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TITLE: Waterfowl Population Monitoring

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

WORK LOCATION(S): Statewide

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ABSTRACT The objectives of this project are to monitor the status of breeding and wintering populations of waterfowl in Pennsylvania and the Atlantic Flyway (AF), and to assess the effects of harvest regulation changes on the waterfowl resource. Pennsylvania duck hunting seasons for 2010-11 were 60 days with a daily bag limit of 6 birds, similar to those offered in 2009-10, except that the pintail daily bag limit was increased to 2 per day. U. S. Fish and Wildlife Service (USFWS) Harvest Information Program estimated active duck and goose hunters in Pennsylvania during 2010-11 were 23,200 and 28,100, down 20% and 26% respectively from the 1999 to 2009 averages. Pennsylvania's total duck harvest estimate was 114,200, down 30% from average. Pennsylvania's 2010-11 estimated Canada goose harvest was 155,700, down 16% from average. Canada goose harvest timing was 27% during September and 73% during the regular season. Pennsylvania's estimated regular season snow goose harvest of 2,045 in 2010-11 was down 72% from average, but there were an additional 5,200 snow geese harvested during the conservation season from 21 February to 16 April 2011. The Pennsylvania portion of the 2011 AF Midwinter Waterfowl Survey was hampered by data loss from computer problems, but in those portions of the survey successfully completed we observed 47,325 waterfowl, which was 14% lower than the 2010 total and 36% below the 2001-2010 average. Numbers of snow geese and tundra swans were well below 2001-2010 averages; most other species totals could not be compared to previous years due to the lost data. At the flyway level, mallards, snow geese, and tundra swans increased from 2010 while black ducks and Canada geese decreased; tundra swans were 3% above their 2001-2010 average, while the other 4 species were 9-29% below their respective 10-year flyway averages. In the Pennsylvania portion of the 2011 AF Breeding Waterfowl Survey, mallard pairs (61,800) were down 35% from the 1993-2010 average. The

American black duck statewide estimate of 426 pairs continued to be below average. There were 51,800 wood duck breeding pairs estimated in 2011, similar to average. Estimates of total hooded mergansers (4,600) and common merganser (25,100) were above average. The Canada goose breeding pair (100,800) and total spring population (245,100) were near average. For the Northeast U. S. survey area, total population estimates for mallards (586,100) and black ducks (38,700) were significantly below average, while the wood duck estimate (382,700) was similar to last year and the average. The spring breeding population estimate for resident population Canada geese (1.02 million) was similar to 2010 and the average. Habitat conditions in the Northeast U. S. were generally favorable for nesting, except for flooding in April and May which could have negatively impacted some nests. Waterfowl populations in the Eastern survey area of Canada were average (except for American black ducks, which were 13% below average) and habitat conditions were good to excellent, which should favor production. Breeding duck populations on the traditional survey area in the mid-continent of North America were significantly above 2010, and 35% above the long-term average. Habitat conditions in the U. S. and Canadian prairies were excellent. Recruitment from this important production region is expected to be above average in 2011. Spring 2011 breeding population estimates for Atlantic Population and Southern James Bay Population Canada geese were similar to average. Production is expected to be near average for both populations. 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 et al. 2011) and the Pennsylvania Game Commission's (PGC) Game Take Survey (GTS) (see Boyd and Weaver 2011 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 2011 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. Due to the high reporting rate observed in 2009 (88.5%) we did not send reminder mailings to individuals that failed to send in their harvest reports and we did not conduct an additional survey of non-respondents to estimate their harvest in either 2010 or 2011.

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 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. 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. Due to problems with this program during aerial surveys in 2011, a substantial amount of data collected on the flights was lost; therefore, follow-up ground surveys were conducted, where feasible, to collect replacement data. Most of these ground surveys occurred 7-10 days after the aerial surveys at the same locations (and 3-6 days after the end of the target survey window). Weather conditions did not change markedly during this period, so waterfowl distribution and numbers were likely similar between survey methods and dates; however, the more restricted coverage area of the follow-up ground surveys did result in reduced counts for some survey segments, and species.

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-km² plots (Fig. 1) 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 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 (1993-2010) averages. Additional breeding survey data for

areas not covered by the AF Breeding Waterfowl Plot Survey was provided by the USFWS (2011).

RESULTS

Hunter Activity and Harvest

As in 2009-10, duck season length in 2010-11 was 60 days with outside framework dates of the Saturday nearest to 24 September and the last Sunday in 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 limit for northern pintails was increased to 2 birds, while other individual species regulations remained the same as 2009-10.

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; daily bag limit of 1 bird in these areas to limit harvest on the resident flocks at each WMA). Regular Canada goose season lengths and bag limits in the AP, RP and SJB zones remained the same as in 2009-10.

The estimates (Raftovich et al. 2011) of active duck and goose hunters in Pennsylvania from HIP were 23,200 and 28,100 respectively and remain the highest in the AF (Table 1). These estimates were 20% and 26% below the 1999-2009 average. The HIP estimate of days hunted for ducks in 2010-11 was down 32% from average while the number of goose hunter days was down 39% from average. The HIP estimate of total Pennsylvania duck harvest (114,200) was down 30% from average. GTS estimates of total duck harvest were 77,508, down 51% from average. HIP Canada goose harvest estimate in Pennsylvania for 2010-11 was 155,700, 16% below average. Pennsylvania ranked 2nd in the AF for total Canada goose harvest. The GTS estimate of Canada goose harvest in the September portion of the season was 89,145. No estimate for the regular season was provided. 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. The September season continues to account for a substantial, but recently declining proportion (27%) of the harvest while the regular season (late-October to late-February) harvest accounted for 73% of the total. Estimated snow goose harvest during the regular season in Pennsylvania was 2,045 birds, down 72% from average. This was likely related to poor weather conditions as well as a low number of juveniles in the fall flight.

Season dates for the snow goose conservation season were 21 February–16 April 2011 with daily bag limit of 25 geese and no possession limit. Additional hunting methods allowed included the use of electronic calls and decoys, and expanded hunting hours (1/2 hour after

sunset). We issued 3,401 permits to hunters to participate in the 2011 Snow Goose Conservation Season. This included 70 nonresident hunters. Data is not available on the percentage of the permits issued to hunters using the online permit registration method. We received 1,302 reports (38.3% reporting rate) by 15 May. Online reporting was very popular, but exact data is not available on the percentage of reports received via this reporting method.

Of the 1,302 reports received, 402 (30.9%) indicated they did not hunt at all during the conservation season. Of the 900 individuals that indicated they hunted during the conservation season, their total retrieved harvest was 5,197 (Table 2). Total hunter days were 2,959 and the number of geese killed per hunter day was 1.75. The additional hunting methods of extended hours and electronic calls resulted in a harvest of 428 and 1,845 geese, respectively. Use of electronic calls accounted for 36% of the snow geese taken, while extended hunting hours had less effect, with only 8% of the total geese taken after sunset.

