

Pennsylvania Waterfowl Data Document



Photo by Hal Korber, PGC.

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Game Bird Section
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Figure 1: Total count of Canada Geese banded from 1991-2008 in Pennsylvania

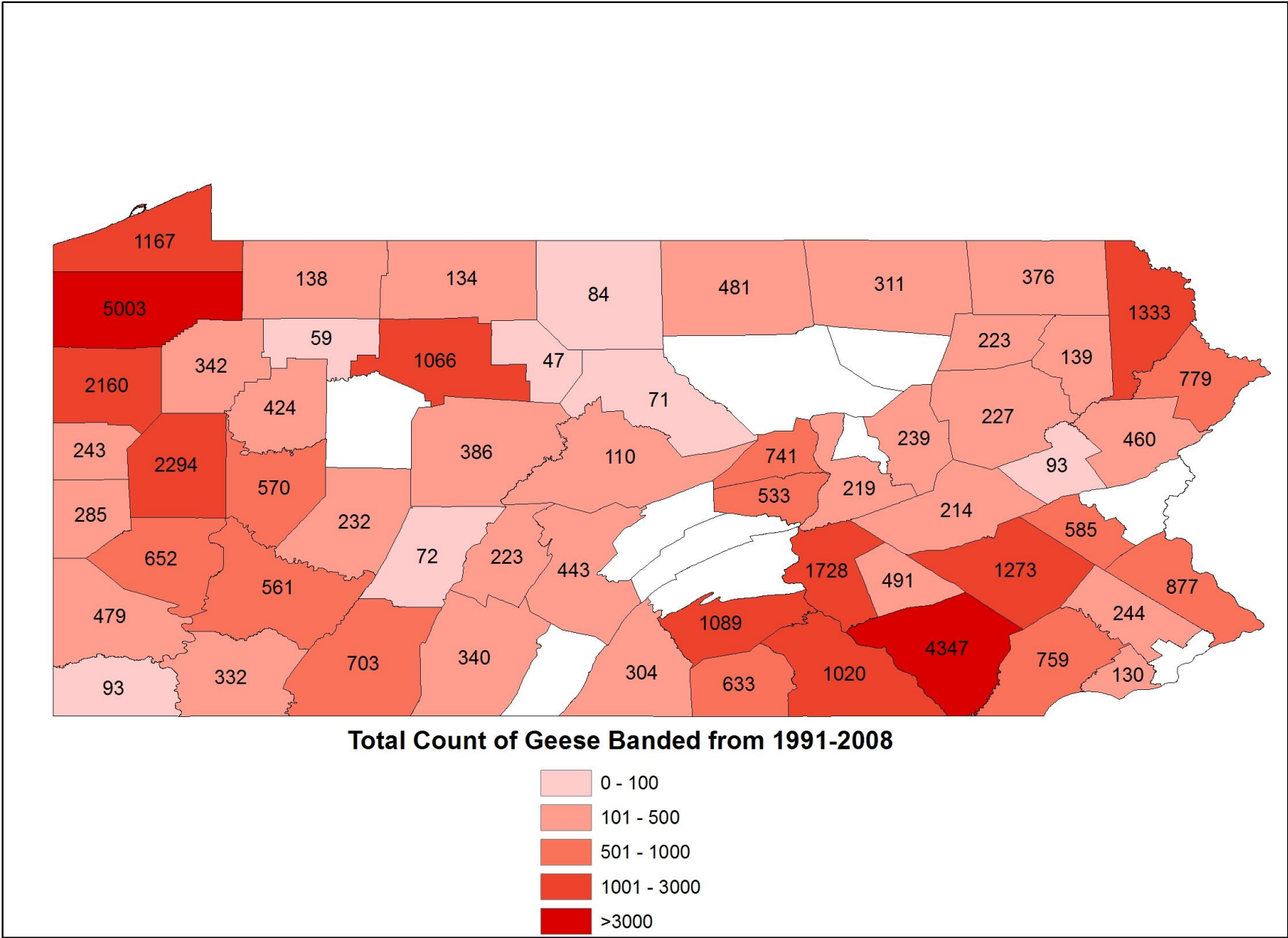


Figure 2: Total count of Mallards banded from 1991-2008

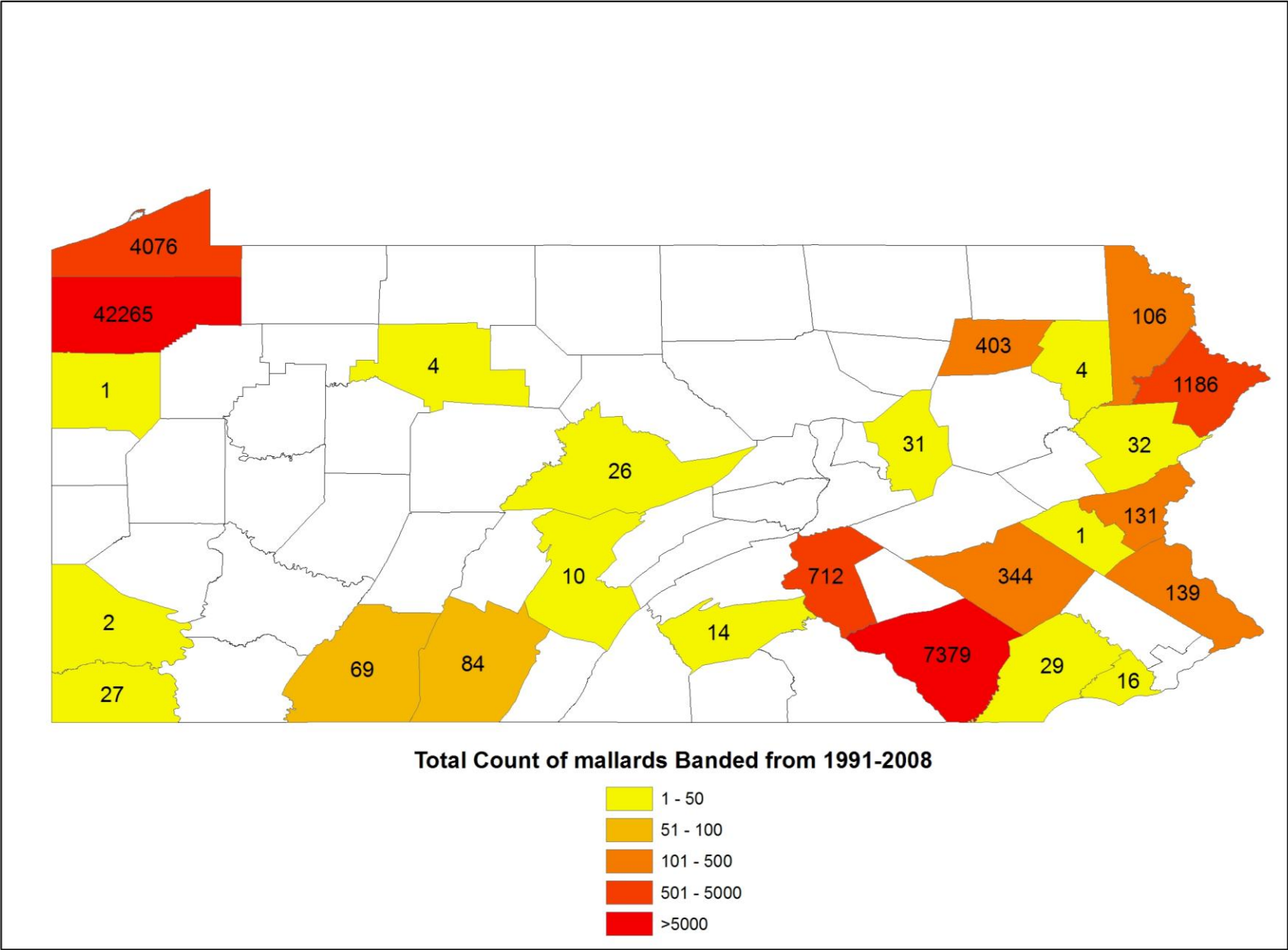
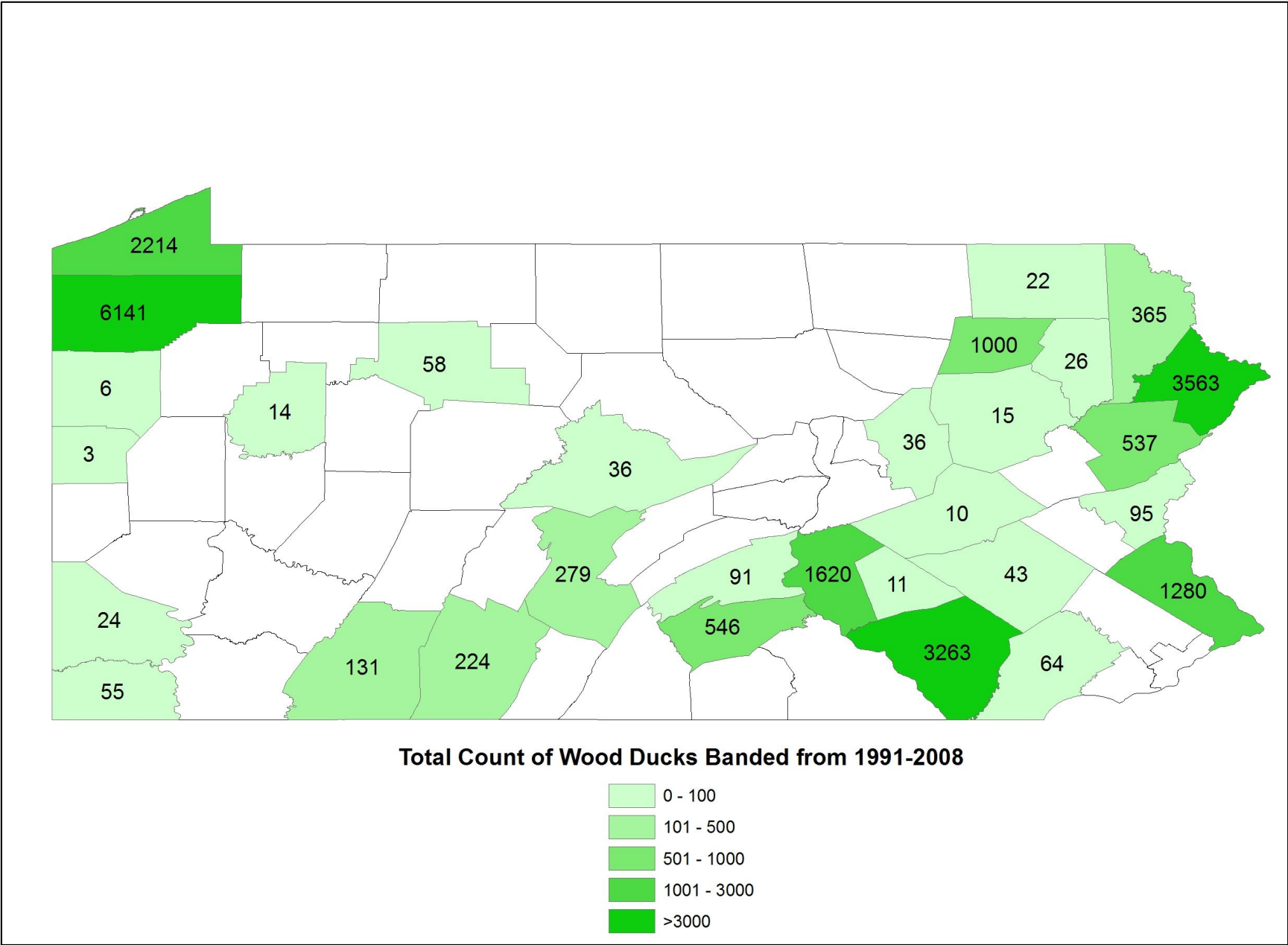


Figure 3: Total count of Wood Ducks banded from 1991-2008



Band Recovery Distribution

The recovery distribution and derivation of Canada Geese, Mallards, and Wood Ducks were investigated to 1) identify areas where locally produced birds are harvested and 2) determine the population sources for Pennsylvania harvested birds. Adequate knowledge about the recovery distribution and derivation are essential for the management of waterfowl in Pennsylvania and throughout the flyway.

Band recovery distribution was determined using direct hunter harvested band recoveries from pre-season birds banded in Pennsylvania during 1989-2008. Direct band recoveries were defined as the percentage of birds banded pre hunting season (August-Sept) and subsequently harvested during the hunting season of the same year. Direct recoveries distribution was calculated as the proportion of birds harvested in each state/province to the total number of banded birds recovered each year from 1989-2008. All banding data was obtained from the U.S Fish and Wildlife Service using the program Bandit. Only direct recoveries from birds harvested or found dead were used in the analysis. The recovery coordinates obtained from the Bird Banding Lab were plotted in ArcMap version 9.3. The points were exported as a layer and joined with a North American county layer. The numbers of points in each county were summed to determine the total number of recoveries in each county. In this analysis distributions were not adjusted for variation of reporting rates between flyways.

The Canada goose recovery distribution is based on band recoveries of geese banded in late June throughout Pennsylvania during 1991-2008. Geese banded during this time period are comprised almost exclusively of resident birds. As expected, the estimated band recovery distribution of Canada Geese shows that a very high proportion (92%) of geese banded in Pa are subsequently harvested there (Figure 4 and Table 1). To a lesser extent, states bordering Pa accounted for approximately 6 % of the recovery distribution. In addition, a small proportion of birds were harvested in Northern Ontario and Quebec. These recoveries were most likely molt migrants that were subsequently harvested.

The estimated band recovery distribution of Mallards also indicates that a high proportion of locally produced birds are subsequently harvested in Pa (Mallards 49%) (Figure 5 and Table 2). Mallard harvest was also substantial in Ohio (22%), especially eastern counties which are in close proximity to Pymatuning wildlife area. Since 1991 more than 42,000 mallards have been banded at Pymatuning wildlife area. In addition, the mallard recovery was distributed along both sides of the Appalachian Mountains. Mallards migrating on the eastern side were harvested in Maryland, Virginia, North Carolina, and South Carolina. Mallards migrating on the western side of the Appalachians were harvested in Tennessee, Kentucky, and Alabama. In addition to this pattern, Mallards banded in Pa were also harvested in New York and Ontario.

As with Canada Geese and Mallards, Wood duck harvest recovery distribution was also highest in Pennsylvania (55%). Wood Duck recovery distribution was more restricted to the Atlantic coast relative to mallard recovery distributions (Figure 6, Table 3). Wood Duck recoveries were also distributed in the southeastern states along the Gulf of Mexico.

Figure 4. Direct band recovery distribution of Canada geese banded in Pennsylvania 1991 to 2008.

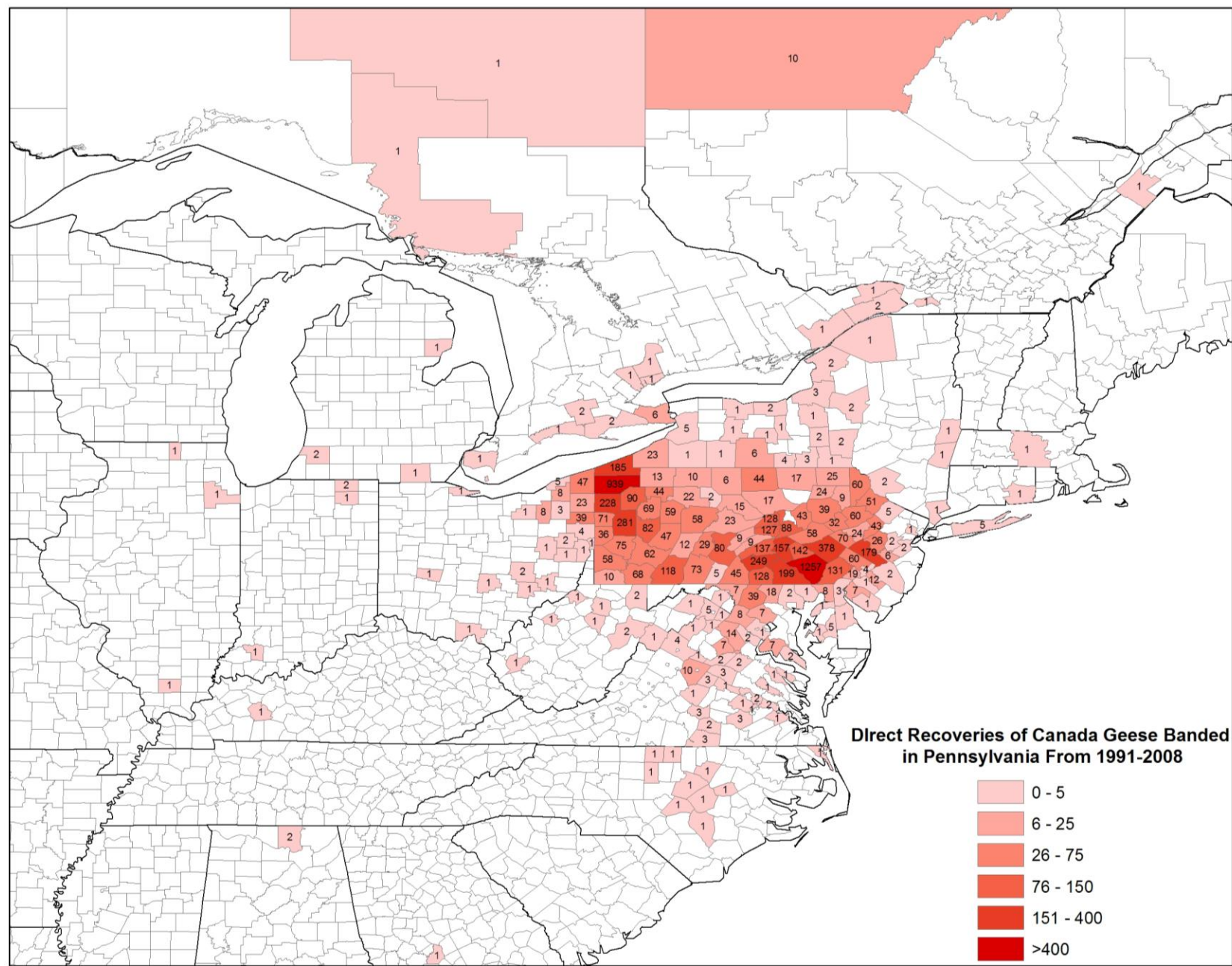


Table 1. Direct recovery distribution by state or province of Canada geese banded in Pennsylvania from 1991 to 2008.

State/Province Name	Birds Recovered (n=7478)	Percentage
Pennsylvania	6882	0.92
Ohio	151	0.02
New Jersey	108	0.01
Maryland	98	0.01
Virginia	88	0.01
New York	69	0.01
Ontario	21	<0.01
West Virginia	13	<0.01
North Carolina	10	<0.01
Quebec	9	<0.01
Indiana	4	<0.01
Delaware	4	<0.01
Michigan	4	<0.01
Illinois	3	<0.01
Missouri	2	<0.01
Alabama	2	<0.01
North Dakota	1	<0.01
Minnesota	1	<0.01
Massachusetts	1	<0.01
Connecticut	1	<0.01
Utah	1	<0.01
Colorado	1	<0.01
Kentucky	1	<0.01
Kansas	1	<0.01
Georgia	1	<0.01
Louisiana	1	<0.01

Figure 5. Direct band recovery distribution of mallards banded in Pennsylvania 1989-2008.

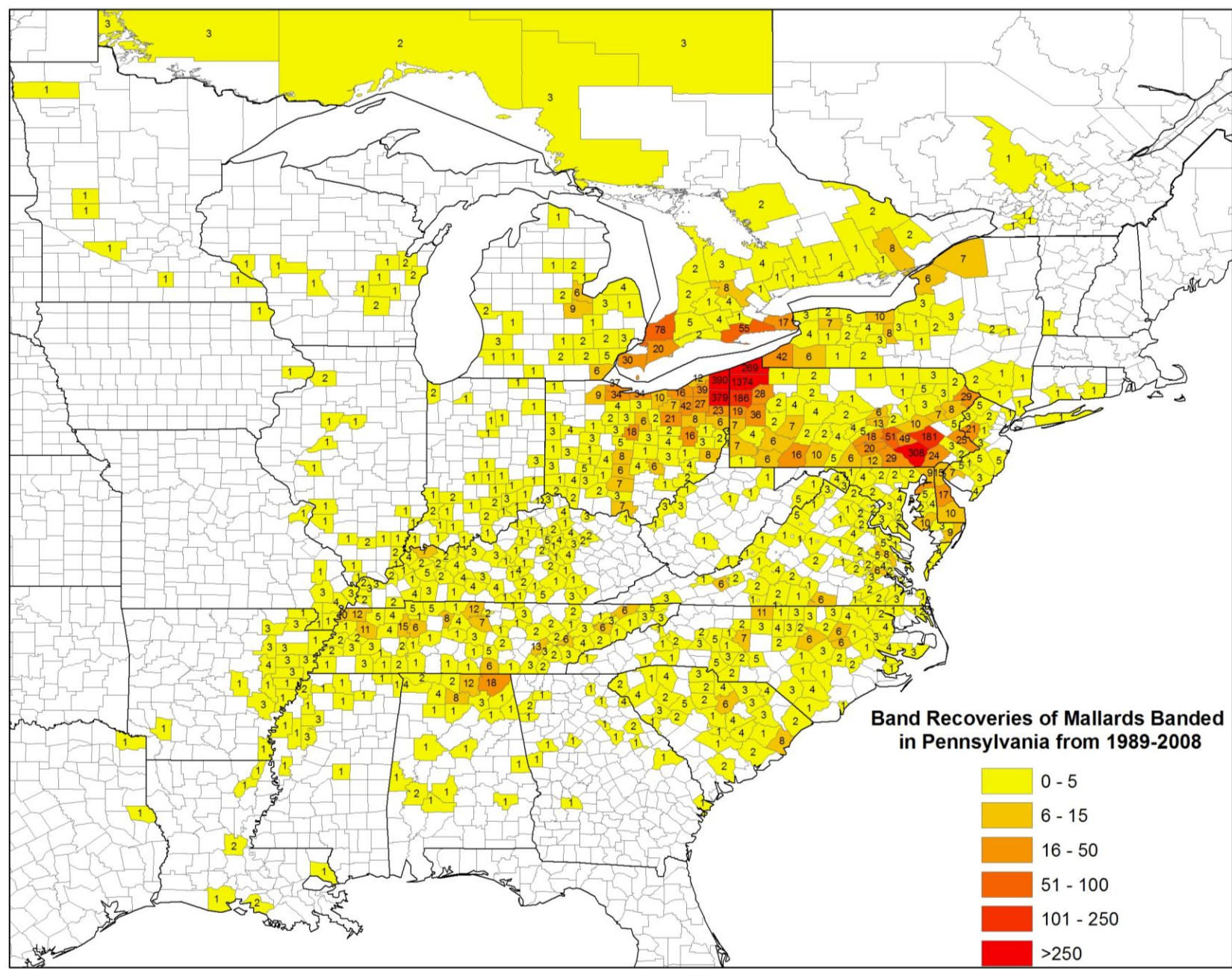


Table 2. Direct recovery distribution of Mallards banded in Pennsylvania from 1989-2008.

State/Province Name	Birds Recovered (n=5862)	Percentage
Pennsylvania	2846	0.49
Ohio	1278	0.22
Ontario	305	0.05
Tennessee	244	0.04
Kentucky	148	0.03
North Carolina	147	0.03
New York	136	0.02
Virginia	128	0.02
Maryland	85	0.01
South Carolina	80	0.01
Alabama	67	0.01
New Jersey	66	0.01
Michigan	63	0.01
Indiana	42	0.01
Delaware	42	0.01
Arkansas	36	0.01
West Virginia	30	0.01
Georgia	21	<0.01
Illinois	20	<0.01
Mississippi	19	<0.01
Missouri	14	<0.01
Wisconsin	13	<0.01
Louisiana	8	<0.01
Minnesota	6	<0.01
Quebec	6	<0.01
Iowa	2	<0.01
Connecticut	2	<0.01
Texas	2	<0.01
Manitoba	2	<0.01
North Dakota	1	<0.01
Wyoming	1	<0.01
Vermont	1	<0.01
New Brunswick	1	<0.01

Figure 6. Direct band recovery distribution of Wood Ducks banded in Pennsylvania 1989 to 2008.

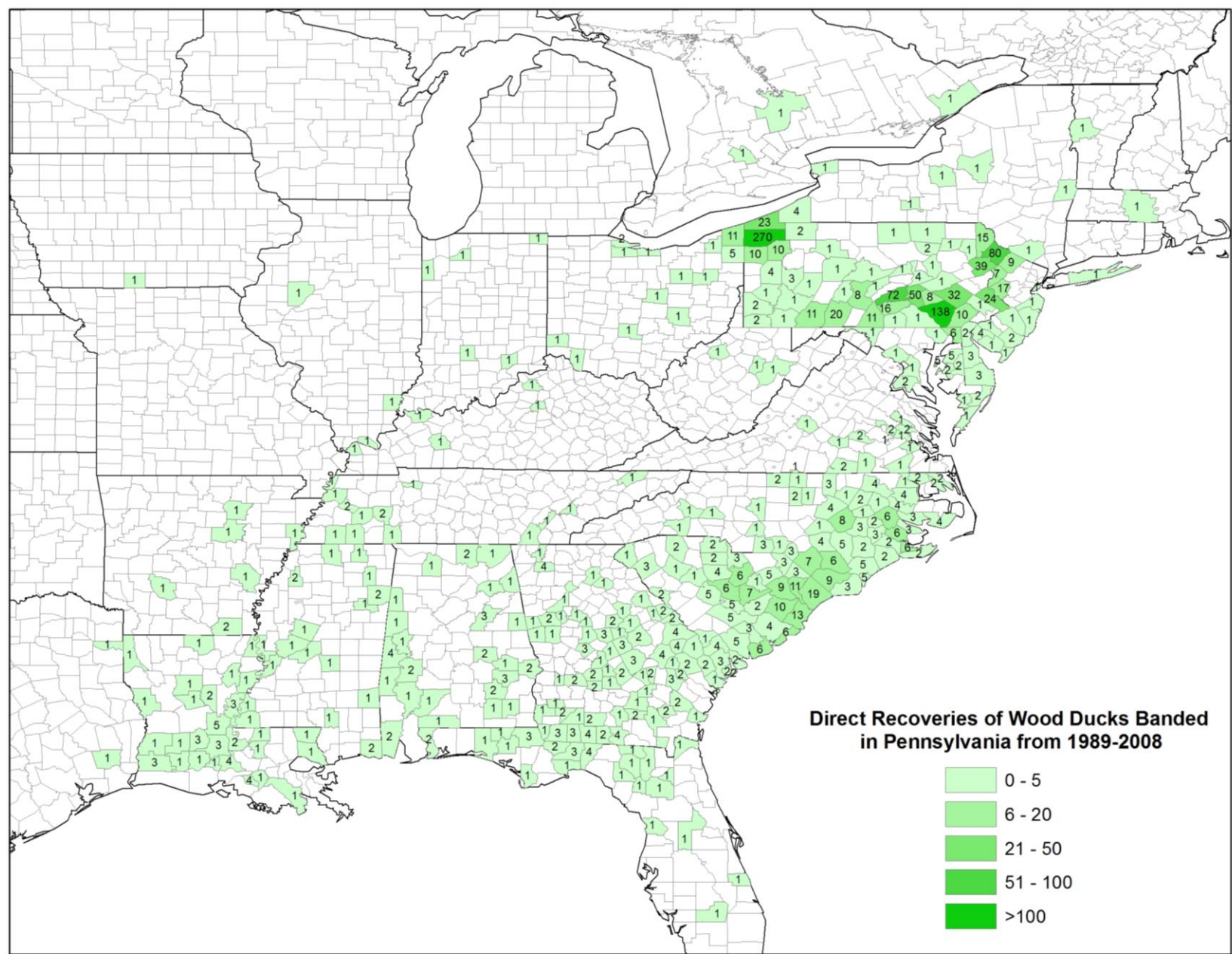


Table 3: Direct recovery distribution of Wood Ducks banded in Pennsylvania from 1989-2008.

