

**PENNSYLVANIA GAME COMMISSION  
BUREAU OF WILDLIFE MANAGEMENT  
PROJECT ANNUAL JOB REPORT**

**PROJECT CODE NO:** 06510

**TITLE:** Waterfowl Research/Management

**JOB CODE NO.:** 51004

**TITLE:** Waterfowl Population Monitoring

**PERIOD COVERED:** 1 July 2009 to 30 June 2010

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

**WORK LOCATION(S):** Statewide

**PREPARED BY:** Kevin J. Jacobs, John P. Dunn, and Ian D. Gregg

**DATE:** 24 September 2010

**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 2009-10 were 60 days with a daily bag limit of 6 birds, similar to those offered in 2008-09, except that canvasbacks had a bag limit of 1 per day and greater and lesser scaup season was a full season with 2 birds per day. U.S. Fish & Wildlife Service (USFWS) Harvest Information Program estimated active duck and goose hunters in Pennsylvania during 2009-10 were 25,200 and 30,500, down 15% and 21% respectively from the 1999 to 2008 averages. Pennsylvania's total duck harvest estimate was 125,900, down 25% from average. Pennsylvania 2009-10 Canada goose harvest was 161,900, down 14% from average. Canada goose harvest timing was 33% during September and 67% during the regular season. Pennsylvania's estimated snow goose harvest of 6,800 in 2009-10 was similar to average. There were an additional 3,000 snow geese harvested during the second conservation season from 22 February to 3 April 2010. During the Pennsylvania portion of the 2010 AF Midwinter Waterfowl Survey conducted in January, we observed 54,809 waterfowl, which was 25% lower than both the total from the 2009 survey, and the 2000-2009 average. All 6 major wintering species (Canada geese, mallards, black ducks, mergansers, snow geese, and tundra swans) decreased from 2009, with snow geese and tundra swans exhibiting the steepest declines. Canada geese were within 1% of their 2000-2009 average at the state level but the other 5 major species and most of the less common species were well below their respective 10-year state level averages. At the flyway level, mallards, snow geese, and tundra swans decreased from 2009 while black ducks and Canada geese increased; mallards and snow geese were 26% and 34% below their respective 10-year flyway averages, while the

other 3 species were within 10% of 2000-2009 averages. On the Pennsylvania portion of the 2010 AF Breeding Waterfowl Survey, mallard pairs (78,677) were down 14% from the 1993-2009 average. The American black duck statewide estimate of 269 pairs continued to be below average. There were 56,265 wood duck breeding pairs estimated in 2009, 10% above average. Trends in wood duck abundance have indicated stable to slightly increasing populations across all years of the survey. Estimates of total hooded mergansers (2,620) and common merganser estimate (14,053) were near average. The trends for both breeding merganser species appear stable since 1993. The breeding pair estimate for Canada geese was near average at 88,845 pairs, while the total spring population of 231,780 was 17% below average. For the Northeast U.S. survey area, mallard total population estimate of 651,709 was 15% below (statistically significant) average. Wood duck numbers were similar to last year and the average. The black duck estimate (38,155) was significantly below average. The spring breeding population estimate for resident population Canada geese was 969,875, similar to 2009 and the average. Habitat conditions in the Northeast U.S. were generally favorable for nesting. Waterfowl populations and habitat conditions in the Eastern survey area of Canada were variable but should favor good production. Breeding duck populations on the traditional survey area in the mid-continent of North America were similar to 2009, and 21% above the long-term average. 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 2010. Spring 2010 breeding population estimates for Atlantic Population Canada geese and Southern James Bay Population were similar to 2009. Production is expected to be average for both populations.

## **OBJECTIVE**

To determine the status of breeding and wintering waterfowl populations in Pennsylvania 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) (Raftovitch et al. 2010) and the Pennsylvania Game Commission's (PGC) Game Take Survey (GTS) (see Boyd and Weaver 2010 for description of methods). 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 2010 Snow 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. We did not send a reminder mailing to those individuals that failed to send in their harvest reports.

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. 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. The current (2002-present) Pennsylvania “MWS-Lite” consists of 11 survey segments covered by the 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. This approach appears to provide data suitable for use in long-term comparisons of species totals in this geographic area, but it should be noted that “MWS-Lite” procedures for the Delaware Valley differ from those used prior to 2002, when 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 also 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.

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. Established 1-km<sup>2</sup> plots are surveyed for ducks and geese once each year between mid-April and early May. 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 2009 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. Additional breeding survey data for areas not covered by the AF Breeding Waterfowl Survey was provided by the USFWS (2010). Breeding population and breeding pair's estimates for this year were compared with estimates from the long-term (1993-2009) averages.

## **RESULTS**

### **Hunter Activity and Harvest**

As in 2008-09, duck season length in 2009-10 was 60 days with outside framework dates of the Saturday nearest to 24 September (26 September) and the last Sunday in January (30 January). Similar to previous years, duck seasons selected for Pennsylvania 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 (Appendix 1). The aggregate daily duck bag limit remained at 6 birds. The daily bag and possession limits for greater and lesser scaup changed to 2 and 4 for the full season. This was in response to a rebound in the status of breeding populations of scaup. The canvasback harvest strategy in 2009 allowed for a 1 bird daily bag limit for the entire season.

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 SGL 214 (Pymatuning Wildlife Management Area (WMA) and SGL 46, the Middle Creek WMA in Lebanon/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) the daily bag limit was 1 goose to limit harvest on the resident flocks at each WMA. Regular Canada goose seasons and bag limits in the AP, RP and SJB zones remained the same as in 2008-09.

The estimates (Raftovitch et al. 2010) of active duck and goose hunters in Pennsylvania from HIP were 25,200 and 30,500 respectively and remain the highest in the AF (Table 1). These estimates were 15% and 21% below the 1999-2008 average. HIP estimates of days hunted for ducks in 2009-10 was down 26% from average while the number of goose hunter days was down 22% from average. The HIP estimate of total Pennsylvania duck harvest was 125,900 was down 25% from average. State-level HIP harvest estimates provided to date have shown higher year-to-year variability than comparable previous federal survey or GTS estimates, and additional analysis and accumulation of HIP data is needed to assess the accuracy and precision of the various surveys for estimating state waterfowl harvests. GTS estimates of total duck harvest were 137,974, down 14% from average. HIP Canada goose harvest estimate in Pennsylvania for 2009-10 was 161,900, 22% below average. Pennsylvania ranked 3<sup>rd</sup> in the AF in total Canada goose harvest, the first time since 1995 that the state didn't lead the AF. The GTS estimate of 195,105 Canada goose harvested was 22% above average. The September season continues to account for a substantial proportion (33%) of the harvest while the regular season (late-October to late-February) harvest accounted for 67% of the total. Estimated snow goose harvest in Pennsylvania was 6,800 birds, similar to average.

Season dates for the snow goose conservation season were 20 February – 3 April 2010 with daily bag limit of 15 geese and no possession limit. Additional hunting methods allowed included the use of electronic calls and expanded hunting hours (1/2 hour after sunset). We did not conduct an additional survey of non-respondents to estimate their harvest.

We issued 3,107 permits to hunters to participate in the 2010 Snow Goose Conservation Season. We received 1,335 reports (42.6% reporting rate) by 30 May. This decline in reporting rate from 2009 (88.5%) was likely due to not providing a reminder mailing to non-respondents. Of the 668 individuals that indicated they hunted during the conservation season their total retrieved harvest was 2,985 (Table 2). The additional hunting methods of extended hours and electronic calls resulted in a harvest of 330 and 1,101 geese, respectively. Use of electronic calls accounted for 37% of the snow geese taken, while extended hunting hours had less effect, with

only 11% of the total geese taken after sunset. Total hunter days were 2,409 and the number of geese killed per hunter day was 0.8, down from 1.5 in 2009.

