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TITLE: Waterfowl Population Monitoring

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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 2007-08 were 60 days with a daily bag limit of 6 birds, and were unchanged from those offered in 2006-07. Canada goose season lengths and bag limits were also similar to 2006-07, except regular season length in the Resident Population zone was liberalized to an 80-day season. Harvest Information Program estimated active duck and goose hunters in Pennsylvania during 2007-08 were 29,800 and 37,500, similar to the 1999 to 2006 averages. Pennsylvania's total duck harvest estimate was 194,400, up 58% from 2006-07, and up 20% from average. Pennsylvania's 2007-08 Canada goose harvest was 276,000, up 72% from 2006-07, and up 61% from average. Canada goose harvest timing was 34% during September, 65.5% during the regular season, and 0.5% during the late season. Pennsylvania's estimated snow goose harvest of 12,000 in 2007-08 was up 5% from 2006-07 and up 107% from average. During the Pennsylvania portion of the 2008 AF Midwinter Waterfowl Survey (MWS), conducted in January, we observed 61,388 waterfowl, which was 25% lower than the total from the 2007 survey and 15% below the 1998-2007 average. Canada and snow goose numbers declined from 2007, while mallards, black ducks, mergansers, and tundra swans increased; all 6 of these species were within 30% (above or below) of their respective 1998-2007 averages at the state level. At the flyway level, snow geese decreased from 2007 while Canada geese, tundra swans, mallards, and black ducks all increased; flyway totals for all 5 of these species were within 15% of their respective 10-year averages. On the Pennsylvania portion of the 2008 Atlantic Flyway Breeding Waterfowl Survey, mallard pairs (65,700) were the lowest since 1992 and 33% below the 1993-

2007 average. This declining trend is consistent with other indices of mallard abundance in the state. The American black duck statewide estimate of 269 pairs was below average. Breeding black ducks in Pennsylvania are increasingly rare and is cause for concern. There were 42,800 wood duck breeding pairs estimated in 2008, 16% below average and the lowest recorded since 1996. Trends in wood duck abundance have indicated stable to slightly increasing populations across all years of the survey. Estimates of total hooded mergansers (3,000) were near average, while the total common merganser estimate (18,800) was above average. The trends for both breeding merganser species appear stable since 1993. For the Northeast U.S. survey area, mallard total population estimate of 619,000 was 21% below (statistically significant) average and the lowest recorded since 1993. Wood duck numbers were similar to last year and average. The black duck estimate was near average. The spring breeding population estimate for resident population Canada geese was 1.03 million, similar to 2007 and the long term average (LTA). 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 average except for Maine and the Maritime Provinces were fair. Breeding duck populations on the traditional survey area in the mid-continent of North America showed a 9% decline over 2007, but 11% above the LTA. Habitat conditions in the U.S. and Canadian Prairies were poor compared with 2007 and the LTA. Production from this important production region is expected to be below average in 2008. Spring 2008 breeding population estimates for Atlantic Population (AP) Canada geese and Southern James Bay Population (SJBP) were similar to 2007. Production is expected to be average or better 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 USFWS Harvest Information Program (HIP) (Richkus et al. 2008) and the Pennsylvania Game Commission's (PGC's) Game Take Survey (GTS) (see Librandi Mumma and Boyd 2007 for description of methods). The HIP survey, which became fully operational in 1999, has replaced the traditional U.S. Fish and Wildlife Service (USFWS) Mail Questionnaire Survey (MQS), which used duck stamp buyers as a sampling frame and was phased out after the 2001 season. From 1999-2001 the 2 surveys were conducted concurrently. 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. A pilot study from 1998-2001 indicated that use of tail fans alone for age classification of geese introduces a substantial negative bias in age ratios, because many juveniles from temperate-nesting populations completely replace their juvenile rectrices with adult feathers before or during the hunting season. Consequently, the USFWS now uses the tips of primary feathers in conjunction with tail fans to assign ages, which provides more accurate age ratio estimates. Productivity data for snow geese, tundra swans, and Atlantic brant is obtained from a survey conducted on major wintering

areas (between New York and North Carolina) by Atlantic Flyway (AF) states and National Wildlife Refuges in early winter. The percentage of immatures and number of young per family group observed during this survey provide an index to production during the previous breeding season for these 3 species that are not well surveyed on their Arctic breeding grounds.

Estimates of numbers of wintering waterfowl are obtained from the Midwinter Waterfowl Survey (MWS). States in the 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.

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^2 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 estimate averaged 8% higher each year from 2003 to 2007 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 (2008). Breeding population and breeding pair's estimates for this year were compared with estimates from the long-term (1993-2007) averages. Statistical comparisons were made with a 2-tailed *z*-test. The statistic was compared with the normal distribution. The *z*-test statistic was calculated as shown in Appendix 3.

RESULTS

Hunter Activity and Harvest

As in 2006-07, duck season length in 2007-08 was 60 days with outside framework dates of the Saturday nearest to 24 September (September 22) and the last Sunday in January (January 27). Similar to previous years, duck seasons selected for Pennsylvania included split seasons in all 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 scaup remained at 2 and 4, respectively. This was in response to the continued long-term decline in the status of breeding populations of scaup. A breeding population estimate of 3.7 million scaup (both species combined) was observed in 2008 and the estimate remains 27% below the long-term average. The canvasback harvest strategy in 2007 allowed for an expansion to a full 60-day season with a 2-bird bag limit within the general duck season. The hooded merganser daily bag limit was 2 for the second year in response to expanding breeding populations that can support additional harvest.

Boundaries of Pennsylvania's 4 Canada goose harvest zones (Resident Canada Goose (RP), Southern James Bay Population (SJBP), Pymatuning, and Atlantic Population (AP)) are presented in Appendix 1. An early Canada goose season (1-25 September) was again held statewide (except for the Pymatuning Zone and SGL 46, the Middle Creek Wildlife Management Area (WMA) in Lebanon/Lancaster counties). The daily bag limit was again 8 birds, 16 in possession statewide. However, in the area surrounding Middle Creek WMA (see Appendix 1) the daily bag limit was reduced to 1 goose to reduce harvest on the Middle Creek resident flock. September hunting remained closed on SGL 46. Regular Canada goose seasons and bag limits in the AP, RP, and SJBP zones remained the same as in 2005. In the Pymatuning zone season length and bag limit were maintained at 50 days and 2 geese (4 in possession). These regulations were consistent with Mississippi Flyway states that harvest SJBP Canada geese.

The estimates (Richkus et al. 2008) of active duck and goose hunters in Pennsylvania from the Harvest Information Program (HIP) were 29,800 and 37,500 respectively and remain the highest in the AF (Table 1) and were similar to the 1999 to 2006 average. The GTS estimated 27,136 duck hunters and 34,803 goose hunters in 2007-08, slightly less than HIP estimates. HIP estimates of days hunted for ducks in 2007-08 was similar to average while the number of goose hunter days was 16% above average. Seasonal duck and goose harvest per hunter in Pennsylvania in 2007-08 was 7.0 and 8.0, respectively and was above 2006-07 and the average.