Compared with the 2009 and 2010 Conservation Seasons, both participation and harvest were near average. The snow goose spring migration timing into Pennsylvania occurred near the last week of February 2011. Many birds staged in Pennsylvania through the middle of March, which is a little later than normal and allowed hunters an extended period to hunt for the birds. Deep snow cover from late December through most of February kept birds south of Pennsylvania before the onset of the Conservation Season. There were relatively few juveniles in the winter population which also contributed to reduced harvest during the regular 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 2011 Conservation Season was 48,279, with an additional 2,308 birds shot and lost. The estimated total harvest of 50,587 was slightly higher than the 2010 estimate, and twice the estimated harvest in the first year of the Conservation Season in 2009. The estimated number of days spent hunting (15,118) was about 20% higher than the previous 2 years. The conservation season in the U. S. has been reasonably successful in providing additional harvest of greater snow geese, but overall harvest rate still may be insufficient to stabilize this overabundant population.

The five most commonly harvested duck and merganser species in Pennsylvania were mallard, wood duck, American black duck, American green-winged teal, and common merganser (Table 3). The 2010-11 harvests of common mergansers and gadwalls were higher than the 1999-2009 average. However, harvests for the following species were below average: mallard (-38%), wood duck (-18%), American black duck (-17%), American green-winged teal (-35%), bufflehead (-31%), lesser scaup (-47%), greater scaup (-80%), ring-necked duck (-13%), American wigeon (-39%), and hooded merganser (-51%).

The number of juveniles per adult in the 2010-11 AF harvest (Table 4) was near the 1996-2009 average for mallard (8% above), wood duck (1% above), green-winged teal (10% above) and ring-necked duck (12% above), above average for black duck (27%), lesser scaup (19%), gadwall (70%), American wigeon (88%) and Canada goose (37%) and below average for greater scaup (-53%), bufflehead (-23%) and snow goose (-48%). These age ratios may partially explain the below average harvest for the species listed above.

Midwinter Waterfowl Survey

The Pennsylvania portion of the 2011 MWS was conducted between 5 January and 14 January. Initial surveys of most of the 11 PGC segments were conducted by fixed-wing aircraft (in cooperation with the Pennsylvania Department of Transportation) early in this period. However, problems with the voice-GPS computer program led to the loss of a substantial amount of the data collected on these flights. Follow-up ground surveys were conducted to collect replacement data where feasible, but it was not possible to obtain complete coverage of all segments. Ground counts were conducted at Middle Creek WMA, as is standard practice for this location. Most lakes surveyed were 75-95% frozen, while most riverine habitats and Lake Erie were open. Waterfowl were generally concentrated on the available open water, making them relatively easy to locate and count.

Unless otherwise noted, 2011 data presented in this report should be considered moderately underestimated due to the incomplete survey coverage described above. A total of 47,325 waterfowl were recorded in those portions of the survey successfully completed (Table 5). This included 3,645 dabbling ducks (mostly mallards and black ducks), 876 diving ducks, 229 mergansers, 41,856 geese (99% of which were Canada geese), and 337 swans (94% tundra swans and 6% mute swans). The overall total was 14% lower than the 2010 total, and 36% below the 2001-10 average. Significance of data loss varied by species and location. Totals for mergansers and for Zone 2 (Susquehanna River) were reduced dramatically. Counts for Canada geese, mallards, and black ducks, and overall numbers for Zones 1 (northwestern Pennsylvania) and 3 (southeastern Pennsylvania) were moderately reduced. Snow goose and tundra swan totals were affected only minimally, if at all. For those 2 species, 2011 totals were below the 2001-2010 average by 97% and 65%, respectively.

For the entire AF, 2,579,938 waterfowl 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 numbers increased 19% from 2010 but were 9% below the 2001-2010 average, while black duck numbers decreased 17% from 2010 and were 21% below the 10-year average. Canada geese were down 24% from 2010 and were 18% below the 2001-2010 average. Snow goose numbers were up 2% from 2010, but remained 29% below the 10-year average. Tundra swans increased 2% from 2010 and were 3% above 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

Habitat and weather conditions were much wetter than average across most of Pennsylvania during spring, with considerable flooding across northern and central portions of the state. Temperatures during the survey were average. First hatches of Canada goose and mallard broods appeared normal. Precipitation in early summer, after the conclusion of the survey period, was less than average across southern portions of the state. Due to nest losses from flooding, we expect below average to average production in 2011 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 2011 survey results with comparison to the 1993 to 2010 average for ducks, mergansers and Canada goose pairs. The Canada goose total bird estimate is averaged from 2003 to 2010 due to a methods change in recording and calculating total birds observed.

The number of indicated mallard breeding pairs (61,790) was statistically below the average of 94,530 pairs and numerically 35% below average and the lowest estimate recorded (Table 6). Other indices of statewide mallard abundance (2nd Breeding Bird Atlas, North American Breeding Bird Survey, and the number of pre-season-banded mallards) also show some evidence of declining trends. A decline in mallard abundance was expected following liberalized hunting frameworks adopted in 1996 through Adaptive Harvest Management (AF Mallard Committee, personal communication). Managers originally expected this trend to stabilize, but recent evidence suggests it may continue if not addressed through more conservative hunting regulations. Stratum 22 in southwestern Pennsylvania had the highest density of breeding mallards (0.90 pairs/km²), while stratum 243 in northeastern Pennsylvania had the next highest density of breeding mallards (0.87 pairs/km²). American black ducks were observed on two survey plot in stratum 243 in northeastern Pennsylvania resulting in a statewide estimate of 426 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 have also been declining since the mid-1990's. There were 51,787 wood duck breeding pairs estimated in 2011, which was similar to the average of 51,668 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, northeastern and southwestern Pennsylvania with 0.94, 0.93 and 0.85 pairs/km², respectively. The estimate of total blue-winged teal (2,970) and American green-winged teal numbers (3,869) were slightly below average in 2011. 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 2011. Breeding Waterfowl Plot Survey estimates are unlikely to be indicative of true breeding populations of teal in Pennsylvania as many migrating teal are encountered during the survey period. Estimates of total hooded mergansers (4,646) and common mergansers (25,100) were above average. The trends for both breeding merganser species are increasing since 1993.

The 2011 Pennsylvania Canada goose breeding pairs estimate was 100,802, which is statistically similar to the average of 91,543. Pairs were most abundant in the southeast (1.73

pairs/km²) and southwest (1.7 pairs/km²). The 2011 total population estimate of 245,061 was statistically similar to the recent 8-year average of 274,298 geese (Table 6). As expected, the highest densities of total geese were observed in southeastern (5.0 geese/km²) and northwestern (3.99 geese/km²) 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 Atlantic Flyway Resident Canada Goose management plan goal of 150,000 spring birds (Atlantic Flyway Resident Canada goose Management Plan 2011). The ratio of juvenile Canada geese banded per adult female from June 2011 statewide banding was 1.66, which is near the 1991 to 2010 long-term average of 1.64 and indicates average production of Canada geese statewide in 2011. Age ratios varied regionally, however, from 2.56 juveniles per adult female in western Pennsylvania, to 1.96 in southcentral Pennsylvania, and 0.86 in eastern Pennsylvania.