Compared with the 2009 Conservation Season both participation and harvest was down about 61% and 49%, respectively. The snow goose spring migration was early in 2010. Geese seemed to move out of the Chesapeake and mid-Atlantic region during the second week of March. Many birds were in southern Quebec by the middle of March, which is much earlier than normal. Deep snow cover in February kept birds south of Pennsylvania before the onset of the Conservation Season. The use of electronic calls appears to be gaining popularity with hunters and their use increased from 26% in 2009 to 37% in 2010.

At the flyway level, the estimated harvest for the 6 states (Delaware, Maryland, New Jersey, Pennsylvania, Virginia and Vermont) participating in the 2010 Conservation Season was 45,120, with an additional 2,506 birds shot and lost. The estimated total harvest of 47,628 is twice the estimated harvest in the first year of the Conservation Season in 2009. The estimated number of days spent hunting was similar between years. Despite an early migration, short stopover times, and lower than hoped for participation, the second year of the Conservation Season in the U.S. was reasonably successful, although not as successful as needed to stem the current population trajectory of greater snow geese. Despite an estimated harvest far greater than that of 2009, overall harvest is not high enough to stabilize the greater snow goose population

The five most commonly harvested duck and merganser species in Pennsylvania were mallard, wood duck, American green-winged teal, American black duck, and bufflehead (Table 3). The 2009-10 harvest of wood ducks was 8% higher than the 1999-2008 average. However, harvests for the following species were below average: mallard (-34%), green-winged teal (-19%), American black duck (-45%), bufflehead (-26%), lesser scaup (-36%), greater scaup (-72%), ring-necked duck (-35%), gadwall (-50%), American wigeon (-57%), common merganser (-5%) and hooded merganser (-69%).

The trend in the number of juveniles per adult in the 2009-10 AF harvest (Table 4) was above average for mallard (15%), wood duck (11%), near average for black duck, and below average for the remaining 7 species. This may partly explain the below average harvest for the species listed above. Canada goose age ratios were 21% below average, while greater snow goose age ratios were 71% below average and a reflection of poor weather conditions on breeding areas in 2009 and also may partly explain the lower harvest last season for these species.

### **Midwinter Waterfowl Survey**

The Pennsylvania portion of the 2010 MWS was conducted between 5 January and 14 January. Survey methods were similar to those used in past years, with fixed-wing aerial surveys supplemented by ground surveys at Middle Creek WMA, and a few other impoundments in northwestern and southeastern Pennsylvania. Ice cover during the survey varied widely but generally fell into 1 of 3 categories: 10% or less (main body of Lake Erie, lakes south of 40° latitude, Schuylkill and Juniata Rivers); around 50% (Susquehanna River, French Creek, most southeastern lakes); or near 100% (northern interior lakes, Presque Isle Bay). Those waterfowl present were generally concentrated on the available open water, making them relatively easy to

locate and count. However, the cold and snowy conditions that predominated in the weeks leading up to the survey likely caused a net reduction in Pennsylvania MWS totals by pushing birds into more southerly portions of their wintering ranges.

We observed 54,809 waterfowl in Pennsylvania (Table 5). This included 2,234 dabbling ducks (mostly mallards and black ducks), 118 diving ducks, 453 mergansers, 51,732 geese (99% of which were Canada geese), and 146 swans (61% tundra swans, 33% mute swans, and 6% unidentified species). The overall total was 25% lower than both the total from the 2009 survey, and the 2000-2009 average. All 6 major wintering species (Canada geese, mallards, black ducks, mergansers, snow geese, and tundra swans) decreased from 2009, with snow geese and tundra swans exhibiting the steepest declines. Canada geese were within 1% of their 2000-2009 average, but the other 5 major species and most of the less common species were well below their respective 10-year averages. Declines occurred statewide with Zone 1 (northwestern Pennsylvania) totals down 12% from 2009 and 34% below the 10-year average, Zone 2 (Susquehanna River) totals down 31% from 2009 and 57% below the 10-year average, and Zone 3 (southeastern Pennsylvania) totals down 27% from 2009 and 21% below the 10-year average.

For the entire AF, 2,612,646 waterfowl were observed in the MWS (Appendix 2). Recent flyway grand totals are not directly comparable to results from previous 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 numbers decreased 25% from 2009 and were 26% below the 2000-2009 average, while black duck numbers increased 9% from 2009 but remained 5% below the 10-year average. Canada geese were up 7% from 2009 and were 8% above the 2000-2009 average. Snow goose numbers were down 34% from 2009 and were also 34% below the 10-year average. Tundra swans decreased 8% from 2009 and were 1% below the 10-year 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 and apparently ongoing increase from 1950's to present; 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**

The objective of the survey is to provide breeding waterfowl population estimates for the portion of the AF from Virginia to New Hampshire. Prior years (1989-2009) of the survey have proven reasonably accurate breeding population estimates can be obtained through these ground counts. Population estimates are utilized in the AF Adaptive Harvest Management process to determine waterfowl hunting season frameworks. Survey participants included Biologists from the Research Division of the Bureau of Wildlife Management and PGC Region Biologists. A total of 346 km<sup>2</sup> plots were part of this survey across six physiographic regions (Figure 1) of Pennsylvania using a stratified random design. Of these, 106 plots were not field checked

because they did not contain habitat for breeding waterfowl. Surveys were conducted from 15 April to 5 May 2010. Habitat and weather conditions were near average across most of Pennsylvania during spring and without any major fluctuations. Temperatures during the survey were above average. First hatches of Canada goose and mallard broods appeared to be slightly earlier than normal. Precipitation was less than average across the state since the survey period ended. We expect average to slightly above average production in 2010 from the birds that attempted to nest.

Survey results are presented in Tables 6 and 7. 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 7 summarizes complete 2010 survey results with comparison to the 1993 to 2009 average for ducks, mergansers and Canada goose pairs. The Canada goose total is averaged from 2003 to 2009 due to a methods change in recording and calculating total birds observed.

The number of indicated mallard breeding pairs (78,677) was statistically similar to the average of 95,462 pairs although numerically 18% below average (Table 6). We've observed some evidence of declining trends in other indices of statewide mallard abundance (the North American Breeding Bird Survey and the number of pre-season-banded mallards). A decline in mallard abundance was expected following liberalized hunting frameworks adopted in 1996 through Adaptive Harvest Management (Atlantic Flyway Mallard Committee, personal communication). Managers expect this trend to stabilize. Stratum 10 in southeastern Pennsylvania had the highest density of breeding mallards (1.24 pairs/km<sup>2</sup>), while stratum 243 and stratum 13 in northeastern and central Pennsylvania had the next highest densities of breeding mallards, (0.85 and 0.76 pairs/km<sup>2</sup> respectively). American black ducks were observed on one survey plot in stratum 10 in southeastern Pennsylvania and resulted in a statewide estimate of 269 pairs. Black ducks have been observed at very low densities since the survey was initiated in 1989. Numbers of black ducks banded pre-season in Pennsylvania has also been declining since the mid-1990s. There were 56,265 wood duck breeding pairs estimated in 2010, which was 10% above the average of 51,398 pairs. However, the 2010 estimate was not significantly above average and falls within expected sampling variation. 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, southwestern and northeastern Pennsylvania with 1.0, 0.8 and 0.75 pairs/km<sup>2</sup>, respectively. The estimate of total blue-winged teal (4,186) and American green-winged teal numbers (2,063) were slightly below average in 2010. Teal abundance in this survey can vary dramatically from year to year due to weather related impacts on teal migration. Teal migration appeared to be earlier than average in 2010. 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 (2,620) and common mergansers (14,053) were near average. The trends for both breeding merganser species appear stable since 1993.

