada geese and snow geese (as determined from wing and tail collections) during the 1999-2016 hunting seasons in the Atlantic Flyway.

Species	2015-16^a	2014-15	% Change from 2014-15	1999-2015 Average	% Change from Avg.
Mallard	1.38	1.33	+4	1.27	+8
Wood duck	1.32	1.33	-1	1.21	+9
Black duck	1.17	1.07	+9	1.19	-1
Green-winged teal	1.66	1.68	-1	1.71	-3
Bufflehead	1.01	1.15	-12	0.86	+18
Common merganser	1.88	1.33	+41	1.27	+48
Hooded merganser	0.73	1.29	-43	0.84	-13
Gadwall	1.09	1.68	-35	1.22	-10
Lesser scaup	0.88	0.83	+6	0.63	+39
Ring-necked duck	2.27	1.59	+43	1.37	+65
American wigeon	0.93	0.68	+37	1.02	-9
Greater scaup	1.69	1.15	+47	1.11	+52
Greater snow goose	0.77	1.32	-42	0.84	-9
Canada goose	0.41	0.36	+14	0.47	-13

^a Preliminary.

Table 5. Estimates of 2017 Pennsylvania waterfowl breeding pairs and standard error by physiographic strata, entire state, 1993-2016 long-term average (LTA) and comparison of 2017 estimate to the LTA from the Atlantic Flyway Breeding Waterfowl Survey.

Stratum	Black duck		Green-winged teal		Blue-winged teal		Canada goose		Common merganser		Hooded merganser		Mallard		Wood duck	
	Pairs	SE	Pairs	SE	Pairs	SE	Pairs	SE	Pairs	SE	Pairs	SE	Pairs	SE	Pairs	SE
10	0	0	0	0	0	0	14,499	2,794	0	0	0	0	5,370	1,751	2,148	1,038
13	0	0	0	0	0	0	13,933	4,622	4,180	2,135	0	0	13,236	5,407	12,540	5,116
22	0	0	0	0	740	739	26,636	11,539	740	739	0	0	10,358	4,635	8,139	4,829
241	0	0	1,131	887	0	0	18,095	3,786	565	341	424	240	3,251	998	12,723	2,540
242	0	0	0	0	0	0	17,146	5,262	2,211	1,022	1,843	1,514	7,740	2,628	15,849	5,659
243	0	0	0	0	0	0	9,582	2,496	1,490	613	213	212	7,240	1,618	11,285	3,269
State	0	0	1,131	887	740	739	99,892	14,510	9,187	2,577	2,480	1,548	47,196	8,018	62,684	9,986
LTA	846	^a	2,061	^a	2,499	^a	92,638	^a	7,967	^a	2,438	^a	87,306	^a	53,328	^a
% change	-100		-45		-70		+8		+15		+2		-46		+18	

^a Standard errors (SEs) on long-term averages not available at the time of preparation of this report

Table 6. Pennsylvania waterfowl population estimates from 2007 to 2017 and the 1993-2016 averages.

Species Estimate	1993-16											
	2017	average	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
Mallard total	95,089	179,955	128,981	136,776	144,031	138,804	127,637	132,903	161,675	187,697	131,477	181,540
Black duck total	-	1,693	1,850	-	716	4,278	-	852	537	1,278	537	3,433
Wood duck total	130,669	112,115	116,167	111,322	122,310	121,256	141,261	107,045	114,797	128,060	87,924	127,848
Canada goose total	244,908	262,612 ^a	250,707	249,218	241,735	278,862	219,611	245,061	231,780	289,879	246,499	255,924
Bl-wing teal total	1,480	5,321 ^b	2,827	4,535	9,533	11,075	3,028	2,970	4,186	7,814	1,840	12,650
Gr-wing teal total	2,262	5,267 ^b	1,556	4,725	5,908	6,279	7,528	3,869	2,064	5,569	1,979	5,064
Hooded merg. total	9,179	6,703 ^b	8,962	17,242	12,590	10,734	5,273	4,646	2,621	2,972	3,031	2,972
Common merg. total	20,176	18,997 ^b	23,503	15,104	27,278	28,004	23,749	25,100	14,053	12,377	18,773	17,429
Mute swan total	708	1,278	708	706	716	1,246	709	1,417	2,268	1,276	3,921	6,064

- No black ducks observed.

^a Average from 2003 to 2016 using new formula for total. Total estimate calculated using new formula 2x(pairs + singles) + groups.

^b Average from 2003 to 2016.

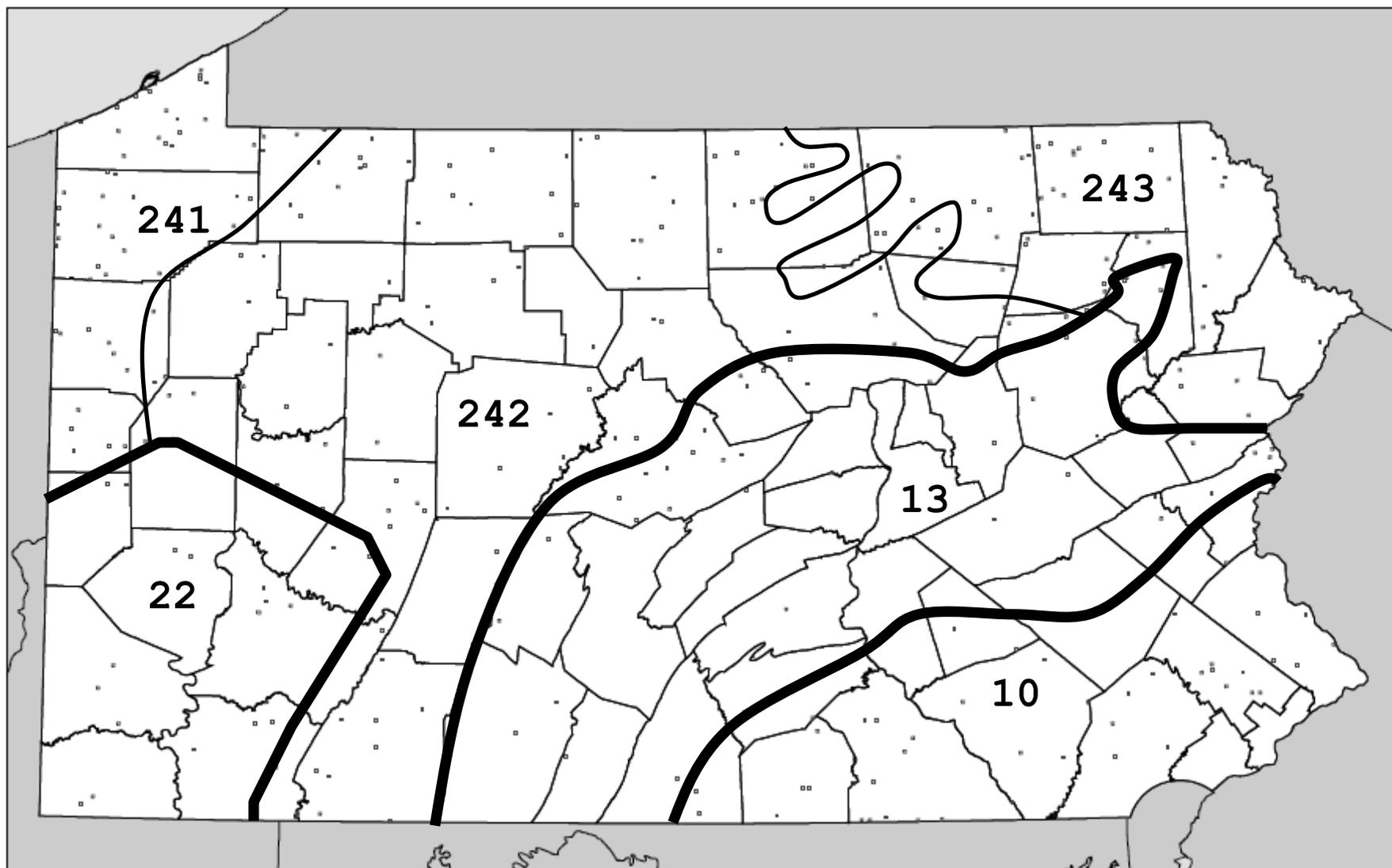


Figure 1. Location of Atlantic Flyway breeding waterfowl survey plots within major physiographic units in Pennsylvania. Physiographic units are Piedmont (10), Ridge and Valley (13), Pittsburgh Plateau (22), Glaciated Northwestern Plateau (241), Allegheny Mountain/Plateau (242), and Pocono/Low Plateau (243)

Appendix 1. 2015/2016 waterfowl hunting season selections.