The HIP estimate of total Pennsylvania duck harvest for 2007-08 (Table 1) was 195,400, up 58% from 2006-07 and up 20% from the average annual estimates for 1999-2006. State-level HIP harvest estimates to date have shown more year-to-year variability than either MQS 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 138,860 down 13% from 2006-07 and down 17% from average. Total 2007-08 AF regular season duck harvest was 1.66 million, unchanged from 2006-07.

The 5 most commonly harvested species in Pennsylvania were mallard (47% of the total harvest), wood duck (19%), black duck (6%), green-winged teal (6%), and bufflehead (5%) (Table 2). The 2007-08 harvest of the following species was higher than the 1999-2006 average; bufflehead (+160%), gadwall (+148%), green-winged teal (+56%), black duck (+33%), combined lesser and greater scaup (+26%), common merganser, and hooded merganser (+59%),

mallard/black hybrid (+24%), ring-necked duck (+14%), and mallard (+11%). However, harvest for the following species were below average: American wigeon (-12%), and wood duck (-4%).

HIP Canada goose harvest estimate in Pennsylvania (Table 1) for 2007-08 was 276,000 72% above 2006-07 and 61% above average. Pennsylvania continues to lead the AF in total Canada goose harvest and was first in the United States for the first time. The GTS estimate of 184,100 Canada goose harvested was similar to 2006-07, and the average. With the recent expansion of regular season harvest opportunities in the AP and RP zones, the regular season (November to mid-January) has regained the distinction of accounting for the largest proportion of the annual Pennsylvania Canada goose harvest (65.5% in 2007-08). The September season continues to account for a substantial proportion (34%) of the harvest while the late season (mid-January to mid-February) harvest accounted for 0.5% of the total. The small proportion in the late season may be a nuance in how late seasons are defined now that the RP zone in PA does not technically have a defined "late season." AF Canada goose harvest during the 2007-08 season was 861,000 up 30% from 2006-07. Estimated snow goose harvest in Pennsylvania was 12,000 birds, up 5% from the 2006-07 estimate and 107% above average. Pennsylvania was the top AF snow goose harvest state for the second consecutive year. This was likely a reflection of larger numbers of snow geese wintering and staging in Pennsylvania as well as growing numbers of hunters targeting this species. Total snow goose harvest for the AF (52,200) was up 57% from 2006-07.

The trend in the number of juveniles per adult in the 2007-08 AF harvest (Table 3) was up from average for 7 of 11 most commonly harvested ducks, while wood ducks and ring-necked ducks were below average. Blue-winged teal and bufflehead were near average. Canada goose age ratios declined 25% between years and 14% below average, likely a reflection of poor weather conditions on both RP and AP breeding areas in 2007. Greater snow goose age ratios were down 36% from average. The 2007 production index for tundra swans was 13% immatures, which was similar to the AF estimate. Production estimates for snow geese at the state level were not determined because lack of observable snow geese during the survey period. AF results showed an increase for Atlantic brant, but a decline in tundra swan productivity over 2006 and the 1996 to 2006 average (Table 4). Indices were not available for greater snow goose

Mid-winter Waterfowl Survey

The Pennsylvania portion of the 2008 MWS was conducted 7-10 January. Survey methods were similar to those used in past years, with fixed-wing aerial surveys supplemented by ground surveys at Middle Creek WMA. Ice cover during the survey was generally <10% on rivers, southern Pennsylvania lakes, and Lake Erie, and ranged from 50-75% on most other surveyed lakes and marshes in northern Pennsylvania. Overall, weather and habitat conditions before and during the 2008 survey were near average, and likely had no major effects on waterfowl distribution or survey totals.

We observed 61,388 waterfowl in Pennsylvania (Table 5). This included 4,778 dabbling ducks (mostly mallards and black ducks), 416 diving ducks, 2,360 mergansers, 52,504 geese (74% Canada geese and 26% snow geese), and 1,201 swans (98% of which were tundra swans). The overall total was 25% lower than the total from the 2007 survey, and 15% below the 1998-2007 average. Although 4 of the 6 major wintering species increased from 2007, Canada geese

and snow geese (the 2 most numerous species) both decreased, accounting for the lower overall numbers. Most individual species totals were somewhat below their respective 10-year averages, but among the 6 major species, 3 were above average and all 6 were within 30% (above or below) of their 1998-2007 levels. As usual, the highest numbers of waterfowl (45,574) were observed in Zone 3 (southeastern Pennsylvania), but totals for this zone were down 32% from 2007, and were 13% below the 1998-2007 average. Zone 1 (northwestern Pennsylvania) totals (12,715) were up 16% from 2007 but remained 18% below the 1998-2007 average, while Zone 2 (Susquehanna River) totals (3,099) were down 21% from 2007 and were 35% below the 10-year average.

For the entire AF, 2,817,133 waterfowl were observed in the MWS (Appendix 2). The flyway grand total is not directly comparable to results from previous years because the MWS was not conducted in South Carolina or Florida this year. However, many of the individual species numbers remain relatively comparable because only negligible proportions of their flyway totals have historically been observed in these 2 states. Flyway mallard numbers increased 38% from 2007 and were essentially equal to the 1998-2007 average, while black duck numbers were up 33% from 2007 and were 15% above the 10-year average. Canada geese were up 19% from 2007 but remained 14% below the 1998-2007 average. Snow goose numbers were down 17% from 2007, but remained 1% above the 10-year average. Tundra swan numbers increased 1% from 2007 and were 4% above the 10-year average. Long-term flyway MWS trends have been increasing for Canada and snow geese, and tundra swans, and relatively stable for most duck species; black ducks declined substantially between the 1950's and 1980's but have been stable over the past 2 decades. A general northward shift in the wintering distribution of many species is also evident from the long-term data. Shorter-term flyway trends appear to indicate a slow but steady decline in mallard numbers and a decrease in Canada geese following a peak in the early 2000s. We will continue to monitor these trends in conjunction with results from breeding ground surveys.

Breeding Waterfowl Survey

A total of 215, 1 km^2 plots containing wetland habitat for waterfowl were surveyed across six physiographic regions (figure 1) of Pennsylvania using a stratified random design. Another 131 plots were not field checked because they did not contain habitat for breeding waterfowl. Surveys were conducted from 15 April to 5 May 2008.

Habitat and weather conditions were 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 normal. Weather has been cooler and wetter than average across the state during most of May. We expect average production in 2008 from the birds that attempted to nest.

Survey results are presented in Table 1. 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. 2008 survey results are compared with the 1993 to 2007 average (average) in Table 2.

