

Waterfowl and Allies Guild

Dabbling Ducks

- Mallard *Anas platyrhynchos*
- Black Duck *Anas rubripes*
- Northern Pintail *Anas acuta*
- Blue-winged Teal *Anas discors*
- Mottled duck *Anas fulgiva*

Allies

- Common Loon *Gavia immer*
- Horned Grebe *Podiceps auritus*



Black duck - Photo by Harry D Sell

Contributor: Robert D. Perry

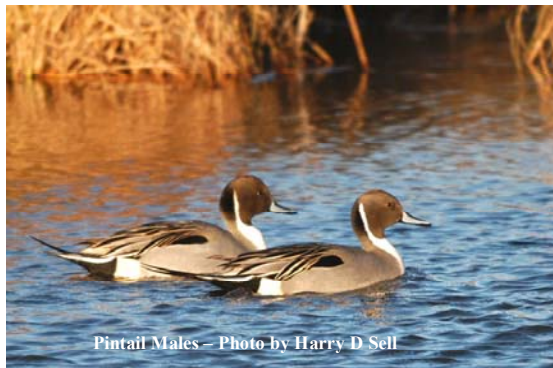
DESCRIPTION

Taxonomy and Basic Description

Dabbling Ducks: Mallards and black ducks are similar in size; adult males weigh approximately 1.25 kg (2.75 pounds). Northern pintails are smaller, longer and more slender than mallards and black ducks; adult pintail males weigh 1.03 kg (2.26 pounds). Blue-winged teal are of the smallest of waterfowl; adult males weigh 0.46 kg (1.02 pounds) (Bellrose 1980). Mottled ducks are of similar size and body weight as mallards and black ducks.



Mallards - Photo by Harry D Sell



Pintail Males - Photo by Harry D Sell

One of the most widely recognized of all waterfowl, winter mallard drakes have an iridescent green head and predominantly gray body with a chestnut colored chest. Mallard hens are straw-brown with streaks of dark brown in winter. On the wing, the violet blue speculum bordered by a pronounced white stripe identifies the mallard in any plumage. Both sexes of black ducks have a sooty-brown, spotted plumage considerably darker than the

mallard hen. Black duck speculum colors are metallic purple to metallic green without borders. In winter, adult male northern pintails are easily identified by long and pointed, black sprig-like tail feathers and a chocolate-brown head. Hen pintails are dusky-brown with noticeably lighter streaks and short, pointed tail feathers. Blue-winged teal drakes are identified by a steel-blue head and neck with a white, crescent shaped stripe anterior to the eye in the winter. Blue-winged teal hens are mottled-brown all over



Blue Winged Teal - Photo by Harry D Sell

throughout the year. Both sexes have predominant chalk-blue shoulder patches. Mottled duck plumage is intermediate between a black duck and a hen mallard, and speculum colors vary as do those of black ducks. Proper identification of a mottled duck at hand typically requires examination by trained personnel to distinguish it from a black duck. During the period May-October large, dark waterfowl observed near salt or brackish marsh generally would be mottled ducks since they are non-migratory and mallards or black ducks would not be present in South Carolina during this time frame (Bellrose 1980).

Common Loon. Common loons are larger water birds than dabbling ducks and weigh up to 1.6 kg (3.53 pounds). Common loons swim low in the water; often the entire body is under water and only the neck and head are emerged. The straight, thick, pointed bill is gray in winter. The predominant winter color of common loons is evenly gray on the head and back with a white neck and underside. Males and females are descriptively similar except that males are typically larger (Rimmer 1992; McIntyre and Barr 1997).



Horned Grebe. Horned grebes resemble small, compact ducks, but they have short, pointed bills. They weigh only 0.3 to 0.5 kg (0.66 to 1.10 pounds). The winter plumage of horned grebes is drab with white cheeks, throat and breast. The crown, nape of neck and back are darker. Male and female horned grebes look alike, but males are often considerably larger (Stedman 2000; Handford and Kirschbaum 2001).

Status

Dabbling Ducks. Mallards, black ducks, Northern pintails and blue-winged teal are high priority waterfowl species as identified by the North American Waterfowl Management Plan (NAWMP). Mallards and blue-winged teal generally are considered species with increasing or stable continental population status trends. However, recent declines have been noted in both species in South Carolina (Perry et al. 2005). Declines in South Carolina wintering mallard populations were concurrent with continental and Atlantic flyway population declines of the mid-1980's (Gordon et al. 1989; Smith and Reynolds 1992). Black ducks and northern pintails both have decreasing population status rangewide (NAWMP 1998). Mottled ducks are non-migratory in SC; little data are available to accurately quantify the status of mottled ducks along the South Atlantic coast. Harvest data and field observation indicate mottled duck populations appear to be stable along coastal South Carolina.