DUCKS, SEA DUCKS, COOTS, AND MERGANSERS

BAG LIMITS

DUCKS: 6 daily, 18 in possession; daily limit may not include more than 4 mallards including 2 hen mallards, 1 black duck, 2 pintails, 1 mottled duck, 1 fulvous tree duck, 3 wood ducks, 2 redheads, 2 canvasbacks, 4 scoters and 2 scaup. Possession limit may not include more than 12 mallards including 6 hens, 3 black ducks, 6 pintails, 3 mottled ducks, 3 fulvous tree ducks, 9 wood ducks, 6 redheads, 3 canvasbacks, 12 scoters and 6 scaup.

MERGANSERS: 5 daily not more than 2 hooded mergansers, 6 in possession.

COOTS: 15 daily, 45 in possession.

Youth Waterfowl Hunting Days (Ducks, Mergansers, Canada Geese, Coots and Moorhens): Statewide: September 19; also in North and Northwest zones, September 26; in Lake Erie Zone, October 17; and in South Zone, November 7.

SEASON DATES

Lake Erie Zone

Ducks, sea ducks, coots and mergansers – Oct. 26 – Jan. 2

North Zone

Ducks, sea ducks, coots and mergansers – Oct. 10 – Nov. 28 & Dec. 19 – Jan. 7, 2016

Northwest Zone

Ducks, sea ducks, coots and mergansers – Oct. 10 – Dec. 12, & Dec. 29 – Jan. 2, 2016

South Zone

Ducks, sea ducks, coots and mergansers – Oct. 17 – 24 & Nov. 14 – Jan. 14, 2016

ATLANTIC BRANT

Oct. 17 – Nov. 20 (1 brant daily bag limit, 3 in possession).

LIGHT GEESE

Atlantic Population Goose Hunting Zone

Regular Season – Oct. 1 – Jan. 30, 2016 (25 daily bag limit, no possession limit).

Conservation Season – Feb. 1, 2016 – Apr. 22, 2016 (25 daily bag limit, no possession limit. Permit required).

Southern James Bay Population Goose Hunting Zone

Regular Season – Oct. 1 – Jan. 22, 2016 (25 daily bag limit, no possession limit).

Conservation Season – Jan. 23, 2016 – Apr. 22, 2016 (25 daily bag limit, no possession limit. Permit required).

Resident Population Goose Hunting Zone

Regular Season – Oct. 28 – Feb. 29, 2016 (25 daily bag limit, no possession limit).

Conservation Season – March 1, 2016 – Apr. 22, 2015 (25 daily bag limit, no possession limit. Permit required).

CANADA GEESE

Atlantic Population Goose Hunting Zone

Nov. 14 – 28 & Dec. 19 – Jan. 30, 2016 (3 goose daily limit; 9 goose possession limit)

Southern James Bay Population Goose Hunting Zone

Oct. 10 – Nov. 28 & Dec. 14 – Jan. 22, 2016 (3 goose daily limit; 9 goose possession limit)

Resident Population Goose Hunting Zone

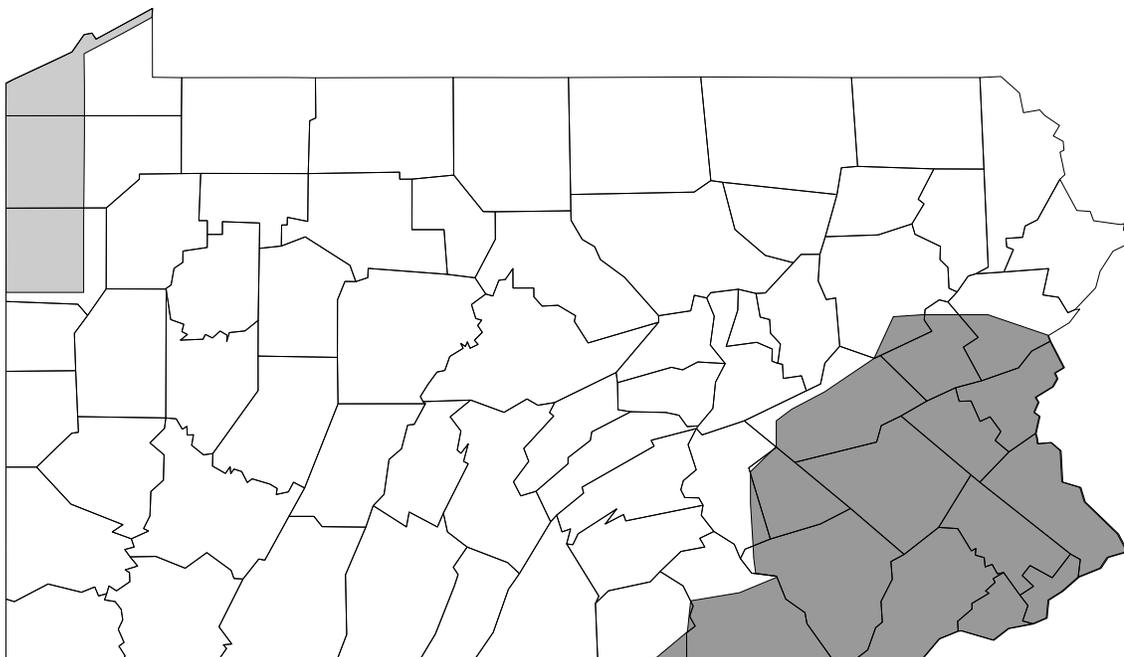
Oct. 24 – Nov. 28, Dec. 18 – Jan. 14, 2016, Feb. 1 – Feb. 29, 2016 (5 goose daily limit; 15 possession limit)

September Canada Goose Season - Statewide

September 1 – September 25 (8 goose daily bag limit, 24 in possession) **except:**

- (1) In the SJBZ zone the daily limit is 3 Canada geese, possession limit 9.
- (2) In the area south of SR 198 from the Ohio state line to intersection of SR 18, SR 18 south to SR 618, SR 618 south to US Route 6, US Route 6 east to US Route 322/SR 18, US Route 322/SR 18 west to intersection of SR 3013, SR 3013 south to the Crawford/Mercer County line. The daily bag limit is one goose; **except** on State Game Lands 214 where the season is closed to September goose hunting. Note: this restriction does not apply to youth participation on youth waterfowl hunting days September 19 & September 26, 2015 when regular season regulations apply.
- (3) Canada geese may be taken on Pymatuning State Park Reservoir and an area to extend 100 yards inland from the shoreline of the reservoir, excluding the area east of SR 3011 (Hartstown Road). The daily bag limit is 3 geese, possession limit of 9 geese.
- (4) In the area of Lancaster and Lebanon counties north of the Pennsylvania Turnpike I-76, east of SR 501 to SR 419, south of SR 419 to Lebanon-Berks county line, west of Lebanon-Berks county line and the Lancaster-Berks county line to SR 1053 (also known as Peartown Road and Greenville Road), west of SR 1053 to Pennsylvania Turnpike I-76, the daily bag limit is one goose, possession limit three geese; **except** on State Game Lands No. 46 (Middle Creek Wildlife Management Area) where the season is closed. Note: this restriction does not apply to youth participation on youth waterfowl hunting days September 19 & November 7, 2015 when regular season regulations apply.

Canada, Snow and White-Fronted Goose hunting zones for 2015-16 season in Pennsylvania



Pennsylvania

Resident Population Goose (RP) Zone

All of Pennsylvania **except** for the Southern James Bay Population (SJBP) zone **and** the Atlantic Population (AP) zone.

Southern James Bay Population (SJBP) Zone

The area north of I-80 and west of I-79 including in the city of Erie west of Bay Front Parkway to and including the Lake Erie Duck zone (Lake Erie, Presque Isle and the area within 150 yds of Lake Erie Shoreline).

Atlantic Population (AP) Zone

The area east of route SR 97 from Maryland state line to the intersection of SR 194, east of SR 194 to intersection of US Route 30, south of US Route 30 to SR 441, east of SR 441 to SR 743, east of SR 743 to intersection of I-81, east of I-81 to intersection of I-80, south of I-80 to New Jersey state line.