State/Province Name	Birds Recovered (n=1612)	Percentage
Pennsylvania	885	0.55
South Carolina	159	0.10
North Carolina	137	0.08
Georgia	117	0.07
New Jersey	45	0.03
Louisiana	44	0.03
Alabama	37	0.02
Florida	31	0.02
Ohio	28	0.02
Maryland	24	0.01
Mississippi	20	0.01
Virginia	18	0.01
Tennessee	15	0.01
New York	12	0.01
Delaware	8	<0.01
Arkansas	7	<0.01
Indiana	5	<0.01
Kentucky	5	<0.01
Illinois	3	<0.01
West Virginia	3	<0.01
Ontario	3	<0.01
Texas	2	<0.01
Vermont	1	<0.01
Oregon	1	<0.01
Iowa	1	<0.01
Massachusetts	1	<0.01

Direct Band Recovery Derivation

Band derivation was determined using direct hunter harvested band recoveries from pre-season banded birds recovered in Pennsylvania during 1989-2008. Direct band recovery derivation was defined as the location where the bird was originally banded pre hunting season and subsequently harvested in Pennsylvania during the hunting season of the same year. Direct recoveries derivation was calculated as the proportion of birds banded in each state/province that were recovered in Pennsylvania to the total number of banded birds recovered in Pennsylvania from 1989-2008. All banding data for birds recovered in Pennsylvania was obtained from the U.S Fish and Wildlife Service using the program Bandit and only direct recoveries from birds harvested or found dead were used in the analysis. The original banding coordinates of each bird recovered in Pennsylvania were plotted in ArcMap version 9.3. The points were exported as a layer and joined with a North American county layer. The number of points in each county was summed to determine the total number of birds originating from each county of a state/province. In this analysis distributions were not adjusted for variation of reporting rates between flyways.

The Canada goose recovery derivation shows that a large proportion (84%) is comprised of birds banded in Pennsylvania (Figure 7 and Table 4). This indicates that the majority of geese harvested in Pennsylvania are resident birds. Ontario and Quebec was the second and third largest population sources for geese harvested in Pennsylvania. Ontario birds included both RP birds from southern Ontario and Southern James Bay Birds originating in northern Ontario along the southern James Bay area. The Akimiski Island, located in Nunavut Canada, also contributed to SJBPs harvested in Pa. Band derivations from Quebec comprised primarily Atlantic Population (AP) birds banded in the Ungava and Hudson Bay area.

Mallard and Wood Duck recovery derivation indicate that locally produced birds are important to both species harvest, comprising of 80% (Mallard) and 83% (Wood Duck) band derivation (Figures 8,9 and Tables 5,6) . Mallard Band derivation also indicates that Ontario, Quebec, and New York are important population sources for Pa Mallards. Wood Duck Derivations indicate that the New England States, especially New York, New Jersey, and Vermont are important population sources for wood ducks harvested in Pennsylvania. Ontario and Quebec are also important population sources for Pa harvested Wood Ducks.

Figure 7. Direct band recovery derivation of Canada geese in Pennsylvania from 1991 to 2009.

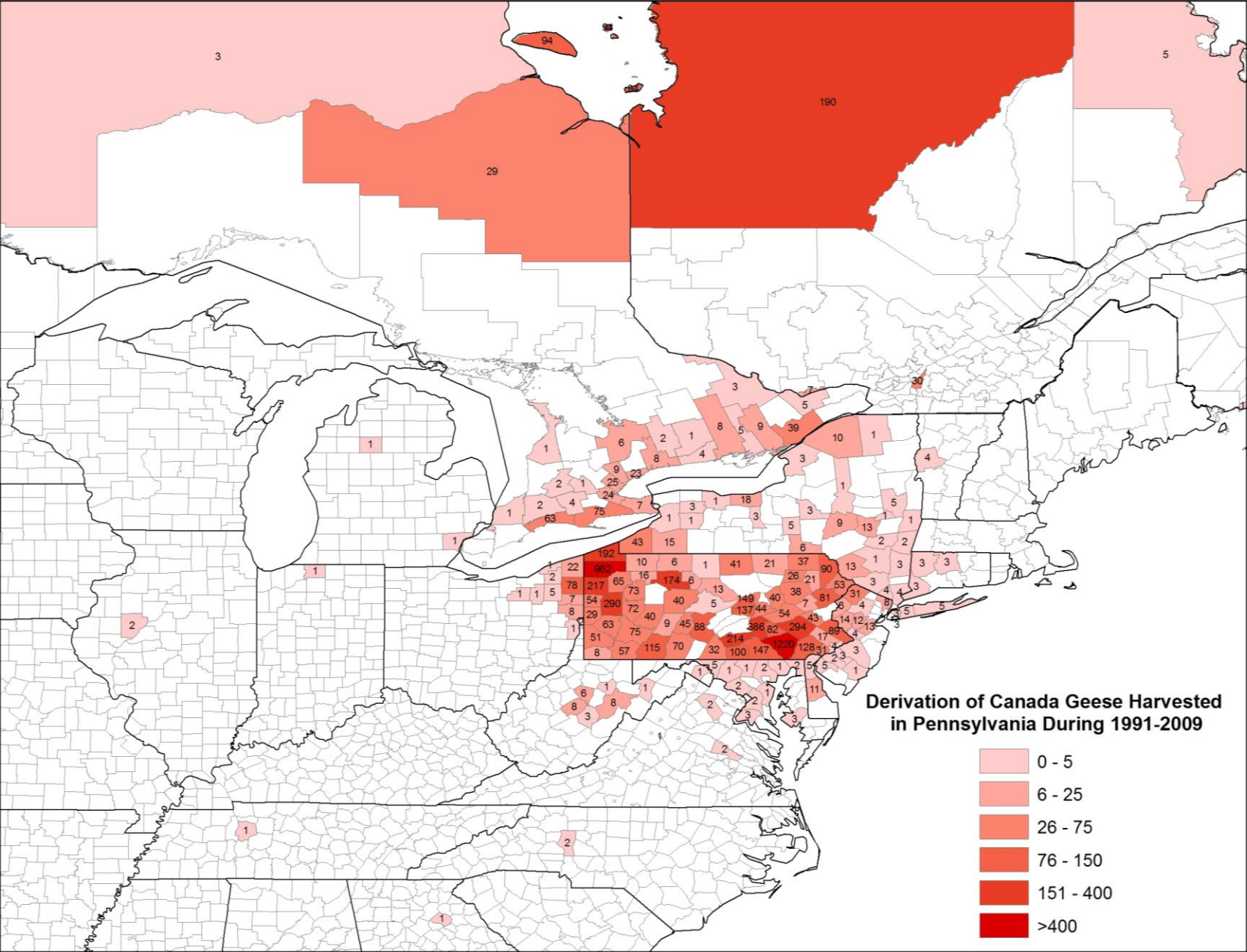


Table 4. Derivation of Direct Canada Goose Bands Recovered in Pennsylvania from 1991-2009

State/Province Name	Birds Recovered (n=7672)	Percentage
Pennsylvania	6472	0.84
Ontario	356	0.05
Quebec	227	0.03
New York	188	0.02
Ohio	126	0.02
New Jersey	106	0.01
Nunavut	93	0.01
West Virginia	30	<0.01
Maryland	23	<0.01
Delaware	16	<0.01
Connecticut	9	<0.01
Virginia	5	<0.01
Vermont	4	<0.01
Illinois	2	<0.01
Colorado	2	<0.01
North Carolina	2	<0.01
Michigan	2	<0.01
New Brunswick	2	<0.01
Montana	1	<0.01
Minnesota	1	<0.01
Iowa	1	<0.01
Indiana	1	<0.01
Oklahoma	1	<0.01
Tennessee	1	<0.01
Georgia	1	<0.01

Figure 8. Direct band recovery derivation of mallards in Pennsylvania from 1989 to 2009.

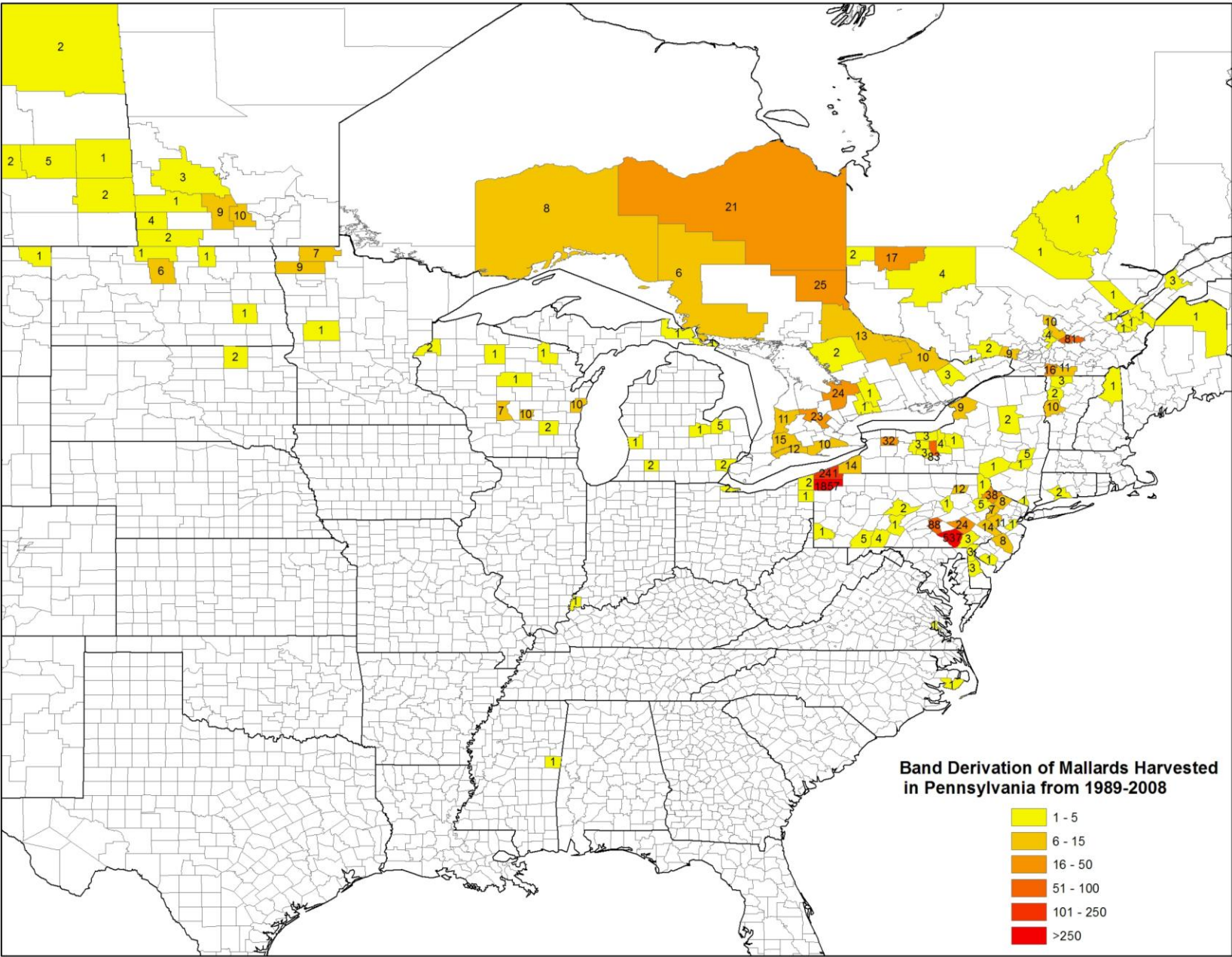


Table 5: Derivation of Direct Mallard Bands Recovered in Pennsylvania from 1989-2009.

State/Province Name	Birds Recovered (n=3554)	Percentage
Pennsylvania	2834	0.80
Ontario	202	0.06
Quebec	163	0.05
New York	162	0.05
New Jersey	36	0.01
Wisconsin	34	0.01
Manitoba	29	0.01
Minnesota	17	<0.01
Saskatchewan	16	<0.01
Vermont	15	<0.01
Michigan	12	<0.01
North Dakota	9	<0.01
Delaware	6	<0.01
Ohio	5	<0.01
South Dakota	2	<0.01
Connecticut	2	<0.01
New Brunswick	2	<0.01
Montana	1	<0.01
Maine	1	<0.01
New Hampshire	1	<0.01
Indiana	1	<0.01
Virginia	1	<0.01
North Carolina	1	<0.01
Mississippi	1	<0.01
Nova Scotia	1	<0.01

Figure 9. Direct band recovery derivation of wood ducks in Pennsylvania 1989 – 2009.

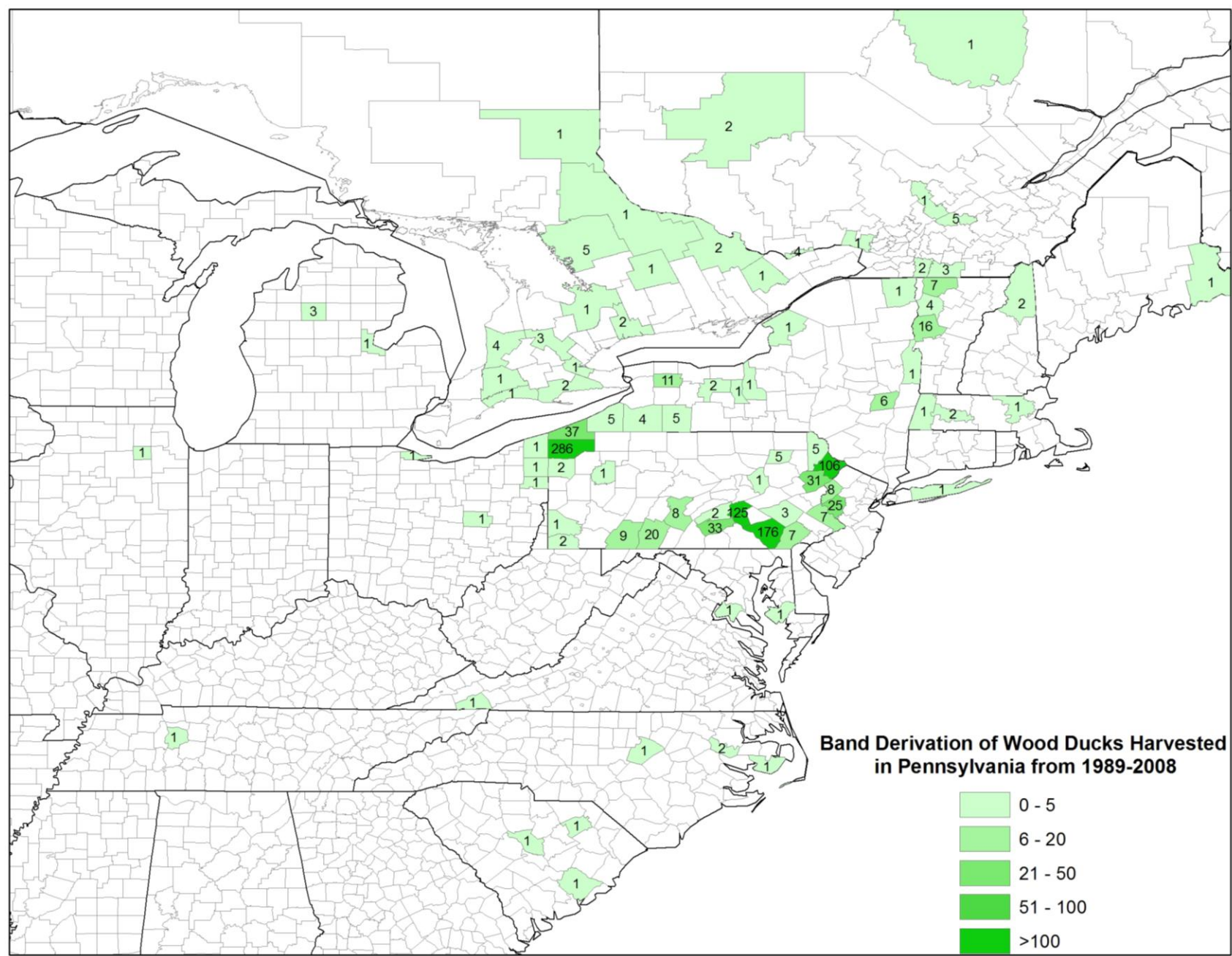
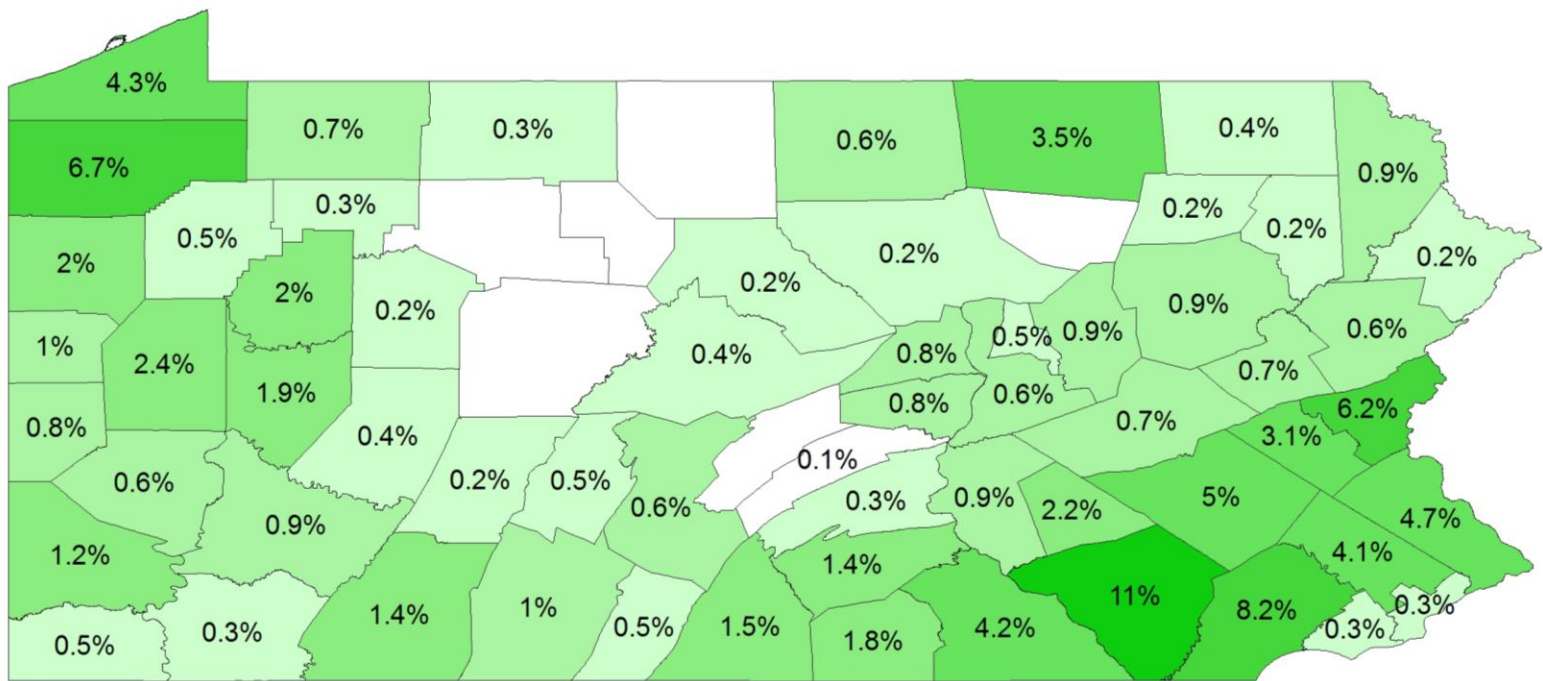


Table 6: Derivation of Direct Wood Duck Bands Recovered in Pennsylvania from 1989-2009.

State/Province Name	Birds Recovered (n=1041)	Percentage
Pennsylvania	867	0.83
New York	39	0.04
New Jersey	33	0.03
Vermont	27	0.03
Ontario	25	0.02
Quebec	20	0.02
Ohio	5	<0.01
Massachusetts	4	<0.01
North Carolina	4	<0.01
Michigan	4	<0.01
South Carolina	3	<0.01
New Hampshire	2	<0.01
Maryland	2	<0.01
Prince Edward Island	2	<0.01
Maine	1	<0.01
Illinois	1	<0.01
Virginia	1	<0.01
Tennessee	1	<0.01

Figure 10. Average percent of total of Canada goose harvest by county in Pennsylvania 1999 to 2007.



Average percent of Canada Goose Harvest by County During 1999-2007

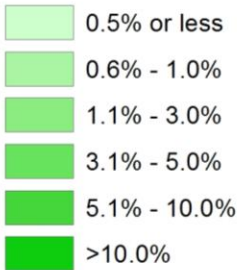
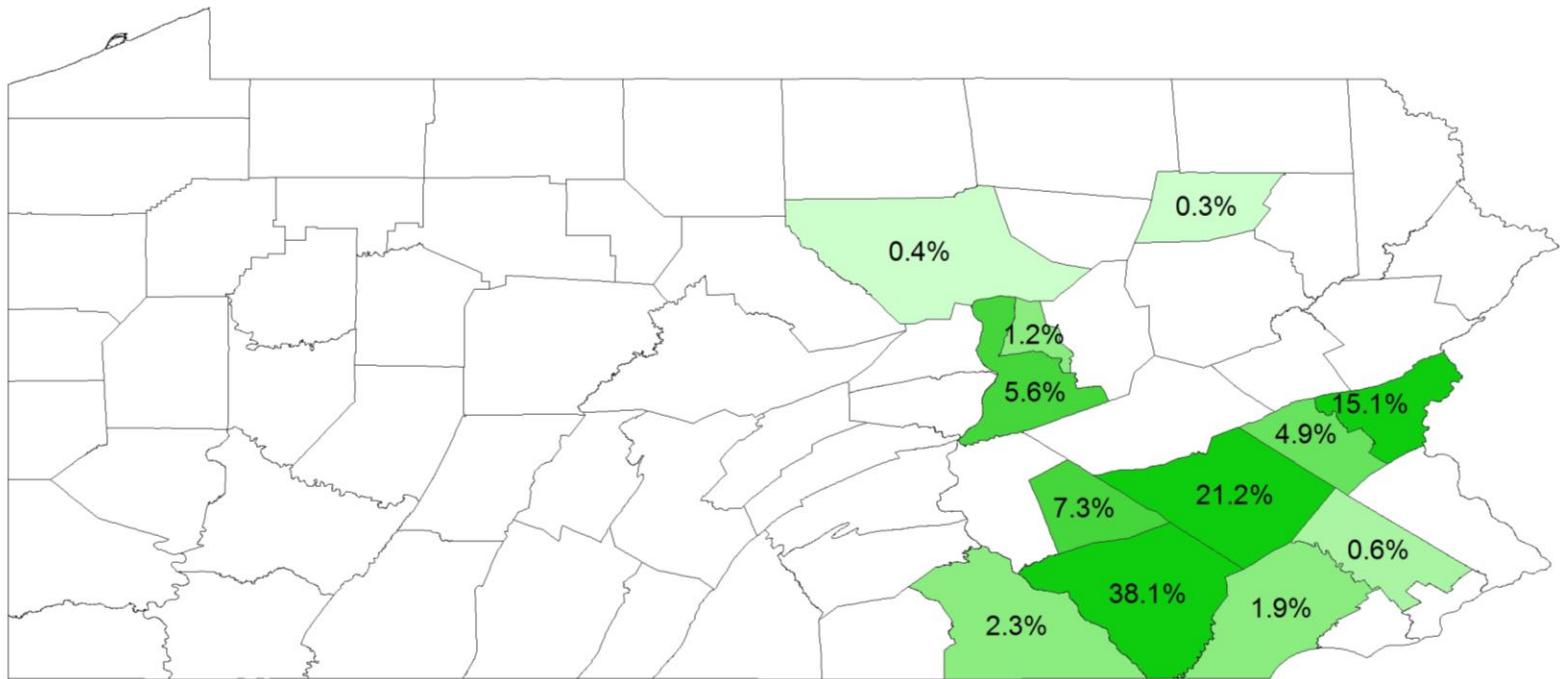


Figure 11. Average percent of total greater snow goose harvest by county in Pennsylvania from 1999 to 2007.



Average percent of Snow Goose Harvest by County During 1999-2007

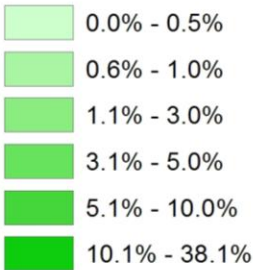
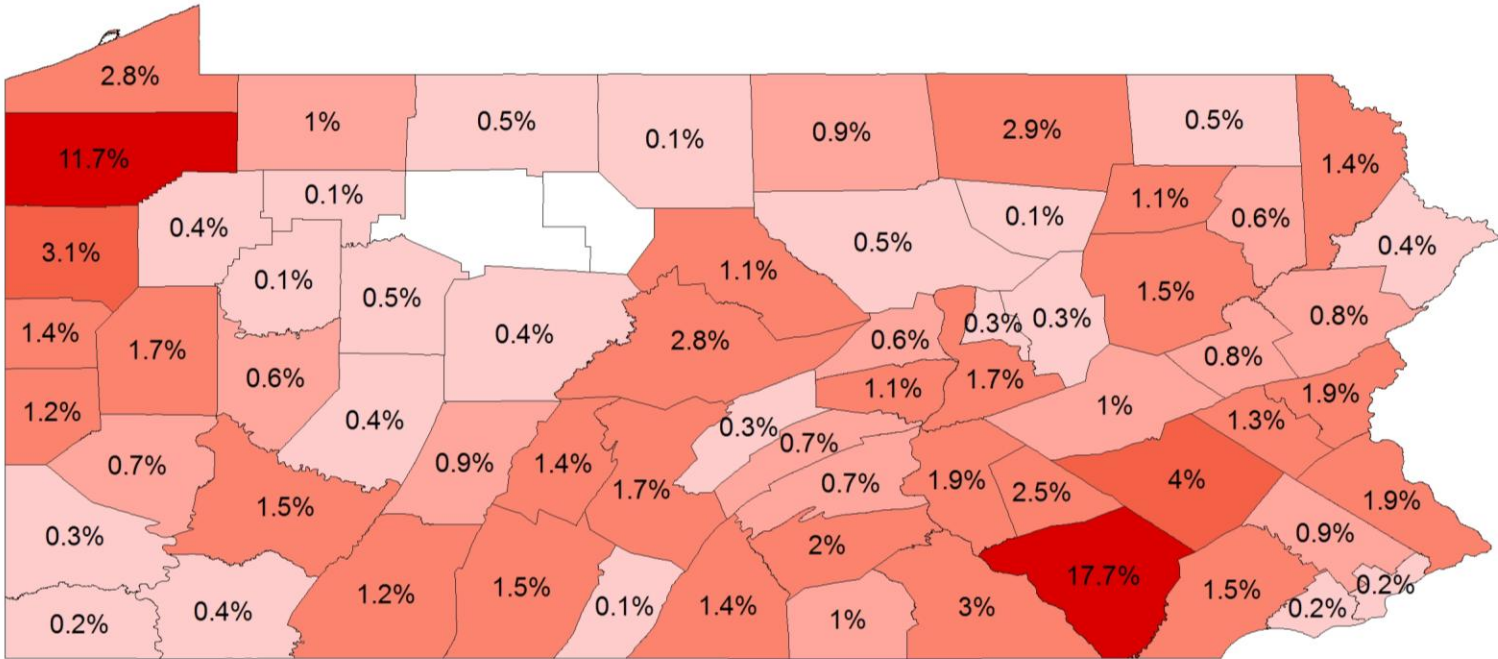


Figure 12. Average percent of total combined dabbling harvest by county in Pennsylvania from 1999 to 2007.