Statistical z-tests results of 2008 mallard and American black duck statewide indicated breeding pairs estimates were significantly below average, while wood duck and Canada goose estimates were similar to average. The number of indicated mallard breeding pairs (65,739) was the lowest since 1992 and 33% below the average of 97,624 pairs (Table 3). This is consistent with trends from other indices of statewide mallard abundance (the North American Breeding Bird Survey (Sauer et al. 2008) and the number of preseason-banded mallards). The trends from all three indices indicate declines in breeding mallard abundance in Pennsylvania since the late 1990's. This 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 or level at some point. As usual, stratum 10 in eastern Pennsylvania had the highest density of breeding mallards, while stratum 243 in northeastern Pennsylvania had the next highest (1.41 and 0.72 pairs/km^2 respectively). Only 1 pair of American black ducks was observed on a 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 in August and September has also been declining since mid-1990. Breeding black ducks in Pennsylvania are increasingly rare and is cause for concern. There were 42,791 wood duck breeding pairs estimated in 2008, over 16% below the average of 51,191 pairs and the lowest recorded since 1996. However, the 2008 estimate was not significantly below average and could be a result of 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 northeastern and northwestern Pennsylvania with 0.71 and 0.54 pairs/km^2 respectively. The estimate of total blue-winged teal (1,840) and green-winged teal numbers (1,979) were below average in 2008. Teal abundance in this survey can vary dramatically from year to year due to weather related impacts on teal migration. Teal migrate relatively late compared with the other species encountered on this survey, so we don't believe these estimates are indicative of true breeding populations of teal in Pennsylvania. Estimates of total hooded mergansers (3,031) were near average, while the total common merganser estimate (18,773) was above average. The trends for both breeding merganser species appear stable since 1993.

The 2008 Pennsylvania Canada goose number of indicated breeding pairs was estimated at 100,174 and similar to the average of 91,328. Pairs were most abundant in southeast (1.78 pairs/km^2) and northwest (1.66 pairs/km^2). The 2008 total population estimate of 246,499 was similar to the recent 5-year average of 285,244 geese (Table 3). A change in the formula used to estimate total Canada geese was initiated by the AF in 2003 and explains the short-term data set of total estimates. As expected, the highest densities of total geese were observed in southeastern (4.94 geese/km^2) and northwestern (3.97 geese/km^2) portions of Pennsylvania. The recent trend in Canada goose estimates appears stable following rapid growth 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. We will continue to closely monitor this population and harvest.

Breeding pair estimates for the most common breeding species from the AF Breeding Waterfowl Plot Survey for 2008 (Klimstra 2008)(Appendix 3) were: mallard, 301,700 pairs, down 20% from average. The 2008 mallard total population and breeding pair estimates were

significantly lower than the long term average (LTA). American black ducks (24,204 pairs); wood duck (185,867 pairs); and Canada goose (377,762 pairs), were similar to average. The estimate for total Canada geese (factoring in non-breeding individuals) was 1.025 million birds and similar to average.

In the eastern surveyed areas of Canada and Maine (U.S. Fish and Wildlife Service 2008), estimates for the ten most numerous species were similar to 2007 and the 1990 to 2007 average. The boreal forests of the eastern survey area were generally in good or excellent condition this spring, except for fair conditions in Maine and the Maritime provinces due to flooding. Spring arrived early in the James and Hudson Bay Lowlands and habitat conditions were classified as excellent.

The number of ducks counted in the traditional mid-continent survey area in May 2008 (U.S. Fish and Wildlife Service 2008.) was 37.3 ± 0.6 [SE] million birds. This was 9% lower than last year's estimate of 41.2 ± 0.7 million birds, and 11% above the 1955-2007 LTA. Mallard abundance was 7.7 ± 0.3 million birds, which was similar last year's estimate of 8.3 ± 0.3 million birds and the LTA. Blue-winged teal abundance was 6.6 ± 0.3 million birds. This value was 45% above the LTA. Estimated abundances of gadwall (2.7 ± 0.2 million) and Northern shovelers (3.5 ± 0.2 million) remained 56% above their LTA. Estimated abundance of American wigeon (2.5 ± 0.2 million) was similar to the LTA. Estimated abundances of green-winged teal (3.0 ± 0.2 million), redheads (1.1 ± 0.1 million) were each >50% above the LTA. Canvasbacks (0.5 ± 0.05 million) were down 44% from 2007 and 14% below average. Estimates for Northern pintails (2.6 ± 0.1 million) were 22% below 2007 and 36% below the LTA. Combined scaup (greater and lesser; 3.7 ± 0.2 million) were unchanged from 200, and remained 27% below the LTA. Overall, habitat conditions in the traditional mid-continent survey area (U.S. Fish and Wildlife Service 2008), in 2008 were characterized by a delayed spring and drought compared to 2007. The total pond estimate (Prairie Canada and U.S. combined) was 4.4 ± 0.2 million ponds. This was 37% below than last year's estimate and 10% below than the long-term average of 4.9 ± 0.03 million ponds.

In the Ungava Peninsula region of northern Quebec, where most breeding AP Canada geese are concentrated, 2008 breeding pair surveys estimated 169,700 pairs compared to 195,709 in 2007 (Harvey and Rodrigue 2008). The proportion of indicated pairs observed as single geese (64%) was consistent with a strong nesting effort. The total population estimate (breeding pairs and grouped birds) was 988,977 birds compared to 1,221,779 in 2007. Spring temperatures in 2007 were above normal and coastal areas thawed earlier than average. A large fall flight with above average number of juveniles is expected from this population. SJBP Canada geese from Akimiski Island, Nunavut, and the James Bay lowlands of Ontario are the predominant migratory goose population in northwest Pennsylvania and especially at Pymatuning. There were 110,000 Canada geese estimated this spring, similar to 2007, especially on Ontario mainland breeding areas. Nesting and banding studies on Akimiski Island confirmed good nesting conditions with above average gosling production. An average to slightly above average fall flight is expected.

The number of greater snow geese counted on spring 2008 staging areas in the St. Lawrence Valley was 1.004 million, unchanged from 2007 and near record high (U.S. Fish and

Wildlife Service 2008). Nesting studies from the largest known breeding colony on Bylot Island indicated early nest initiation, high clutch sizes and nest predation was moderately low. Fall-flight is expected to at record high with above average numbers of juveniles.

RECOMMENDATION

Continue waterfowl breeding and wintering survey efforts during FY 2008-09 to provide annual information on waterfowl population status.

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Table 1. 2007-08 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.