Appendix 2. Proposed 2016/2017 waterfowl hunting season recommendations.
Footnotes indicate changes from 2015-16 frameworks

Ducks, Mergansers, and Coots

Framework Dates: Saturday, September 24 – Saturday, January 28

Season Length: 60 days, with split into 2 segments per zone allowed

Daily Bag Limit (possession limit is three times the daily bag unless otherwise specified):

Ducks: 6 ducks, including no more than 4 mallards (2 hens)

- 2 scaup
- 1 black duck
- 3 wood ducks
- 2 redheads
- 2 canvasbacks
- 2 pintails
- 1 mottled duck
- 1 fulvous whistling duck
- 4 scoters
- 4 eiders^a
- 4 long-tailed ducks^b

Mergansers: 5 mergansers, of which not more than 2 may be hooded mergansers

Coots: 15 coots

Atlantic Brant

Framework Dates: September 24 – January 31

Season Length: 60 days^c, season may be split into 2 segments

Daily Bag Limit: 2 brant^d

Light Geese (Snow & Ross's)

Framework Dates: October 1 – March 10

Season Length: 107 days, season may be split into 3 segments

Daily Bag Limit: 25 light geese, no possession limit

White-fronted Geese

Included as part of framework dates and daily bag limits with Canada geese.

^a Decrease from 6 daily in 2015-16

^b Decrease from 6 daily in 2015-16

^c Increase from 30 days in 2015-16

^d Increase from 1 daily in 2015-16

Canada Geese

Atlantic Population Zone. The area east of SR 97 from Maryland state line to the intersection of SR 194, east of SR 194 to intersection of US Route 30, south of US Route 30 to SR 441, east of SR 441 to SR 743, east of SR 743 to intersection of I-81, east of I-81 to intersection of I-80, south of I-80 to New Jersey state line.

Framework Dates: October 22 – February 4

Season Length: 50 days, season may be split into 2 segments

Daily Bag Limit: 3 geese

Southern James Bay Population Zone. The area north of I-80 and west of I-79 including in the city of Erie west of Bay Front Parkway to and including the Lake Erie Duck zone (Lake Erie, Presque Isle and the area within 150 yds of Lake Erie Shoreline).

Framework Dates: October 1 – February 15

Season Length: 78 days, season may be split into 2 segments

Daily Bag Limit: 3 geese

Resident Population Zone. All of Pennsylvania **except** for the Southern James Bay Population zone and the Atlantic Population zone.

Framework Dates: October 22 – March 10

Season Length: 80 days, season may be split into 3 segments

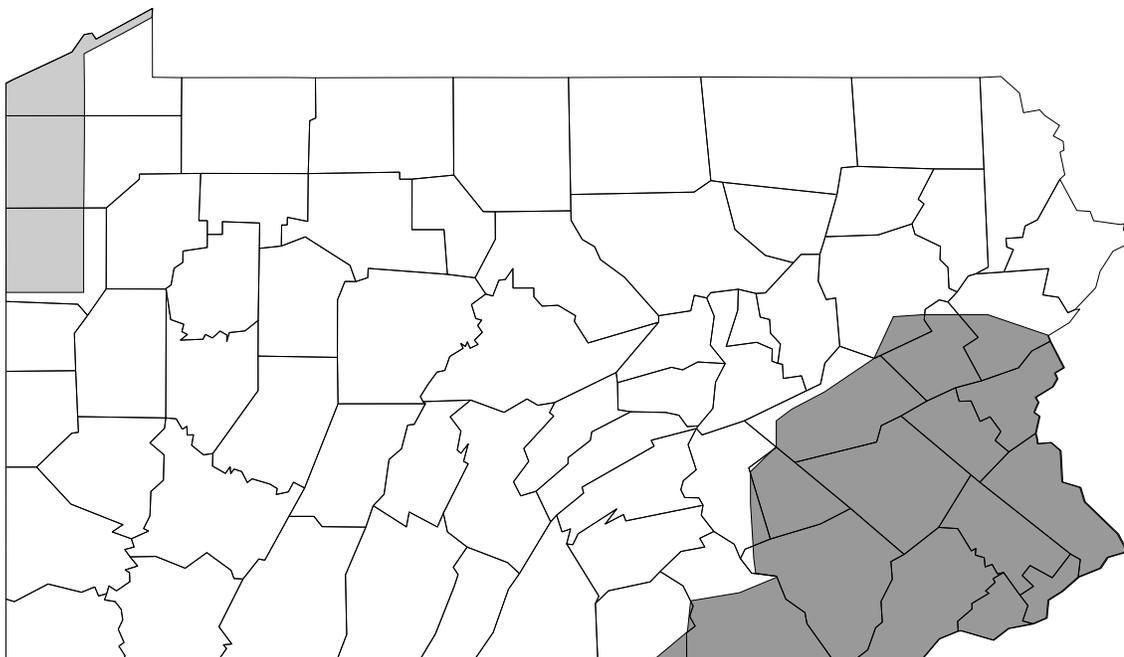
Daily Bag Limit: 5 geese

Early Canada Goose Hunting Season (Statewide)

September 1 – September 24 (8 goose daily bag limit, 24 in possession) except:

- (1) In the SJBZ zone the daily limit is 3 Canada geese, possession limit 9.
- (2) In the area south of SR 198 from the Ohio state line to intersection of SR 18, SR 18 south to SR 618, SR 618 south to US Route 6, US Route 6 east to US Route 322/SR 18, US Route 322/SR 18 west to intersection of SR 3013, SR 3013 south to the Crawford/Mercer County line: the daily bag limit is 1 Canada goose; **except** on State Game Lands 214 where is season is closed to September goose hunting.
- (3) Canada geese may be taken on Pymatuning State Park Reservoir and an area to extend 100 yards inland from the shoreline of the reservoir, excluding the area east of SR 3011 (Hartstown Road). The daily bag limit is 3 Canada geese, possession limit of 9.
- (4) In the area of Lancaster and Lebanon counties north of the Pennsylvania Turnpike I-76, east of SR 501 to SR 419, south of SR 419 to Lebanon-Berks county line, west of Lebanon-Berks county line and the Lancaster-Berks county line to SR 1053 (also known as Peartown Road and Greenville Road), west of SR 1053 to Pennsylvania Turnpike I-76: the daily bag limit is 1 Canada goose, possession limit 3; **except** on State Game Lands No. 46 (Middle Creek Wildlife Management Area) where the season is closed.

Canada, Snow and White-Fronted Goose hunting zones for 2016-17 season in Pennsylvania



Pennsylvania

Resident Population Goose (RP) Zone

All of Pennsylvania **except** for the Southern James Bay Population (SJBP) zone **and** the Atlantic Population (AP) zone.

Southern James Bay Population (SJBP) Zone

The area north of I-80 and west of I-79 including in the city of Erie west of Bay Front Parkway to and including the Lake Erie Duck zone (Lake Erie, Presque Isle and the area within 150 yds of Lake Erie Shoreline).

Atlantic Population (AP) Zone

The area east of route SR 97 from Maryland state line to the intersection of SR 194, east of SR 194 to intersection of US Route 30, south of US Route 30 to SR 441, east of SR 441 to SR 743, east of SR 743 to intersection of I-81, east of I-81 to intersection of I-80, south of I-80 to New Jersey state line.

Appendix 3. 2017 Atlantic Flyway Midwinter Waterfowl Survey results.

REPORT ON POPULATION STATUS AND PRODUCTIVITY OF EASTERN POPULATION TUNDRA SWANS AND ATLANTIC BRANT

Anthony Roberts and Paul Padding, USFWS Division of Migratory Bird Management



ACKNOWLEDGEMENTS

Surveys were conducted by numerous partners including Canadian Wildlife Service, Environmental Stewardship Branch; Connecticut Dept. of Environmental Protection; Delaware Dept. of Natural Resources and Environmental Control; Maryland Dept. of Natural Resources, Wildlife and Heritage Service; New Jersey Division of Fish and Wildlife; New York State Dept. of Environmental Conservation; North Carolina Wildlife Resources Commission; Ontario Ministry of Natural Resources and Forestry, Pennsylvania Game Commission; Rhode Island Division of Fish and Wildlife; South Carolina Dept. of Natural Resources; Virginia Dept. of Game and Inland Fisheries; US Fish and Wildlife Service National Wildlife Refuges (Alligator River, Blackwater National Wildlife Refuge, Bombay Hook National Wildlife Refuge, Eastern Neck National Wildlife Refuge, Mackey Island National Wildlife Refuge, Mattamuskeet National Wildlife Refuge, Pea Island National Wildlife Refuge, Pocosin Lakes National Wildlife Refuge)

PURPOSE

Harvest management of Atlantic brant and tundra swans relies on information about population size. In addition, productivity estimates provide insight into population trajectory that the Atlantic Flyway Council may take into consideration when discussing harvest management or other population goals. This report summarizes results from 2016-2017 Atlantic brant and eastern population tundra swan productivity and population surveys.