Average percent of Dabbling Duck Harvest by County During 1999-2007

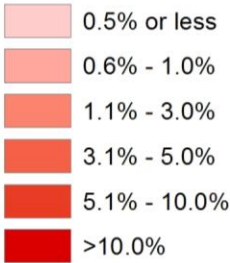
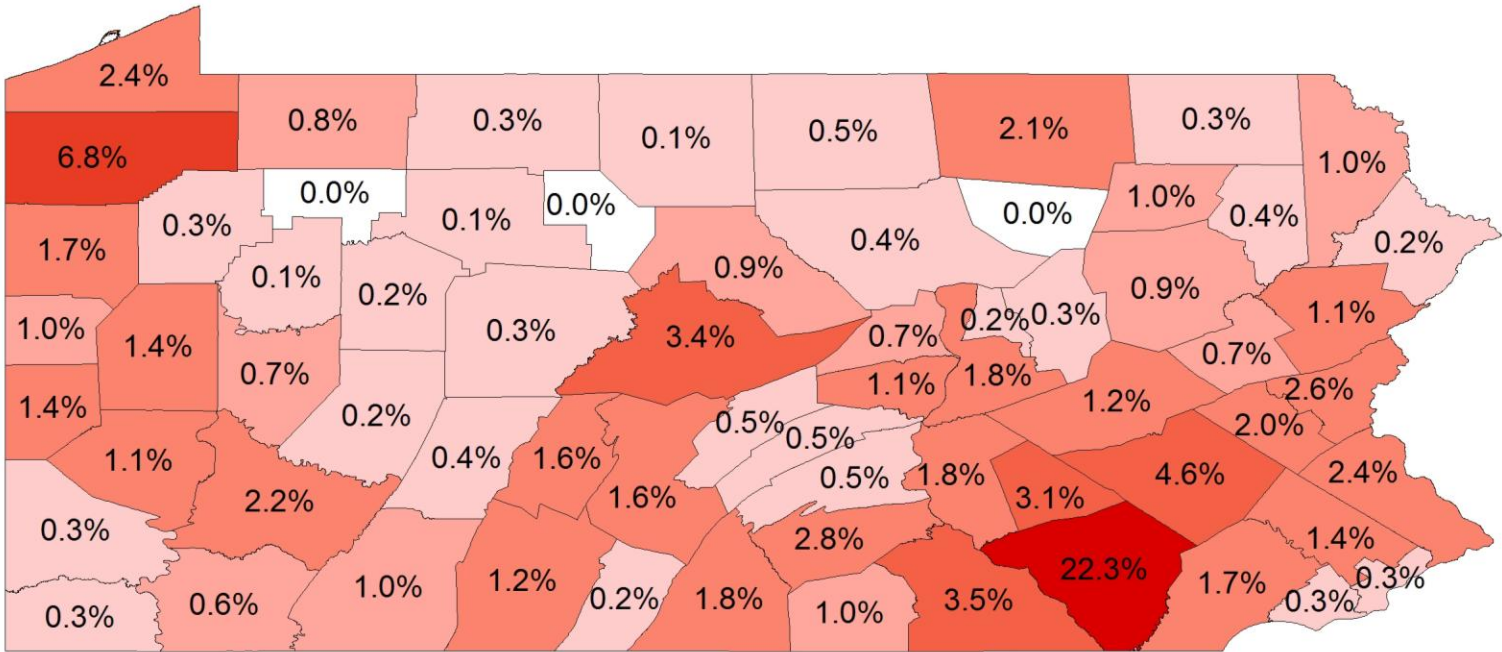


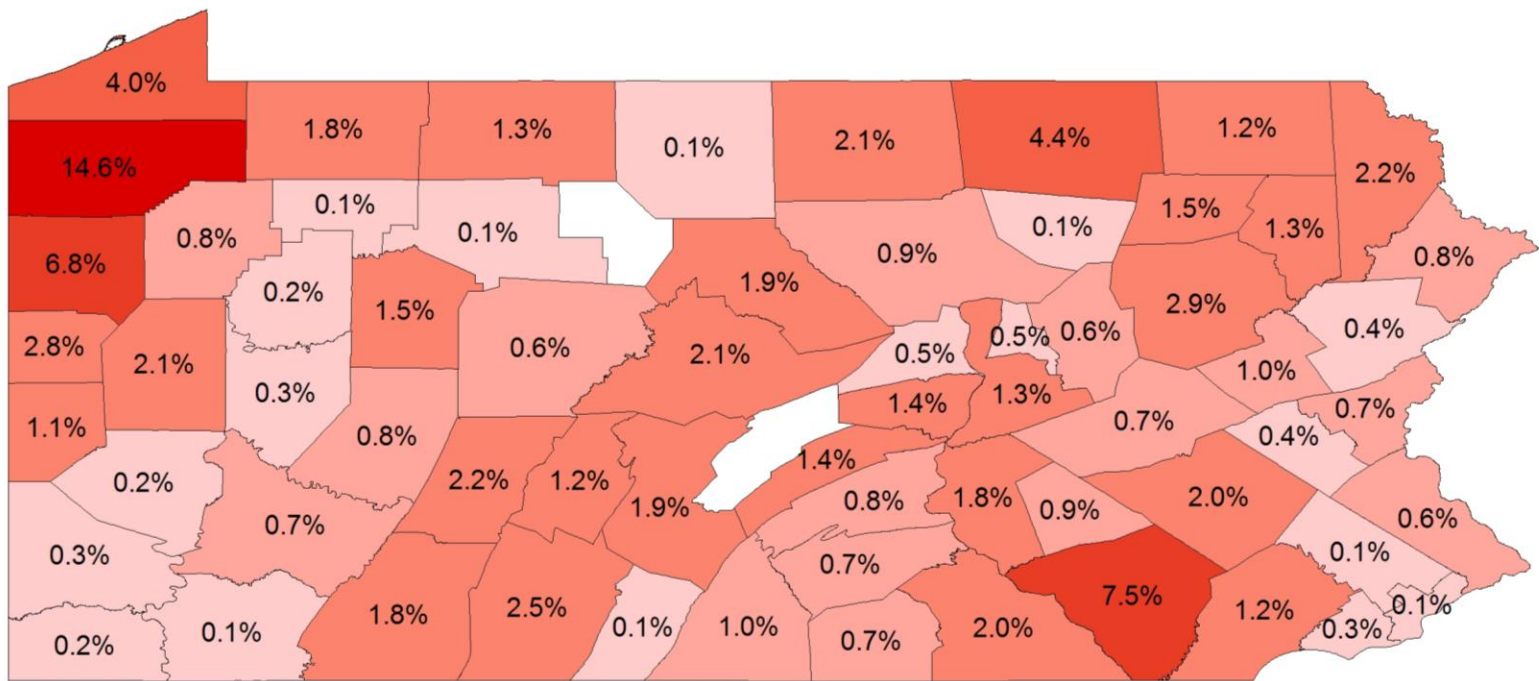
Figure 13. Average percent of mallard harvest by county in Pennsylvania from 1999-2007.



Average percent of Mallard Harvest by County During 1999-2007



Figure 14. Average percent of wood duck harvest by county in Pennsylvania from 1999 to 2007.



Average percent of Wood Duck Harvest by County During 1999-2007

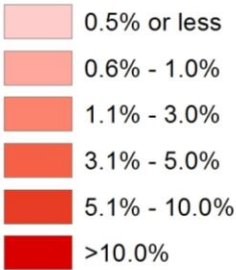
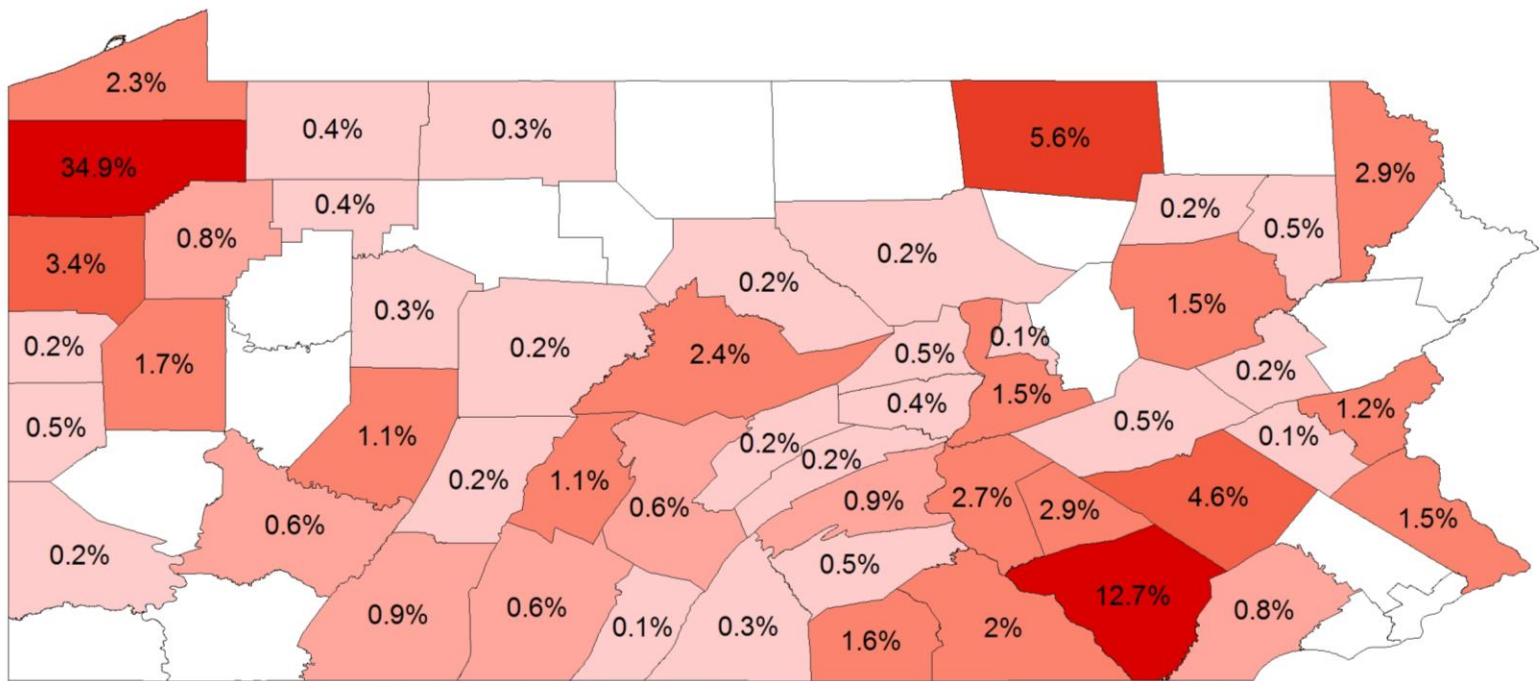


Figure 15. Average percent of American green-winged teal harvest by county in Pennsylvania from 1999 to 2007.



**Average percent of American Green Wing
Teal Harvest by County During 1999-2007**

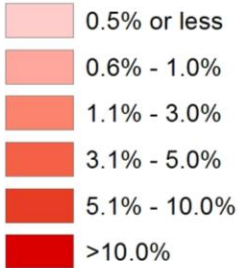
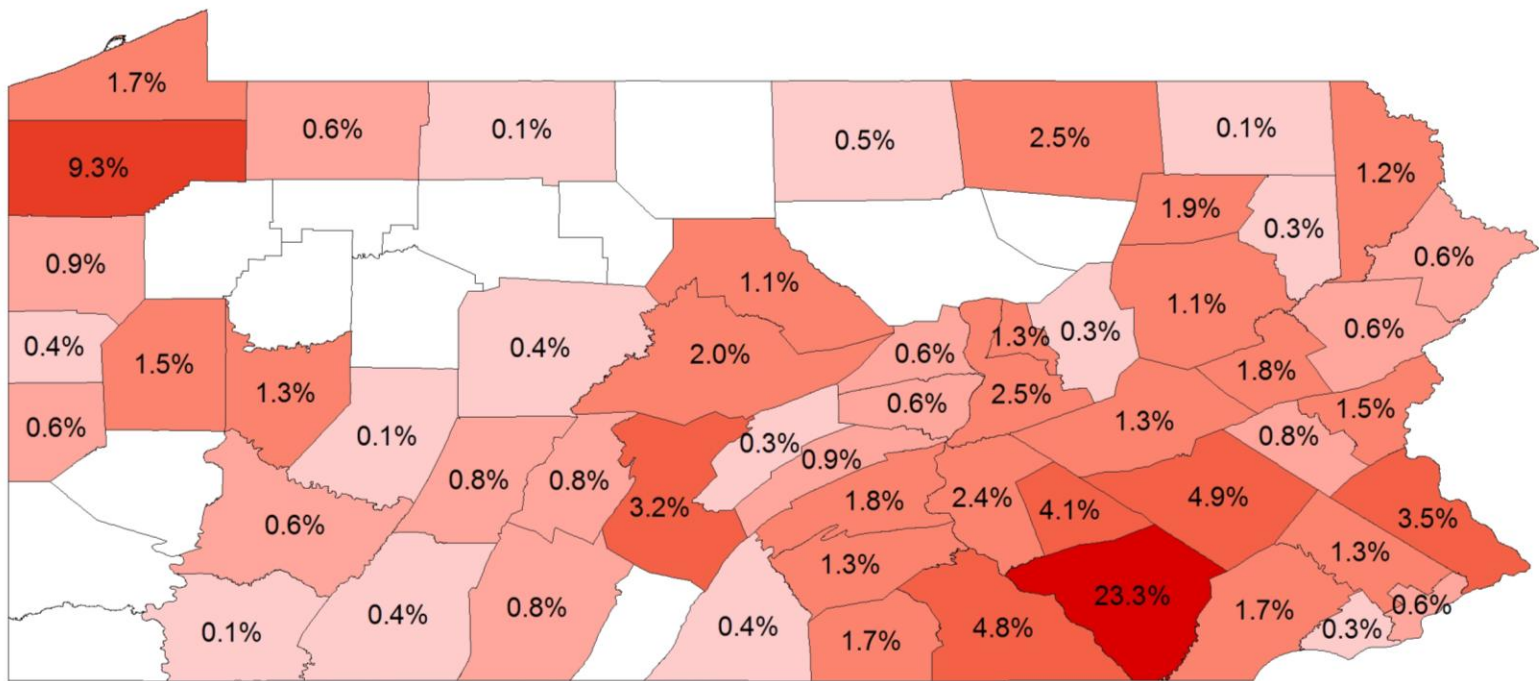


Figure 16. Average percent of American black duck harvest by county in Pennsylvania from 1999 to 2007.



Average percent of Black Duck Harvest by County During 1999-2007

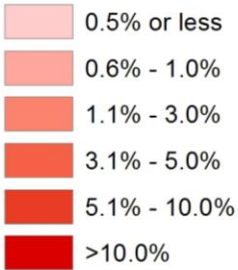
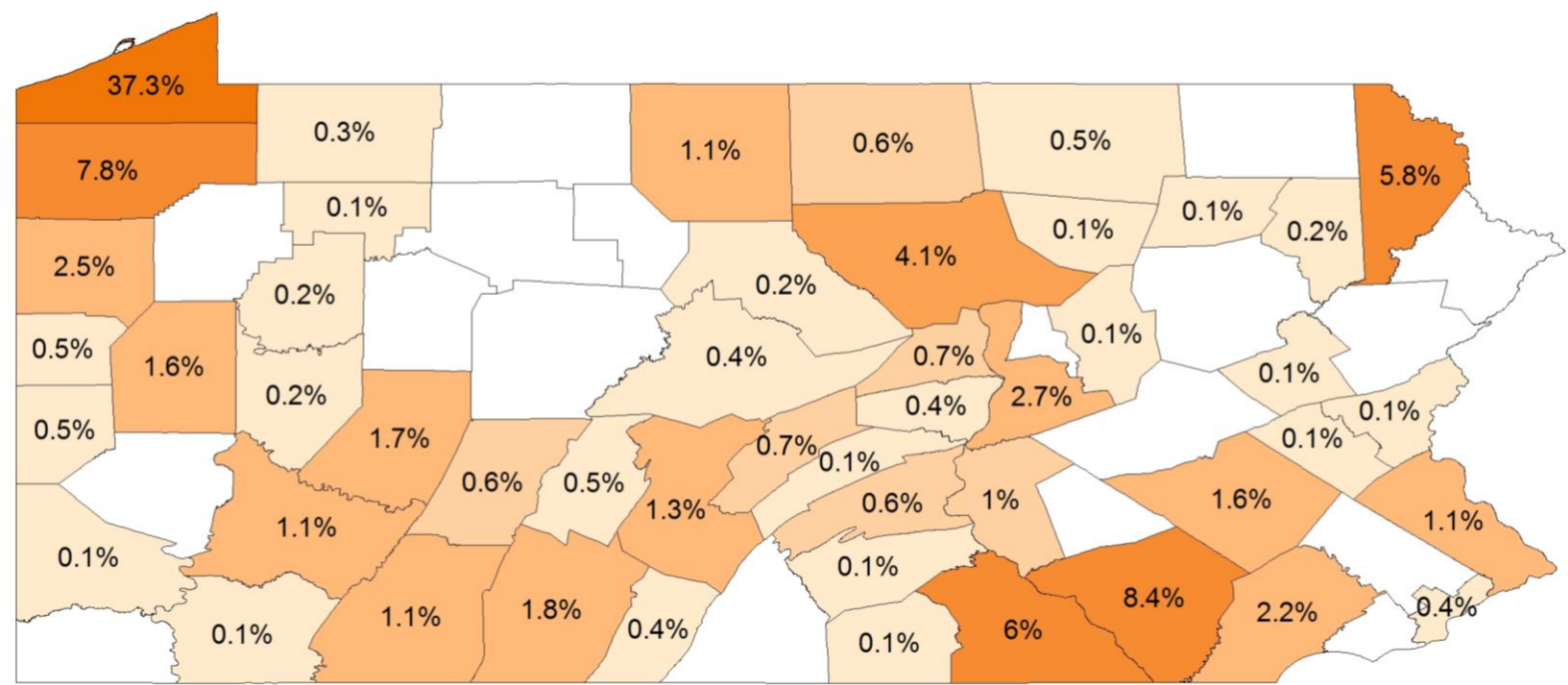


Figure 17. Average percent of total combined diving duck harvest by county in Pennsylvania from 1999 to 2007.



Average percent of Diving Duck Harvest by County During 1999-2007

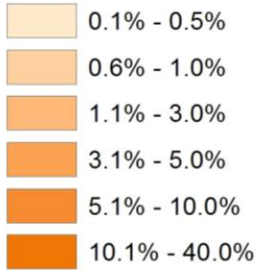
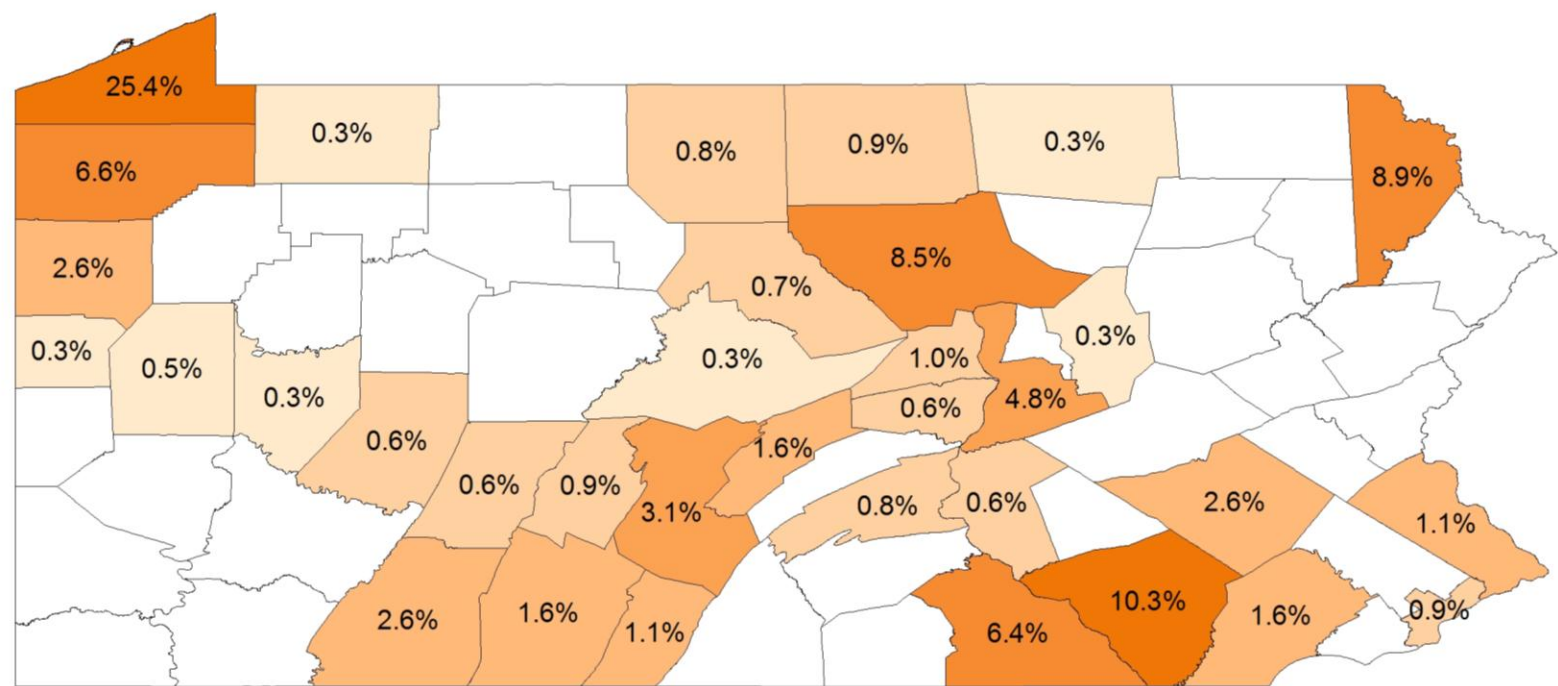


Figure 18. Average percent of bufflehead harvest by county in Pennsylvania from 1999 to 2007.



Average percent of Bufflehead Harvest by County During 1999-2007

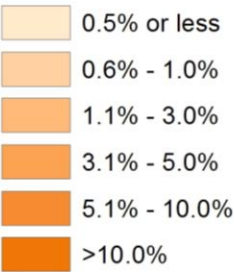
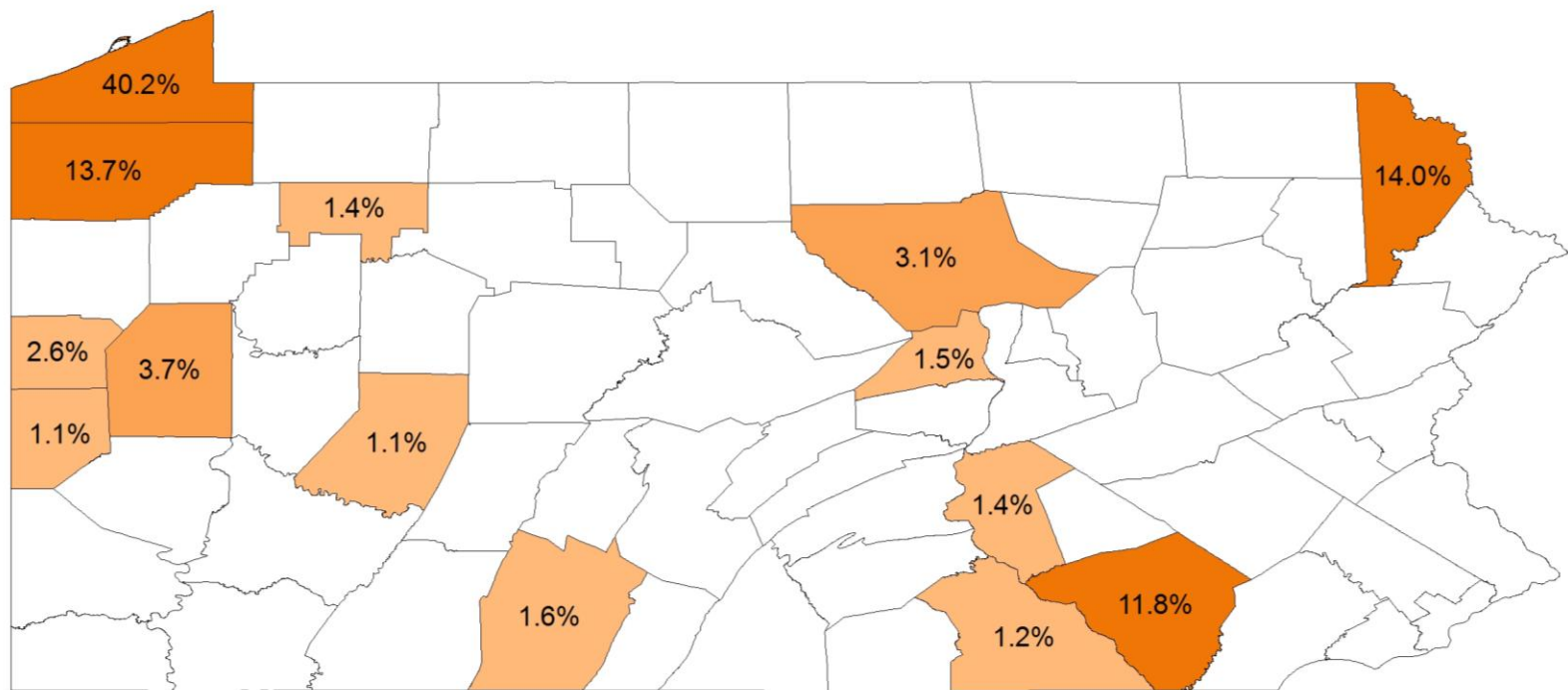


Figure 19. Average percent of common goldeneye harvest by county in Pennsylvania from 1999 to 2007.



Average percent of Common Goldeneye Harvest by County During 1999-2007

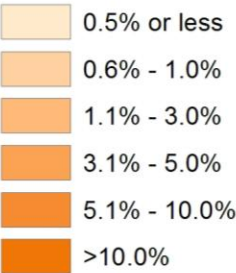
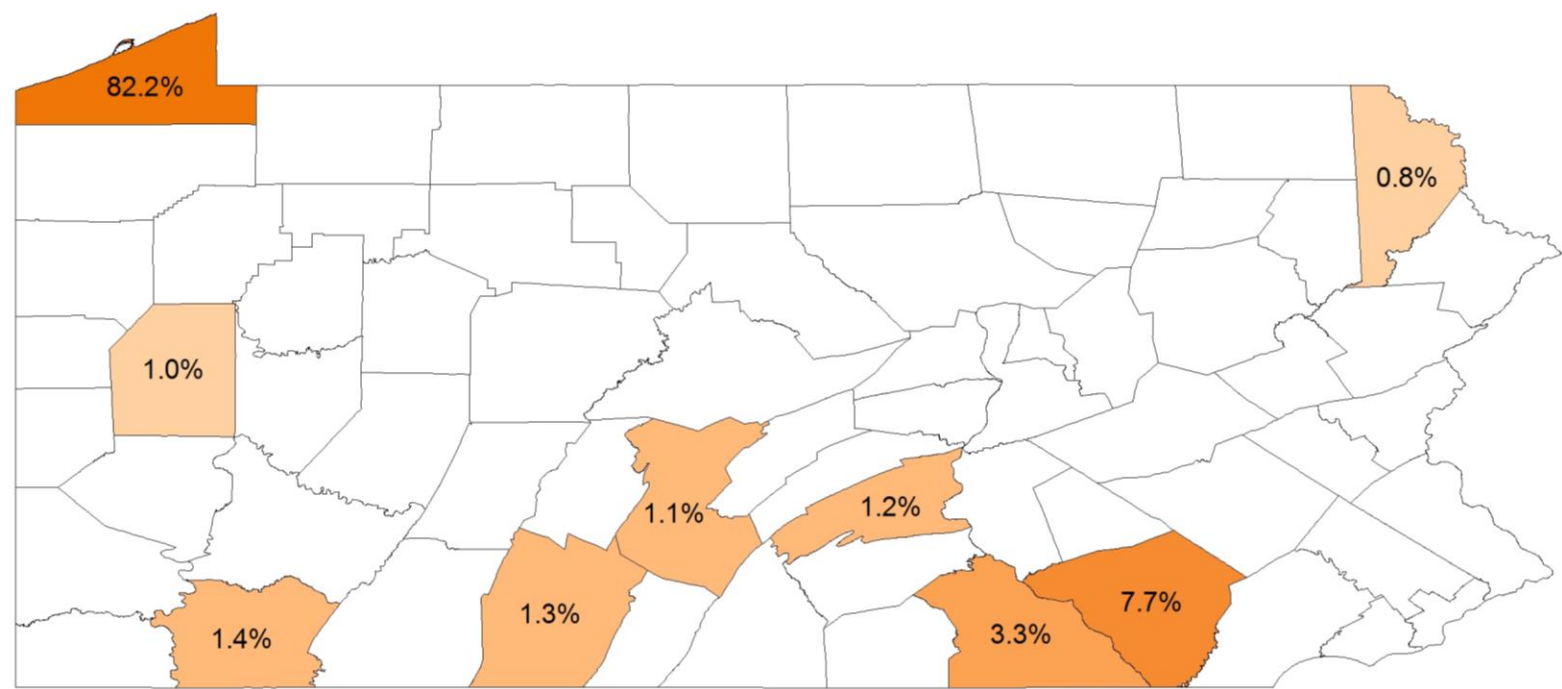


Figure 20. Average percent of greater scaup harvest by county in Pennsylvania from 1999 to 2007.