Common Loon. McIntyre and Barr (1997) indicated that North American Breeding Bird Survey data demonstrate increases in common loon productivity over a 20-year period, from 1970 through 1989. Baselines documenting wintering population numbers, however, are not well

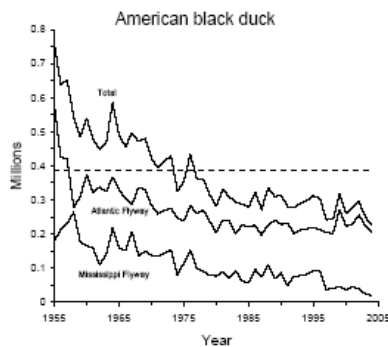
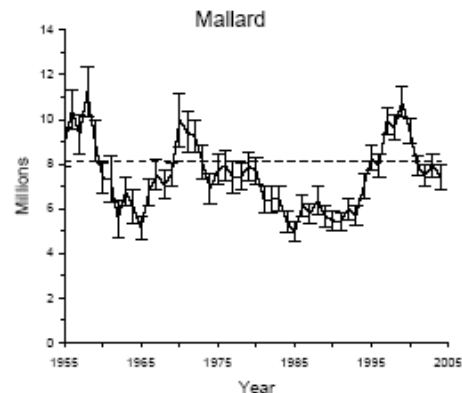
established. Basic information on population demography and factors limiting expansion of common loon populations are not well understood and need further study (Rimmer 1992; McIntyre and Barr 1997).

Horned Grebe. Kaufman (1996) indicated horned grebes appear to have declined in recent decades. The lack of data documenting the population status of horned grebes makes it difficult to accurately determine their status. As in the case of common loons, baseline numbers documenting wintering population status of horned grebes are not well established.

POPULATION DISTRIBUTION AND SIZE

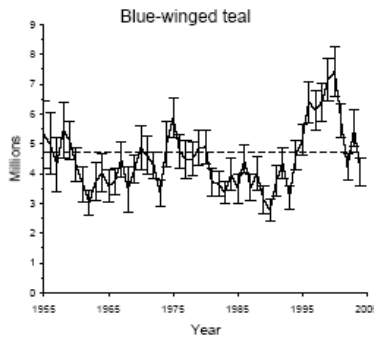
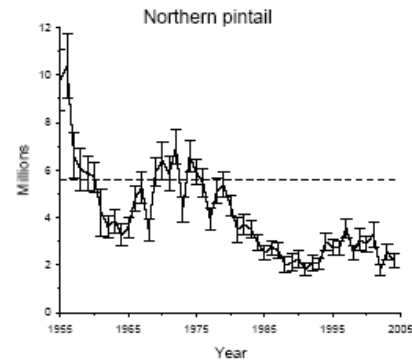
Dabbling Ducks. Continental waterfowl populations, including species for which South Carolina provides important wintering habitat, are estimated annually in North America using a complex set of related aerial and ground surveys that determine habitat conditions and numbers of breeding ducks. Mottled ducks are non-migratory waterfowl native to and typically located along coastal areas of Alabama, Louisiana and Texas. Mottled ducks were introduced to South Carolina during the late 1970's, and they occur along coastal marshes descriptively similar to those of coastal Louisiana and Texas (Cowardin et. al. 1979; Stutzenbaker 1989).

Mallard populations wintering in South Carolina originate in distinct breeding population reference areas; the majority of mallards wintering in this state appear to originate from the mid-continent reference area that encompasses the western and central Great Lakes areas and the traditional prairie-pothole regions of the north-central United States and south-central Canada. Fewer mallards that winter in South Carolina originate from eastern Canada (Bellrose 1980; Bellrose and Crompton 1970; Munro and Kimball 1982; Nichols and Hines 1987; Sheaffer and Malecki 1996). Mallard production between 1955 and 2004 and the associated NAWMP population goal for this species are depicted in the adjacent graph (USFWS 2004).