METHODS

Atlantic Flyway productivity surveys for Atlantic brant and tundra swans have been conducted annually since 1978. Productivity data are collected following the 2007 draft USFWS document "Standard operating procedures for productivity surveys of geese, swans, and brant." Each state or province has a sample size of birds where they attempt to enumerate the age of Atlantic brant and tundra swans and determine the number of young per family group. Productivity surveys occur in November and December each year.

Population size data are traditionally collected during annual midwinter survey counts. Since 2016, in states that no longer conduct midwinter surveys, states that traditionally have wintering populations of Atlantic brant and tundra swans conduct ground or aerial counts of these species. Mid-winter, and Atlantic brant and tundra swan specific, surveys are conducted in early January.

RESULTS

The Atlantic brant productivity estimate was up 37% from the long-term average (Table 1). November 2016 surveys indicated mean percent immature birds in the population of 25%, the first year since 2011 where the percent immature birds was >10%. Eastern population of tundra swan estimated productivity in 2016 was 11% immature birds (Table 2). This estimate is down 18% from the long-term average but near annual estimates for the period 2012-2015.

Atlantic brant counts were up from 2016 count of 157,899 to 161,661 in 2017 (Table 3). This is the highest number of birds counted since 2008. The Atlantic Flyway portion of the eastern population tundra swan total count was 115,425 (Table 4). As of this report Mississippi Flyway and Ontario counts have not been reported. The 2017 population count from the Atlantic Flyway resulted in a three-year average of 115,371 eastern population tundra swans.

Table 2. Productivity Data for Tundra Swans in the Atlantic Flyway

Year	Number	Families		Other		Total	Total	Total	Percent	Average Young
	Families	Adults	Immature	Adults	Immature	Adults	Immature	Birds	Immature	Per Family
1978	8	10	8	433	178	443	184	827	29.3	1.3
1979	15	27	24	1,280	102	1,307	128	1,435	8.8	1.8
1980	19	38	35	1,807	182	1,843	217	2,060	10.5	1.8
1981	18	32	37	1,000	410	1,032	447	1,479	30.2	2.3
1982	144	281	282	4,858	357	4,937	839	5,576	11.5	2.0
1983	448	889	880	5,152	818	6,041	1,498	7,537	19.8	2.0
1984	240	487	518	6,882	1,248	7,149	1,784	8,913	19.8	2.2
1985	718	1,313	1433	7,397	1,251	8,710	2,884	11,394	23.8	2.0
1986	235	484	311	10,405	723	10,889	1,034	11,903	8.7	1.3
1987	109	203	179	7,199	829	7,402	808	8,210	9.8	1.8
1988	247	588	471	8,172	1,051	8,738	1,522	10,280	14.8	1.9
1989	481	883	791	10,858	1,308	11,739	2,097	13,836	15.2	1.7
1990	297	541	582	9,872	829	10,413	1,191	11,604	10.3	1.9
1991	139	281	219	3,002	237	3,283	458	3,719	12.3	1.8
1992	125	241	197	11,070	292	11,311	489	11,800	4.1	1.8
1993	434	858	418	10,482	1,582	11,320	2,000	13,320	15.0	1.0
1994	497	1,099	835	3,115	385	4,214	1,000	5,214	19.2	1.3
1995	234	475	288	8,458	519	8,933	787	9,720	8.1	1.1
1996	922	1,800	1,114	11,958	420	13,756	1,534	15,290	10.0	1.2
1997	848	1,707	897	8,974	174	10,881	871	11,552	7.5	0.8
1998	1,411	2,325	1,897	8,875	345	11,000	2,042	13,042	15.7	1.2
1999	700	1,244	1,097	10,993	328	12,237	1,423	13,880	10.4	1.8
2000	878	1,375	577	5,117	180	8,492	737	7,229	10.2	0.9
2001	947	1,904	1,147	10,189	188	12,073	1,313	13,386	9.8	1.2
2002	1,278	2,783	1,149	20,402	878	23,185	2,027	25,212	8.0	0.9
2003	894	1,278	929	31,927	887	33,203	1,818	35,019	5.2	1.3
2004	535	1,829	1,301	9,087	784	10,898	2,085	12,981	18.1	2.4
2005	477	941	538	5,350	132	8,291	870	8,981	9.8	1.1
2006	787	1,480	1,275	3,599	205	5,079	1,480	6,559	22.8	1.7
2007	49	82	81	9,891	1,320	9,973	1,401	11,374	12.3	1.7
2008	214	433	413	13,507	2383	13,940	2,778	16,718	18.8	1.9
2009	155	285	259	13,958	1583	14,241	1,842	16,083	11.5	1.7
2010	257	518	445	15,989	2137	18,505	2,582	19,087	13.5	1.7
2011	335	683	673	18,054	3851	18,717	4,524	23,241	19.5	2.0
2012	228	474	401	21,724	2152	22,198	2,553	24,751	10.3	1.8
2013	444	884	792	21,530	1747	22,414	2,539	24,953	10.2	1.8
2014	407	817	707	23,517	2234	24,334	2,941	27,275	10.8	1.7
2015	339	684	579	18,943	1889	17,807	2,248	19,855	11.3	1.7
2016	340	692	531	20,518	2073	21,208	2,804	23,812	10.9	1.8
% change from 2015								19.9	-3.4	
% change from mean								83.3	-18.4	
MEAN *(1978-2018)	421	842	807	10,587	958	11,428	1,583	12,991	13.4	1.8

Table 3. Numbers of Atlantic brant observed during the midwinter waterfowl survey in the Atlantic Flyway, 2001-2017

YEAR	MA	CT	RI	NY	NJ	DE	MD	VA	NC	AF TOTAL
2001	2,204	465	1,445	25,201	96,685	3,657	925	14,677	0	145,259
2002	3,025	500	940	37,675	124,590	0	535	14,355	0	181,620
2003	1,821	77	3,165	22,222	118,005	601	1,510	17,125	0	164,526
2004	1,989	1,548	401	20,748	83,850	2,271	1,295	17,480	0	129,582
2005	875	1,415	634	24,759	73,805	1,400	1,723	18,635	2	123,248
2006	1,760	1,002	1,750	60,324	63,815	2,145	2,353	13,122	368	146,639
2007	2,018	1,328	1,500	65,745	67,305	1,378	505	8,906	1,874	150,559
2008	2,916	1,214	1,257	56,115	88,190	1,300	1,400	7,760	1,460	161,612
2009	2,162	1,724	1,430	57,030	73,935	219	805	11,210	2,758	151,273
2010	1,572	935	3,509	65,580	55,485	504	1,035	9,040	1,690	139,350
2011	1,213	1,558	4,585	67,260	61,195	525	1,465	9,875	1,210	148,886
2012	1,550	1,664	2,115	66,250	69,560	750	548	6,720	0	149,157
2013	2,153	940	1,411	54,100	39,730	961	1,505	10,375	575	111,750
2014	1,185	1,144	2,970	66,543	48,535	350	638	11,271	300	132,936
2015	1,415	628	2,251	51,000	43,115	100	930	11,995	0	111,434
2016	1,128	2,019	4,059	57,265	83,894	0	1,043	8,446	45	157,899
2017	727	2,564	4,100	72,250	70,120	505	900	9,805	690	161,661

Table 4. Numbers of eastern population tundra swans observed during midwinter waterfowl surveys, 2001-2017

YEAR	NY	PA	NJ	DE	MD	VA	NC	SC	AF TOTAL
2001	99	363	197	72	20,798	9,428	66,966	220	98,143
2002	116	1,098	473	920	16,610	5,994	78,394	222	103,627
2003	205	548	105	802	15,112	7,725	83,351	339	108,187
2004	8	1,261	495	667	17,891	7,173	67,188	292	94,975
2005	132	786	205	387	13,248	6,488	47,364	125	68,735
2006	399	2,464	165	147	8,239	4,576	54,064	398	70,452
2007	0	363	290	520	8,656	4,979	72,653	379	87,840
2008	0	1,178	332	651	10,580	6,738	69,023	NS	88,502
2009	0	783	165	223	14,183	6,584	76,788	578	99,304
2010	0	89	425	215	14,004	6,584	70,273	319	91,909
2011	0	316	155	258	14,355	8,778	69,501	404	93,767
2012	0	691	425	178	16,599	8,884	59,716	300	86,793
2013	0	1,711	183	1,392	17,330	8,987	68,578	312	98,493
2014	0	975	480	264	16,145	9,399	76,276	305	103,844
2015	461	506	540	273	17,837	9,194	78,663	462	107,936
2016	0	810	82	341	11,220	10,368	63,466	332	86,619
2017	0	223	124	329	14,495	7,475	92,193	586	115,425