Average percent of Greater Scaup Harvest by County During 1999-2007

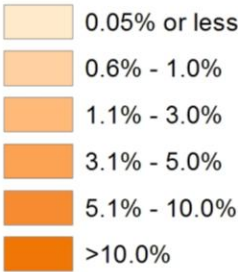
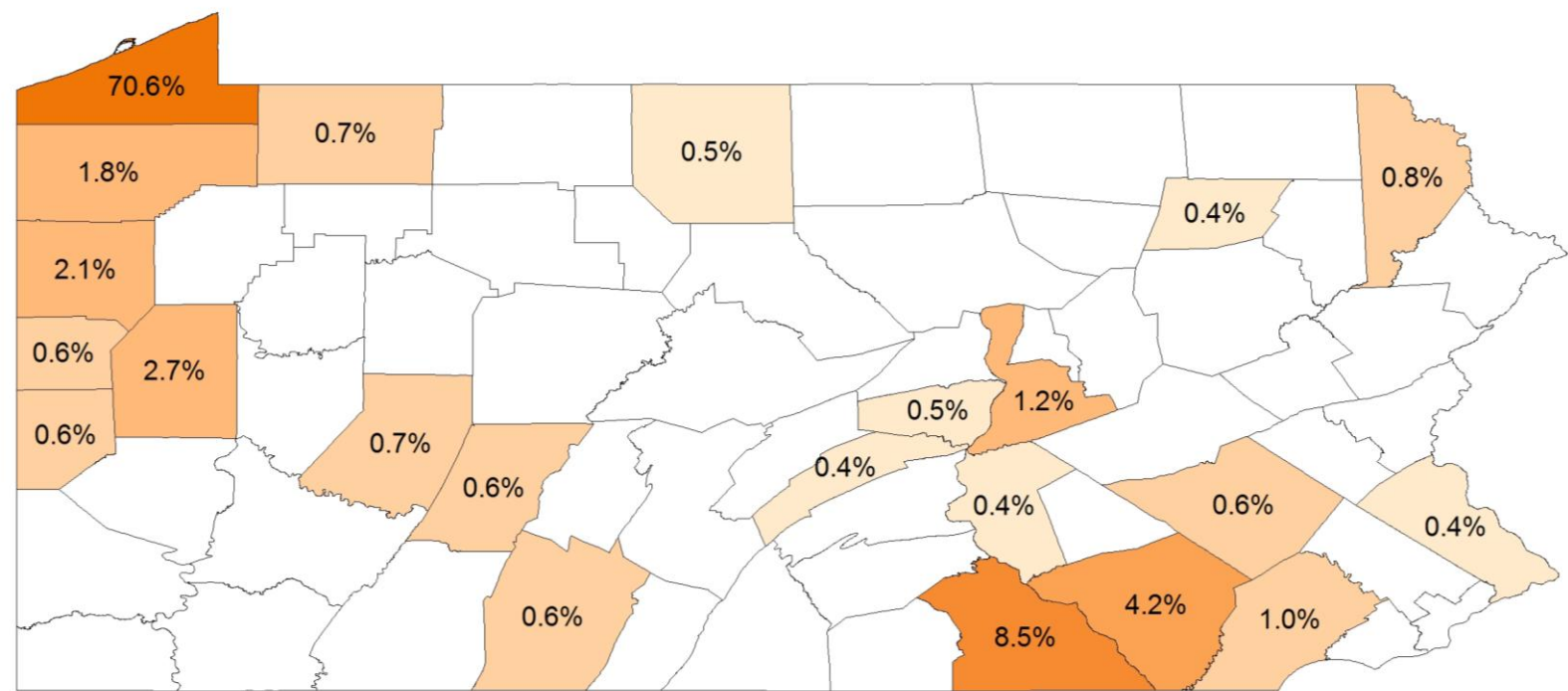


Figure 21. Average percent of lesser scaup harvest by county in Pennsylvania from 1999 to 2007.



Average percent of Lesser Scaup Harvest by County During 1999-2007

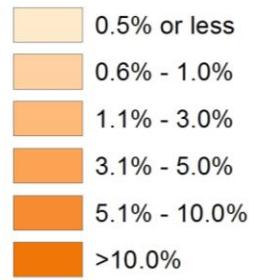
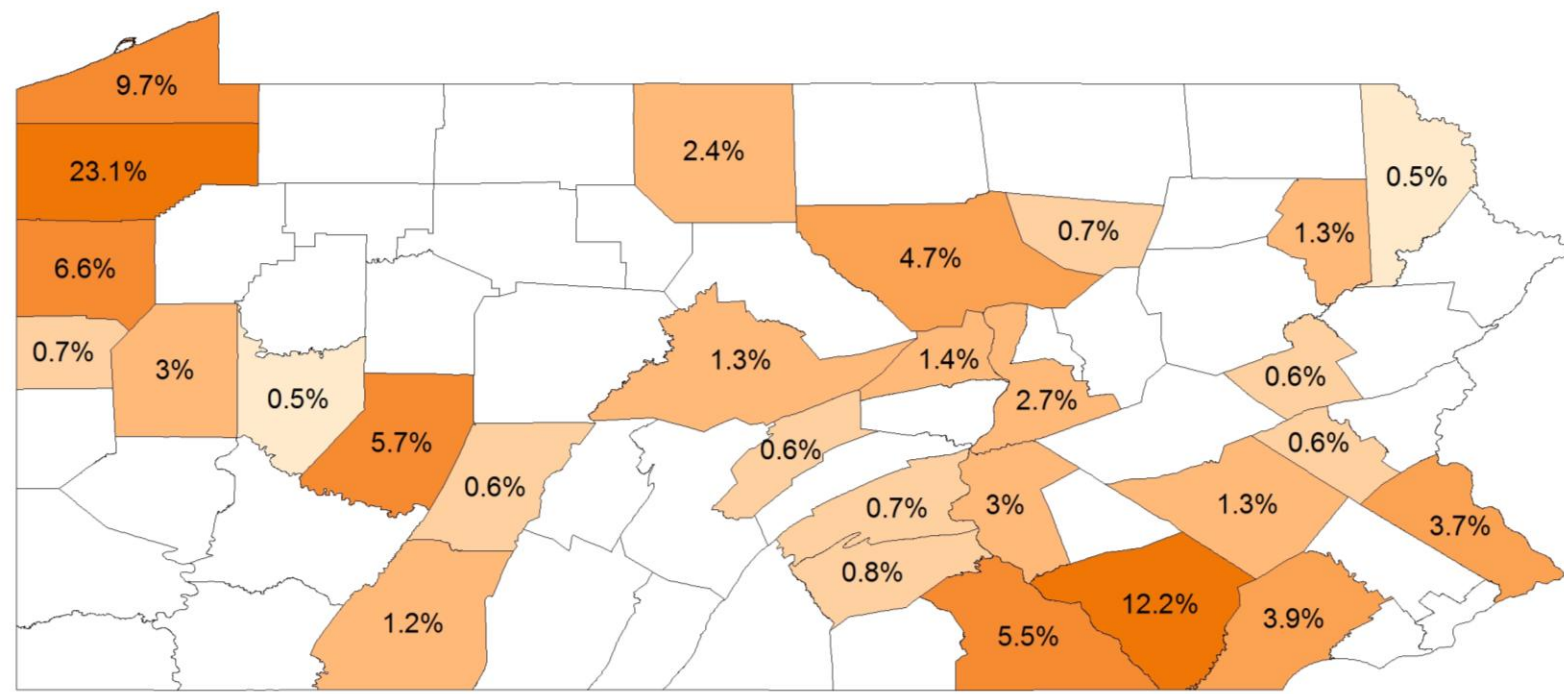


Figure 22. Average percent of ring-necked duck harvest by county in Pennsylvania from 1999 to 2007.



Average percent of Ring Necked Duck Harvest by County During 1999-2007

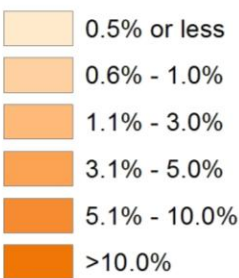
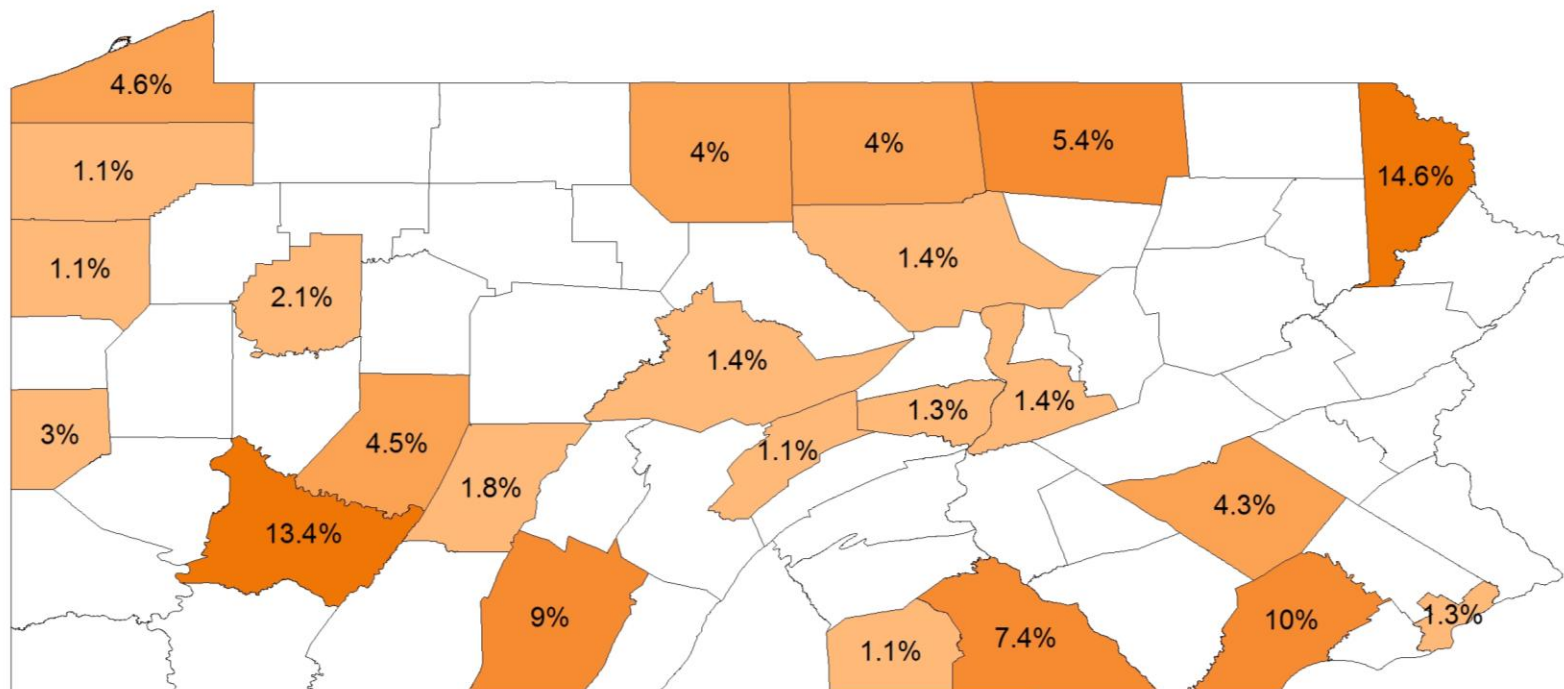


Figure 23. Average percent of ruddy duck harvest by county in Pennsylvania from 1999 to 2007.



Average percent of Ruddy Duck Harvest by County During 1999-2007

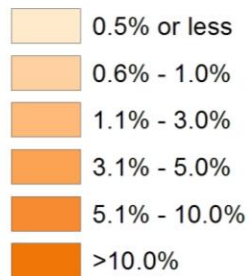


Figure 24. PA estimated mallard harvest 1960 to 2008.

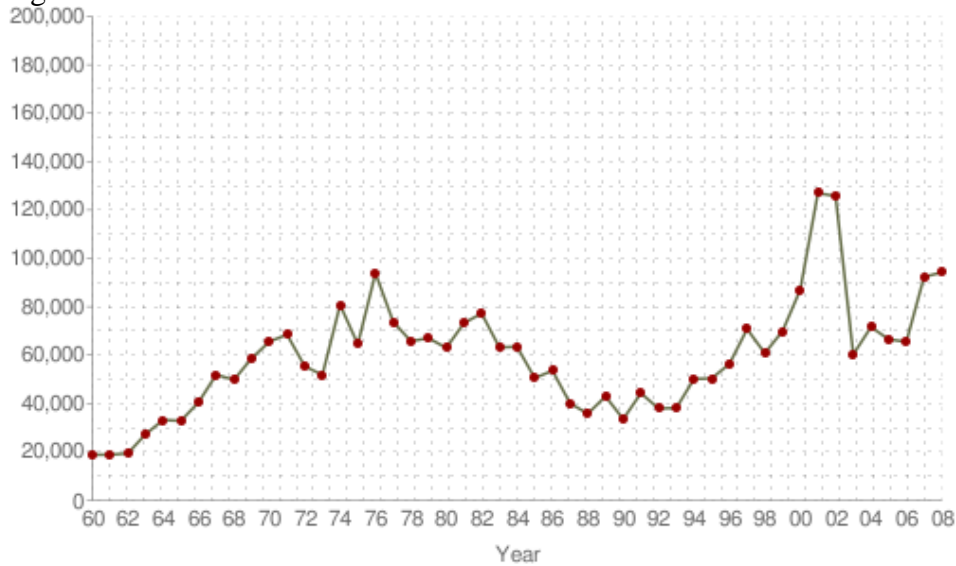


Figure 25. PA estimated wood duck harvest 1960 to 2008.

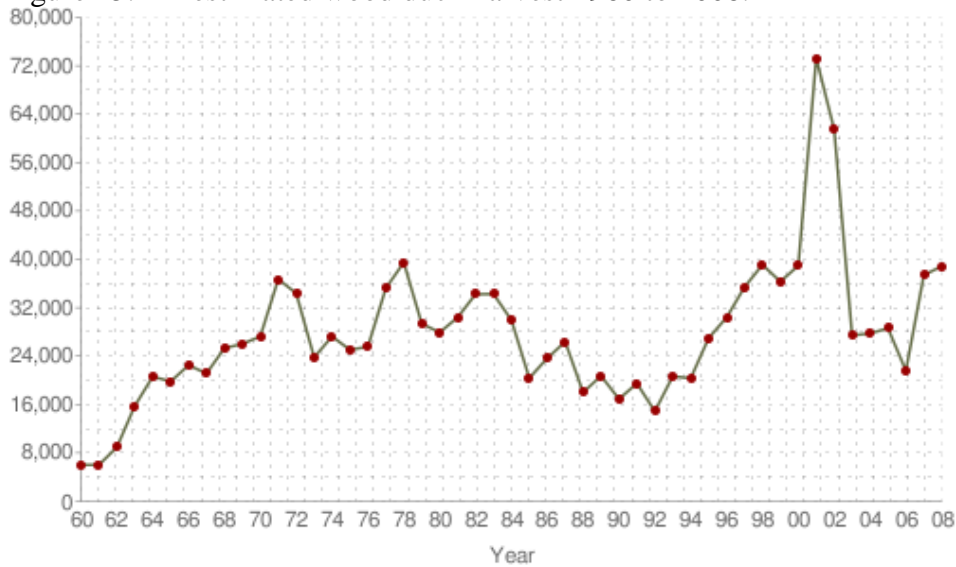


Figure 26. PA estimated American black duck harvest 1960 to 2008.

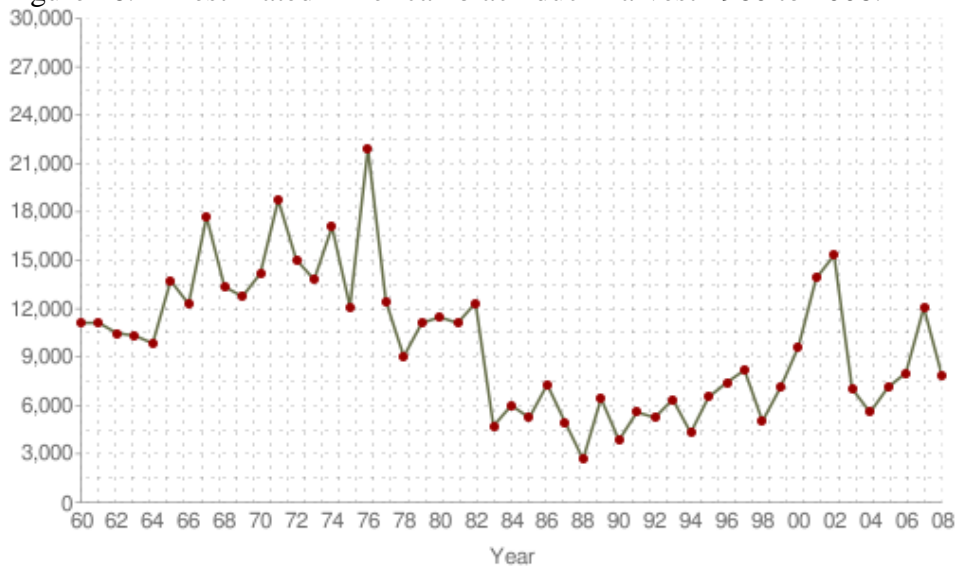


Figure 27. PA estimated American green-winged teal harvest 1960 to 2008.

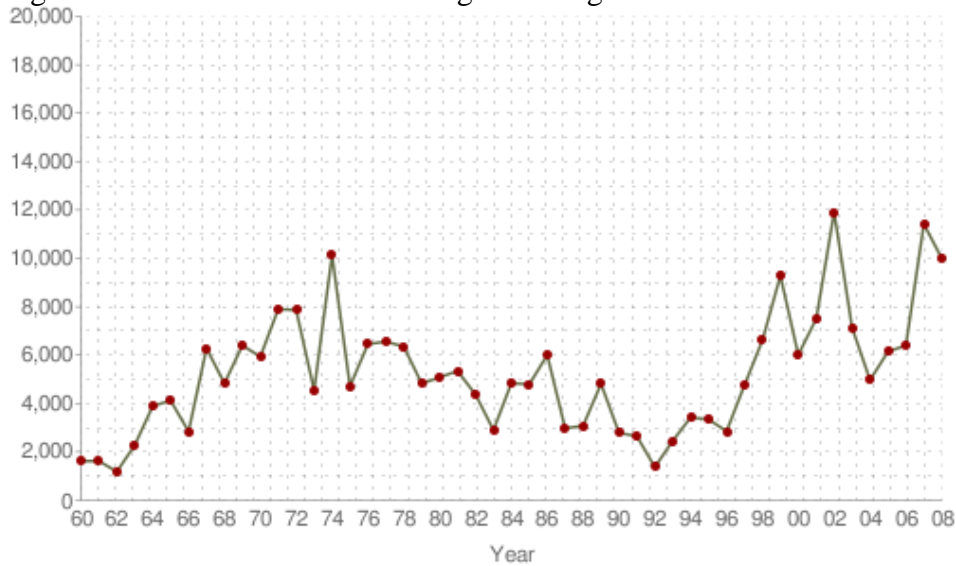


Figure 28. PA estimated bufflehead harvest 1960 to 2008.

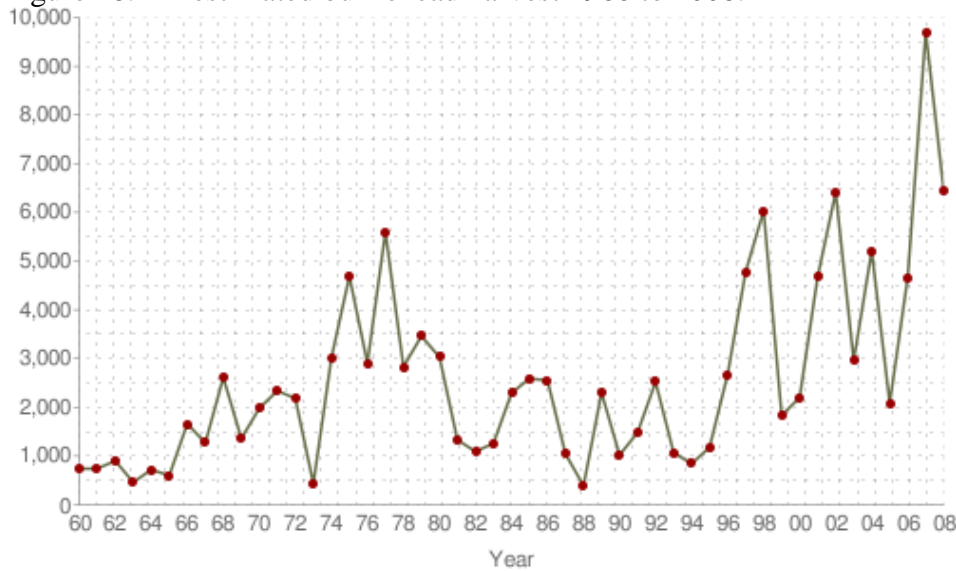


Figure 29. PA estimated lesser scaup harvest 1960 to 2008.

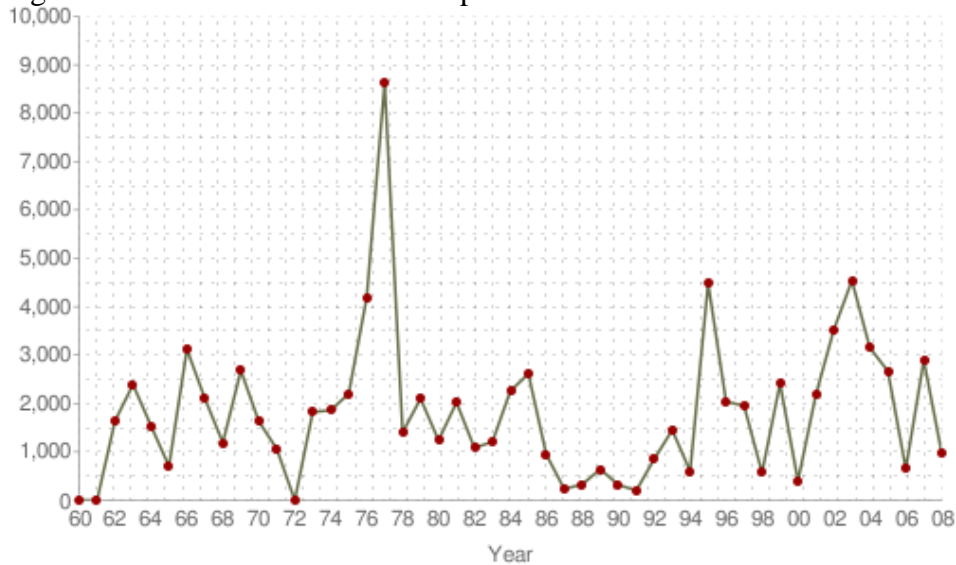


Figure 30. PA estimated greater scaup harvest 1960 to 2008.

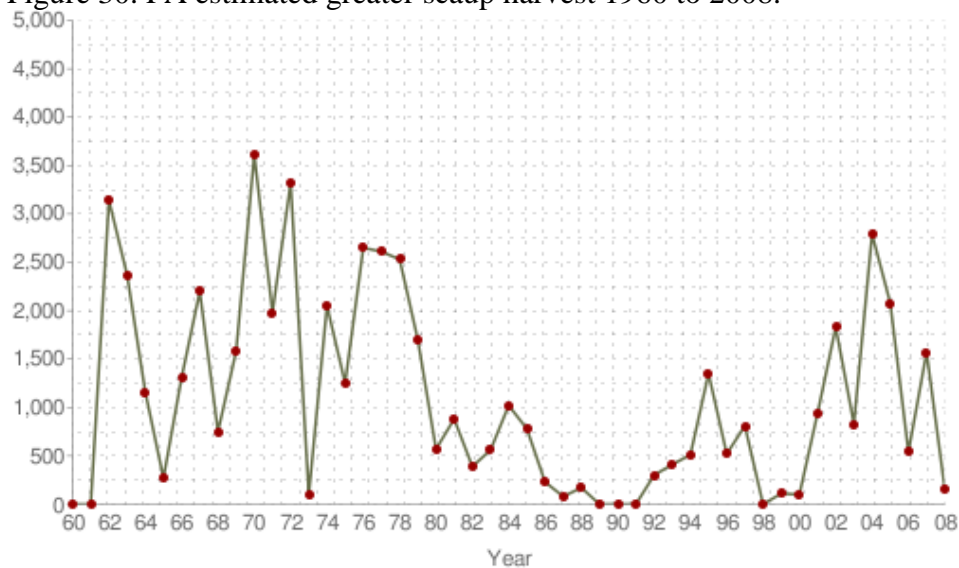


Figure 31. PA estimated ring-necked duck harvest 1960 to 2008.

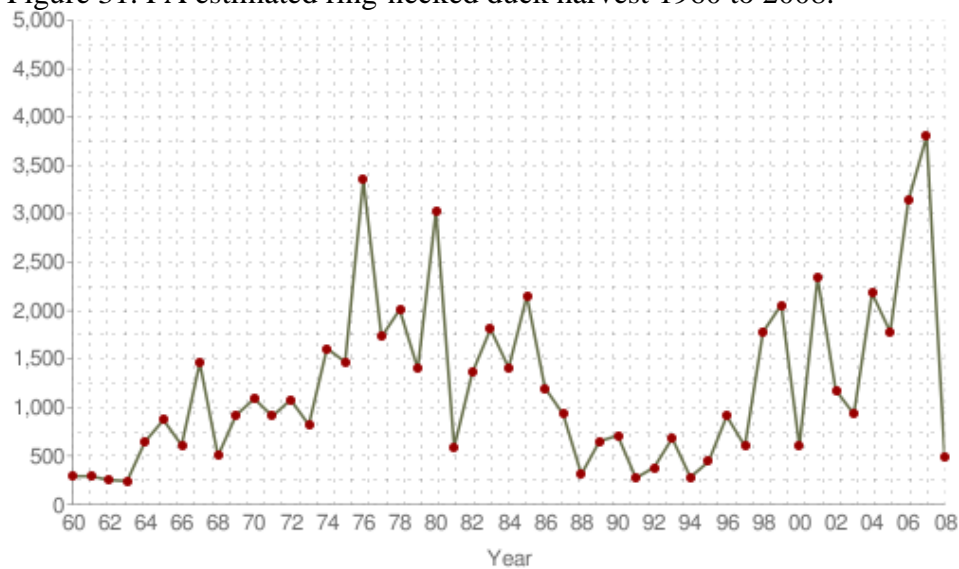


Figure 32. PA estimated gadwall harvest 1960 to 2008.

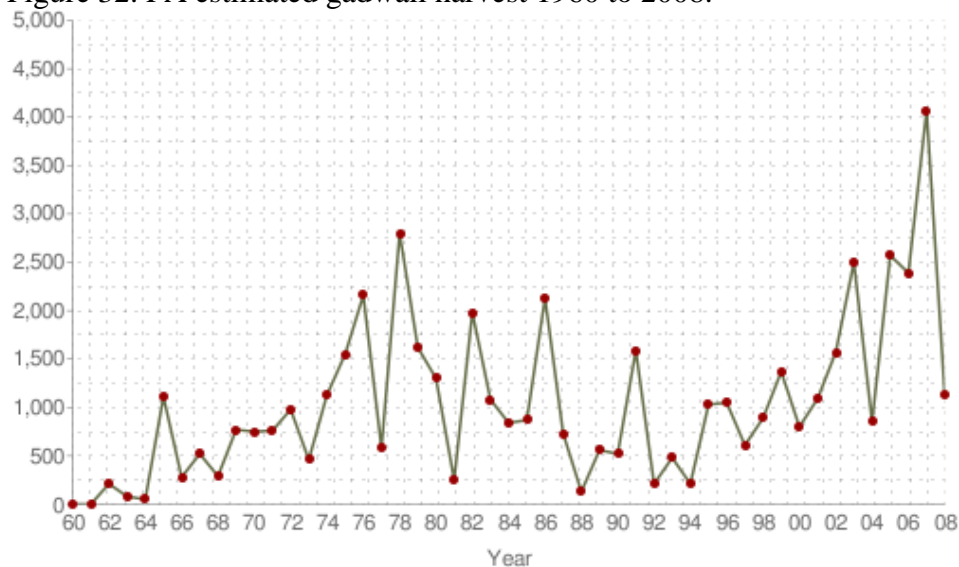


Figure 33. PA estimated American wigeon harvest 1960 to 2008.