Survey results for the entire AF Breeding Waterfowl Plot Survey for 2011 (Klimstra 2011, Appendix 3) included a mallard total population estimate of 586,089, which was 23% below average (statistically significant) and the lowest recorded since 1993. The American black duck estimate (38,717) was down 41% from average. There has been a declining trend in mallard and black duck abundance over the last 12 years of this survey. Wood duck numbers (382,736) were similar to last year and the average. Wood duck trends appear stable to slightly increasing. Nesting ducks in the northeast U. S. should have at least average production in 2011 due to favorable weather and habitat conditions. In the eastern surveyed areas of Canada and Maine (USFWS 2011), estimates for mallards, green-winged teal, ring-necked ducks, goldeneyes, buffleheads and mergansers were similar to last year and to their 1990-2010 averages. The American black duck estimate was similar to 2010, but 13% below average. Habitat conditions were favorable overall.

The number of ducks counted in the traditional mid-continent survey area in May 2011 (USFWS 2011) was 45.6 million birds. This was above last year's estimate of 40.9 million birds, and 35% above the 1955-2010 long-term average (LTA). Mallard abundance was 9.1 million birds, 9% above last year's estimate and 22% above the LTA. Blue-winged teal (8.9 million birds, all-time record high, 91% above LTA), green-winged teal (2.9 million, 47% above LTA), gadwalls (3.3 million, 80% above LTA), northern shovelers (4.6 million, all-time record high, 98% above LTA), redheads (1.4 million, all-time record high, 106% above LTA), and canvasbacks (0.7 million), were all above their LTA in 2011. Estimated abundance of northern pintails (4.4 million) was similar to the LTA, and the highest estimate for this species since 1980. The estimates for American wigeon (2.1 million, 20% below LTA) and combined greater and lesser scaup (4.3 million, 15% below LTA) remained below their LTA. Habitat conditions during the 2011 survey were characterized by above-average moisture across large portions of the traditional survey area and good habitat overall in the eastern survey area. The total pond estimate (prairie Canada and U. S. combined) was 8.1 million. This was 22% above last year and 62% above the long-term average of 5 million ponds.

AP 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

2011 were normal and snow melt was near average. The estimated number of breeding pairs (194,000) was 17% above the previous 10-year average (Harvey and Rodrigue 2011). The total population estimate (breeding pairs and grouped birds) was 919,000 individuals, up 18% from 2010. The forecast based upon weather modeling, as well as nesting and banding studies along Ungava Bay, predicted slightly below average productivity. SJBP 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 5-10% of the overall harvest in the SJBP zone (the balance being resident geese). The spring population estimate of 99,300 SJBP Canada geese was statistically unchanged from 2010 and the average (Brook and Hughes 2011). Nesting studies on Akimiski Island indicate good nesting conditions and breeding effort in James Bay. 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 over 1.02 million, similar to 2010 and the LTA (Klimstra 2011). Field reports indicate average gosling production. Another large fall flight, with many juveniles, is expected for the 2011-12 hunting season. Greater snow geese nest principally on Bylot, Axel Heiberg, Ellesmere, and Baffin Islands in the Canadian Arctic. Spring estimates on the size of this population, which are obtained during staging in southern Québec, were not available at the time of this report. Breeding conditions for greater snow geese were rated average on Bylot Island (USFWS 2011). 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 2011-12 to provide annual information on waterfowl population status.

LITERATURE CITED

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Table 1. 2010-11 waterfowl hunting season activity and harvest in Pennsylvania and percentage change as estimated by USFWS Harvest Information Program Survey (HIP) and PGC game take survey.

	2010-11 ^a	2009-10	% Change from 2009	99-10 Average	% Change from Avg.
Ducks					
HIP Hunters	23,200	25,200	-8	29,109	-20
HIP Hunter Days	104,800	118,200	-11	155,164	-32
HIP Harvest	114,200	125,900	-9	163,682	-30
PGC Harvest ^b	77,508	137,974	-44	158,891 ^b	-51
Canada goose					
HIP Hunters	28,100	30,500	-8	37,764	-26
HIP Hunter Days	127,100	167,500	-24	209,882	-39
HIP Harvest	155,700	161,900	-4	185,658	-16
PGC Harvest ^b	89,145 ^c	195,105	-	179,657 ^b	-
Snow goose					
HIP Harvest	2,045	6,800	-70	7,346	-72

^a Preliminary.

^b PGC Game take survey not conducted in 2004-05.

^c Includes September season harvest only. No regular season results.

Table 2. Number of permits issued, reports received, hunter days and number of geese taken by hunting method during the 2009 to 2011 Snow Goose Conservation Season in Pennsylvania.

Year	Permits Issued	No. Hunted	Percentage Hunted	Days Hunted	Geese Shot	Geese Lost	After Sunset	W/ e- calls
2009	3,276	1,724	53	3,840	5,903	317	736	1,522
2010	3,107	668	21	2,409	2,985	141	330	1,101
2011	3,401	900	26	2,959	5,197	259	428	1,845

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

Species	2010-11^a	2009-10	% Change from 2009	99-09 Average	% Change from Avg.
Mallard	50,700	56,300	-10	82,355	-38
Wood duck	31,800	41,800	-24	38,973	-18
Black duck	7,400	5,100	45	8,882	-17
Green-winged teal	5,100	6,500	-22	7,864	-35
Bufflehead	3,100	3,400	-9	4,500	-31
Lesser scaup	1,200	1,500	-20	2,268	-47
Greater scaup	200	300	-33	1,018	-80
Ring-necked duck	1,500	500	200	1,727	-13
Gadwall	1,900	1,200	58	1,779	7
American wigeon	700	600	17	1,141	-39
Mallard/black Hybrid	1,100	500	120	1,112	-1
Common merganser	4,100	3,300	24	3,449	19
Hooded merganser	1,500	1,000	50	3,045	-51

^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 1996-2011 hunting seasons in the Atlantic Flyway.

Species	2010-11^a	2009-10	% Change from 2009	96-09 Average	% Change from Avg.
Mallard	1.3	1.37	-5	1.2	8
Wood duck	1.2	1.31	-8	1.19	1
Green-winged teal	1.95	1.62	20	1.77	10
Black duck	1.43	1.15	24	1.13	27
Ring-necked duck	1.45	0.93	56	1.3	12
Lesser scaup	0.8	0.52	54	0.67	19
Greater scaup	0.57	0.63	-10	1.2	-53
Bufflehead	0.62	0.47	32	0.8	-23
Gadwall	1.82	1.0	82	1.07	70
American wigeon	1.79	0.66	171	0.95	88
Canada goose	0.63	0.37	70	0.46	37
Greater snow goose	0.44	0.26	69	0.84	-48

^a Preliminary.

Table 5. Number of waterfowl recorded in zones 1-3 during Pennsylvania's Midwinter Waterfowl Survey, 2001-2011.