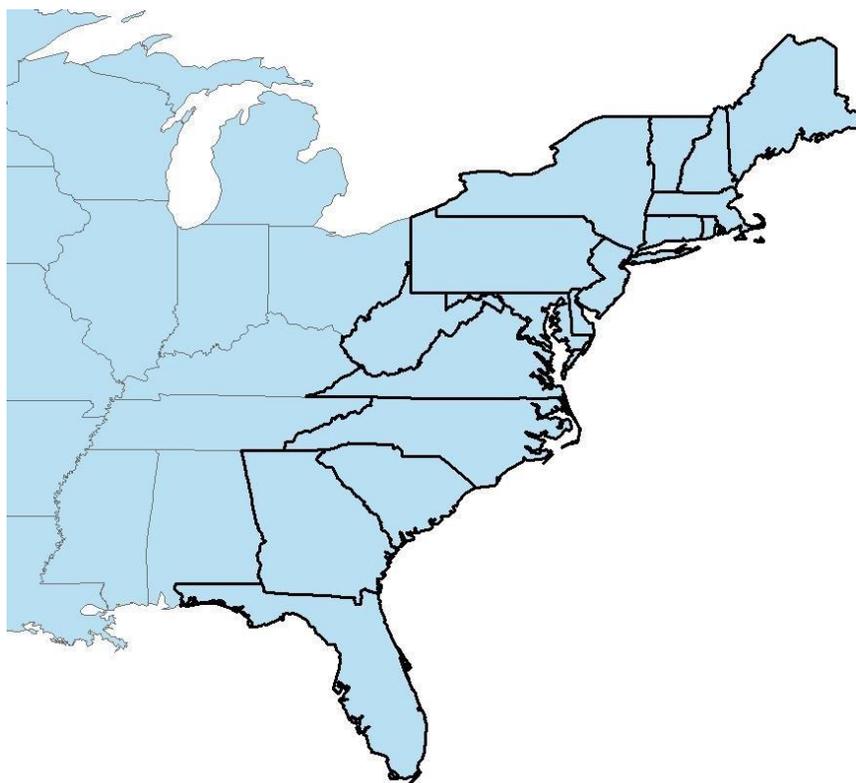
Appendix 4. 2017 Atlantic Flyway Breeding Waterfowl Plot Survey results.

ATLANTIC FLYWAY BREEDING WATERFOWL PLOT SURVEY

Breeding Pair and Population Size Estimates Report

Anthony Roberts
14 June 2017

U.S. Fish and Wildlife Service
Division of Migratory Bird Management
Atlantic Flyway Office
11510 American Holly Drive
Laurel, Maryland 20708



Suggested citation: U.S. Fish and Wildlife Service. 2017. Atlantic Flyway Breeding Waterfowl Plot Survey report 2017. U.S. Department of the Interior, Washington D.C. USA.

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Department of Energy and Environmental Protection: Min Huang and Kelly Kubik

Delaware

Division of Fish and Wildlife: Agency personnel and cooperators

Maryland

Department of Natural Resources: Agency personnel and cooperators

Massachusetts

Department of Fish and Game: Agency personnel and cooperators

New Hampshire

Department of Fish and Game: Agency personnel and cooperators

New Jersey

Department of Fisheries and Wildlife: Ted Nichols, Lisa Clark, Joe Garris, Jodi Powers, Lee Widjeskog, and Andrew Burnett

U.S. Fish and Wildlife Service: Paul Castelli and Vinny Turner

New York

Division of Fish and Wildlife personnel and cooperators

Pennsylvania

Game Commission: Agency personnel and cooperators

Rhode Island

Division of Fish and Wildlife: Agency personnel and cooperators

Vermont

Department of Fish and Wildlife: Agency personnel and cooperators

Virginia

Department of Game and Inland Fisheries: Agency personnel and cooperators

Introduction and Methods

The Atlantic Flyway Northeast Plot survey was considered operational in 1993 and was initiated in an effort to collect information about locally breeding waterfowl. The intent was to collect data that would provide the basis for setting waterfowl hunting regulations in the Atlantic Flyway. Currently this effort involves 11 states from Virginia to New Hampshire in which cooperators survey randomly selected 1-km² plots (Figure 1). These data are then sent to the Atlantic Flyway office in the USFWS's Division of Migratory Bird Management for analysis. This analysis produces both population and breeding pairs estimates for selected species that are surveyed.

The purpose of this report is not to provide detail about the evolution of the survey. Rather this report outlines the results from the current year and compares them with the previous year and the long-term average. For a more in-depth understanding of the Atlantic Flyway breeding waterfowl plot survey (including rationale/justification, design, and implementation) please see Heusmann and Sauer (1997; 2000).

Results

The Northeastern and Mid-Atlantic states experienced a mild winter in 2016/17, though March had near normal temperatures across the survey area. Northeastern states had been experiencing low rainfall totals for many years and some areas were in drought conditions. These conditions were somewhat alleviated across the Northeast due to early and abundant spring rains. Some states reported heavy spring rains and tidal flooding that was predicted or observed to reduce waterfowl nesting in some areas. Following the mild winter and average to above average spring rainfall, Mid-Atlantic states experienced rapid spring green-up then near normal spring phenology and rainfall totals.

In 2017, 2 population estimates are again presented for Canada geese. The first is based on the method of calculating total indicated birds (TIB) that was used from 1993 to 2002 ($TIB = (2 \times \text{pairs}) + \text{singles} + \text{grouped birds}$). The newer method, more comparable with that used for duck species in this survey and for other goose surveys, calculates TIB as $2 \times (\text{pairs} + \text{singles}) + \text{grouped birds}$. As in years past stratum-within-state-, state-, stratum-, and survey-area-specific estimates will be distributed in an Excel file (Appendix A). This will make these estimates more accessible to cooperators.

Breeding population and breeding pair estimates for this year are compared with estimates from 2016 and long-term (1993-2016) averages for ten species: mallards, American black ducks, wood ducks, Canada geese, gadwall, American green-winged teal, blue-winged teal, common mergansers, hooded mergansers, and mute swans. Statistical comparisons were made with a 2tailed z-test. The statistic was compared with the normal distribution. The z test statistic and variance of the long term average was calculated as in previous years (Heusmann and Sauer 2000, U.S. Fish and Wildlife Service 2016). All comparisons were made at the $\alpha = 0.05$ level.

The 2017 mallard population and breeding pair estimates were the lowest since the survey began in 1993. The population and breeding pair point estimates decreased from 2016 by about 18% (Tables 1 and 2; Figures 2 and 3). The differences from the LTA for mallard population and breeding pair estimates were a decrease of about 37%. The population and pairs estimates for American black ducks decreased from the 2016 estimates by about 20%. American black duck population and breeding pairs estimates both have decreases from the LTA of about 50% (Tables 1 and 2; Figures 2 and 3). The wood duck population and pairs point estimates each decreased from 2016 estimates (Tables 1 and 2; Figures 2 and 3), by about 8%. In contrast, wood duck population and pairs estimates are each above the LTA by about 4% (Tables 1 and 2).

The population estimates for Canada geese were down by about 2% using both the old and new methods of estimation compared to 2016 (Table 1). Resident Canada goose population estimates remains well above the Atlantic Flyway's population goal of 700,000. The 2017 Canada goose pair estimate was also down about 2% compared to 2016 and was relatively near the LTA (Table 2; Figure 3).

Caution should be used in interpreting results for gadwall, American green-winged and bluewinged teal, common

and hooded mergansers, and mute swans as these estimates have large confidence intervals and estimates tend to fluctuate greatly from year to year. Changes in population or breeding pair estimates from the previous year may be seen in the data, but they are always insignificant. Differences from the LTA may show a significant trend, but the estimates still have large confidence intervals. Gadwall population estimates were lower than the LTA by about 3% though breeding pair estimates were higher than the LTA by about 25% (Tables 3 and 4). The 2017 American green-winged teal population was below the LTA by about 30% and breeding pairs estimates were unchanged from the LTA (Tables 3 and 4). The bluewinged teal population estimate and breeding pairs estimates were lower than the LTA by 50% and 34% respectively (Tables 3 and 4). Common and hooded mergansers had population estimates above the LTA. Likewise, common merganser breeding pair estimates were above the LTA while hooded merganser breeding pair estimates were below the LTA by about 10% (Tables 3 and 4). Estimates in 2017 of mute swan population and breeding pairs were above 2016 estimates (7% and 17% respectively), but were below the LTA (25% and 12% respectively; Tables 3 and 4).