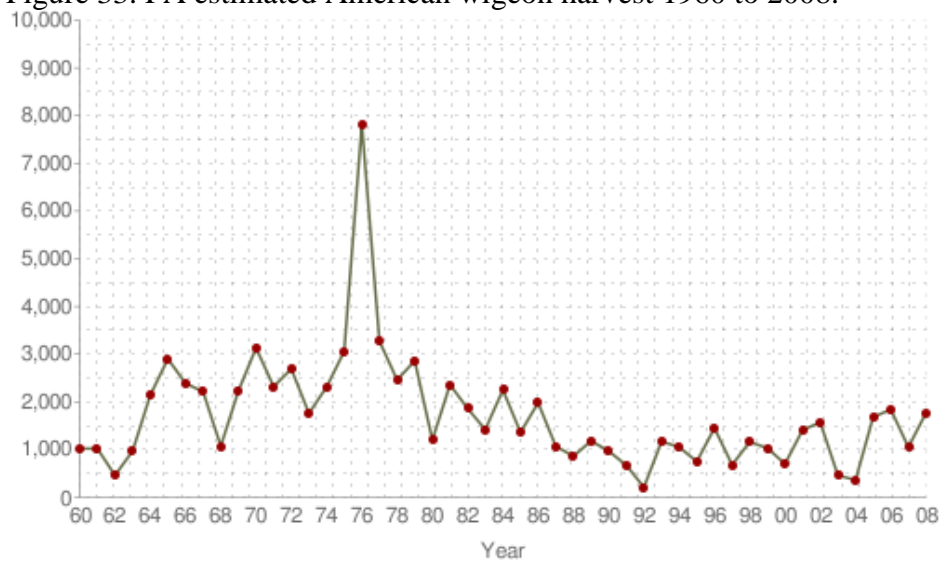


Figure 34. PA estimated common merganser harvest 1960 to 2008.

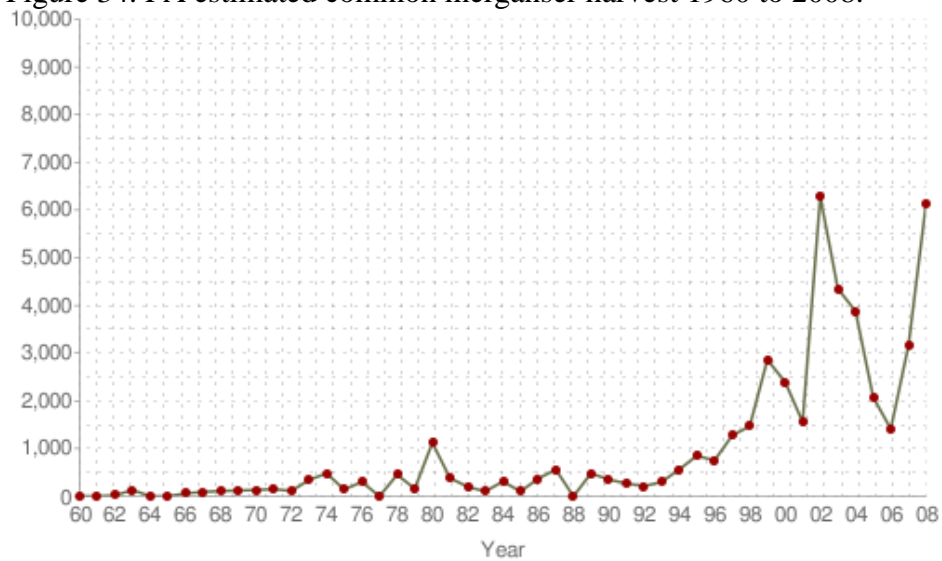


Figure 35 PA estimated hooded merganser harvest 1960 to 2008.

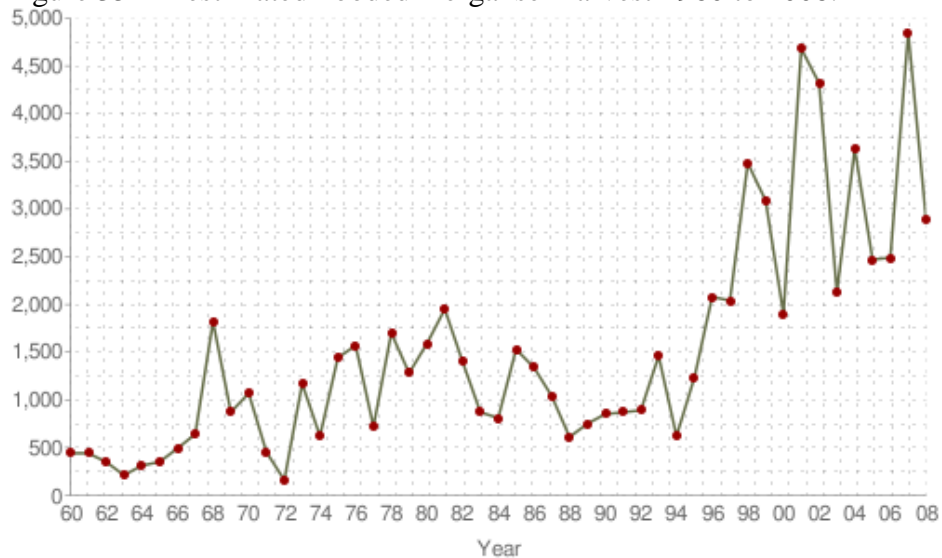


Figure 36. PA estimated Canada goose harvest 1960 to 2008.

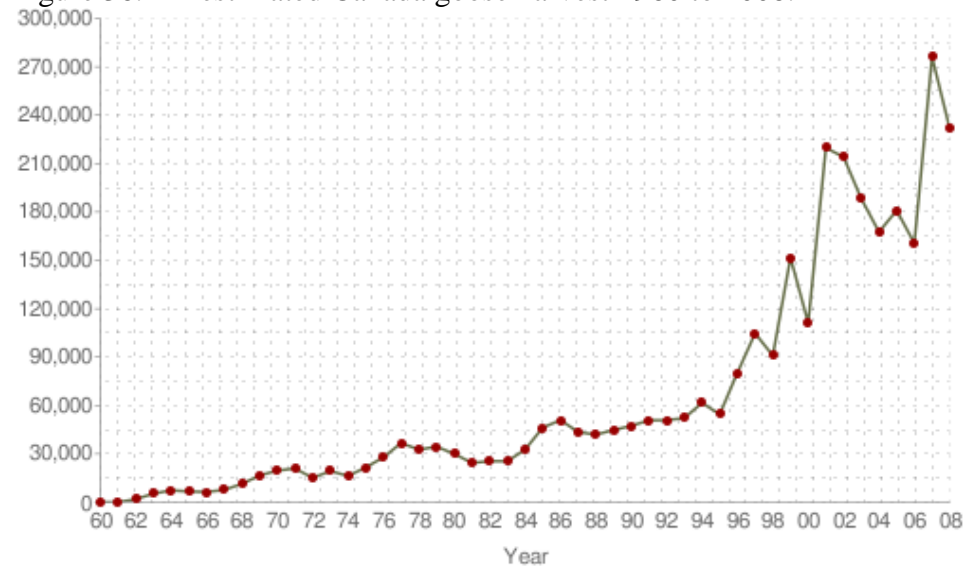


Figure 37. PA estimated greater snow goose harvest 1960 to 2008.