Species	2011 ^{ab}	2010 ^a	2009 ^a	2008 ^a	2007 ^a	2006 ^a	2005 ^a	2004 ^a	2003 ^a	2002 ^a	2001	2001-2010
												Avg.
Canada goose	41,495	51,321	54,267	38,602	42,456	51,844	41,839	48,454	77,224	78,828	48,198	53,303
Mallard	2,131	1,098	2,544	2,992	2,613	2,676	2,453	4,460	3,082	4,124	4,306	3,035
Black duck	1,452	1,131	1,448	1,770	906	1,865	2,763	2,079	1,775	2,904	1,570	1,821
Gadwall	11	3	0	2	29	5	13	18	0	0	2	7
Wigeon	0	1	0	1	0	1	0	0	0	11	0	1
Green-winged teal	0	0	3	2	13	12	13	0	2	1	0	5
Blue-winged teal	0	0	0	0	0	0	0	0	0	0	0	0
Shoveler	30	0	12	5	32	1	0	25	0	119	9	20
Pintail	21	0	5	6	0	10	1	24	0	6	0	5
Wood duck	0	1	0	0	0	0	0	0	0	0	0	0
Redhead	11	69	0	0	0	0	0	10	0	20	1	10
Canvasback	153	5	0	1	0	0	91	10	0	0	0	11
Scaup	634	9	0	290	80	302	2,379	260	0	0	34	335
Ring-necked duck	6	4	0	32	0	0	0	0	11	12	44	10
Goldeneye	42	21	0	26	29	159	16	116	70	41	10	49
Bufflehead	24	10	25	67	252	66	13	204	237	1,841	191	291
Ruddy duck	6	0	0	0	9	0	0	6	1	8	33	6
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	0	0
Mergansers	229	453	704	2,360	1,988	1,009	3,993	759	992	564	1,070	1,389
Unidentified ducks	160	21	9	29	219	31	12	0	25	27	53	43
Brant	0	0	0	0	0	0	0	0	0	0	2	0
Snow goose	361	411	12,899	13,902	32,096	10,314	25,909	11,100	9,602	4,347	0	12,058
White-fronted goose	0	0	0	0	0	0	0	0	0	0	0	0
Tundra swan	316	89	783	1,178	363	2,464	786	1,261	548	1,098	363	893
Mute swan	21	48	36	23	23	23	22	33	27	13	32	28
Unidentified swans	0	9	0	0	0	0	2	0	0	0	3	1
Coot	222	105	0	100	552	200	75	25	50	250	265	162
Totals	47,325	54,809	72,735	61,388	81,660	70,982	80,380	68,844	93,646	94,214	56,186	73,484

^a Totals for 2002-11 may not be completely comparable to those from 2001 and prior because of procedural changes to survey in 2002.

^b 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, 2011.

Strata	Mallard		Black duck		Wood duck		Canada goose		Canada goose	
	Pairs	SE	Pairs	SE	Pairs	SE	Pairs	SE	Total	SE
10	9,398	3,249	0	0	4,565	1,973	22,823	5,547	65,785	15,877
13	15,326	6,107	0	0	4,877	2,430	11,146	3,173	25,079	8,306
22	11,986	4,720	0	0	11,320	4,347	22,641	8,532	45,281	17,064
241	7,069	2,227	0	0	9,331	2,233	15,127	3,869	39,443	11,146
242	6,726	2,597	0	0	9,557	3,584	14,159	6,666	33,274	13,979
243	11,286	3,255	426	298	12,137	2,935	14,905	4,207	36,199	9,546
2011 PA Total	61,790	9,614	426	298	51,787	7,426	100,802	13,811	245,061	31,985
1993 –2010 avg.	94,530	13,780	915	650	51,668	7,999	91,543	11,871	274,298 ^a	29,324
% Change	- 35 %		- 53 %		+0 %		+10 %		- 11 %	

^a 2003 to 2010, 8-year average.

Table 7. Pennsylvania waterfowl population estimates from 2002 to 2011 and the 1993-2010 averages.

Species Estimate	2011	93-10									
		2011	average	2010	2009	2008	2007	2006	2005	2004	2003
Mallard pairs	61,790	94,530	78,677	92,509	65,739	90,237	80,667	95,685	84,806	82,302	84,534
Mallard total	132,903	194,988	161,675	187,697	131,477	181,504	174,374	197,975	177,715	170,067	171,752
Black duck pairs	426	915	269	639	269	1,716	-	-	-	622	2,010
Black duck total	852	1,830	537	1,278	537	3,433	-	-	-	1,245	4,020
Wood duck pairs	51,787	51,668	56,265	63,118	42,791	56,671	61,014	60,536	47,368	46,855	65,684
Wood duck total	107,045	109,522	114,797	128,060	87,924	127,847	128,009	132,552	94,736	93,711	132,858
Canada goose pairs	100,802	91,543	88,845	88,617	100,174	100,741	88,478	115,291	122,857	101,564	85,192
Canada goose total	245,061 ^a	274,298 ^b	231,780 ^a	289,879 ^a	246,499 ^a	255,924 ^a	245,689 ^a	311,171 ^a	338,230 ^a	275,207 ^a	234,754
Bl-winged teal total	2,970	7,434	4,186	7,814	1,840	12,650	1,979	2,746	8,041	1,273	7,842
Gr-winged teal total	3,869	4,432	2,063	5,569	1,979	5,064	7,172	7,089	9,138	5,266	4,131
Hooded merg. total	4,646	1,521	2,620	2,975	3,031	2,972	7,646	9,625	1,272	4,318	4,205
Common merg. total	25,100	6,522	14,053	12,377	18,773	17,429	15,167	12,916	14,671	14,335	14,371
Mute swan total	1,417	1,367	2,268	1,276	3,921	6,064	2,102	2,245	2,528	709	426

- No black ducks observed.

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

^b Average from 2003 to 2010 using new formula for total.