References

Heusmann, H. W. and J. R. Sauer. 1997. A survey for mallard pairs in the Atlantic Flyway. *Journal of Wildlife Management* 61:1191-1198.

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Table 1. Population estimates and standard errors for mallards, American black ducks, wood ducks, and Canada geese from the Atlantic Flyway Breeding Waterfowl Plot Survey, 1993-2014, and percent change from 2013 to 2014 and from the long-term average to 2014.

Year	N	Mallards		American black ducks		Wood ducks		Canada geese			
		Estimate	SE	Estimate	SE	Estimate	SE	Estimate ^a	SE	Estimate ^b	SE
1993	1,475	686,562	49,870	80,158	11,033	311,924	32,660	647,509	111,770		
1994	1,468	856,313	62,774	60,930	8,667	323,285	34,730	648,684	72,971		
1995	1,465	864,120	70,395	72,507	13,169	367,019	35,473	780,027	98,816		
1996	1,469	848,645	61,074	77,316	17,521	344,659	32,139	932,656	107,423		
1997	1,472	795,176	49,596	65,578	9,050	385,644	33,863	1,013,324	132,539		
1998	1,474	775,213	49,718	81,689	20,458	382,778	28,585	970,092	115,663		
1999	1,491	879,953	60,173	82,421	14,392	402,170	34,542	999,517	120,811		
2000	1,480	762,555	48,701	87,009	15,421	376,212	35,008	1,022,299	101,930		
2001	1,485	809,438	51,572	69,627	11,263	388,204	37,891	1,016,629	89,337		
2002	1,487	833,514	56,235	68,637	12,211	420,000	37,804	965,657	86,932		
2003	1,495	731,907	47,025	64,898	11,357	341,945	29,497	1,040,474	89,820	1,126,731	94,540
2004	1,485	806,554	51,747	53,891	7,713	360,185	36,035	978,554	89,813	1,073,096	93,828
2005	1,488	753,622	53,619	49,745	8,469	413,558	38,981	1,064,696	96,415	1,167,075	102,279
2006	1,455	721,402	47,639	51,924	8,880	400,967	34,124	1,057,251	103,397	1,143,951	106,242
2007	1,485	687,578	46,724	62,355	11,608	420,574	36,086	1,046,067	90,513	1,127,987	94,528
2008	1,476	619,095	40,682	65,121	16,838	386,127	34,468	951,501	79,003	1,024,914	82,157
2009	1,445	666,752	45,695	39,523	6,228	367,998	34,312	943,274	72,554	1,006,133	75,112
2010	1,463	651,709	49,122	38,155	8,495	409,599	35,018	896,254	87,327	977,085	92,408
2011	1,471	586,089	41,561	38,717	6,919	382,736	32,978	941,359	82,828	1,015,076	86,473
2012	1,474	612,587	45,776	28,619	4,370	418,910	33,177	823,257	69,346	879,793	71,582
2013	1,327	604,157	42,755	49,735	8,041	361,156	28,918	883,578	75,510	951,936	79,106
2014	1,290	634,582	48,937	54,493	13,141	421,557	36,137	1,011,944	112,529	1,084,913	114,367
2015	1,310	540,087	45,546	42,429	14,573	406,178	37,759	891,123	79,660	963,809	81,744
2016	1,306	551,258	45,110	39,750	8,468	430,636	37,494	883,155	76,930	949,990	80,130
2017	1,329	448,467	35,020	31,176	6,837	396,376	36,122	860,973	70,677	933,321	73,979
Long-term average (1993-2016)											
		719,953	10,407	59,384	2,414	384,334	7,061	933,703	19,380	1,039,308	24,159
Percent change from:											
		%	P	%	P	%	P	%	P	%	P
	2016	-18.65	0.0227	-21.57	0.3113	-7.96	0.3609	-2.51	0.7731	-1.75	0.0000
	LTA	-37.71	0	-47.50	0.0000	3.13	0.1022	-7.79	0.0003	-10.20	0.0000

^a Estimates based on the 1993-2002 method of calculating total indicated birds [TIB = (2×pairs) + singles + groups].

^b Estimates based on the post-2002 method of calculating total indicated birds [TIB = 2×(pairs + singles) + groups].

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Table 2. Breeding pair estimates and standard errors for mallards, American black ducks, wood ducks, and Canada geese from the Atlantic Flyway Breeding Waterfowl Plot Survey, 1993-2014, and percent change from 2013 to 2014 and from the long-term average to 2014.

Year	N	Mallards		American black ducks		Wood ducks		Canada geese	
		Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
1993	1,475	324,020	23,075	39,464	5,485	140,506	14,229		
1994	1,468	427,254	31,354	29,472	4,255	148,298	14,448	202,281	19,827
1995	1,465	404,837	30,111	32,670	5,919	172,944	16,949	245,233	23,023
1996	1,469	403,919	28,367	31,674	5,042	156,201	14,023	277,608	25,468
1997	1,472	383,296	23,653	29,792	4,079	186,127	16,610	326,982	40,080
1998	1,474	374,612	24,079	31,833	4,885	184,725	13,938	324,648	29,188
1999	1,491	421,492	28,771	38,693	6,620	195,197	16,512	379,479	38,088
2000	1,480	359,398	22,288	36,006	4,902	174,417	15,066	339,936	26,316
2001	1,485	385,824	23,400	31,942	4,544	187,322	18,336	392,055	27,777
2002	1,487	400,730	26,599	29,026	3,645	202,090	18,298	405,898	32,094
2003	1,495	347,309	22,299	28,863	4,186	167,135	14,664	389,793	28,280
2004	1,485	387,141	25,135	25,028	3,499	173,292	16,971	394,626	28,065
2005	1,488	358,214	25,213	21,471	3,127	195,916	17,690	410,544	30,402
2006	1,455	345,742	22,568	24,907	4,225	194,578	16,713	384,715	27,397
2007	1,485	332,549	22,778	24,714	4,253	196,717	15,616	390,630	27,454
2008	1,476	301,700	19,728	24,204	4,360	185,867	16,642	377,762	26,780
2009	1,445	321,830	22,256	17,823	2,933	173,898	15,767	329,638	22,291
2010	1,463	300,558	22,346	15,431	2,736	198,490	17,247	359,627	26,875
2011	1,471	277,354	18,157	18,146	3,348	184,559	15,817	363,841	25,776
2012	1,474	292,799	21,529	13,407	2,093	200,618	15,832	312,766	21,763
2013	1,327	289,552	19,233	23,426	3,832	177,710	13,958	341,100	26,154
2014	1,290	301,699	22,353	20,907	4,569	209,525	17,806	357,492	27,215
2015	1,310	258,762	21,075	20,756	7,278	194,915	16,440	357,219	28,348
2016	1,306	260,793	19,638	15,214	2,417	210,335	18,447	354,215	25,953
2017	1,329	213,962	16,487	12,465	2,730	191,550	17,289	347,325	25,018
Long-term average (1993-2016)		344,224	4,862	26,036	905	183,808	3,313	348,612	5,828
Percent change from:		%	<i>P</i>	%	<i>P</i>	%	<i>P</i>	%	<i>P</i>
2016		-17.96	0.9438	-18.07	0.4699	-8.93	0.5326	-1.95	0.9377
LTA		-37.84	1.739E-05	-52.13	0.0000	4.21	0.1399	-0.37	0.8259

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Table 3. Population estimates and standard errors for gadwall, American green-winged teal, blue-winged teal, common mergansers, hooded mergansers, and mute swans from the Atlantic Flyway Breeding Waterfowl Plot Survey, 2003-2014, and percent change from 2013 to 2014 and from the long-term average to 2014.