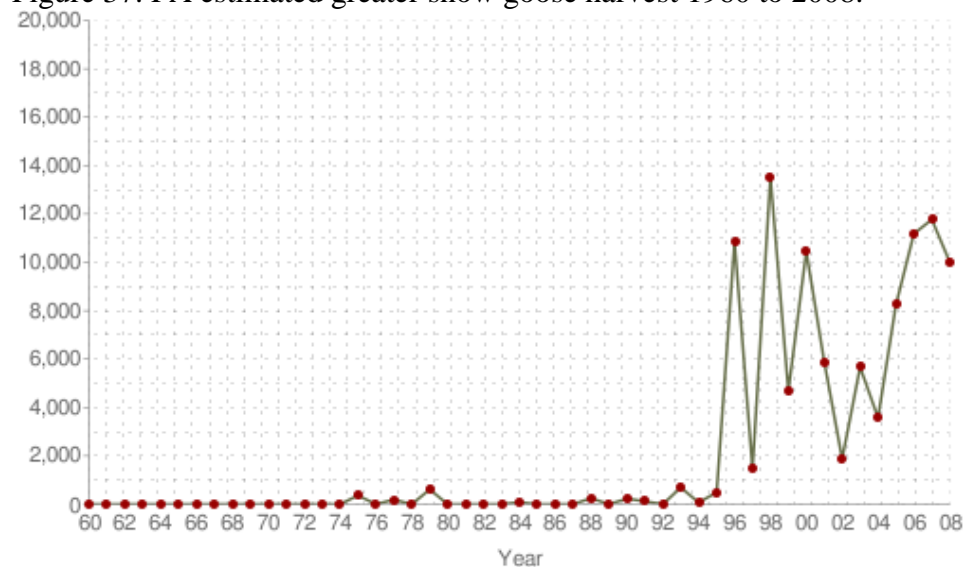


Figure 38. Canada goose harvest rates 1991-2008

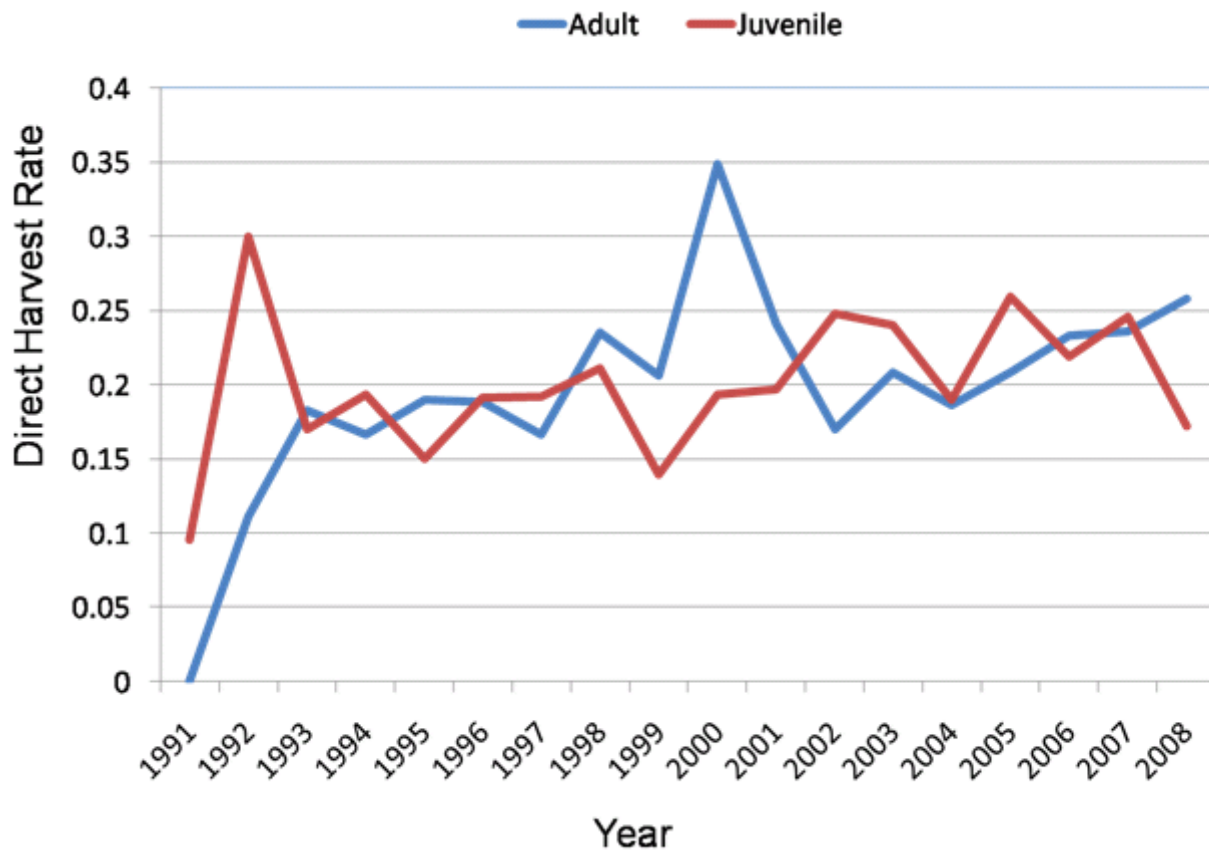


Figure 39. Adult mallard harvest rates 1989-2008

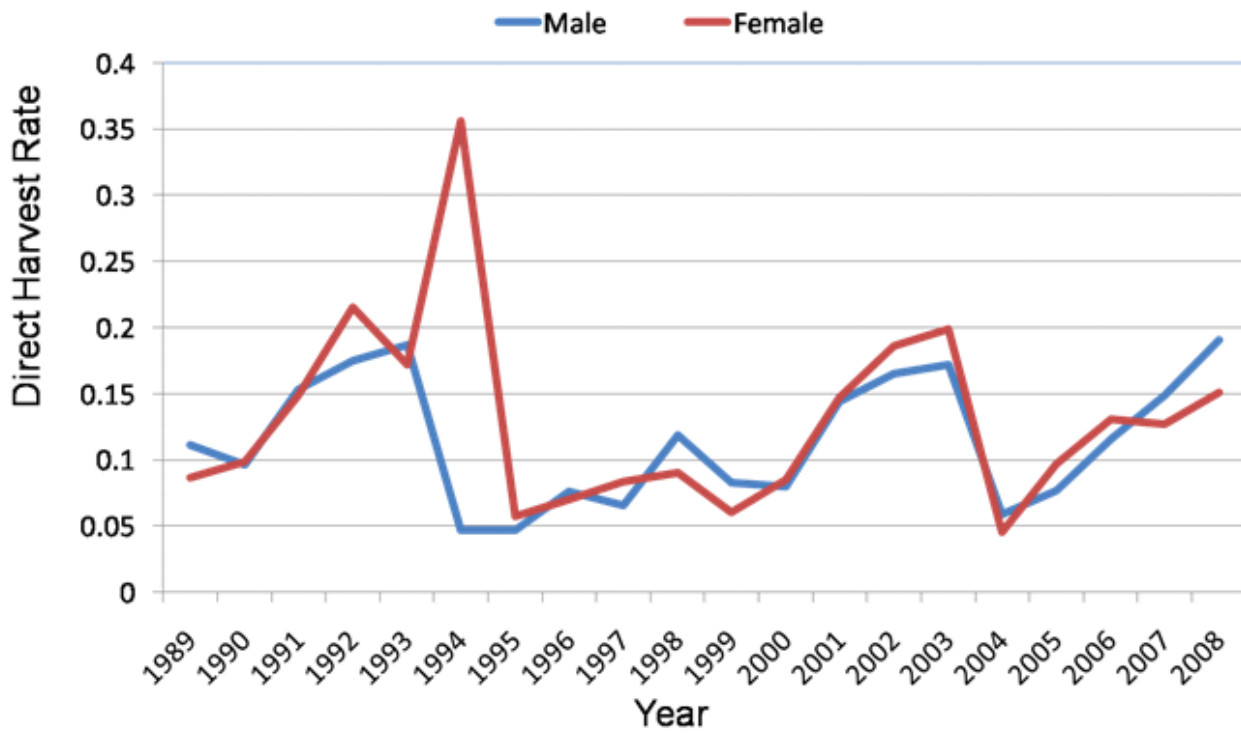


Figure 40. Juvenile mallard harvest rates 1989-2008

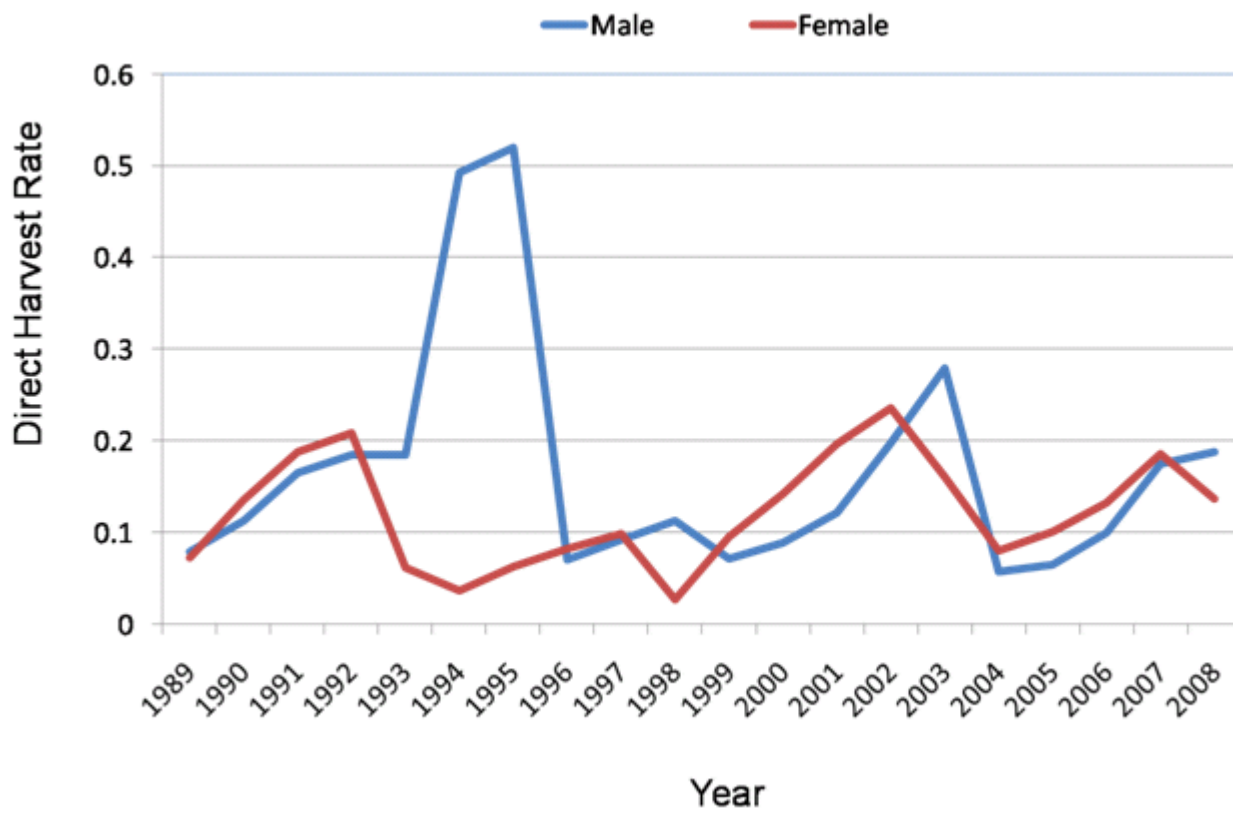


Figure 41. Male mallard harvest rates 1989-2008

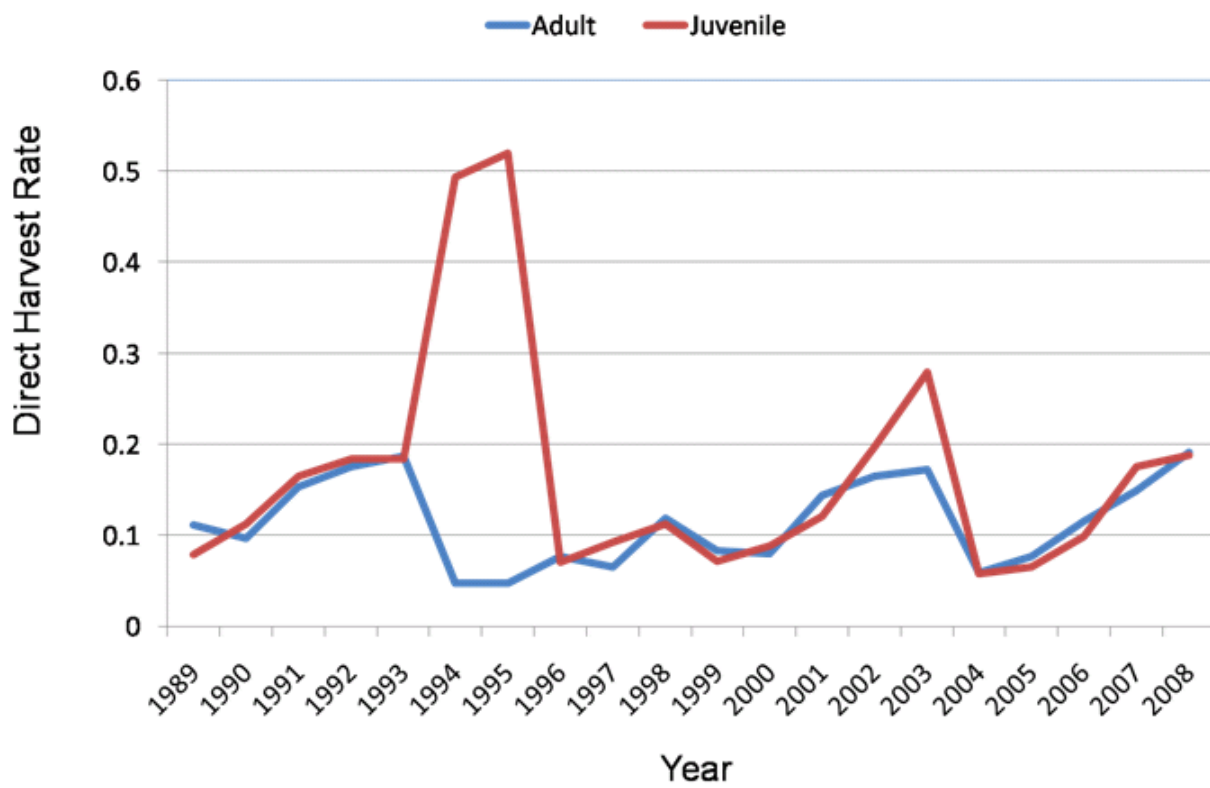


Figure 42. Female mallard harvest rates 1989-2008

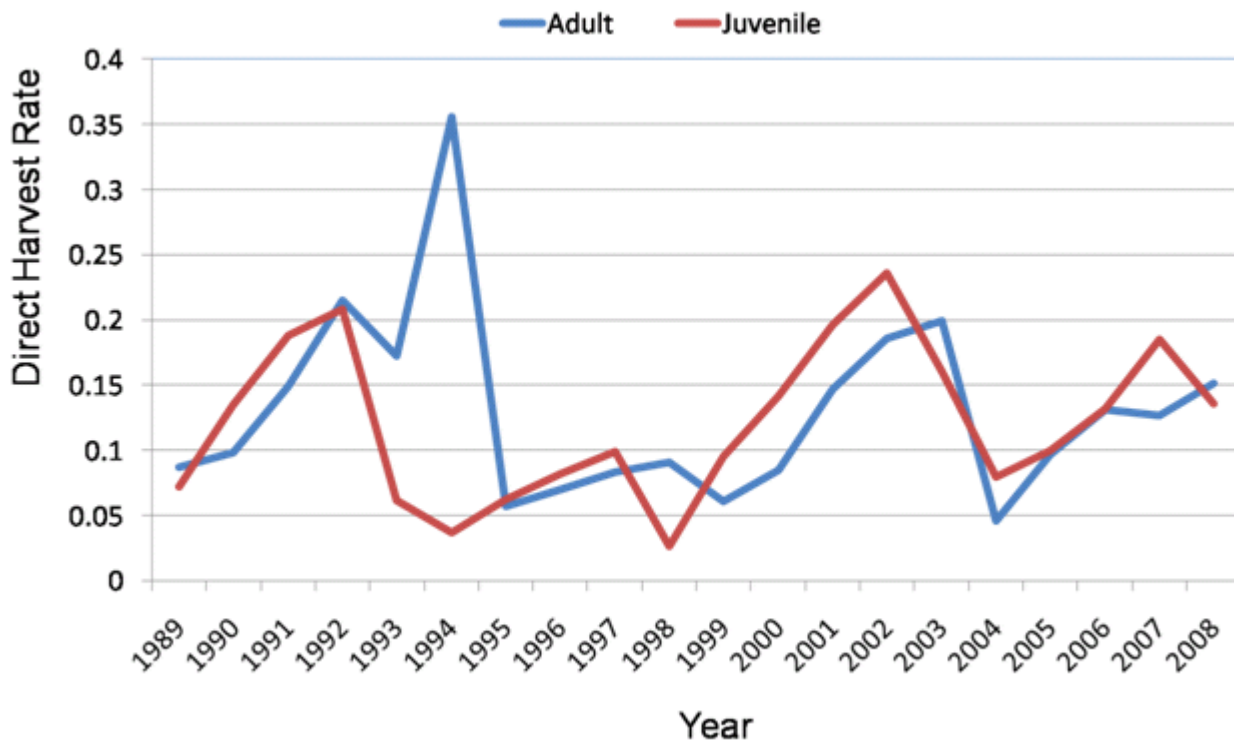


Figure 43. Wood Duck harvest rates 1989-2008

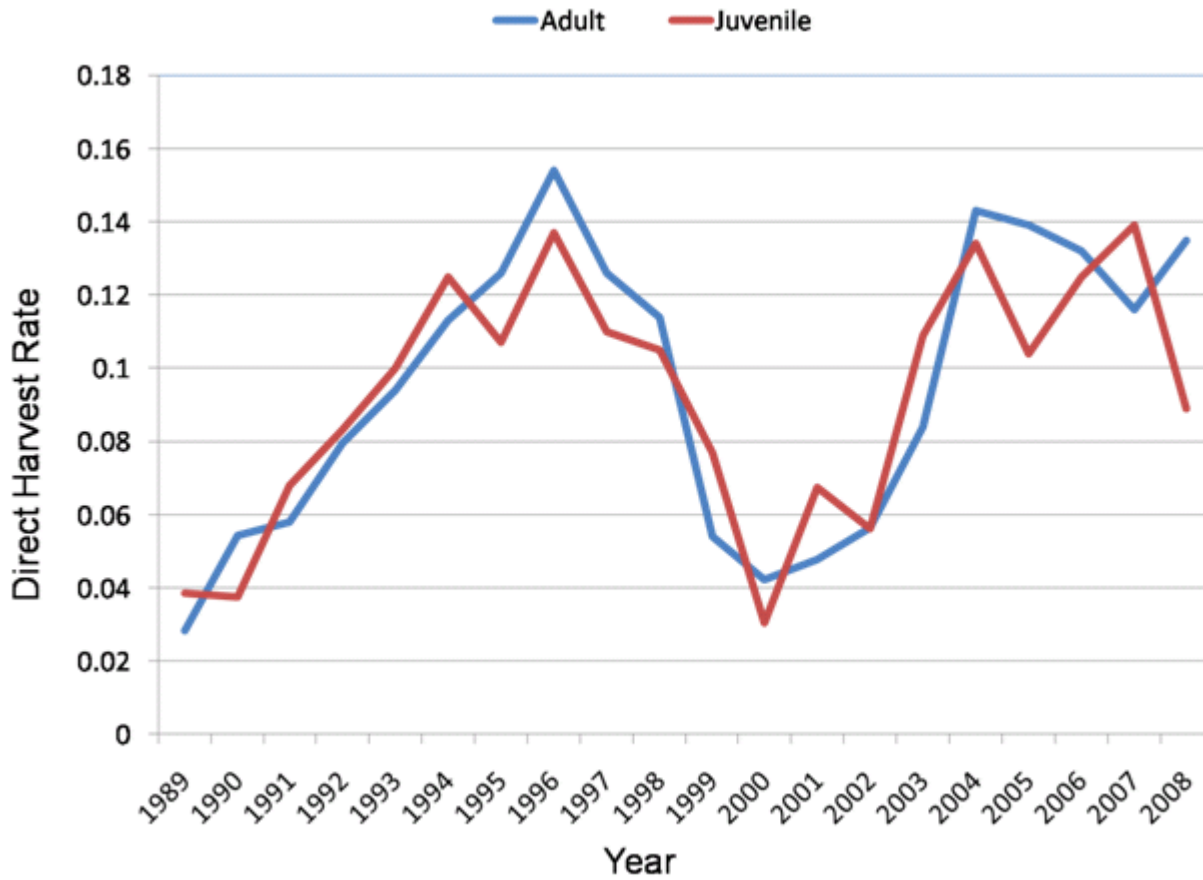


Figure 44. Canada goose annual survival rates 1991-2008

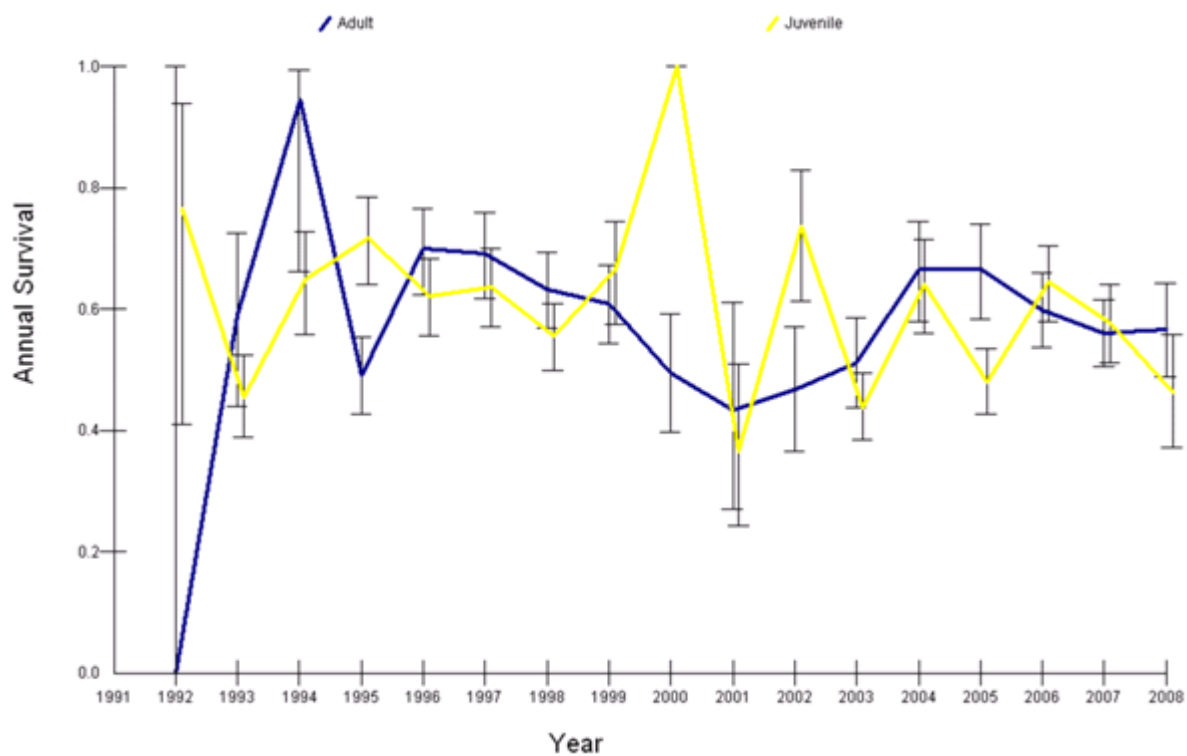


Figure 45. Canada goose recovery rates 1991-2008

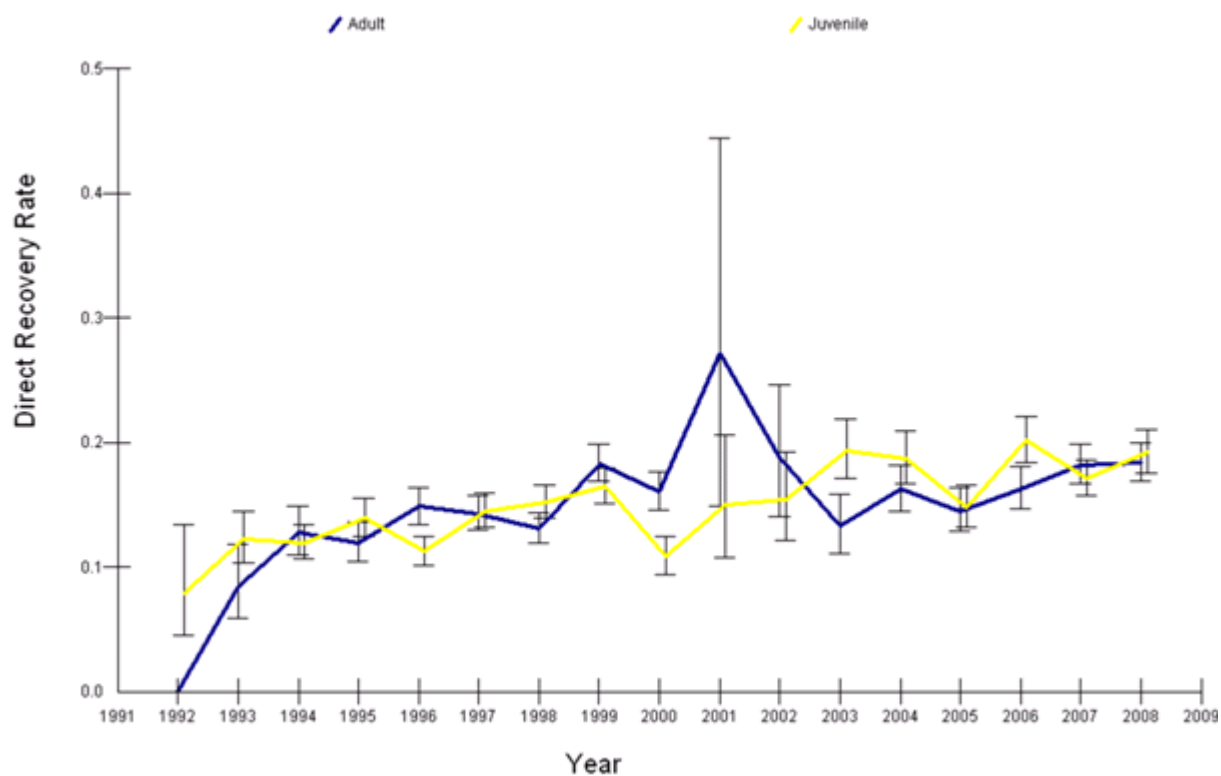


Figure 46. Adult mallard annual survival rates 1989-2008

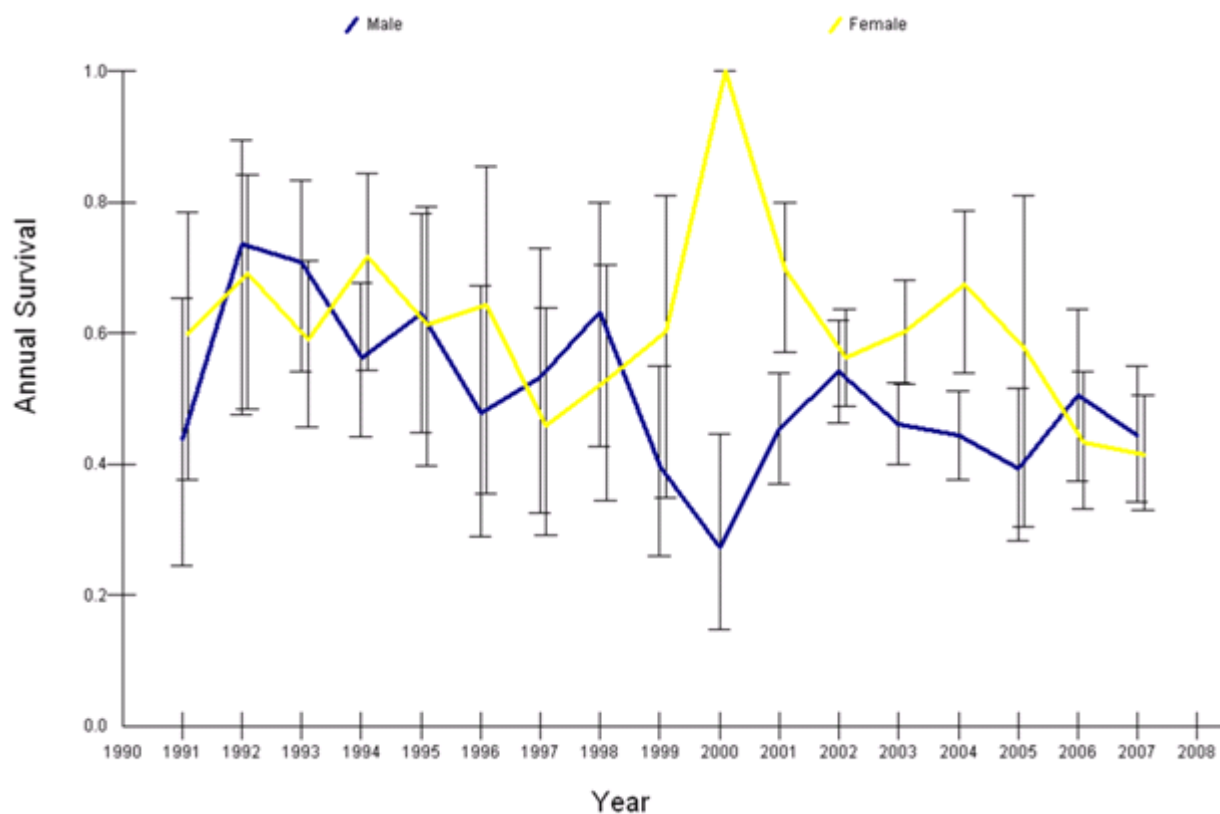


Figure 47. Juvenile mallard annual survival rates 1989-2008

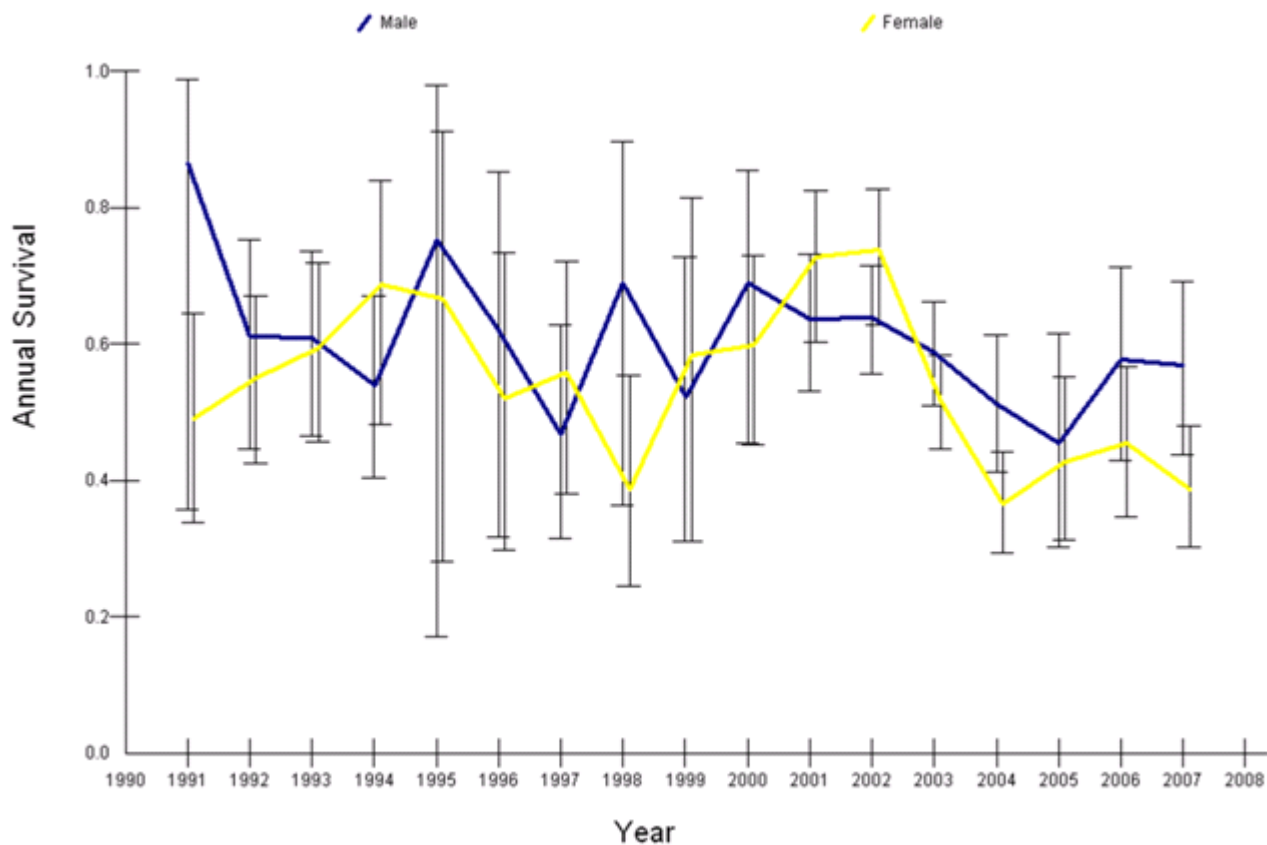


Figure 48. Male mallard survival rates 1989-2008

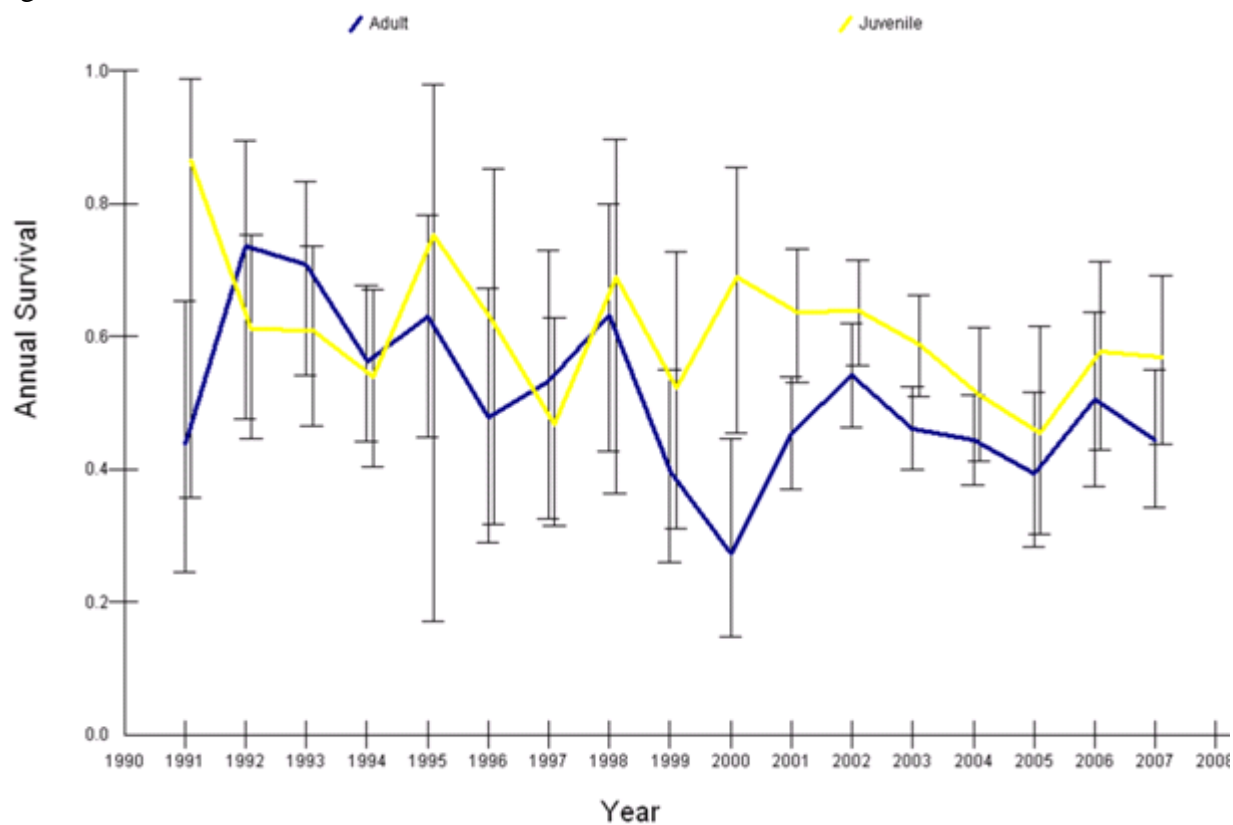


Figure 49. Female mallard annual survival rates 1989-2008

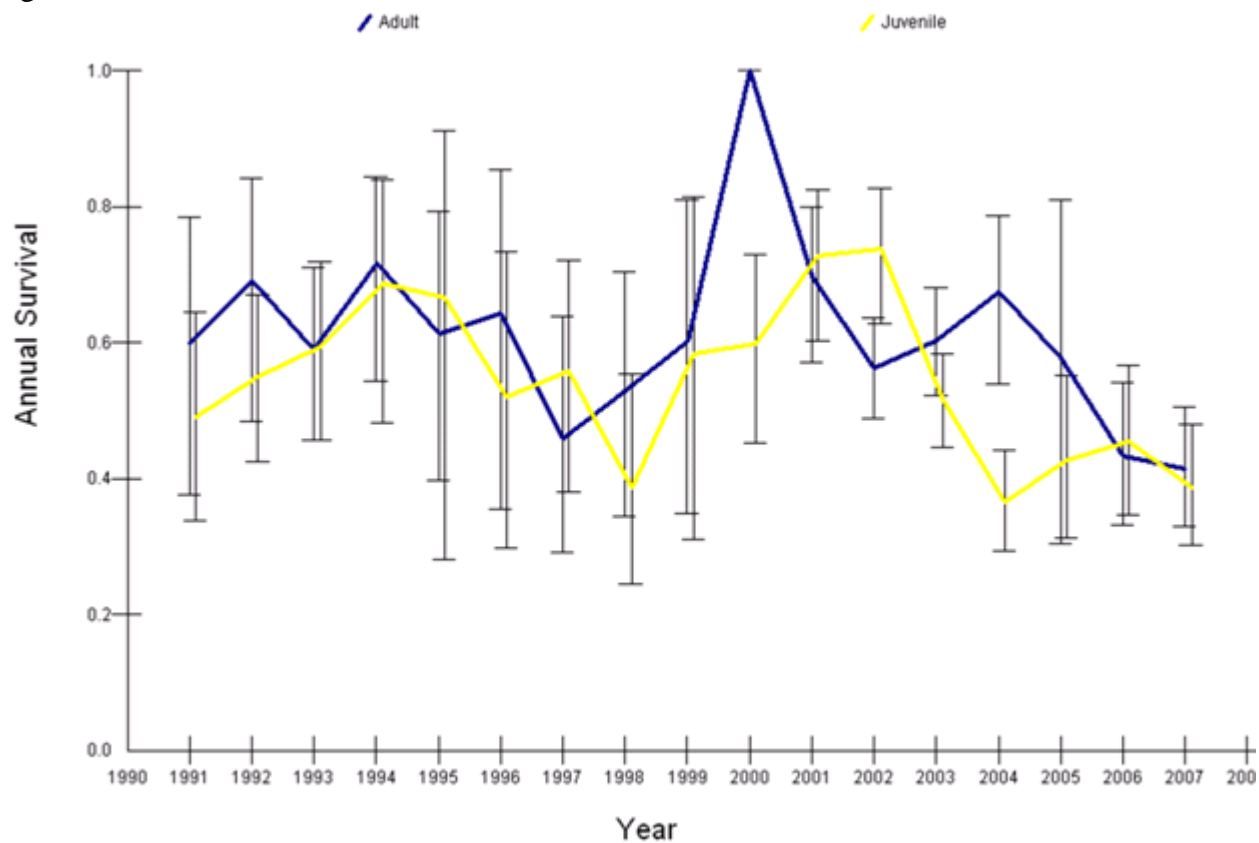


Figure 49. Adult mallard recovery rates 1989-2008

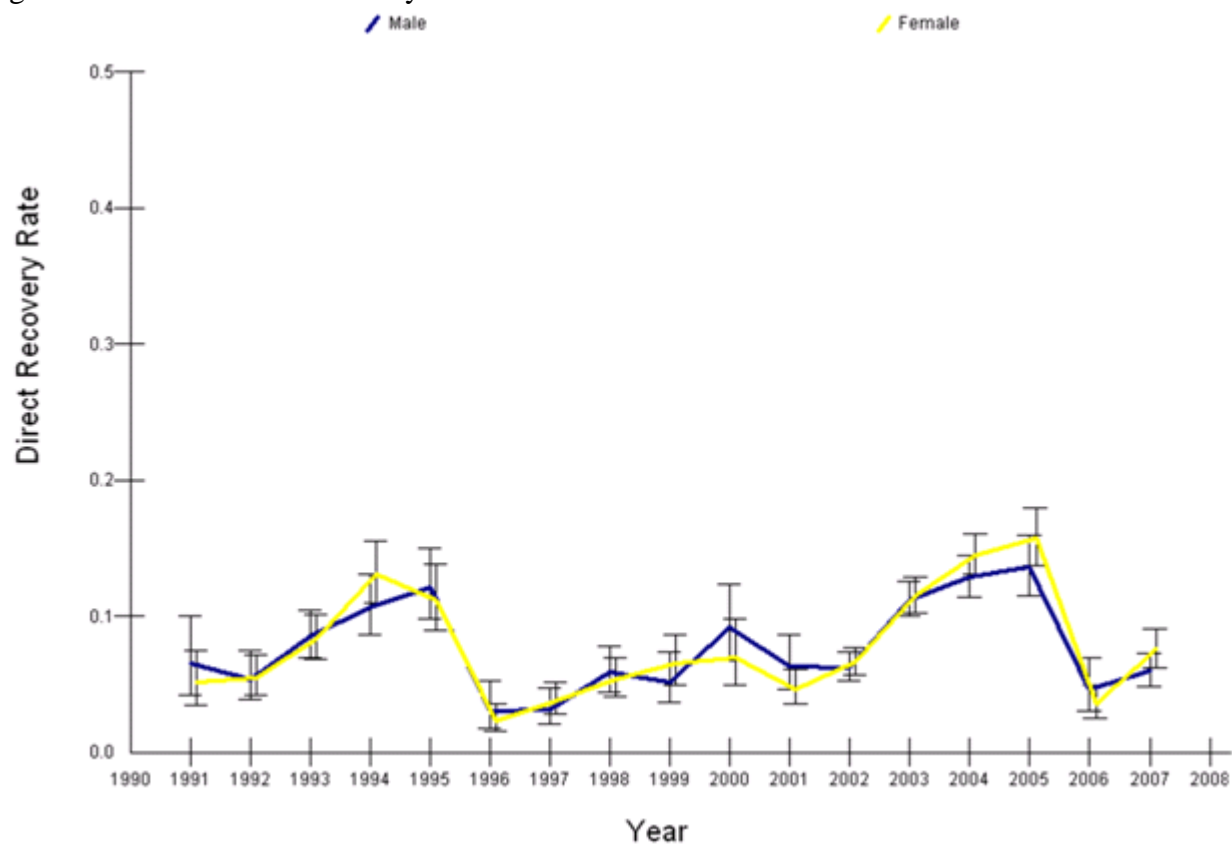


Figure 50. Juvenile mallard recovery rates 1989-2008

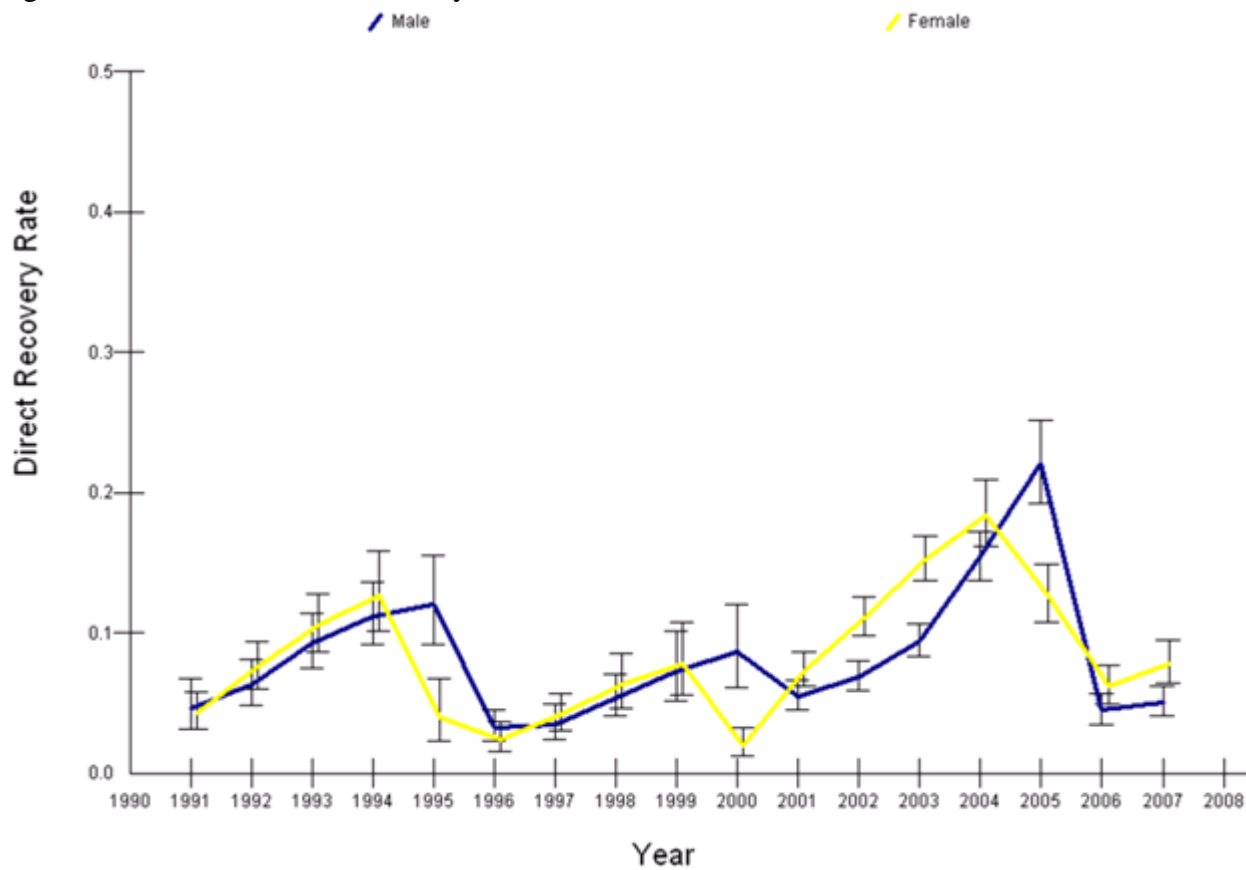


Figure 51. Male mallard recovery rates 1989-2008

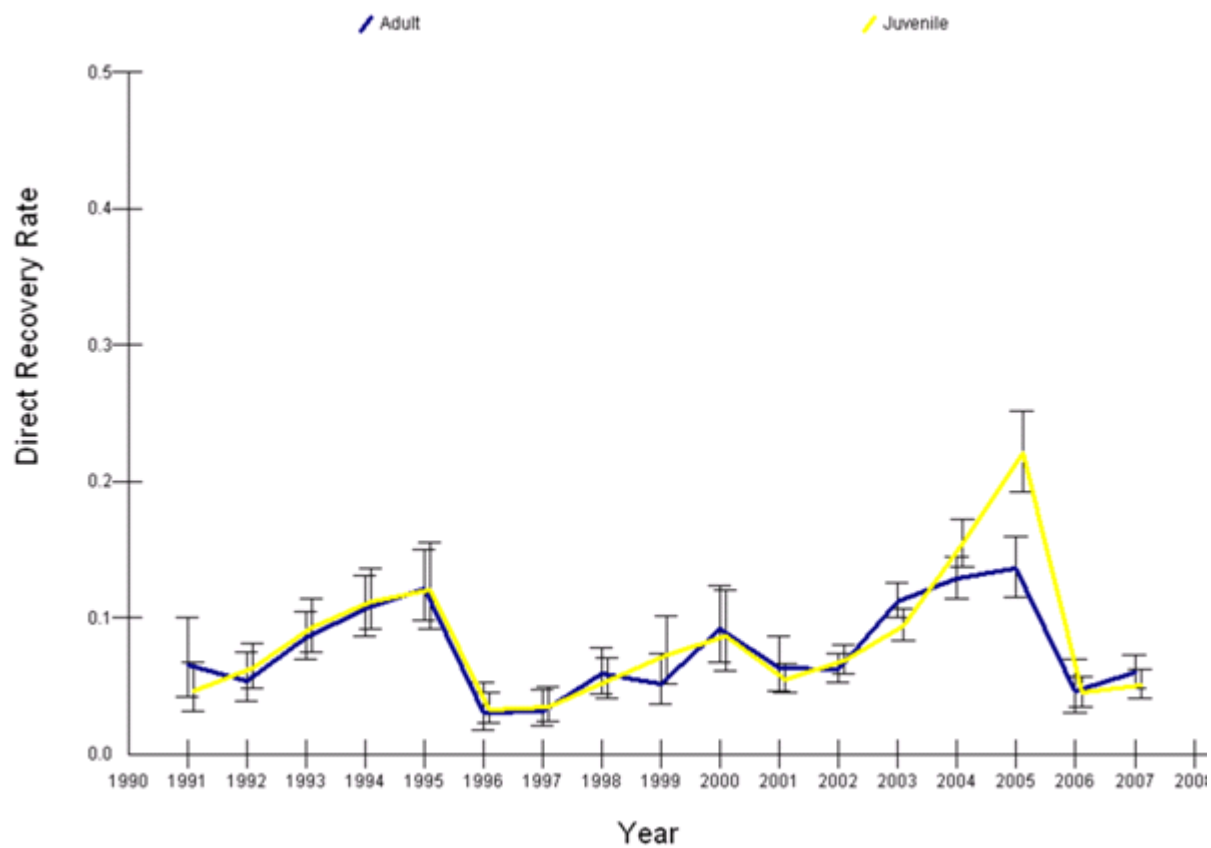


Figure 52. Female mallard recovery rates 1989-2008

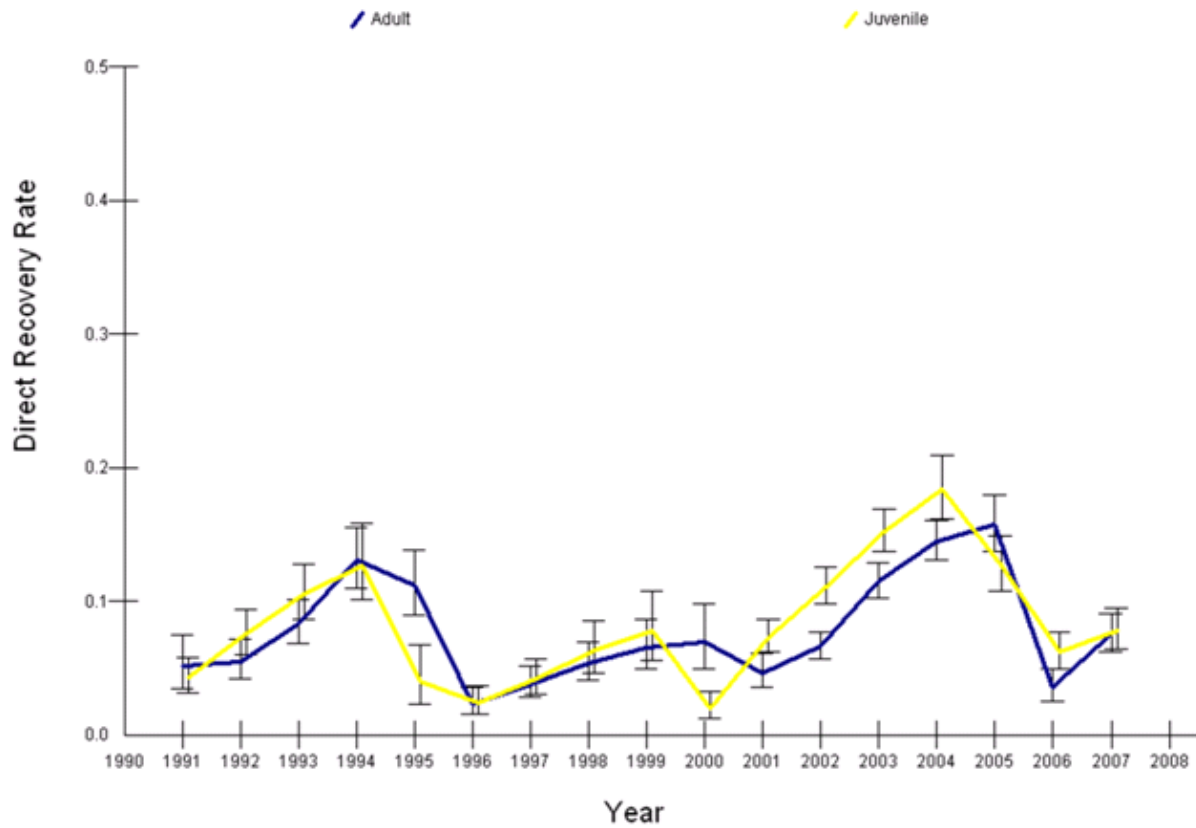


Figure 53. Wood Duck annual survival rates 1989-2008

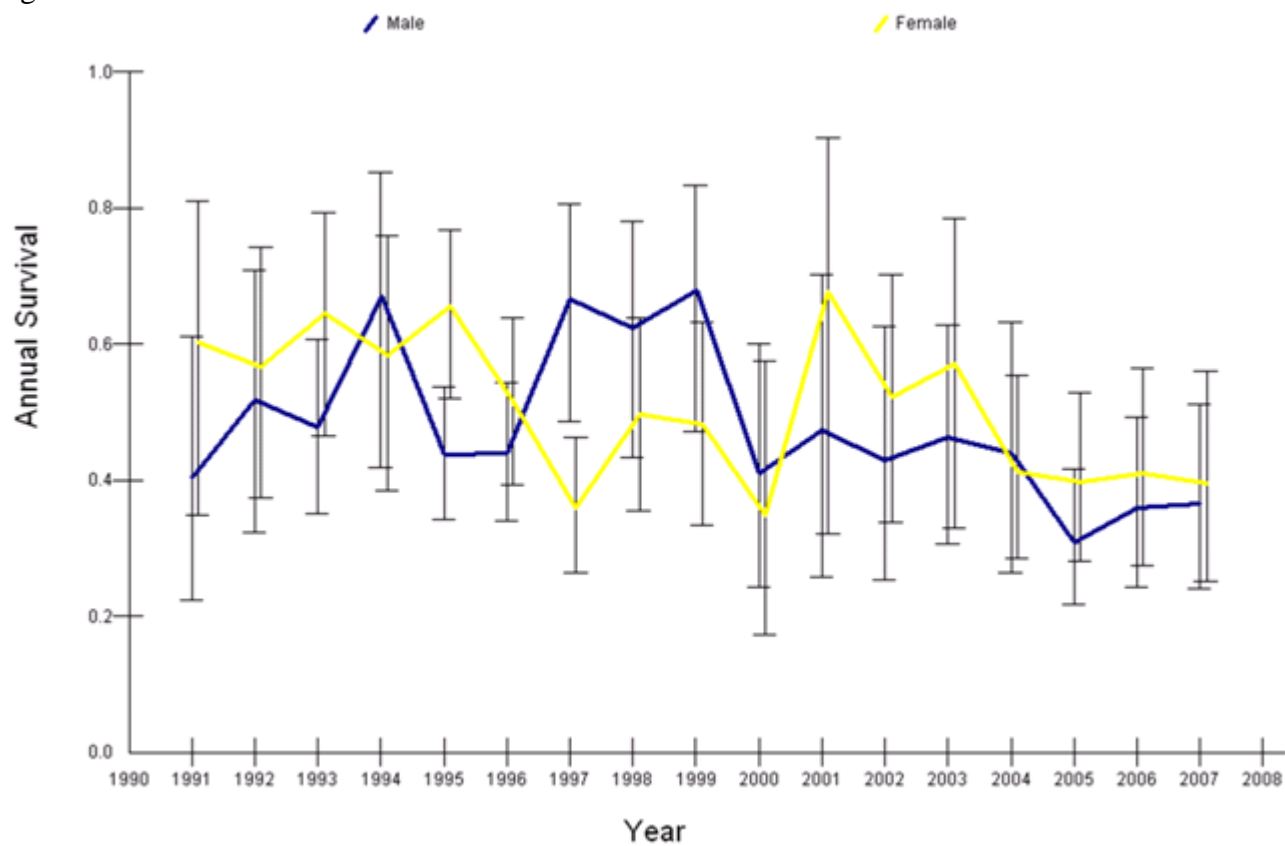


Figure 54. Wood Duck recovery rates 1989-2008

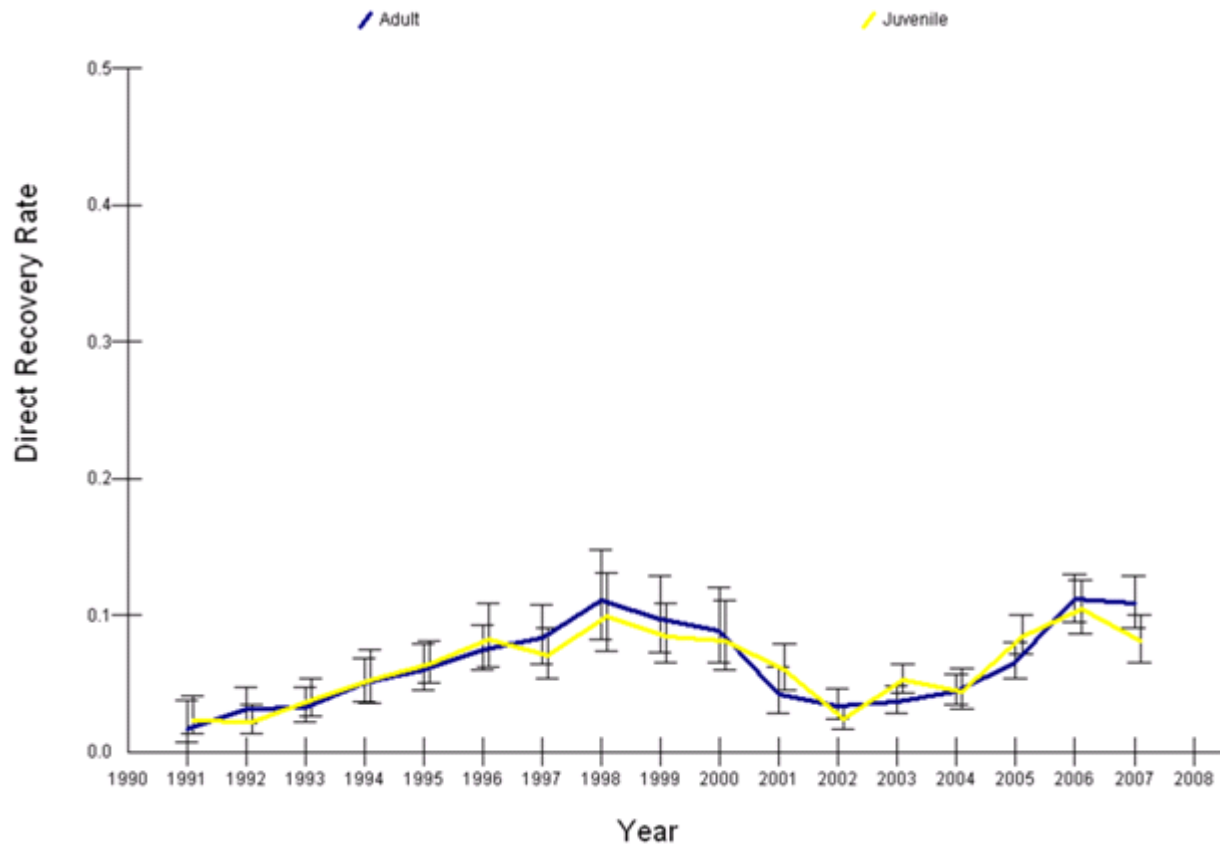


Table 7. Estimates of waterfowl breeding pairs and standard error by physiographic strata in Pennsylvania, 2010.

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

^a 2003 to 2009, 7-year average.

Table 8. Pennsylvania waterfowl population estimates from 2001 to 2010 and the 1993-2009 averages.

Species Estimate	2010	93-09 average	2009	2008	2007	2006	2005	2004	2003	2002	2001
Mallard pairs	78,677	95,462	92,509	65,739	90,237	80,667	95,685	84,806	82,302	84,534	89,030
Mallard total	161,675	196,947	187,697	131,477	181,504	174,374	197,975	177,715	170,067	171,752	189,711
Black duck pairs	269	953	639	269	1,716	-	-	-	622	2,010	2,026
Black duck total	537	1,906	1,278	537	3,433	-	-	-	1,245	4,020	4,052
Wood duck pairs	56,265	51,398	63,118	42,791	56,671	61,014	60,536	47,368	46,855	65,684	56,276
Wood duck total	114,797	109,211	128,060	87,924	127,847	128,009	132,552	94,736	93,711	132,858	116,298
Canada goose pairs	88,845	91,711	88,617	100,174	100,741	88,478	115,291	122,857	101,564	85,192	96,468
Canada goose total	231,780 ^a	280,371 ^b	289,879 ^a	246,499 ^a	255,924 ^a	245,689 ^a	311,171 ^a	338,230 ^a	275,207 ^a	234,754	246,859
Bl-wing teal total	4,186	7,625	7,814	1,840	12,650	1,979	2,746	8,041	1,273	7,842	8,373
Gr-wing teal total	2,063	4,571	5,569	1,979	5,064	7,172	7,089	9,138	5,266	4,131	4,664
Hooded merg. total	2,620	3,586	2,975	3,031	2,972	7,646	9,625	1,272	4,318	4,205	1,417
Common merg. total	14,053	15,038	12,377	18,773	17,429	15,167	12,916	14,671	14,335	14,371	14,020
Mute swan total	2,268	1,314	1,276	3,921	6,064	2,102	2,245	2,528	709	426	354

- No black ducks observed.

^a Total estimate calculated using new formula 2x(pairs + singles) + groups.^b Average from 2003 to 2008 using new formula for total.

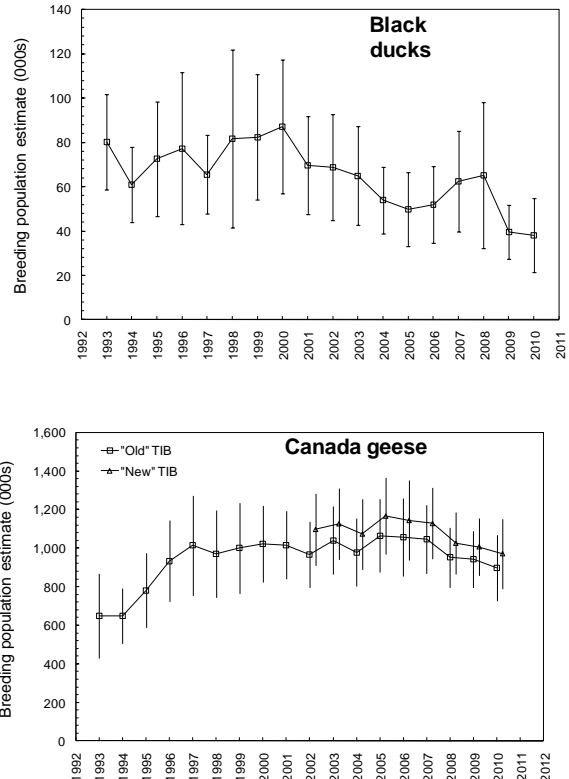
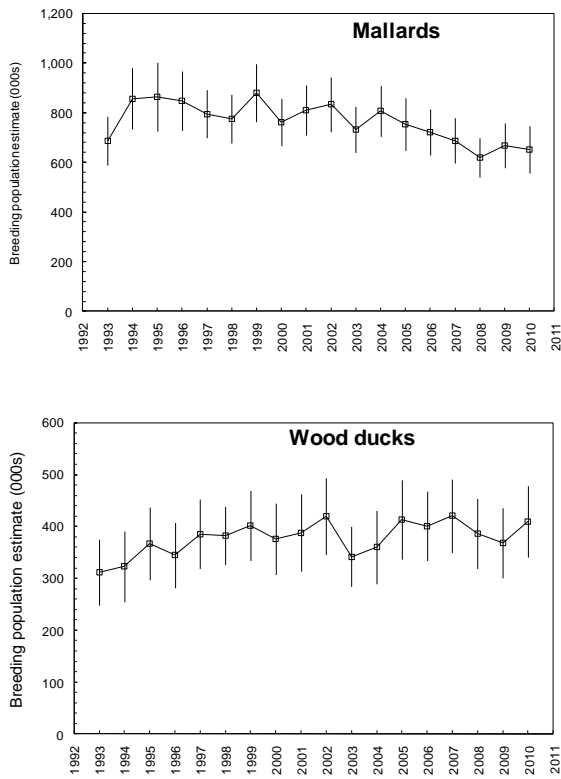


Figure 55. Population estimates and 95 % confidence intervals for mallards, black ducks wood ducks and Canada geese, 1993-2010.

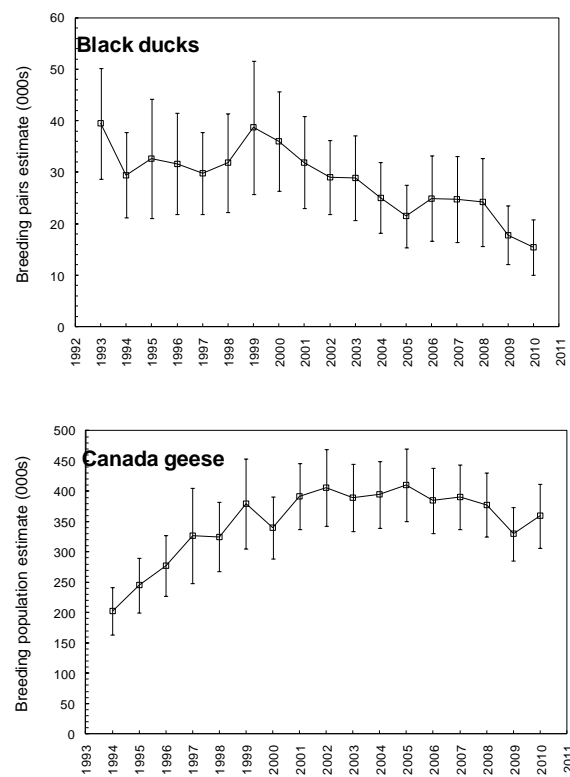
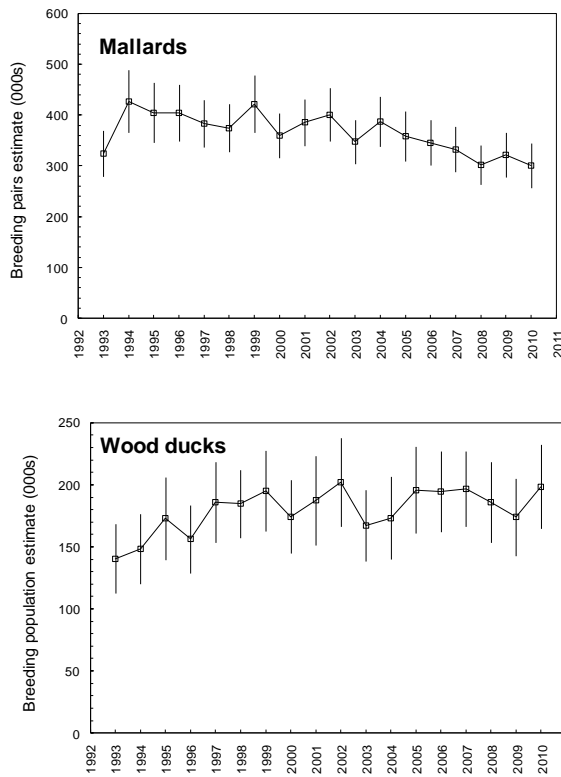


Figure 56. Breeding pair estimates and 95% confidence intervals for black ducks, wood ducks, and Canada geese, 1993-2010.

Pennsylvania Breeding Bird Atlas draft waterfowl species accounts
(note: these accounts are draft form and will be published in 2011)

Mallard, *Anas platyrhynchos*

Kevin Jacobs & Jeremy Stempka