The 2010 Pennsylvania Canada goose indicated breeding pairs was estimated at 88,845 which is similar to the average of 91,711. Pairs were most abundant in the southeast (1.65 pairs/km<sup>2</sup>) and northwest (1.4 pairs/km<sup>2</sup>). The 2010 total population estimate of 231,780 was

statistically similar to the recent 7-year average of 280,371 geese (Table 6). As expected, the highest densities of total geese were observed in southeastern (5.69 geese/km<sup>2</sup>) and northwestern (3.97 geese/km<sup>2</sup>) portions of Pennsylvania. The Pennsylvania Canada goose spring breeding population appears to have stabilized near 250,000 birds following the rapid growth observed during the 1990's. This is a result of significant expansion of hunting seasons and other lethal and non-lethal programs implemented to control Canada goose numbers. This population remains well above the Resident Population management plan goal of 150,000 spring birds.

Breeding pair estimates for the most common breeding species from the AF Breeding Waterfowl Plot Survey for 2010 (Klimstra 2010, Appendix 3) were: mallard total population estimate of 651,709 was 15% below (statistically significant) average and the second lowest recorded since 1993 (lowest was 619,095 in 2008). The American black duck estimate (38,155) was down 43% from average. There has been a declining trend in mallard and black duck abundance over the last 11 years of this survey. Wood duck numbers (409,599) were similar to last year and the average. Wood duck trends appear stable to slightly increasing. Nesting ducks should have at least average production due to favorable weather and habitat conditions. In the eastern surveyed areas of Canada and Maine (U.S. Fish and Wildlife Service 2010), estimates for mallards, green-winged teal, American wigeon, scaup, ring-necked duck, goldeneye, bufflehead, and scoters were similar to last year and to their 1990-2009 averages, while the estimate for mergansers was 14% below the Long Term Average (LTA). The American black duck estimate was similar to 2009 and 7% below average. Habitat conditions were favorable overall due to an early spring. However, much of southern Quebec and Ontario were classified as poor to fair due to dry conditions, with the exception of an area of adequate moisture in west central Ontario. More northern boreal forest locations benefited from near-normal precipitation and early ice-free conditions. Although winter precipitation from southwestern Ontario along the St. Lawrence River Valley and into Maine was below average, waterfowl habitat was classified as good to excellent, as in 2009.

The number of ducks counted in the traditional mid-continent survey area in May 2010 (U.S. Fish and Wildlife Service 2010) was 40.9 million birds. This was similar to last year's estimate of 42 million birds, and 21% above the 1955-2009 LTA. Mallard abundance was 8.4 million birds, which was similar to last year's estimate and 12% above the LTA. Blue-winged teal (6.3 million birds, 36% above LTA), green-winged teal (3.5 million, 78% above LTA), gadwall (3.0 million, 67% above LTA), northern shovelers (4.1 million, 76% above LTA), and redheads (1.1 million, 63% above LTA), were all above their LTA in 2010. Estimated abundance of American wigeon (2.4 million) and canvasback (0.6 million), was similar to the LTA. The estimate for northern pintails (3.5 million, 13% below the LTA) and scaup estimate (greater and lesser combined, 4.2 million, 16% below the LTA) remained below their LTA. Habitat conditions during the 2010 survey were characterized by above-average moisture across the southern portions of the traditional survey area and variable but good habitat overall in the eastern survey area. The total pond estimate (prairie Canada and U.S. combined) was 6.7 million. This was similar to last year's estimate and 34% above the long-term average of 5 million ponds.

AP Canada geese nest across a broad area of Northern Quebec with highest densities occurring in the Ungava Peninsula, and along the Hudson Bay coast. Spring temperatures in 2010 were normal and snow melt was near average. The estimated number of breeding pairs was

154,000, near the recent average (Harvey and Rodrigue, 2010). Nesting and banding studies along Ungava Bay also indicated average productivity. The total population estimate (breeding pairs and grouped birds) was 776,000 individuals, down 29% from 2009, likely a result of poor production in 2009. The forecast is for average production. An average fall flight, with average numbers of juveniles is expected from this population. SJBPC Canada geese nest on Akimiski Island, Nunavut, and the James Bay lowlands of Ontario. The SJBPC is the predominant migratory goose population in northwest Pennsylvania, contributing approximately 5-10% of the overall harvest in the SJBPC zone (the balance being resident geese). The spring population estimate of 87,300 Canada geese was statistically unchanged from 2009 and the average (Brook and Hughes 2010). Nesting studies on Akimiski Island indicate good nesting conditions and breeding effort due to an early spring in James and Hudson Bay. However, nest predation by polar bears on Akimiski Island, an important breeding area, was very high. Productivity from mainland areas should be good. An average fall flight with average juveniles is expected. Atlantic Flyway Resident Population (AFRP) breeds locally throughout the AF extending into southern Ontario and Quebec. The AFRP overlaps both SJBPC and AP geese during the fall and winter periods. The spring breeding population estimate was over 1.0 million, similar to 2009 and the LTA (Klimstra 2010). Field reports indicate average or better gosling production. Expect another large fall flight with many juveniles this hunting season. Greater Snow Geese nest principally on Bylot, Axel Heiberg, Ellesmere, and Baffin Islands in the Canadian Arctic. The size of the 2010 spring population, counted during staging in southern Québec, was 814,000 geese, down 43% from 2009, but near average. Breeding conditions of greater snow geese were rated above average on Bylot Island (U.S. Fish and Wildlife Service 2010). Snow melt was early due to warm and sunny temperatures in early June. Nesting phenology was near normal, clutch sizes were above normal and nesting success was above average. Nest density in the Bylot Island colony was relatively high this year, indicative of a good reproductive effort. Therefore, expect a good production and an above average fall flight for greater snow geese.

## **RECOMMENDATION**

Continue waterfowl breeding and wintering survey efforts during Fiscal Year 2010-11 to provide annual information on waterfowl population status.

## **LITERATURE CITED**

Boyd, R. C., and M. Weaver. 2010. Game Take Survey. Annual Job Report 11101. Pennsylvania Game Commission, Harrisburg, USA.

Brook, R., and J. Hughes. 2010. 2010 Spring population estimates for Southern James Bay Population Canada geese. Canadian Wildlife Service.

Harvey, W. F., and J. Rodrigue. 2010. A breeding pair survey of Canada geese in Northern Quebec. Report to Atlantic Flyway Council.

Klimstra, J. 2010. Atlantic Flyway Breeding Waterfowl Plot Survey Draft Report. United States Fish and Wildlife Service.

Raftovich, R.V., K.A. Wilkins, K.D. Richkus, S.S. Williams, and H.L. Spriggs. 2010. Migratory bird hunting activity and harvest during the 2008 and 2009 hunting seasons. U.S. Fish and Wildlife Service, Laurel, Maryland, USA.

U.S. Fish and Wildlife Service. 2010. Waterfowl population status, 2010. U.S. Department of the Interior, Washington, D.C., USA.

Table 1. 2009-10 waterfowl hunting season activity and harvest in Pennsylvania as estimated by USFWS Harvest Information Program Survey (HIP) and PGC game take survey and percentage change.

	<b>2009-10<sup>a</sup></b>	<b>2008-09</b>	<b>% Change from 2008</b>	<b>99-08 Average</b>	<b>% Change from Avg.</b>
Ducks					
Hunters	25,200	26,300	-4	29,500	-15
Hunter Days	118,200	130,000	-9	158,860	-26
HIP Harvest	125,900	176,600	-29	167,460	-25
PGC Harvest	137,974	135,234	2	161,215	-14
Canada goose					
Hunters	30,500	37,800	-19	38,490	-21
Hunter Days	167,500	204,500	-18	214,120	-22
HIP Harvest	161,900	231,590	-30	188,034	-14
PGC Harvest	195,105	178,588	9	160,146	22
Snow Goose PGC					
HIP Harvest	4,109	33,570			
HIP Harvest	6,800	10,009	-32	6,800	-8

<sup>a</sup> Preliminary.

<sup>b</sup> PGC Game take survey not conducted in 2004-05.

Table 2. Number of permits issued, reports received, hunter days and number of geese taken by hunting method during the 2010 Snow Goose Conservation Season in Pennsylvania.