Year	N	Gadwall		American green-winged teal		Blue-winged teal		Common merganser		Hooded merganser		Mute swan	
		Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
2003	1,495	8,933	3,494	60,173	13,237	33,948	11,397	45,653	8,306	28,878	5,518	14,368	2,999
2004	1,485	11,247	5,272	55,016	13,356	39,344	11,862	49,163	14,923	44,143	11,366	22,706	8,653
2005	1,488	16,062	14,012	36,321	9,097	19,066	6,467	40,420	7,027	43,035	8,921	12,614	3,051
2006	1,455	7,199	3,320	64,402	17,330	8,988	5,556	43,214	12,409	34,355	9,931	24,902	6,825
2007	1,485	6,230	2,321	55,108	11,019	42,505	19,342	49,230	9,710	43,121	9,356	17,064	3,591
2008	1,476	8,438	6,540	43,995	12,720	15,116	8,203	39,515	7,084	31,197	6,878	21,251	7,893
2009	1,445	14,551	6,165	67,003	12,629	23,143	8,881	40,615	7,704	25,019	5,671	21,859	5,816
2010	1,463	3,821	2,681	70,763	22,638	35,834	25,829	43,340	12,490	20,187	4,979	18,243	3,517
2011	1,472	6,078	2,650	61,412	20,495	8,761	3,364	52,232	9,302	28,078	6,185	24,972	8,588
2012	1,474	5,557	3,726	60,028	13,751	13,224	4,325	50,128	9,106	34,092	7,544	30,606	9,728
2013	1,327	13,746	7,923	70,486	21,009	20,744	8,938	55,550	10,064	45,344	8,651	24,468	11,050
2014	1,290	25,361	11,879	48,367	14,975	25,205	8,798	57,219	9,645	42,340	11,806	17,375	3,672
2015	1,310	8,328	3,399	67,063	25,336	11,821	4,043	59,936	16,856	51,567	8,919	13,758	3,057
2016	1,306	6,292	2,411	49,674	11,794	13,846	4,819	53,692	9,360	37,225	6,603	13,685	3,057
2017	1,329	9,832	4,604	40,262	12,511	11,024	6,112	54,496	9,631	38,284	6,918	14,725	5,600
Long-term average (2003-2016)		10,131	1,724	57,844	4,373	22,253	2,995	48,565	2,849	36,327	2,216	19,848	1,726
Percent change from:		%	<i>p</i>	%	<i>p</i>	%	<i>p</i>	%	<i>p</i>	%	<i>p</i>	%	<i>p</i>
2016		56.25	0.5493	-18.95	0.4925	-20.38	0.6165	1.50	0.7111	2.84	0.1078	7.60	0.9808
LTA		-2.96	0.0389	-30.40	0.0788	-50.46	0.0091	12.21	0.0874	5.39	0.7018	-25.81	0.0009

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Table 4. Breeding pair estimates and standard errors for gadwall, American green-winged teal, blue-winged teal, common mergansers, hooded mergansers, and mute swans from the Atlantic Flyway Breeding Waterfowl Plot Survey, 2003-2014, and percent change from 2013 to 2014 and from the long-term average to 2014.

Year	N	Gadwall		American green-winged teal		Blue-winged teal		Common merganser		Hooded merganser		Mute swan	
		Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
2003	1,495	4,466	1,747	12,622	3,510	7,445	2,891	19,561	3,432	12,783	2,555	7,184	1,499
2004	1,485	3,259	1,265	8,690	2,743	16,342	5,024	19,544	6,891	20,158	5,514	9,267	2,538
2005	1,488	1,071	897	7,389	2,106	7,251	2,110	17,369	2,961	20,051	4,130	6,031	1,508
2006	1,455	1,754	839	13,665	4,194	4,494	2,778	17,233	5,117	11,563	2,463	10,184	2,938
2007	1,485	3,115	1,160	13,155	3,851	13,444	6,211	17,620	3,119	18,673	4,069	8,023	1,649
2008	1,476	971	430	12,172	4,315	7,041	4,070	18,520	3,329	14,361	3,322	10,001	3,898
2009	1,445	3,108	1,231	17,022	4,232	11,494	4,439	16,619	3,189	10,804	2,717	9,562	2,487
2010	1,463	630	404	10,308	3,624	5,032	2,271	16,088	5,514	8,081	2,245	9,514	1,846
2011	1,472	2,880	1,320	15,207	7,153	3,637	1,509	23,169	4,062	13,323	3,024	8,524	1,752
2012	1,474	934	430	16,631	4,670	6,496	2,158	20,620	3,528	15,998	3,624	8,481	1,834
2013	1,327	3,078	1,155	15,974	4,238	10,372	4,469	22,886	3,834	18,432	3,506	9,245	4,164
2014	1,290	3,606	1,621	8,791	2,578	10,676	3,963	24,787	4,164	16,851	4,987	8,688	1,836
2015	1,310	2,717	1,100	14,529	4,163	5,911	2,022	25,589	8,056	23,237	4,100	6,564	1,513
2016	1,306	2,481	1,103	11,393	2,877	6,923	2,409	23,539	4,198	16,273	2,964	6,318	1,474
2017	1,329	3,033	1,885	12,747	4,938	5,512	3,056	26,153	4,685	14,289	2,767	7,362	2,800
Long-term average (2003-2016)		2,434	300	12,682	1,082	8,325	954	20,225	1,235	15,756	972	8,399	729
Percent change from:		%	<i>p</i>	%	<i>p</i>	%	<i>p</i>	%	<i>p</i>	%	<i>p</i>	%	<i>p</i>
2016		22.24	0.8300	11.88	0.4513	-20.38	0.6165	11.10	0.7991	-12.19	0.0894	16.53	0.8706
LTA		24.62	0.8800	0.51	0.2629	-33.79	0.1676	29.31	0.0107	-9.31	0.6151	-12.34	0.0021

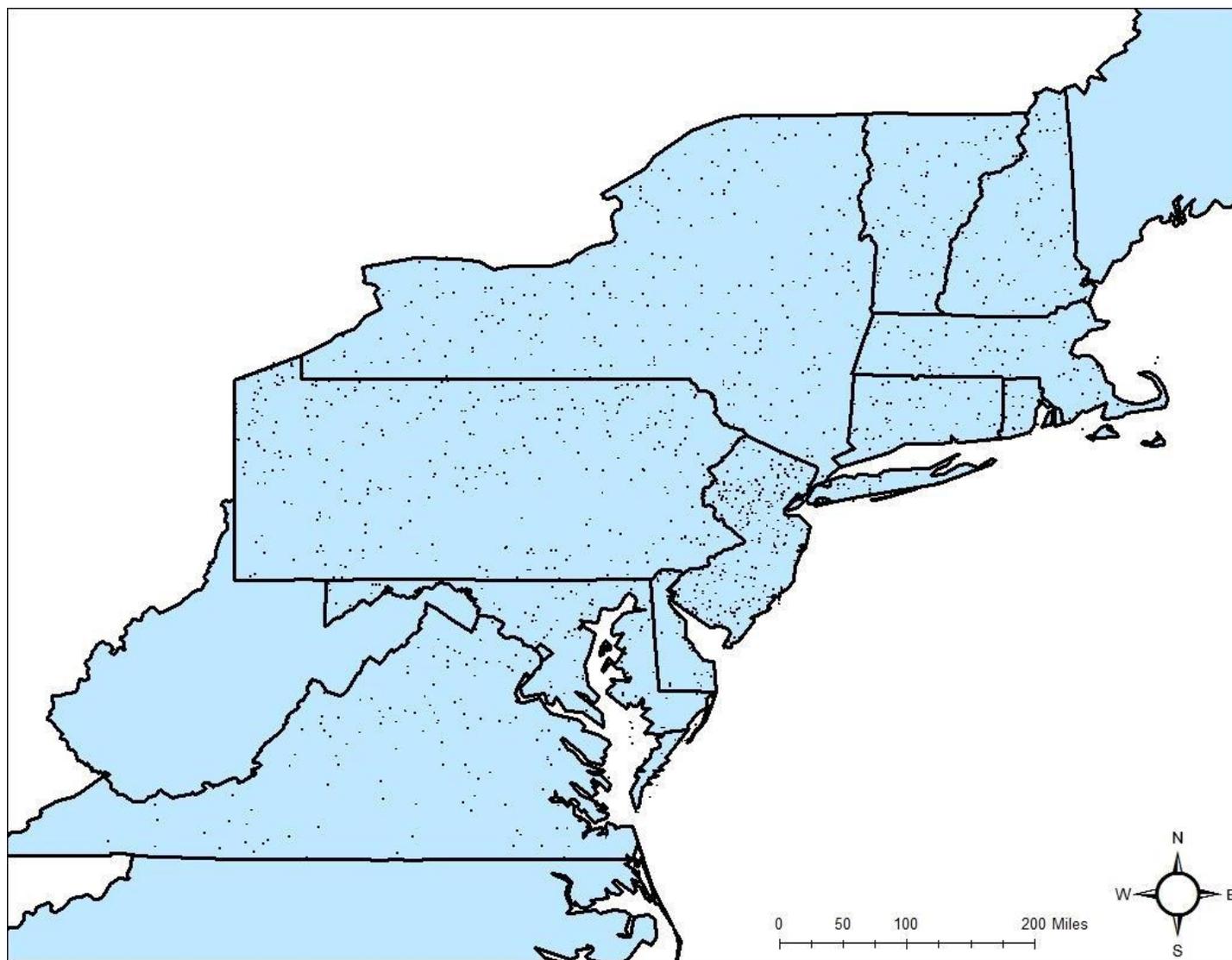


Figure 1: Map of 1-km² plots in the Atlantic Flyway breeding plot survey, Virginia to New Hampshire, distributed across Breeding Bird Strata relative to the amount of a stratum in a state.

