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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; Pennsylvania Department of Transportation, Bureau of Aviation

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 2012-13 were 60 days with a daily bag limit of 6 birds, similar to those offered in 2011-12. The U.S. Fish and Wildlife Service Harvest Information Program estimated active duck and goose hunters in Pennsylvania during 2012-13 numbered 21,300 and 26,300, down 25% and 27% respectively from the 1999 to 2012 averages. Pennsylvania's total duck harvest estimate was 91,800, down 40% from average. Pennsylvania's 2012-13 estimated Canada goose harvest was 104,000, down 41% from average. Canada goose harvest timing was 26% during September and 74% during the regular season. Pennsylvania's estimated regular season snow goose harvest of 11,200 in 2012-13 was up 39% from average. Additionally, a minimum of 3,162 snow geese were harvested during the conservation season. During the Pennsylvania portion of the 2013 AF Midwinter Waterfowl Survey conducted in January, we observed 58,474 waterfowl, which was 12% higher than the 2012 total but 15% below the 2003-2012 average. Among major wintering species, no snow geese were observed for the first time since 2001; mallards, black ducks, and Canada geese increased from 2012 but remained below their 10-year averages; tundra swans increased from 2012 and were well above average; and mergansers were slightly below both their 2012 level and 2003-2012 average. At the flyway level, with the exception of mallards which were down 24% from 2012 and 19% below the 2003-2012 average, major wintering species were within 15% of both their 2012 counts and their respective 10-year flyway averages. In the Pennsylvania portion of the 2013 AF Breeding Waterfowl Survey, mallard pairs (69,399) were down 24% from

the 1993-2012 average. There were 59,561 wood duck breeding pairs estimated in 2012 which was near average. Estimates of total hooded mergansers (10,732) and common merganser (28,002) were above average. The Canada goose breeding pair (96,383) and total spring population (279,212) were near average. For the Northeast U.S. survey area, total population estimate for mallards (604,157) was significantly below average, while the wood duck estimate (361,156) and American black duck (49,735) were similar to average. The spring breeding population estimate for resident population Canada geese (951,936) was similar to average. Habitat conditions in the Northeast U.S. were generally favorable for nesting. Waterfowl populations in the Eastern survey area of Canada were near or above average and habitat conditions were generally rated as good and should favor production. Breeding duck populations on the traditional survey area in the mid-continent of North America were significantly above (33%) the long-term average. Pond counts and habitat conditions in the U.S. and Canadian prairies were above average. Recruitment from this important production region is expected to be above average in 2013. Spring 2013 breeding production is below average for Atlantic Population and above average for Southern James Bay Population Canada geese. For greater snow geese, good production and an average fall flight are expected.

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 were estimated from the U.S. Fish and Wildlife Service (USFWS) Harvest Information Program (HIP) (Raftovich and Wilkins 2013). The species, age, sex, geographical, and temporal distribution of the total harvest were 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 2013 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 sent an e-mail reminder on 6 June 2013 to those permit holders: a) who had not responded within the initial 30-day reporting period and b) for whom we had an e-mail address on file. Flyway-level conservation season data was obtained from the Snow Goose, Brant, and Swan Committee of the Atlantic Flyway Migratory Game Bird Technical Section.

Estimates of numbers of wintering waterfowl are obtained from the Midwinter Waterfowl Survey (MWS). States in the Atlantic Flyway (AF) conduct this survey, primarily from aircraft, each January on major coastal and inland waterfowl wintering areas. These results guide harvest management for select species (e.g. tundra swans and Atlantic brant) and provide information on population status, distribution, and habitats of all waterfowl species during this portion of the annual cycle. The current (2002-present) Pennsylvania “MWS-Lite” consists of 11 survey segments covered by the Pennsylvania Game Commission (PGC) plus 1 segment in the middle Delaware River Valley (river proper plus some inland areas on both Pennsylvania and New Jersey sides) covered by the New Jersey Division of Fish and Wildlife (NJDFW). For the purposes of state-level summary reports, one-half of each species total from the NJDFW survey is used as an estimate for the Pennsylvania portion of this segment. These procedures have now been in place for longer than the full 10-year period typically used for long-term comparisons, and they also appear to provide data comparable with the pre-2002 methodology, in which both the PGC and NJDFW surveyed portions of the Delaware River proper (with some overlap), and inland areas only within their respective states. Current procedures result in superficial discrepancies between state- and flyway-level reports in some species totals for Pennsylvania because, while both contain identical data from the 11 PGC segments, the Delaware Valley data included in state-level reports is recorded under New Jersey at the flyway level. Data for all aerially surveyed MWS segments in Pennsylvania is recorded using a USFWS voice/Global Positioning System (GPS) software program. This program links voice recordings of waterfowl observations to the GPS position of the aircraft. Transcribed species totals from this program can be input into the USFWS database and the geo-referenced data on waterfowl concentrations provides important information for habitat conservation programs. In the 2011 MWS, some data was lost due to computer problems during the aerial portions. This data loss produces a slight negative bias in the calculation of some 10-year species averages.

Information on breeding population size of mallards, black ducks, wood ducks, Canada geese, and other waterfowl was obtained from the 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 PGC 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, 118 plots were not field checked because they did not contain habitat for breeding waterfowl. Surveys were conducted from 15 April to 2 May 2013. 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 (1993-2012) averages. Additional breeding survey data for areas not covered by the AF Breeding Waterfowl Plot Survey was provided by the USFWS (2013).

RESULTS

Hunter Activity and Harvest

As in 2011-12, duck season length in 2012-13 was 60 days with outside framework dates of the Saturday nearest to 24 September and the last Sunday in January. Similar to last year, duck seasons selected for Pennsylvania included split seasons in 2 of 4 zones with the first split opening in October and the second split closing in early to mid-January; and non-split seasons opening in October and closing in December in the other 2 zones (Appendix 1). The aggregate daily duck bag limit remained at 6 birds. The daily bag limit for individual species regulations remained the same as 2011-12 except scaup daily bag limit was increased to 4 per day.

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 Appendix 1. An early Canada goose season (1-25 September) was again held statewide, 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, 16 in possession statewide except the SJB zone (3 per day) and the areas surrounding Pymatuning WMA and Middle Creek WMA (see Appendix 1; daily bag limit of 1 bird in these areas to limit harvest on the resident flocks at each WMA). Regular Canada goose season lengths were increased from 45 to 50 days in the AP Zone and from 70 to 78 days in the SJB zone, with the SJB zone framework opening date moved from the second Saturday in October to the first Saturday in October. Season length in the RP zone, and bag limits in all 3 zones, remained the same as in 2011-12.

The estimates (Raftovich and Wilkins 2013) of active duck and goose hunters in Pennsylvania from HIP were 21,300 and 26,300 respectively and were second highest and highest, respectively in the AF (Table 1). However, these estimates were 25% and 27% below the 1999-2012 average and continue recent declines in participation among Pennsylvania waterfowlers. The HIP estimate of days hunted for ducks in 2012-13 was down 38% from average while the number of goose hunter days was down 39% 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 HIP estimate of total Pennsylvania duck harvest (91,800) was down 40% from average. HIP Canada goose harvest estimate in Pennsylvania for 2012-13 was 104,000 and was 41% below average. Pennsylvania ranked third in the AF for total Canada goose harvest. State-level HIP harvest estimates provided to date have shown higher year-to-year variability than comparable previous federal survey estimates. Additional analysis and accumulation of HIP data is needed to assess the accuracy and precision of the various surveys for estimating state waterfowl harvests. The September season continues to account for a substantial proportion (26%) of the Canada goose harvest while the regular season (early October to late February) harvest accounted for 74% of the total. Estimated snow goose harvest during the regular season in Pennsylvania was 11,200 birds, up 39% from average. This increase was unexpected based upon field reports during the regular season. This may be related to an average number of juveniles in the fall flight as well as the relatively mild fall and winter weather allowing a higher proportion of the AF wintering snow goose population to remain in the commonwealth through hunting seasons.

We issued 2,606 permits to hunters to participate in the 2013 Snow Goose Conservation Season. We received 698 reports (26.8% initial reporting rate) by 28 May. Approximately 34% of initial non-respondents did not have an e-mail address in our license database and thus were not sent a reminder. An additional 283 reports were received following distribution of the e-mail reminder for a total of 981 harvest reports (37.6% overall reporting rate).