	2007-08[a]	2007-08[b]	% Change from 2007-08	99-06 Average	% Change from Avg.
Ducks					
Hunters	29,800	25,200	18	29,875	0
Hunter Days	161,000	126,000	28	162,200	-1
HIP Harvest	195,400	123,400	58	162,825	20
PGC Harvest	138,860	159,400	-13	168,121	-17
Canada goose					
Hunters	37,500	34,100	10	38,700	-3
Hunter Days	244,800	168,300	45	211,488	16
HIP Harvest	276,000	160,553	72	171,594	61
PGC Harvest	184,100	178,300	3	176,968	4
Snow Goose					
HIP Harvest	12,000	11,400	5	5,800	7

[a] Preliminary.
[b] PGC Game take survey not conducted in 2004-05.

Table 2. USFWS HIP Harvest estimates for major duck and merganser species in Pennsylvania, 1999-2007.

Species	2007-08[a]	2006-07	% Change from 2006	99-06 Average	% Change from Avg
Mallard	92,300	65,500	41	82,888	11
Wood duck	37,400	21,600	73	38,825	-4
Black duck	12,100	8,000	51	9,075	33
Green-winged teal	11,400	6,400	78	7,325	56
Bufflehead	9,700	4,700	106	3,738	160
Lesser scaup	2,900	651	345	2,444	19
Greater scaup	1,600	500	220	1,138	41
Ring-necked duck	1,400	3,100	-18	1,125	24
Gadwall	3,800	2,400	23	1,775	114
American wigeon	4,100	1,800	71	1,650	148
Mallard/black Hyb.	1,000	1,700	-44	1,138	-12
Common merganser	3,100	1,400	121	3,125	-1
Hooded merganser	4,900	2,500	96	3,088	59

[a] Preliminary.

Table 3. Age ratios (Immature/Adult) of the 9 most commonly harvested duck species and Canada geese (as determined from wing and tail collections) during the 1996-2007 hunting seasons in the Atlantic Flyway.

Species	2007-08 [a]	2006-07	% Change from 2006	1996-2007 Average	% Change from Avg.
Mallard	1.31	1.35	-3	1.17	12
Wood duck	0.97	0.99	-2	1.2	-19
Green-winged teal	1.9	2.0	-5	1.79	6
Black duck	1.31	1.39	-6	1.12	16
Ring-necked duck	1.01	1.93	-48	1.39	-27
Lesser scaup	0.77	0.85	-9	0.69	12
Bufflehead	0.81	0.97	-16	0.84	-3
Gadwall	1.35	1.35	0	1.08	25
American wigeon	1.22	1.95	-37	0.98	25
Canada goose	0.4	0.53	-25	0.46	-14

[a] Preliminary

Table 4. Productivity data (percent immatures) for Atlantic brant, greater snow geese, and tundra swans wintering in the Atlantic Flyway, 1996-2007.

Species	2007	2006	% Change from 2006	Average	% Change from Avg.
Atlantic brant	31.1	24.2	29	16	94
Gr. snow geese	NA[a]	27.1		19	
Tundra swans	13.1	22.6	-42	10.3	27

[a] NA = not available.

Table 5. Number of waterfowl recorded in zones 1-3 during Pennsylvania's Midwinter Waterfowl Survey, 1998-2008. Totals for 2002-08 may not be completely comparable to those from 2001 and prior because of procedural changes to survey in 2002.

Species	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1998-2007 Avg.
Canada goose	38,602	42,456	51,844	41,839	48,454	77,224	78,828	48,198	29,388	44,821	33,350	49,640
Mallard	2,992	2,613	2,676	2,453	4,460	3,082	4,124	4,306	7,184	6,274	5,921	4,309
Black duck	1,770	906	1,865	2,763	2,079	1,775	2,904	1,570	3,878	2,185	5,098	2,502
Gadwall	2	29	5	13	18	0	0	2	12	1	20	10
Wigeon	1	0	1	0	0	0	11	0	1	0	0	1
Green-winged teal	2	13	12	13	0	2	1	0	6	0	18	7
Blue-winged teal	0	0	0	0	0	0	0	0	0	0	0	0
Shoveler	5	32	1	0	25	0	119	9	61	49	79	38
Pintail	6	0	10	1	24	0	6	0	12	2	13	7
Wood duck	0	0	0	0	0	0	0	0	0	1	0	0
Redhead	0	0	0	0	10	0	20	1	0	60	16	11
Canvasback	1	0	0	91	10	0	0	0	13	66	164	34
Scaup	290	80	302	2,379	260	0	0	34	357	400	287	410
Ring-necked duck	32	0	0	0	0	11	12	44	15	1	0	8
Goldeneye	26	29	159	16	116	70	41	10	352	82	161	104
Bufflehead	67	252	66	13	204	237	1,841	191	335	102	238	348
Ruddy duck	0	9	0	0	6	1	8	33	25	56	66	20
Long-tailed duck	0	0	0	0	0	0	0	0	0	6	0	1
Scoters	0	0	0	0	0	0	0	0	2	0	0	0
Mergansers	2,360	1,988	1,009	3,993	759	992	564	1,070	7,968	1,949	2,886	2,318
Unidentified ducks	29	219	31	12	0	25	27	53	9	0	35	41
Brant	0	0	0	0	0	0	0	2	0	0	0	0
Snow goose	13,902	32,096	10,314	25,909	11,100	9,602	4,347	0	1,400	9,023	10,463	11,425
White-fronted goose	0	0	0	0	0	0	0	0	0	1	0	0
Tundra swan	1,178	363	2,464	786	1,261	548	1,098	363	1,106	553	1,949	1,049
Mute swan	23	23	23	22	33	27	13	32	32	10	13	23
Unidentified swans	0	0	0	2	0	0	0	3	0	0	0	1
Coot	100	552	200	75	25	50	250	265	1,050	339	420	323
Totals	61,388	81,660	70,982	80,380	68,844	93,646	94,214	56,186	53,206	65,981	61,197	72,630

Table 6. Estimates of waterfowl breeding pairs and standard error by physiographic strata in Pennsylvania, 2008.

Strata	Mallard		Black duck		Wood duck		Canada goose		Canada goose	
	Pairs	SE	Pairs	SE	Pairs	SE	Pairs	SE	Total	SE
10	18,527	5,562	269	268	3,491	1,569	23,360	4,252	64,980	14,539
13	17,416	5,593	-	-	11,843	4,485	14,630	4,627	34,832	11,186
22	5,993	2,972	-	-	2,664	1,557	15,315	5,973	30,631	11,946
241	5,938	1,425	-	-	5,372	1,626	16,399	4,513	39,301	11,532
242	8,496	2,804	-	-	10,265	3,737	19,823	9,050	44,602	1,884
243	9,369	2,908	-	-	9,156	2,128	10,647	3,213	32,153	9,126
2008 PA Total	65,739	9,455	269	268	42,791	6,792	100,174	13,702	246,499	32,411
1993 –2007 avg.	97,641	3,998	1,019	206	51,191	2,222	91,328	3,335	285,244[a]	17,783
% Change from LTA,	-33%		-74%		-16.5%		10%		-14%	

[a] 2003 to 2007 average estimate.