<b>Permits Issued</b>	<b>Reports received</b>	<b>Number of Hunters</b>	<b>Days Hunted</b>	<b>Geese Shot &amp; Retrieved</b>	<b>Geese Shot &amp; Lost</b>	<b>Geese Shot after sunset</b>	<b>Geese Shot with e'calls</b>
3,107	1,335	668	2,409	2,985	141	330	1,101

Table 3. USFWS HIP Harvest estimates for major duck and merganser species in Pennsylvania, 1999-2010.

<b>Species</b>	<b>2009-10<sup>a</sup></b>	<b>2008-09</b>	<b>% Change from 2008</b>	<b>99-08 Average</b>	<b>% Change from Avg.</b>
Mallard	56,300	94,187	-40	84,960	-34
Wood duck	41,800	38,868	7	38,690	8
Black duck	5,100	7,903	-35	9,260	-45
Green-winged teal	6,500	10,000	-35	8,000	-19
Bufflehead	3,400	6,451	-48	461	-26
Lesser scaup	1,500	968	50	2,345	-36
Greater scaup	300	161	50	1,090	-72
Ring-necked duck	500	484	0	1,850	-73
Gadwall	1,200	1,129	9	1,837	-35
American wigeon	600	1,774	-67	1,195	-50
Mallard/black Hyb.	500	1,290	-61	1,173	-57
Common merganser	3,300	6,129	-46	3,464	-5
Hooded merganser	1,000	2,903	-66	3,250	-69

<sup>a</sup> 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 1996-2010 hunting seasons in the Atlantic Flyway.

<b>Species</b>	<b>2009-10<sup>a</sup></b>	<b>2008-09</b>	<b>% Change from 2008</b>	<b>99-08 Average</b>	<b>% Change from Avg.</b>
Mallard	1.37	1.22	12	1.19	15
Wood duck	1.31	1.21	8	1.19	11
Green-winged teal	1.62	1.61	1	1.78	-9
Black duck	1.15	0.96	20	1.13	2
Ring-necked duck	0.93	0.92	1	1.33	-30
Lesser scaup	0.52	0.46	13	0.68	-23
Greater scaup	0.63	0.37	70	1.24	-49
Bufflehead	0.47	0.67	-30	0.82	-43
Gadwall	1.0	0.79	27	1.08	-7
American wigeon	0.66	0.67	-1	0.97	-32
Canada goose	0.37	0.59	-37	0.47	-21
Greater snow goose	0.26	1.46	-82	0.91	-71

<sup>a</sup> Preliminary

Table 5. Number of waterfowl recorded in zones 1-3 during Pennsylvania's Midwinter Waterfowl Survey, 2000-2010. Totals for 2002-10 may not be completely comparable to those from 2001 and prior because of procedural changes to survey in 2002.

Species	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	2000-2009
												Avg.
Canada goose	51,321	54,267	38,602	42,456	51,844	41,839	48,454	77,224	78,828	48,198	29,388	51,110
Mallard	1,098	2,544	2,992	2,613	2,676	2,453	4,460	3,082	4,124	4,306	7,184	3,643
Black duck	1,131	1,448	1,770	906	1,865	2,763	2,079	1,775	2,904	1,570	3,878	2,096
Gadwall	3	0	2	29	5	13	18	0	0	2	12	8
Wigeon	1	0	1	0	1	0	0	0	11	0	1	1
Green-winged teal	0	3	2	13	12	13	0	2	1	0	6	5
Blue-winged teal	0	0	0	0	0	0	0	0	0	0	0	0
Shoveler	0	12	5	32	1	0	25	0	119	9	61	26
Pintail	0	5	6	0	10	1	24	0	6	0	12	6
Wood duck	1	0	0	0	0	0	0	0	0	0	0	0
Redhead	69	0	0	0	0	0	10	0	20	1	0	3
Canvasback	5	0	1	0	0	91	10	0	0	0	13	12
Scaup	9	0	290	80	302	2,379	260	0	0	34	357	370
Ring-necked duck	4	0	32	0	0	0	0	11	12	44	15	11
Goldeneye	21	0	26	29	159	16	116	70	41	10	352	82
Bufflehead	10	25	67	252	66	13	204	237	1,841	191	335	323
Ruddy duck	0	0	0	9	0	0	6	1	8	33	25	8
Long-tailed duck	0	0	0	0	0	0	0	0	0	0	0	0
Scoters	0	0	0	0	0	0	0	0	0	0	2	0
Mergansers	453	704	2,360	1,988	1,009	3,993	759	992	564	1,070	7,968	2,141
Unidentified ducks	21	9	29	219	31	12	0	25	27	53	9	41
Brant	0	0	0	0	0	0	0	0	0	2	0	0
Snow goose	411	12,899	13,902	32,096	10,314	25,909	11,100	9,602	4,347	0	1,400	12,157
White-fronted goose	0	0	0	0	0	0	0	0	0	0	0	0
Tundra swan	89	783	1,178	363	2,464	786	1,261	548	1,098	363	1,106	995
Mute swan	48	36	23	23	23	22	33	27	13	32	32	26
Unidentified swans	9	0	0	0	0	2	0	0	0	3	0	1
Coot	105	0	100	552	200	75	25	50	250	265	1,050	257
<b>Totals</b>	<b>54,809</b>	<b>72,735</b>	<b>61,388</b>	<b>81,660</b>	<b>70,982</b>	<b>80,380</b>	<b>68,844</b>	<b>93,646</b>	<b>94,214</b>	<b>56,186</b>	<b>53,206</b>	<b>73,324</b>

Table 6. Estimates of waterfowl breeding pairs and standard error by physiographic strata in Pennsylvania, 2010.

Strata	Mallard		Black duck		Wood duck		Canada goose		Canada goose	
	Pairs	SE	Pairs	SE	Pairs	SE	Pairs	SE	Total	SE
10	16,397	4,080	269	268	4,565	2,185	21,749	5,117	74,914	23,364
13	23,686	7,658	0	0	14,630	5,597	16,023	4,296	32,046	8,593
22	13,318	7,416	0	0	10,654	3,813	11,986	4,913	27,968	11,172
241	5,372	1,802	0	0	9,896	2,530	13,854	3,059	39,301	11,239
242	8,850	3,193	0	0	6,726	2,548	14,159	6,981	32,212	15,432
243	11,073	2,740	0	0	9,795	2,156	11,073	2,934	25,339	7,666
2010 PA Total	78,677	12,298	269	268	56,265	8,257	88,845	11,640	231,780	34,172
1993–2009 avg.	95,462	14,538	639	612	51,398	8,436	91,711	12,313	280,371 <sup>a</sup>	39,114
% Change	- 18 %		- 58 %		+ 10 %		- 3 %		- 17 %	

<sup>a</sup> 2003 to 2009, 7-year average.

Table 7. Pennsylvania waterfowl population estimates from 2001 to 2010 and the 1993-2009 averages.

Species Estimate	2010	93-09 average	2009	2008	2007	2006	2005	2004	2003	2002	2001
	Mallard pairs	78,677	95,462	92,509	65,739	90,237	80,667	95,685	84,806	82,302	84,534
Mallard total	161,675	196,947	187,697	131,477	181,504	174,374	197,975	177,715	170,067	171,752	189,711
Black duck pairs	269	953	639	269	1,716	-	-	-	622	2,010	2,026
Black duck total	537	1,906	1,278	537	3,433	-	-	-	1,245	4,020	4,052
Wood duck pairs	56,265	51,398	63,118	42,791	56,671	61,014	60,536	47,368	46,855	65,684	56,276
Wood duck total	114,797	109,211	128,060	87,924	127,847	128,009	132,552	94,736	93,711	132,858	116,298
Canada goose pairs	88,845	91,711	88,617	100,174	100,741	88,478	115,291	122,857	101,564	85,192	96,468
Canada goose total	231,780 <sup>a</sup>	280,371 <sup>b</sup>	289,879 <sup>a</sup>	246,499 <sup>a</sup>	255,924 <sup>a</sup>	245,689 <sup>a</sup>	311,171 <sup>a</sup>	338,230 <sup>a</sup>	275,207 <sup>a</sup>	234,754	246,859
Bl-wing teal total	4,186	7,625	7,814	1,840	12,650	1,979	2,746	8,041	1,273	7,842	8,373
Gr-wing teal total	2,063	4,571	5,569	1,979	5,064	7,172	7,089	9,138	5,266	4,131	4,664
Hooded merg. total	2,620	3,586	2,975	3,031	2,972	7,646	9,625	1,272	4,318	4,205	1,417
Common merg. total	14,053	15,038	12,377	18,773	17,429	15,167	12,916	14,671	14,335	14,371	14,020
Mute swan total	2,268	1,314	1,276	3,921	6,064	2,102	2,245	2,528	709	426	354

- No black ducks observed.