Of the 981 reports received, 403 (41.1%) indicated they did not hunt at all during the conservation season. Of the 578 individuals that indicated they hunted during the conservation season, their total retrieved harvest was 3,162 (Table 2). Total hunter days were 2,051 and the number of geese killed per hunter day was 1.54. Among additional hunting methods, electronic calls were used for 32% of the snow geese taken (similar to the 2009-12 average) and electronic decoys were used for 22% of geese taken (31% in 2012), while extended hunting hours had less effect, with 14% of the total geese taken after sunset (2009-12 average was 11%). (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).

Respondents to the e-mail reminder accounted for 29% of total respondents, 20% of hunter days, and 17% of harvest. Although their per capita hunting activity and harvests were lower than those of initial respondents, they still accounted for a substantial amount of effort and harvest. Previously, we theorized that most non-respondents were non-participants, but the 2013 results suggest this is not the case and therefore that we have been underestimating participation and harvest from 2010-present. We have not attempted to introduce a correction factor, so the data presented herein reflects only actual reported activity and harvest (i.e., minimum estimates) and may not be completely comparable between years. We will investigate options to improve our harvest estimates or revise previous estimates as we prepare for the 2014 conservation season.

At the flyway level, the estimated harvest for the 7 states (Delaware, Maryland, New Jersey, New York, Pennsylvania, Virginia and Vermont) participating in the 2013 conservation season was 55,903, with an additional 2,778 birds shot and lost. The retrieved harvest was the highest since initiation of the conservation order and 45% above the 2009-2012 average. Days hunted (23,014) was also the highest recorded, and 67% above the 2009-2012 average. The conservation season in the U.S. has been reasonably successful in providing additional harvest of greater snow geese (for example, estimates of average total snow goose harvest (HIP regular season estimate + PGC conservation season minimum estimate) in Pennsylvania for the first 5 years with a conservation season are 77% higher than those for the 5 years prior to initiation of the conservation season), and this overabundant population appears to be stabilizing. However, overall harvest rate may be insufficient to achieve reductions needed to reach management plan goals.

The five most commonly harvested duck and merganser species in Pennsylvania were mallard, wood duck, American black duck, American green-winged teal, and bufflehead (Table 3). The 2012-13 harvests of all major duck and merganser species (except bufflehead and lesser scaup) were below the 1999-2012 average: mallard (-51%), wood duck (-40%), American black duck (-35%), American green-winged teal (-44%), bufflehead (+52%), lesser scaup (+25%), greater scaup (-68%), ring-necked duck (-46%), gadwall (-20%), common merganser (-1%) and hooded merganser (-33%). The below average harvest was most likely related to declines in hunter

participation but also the relatively mild weather conditions experienced during the fall and winter 2012-13.

The number of juveniles per adult in the 2012-13 AF harvest (Table 4) was near the 1996-2012 average for mallard (10%), wood duck (-8%), gadwall (-3%), American wigeon (-6%) and Canada goose (-5%). Above average were black duck (25%), green-winged teal (23%), bufflehead (29%), common merganser (11%) and ring-necked duck (17%). Below average were hooded merganser (-38%), lesser scaup (-28%), greater scaup (-27%) and snow goose (-62%).

Midwinter Waterfowl Survey

The Pennsylvania portion of the 2013 MWS was conducted between 7 January and 25 January. Survey methods were similar to those used in past years, with fixed-wing aerial surveys (in cooperation with the Pennsylvania Department of Transportation, Bureau of Aviation) supplemented by ground surveys at Middle Creek WMA, Conneaut Lake, Presque Isle and Presque Isle Bay. During the survey period, most lakes were 10-50% frozen in southern Pennsylvania and 50-90% frozen in the northern tier; Lake Erie (except for Presque Isle Bay which was about 25% frozen) and major rivers were largely ice-free. For most species, observability and degree of concentration on surveyed areas were probably near-normal.

We observed 58,474 waterfowl in Pennsylvania (Table 5). This included 4,151 dabbling ducks (mostly mallards and black ducks), 5,949 diving ducks, 1,232 mergansers, 41,048 geese (all Canada geese), and 1,759 swans (97% tundra swans and 3% mute swans). The overall total was 12% higher than the 2012 total, but 15% below the 2003-12 average. For the first time since 2001, no snow geese were observed during Pennsylvania's MWS. Snow goose winter distribution and movements are highly responsive to weather-related impacts on accessibility of roosting and feeding sites, and therefore numbers observed in individual states can fluctuate dramatically without necessarily being a reflection of overall population status. Among the other 5 common wintering species, Canada geese, mallards, and black ducks all increased from 2012 but remained slightly below their respective 10-year averages; tundra swans increased from 2012 and were well above their 10-year average; while merganser numbers were slightly below both 2012 and the 2003-2012 average (Table 5). From a geographic standpoint, totals were notably high in Zone 1 (northwestern Pennsylvania) with the number of waterfowl observed up 81% from 2012, and 82% above average. Abundance and diversity of waterfowl at Presque Isle in particular were as high as long-term observers could remember. Conversely, totals in Zones 2 (Susquehanna River) and 3 (southeastern Pennsylvania) were down 26% and 10%, respectively, from 2012, and fell below their respective 10-year zone averages by 47% and 36%.

For the entire AF, 2,867,328 waterfowl (including coots) were observed in the MWS (Appendix 2). Recent flyway grand totals are not directly comparable to results from earlier years, primarily because the MWS has not been conducted in Florida since 2004. However, many of the individual species numbers remain relatively comparable because only negligible proportions of their flyway totals have historically been observed in Florida. Flyway mallard and black duck numbers decreased 24% and 7%, respectively, from 2012; mallards were 19% below their 2003-2013 average while black ducks remained 3% above their 10-year average. Canada geese, snow geese, and tundra swans all increased from 2012 (by 12%, 11%, and 13%, respectively), with Canada geese 2% above and tundra swans 11% above their respective 10-year averages and snow

geese 5% below their 2003-2012 average. Flyway MWS trends for these 5 major species are as follows: mallards, relatively stable from 1950's through 1980's with a slow but steady decline ongoing since the early 1990's; black ducks, substantial decline from 1950's to 1980's, but relatively stable since that time; Canada geese, generally increasing from 1950's to a peak in the early 2000's, with a slight decrease since; snow geese, steady increase from 1950's to early 2000's with some stabilization recently; and tundra swans, steady increase from 1950's through 1980's and relatively stable since. We will continue to monitor these trends in conjunction with results from breeding ground surveys. In addition to population trend information provided by the MWS, this survey has documented a general northward shift in the wintering distribution of many waterfowl species over recent decades.

Breeding Waterfowl Surveys

Habitat conditions were average across most of Pennsylvania in early spring despite cooler than average March temperatures. Vegetation growth during the survey period was average. First hatches of Canada goose and mallard broods were average. Precipitation was below average in May which may have resulted in below average habitat for broods and reneating waterfowl. We expect average production in 2013 from the birds that attempted to nest.

Results from the Pennsylvania portion of the AF Breeding Waterfowl Plot Survey are presented in Tables 6 and 7. 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 7 summarizes complete 2013 survey results with comparison to the 1993 to 2012 average for ducks, mergansers and Canada goose pairs.

The number of mallard breeding pairs (69,399) was numerically 24% below (not statistically significant) the average of 91,191 pairs. This is consistent with recent trends in other indices of statewide mallard abundance (Pennsylvania Breeding Bird Atlas, North American Breeding Bird Survey and the number of pre-season-banded mallards). Strata 13 and 10 in southeastern Pennsylvania had the highest density of breeding mallards (0.91 and 0.85 pairs/km² respectively). American black ducks were observed in 4 of the 6 strata during the survey and resulted in a statewide estimate of 2,137 pairs. While breeding black ducks have been observed at very low densities since the survey was initiated in 1989, there is evidence of declining statewide abundance and distribution over the past 15 years. 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 59,561 wood duck breeding pairs estimated in 2013, which was near the average of 52,487 pairs. Trends in wood duck abundance have indicated stable to slightly increasing populations across all years of the survey. Wood duck densities were highest in northwestern and northeastern Pennsylvania with 1.13 and 0.98 pairs/km² respectively. The estimate of total blue-winged teal (11,072) was 58% above average in 2013, while American green-winged teal numbers (6,277) were 38% above average. Teal abundance in this survey can vary dramatically from year to year due to weather related impacts on teal migration. Teal migration appeared average in 2013. We don't believe these estimates are indicative of true breeding populations of teal in Pennsylvania as many migrating teal are encountered during the survey period. Estimates of total hooded

mergansers (10,732) and common mergansers (28,002) were 190% and 75% above average respectively. Populations of both breeding merganser species have increased significantly since 1993 and are confirmed by Breeding Bird Atlas results.