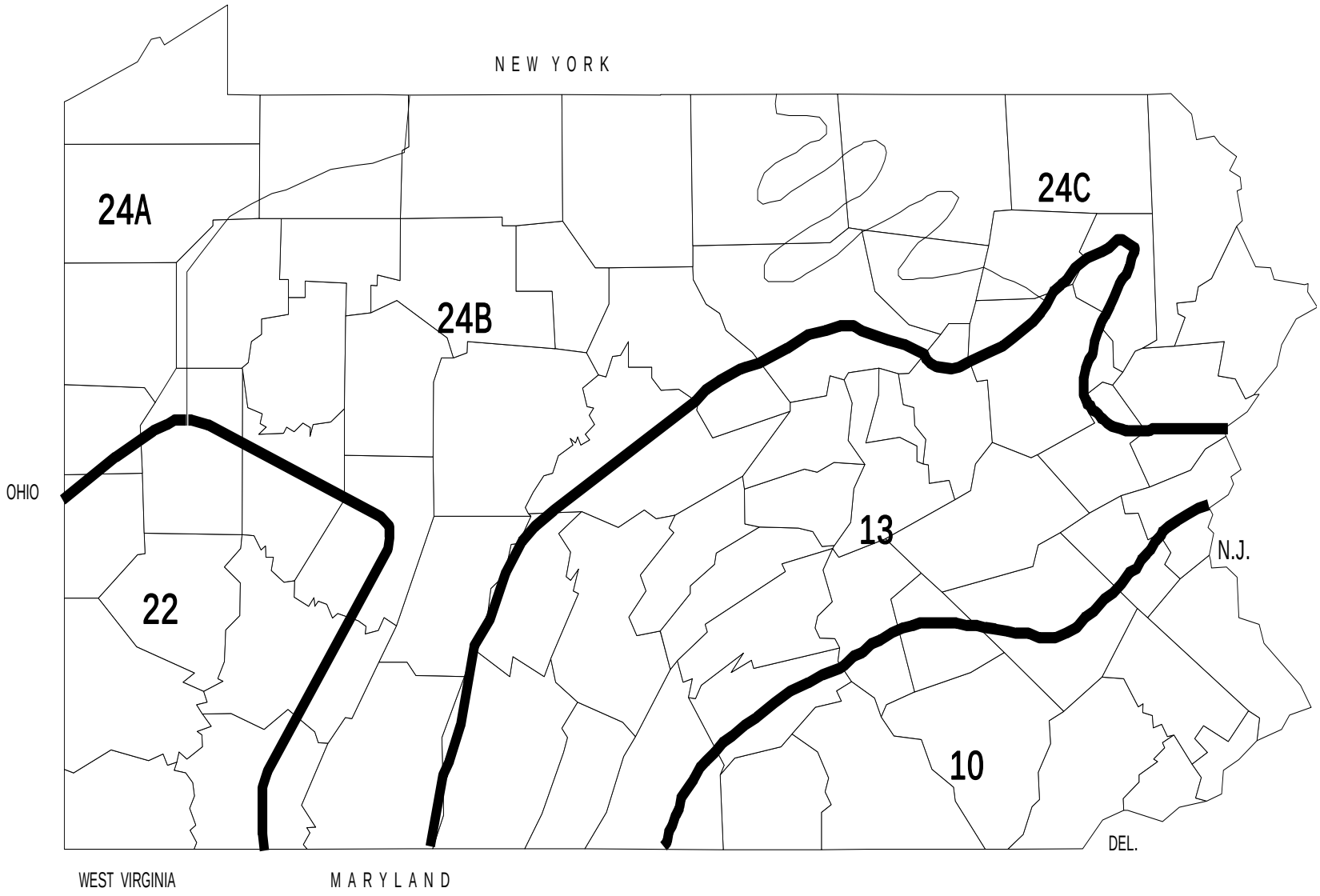
Table 7. Pennsylvania waterfowl population estimates from 1999 to 2008 and the 1993-2007 averages.

Species Estimate	2008	93-07 average.	2007	2006	2005	2004	2003	2002	2001	2000	1999
Mallard pairs	65,739	97,641	90,237	80,667	95,685	84,806	82,302	84,534	89,030	88,443	121,515
Mallard total	131,477	201,886	181,504	174,374	197,975	177,715	170,067	171,752	189,711	185,318	246,359
Black duck pairs	269	1,019	1,716	-	-	-	622	2,010	2,026	354	1,444
Black duck total	537	2,028	3,433	-	-	-	1,245	4,020	4,052	709	2,889
Wood duck pairs	42,791	51,191	56,671	61,014	60,536	47,368	46,855	65,684	56,276	43,296	59,011
Wood duck total	87,924	106,124	127,847	128,009	132,552	94,736	93,711	132,858	116,298	92,648	122,783
Canada goose pairs	100,174	91,328	100,741	88,478	115,291	122,857	101,564	85,192	96,468	85,379	104,343
Canada goose total	246,499[a]	285,244	255,924[a]	229,321[a]	282,237[a]	299,000[a]	254,194[a]	234,754	246,859	225,472	261,965
Bl-wing teal total	1,840	8,122	12,650	1,979	2,746	8,041	1,273	7,842	8,373	10,293	9,305
Gr-wing teal total	1,979	4,836	5,064	7,172	7,089	9,138	5,266	4,131	4,664	7,015	4,338
Hooded merg. total	3,031	3,570	2,972	7,646	9,625	1,272	4,318	4,205	1,417	3,686	2,833
Common merg. total	18,773	13,845	17,429	15,167	12,916	14,671	14,335	14,371	14,020	12,292	33,325

- No black ducks observed.

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

Figure 1. Physiographic zones sampled for breeding waterfowl surveys



APPENDIX 1.

2007/2008 WATERFOWL HUNTING SEASON REGULATIONS

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, 2 wood ducks, 2 redheads, 2 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 duck, 2 fulvous tree duck, 4 wood ducks, 4 redheads, 4 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 22.

SEASON DATES

Lake Erie Zone

Ducks, sea ducks, coots and mergansers- Oct. 29 – Jan. 5.

North Zone

Ducks, sea ducks, coots and mergansers -Oct. 13–27 & Nov. 8 – Jan. 1.

Northwest Zone

Ducks, sea ducks, coots and mergansers Oct. 13 – Nov. 24 & Dec. 10 – Jan. 4.

South Zone

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

ATLANTIC BRANT

Oct. 13 –Dec. 11 (2 brant daily bag limit, 4 in possession).

SNOW GEESE

Nov. 6 – Mar. 9 (15 daily bag limit, no possession limit).