South Carolina wintering black ducks originate primarily from eastern Canada (Bellrose 1980; Bellrose and Crompton 1970; Kirby 1988; Blandin 1992). Conroy et al. (2002) indicate continental black duck populations declined greatly during the period from 1950 through 1970, but have stabilized somewhat since then. In an extensive review and modeling exercise Conroy et al. (2002) could neither resolve which factors contributed to black duck declines, nor determine the management actions necessary to stabilize or increase black duck populations. Black duck production between 1955 and 2004 and the associated NAWMP population goal for this species are depicted in the adjacent graph (USFWS 2004).

South Carolina wintering northern pintails originate from the mid-continent reference area and areas eastward in Canada toward James Bay (Bellrose 1980). Johnson and Grier (1988) suggested that northern pintails entering production grounds in spring from the southern portal, including the South Atlantic Flyway, settle in the mid-continent. The mid-continent prairie-pothole region has suffered more from drought than any other area important to waterfowl production. Droughts, therefore, have adversely affected northern pintail populations more so than any other species of waterfowl (Smith 1970; Derksen and Eldridge 1980; Johnson and Grier 1988; Hestbeck 1995). Breeding populations of northern pintails are of special concern for all waterfowl enthusiasts (NAWMP 1998). Northern pintail production between 1955 and 2004 and the associated NAWMP population goal for this species are depicted in the adjacent graph (USFWS 2004).



The impact of drought in North American mid-continent regions lowers recruitment and survival of blue-winged teal (Sousa 1985). Johnson and Grier (1988) demonstrated that blue-winged teal are not philopatric. However, they are strong pioneers; blue-winged teal have been reported nesting well outside their normal breeding range in response to newly flooded habitat (Bellrose 1980). Recent improvement in blue-winged teal productivity may be based on the ability of this species to adapt to a changing environment. Blue-winged teal production between 1955 and 2004 and the associated

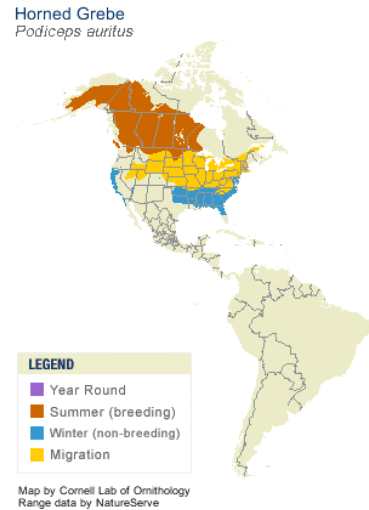
NAWMP population goal for the species are depicted in the adjacent graph (USFWS 2004).

Recent mid-winter waterfowl inventory (MWI) trends indicate relatively stable South Carolina wintering mallard populations after substantial declines in their wintering numbers over a two-decade period. Counts obtained through the MWI include an average of 3,259 mallards per year between 1999 and 2004. Numbers of wintering black ducks have also stabilized in South Carolina; an average of 860 black ducks per year have been observed from 1999 through 2004. Black ducks are believed to be under-represented in MWI estimates because they tend to be distributed in expansive emergent, tidal salt marsh; such areas are not usually included in MWI survey routes. There has been a substantial decline in wintering populations of northern pintails in South Carolina since 1985. MWI counts from 1999 through 2004 estimate that an average of 5,518 northern pintails primarily used traditional habitats along coastal South Carolina in managed brackish wetlands. Blue-winged teal also winter primarily along coastal South Carolina in managed fresh and brackish wetlands, from 1999 through 2004, an average of 1,490 blue-winged teal were counted per year during MWIs.

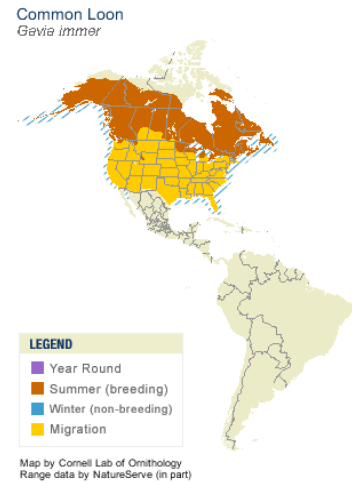
Very little data exist on productivity of mottled ducks in South Carolina. Periodic summer surveys have been conducted indicating relative stability of mottled duck populations along coastal areas (SCDNR unpublished data). There are no reliable winter population data for

mottled ducks in South Carolina since observers often lump the few mottled ducks observed along with black duck tallies.