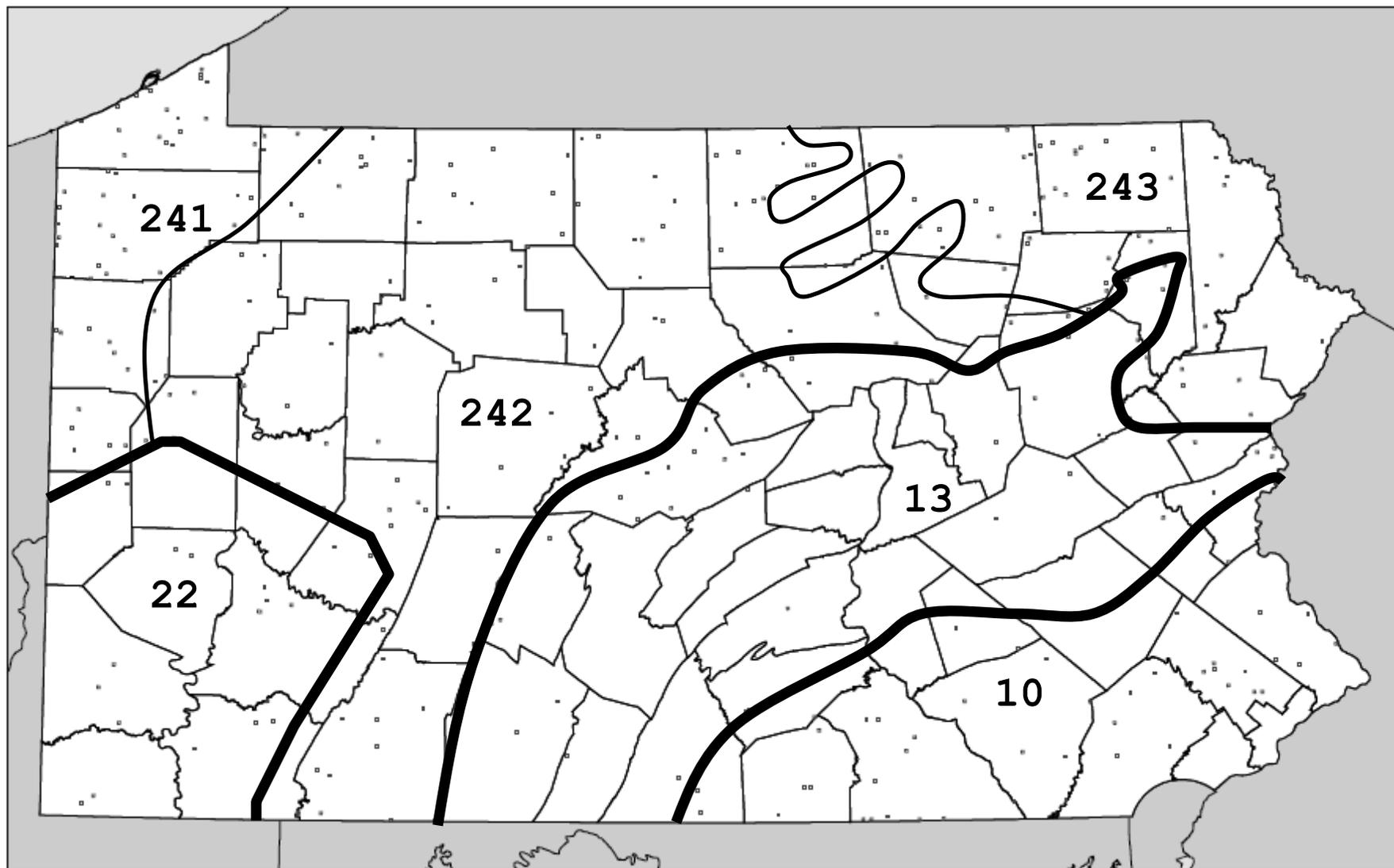


Figure 1. Location of Atlantic Flyway breeding waterfowl survey plots within major physiographic provinces in Pennsylvania. Physiographic Provinces are Piedmont (10), Ridge and Valley (13), Pittsburgh Plateau (22), Glaciated NW (241), Allegheny Mountain/Plateau (242), and Pocono/Low Plateau (243).

Appendix 1. Proposed 2010/2011 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 2 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 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 18.

SEASON DATES

Lake Erie Zone

Ducks, sea ducks, coots and mergansers – Oct. 25 – Jan.1, 2011

North Zone

Ducks, sea ducks, coots and mergansers – Oct. 9 – 23 & Nov. 11– Jan. 4, 2011

Northwest Zone

Ducks, sea ducks, coots and mergansers – Oct. 9 – 23 & Nov. 6 – Dec. 30, 2010

South Zone

Ducks, sea ducks, coots and mergansers – Oct. 9 – 16 & Nov. 17 – Jan. 17, 2011

ATLANTIC BRANT

Oct. 9 – Dec. 6 (2 brant daily bag limit, 4 in possession).

SNOW GEESE

Regular Season – Nov. 6 – Feb. 19, 2011 (25 daily bag limit, no possession limit).

Conservation Season – Feb. 21 – Apr. 16, 2011 (25 daily bag limit, no possession limit. Permit required).

CANADA GEESE

Atlantic Population Canada Goose Hunting Zone

Nov. 17 – 27 & Dec. 21 – Jan. 29, 2011 (3 goose daily limit)

Southern James Bay Population Canada Goose Hunting Zone

Oct. 23 – Nov. 27 & Dec. 13 – Jan. 26, 2011 (3 goose daily limit)

Resident Population Canada Goose Hunting Zone

Oct. 23 – 30, Nov. 8 – 27 & Dec. 18 – Feb. 19, 2011 (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 SJBP 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 one goose; **except** on State Game Lands 214 where the season is closed to September goose hunting. Note: this restriction does not apply to youth participation on youth waterfowl hunting day September 18, 2010 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 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. Note: this restriction does not apply to youth participation on youth waterfowl hunting day September 18, 2010 when regular season regulations apply.

Canada goose hunting zones for 2010-11 season in Pennsylvania

Resident Population Canada Goose (RP) Zone

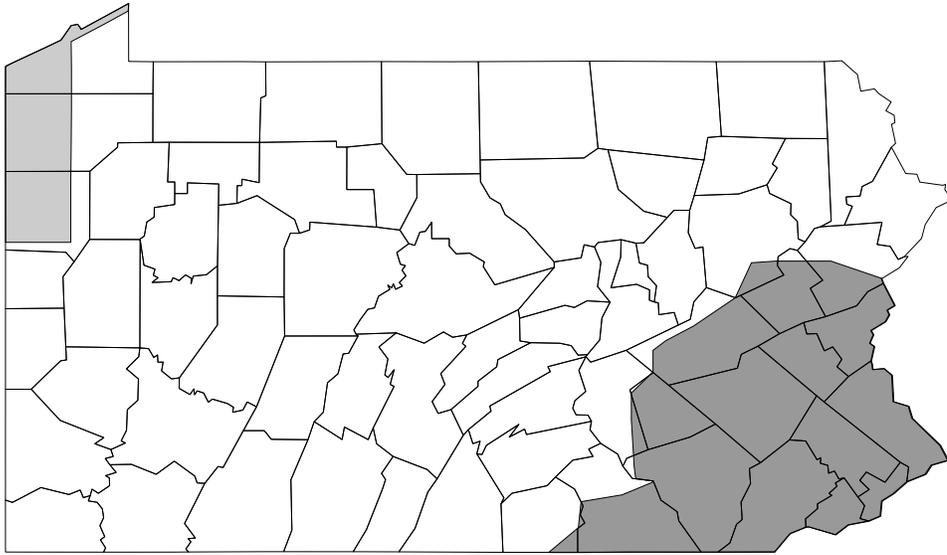
All of Pennsylvania **except** for the Southern James Bay Population (SJBP) zone **and** the Atlantic Population (AP) zone.

Southern James Bay Population (SJBP) Zone

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

Atlantic Population (AP) Zone

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



Pennsylvania

Appendix 2. 2011 Atlantic Flyway Midwinter Waterfowl Survey results.