CANADA GEESE

Pymatuning Zone
Oct. 27 - Nov. 24 & Dec.10 – Jan. 5 (2 goose daily bag limit)

Atlantic Population Zone
Nov. 15 – 24 & Dec. 13 – Jan. 23 (3 goose daily limit).

Southern James Bay Canada Goose Hunting Zone
Oct. 27- Nov. 24 & Dec. 10 –Jan. 14 (2 goose daily bag limit) &
Jan. 15 - Jan. 30 (5 goose daily bag limit).

Resident Canada Goose Zone.
Nov. 15 - Feb. 15 (5 goose daily limit)

Early Resident Canada Goose Season - Statewide

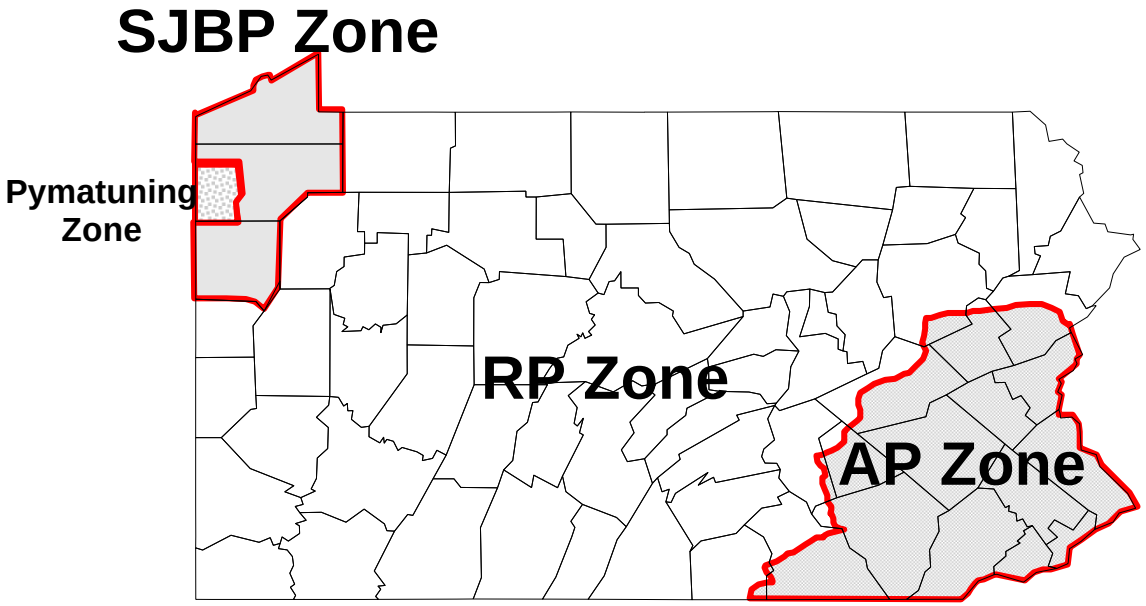
September 1 – September 25 (8 goose daily bag limit, 16 in possession) **except:**

.

(1) No September goose season in the Pymatuning zone, **except** 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).

(2) 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 No. 46 (Middle Creek Wildlife Management Area) where the season is closed.

Canada goose hunting zones for 2007-08 season in Pennsylvania.



Resident Canada Goose Zone (RP).

All of Pennsylvania **except** for Crawford, Erie, and Mercer counties **and** 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).

Southern James Bay Population (SJBP) Zone

Erie, Mercer and Crawford Counties **except** for the Pymatuning Zone (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.)

Pymatuning Zone

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.

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.

Early Canada Goose Hunting Season (Statewide)

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

.

(3) No September goose season in the Pymatuning zone, **except** 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).

(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 No. 46 (Middle Creek Wildlife Management Area) where the season is closed

Appendix 2. Atlantic Flyway Midwinter Waterfowl Survey, 2008 Final Report

Species	ME	VT	NH	MA	CT	RI	NY [a]	PA	WV	NJ	DE	MD	VA	NC	SC	GA	FL	Flyway Total [b]
Mallard	2,142	45	125	5,903	1,205	1,110	746	2,842	1,174	35,725	13,105	55,507	14,644	9,777		659		144,709
Black duck	19,099	6	265	18,491	2,041	1,757	15,060	1,660	322	136,520	8,547	22,952	15,355	8,551		0		250,626
Mexican duck	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		40		40
Gadwall	0	0	0	0	112	35	60	2	20	750	835	2,987	6,154	5,857		647		17,459
American wigeon	0	0	0	0	101	210	70	1	2	1,320	1,002	752	4,283	16,518		348		24,607
G-w teal	0	0	0	25	0	0	20	2	2	6,150	2,478	4,556	7,658	29,993		1,890		52,774
B-w teal	0	0	0	0	0	0	0	0	0	0	0	0	0	0		718		718
N. shoveler	0	0	0	0	0	0	0	5	0	200	1,119	598	260	163		85		2,430
N. pintail	0	0	0	0	0	0	100	6	0	5,570	5,470	1,963	2,158	43,813		20		59,100
Wood duck	0	0	0	0	0	0	0	0	3	0	24	7	92	33		169		328
Whistling duck	0	0	0	0	0	0	0	0	0	0	0	0	0	0		6		6
Total Dabblers	21,241	51	390	24,419	3,459	3,112	16,056	4,518	1,523	186,235	32,580	89,322	50,604	114,705		4,582		552,797
Redhead	0	0	0	0	0	0	0	0	0	50	0	11,871	968	14,760		0		27,649
Canvasback	0	0	0	0	96	4	0	1	0	1,210	1,285	40,092	16,717	2,538		2,039		63,982
Scaup	175	0	1,800	4,732	2,880	7,285	16,120	290	3	76,930	2,185	139,959	15,664	35,029		910		303,962
Ringneck	0	0	0	0	33	20	0	27	56	1,590	50	2,133	17,077	13,295		11,526		45,807
Goldeneye	6,031	2,495	77	5,258	826	1,590	2,831	26	0	345	2	756	25	0		0		20,262
Bufflehead	8,687	0	0	7,853	647	1,387	6,270	52	24	26,975	489	18,413	14,371	2,491		161		87,820
Ruddy duck	0	0	0	55	44	75	225	0	0	2,450	223	19,724	26,203	18,835		91		67,925
Total Divers	14,893	2,495	1,877	17,898	4,526	10,361	25,446	396	83	109,550	4,234	232,948	91,025	86,948		14,727		617,407
Eider	20,606	0	129	83,461	25	710	0	0	0	0	0	0	0	0		0		104,931
Scoter	1,147	0	0	24,000	196	170	0	0	0	200	0	2,987	5,626	0		0		34,326
Long-tailed duck	1,754	0	0	383	257	0	20	0	0	845	0	362	268	0		0		3,889
Harlequin	10	0	0	1	0	100	0	0	0	0	0	0	0	0		0		111
Total Sea ducks	23,517	0	129	107,845	478	980	20	0	0	1,045	0	3,349	5,894	0		0		143,257