Common Loon. Common loons spend much of their time in Canada; world population was estimated to number between 500,000 to 700,000 individuals in the mid-1990s (Rose and Scott 1996, cited in McIntyre and Barr 1997). Large declines in breeding populations were recorded in the northeastern US from 1971 through 1990 (Rimmer 1992). However, Droege and Sauer (1990, cited in Rimmer 1992) documented a significant 2.2 percent annual increase in North American common loon production between 1966 and 1989.



Differences in these reports may be related to stabilized or improved production in more rural, western areas as opposed to northeastern United States habitats impacted by urbanization and development pressures. No accurate database exists documenting wintering population status of common loons in South Carolina.



Horned Grebe. Horned grebe populations are believed to be declining; limited data exist to accurately document reasons for this decline or current status of the population (Stedman 2000).

HABITAT AND NATURAL COMMUNITY REQUIREMENTS

Dabbling Ducks. Gordon et al. (1989) described the importance of south Atlantic coastal wetlands to dabbling ducks, particularly managed tidal wetlands in South Carolina. These wetlands periodically provide habitat for up to 40 percent of the wintering dabbling ducks in the Atlantic Flyway. These species predominantly demonstrate a strong fidelity for particular wintering sites, which indicates the importance of site-specific wintering habitat management for dabbling ducks (Robb 2002).

Mallards historically wintered in South Carolina in large numbers along coastal emergent freshwater wetlands and associated inland freshwater lacustrine and riverine habitats. These ducks are notorious pioneers into new habitats; there is substantial anecdotal evidence as well as landowner/manger observations that migratory mallards are wintering in newly constructed inland impoundments across the state since 1990. Many of these impoundments, managed exclusively for ducks, are planted to cereal grains, important food resources for wintering waterfowl. Wintering mallards are readily attracted to these shallowly flooded grain impoundments where disturbance is limited; they will move considerable distances in order to exploit these sites. Currently, sufficient band return data to support the hypothesis that large numbers of migrating and wintering mallards are moving to and using these habitats does not exist. However, there may be a temporal lag in band returns as the dynamics of mallard habitat utilization undergo changes (Munro and Kimball 1982).

Migrating black ducks prefer emergent coastal wetlands and mud flats in South Carolina (Morton et al. 1989). Fewer black ducks use inland lake and riverine habitats (Johnson and Montalbano 1989). Wintering black ducks also require adequate food resources, open water and shelter from low temperatures and human disturbance. Vegetation, including seeds, and aquatic organisms make up the black ducks' diet during the winter. Widgeon grass (*Ruppia maritima*) is particularly important to the black duck; this plant is very important in management of brackish wetlands along coastal South Carolina. Important invertebrate prey species are located primarily in mud flats and include mollusks, crustaceans and insects (Lewis and Garrison 1984).

Emergent salt and freshwater wetlands and tidal mud flats are important habitats for all dabbling ducks, particularly black ducks. Field et al. (1991) estimated 106,921 ha (264,200 acres) of salt marsh, 46,460 ha (114,800 acres) of freshwater marsh and 4,979 ha (12,300 acres) of tidal flats occur in South Carolina. Tiner (1984) estimated that over 30,757 ha (76,000 acres) of managed wetlands in South Carolina are the result of continued maintenance, development and water level manipulation of impoundments formerly used for colonial rice culture. These habitats are vital wintering habitat for all dabbling ducks. Northern pintails and blue-winged teal wintering in South Carolina use managed fresh and brackish wetlands almost exclusively (Gordon et al. 1989). Additionally, many black ducks wintering along coastal regions of the state use managed wetlands during some portion of the diurnal cycle (Gordon et al. 1989). Virtually all life cycle requirements of mottled ducks in South Carolina are met within the confines of a narrow range of habitat occurring specifically within coastal, brackish managed wetlands.

Common Loon. In winter, common loons are generally located utilizing shallow coastal marine habitat. However, these birds will also use lakes and rivers where forage organisms, such as small fish crayfish, shrimp and leeches, are available (McIntyre and Barr 1997; Rodriguez and Kirschbaum 2002).

Horned Grebe. Horned grebes winter mainly on salt or brackish water in South Carolina, but can also be located on lakes and rivers where the water does not freeze. Protected bays, exposed shores and, occasionally, larger freshwater lakes are important winter habitat (Kaufman 1996). Fish and crustaceans comprise the balance of winter diet, but small mollusks and some plant material may be consumed (Kaufman 1996; Stedman 2000). Horned grebes have been seen (pers. obs.) using canal networks in saline and brackish managed wetlands along coastal South Carolina; these habitats are rich in fish, crustaceans and invertebrates (Gordon et al. 1989). These areas may play a greater role in providing winter habitat for horned grebes than has previously been documented.