The 2013 Pennsylvania Canada goose breeding pairs was estimated at 96,383 which is statistically similar to the average of 91,628. Pair densities were highest in the southwest (1.95 pairs/km²) and southeast (1.6 pairs/km²) portions of the Commonwealth. The 2013 total population estimate of 279,212 was statistically similar to the recent 10-year average of 265,905 geese. As expected, the highest densities of total geese were observed in southeastern (5.5 geese/km²), southwestern and northwestern (3.9 geese/km² respectively) 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 efforts 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 2013 (Klimstra 2013, Appendix 3) included a mallard total population estimate of 604,157, which was 19% below average (statistically significant). The American black duck estimate (49,735) was down 20% (not statistically significant) from average. There has been a declining trend in mallard and black duck abundance over the last 13 years of this survey. Wood duck estimate (361,156) was similar to last year and the average. Wood duck trends appear stable over the long-term. There were generally favorable weather and habitat conditions for nesting ducks in the northeast U.S. which should result in average production for 2013. In the eastern surveyed areas of Canada and Maine (USFWS 2013), aircraft problems significantly changed normal survey protocol. Estimates provided for mallards, American black duck, green-winged teal, ring-necked ducks, goldeneye and mergansers were similar or above 1990-2012 averages. Habitat conditions were favorable overall.

The number of ducks counted in the traditional mid-continent survey area in May 2013 (USFWS 2013) was 45.6 million. This was 33% above the 1955-2012 long-term average (LTA) of 34.3 million total ducks. Mallard abundance was 10.4 million birds, 36% above the LTA. Blue-winged teal (7.7 million birds, 60% above LTA), green-winged teal (3.05 million, 51% above LTA), gadwall (3.35 million, 80% above LTA), northern shovelers (4.75 million, 96% above LTA), redheads (1.2 million, 76% above LTA), and canvasbacks (0.79 million, 37% above LTA), were all above their LTA in 2013. Estimated abundance of combined greater and lesser scaup (4.17 million) and northern pintails (3.34 million) were each 17% below the respective LTA. American wigeon (2.64 million) were similar to the LTA. Habitat conditions during the 2013 survey were characterized by below average moisture across the Western Dakotas and Eastern Montana, but relatively abundant pond counts in the Eastern Dakotas and much of prairie Canada. Spring thaw was significantly later than average which caused delayed migration, especially in the Canadian parklands and boreal region. The total pond estimate (prairie Canada and U.S. combined) was 6.89 million which was 35% above the LTA of 5.1 million ponds and should favor production, particularly in prairie Canada.

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. Spring temperatures in 2013 were average along Ungava Bay and below average along Hudson Bay. The

aforementioned aircraft problems in Eastern Canada canceled the spring AP population survey. August leg banding studies indicated good breeding productivity along Ungava Bay but poor along Hudson Bay portions of the Ungava Peninsula. Southern James Bay Population Canada geese nest on Akimiski Island, Nunavut, and the James Bay lowlands of Ontario. 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). The total spring population index of 64,100 SJBP Canada geese was 33% below the 1993-2012 average (Brook and Hughes 2013). Nesting studies on Akimiski Island (Bennett et al. 2013) indicated good nesting conditions and breeding effort in James Bay resulted in above average production (Hagey et al. 2013). An average fall flight is expected. The Atlantic Flyway Resident Population (AFRP) breeds locally throughout the AF extending into southern Ontario and Québec. The AFRP overlaps both SJBP and AP geese during the fall and winter periods. The spring breeding population estimate was 951,936, similar to the LTA (Klimstra 2013). Field reports from the AFRP range indicate average to above average gosling production. Another large fall flight, with many juveniles, is expected for the 2013-14 hunting season. Greater snow geese nest principally on Bylot, Axel Heiberg, Ellesmere, and Baffin Islands in the Canadian Arctic. The 2013 spring population estimate of 921,000 was similar to recent average. Breeding conditions for greater snow geese were rated average on Bylot Island (USFWS 2013). Nesting phenology was near normal, clutch sizes were above normal, and nesting success was above average. Therefore, good production and an average fall flight are expected for greater snow geese.

RECOMMENDATION

Continue waterfowl breeding and wintering survey efforts during Fiscal Year 2013-14 to provide annual information on waterfowl population status.

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Table 1. 2012-13 waterfowl hunting season activity and harvest in Pennsylvania and percentage change as estimated by USFWS Harvest Information Program Survey (HIP).

	2012-13 ^a	2011-12	% Change from 2011	99-12 Average	% Change from Avg.
Ducks					
HIP Hunters	21,300	24,200	-12	28,277	-25
HIP Hunter Days	92,100	109,400	-16	147,769	-38
HIP Harvest	91,800	81,500	13	153,554	-40
Canada goose					
HIP Hunters	26,300	27,900	-6	36,262	-27
HIP Hunter Days	119,500	130,500	-8	197,408	-39
HIP Harvest	104,000	75,100	38	174,849	-41
Snow goose					
HIP Harvest	11,200	21,738	-48	8,046	39

^a Preliminary.

Table 2. Number of permits issued, reports received, hunter days and number of geese taken by hunting method during the 2009 to 2013 Light Goose Conservation Season in Pennsylvania.

Year	Permits Issued	No. Hunted	% Hunted	Days Hunted	Geese Bagged	Geese Lost	After Sunset	W/ e^a calls	W/ e^a decoys
2009 ^b	3,276	1,724	53	3,840	5,903	317	736	1,522	- ^e
2010 ^c	3,107	668	21	2,409	2,985	141	330	1,101	- ^e
2011 ^c	3,401	900	26	2,959	5,197	259	475	1,845	Unknown ^f
2012 ^c	2,649	568	21	2,123	3,420	134	542	1,356	1,091
2013 ^d	2,606	578	22	2,051	3,162	162	457	1,049	739

^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 38% reporting rate by permit holders.

^e Method prohibited by state regulation.

^f No data collected on this method during 2011 conservation season.

Table 3. USFWS HIP harvest estimates for major duck and merganser species in Pennsylvania, 1999-2012.

Species	2012-13^a	2011-12	% Change from 2011	99-12 Average	% Change from Avg.
Mallard	37,900	40,900	-7	76,731	-51
Wood duck	22,100	16,400	35	36,685	-40
Black duck	5,500	4,700	17	8,446	-35
Green-winged teal	4,100	4,000	2	7,354	-44
Bufflehead	6,600	3,700	78	4,331	52
Common merganser	3,300	1,300	154	3,334	-1
Hooded merganser	1,900	1,800	6	2,831	-33
Gadwall	1,700	1,400	21	2,119	-20
Lesser scaup	2,200	1,500	47	1,767	25
Mallard/black Hybrid	700	1,000	-30	1,654	-58
Ring-necked duck	600	1,100	-45	1,104	-46
American wigeon	700	300	133	1,049	-33
Greater scaup	300	600	-50	923	-68

^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 1999-2012 hunting seasons in the Atlantic Flyway.

Species	2012-13^a	2011-12	% Change from 2011	99-12 Average	% Change from Avg.
Mallard	1.38	1.24	11	1.25	10
Wood duck	1.09	0.9	21	1.19	-8
Black duck	1.44	1.23	17	1.15	25
Green-winged teal	2.05	1.97	4	1.67	23
Bufflehead	1.02	0.97	5	0.79	29
Common merganser	1.39	1.62	-14	1.25	11
Hooded merganser	0.52	0.66	-21	0.84	-38
Gadwall	1.13	2.61	-57	1.16	-3
Lesser scaup	0.46	1.18	-61	0.64	-28
Ring-necked duck	1.53	1.54	-1	1.3	17
American wigeon	0.99	1.43	-31	1.05	-6
Greater scaup	0.79	0.86	-8	1.08	-27
Greater snow goose	0.33	0.77	-57	0.88	-62
Canada goose	0.46	0.34	35	0.48	-5

^a Preliminary.

Table 5. Number of waterfowl recorded in zones 1-3 during Pennsylvania's Midwinter Waterfowl Survey, 2003-2013.