Mallards continue to be Pennsylvania's most widespread, abundant, and economically important duck, a distinction the species has long held in the Commonwealth (Conklin 1938, Hartman 1992, McWilliams and Brauning 2000). Mallards are the most prized duck pursued by waterfowlers in the state with recent annual harvests ranging from 60,000 to over 90,000, easily comprising half or more of the annual state duck harvest (Raftovitch et al. 2009). And breeding mallards in Pennsylvania are very important in supporting these seasons; these birds and their offspring comprise 80% or more of the harvest annually (Sheaffer & Malecki 1996, Jacobs et al. 2009). With these levels of exploitation, it's imperative to maintain robust monitoring programs to ensure mallard conservation.

Nesting typically occurs from March 19 to mid June, with the majority of nest initiation occurring during March 24 to April 7 (Stempka 2009). Mallards prefer to nest in grassland, hayfields, and shrubby vegetation but will also be found nesting in forested and wetland areas (Hoekman et al. 2006). Nests are most commonly constructed on the ground and lined with down after the last egg is laid. Clutch size averages 9.5 olive to light green eggs per nest (range 7-13 eggs) (Hoekman et al. 2004, Stempka 2009) and are incubated by the hen for 28 days (Weller 1956).

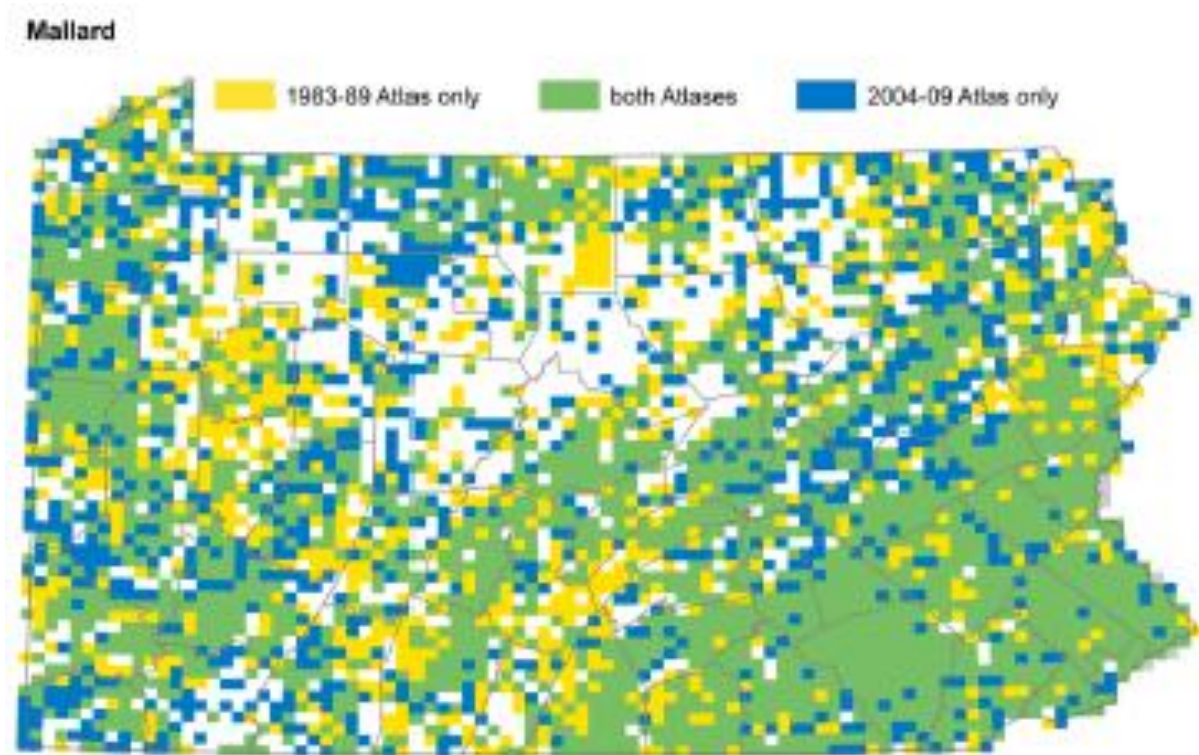
Pennsylvania mallard abundance and distribution appears stable between atlas periods with some exceptions that are noted below. No significant changes in occupied atlas blocks were observed either statewide or by physiographic province for either all blocks or priority blocks between atlas periods. Southeastern Pennsylvania provinces (Piedmont, New England, and Atlantic Coastal Plain) consistently had the highest density of breeding mallards. The provinces had over 89%, 87% and 83% occupied blocks respectively. These were followed by the Ridge and Valley province at 70% overall occupancy; however occupancy rates in the eastern sections of this province was similar to the Southeastern provinces, while the western sections occupancy rates were much lower and similar to the Appalachian Plateau province. Occupancy rates in most sections of the Appalachian Plateau province were only half of that observed in the Southeastern provinces; excepting the glaciated, Pittsburgh and Waynesburg sections.

Some evidence of increased occupancy rates was noted across all blocks of the Northwestern Glaciated Plateau section within the Appalachian Plateau province, and for both all and priority blocks of the Anthracite Upland section within the Ridge and Valley province. A decline in occupancy was noted for all blocks in the Appalachian Mountain section of the Ridge and Valley province.

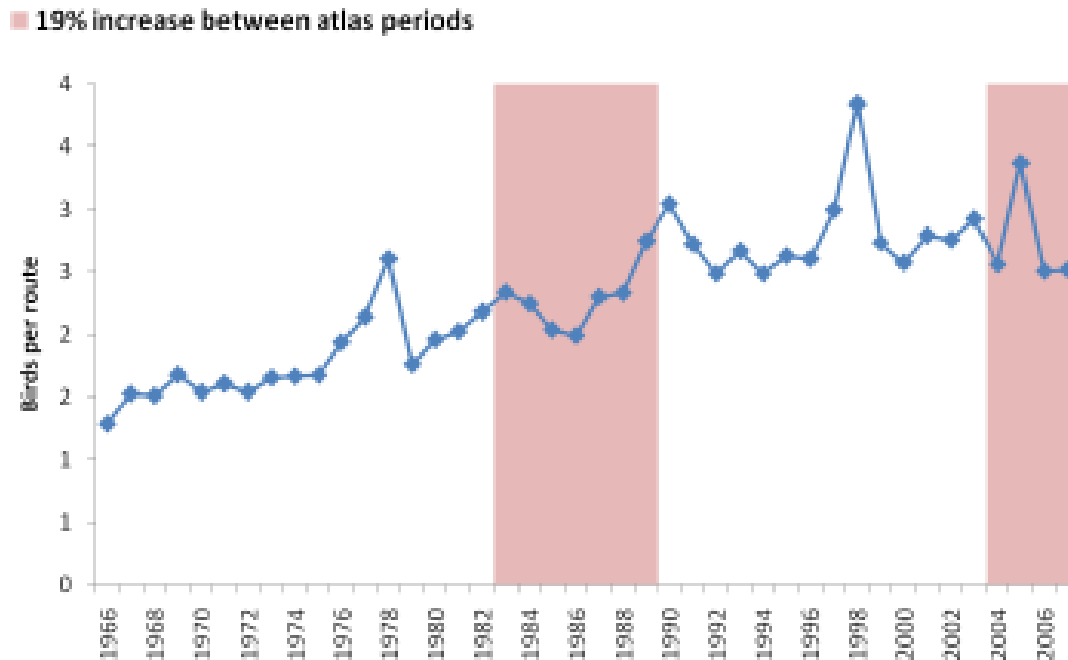
Trends in Pennsylvania mallard abundance from the Breeding Bird Survey (BBS) (Sauer et al. 2007) vary by time period examined. For example, a non-significant increasing trend of 1.87% per year was observed over the 1966 to 2007 BBS survey period. Also, between atlas periods the BBS index rose 19% for mallards. However, the more recent period from 1997 to 2007 indicates a significant ($P = 0.028$) declining population trend of over 7% per year. There have been similar recent declining trends in the number of mallards banded in late summer in Pennsylvania and from the results of the Pennsylvania portion of the Atlantic Flyway breeding waterfowl survey (AFBWS) (Jacobs et al. 2009). Estimated spring mallard breeding population abundance in the state has ranged from a high of nearly 271,000 in 1994 to a low of over 131,000 in 2008. Long-term AFBWS counts were similar to the atlas block occupancy rates; breeding mallard densities are highest in the combined Southeastern provinces (3.01 birds/km²) followed by the combined Pittsburgh/Waynesburg sections (2.89 birds/km²), the glaciated NW (1.64 birds/km²), and glaciated NE (1.57 birds/km²) sections. Over the 17-year survey period mallards were detected in 45%, 43%, 36%, 30%, 28% and 13% of respective 1-km² survey plots

in combined Southeastern provinces, combined Pittsburgh/Waynesburg sections, glaciated NE sections, Ridge and Valley Province, glaciated NW section and remaining non-glaciated Appalachian plateaus. There was evidence of a declining trend in average mallard density between the periods 1993-98, 1999-2004, and 2005-2009 for the Southeastern provinces (-26%), Pittsburgh/Waynesburg (-34%) and NW glaciated sections (-18%), whereas the other provinces and sections appeared stable over the same periods. Habitat change is likely the culprit; these same areas of the state have the greatest losses of agriculture and grassland habitats as well as highest increases in the amount of developed land between atlas periods.