<sup>a</sup> Total estimate calculated using new formula 2x(pairs + singles) + groups.

<sup>b</sup> Average from 2003 to 2008 using new formula for total.

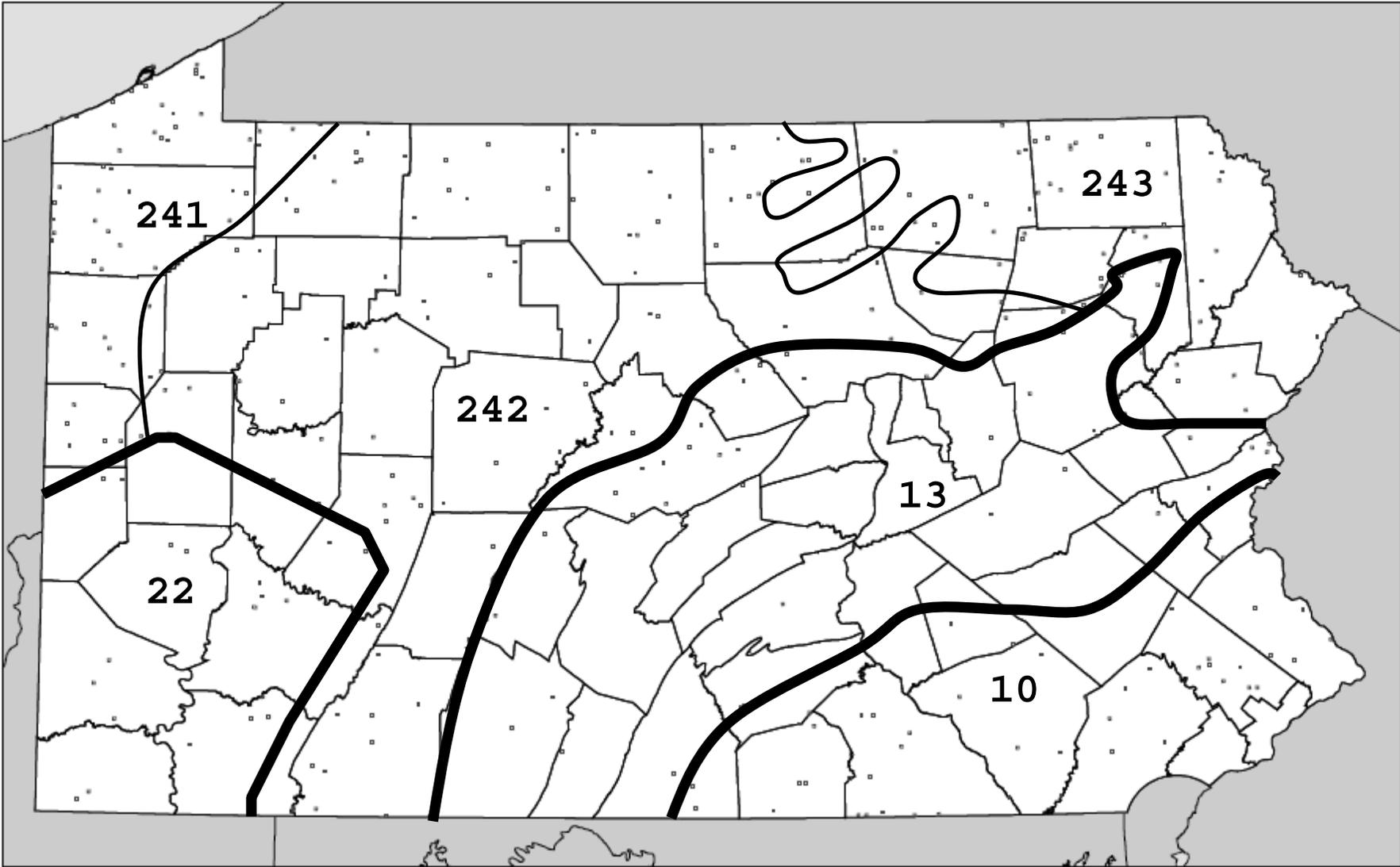


Figure 1. Location of Atlantic Flyway breeding waterfowl survey plots within major physiographic provinces in Pennsylvania. Physiographic Provinces are Piedmont (10), Ridge and Valley (13), Pittsburgh Plateau (22), Glaciated NW (241), Allegheny Mountain/Plateau (242), and Pocono/Low Plateau (243).

Appendix 1. Proposed 2009/2010 waterfowl hunting season recommendations.

## **PROPOSED 2009/2010 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, 1 pintail, 1 mottled duck, 1 fulvous tree duck, 3 wood ducks, 2 redheads, 1 canvasback, 4 scoters and 2 scaup. Possession limit may not include more than 8 mallards including 4 hens, 2 black ducks, 2 pintails, 2 mottled ducks, 2 fulvous tree ducks, 6 wood ducks, 4 redheads, 2 canvasbacks, 8 scoters and 4 scaup.

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

**COOTS:** 15 daily, 30 in possession.

**Youth Waterfowl Hunting Day (Ducks, Mergansers, Canada Geese, Coots and Moorhens):** September 19.

#### **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 – 24 & Nov. 17 – Jan. 9

##### **Northwest Zone**

Ducks, sea ducks, coots and mergansers – Oct. 10 – Nov. 28 & Dec. 14 – Jan. 1

##### **South Zone**

Ducks, sea ducks, coots and mergansers – Oct. 10 – 17 & Nov. 16 – Jan. 15

#### **ATLANTIC BRANT**

Oct. 10 – Nov. 14 & Dec. 10 – 31 (2 brant daily bag limit, 4 in possession).

#### **SNOW GEESE**

Regular Season – Nov. 6 – Feb. 19 (15 daily bag limit, no possession limit).

Conservation Season – Feb. 20 – Apr. 3 (15 daily bag limit, no possession limit. Permit required).

## **CANADA GEESE**

#### **Atlantic Population Canada Goose Hunting Zone**

Nov. 16 – 28 & Dec. 19 – Jan. 26 (3 goose daily limit).

#### **Southern James Bay Population Canada Goose Hunting Zone**

Oct. 26 – Nov. 28 & Dec. 14 – Jan. 28 (3 goose daily limit)