Species	2013	2012	2011 ^a	2010	2009	2008	2007	2006	2005	2004	2003	2003-2012
												Avg.
Canada goose	41,048	34,863	41,495	51,321	54,267	38,602	42,456	51,844	41,839	48,454	77,224	48,237
Mallard	2,319	1,054	2,131	1,098	2,544	2,992	2,613	2,676	2,453	4,460	3,082	2,510
Black duck	1,496	798	1,452	1,131	1,448	1,770	906	1,865	2,763	2,079	1,775	1,599
Gadwall	213	18	11	3	0	2	29	5	13	18	0	10
Wigeon	10	0	0	1	0	1	0	1	0	0	0	0
Green-winged teal	1	0	0	0	3	2	13	12	13	0	2	5
Blue-winged teal	0	0	0	0	0	0	0	0	0	0	0	0
Shoveler	40	3	30	0	12	5	32	1	0	25	0	11
Pintail	72	2	21	0	5	6	0	10	1	24	0	7
Wood duck	0	0	0	1	0	0	0	0	0	0	0	0
Redhead	1,005	25	11	69	0	0	0	0	0	10	0	12
Canvasback	185	655	153	5	0	1	0	0	91	10	0	92
Scaup	4,095	410	634	9	0	290	80	302	2,379	260	0	436
Ring-necked duck	85	60	6	4	0	32	0	0	0	0	11	11
Goldeneye	65	293	42	21	0	26	29	159	16	116	70	77
Bufflehead	379	217	24	10	25	67	252	66	13	204	237	112
Ruddy duck	135	25	6	0	0	0	9	0	0	6	1	5
Long-tailed duck	0	0	0	0	0	0	0	0	0	0	0	0
Scoters	0	5	0	0	0	0	0	0	0	0	0	1
Mergansers	1,232	1,390	229	453	704	2,360	1,988	1,009	3,993	759	992	1,388
Unidentified ducks	25	8	160	21	9	29	219	31	12	0	25	51
Brant	0	0	0	0	0	0	0	0	0	0	0	0
Snow goose	0	9,301	361	411	12,899	13,902	32,096	10,314	25,909	11,100	9,602	12,590
White-fronted goose	0	0	0	0	0	0	0	0	0	0	0	0
Tundra swan	1,711	691	316	89	783	1,178	363	2,464	786	1,261	548	848
Mute swan	48	51	21	48	36	23	23	23	22	33	27	31
Unidentified swans	0	0	0	9	0	0	0	0	2	0	0	1
Coot	4,310	2,270	222	105	0	100	552	200	75	25	50	360
Totals	58,474	52,139	47,325	54,809	72,735	61,388	81,660	70,982	80,380	68,844	93,646	68,391

^a 2011 totals reduced due to data loss from aerial surveys, with effects varying in significance by species.

Table 6. Estimates of waterfowl breeding pairs and standard error by physiographic strata in Pennsylvania, 2013.

Strata	Mallard		Black duck		Wood duck		Canada goose		Canada goose	
	Pairs	SE	Pairs	SE	Pairs	SE	Pairs	SE	Total	SE
10	11,277	2,966	806	594	4,565	1,558	21,212	4,796	72,498	20,329
13	28,562	6,515	697	696	13,236	4,395	9,056	3,537	22,293	8,884
22	8,657	4,127	0	0	9,323	3,358	25,970	11,112	51,940	22,225
241	3,110	1,535	424	313	11,168	2,374	12,158	2,984	39,160	14,004
242	7,788	2,640	0	0	8,495	2,712	18,407	10,155	59,469	35,833
243	10,008	2,864	213	212	12,776	3,155	9,582	2,478	33,857	9,308
2013 PA Total	69,399	9,263	2,137	990	59,561	7,481	96,383	16,648	279,212	50,526
1993 –2012 avg.	91,191	4,526	845	166	52,487	2,150	91,628	3,509	265,905 ^a	8,573
% Change	- 24 %		153 %		13 %		5 %		5 %	

^a 2003 to 2012, 10-year average.

Table 7. Pennsylvania waterfowl population estimates from 2004 to 2013 and the 1993-2012 averages.

Species Estimate	93-12										
	2013	average	2012	2011	2010	2009	2008	2007	2006	2005	2004
Mallard pairs	69,399	91,191	60,496	61,790	78,677	92,509	65,739	90,237	80,667	95,685	84,806
Mallard total	139,935	188,516	127,633	132,903	161,675	187,697	131,477	181,504	174,374	197,975	177,715
Black duck pairs	2,137	845	-	426	269	639	269	1,716	-	-	-
Black duck total	4,277	1,689	-	852	537	1,278	537	3,433	-	-	-
Wood duck pairs	59,561	52,487	67,927	51,787	56,265	63,118	42,791	56,671	61,014	60,536	47,368
Wood duck total	121,467	110,985	141,258	107,045	114,797	128,060	87,924	127,847	128,009	132,552	94,736
Canada goose pairs	96,383	91,628	83,897	100,802	88,845	88,617	100,174	100,741	88,478	115,291	122,857
Canada goose total	279,212 ^a	265,905 ^b	219,609 ^a	245,061 ^a	231,780 ^a	289,879 ^a	246,499 ^a	255,924 ^a	245,689 ^a	311,171 ^a	338,230 ^a
Bl-wing teal total	11,072	6,991	3,027	2,970	4,186	7,814	1,840	12,650	1,979	2,746	8,041
Gr-wing teal total	6,277	4,558	7,526	3,869	2,063	5,569	1,979	5,064	7,172	7,089	9,138
Hooded merg. total	10,732	3,696	5,695	4,646	2,620	2,975	3,031	2,972	7,646	9,625	1,272
Common merg. total	28,002	15,959	24,386	25,100	14,053	12,377	18,773	17,429	15,167	12,916	14,671
Mute swan total	1,244	1,336	707	1,417	2,268	1,276	3,921	6,064	2,102	2,245	2,528

- No black ducks observed.

^a Total estimate calculated using new formula 2x(pairs + singles) + groups.

^b Average from 2003 to 2012 using new formula for total.