Species	ME	VT	NH	MA	CT	RI	NY [a]	PA	WV	NJ	DE	MD	VA	NC	SC	GA	FL	Flyway Total [b]
Merganser	4,323	1,235	80	4,203	1,209	1,462	3,947	2,277	108	22,765	90	4,290	2,472	2,969		318		51,748
Unidentified duck	134	0	0	51	0	0	0	29	0	0	0	250	0	551		2		1,017
Total Ducks	64,108	3,781	2,476	154,416	9,672	15,915	45,469	7,220	1,714	319,595	36,904	330,159	149,995	205,173		19,629		1,366,226
Brant	6	0	0	2,916	1,214	1,257	56,115	0	0	88,190	1,300	1,400	7,760	1,460		0		161,618
Snow goose	0	0	0	0	8	0	1,380	13,402	3	139,310	91,652	107,996	15,780	37,655		0		407,186
Canada goose	4,487	2	4,203	12,243	2,469	6,825	3,408	36,457	3,466	144,400	67,795	373,057	109,882	16,517		793		786,004
W-f goose	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0		0
Total Geese	4,493	2	4,203	15,159	3,691	8,082	60,903	49,859	3,469	371,900	160,747	482,453	133,422	55,632		793		1,354,808
Tundra swan	0	0	0	0	0	0	0	1,178	4	332	651	10,580	6,738	69,023		0		88,506
Trumpeter swan	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0		0
Mute swan	0	0	40	722	811	944	378	21	0	2,246	45	319	375	0		0		5,901
Unidentified swan	0	0	0	0	0	0	5	0	0	0	0	1,687	0	0		0		1,692
Total Swans	0	0	40	722	811	944	383	1,199	4	2,578	696	12,586	7,113	69,023		0		96,099
Total Waterfowl	68,601	3,783	6,719	170,297	14,174	24,941	106,755	58,278	5,187	694,073	198,347	825,198	290,530	329,828		20,422		2,817,133
Coot	0	0	0	0	0	140	0	100	0	140	0	3,451	2,144	10,460		17,826		34,261
Sandhill crane	0	0	0	0	0	0	0	0	0	0	0	0	0	0		77		77

ATLANTIC FLYWAY
BREEDING WATERFOWL PLOT SURVEY

Breeding Pair
and
Population Size Estimates

Report
2008

Jon D. Klimstra

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

9 July, 2008

Habitat conditions were generally reported as good for nesting waterfowl across the survey area. Much of the survey area experienced a cooler than normal spring. However during the survey period there were June like temperatures in much of the survey area. Some areas experienced heavy rain events which flooded out early nesters. It does appear that there is a strong re-nesting attempt in many of these areas. It appears based on where flooding occurred and spring temperatures that production will be about average.

In 2008, 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 × pairs) + singles + grouped birds]. The newer method, more comparable with that used for duck species in this survey and for other goose surveys, calculates TIB as 2 × (pairs + singles) + grouped birds.

This year, stratum-within-state-, state-, stratum-, and survey-area specific estimates (formerly printed as "Appendix A") are being 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 pairs estimates for this year are compared with estimates from 2007 and long-term (1993-2007) 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 sixth 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 2007 were made as with mallards, black ducks, wood ducks, and Canada geese. This is the first year that the current years estimates will be compared with the long-term average (LTA).

Results

Population and breeding pair estimates for mallards declined from 2007 and remain well below the long-term average (LTA) (Tables 1 and 2; Figures 1 and 2). The difference between this year's population estimate and the LTA was statistically significant (P = 0.028, Table 1). The black duck population estimate showed a slight but statistically insignificant increase from last year (Table 1; Figure 2), while the breeding pairs estimate remained essentially unchanged (Table 2; Figure 2). However, these are 5 and 20 percent (respectively) below the long-term average. Wood ducks showed a slight decrease in both population and breeding pairs estimates, but were essentially flat. Neither of these changes were significant. These estimates are more than 3 and 4 percent above the LTA, but again are not significant (Tables 1 and 2; Figures 1 and 2). The Canada goose population estimate showed a slight, non-significant decrease from last

year as did the breeding pairs estimate (non-significant) (Tables 1 and 2).

While not significant, population estimates for gadwall increased from last year but still remains below the LTA. Both population estimates for green-winged teal and blue-winged teal declined from the previous with both still remaining below the LTA (Table 3). Neither decline was significant, however for blue-winged teal the decline was around 64%. This difference was nearly statistically significant, which hints at the large amount of variability associated with theses estimates. Both the common and hooded mergansers showed declines that were not significant and were still below the LTA (Table 3). The mute swan showed a non-significant increase from 2007 of 24% (Table 3).

For gadwall, green-winged teal, blue-winged teal, and hooded-merganser all four showed a decline in the number of breeding pairs but none were significant (Table 4). All four were below the LTA average as well. It is worth noting that gadwall and blue-winged teal had a 68 and 47 percent decline respectively (Table 4). Both the common merganser and mute swan showed an insignificant increase in breeding pairs from 2007 and both were above their respective LTA (Table 4).

Table 1. Population estimates and standard errors for mallards, black ducks, wood ducks, and Canada geese from the Atlantic Flyway Breeding Waterfowl Plot Survey, 1993-2006, and percent change from 2005 to 2006 and from the long-term average to 2006.

		Mallards		Black ducks		Wood ducks		Canada geese			
Year	N	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
Long-term average (1993-2007)											
		787,503	14,996	68,579	3,479	375,942	9,574	945,562	28,113	1,122,662	55,014
Percent change from:		%	*P*	%	*P*	%	*P*	%	*P*	%	*P*
	2007	-9.96	0.6122	4.44	0.4754	-8.19	0.6930	-9.04	0.9351	-9.14	0.9106
	LTA	-21.39	0.0288	-5.04	0.4281	2.71	0.1979	0.63	0.2514	-8.71	0.9517

[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].

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, 1993-2006, and percent change from 2005 to 2006 and from the long-term average to 2006.

		Mallards		Black ducks		Wood ducks		Canada geese	
Year	N	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
Long-term average (1993-2007)									
		377,089	7,049	30,370	1,291	178,364	4,446	347,459	8,423
Percent change									
from:		%	*P*	%	*P*	%	*P*	%	*P*
	2007	-9.28	0.6807	-2.06	0.9742	-5.52	0.9255	-3.29	0.8788
	LTA	-19.99	0.0449	-20.30	0.1715	4.21	0.2239	8.72	0.1045

Table 3. Population estimates and standared errors for gadwall, green-winged teal, blue winged teal, common mergansers, hooded mergansers, and mute swans from the Atlantic Flyway Breeding Waterfowl Plot Survey, 2003-2006, and percent change from 2005 to 2006.