Species	ME	VT	NH	MA	CT	RI	NY ^a	PA ^b	WV	NJ	DE	MD	VA	NC	SC	GA	FL	Flyway Total ^c
Mallard	1,992	198	1,188	1,808	2,618	1,389	1,438	1,826	3,933	19,230	6,986	54,622	13,082	6,981	5,136	844		123,271
Black duck	15,302	139	845	16,589	3,463	1,816	12,032	1,412	789	62,220	5,585	22,923	17,288	7,593	103	0		168,099
Mexican duck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Mottled duck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Gadwall	0	0	0	0	296	94	0	11	0	275	220	6,396	11,573	28,034	20,027	2,366		69,292
American wigeon	0	0	0	0	265	130	10	0	0	1,065	242	175	2,042	48,586	7,063	729		60,307
G.W. Teal	40	0	0	0	15	0	0	0	0	30	150	54	1,099	79,944	25,788	2,340		109,960
B.W. Teal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		4,811
N. Shoveler	0	0	0	0	0	0	0	30	0	20	166	65	565	816	775	105		4,811
N. Pintail	0	0	0	0	4	0	250	21	0	1,520	1,043	1,191	578	74,774	11,580	10		90,972
Wood duck	0	0	0	0	3	0	0	0	20	0	0	0	30	55	2,684	755		3,547
Whistling duck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Total Dabblers	17,334	337	2,033	18,397	6,664	3,430	13,730	3,300	4,742	84,360	14,392	85,926	46,257	246,783	81,878	9,140		638,703
Redhead	0	0	0	0	0	0	0	11	1	1,180	700	4,745	2,600	25,610	206	125		33,298
Canvasback	0	0	0	1	110	2	100	133	6	1,180	320	43,564	19,135	2,830	532	2,655		70,968
Scup	100	1,500	2,202	2,382	5,410	4,230	46,670	634	41	63,500	320	29,672	4,972	22,725	3,741	36,098		224,197
Ringneck	0	0	0	0	85	6	0	6	3	10	189	1,600	6,919	48,262	19,292	7,472		83,844
Goldeneye	5,088	2,194	144	835	1,005	1,278	2,337	42	0	315	2	334	78	0	20	0		13,672
Bufflehead	2,889	0	219	2,032	1,172	2,573	5,660	24	32	23,670	295	7,504	10,978	4,091	675	83		61,897
Ruddy duck	0	0	0	0	128	0	190	6	0	110	744	16,506	17,262	6,582	1,144	361		43,033
Total Divers	8,077	3,694	2,565	5,250	7,910	8,089	54,957	876	83	88,785	2,250	103,925	61,944	110,100	25,590	46,814		530,909
Eider	11,524	0	765	46,198	0	2,153	0	0	0	790	64	238	1,183	307	519	15,335		25,547
Scoter	816	0	62	4,817	688	603	125	0	0	900	0	360	74	0	0	50		3,362
Long-tailed Duck	1,004	0	0	148	576	0	250	0	0	0	0	0	0	0	0	0		28
Harlequin	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Total Seeducks	13,372	0	827	51,163	1,264	2,756	375	0	0	1,690	64	598	1,257	307	519	15,385		89,577
Merganser	4,077	2,679	1	4,643	1,054	1,460	2,513	24	204	8,330	146	7,727	1,129	2,360	2,683	1,253		40,283
Unidentified Duck	0	0	26	12	0	0	0	160	15	0	0	108	273	0	3,000	265		3,859
Total Ducks	42,860	6,710	5,452	79,465	16,892	15,735	71,575	4,360	5,044	183,165	16,852	198,284	110,860	359,550	113,670	72,857		1,303,331
Brant	0	0	0	1,213	1,558	4,585	67,260	0	0	61,195	525	1,465	9,924	1,210	0	0		148,935
Snow goose	0	0	0	0	0	0	1,800	361	4	62,315	132,156	28,178	7,100	44,775	412	0		277,101
Canada Goose	3,877	12	3,328	11,299	3,751	7,867	1,465	33,220	6,147	106,025	50,506	397,102	105,520	19,745	1,831	567		752,262
W.F. Goose	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Total Geese	3,877	12	3,328	12,512	5,309	12,452	70,525	33,581	6,151	229,535	183,187	426,745	122,544	65,730	2,243	567		1,178,298
Tundra swan	0	0	0	0	0	0	0	316	0	155	258	14,355	8,767	69,501	404	0		93,756
Trumpeter swan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Mute Swan	0	0	57	467	728	1,649	193	11	0	1,303	14	74	41	5	0	0		4,542
Unidentified Swan	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0		11
Total Swans	0	0	57	467	728	1,649	193	327	0	1,458	272	14,429	8,819	69,506	404	0		98,309
Total Waterfowl	46,737	6,722	8,837	92,444	22,929	29,936	142,293	38,268	11,195	414,158	200,311	639,558	242,223	494,786	116,317	73,424		2,579,938
Coot	0	0	0	0	0	0	0	222	39	0	0	75	7,846	36,908	24,245	62,885		132,238
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.

^b Counts for PA are potentially low, because of technical problems some data were lost.

^c 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, ringnecked ducks, and to a lesser extent, wigeon and shovellers are especially suspect.

Appendix 3. 2011 Atlantic Flyway Breeding Waterfowl Plot Survey results.

ATLANTIC FLYWAY
BREEDING WATERFOWL PLOT SURVEY

Breeding Pair
and
Population Size Estimates
Report

2011

Jon D. Klimstra

U.S. Fish and Wildlife Service
Division of Migratory Bird Management
11510 American Holly Drive
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28 June, 2011

In much of the survey area states experienced a wet cool spring with prolonged periods of rainfall. Some states such as Pennsylvania in the north and central part of the state received more than 100% of their 90 day average rainfall. For most New England states much of this rainfall occurred during peak hatch which could impact brood survival in these areas. There was some localized flooding in states such as New Jersey. In the New England region down to New Jersey, habitat conditions can be summed up as average to slightly below average because of cool wet weather. Both Delaware and Maryland experienced slightly above average temperatures from March to April. For both states conditions appeared normal for both nesting and brood rearing. Virginia experienced fair to somewhat unfavorable conditions because of a low pressure system influencing higher than normal tides creating flooding conditions in coastal marshes. Higher than normal June temperatures quickened drying of wetland areas which possibly prevented re-nesting attempts.

In 2011, 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 2010 and long-term (1993-2010) 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 ninth 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 2010 were made with mallards, black ducks, wood ducks, and Canada geese. This is the fourth year that the current years estimates will be compared with the long-term average (LTA).

Results

The overall population estimate for Mallards again declined for the second straight year with a 10 percent change from 2010 however this decline was not significant compared to the 2010 estimate (Table 1). More importantly this year’s estimate does continue to show the trend of a declining population estimate when compared to the long term average (LTA) with this difference being highly significant ($p=4.16E-5$) (Table 1). Like the population estimate the mallard breeding pair estimate declined for the second year (approximately 7%) but was not

significantly different from 2010. When compared to the LTA however there was a significant decline in breeding pairs (Table 2). The population estimate for the American black duck increased slightly from 2010 (1.47%) but was not significant (Table 1). However the population estimate continued to decline for the fourth straight year by about 40 percent when compared to the LTA with this decline being significant ($p=0.0014$) (Table 1). The breeding pairs estimate for the black duck increased by almost 18 percent compared to the 2010 estimate but was not significant. When compared to the LTA the breeding pairs estimate continued to decline by about 36 percent which represented a significant decline (Table 2). The population estimate for Wood ducks decreased by about 6 percent from 2010 but increased slightly from the LTA with neither being significant (Table 1). The breeding pairs estimate followed the same trend with the difference from 2010 decreasing slightly but increasing compared to the LTA (Table 2). For the Canada goose both the old and new population estimate showed a non-significant increase compared to 2010 but experienced a non-significant decrease from the LTA (Table 1). For the second year the breeding pair estimate increased slightly and was also slightly above the LTA, but neither were significant (Table 2). Like last year 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.