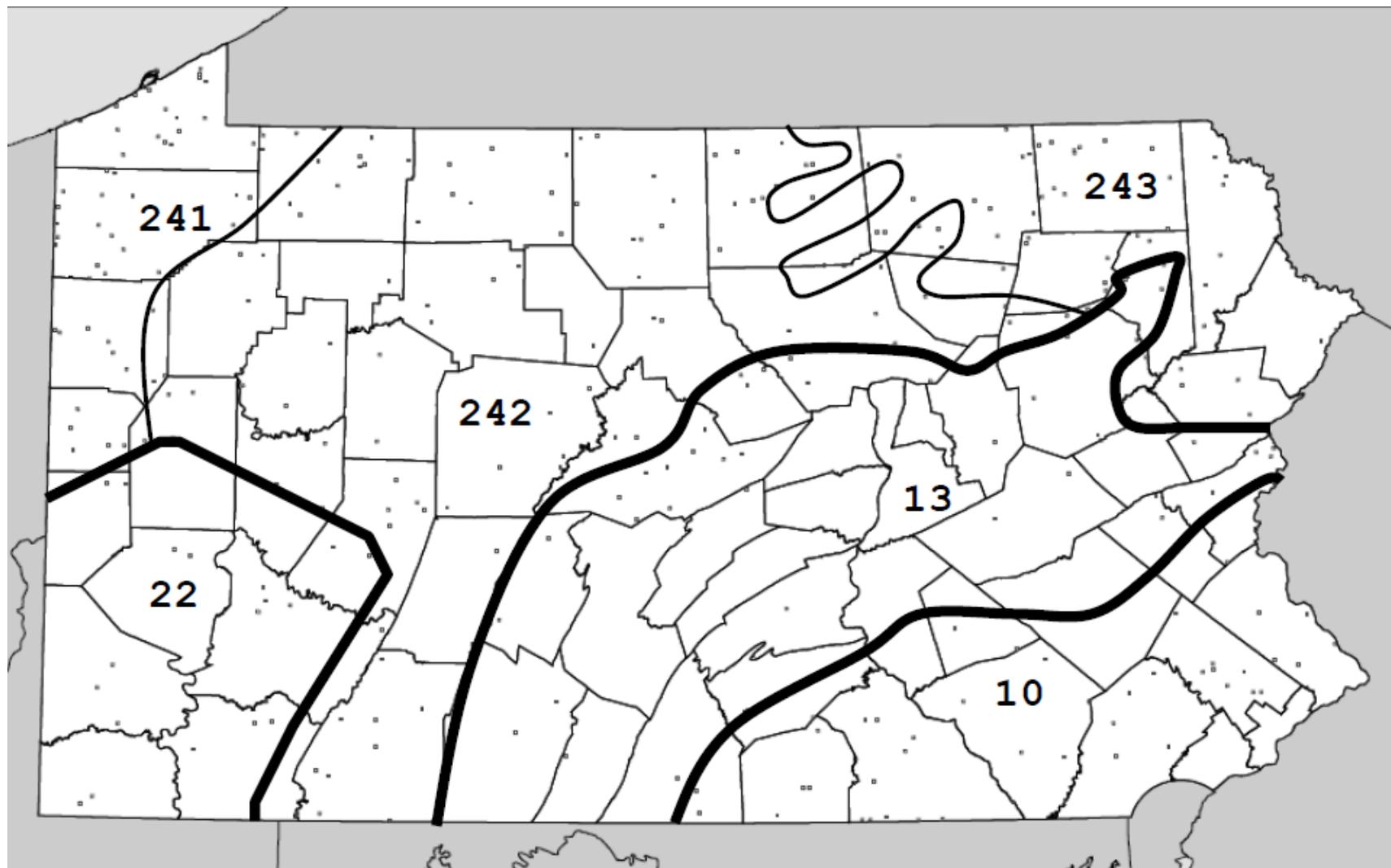


Figure 1. Location of Atlantic Flyway breeding waterfowl survey plots within major physiographic provinces in Pennsylvania. Physiographic Provinces are Piedmont (10), Ridge and Valley (13), Pittsburgh Plateau (22), Glaciated NW (241), Allegheny Mountain/Plateau (242), and Pocono/Low Plateau (243).

Appendix 1. Proposed 2012/2013 waterfowl hunting season recommendations.

DUCKS, SEA DUCKS, COOTS, AND MERGANSERS

BAG LIMITS

DUCKS: 6 daily, 12 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, 1 canvasback, 4 scoters and 4 scaup. Possession limit may not include more than 8 mallards including 4 hens, 2 black ducks, 4 pintails, 2 mottled ducks, 2 fulvous tree ducks, 6 wood ducks, 4 redheads, 2 canvasbacks, 8 scoters and 8 scaup.

MERGANSERS: 5 daily not more than 2 hooded mergansers, 4 in possession.

COOTS: 15 daily, 30 in possession.

Youth Waterfowl Hunting Days (Ducks, Mergansers, Canada Geese, Coots and Moorhens): September 15 and 22.

SEASON DATES

Lake Erie Zone

Ducks, sea ducks, coots and mergansers – Oct. 22 – Dec. 29

North Zone

Ducks, sea ducks, coots and mergansers – Oct. 6 – 20 & Nov. 13 – Jan. 5, 2013

Northwest Zone

Ducks, sea ducks, coots and mergansers – Oct. 6 – Dec. 14

South Zone

Ducks, sea ducks, coots and mergansers – Oct. 13 – 20 & Nov. 15 – Jan. 15, 2013

ATLANTIC BRANT

Oct. 6 – Dec. 3 (2 brant daily bag limit, 4 in possession).

SNOW GEESE

Atlantic Population Goose Hunting Zone

Regular Season – Oct. 27 – Jan. 26, 2013 (25 daily bag limit, no possession limit).

Conservation Season – Jan. 28, 2013 – Apr. 26, 2013 (25 daily bag limit, no possession limit. Permit required).

Southern James Bay Population Goose Hunting Zone

Regular Season – Oct. 27 – Jan. 18, 2013 (25 daily bag limit, no possession limit).

Conservation Season – Jan. 19, 2013 – Apr. 26, 2013 (25 daily bag limit, no possession limit. Permit required).

Resident Population Goose Hunting Zone

Regular Season – Oct. 27 – Feb. 28, 2013 (25 daily bag limit, no possession limit).

Conservation Season – March 1, 2013 – Apr. 26, 2013 (25 daily bag limit, no possession limit. Permit required).

CANADA GEESE

Atlantic Population Goose Hunting Zone

Nov. 13 – 24 & Dec. 13 – Jan. 26, 2013 (3 goose daily limit)

Southern James Bay Population Goose Hunting Zone

Oct. 6 – Nov. 24 & Dec. 10 – Jan. 18, 2013 (3 goose daily limit)

Resident Population Goose Hunting Zone

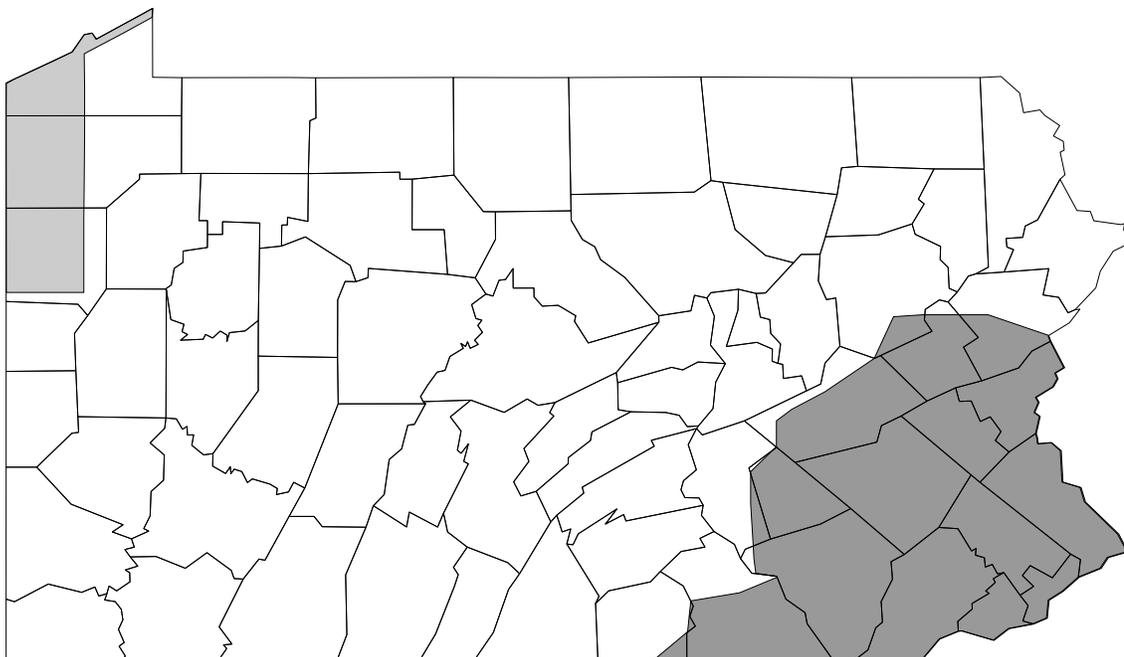
Oct. 27 – Nov. 24, Dec. 11 – Jan. 15, 2013, Feb. 1 – Feb. 28, 2013 (5 goose daily limit)

September Canada Goose Season - Statewide

September 1 – September 25 (8 goose daily bag limit, 16 in possession) **except:**

- (1) In the SJBZ zone the daily limit is 3 Canada geese, possession limit 6.
- (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 goose, possession limit 2 geese; **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 15 & September 22, 2012 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 6 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 1 goose, possession limit 2 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 15 & September 22, 2012 when regular season regulations apply.

Canada, Snow and White-Fronted Goose hunting zones for 2012-13 season in Pennsylvania



Pennsylvania

Resident Population (RP) Goose Zone

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

Southern James Bay Population (SJBP) Goose 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) Goose 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. 2013 Atlantic Flyway Midwinter Waterfowl Survey results.