**Resident Population Canada Goose Hunting Zone**

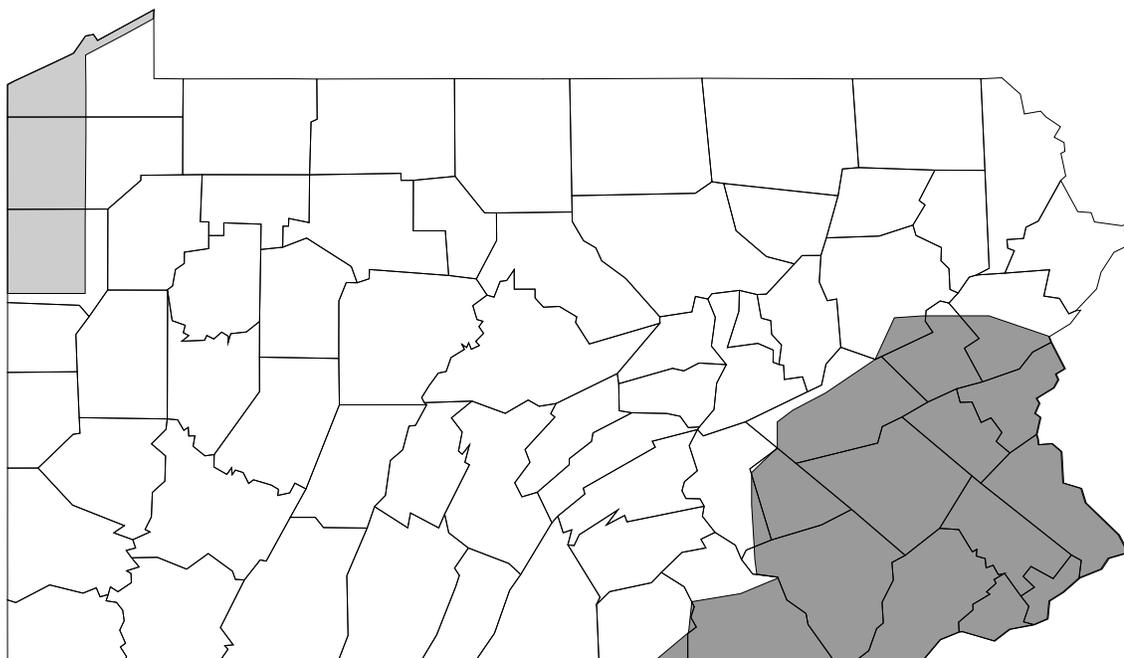
Oct. 24 – 31 & Nov. 16 – 28 & Dec. 11 – Feb. 19 (5 goose daily limit)

**Early Resident Population 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 of 6 geese.
- (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, possession limit two geese; **except** on State Game Lands 214 where the 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 geese, possession limit of six 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 two geese; **except** on State Game Lands 46 (Middle Creek Wildlife Management Area) where the season is closed to September goose hunting.

## Canada goose hunting zones for 2009-10 season in Pennsylvania



### Pennsylvania

#### **Resident Population Canada Goose Zone (RP)**

All of Pennsylvania **except** for the 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) **and** the Atlantic Population 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. Atlantic Flyway Midwinter Waterfowl Survey, 2010 Final Report

Species	ME	VT	NH	MA	CT	RI	NV	PA	WV	WV	NY	DE	MID	VA	NC	SC	GA	FL	Flyway Total
Mallard	2,799	388	459	2,452	2,520	2,107	514	960	1,926	13,895	9,982	34,194	21,287	7,404	2,130	903	NO SURVEY	NO SURVEY	103,980
Black duck	15,587	227	996	18,589	3,165	1,595	11,825	1,071	776	74,701	11,775	22,467	29,037	10,012	1,233	10	NO SURVEY	NO SURVEY	203,030
Mottled duck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NO SURVEY	NO SURVEY	20
Garwhall	0	0	0	0	47	112	20	3	1	230	586	2,021	4,107	13,945	23,035	17,096	429	NO SURVEY	57,505
American wigeon	0	0	0	0	214	467	20	1	0	345	47	252	4,107	19,265	5,664	476	NO SURVEY	NO SURVEY	30,858
G.W. Teal	0	0	0	1	0	0	0	0	0	20	39	583	2,374	103,294	29,266	1,548	NO SURVEY	NO SURVEY	137,125
B.W. Teal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	2,558	220	NO SURVEY	2,791
N. Shoveler	0	0	0	0	0	0	0	0	0	20	513	61	220	219	9,129	153	NO SURVEY	NO SURVEY	10,315
N. Pintail	0	0	0	0	0	0	0	0	0	1,885	1,993	489	1,229	45,414	12,051	0	NO SURVEY	NO SURVEY	63,061
Wood duck	0	0	0	0	0	0	0	1	0	0	8	0	0	40	127	857	59	NO SURVEY	1,092
Whistling duck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	45	NO SURVEY	55
<b>Total Dabblers</b>	<b>18,386</b>	<b>615</b>	<b>1,455</b>	<b>21,052</b>	<b>5,946</b>	<b>4,281</b>	<b>12,359</b>	<b>2,036</b>	<b>2,703</b>	<b>91,100</b>	<b>24,893</b>	<b>60,057</b>	<b>72,239</b>	<b>208,783</b>	<b>80,054</b>	<b>80,054</b>	<b>3,863</b>	<b>NO SURVEY</b>	<b>609,332</b>
Redhead	0	0	0	0	32	0	40	0	47	370	850	3,360	2,614	11,035	4,918	684	1,823	NO SURVEY	28,042
Canvasback	0	0	0	0	784	8,766	17,550	9	0	14,610	1,002	43,538	5,729	9,083	9,961	5,270	NO SURVEY	NO SURVEY	46,218
Scup	232	0	1,025	4,273	88	0	0	4	6	390	90	918	11,137	22,200	22,739	0	NO SURVEY	NO SURVEY	121,832
Ringneck	0	0	6	0	88	0	0	16	2	170	78	616	15	15	2	0	NO SURVEY	NO SURVEY	69,343
Goldeneye	7,413	4,890	180	1,092	438	1,510	1,632	0	7	14,895	1,263	13,724	13,412	2,394	630	189	NO SURVEY	NO SURVEY	18,054
Bufflehead	6,558	0	135	5,790	1,069	2,226	2,000	0	0	290	286	13,441	11,928	2,962	1,727	29	NO SURVEY	NO SURVEY	64,292
Ruddy duck	84	0	0	0	15	20	0	0	0	290	286	13,441	11,928	2,962	1,727	29	NO SURVEY	NO SURVEY	30,782
<b>Total Divers</b>	<b>14,287</b>	<b>4,890</b>	<b>1,346</b>	<b>11,155</b>	<b>2,426</b>	<b>12,522</b>	<b>21,222</b>	<b>98</b>	<b>62</b>	<b>30,725</b>	<b>3,589</b>	<b>102,016</b>	<b>55,870</b>	<b>63,524</b>	<b>35,775</b>	<b>19,076</b>	<b>NO SURVEY</b>	<b>NO SURVEY</b>	<b>378,563</b>
Eider	14,970	0	1,001	46,097	0	1,430	20	0	0	240	0	882	4,306	466	5,418	10	NO SURVEY	NO SURVEY	63,518
Scoter	901	0	5,450	269	478	0	0	0	0	655	21	161	60	0	0	0	NO SURVEY	NO SURVEY	18,420
Long-tailed Duck	1,209	0	0	239	0	0	50	0	0	0	0	0	0	0	0	0	NO SURVEY	NO SURVEY	2,622
Harequin	33	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	NO SURVEY	NO SURVEY	63
<b>Total Seaducks</b>	<b>17,113</b>	<b>0</b>	<b>1,001</b>	<b>51,786</b>	<b>496</b>	<b>1,538</b>	<b>70</b>	<b>0</b>	<b>0</b>	<b>895</b>	<b>21</b>	<b>1,043</b>	<b>4,366</b>	<b>466</b>	<b>5,418</b>	<b>10</b>	<b>NO SURVEY</b>	<b>NO SURVEY</b>	<b>84,623</b>
Meranser	3,030	5,741	21	8,940	929	1,402	2,747	273	97	8,125	205	10,618	3,006	873	1,480	213	NO SURVEY	NO SURVEY	47,700
Unidentified Duck	3	0	0	0	0	0	0	0	0	21	6	0	0	0	20	13	NO SURVEY	NO SURVEY	63
<b>Total Ducks</b>	<b>52,819</b>	<b>11,246</b>	<b>3,823</b>	<b>92,933</b>	<b>9,797</b>	<b>20,143</b>	<b>36,398</b>	<b>2,428</b>	<b>2,868</b>	<b>130,845</b>	<b>28,688</b>	<b>113,744</b>	<b>135,481</b>	<b>273,666</b>	<b>122,740</b>	<b>23,162</b>	<b>NO SURVEY</b>	<b>NO SURVEY</b>	<b>1,120,781</b>
Brent	0	0	0	1,572	935	3,509	65,580	0	0	55,485	504	1,035	9,040	1,690	0	0	NO SURVEY	NO SURVEY	139,350
Snow goose	0	0	0	25	0	3,053	411	0	0	71,495	54,080	78,532	16,280	47,105	603	0	NO SURVEY	NO SURVEY	271,584
Canada Goose	3,328	90	1,422	8,229	4,781	10,002	2,347	42,201	7,789	152,565	48,149	160,508	21,588	1,167	952	NO SURVEY	NO SURVEY	984,606	
<b>Total Geese</b>	<b>3,328</b>	<b>90</b>	<b>1,422</b>	<b>9,826</b>	<b>5,716</b>	<b>13,511</b>	<b>70,980</b>	<b>42,612</b>	<b>7,789</b>	<b>279,545</b>	<b>102,733</b>	<b>589,075</b>	<b>185,828</b>	<b>70,363</b>	<b>1,770</b>	<b>952</b>	<b>NO SURVEY</b>	<b>NO SURVEY</b>	<b>1,395,540</b>
Tundra swan	0	0	0	0	0	2	0	89	2	425	215	14,004	6,584	70,273	0	0	NO SURVEY	NO SURVEY	91,594
Mute Swan	0	0	42	854	735	729	66	28	0	1,591	3	276	0	0	0	0	NO SURVEY	NO SURVEY	4,394
Unidentified Swan	9	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	NO SURVEY	NO SURVEY	337
<b>Total Swans</b>	<b>9</b>	<b>0</b>	<b>42</b>	<b>854</b>	<b>735</b>	<b>735</b>	<b>66</b>	<b>28</b>	<b>2</b>	<b>2,016</b>	<b>218</b>	<b>14,280</b>	<b>6,554</b>	<b>70,273</b>	<b>319</b>	<b>0</b>	<b>NO SURVEY</b>	<b>NO SURVEY</b>	<b>96,325</b>
<b>Total Waterfowl</b>	<b>56,156</b>	<b>11,336</b>	<b>5,287</b>	<b>103,613</b>	<b>16,248</b>	<b>34,385</b>	<b>107,444</b>	<b>45,166</b>	<b>10,659</b>	<b>412,406</b>	<b>131,639</b>	<b>787,099</b>	<b>327,963</b>	<b>414,502</b>	<b>124,829</b>	<b>24,114</b>	<b>NO SURVEY</b>	<b>NO SURVEY</b>	<b>2,612,646</b>
Coot	0	0	0	0	22	9	0	105	0	50	0	200	2,053	8,810	19,522	27,397	NO SURVEY	NO SURVEY	58,168