The population estimate for Gadwall increased by almost 60 percent from 2010 but decreased by about 36 percent from the LTA with neither being a significant increase or decrease ($p=0.54$ and 0.32 respectively) (Table 3). The Gadwall breeding pair estimate increased by over 300 percent compared to 2010 but was not a significant increase ($p=0.10$). Compared to the LTA, breeding pairs increased by about 25 percent but was not significant ($p=0.67$) (Table 4). The green-winged teal population estimate decreased by about 13 percent compared to 2010 but increased for the third straight year compared to the LTA with neither increase or decrease significant (Table 3). The number of breeding pairs increased from 2010 and the LTA by about 47 and 28 percent respectively but neither were significant ($p=0.54$ and 0.64) (Table 4). Blue-winged teal population estimates and breeding pair estimate decreased from 2010 estimate by about 75 and 27 percent with neither being a significant decrease (Table 3 and 4). However, both the population and pairs estimate decreased from the LTA with both being a significant decrease (Table 3 and 4). One explanation the population and pairs decline (75 and 27% respectively) from 2010 were not significant is due to the fact that these estimates are highly variable from year to year. This is especially true of the population estimate for blue-winged teal which has a very large standard error and confidence interval for the 2010 estimate. The population and breeding pair estimate for the common merganser increased from 2010 and the LTA with none of the increases significant (Table 3 and 4). The hooded merganser population and breeding pair estimate increased from 2010 by about 40 and 64 percent respectively, with neither increase being significant ($p=0.32$ and 0.16 respectively) (Table 3 and 4). In both cases

the population and breeding pair estimates for common mergansers decreased from the LTA but neither were significant (Table 3 and 4). The overall population estimate for the Mute swan increased compared to 2010 and the LTA, while the breeding pair estimate decreased from 2010 and the LTA, with none of the increases being significant (Table 3 and 4).

AF Breeding Waterfowl Plot Survey
(DRAFT) Report, 6/28/2011

Table 1. Population estimates and standard errors for mallards, black ducks, wood ducks, and Canada geese from the Atlantic Flyway Breeding Waterfowl Plot Survey, 1993-2011, and percent change from 2010 to 2011 and from the long-term average to 2011.

Year	N	Mallards		Black ducks		Wood ducks		Canada geese			
		Estimate	SE	Estimate	SE	Estimate	SE	Estimate ^a	SE	Estimate ^b	SE
1993	1,475	686,562	49,870	80,158	11,033	311,924	32,660	647,509	111,770		
1994	1,468	856,313	62,774	60,930	8,667	323,285	34,730	648,684	72,971		
1995	1,465	864,120	70,395	72,507	13,169	367,019	35,473	780,027	98,816		
1996	1,469	848,645	61,074	77,316	17,521	344,659	32,139	932,656	107,423		
1997	1,472	795,176	49,596	65,578	9,050	385,644	33,863	1,013,324	132,539		
1998	1,474	775,213	49,718	81,689	20,458	382,778	28,585	970,092	115,663		
1999	1,491	879,953	60,173	82,421	14,392	402,170	34,542	999,517	120,811		
2000	1,480	762,555	48,701	87,009	15,421	376,212	35,008	1,022,299	101,930		
2001	1,485	809,438	51,572	69,627	11,263	388,204	37,891	1,016,629	89,337		
2002	1,487	833,514	56,235	68,637	12,211	420,000	37,804	965,657	86,932		
2003	1,495	731,907	47,025	64,898	11,357	341,945	29,497	1,040,474	89,820	1,126,731	94,540
2004	1,485	806,554	51,747	53,891	7,713	360,185	36,035	978,554	89,813	1,073,096	93,828
2005	1,488	753,622	53,619	49,745	8,469	413,558	38,981	1,064,696	96,415	1,167,075	102,279
2006	1,455	721,402	47,639	51,924	8,880	400,967	34,124	1,057,251	103,397	1,143,951	106,242
2007	1,485	687,578	46,724	62,355	11,608	420,574	36,086	1,046,067	90,513	1,127,987	94,528
2008	1,476	619,095	40,682	65,121	16,838	386,127	34,468	951,501	79,003	1,024,914	82,157
2009	1,445	666,752	45,695	39,523	6,228	367,998	34,312	943,274	72,554	1,006,133	75,112
2010	1,463	651,709	49,122	38,155	8,495	409,599	35,018	896,254	87,327	977,085	92,408
2011	1,471	586,089	41,561	38,717	6,919	382,736	32,978	941,359	82,828	1,015,076	86,473
Long-term average (1993-2010)											
		763,895	12,451	65,082	2,922	377,936	8,157	943,026	23,176	1,082,679	32,919
Percent change											
from:		%	<i>P</i>	%	<i>P</i>	%	<i>P</i>	%	<i>P</i>	%	<i>P</i>
	2010	-10.07	0.31	1.47	0.9591	-6.56	0.5765	5.03	0.7078	3.89	0.7640
	LTA	-23.28	4.2E-05	-40.51	0.0014	1.27	0.8966	-0.18	0.9857	-6.24	0.4966

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

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

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Table 2. Breeding pair estimates and standard errors for mallards, black ducks, wood ducks, and Canada geese from the Atlantic Flyway Breeding Waterfowl Plot Survey, 1993-2011, and percent change from 2010 to 2011 and from the long-term average to 2011.

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
Long-term average (1993-2010)									
		365,579	5,859	28,501	1,056	179,651	3,808	348,909	6,942
Percent change									
from:		%	<i>P</i>	%	<i>P</i>	%	<i>P</i>	%	<i>P</i>
	2010	-7.72	0.4203	17.59	0.5301	-7.02	0.5516	1.17	0.9099
	LTA	-24.13	3.759E-06	-36.33	0.0032	2.73	0.7629	4.28	0.5759

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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, 2003-2011, and percent change from 2010 to 2011 and from the long-term average to 2011.

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
Long-term average (2003-2010)		9,560	2,307	56,598	5,142	27,243	4,890	43,894	3,655	33,742	2,877	19,126	2,020
Percent change													
from:		%	<i>p</i>	%	<i>p</i>	%	<i>p</i>	%	<i>p</i>	%	<i>p</i>	%	<i>p</i>
2010		59.09	0.5492	-13.21	0.7594	-75.55	0.2986	20.52	0.5680	39.09	0.3203	36.89	0.4684
LTA		-36.42	0.32	8.51	0.8198	-67.84	0.0018	19.00	0.4041	-16.79	0.4063	30.57	0.5076

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, 2003-2011, and percent change from 2010 to 2011 and from the long-term average to 2011.