		Gadwall		Green-winged teal		Blue-winged teal		Common merganser		Hooded merganser		Mute swan	
Year	N	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
Long-term average (2003-2007)		9,934	3,974	54,204	7,323	28,770	6,696	45,536	6,069	38,706	5,156	18,331	3,089
Percent change from:		%	*p*	%	*p*	%	*p*	%	*p*	%	*p*	%	*p*
	2007	35.46	0.8108	-20.17	0.6509	-64.44	0.0958	-19.73	0.7026	-27.65	0.5206	24.54	0.3094

Table 4. Breeding pair estimates and standared errors for gadwall, green-winged teal, blue winged teal, common mergansers, hooded mergansers, and mute swans from the Atlantic Flyway Breeding Waterfowl Plot Survey, 2003-2006, and percent change from 2005 to 2006.

		Gadwall		Green-winged teal		Blue-winged teal		Common merganser		Hooded merganser		Mute swan	
Year	N	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
Long-term average (2003-2007)		2,733	685	11,104	1,882	9,795	2,296	18,265	2,549	16,646	2,188	8,138	1,181
Percent change from:		%	*p*	%	*p*	%	*p*	%	*p*	%	*p*	%	*p*
	2007	-68.81	0.3417	-7.47	0.9285	-47.63	0.1884	5.11	0.9484	-23.09	0.1350	24.65	0.5214

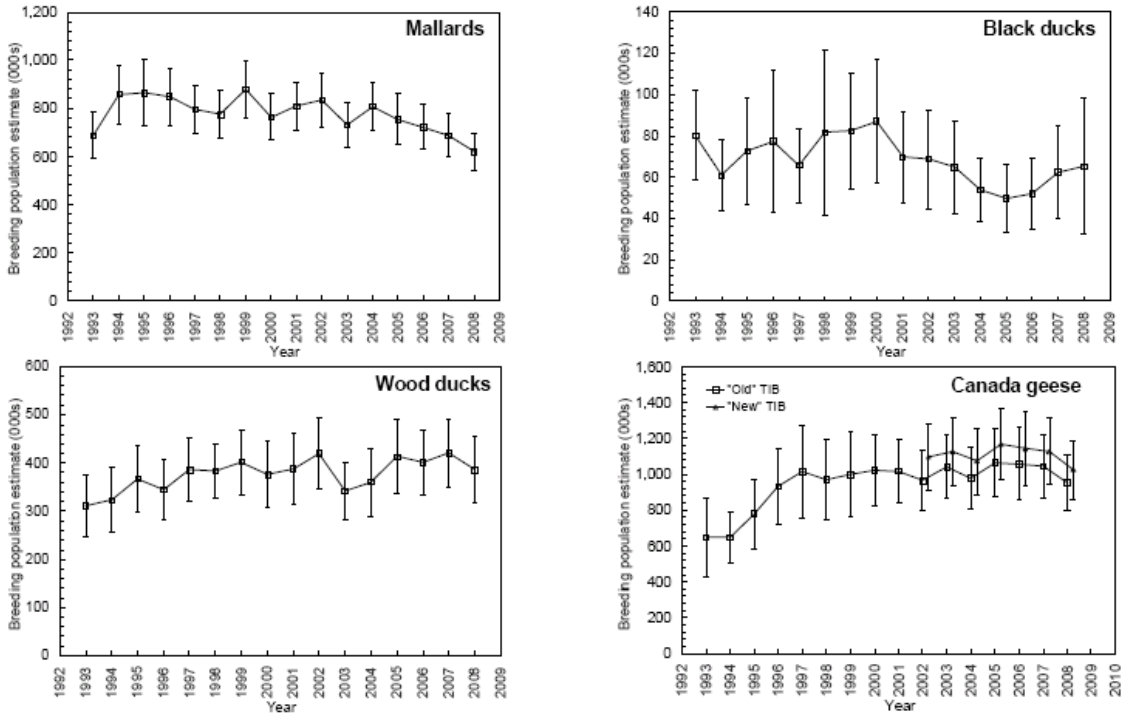


Figure 1. Population estimates and 95 % confidence intervals for mallards, black ducks wood ducks and Canada geese, 1993-2006.

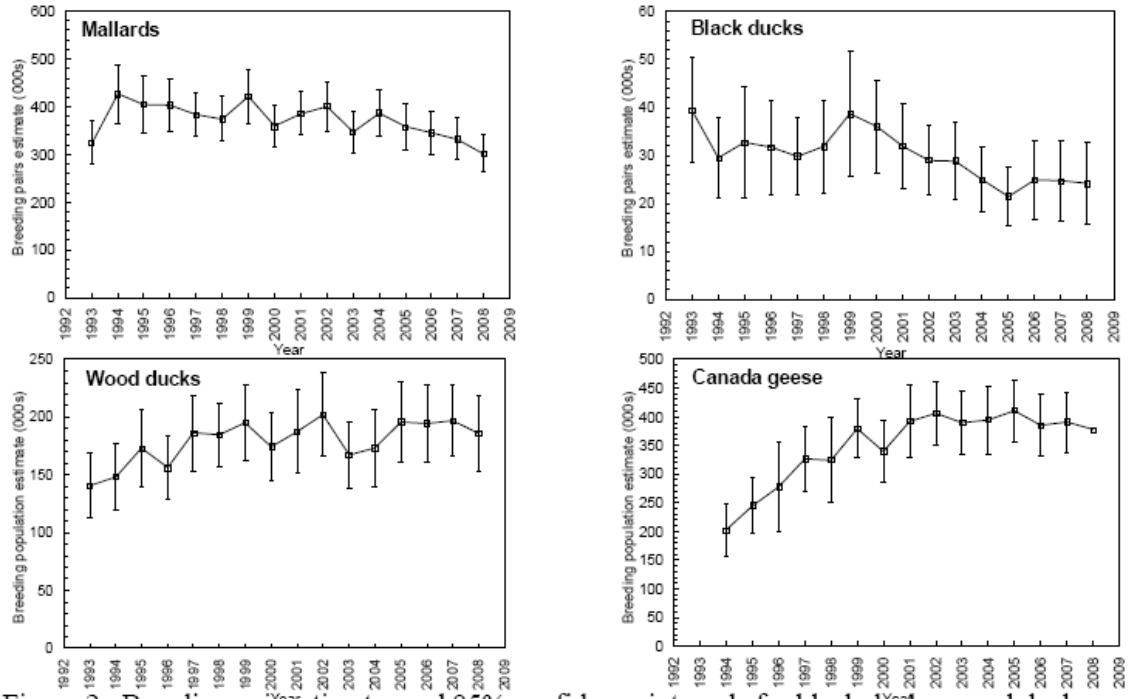


Figure 2. Breeding pair estimates and 95% confidence intervals for black ducks, wood ducks, and Canada geese, 1993-2006.