<sup>a</sup> New York survey data from Long Island and Lake Champlain 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.

<sup>b</sup> 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, scup, ring-necked ducks, and to a lesser extent, wigeon and shovellers are especially suspect.

ATLANTIC FLYWAY  
BREEDING WATERFOWL PLOT SURVEY

Breeding Pair  
and  
Population Size Estimates  
Report

2010

Jon D. Klimstra

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

10 September, 2010

Habitat conditions were generally reported as good again this year. Many states experienced record snow fall that provided a large amount of water to recharge wetlands. Most all of the states experienced an early spring. April and May temperatures were well above normal this year which progressed spring by about a week to 10 days. Because of this some states reported early nesting. As is usual there were areas with localized flooding that will affect the production for that general area. Rhode Island in particular experienced a flooding event from rain storms that impacted early nesters.

In 2010, 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 (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 NBII Migratory Bird Data Center (<http://mbdcapps.fws.gov/>).

Breeding population and breeding pair estimates for this year are compared with estimates from 2009 and long-term (1993-2009) 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:

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

The variance of the long-term average was calculated as;

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

Where:

$i$  = survey year

$Var_i$  = estimated variance for year  $i$

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

This was the eighth 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 2009 were made with mallards, black ducks, wood ducks, and Canada geese. This is the third year that the current years estimates will be compared with the long-term average (LTA).

## Results

For the Mallard, both the population and breeding pair estimates decreased from 2009 with a percent change of approximately 2 and 6 percent respectively (Tables 1 and 2; Figures 1 and 2). Both of these estimates were not significant ( $P= 0.83$  and  $P= 0.51$ ) however both still remain well below the long term average (LTA) with this difference being statistically significant ( $P = 0.01$  and  $P= 0.0029$ , Table 1 and 2). Both the black duck population and pairs estimate declined from the 2009 estimate (but were not significant) and also the LTA with both estimates again being approximately 40% below the LTA (Tables 1 and 2; Figures 1 and 2). Population and breeding pairs estimates were again both statistically significant in their difference from the LTA ( $P = 0.0006$  and  $P = 0.000003$ , Tables 1 and 2). Wood ducks showed an increase for the population and breeding pairs estimate compared to 2009 and the LTA. However, neither increase was significant (Tables 1 and 2; Figures 1 and 2). For the Canada

goose both the old and new population estimate showed a non-significant decline from both 2009 and the LTA (Table 1). However the breeding pair estimate increased slightly from 2009 and was also slightly above the LTA, but neither were significant (Table 2). The reason for the decrease in the population and increase in breeding pairs could be that there were fewer birds seen in groups, which was not compensated for in an increase in number of pairs seen.

Both the population and breeding pairs estimate for Gadwall declined from 2009 and the LTA (Table 3 and 4). Only the breeding pair estimate change from the LTA was significant. Although not significant, the population estimates for both green and blue-winged teal increased from 2009 and also the LTA (Table 3). However, for both teal the breeding pair estimates decreased from 2009 and the LTA with neither being significant (Table 4). Again as in 2009, the population estimate for the common merganser increased slightly from the previous year but remains below the LTA (Table 3). The breeding pair estimate for the common merganser declined from 2009 and the LTA but neither were significant (Table 4). The population estimate for the hooded merganser showed a decrease for the third straight year and also from the LTA. Both the population estimate and pair estimate were significantly different ( $P=0.0089$  and  $P=0.0051$ ) from the LTA (Table 3 and 4). The mute swan population estimate did decrease slightly from 2009 and the LTA but were not significant (Table 3). However the breeding pair population remained relatively stable from 2009 with a slight increase for the second straight year compared to the LTA (Table 4). However this increase compared to the LTA was not significant.

goose both the old and new population estimate showed a non-significant decline from both 2009 and the LTA (Table 1). However the breeding pair estimate increased slightly from 2009 and was also slightly above the LTA, but neither were significant (Table 2). The reason for the decrease in the population and increase in breeding pairs could be that there were fewer birds seen in groups, which was not compensated for in an increase in number of pairs seen.

Both the population and breeding pairs estimate for Gadwall declined from 2009 and the LTA (Table 3 and 4). Only the breeding pair estimate change from the LTA was significant. Although not significant, the population estimates for both green and blue-winged teal increased from 2009 and also the LTA (Table 3). However, for both teal the breeding pair estimates decreased from 2009 and the LTA with neither being significant (Table 4). Again as in 2009, the population estimate for the common merganser increased slightly from the previous year but remains below the LTA (Table 3). The breeding pair estimate for the common merganser declined from 2009 and the LTA but neither were significant (Table 4). The population estimate for the hooded merganser showed a decrease for the third straight year and also from the LTA. Both the population estimate and pair estimate were significantly different ( $P=0.0089$  and  $P=0.0051$ ) from the LTA (Table 3 and 4). The mute swan population estimate did decrease slightly from 2009 and the LTA but were not significant (Table 3). However the breeding pair population remained relatively stable from 2009 with a slight increase for the second straight year compared to the LTA (Table 4). However this increase compared to the LTA was not significant.

AF Plot Survey  
Final Report 09/10/2010

Table 1. Population estimates and standard errors for mallards, black ducks, wood ducks, and Canada geese from the Atlantic Flyway Breeding Waterfowl Plot Survey, 1993-2009, and percent change from 2008 to 2009 and from the long-term average to 2009.