Species	ME	VT	NH	MA	CT	RI	NY ^a	PA	WV	NJ	DE	MD	VA	NC	SC	GA	FL	Flyway Total ^b
Mallard	3,577	1,595	290	2,132	2,342	1,421	788	1,866	4,152	22,875	10,943	33,076	10,456	3,956	2,744	953	.	103,166
Black duck	15,569	472	450	18,625	3,050	2,225	16,076	1,331	740	96,920	9,177	22,480	12,232	8,189	659	0	.	208,195
Mottled duck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	10	.	28
Gadwall	0	0	0	6	84	183	115	213	21	965	2,550	7,404	11,613	44,597	18,313	794	.	86,858
American wigeon	0	0	0	0	220	152	30	10	0	1,585	584	453	6,480	47,913	2,010	416	.	59,853
G.W. Teal	0	0	0	16	4	0	50	1	0	9,505	3,550	6,319	4,981	56,419	16,612	1,160	.	98,617
B.W. Teal	0	0	0	0	0	0	0	0	0	0	0	0	0	15	6,075	1,177	.	7,267
N. Shoveler	0	0	0	0	0	0	0	40	0	535	1,938	1,670	560	1,061	10,911	437	.	17,152
N. Pintail	0	0	0	0	4	0	50	72	2	5,225	1,650	1,337	1,778	35,516	2,640	0	.	48,274
Wood duck	0	0	0	0	0	0	0	0	8	0	4	2	0	35	1,207	381	.	1,637
Total Dabblers	19,146	2,067	740	20,779	5,704	3,981	17,109	3,533	4,923	137,610	30,396	72,741	48,100	197,701	61,189	5,328	.	631,047
Redhead	0	0	0	0	0	0	0	1,005	1	0	0	16,675	5,000	10,575	62	131	.	33,449
Canvasback	0	0	0	0	50	0	0	185	8	195	250	18,426	6,700	2,362	3	3,370	.	31,549
Scaup	260	600	1,275	1,083	2,380	5,600	12,145	4,095	2	57,755	85	27,522	10,123	62,050	445	3,844	.	189,264
Ringneck	0	0	5	0	263	0	0	85	3	1,225	1,355	1,880	8,384	50,557	16,495	11,141	.	91,393
Goldeneye	5,029	2,013	57	3,538	458	725	3,068	65	0	65	4	849	4	0	0	0	.	15,875
Bufflehead	9,866	0	193	11,879	1,025	2,927	7,495	304	116	40,655	984	15,572	15,359	16,975	381	51	.	123,782
Ruddy duck	8	0	0	6	28	0	150	135	0	3,165	645	17,179	44,179	5,976	1,531	75	.	73,077
Total Divers	15,163	2,613	1,530	16,506	4,204	9,252	22,858	5,874	130	103,060	3,323	98,103	89,749	148,495	18,917	18,612	.	558,389
Eider	11,679	0	950	45,260	0	1,693	0	0	0	0	0	0	0	0	0	0	.	59,582
Scoter	1,912	0	7	15,450	156	48	0	0	0	310	30	2,006	3,075	1,824	16	534	.	25,368
Long-tailed Duck	2,208	0	10	1,052	360	0	960	0	0	485	0	627	155	0	0	0	.	5,857
Harlequin	79	0	0	8	0	6	0	0	0	0	0	0	0	0	0	0	.	93
Total Seaducks	15,878	0	967	61,770	516	1,747	960	0	0	795	30	2,633	3,230	1,824	16	534	.	90,900
Merganser	5,618	2,186	0	5,052	1,312	1,245	4,467	1,069	120	13,345	182	1,990	1,135	5,575	187	472	.	43,955
Unidentified Duck	0	0	0	0	0	0	0	25	79	0	0	111	40	19	297	0	.	571
Total Ducks	55,805	6,866	3,237	104,107	11,736	16,225	45,394	10,501	5,252	254,810	33,931	175,578	142,254	353,614	80,606	24,946	.	1,324,862
Brant	2	0	0	2,153	940	1,411	54,100	0	0	39,730	961	1,505	10,375	575	0	0	.	111,752
Snow goose	0	0	0	0	0	2	2,200	0	0	89,515	124,900	83,261	11,150	55,240	250	8	.	366,526
Canada Goose	6,956	250	2,964	10,367	4,135	9,384	3,200	34,278	6,262	159,285	34,245	462,049	132,833	16,233	1,356	721	.	884,518
Total Geese	6,958	250	2,964	12,520	5,075	10,797	59,500	34,278	6,262	288,530	160,106	546,815	154,358	72,048	1,606	729	.	1,362,796
Tundra swan	0	0	0	0	0	0	0	1,711	3	183	1,392	17,330	8,987	68,578	312	1	.	98,497
Mute Swan	0	0	19	226	540	1,060	236	42	0	1,032	12	38	42	1	0	0	.	3,248
Total Swans	0	0	19	226	540	1,060	236	1,753	3	1,215	1,404	17,368	9,029	68,579	312	1	.	101,745
Total Waterfowl	62,763	7,116	6,220	116,853	17,351	28,082	105,130	46,532	11,517	544,555	195,441	739,761	305,641	494,241	82,524	25,676	.	2,789,403
Coot	0	0	0	0	15	0	0	4,310	3	300	1,690	400	3,350	20,781	24,047	23,029	.	77,925
Sandhill Crane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.	0

^a New York survey data from Long Island only. Counts for black ducks and brant are probably reasonable, but are likely too small for other species, especially mallards, canvasbacks, Canada geese and, mute swans.

^b Flyway totals are not comparable with totals from previous years because of lack of survey in Florida. Totals for mottled ducks, whistling ducks, blue-winged teal, redheads, scaup, ringnecked ducks, and to a lesser extent, wigeon and shovellers are especially suspect.

Appendix 3. 2013 Atlantic Flyway Breeding Waterfowl Plot Survey results.

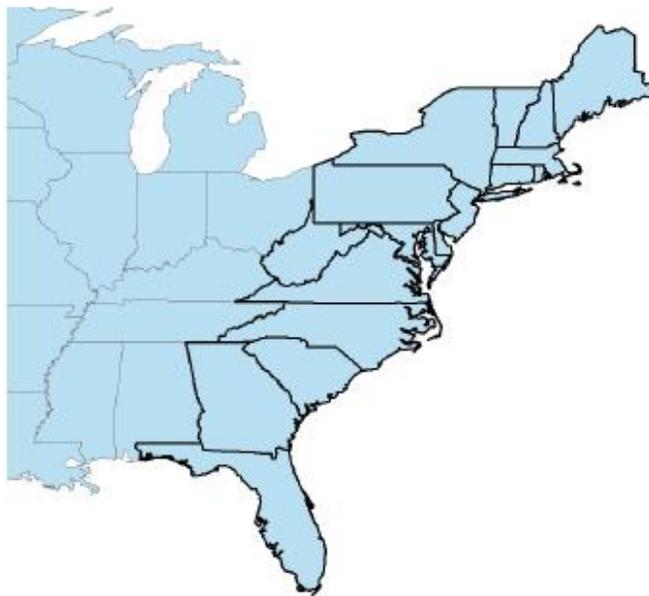
ATLANTIC FLYWAY BREEDING WATERFOWL PLOT SURVEY

Breeding Pair and Population Size Estimates Report

Jon D. Klimstra

July 19, 2013

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. 2012. Atlantic Flyway Breeding Waterfowl Plot Survey report 2012. U.S. Department of the Interior, Washington, D.C. USA.

Introduction/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 idea was to collect data such that Flyway specific hunting regulations could be devised for 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 submitted to the Atlantic Flyway office in the Division of Migratory Bird Management (USFWS) 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 go into 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 indepth understanding of the Northeast Plot survey (including rationale/justification, design, and implementation) please see the following:

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

Heusmann, H. W. and J. R. Sauer. 2000. The northeastern state's waterfowl breeding population survey. *Wildlife Society Bulletin* 28:355–364.

Results

The timing of spring phenology across the survey area was much different than last year. While spring phenology was advanced last year this year in many states it was delayed by about a week with cooler than normal temperatures in many states. Although slightly delayed, habitat conditions in the southern half of the survey area (VA, MD, and DE) were typically good to very good with many areas receiving above average precipitation during the first part of spring. In NJ, PA, and NY cooler than average temperatures and above average rainfall created wet cool conditions that resulted in average habitat conditions. New Jersey was especially delayed in their spring phenology and overall these states experienced an average nesting period. The New England states experienced below average winter precipitation which has resulted in most of this area being described as abnormally dry. Like the rest of the survey area New England experienced a delayed spring phenology with habitat conditions being about average. Overall production should be about average with some small isolated areas with good production.