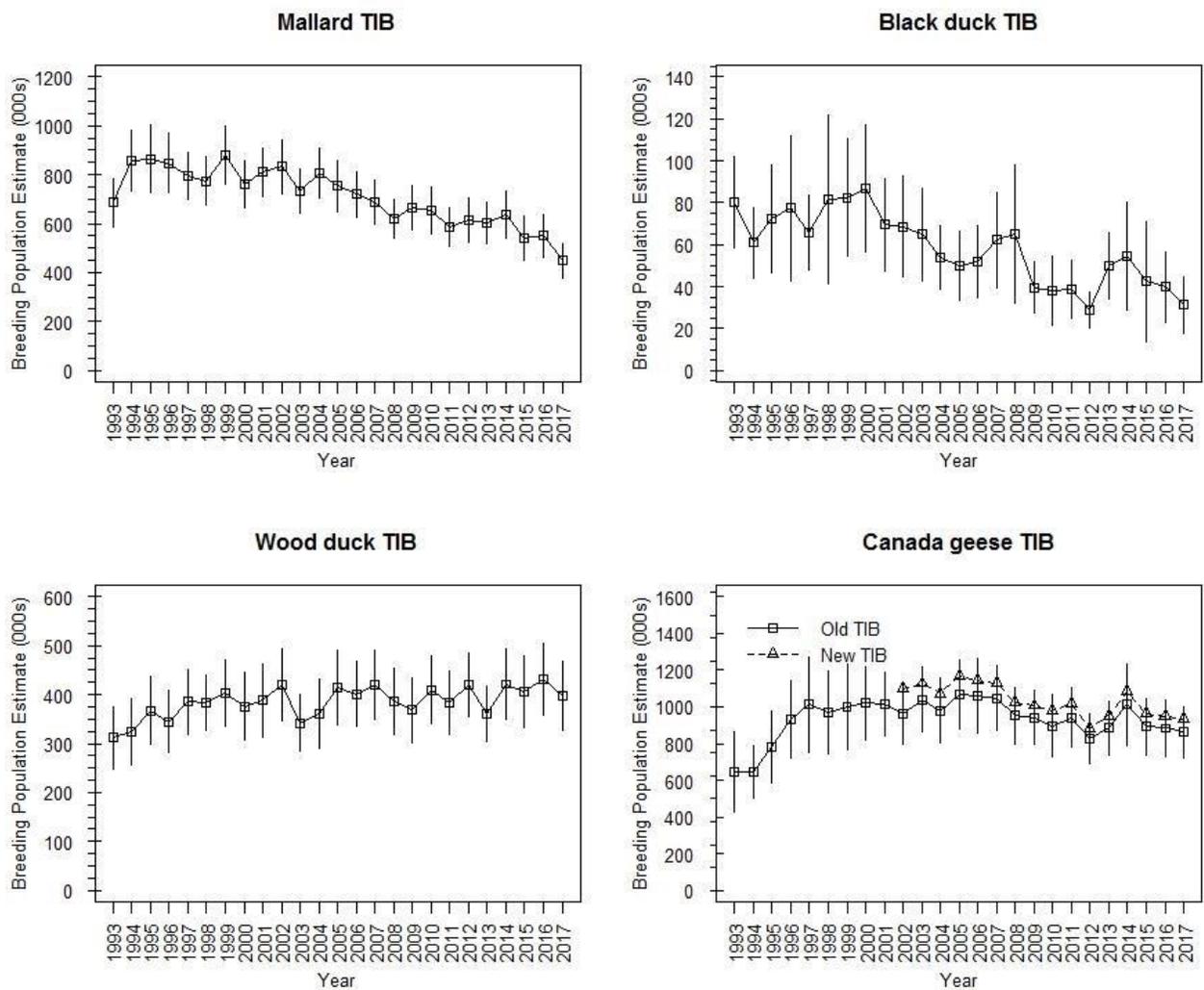
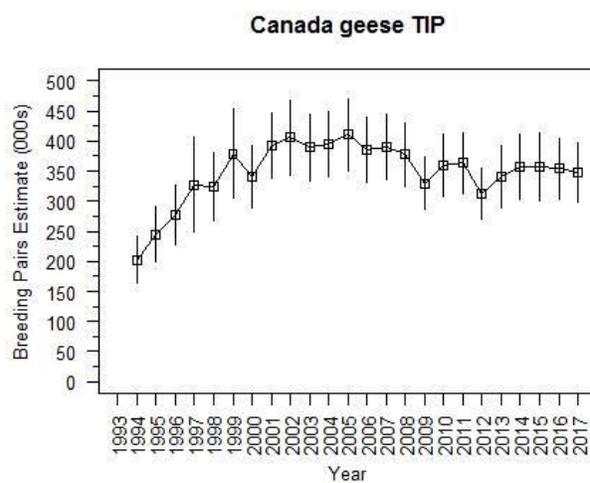
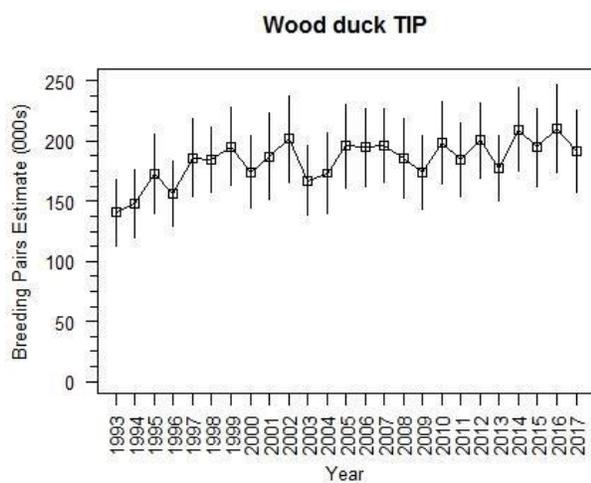
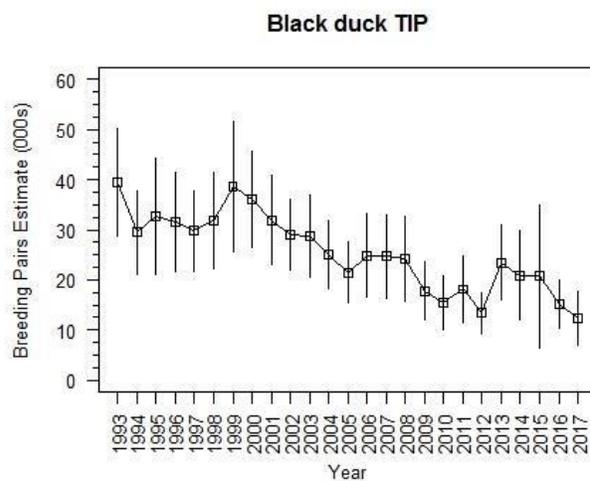
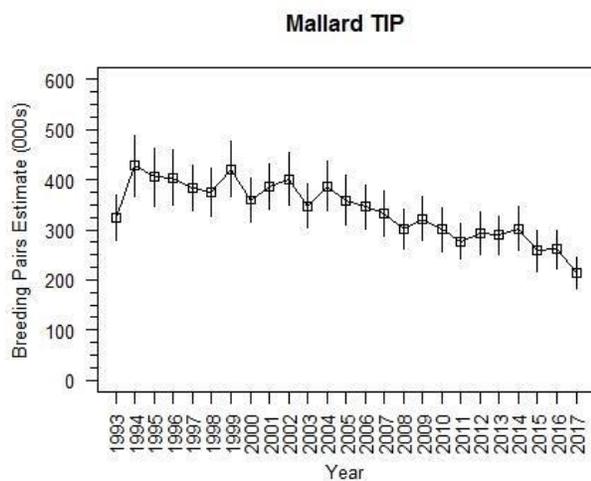


Figure 2: Population estimates (total indicated birds [TIB]) and 95% confidence intervals from the Atlantic Flyway breeding waterfowl plot survey for mallards, American black ducks, wood ducks, and Canada geese, 1993-2017.



Breeding pair estimates (total indicated pairs [TIP]) and 95% confidence intervals from the Atlantic Flyway breeding waterfowl plot survey for mallards, American black ducks, wood ducks and Canada geese, 1993-2017.