Year	N	Mallards		Black ducks		Wood ducks		Canada geese			
		Estimate	SE	Estimate	SE	Estimate	SE	Estimate <sup>a</sup>	SE	Estimate <sup>b</sup>	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	969,875	92,142
Long-term average (1993-2009)											
		770,494	12,863	66,666	3,054	376,074	8,388	945,777	23,996	1,095,878	35,230
Percent change											
from:	%	<i>P</i>	%	<i>P</i>	%	<i>P</i>	%	<i>P</i>	%	<i>P</i>	
2009	-2.12	0.4360	-3.46	0.8966	11.30	0.3961	-4.98	0.6788	-3.60	0.8073	
LTA	-15.30	0.0206	-42.77	0.0006	8.91	0.3649	-5.24	0.5942	-11.50	0.2359	

<sup>a</sup> Estimates based on the 1993-2002 method of calculating total indicated birds [TIB = 2\*(pairs) + singles + groups].<sup>b</sup> Estimates based on the post-2002 method of calculating total indicated birds [TIB = 2\*(pairs + singles) + groups].

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, 1993-2009, and percent change from 2008 to 2009 and from the long-term average to 2009.

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
Long-term average (1993-2009)									
		369,404	6,063	29,270	1,107	178,543	3,902	348,239	7,182
Percent change									
from:	%	<i>P</i>	%	<i>P</i>	%	<i>P</i>	%	<i>P</i>	
2009	-6.61	0.5000	-13.42	0.5509	14.14	0.2926	9.10	0.3904	
LTA	-18.64	0.0029	-47.28	0.0000	11.17	0.2593	3.27	0.6823	

Table 3. Population estimates and standard errors for gadwall, green-winged teal, blue winged teal, common mergansers, hooded mergansers, and mute swans from the Atlantic Flyway Breeding Waterfowl Plot Survey, 2003-2009, and percent change from 2008 to 2009.

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
Long-term average (2003-2009)													
		10,380	2,609	54,574	4,906	26,016	14,146	43,973	4,375	35,678	3,210	19,252	7,438
Percent change													
from:		%	<i>p</i>	%	<i>p</i>	%	<i>p</i>	%	<i>p</i>	%	<i>p</i>	%	<i>p</i>
	2009	-73.74	0.1105	5.61	0.8847	54.83	0.8964	6.71	0.9163	-19.31	0.5220	-16.54	0.9325

Table 4. Breeding pair estimates and standard errors for gadwall, green-winged teal, blue winged teal, common mergansers, hooded mergansers, and mute swans from the Atlantic Flyway Breeding Waterfowl Plot Survey, 2003-2009, and percent change from 2008 to 2009.

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
Long-term average (2003-2009)													
		2,535	433	12,102	1,379	9,644	1,569	18,067	1,598	15,485	1,393	8,607	944
Percent change													
from:		%	<i>p</i>	%	<i>p</i>	%	<i>p</i>	%	<i>p</i>	%	<i>p</i>	%	<i>p</i>
	2009	-79.74	0.0558	-39.44	0.2282	-56.22	0.1950	-3.19	0.9336	-25.20	0.4398	-0.50	0.9876

AF Plot Survey  
Final Report 09/10/2010

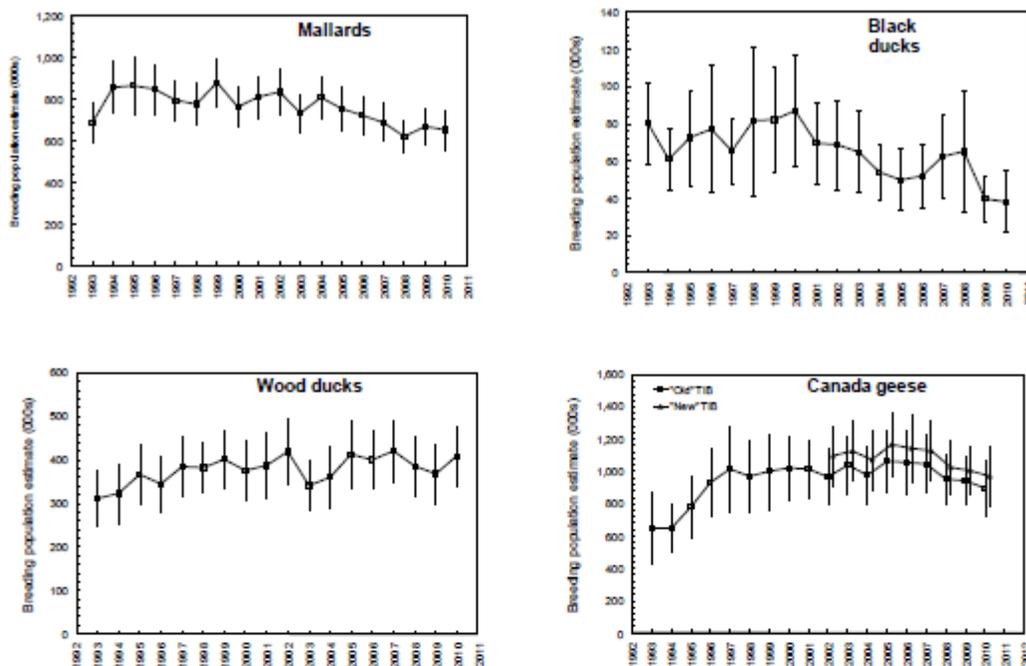


Figure 1. Population estimates and 95 % confidence intervals for mallards, black ducks wood ducks and Canada geese, 1993-2010.

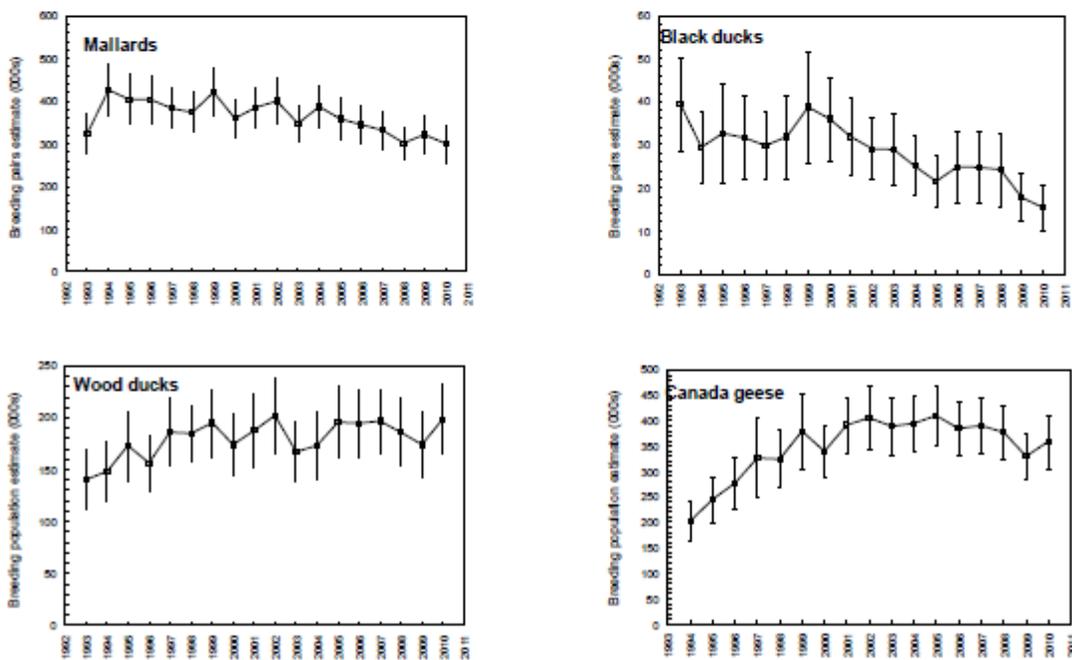


Figure 2. Breeding pair estimates and 95% confidence intervals for black ducks, wood ducks, and Canada geese, 1993-2010.