Conservation of this species will be driven by the continuation of landscape level programs included the U.S. Farm Bill such as the Conservation Reserve Enhancement Program, as well as myriad wetlands and associated uplands habitat partnerships among government, NGO's and private landowners across the Commonwealth.



BBS Trend 1966-2007



Wood duck, *Aix sponsa*

Kevin Jacobs

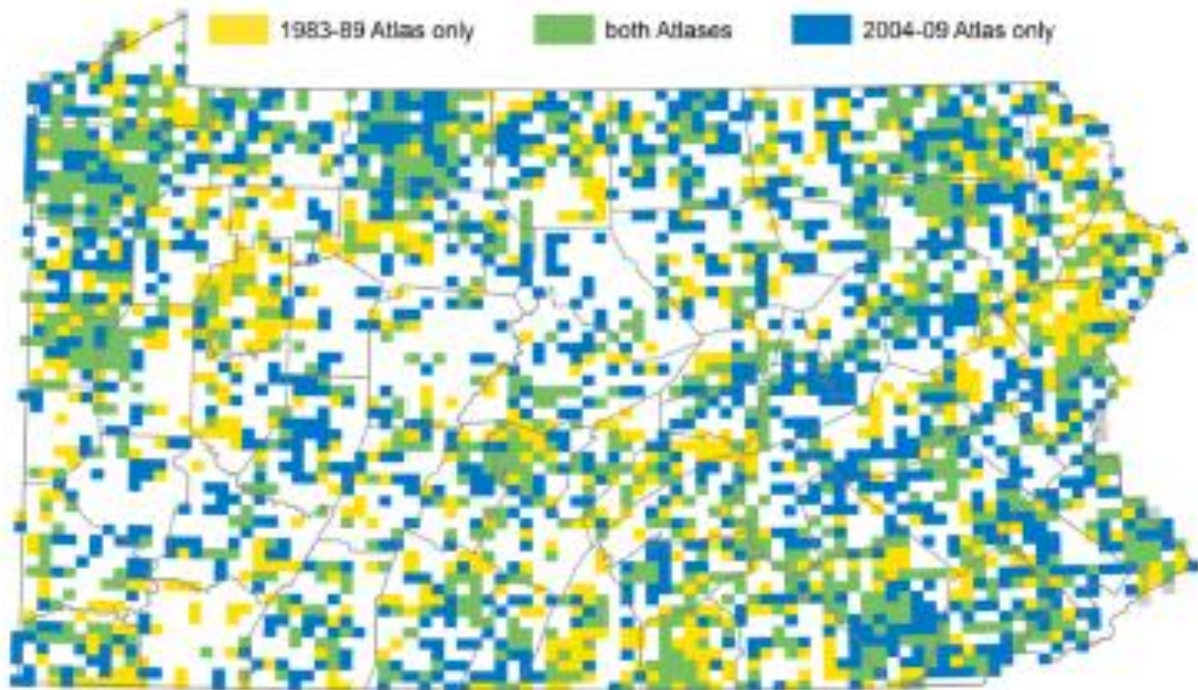
Wood ducks are one of our native forest wildlife species that can instill passion for wild creatures and places by all who cherish Penn's Woods. Extensive writings on wood duck natural history and population recovery can be found in Bellrose and Holm (1994), and specific to Pennsylvania in Hartman (1992) and McWilliams and Brauning (2000). "Woodies" are the second most harvested duck (mallard is first) in the state with recent annual harvests ranging from 20,000 to nearly 40,000 (Raftovitch et al. 2009). Wood ducks comprise nearly 20% of the average annual state duck harvest. Breeding wood ducks and their offspring in the state are very important in supporting these seasons comprise 83% or more of the harvest annually based upon band recoveries (Jacobs et al. 2009). With these levels of exploitation, it's imperative to maintain robust monitoring programs to ensure wood duck conservation.

By most accounts, Wood ducks have experienced significant range expansion in Pennsylvania between the first and second atlas periods being observed in over 26% more total blocks and priority blocks. Wood ducks were observed in over 41% and 47% of all and priority blocks respectively. These significant increasing trends in occupied blocks were observed for the Appalachian Plateau, Piedmont, and Ridge and Valley provinces. Wood ducks were observed in more blocks during the second atlas period in 21 of 23 sections in the commonwealth when comparing all surveyed blocks, and 18 of 23 sections for only priority blocks. No significant declines in block occupancy were observed between atlas periods. For all blocks, wood ducks were most frequently detected in the combined Southeastern provinces (Piedmont - 55.7% & New England 52.2) followed by the Central Lowlands (45.9%), Ridge & Valley (42.6%), Appalachian Plateau (38.1%), and Coastal Plain provinces. The northwestern glaciated plateau section (61.6%), Piedmont lowland section (60.9%) and Blue Mountain section (57.8%) had the highest block occupancy rates in the state. No between periods change in the latitude of occupied blocks were noted. Dates of nests with eggs varied from March 7 to July 13, while broods were observed from April 21 to August 5.

Significant ($P = 0.043$) population growth is documented in the BBS with 10.2% annual growth from 1966 to 2007. Between atlas periods, woodies abundance increased by 207% as measured by the BBS. However, this index should be used with caution as they are detected at low frequencies due to their secretive nature and habitat preferences. Bellrose and Holm (1994) estimated the Pennsylvania breeding population of nearly 35,000 between 1961 and 1970, and 45,000 ($0.38/\text{km}^2$) between 1981 and 1985 using band recovery and kill statistics. The Atlantic Flyway breeding waterfowl survey (AFBWS) initiated in 1989 (Huesman and Sauer 2000) was a major step forward with estimating annual wood duck populations. Estimated spring woodie breeding population abundance in the state has ranged from a low of nearly 81,500 in 1993 to a high of nearly 133,000 in 2002. Estimates have ranged between 112,000 and 133,000 in 9 of the 13 years between 1997 and 2009 (Jacobs et al. 2009). Average breeding population densities ranged from 1.73 birds/ km^2 in the glaciated NW section, 1.57 birds/ km^2 in glaciated NE sections, 1.19 birds/ km^2 in the combined Pittsburgh/Waynesburg sections, 1.01 birds/ km^2 in the combined Southeastern provinces, 0.71 birds/ km^2 in the Ridge and Valley province and 0.57 in the non-glaciated Appalachian plateaus province. There was evidence of a declining trend in average wood duck density between the periods 1993-98, 1999-2004, and 2005-2009 for the Southeastern provinces (-44%). The breeding population densities in the combined Pittsburgh/Waynesburg sections and Ridge and Valley province increased 60% and 229% respectively. The remaining sections of the Appalachian Plateaus indicate stable trends in breeding population density. Over the 17-year survey period wood ducks were detected in 32%, 31%, 25%, 21%, 14% and 10% of respective plots in glaciated NE sections, glaciated NW section, combined Pittsburgh/Waynesburg sections, combined Southeastern provinces, Ridge and Valley province, and the non-glaciated Appalachian Plateaus province.

Important considerations for available wood duck breeding habitat in Pennsylvania are the proportion of mature trees that can host natural cavities and available wetland habitats. Statistically significant increases in large class trees ($\geq 11''$ dbh) have occurred statewide between 1989 and 2004 (McWilliam et al. 2007). Since the 1955 inventory, large stands have increased by 33 percent. From 1989 to 2004, increases in the 16-inch and larger classes exceeded 20 percent. However, forest cover declined notably between survey periods in the Southeastern provinces. A beneficial critter for woodies on Penn's Woods landscape is the beaver (*Castor canadensis*). Current status of beaver populations appears strong, with 76% of Pennsylvania Game Commission Wildlife Conservation Officer (WCO) districts reporting increasing or stable populations (Lovallo and Hardisky 2009). WCOs observed decreases in established populations within 9% of districts. Non-established populations comprised 14% of WCO districts, mainly in the Southeastern provinces. Continued conservation of this species along with proper forestry management and wetlands protections will ensure woodies maintain or improve their abundant population status.

Wood Duck

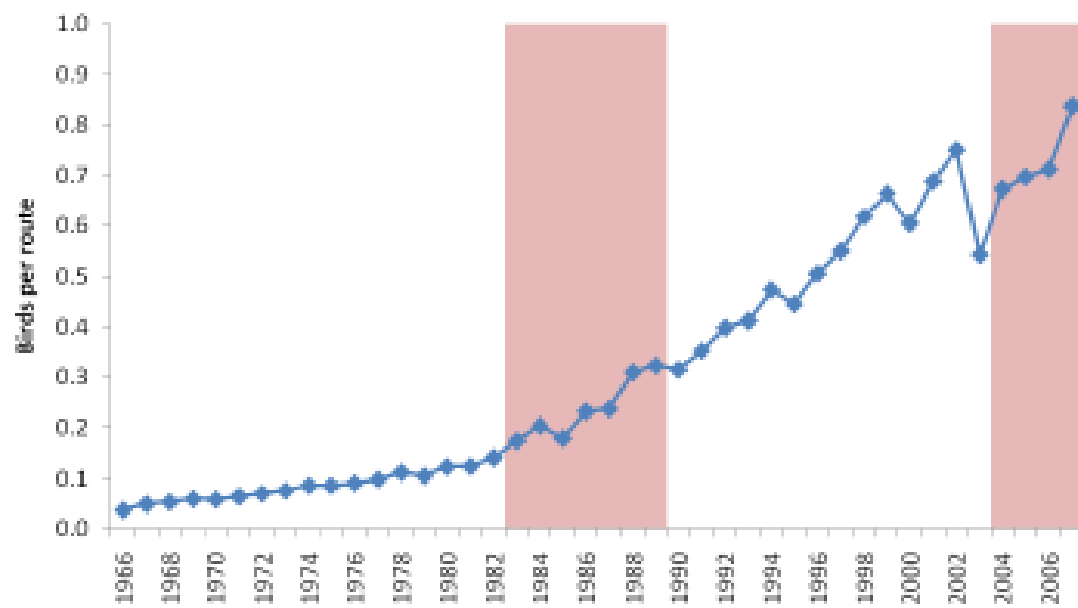


2nd PBBA Data summary for Wood Duck

BBS trend 1966-2007

Caution - small sample sizes

■ 207% increase between atlas periods



American Black Duck, *Anas rubripes*

John P. Dunn

The American Black Duck, as its name implies, has a dark plumage, and the sexes are similar in appearance. Unlike other male dabbling duck species, the male black duck does not exhibit a colorful alternate plumage. Similar in size and appearance to the female Mallard (*Anas platyrhynchos*), Black Ducks often are found together with mallards in similar breeding habitat, and the two species will frequently hybridize (Longcore 2000).

The American Black Duck is found primarily east of the Mississippi River, breeding from eastern Manitoba to the Canadian Maritimes and southward through the Mid-Atlantic States to coastal North Carolina (Longcore 2000). Historically, it was more or less confined to forested and shrub-scrub wetlands and was, therefore, mostly isolated from mallards. Black ducks once rivaled the Mallard in abundance in parts of Pennsylvania (Todd 1940, Grimm 1952). In fact, numbers of resident black ducks banded at Pymatuning in the late 1930's exceeded mallards by more than two to one (Warren 1950).

McWilliams and Brauning (2000) considered breeding American Black Ducks to be widely distributed, but locally uncommon breeding birds in Pennsylvania, concentrated mostly in the Pocono region. This is because the first Atlas revealed that black ducks occurred in only 6% of the blocks statewide, with the highest number in the Glaciated Pocono Plateau section (39% of blocks there). By the second Atlas the black duck had decreased in statewide occurrence by 62%, being found in only 111 blocks compared to 270 during the first Atlas. This was a highly significant decrease, and the number of blocks with confirmed breeding had also decreased from 99 to 35 (down 65%). Declines of similar magnitude were observed during the recent second atlas efforts conducted in New York state (McGowan and Corwin 2008) and Ontario (Cadman 2007).

The distribution of black ducks has only 27 blocks in common between the first and second atlas, which means that black ducks were not observed in 90% of the blocks where they were found in the first atlas. Overall, the breeding range of the species in Pennsylvania has shown a significant northward contraction of >50 km.

All of the physiographic provinces where black ducks were observed in the first Atlas exhibited significant declines in the second atlas. But, perhaps of greatest concern is that in the former stronghold of the black duck in the Pocono region, the number of occupied blocks declined by 68%. Simply put, the black duck is becoming a very uncommon and widely scattered breeding species in the state, with the only remaining concentrations occurring primarily in the glaciated sections of the Appalachian Plateau and northern portion of the Ridge and Valley.

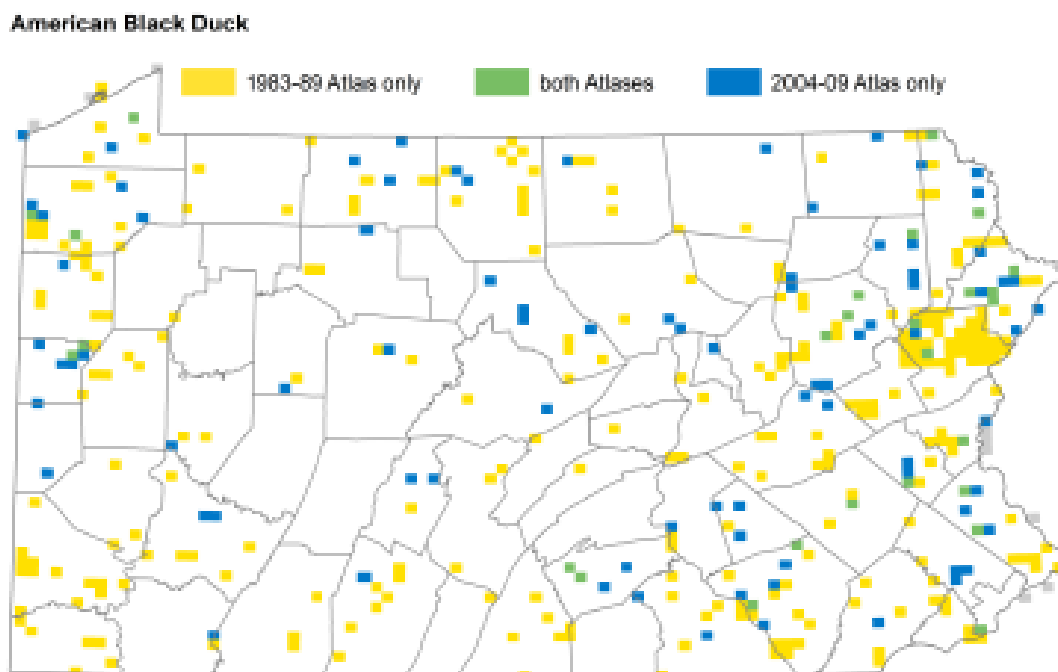
Loss and degradation of emergent and shrub-scrub wetlands statewide, and high losses in the Pocono region where black duck nesting densities are highest, have been especially detrimental (Tautin 2005). Expansion of Mallard populations into former black duck habitat, with resulting competition and hybridization (Merendino et al. 1993, Kirby et al. 2004, Mank et al. 2004), may also be responsible for limiting black duck populations in otherwise suitable habitat.

BBS data show no significant trends in Pennsylvania or across its breeding range over the 1980-2007 period (Sauer et al. 2008). Pennsylvania's breeding black duck population was estimated at about 300 breeding pairs over the 1993 -2009 period, about 1 black duck pair for every 20 Mallard pairs (Jacobs et al. 2009). However, both the BBS and PGC waterfowl surveys record too few Black Ducks to draw meaningful conclusions about breeding population trends.

The decline of breeding black ducks in Pennsylvania coincided with a long-term decline in winter counts in the Atlantic Flyway as measured by the Mid-Winter Waterfowl Survey. The MWS has declined about 50% from an average of 400,000 in the late 1950's to about 204,000 during 2006-2009 (Klimstra 2009). Winter counts of

black ducks in Pennsylvania during the years 2006-09 averaged 1,432 birds, only 10% of the 1955-1960 average of 13,555 (Klimstra 2009). Paralleling the northward shift in breeding range in Pennsylvania, there is some evidence for a northward shift in the winter range of black ducks, which may bias traditional winter count data (Atlantic Flyway Council 2006).

The declining status of the Black Duck has received much attention from agencies and non-governmental organizations concerned about its conservation status (Tautin In press). The PGC lists the black duck as a species of conservation concern and the U.S. Fish and Wildlife Service formally lists it as a “Game Bird Below Desired Condition.” Numerous conservation plans address Black Duck conservation on both breeding and wintering areas. It remains uncertain whether or not these conservation actions, if implemented, can ensure that the American Black Duck remains as a viable breeding species in Pennsylvania.



Canada goose, *Branta Canadensis*

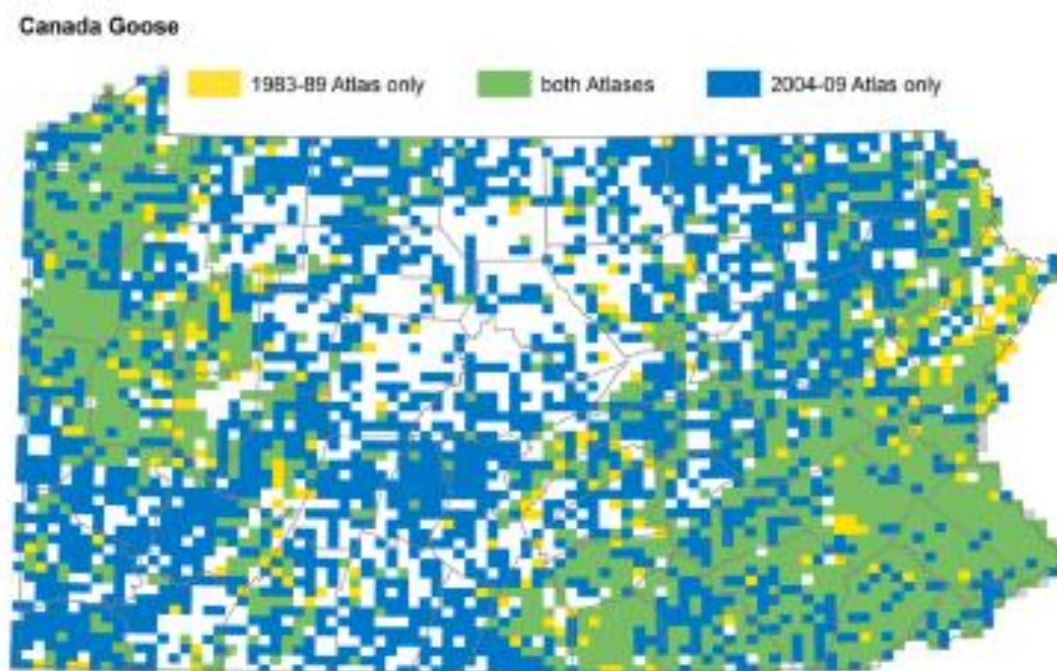
John P. Dunn

The Canada goose is one of the best known and widely distributed waterfowl of North America and the sight of the familiar V formations overhead have long been associated with the return of spring and the arrival of autumn. Due to introduction efforts and translocations the Canada goose is now found through out North America, breeding in every state and Canadian province on the continent. (Mowbray et al. 2002) Resident or temperate nesting Canada geese are defined as geese that were hatched or nest in any state, or in Canada at or below 48 degrees N latitude, excluding Newfoundland. As their name implies, resident geese spend most of the year near their breeding areas, although many in northern latitudes do migrate. Historically the Canada goose did not breed in Pennsylvania, but by the 1980's were breeding in every county. The present day population was introduced and established during the early 20th century, and is comprised of various subspecies or races of Canada geese, including *B. c. maxima*, *B. c. moffitti*, *B. c. interior*, *B. c. canadensis*, and possibly other subspecies, reflecting their diverse origins (Dill 1970, Pottie and Heusmann 1979, Dunn 1992). Beginning in the 1970s the PGC began translocation efforts in and out of state to deal with nuisance and crop damage problems, but these efforts were terminated in 1995 due to their high cost and ineffectiveness.

Preferred habitat for Canada geese is best characterized as areas with water (lakes, streams, ponds) that provide refuge and roosting areas adjacent to farmland or grazing areas, particularly lawns, golf courses and parks. Suburban/urban landscapes with water provide preferred habitat due to abundance of lush lawns for grazing. Since resident Canada geese live in temperate climates with stable breeding habitat conditions, low predation rates, and an abundance of preferred habitat, they exhibit high annual survival and production rates (Dunn and Jacobs 2000).

During the first Atlas period the Canada goose was most prevalent as a breeding bird in the glaciated sections of the Appalachian Plateau and south of the Great Valley. It was a confirmed breeder in 34% of the blocks surveyed. By the second atlas period the Canada goose was common throughout the state, breeding in all counties and had increased over 500% from the first Atlas period. It was confirmed breeding in 68% of all blocks with lesser occupancy occurring in the mountains of the Deep Valley section of the Appalachian plateau, a region with few wetlands or pond and lake habitat geese frequently use for nesting. There has been a significant expansion of the breeding range into the northern and central portions of the state since the first Atlas.

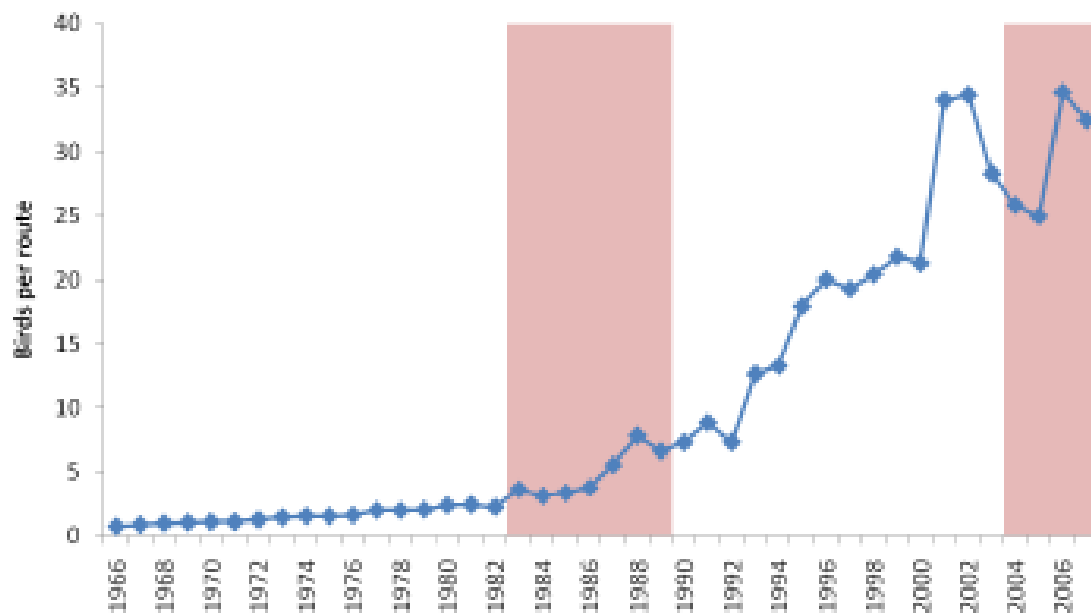
Numbers of resident Canada geese in Pennsylvania have increased dramatically since being established. Sheaffer and Malecki (1998) conducted the first statewide survey of nesting Canada geese and estimated the number of breeding pairs at 11,819 (1,624 SE) from 1986-89. Breeding Bird Survey data (Sauer et al. 2008) also show a highly significant increase in Canada goose numbers in Pennsylvania since 1990. Breeding waterfowl surveys conducted by the PGC (Jacobs et al. 2009) have estimated the current number of breeding pairs at 88,600 and total population (pairs plus nonbreeders) at 289,900. Average breeding pair densities were estimated statewide at 2.43 pairs/km², with the highest densities observed in the glaciated Northwestern and Southeastern piedmont. The Pennsylvania Canada goose spring breeding population appears to have stabilized at between 250,000 and 300,000, following the rapid growth observed during the 1990's. Expansion of hunting seasons and other lethal and non-lethal programs implemented to control overabundant Canada goose populations may be having an effect on the population's growth rate. Overabundant populations of resident Canada geese are often involved in damage to property, agriculture, or natural resources, and conflicts with public health and safety (Conover and Chasko 1985).



2nd PBBA Data summary for Canada Goose

PA BBS trend 1966-2007

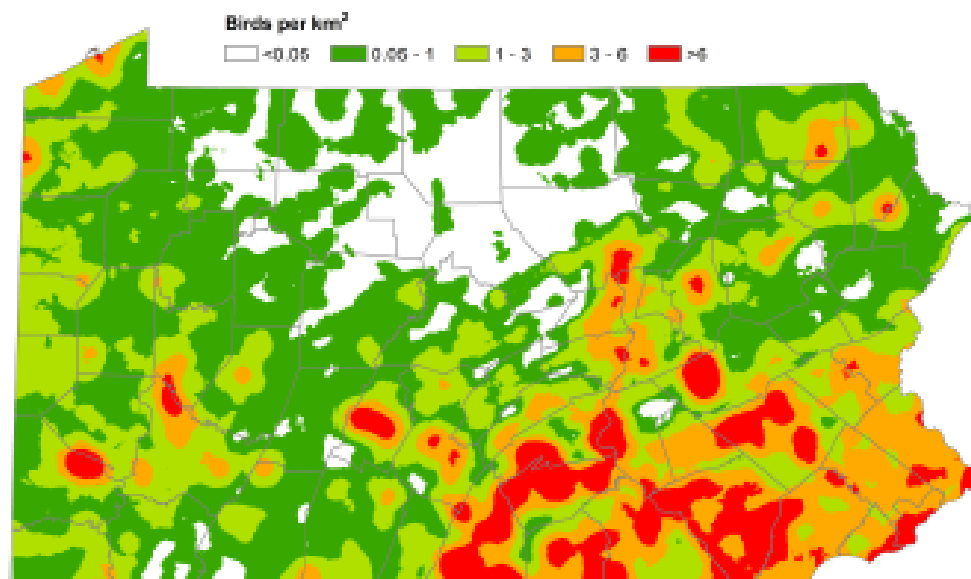
■ 509% increase between atlas periods



BBS trend for 1980 to 2007: 10.3% increase per year (statistically significant)

source: Sauer, J. R., J. E. Hines, and J. Fallon. 2008. *The North American Breeding Bird Survey, Results and Analysis 1966 - 2007. Version 5.15.2008.* [USGS Patuxent Wildlife Research Center, Laurel, MD](#)

2nd PBBA Data summary for Canada Goose



Top 20 counties by density

rank	county	birds/km ²
1	PHILADELPHIA	6.99
2	LANCASTER	6.88
3	CUMBERLAND	6.83
4	FRANKLIN	6.23
5	BERKS	5.16
6	ADAMS	5.10
7	CHESTER	4.97
8	BUCKS	4.90
9	YORK	4.38
10	DELAWARE	4.33
11	PERRY	4.23
12	DAUPHIN	4.14
13	MONTGOMERY	4.08
14	SCHUYLKILL	3.54
15	LEBANON	3.31
16	NORTHUMBERLAND	3.29
17	NORTHAMPTON	3.23
18	BLAIR	3.00
19	LEHIGH	2.97
20	UNION	2.57

Top 20 counties by population size

county	% of total
LANCASTER	8.24
FRANKLIN	5.83
BERKS	5.41
YORK	4.94
CUMBERLAND	4.56
CHESTER	4.56
BUCKS	3.71
SCHUYLKILL	3.40
ADAMS	3.20
PERRY	2.87
DAUPHIN	2.81
WESTMORELAND	2.71
MONTGOMERY	2.44
HUNTINGDON	2.24
WASHINGTON	2.11
BLAIR	1.92
NORTHUMBERLAND	1.89
SUSQUEHANNA	1.68
CRAWFORD	1.56
NORTHAMPTON	1.48

TOTAL POPULATION SIZE: approximately **215,000** individuals

95% confidence interval: 206,000 - 224,000

Point Count data: 4,323 birds counted at 660 of 33,852 points (1.9% of points)

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