In 2013, 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 x pairs) + singles + 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 x (pairs + singles) + grouped birds. As in years past stratum-within-state-, state-, stratum-, and survey-area specific estimates (formerly printed as Appendix A) will be distributed in an Excel file. This will again make these estimates more accessible to cooperators. Note that these estimates will also be uploaded to the USFWS Migratory Bird Data Center (<https://migbirdapps.fws.gov>). Breeding population and breeding pair estimates for this year are compared with estimates from 2012 and long-term (1993-2012) averages. Statistical comparisons were made with a 2-tailed z-test. The statistic was compared with the normal distribution in SAS. The z test statistic was calculated as:

$$z = \frac{Estimate_t - Estimate_{t-1}}{\sqrt{Var_t + Var_{t-1}}}$$

OR

$$z = \frac{Estimate_t - Estimate_{LTA}}{\sqrt{Var_t + Var_{LTA}}}$$

The variance of the long term average was calculated as;

$$Var_{LTA} = \sum_{i=1}^n Var_i n^2$$

Where:

i = survey year

Var_i = estimated variance for year i

n = number of years used in the long-term average

AF Breeding Waterfowl Plot Survey
Final Report, July 19, 2013

This was the eleventh year that social grouping information (i.e. singles, pairs, flocks, groups) was collected for gadwall, green-winged and blue-winged teal, common and hooded mergansers, and mute swans. Comparisons with estimates from 2012 were made with mallards, black ducks, wood ducks, Canada geese, gadwall, teal (green and blue), mergansers (common and hooded), and mute swan. This is the sixth year that the current years estimates will be compared with the long-term average (LTA). All comparisons were made at the 0.05 level and were considered significant when the p -value (p) was below the prespecified level. It should be noted that for the 2013 survey NJ reduced the number of plots surveyed from 250 to 105. This reduced the number of plots flyway wide from around 1,470 to about 1,327.

For the mallard, both the population and breeding pair estimates decreased from 2012 by approximately 1.38 and 1.11 percent, respectively (Tables 1 and 2; Figures 2 and 3). Neither change from 2012 was significantly different ($p=0.89$ and $p=0.91$ respectively) however both estimates remain well below the long-term averages (LTA). When compared to the LTA both population and breeding pairs estimates declined 19.17 and 19.01 percent with the decline for both estimates significantly different ($p=0.001$ and $p=0.0006$) from the LTA. The population and pairs estimate for the black duck increased dramatically over the 2012 estimate with both being significant increases ($p=0.02$ and $p=0.02$, Table 1 and 2; Figures 2 and 3). For both estimates this was almost a 75 percent increase over the 2012 estimate. While not a significant decrease, both the population and pairs estimates decreased from the LTA which was the fifth and tenth consecutive years of decreasing estimates, respectively (Tables 1 and 2). The wood duck population and pairs estimate both decreased from the previous years estimate (Tables 1 and 2; Figures 2 and 3). The decrease was approximately 13 and 11 percent, respectively, however neither was significant ($p=0.18$ and $p=0.27$). In addition to a decrease from last years estimate both the population and pairs estimates decreased from the LTA by around 5 and 1 percent, respectively (Tables 1 and 2). Neither decrease was significant ($p=0.52$ and $p=0.82$). Both the "Old" and "New" population estimate for Canada geese increased slightly over 2012 (Table 1; Figure 2). While both estimates are still above the Flyway population goal of 700,000 the "New" estimate does display a negative trend. However this could be explained by the shorter time series compared to the "Old" estimate which displays a positive trend. While both estimates increased neither increase was significant from 2012 ($p=0.55$ and $p=0.49$). While the 2013 population estimate increased from last year both the "Old" and "New" estimates decreased from the LTA by about 5 and 10 percent with neither being significant changes ($p=0.49$ and $p=0.20$ respectively). Like the population estimate the pair estimate increased from 2012 by around 9 percent and decreased from the LTA by almost 2 percent (Table 1; Figure 3). Neither change was significant ($p=0.40$ and $p=0.80$).

The population and pairs estimate for gadwall more than doubled from last year and also increased from the LTA (Tables 3 and 4). Although these increases were very large none were significant (Tables 3 and 4). It should be noted though that as in years past, caution should be used in interpreting results for gadwall as these large estimates have large confidence intervals and overall estimates tend to fluctuate between years. While the population estimate for green-winged teal increased by about 17 percent the pairs estimate decreased by around 3 percent with neither significant (Tables 3 and 4). While not significant ($p=0.54$ and $p=0.45$), both estimates increased from the LTA and remain above the LTA with this year being the 5th year for the population estimate and 3rd year for the pairs estimate. Part of the reason for increase in the population estimate and decrease in the pairs estimate could be related to timing. If states counted groups of green-wings that were still migrating through these would be added directly into the population estimate and not included in the pairs calculation. The population estimate for blue-winged teal increased from 2012 which represents the 2nd year in a row for an increasing estimate from a low of around 8,700 birds in 2011 (Table 3). However the 2013 estimate still remains below the LTA with

neither the change from 2012 or from the LTA significant ($p=0.44$ and $p=0.73$). The pairs estimate increased from 2012 and the LTA but neither was significant (Table 4). Like the gadwall caution should be used as the estimates for blue-wings are highly variable from year to year and have large confidence intervals associated with the estimates. Both the common and hooded merganser population and pairs estimates increased from 2012 and from the LTA with none being significant (Table 3 and 4). The mute swan population estimate decreased by about 20 percent from 2012 but increased compared to the LTA (Table 3). The pairs estimate increased compared to both 2012 and the LTA, however neither were significant (Table 4). This represents a reversal as the pairs estimate had decreased over the previous two years. For both the population and pairs estimate caution should be used for these as the confidence intervals associated with both estimates are fairly large.

Table 1: Population estimates and standard errors for mallards, black ducks, wood ducks, and Canada geese from the Atlantic Flyway Breeding Waterfowl Plot Survey, 1993-2013, and percent change from 2012 to 2013 and from the long-term average to 2013.

Year	N	Mallards		Black ducks		Wood ducks		Canada geese			
		Estimate	SE	Estimate	SE	Estimate	SE	Estimate	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
Long-term average (1993-2012)		747,439	11,625	61,941	2,662	380,225	7,705	936,954	21,547	1,058,089	28,628
Percent change from:		%	<i>P</i>	%	<i>P</i>	%	<i>P</i>	%	<i>P</i>	%	<i>P</i>
2012		-1.38	0.8929	73.78	0.0210	-13.79	0.1894	7.33	0.5563	8.20	0.4989
LTA		-19.17	0.0012	-19.71	0.1495	-5.02	0.5240	-5.70	0.4967	-10.03	0.2070

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Table 2: Breeding pair estimates and standard errors for mallards, black ducks, wood ducks, and Canada geese from the Atlantic Flyway Breeding Waterfowl Plot Survey, 1993-2013, and percent change from 2012 to 2013 and from the long-term average to 2013.

Year	N	Mallards		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
Long-term average (1993-2012)		357,529	5,458	27,228	971	180,945	3,605	347,793	6,460
Percent change									
from:		%	<i>P</i>	%	<i>P</i>	%	<i>P</i>	%	<i>P</i>
	2012	-1.11	0.9105	74.72	0.0218	-11.42	0.2778	9.06	0.4050
	LTA	-19.01	0.0006	-13.97	0.3361	-1.79	0.8225	-1.92	0.8038

Table 3: Population estimates and standard errors for gadwall, green-winged teal, blue-winged teal, common merganser, hooded merganser, and mute swans from the Atlantic Flyway Breeding Waterfowl Plot Survey, 2001-2013, and percent change from 2012 to 2013 and from the long-term average to 2013.

Year	N	Gadwall		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
Long-term average (1993-2012)													
		8,811	1,902	57,422	4,797	23,993	3,951	45,351	3,201	33,211	2,500	20,858	2,073
Percent change													
from:		%	<i>P</i>	%	<i>P</i>	%	<i>P</i>	%	<i>P</i>	%	<i>P</i>	%	<i>P</i>
	2012	147.35	0.3497	17.42	0.6770	56.86	0.4488	10.82	0.6895	33.00	0.3269	-20.05	0.6767
	LTA	56.00	0.5448	22.75	0.5444	-13.54	0.7396	22.49	0.3342	36.54	0.1778	17.30	0.7482

Table 4: Breeding pair estimates and standard errors for gadwall, green-winged teal, blue-winged teal, common merganser, hooded merganser, and mute swans from the Atlantic Flyway Breeding Waterfowl Plot Survey, 2001-2013, and percent change from 2012 to 2013 and from the long-term average to 2013.