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
Long-term average (2003-2010)		2,297	383	11,878	1,289	9,068	1,402	17,819	1,559	14,559	1,251	8,721	858
Percent change													
from:		%	<i>p</i>	%	<i>p</i>	%	<i>p</i>	%	<i>p</i>	%	<i>p</i>	%	<i>p</i>
2010		357.38	0.1031	47.52	0.5412	-27.73	0.6089	44.02	0.3011	64.87	0.1640	-10.41	0.6971
LTA		25.41	0.6712	28.03	0.6469	-59.90	0.0084	30.02	0.2189	-8.49	0.7056	-2.26	0.9195

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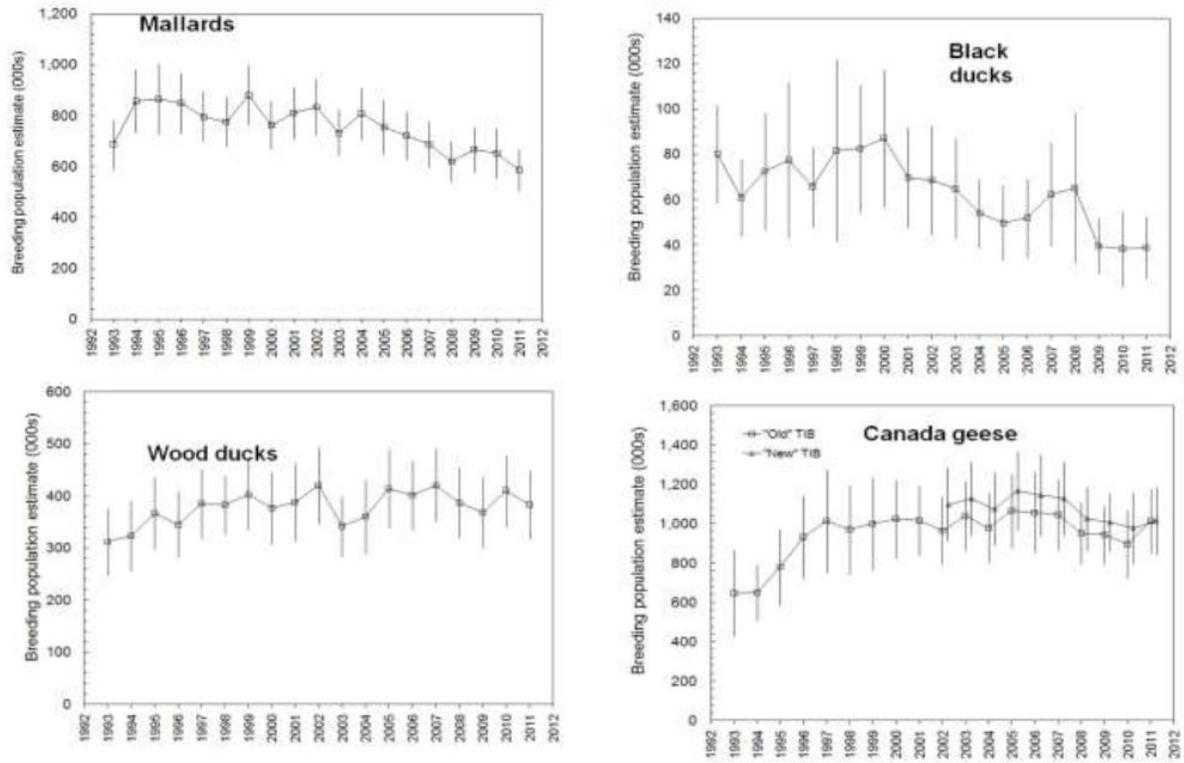


Figure 1. Population estimates and 95 % confidence intervals for mallards, black ducks wood ducks and Canada geese, 1993-2011.

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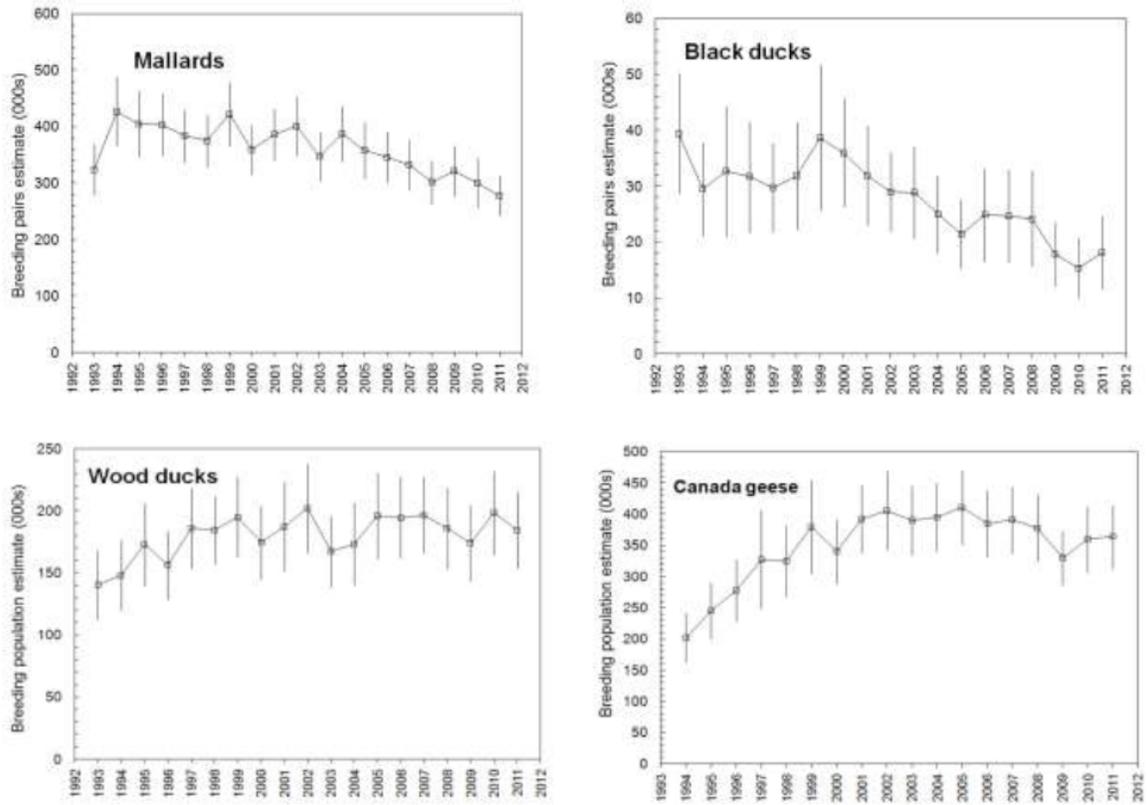


Figure 2. Breeding pair estimates and 95% confidence intervals for black ducks, wood ducks, and Canada geese, 1 2011.