Year	N	Gadwall		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
Long-term average (1993-2012)													
		2,219	336	12,686	1,339	8,267	1,152	18,634	1,358	14,580	1,106	8,677	732
Percent change													
from:		%	<i>P</i>	%	<i>P</i>	%	<i>P</i>	%	<i>P</i>	%	<i>P</i>	%	<i>P</i>
	2012	229.56	0.0819	-3.95	0.9170	59.68	0.4347	10.99	0.6636	15.22	0.6293	9.01	0.8667
	LTA	38.74	0.4749	25.92	0.4594	25.46	0.6484	22.82	0.2959	26.42	0.2947	6.54	0.8932

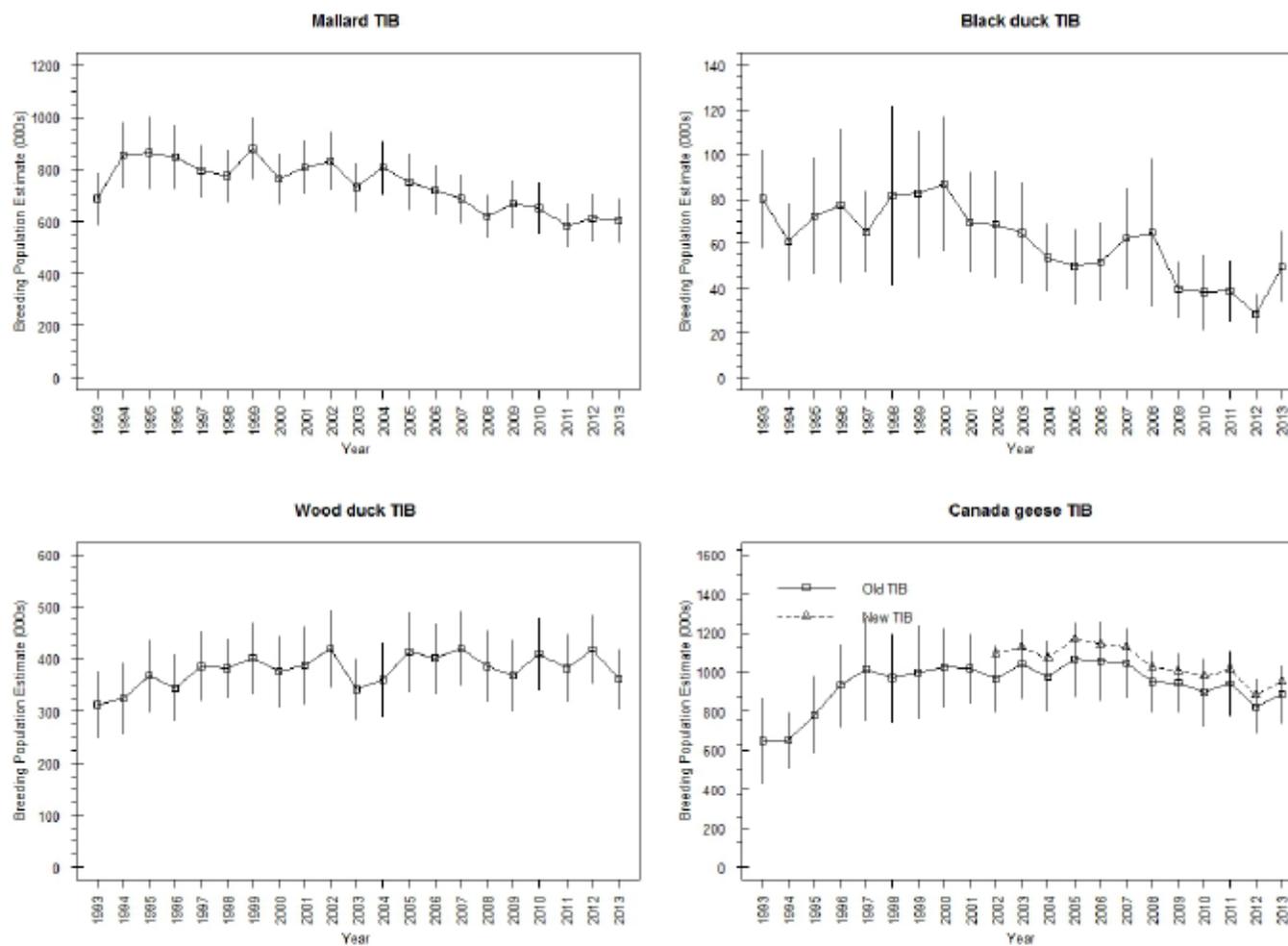


Figure 2: Population estimates and 95% confidence intervals for mallards, black ducks, wood ducks, and Canada geese, 1993-2013.

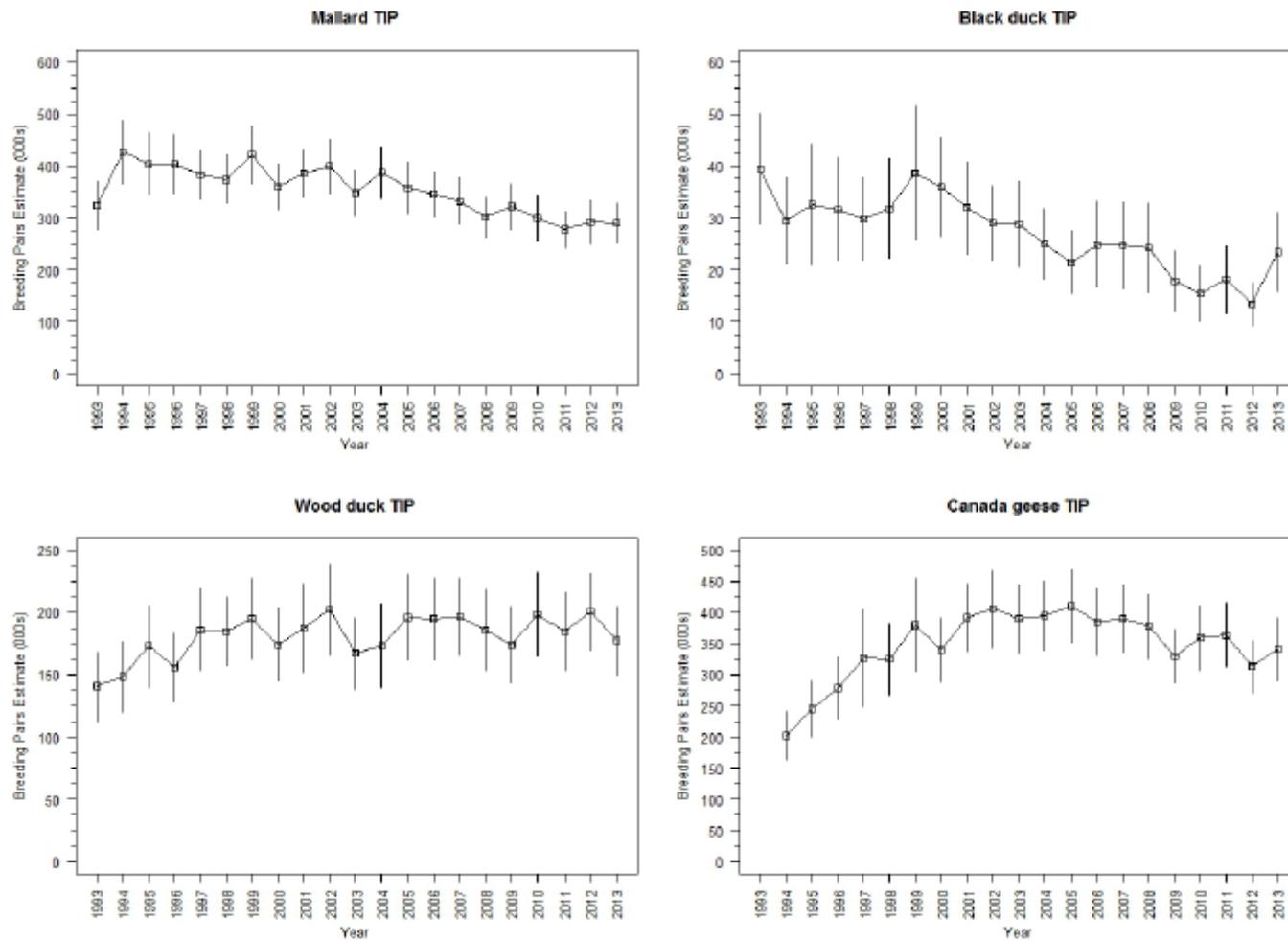


Figure 3: Breeding pair estimates and 95% confidence intervals for mallards, black ducks, wood ducks, and Canada geese, 1993-2013.