CHALLENGES

Land use development directly impacts aquatic ecosystems (Langner and Flather 1994). Conversion of historically expansive agricultural and forested landscapes adjacent to important emergent wetlands and riverine and lacustrine habitats to urban use is the major cause for loss and degradation of waterfowl habitat. More than half of coastal South Carolina's historically significant plantations have been developed into residential communities. Many of these sites are within major riparian corridors. Development reduces availability of habitat for wintering dabbling ducks and allies through loss and degradation of habitat, alteration of food chains and

degradation of related aquatic resources due to pollution and upland runoff (McKenzie et al. 1980, Sandifer et al. 1980; Bildstein et al. 1991).

The Center for Wildlife Law (1996) indicated population growth in South Carolina has increased to 116 people per 2.59 sq km (1 square mile), which has greatly increase development pressure on natural landscapes. South Carolina also has lost 27 percent of its wetlands since 1780 with more than half of that loss occurring since 1960 (Center for Wildlife Law 1996). Population growth and concurrent wetland habitat loss along coastal areas are of the most significant reasons requiring planning attention and holistic conservation approaches benefiting vital coastal resources (Bildstein et al. 1991).

Destruction of emergent wetlands along tidal, coastal areas is a problem for wintering black ducks and mottled ducks (Conroy et al. 2002). Invasive species, most notably common reed (*Phragmites communis*), are a concern in and around coastal managed wetlands. The common reed engulfs formerly productive wetlands and renders them useless as wintering waterfowl habitat.

Northern pintail population declines are continental in scope with primary causes rooted in widespread conversion of prairie grasslands to agriculture (Miller and Duncan 1999). In South Carolina, the greatest challenge is protection and proper management of critical coastal wintering habitats. Body condition of northern pintails when they arrive on breeding grounds in the spring is directly related to habitat indices on wintering grounds. Raveling and Heitmeyer (1989) indicated quality of winter habitat might affect northern pintail body reserves and, therefore, recruitment more so than any other dabbling duck.

Johnson et al. (1984) indicated the most critical management need of mottled ducks is to develop and maintain a reliable population survey. MWI data do not accurately reflect mottled duck numbers in South Carolina. Johnson et al. (1991) indicated less than one percent of the mottled ducks in Florida were counted in MWI surveys in that state, and Ballard et al. (2001) stated that according to their surveys, there were substantially more mottled ducks in Texas than previously reported using the MWI to estimate the population status of these ducks.

Common loon populations are also reduced in the face of habitat loss and degradation, human disturbance through recreation or development of secluded habitats, and pollution such as mercury and other heavy metals. Oil spills are catastrophic to common loons because they become unable to thermoregulate, fly, swim or dive when their plumage is only slightly saturated with oil (McIntyre and Barr 1997; Rodriguez and Kirschbaum 2002). Lead poisoning from fishing sinkers (Perry 1994) and entanglement in commercial and recreational fishing gear are other mortality factors for wintering loon populations (McIntyre and Barr 1997). Iron, bismuth, tin and tungsten have received full approval for use in nontoxic shot shells for hunting waterfowl (USFWS 2001); Thomas (2003) indicated the same materials should be able to receive approval for use as components of fishing weights in order to reduce lead mortality to diving waterbirds including common loons and horned grebes.

Oil spills along coastal wintering grounds and pesticide accumulation in their wintering aquatic habitats negatively affect horned grebe populations. Other sources of mortality for the horned

grebes include plastics and lead ingestion as well as entanglement in commercial and recreation fishing gear (Kaufman 1996; Handford and Kirschbaum 2001).

CONSERVATION ACCOMPLISHMENTS

Research projects have been undertaken to clarify the derivation of mallards and northern pintails migrating to and wintering in South Carolina. Between 2003 and 2004, SCDNR personnel fitted eight female northern pintails and six female mallards with satellite-telemetry transmitters. Most of these ducks were successfully tracked; the research indicated a migration corridor through the Great Lakes and western Quebec-eastern Ontario and a preference for nesting near or on Hudson Bay (Rhodes 2004; Perry et al. 2005). Post-season banding efforts have been redoubled in recent years resulting in an increased dabbling ducks banding; blue-winged teal have been specifically targeted for banding.

Habitat conservation accomplishments for these ducks have been numerous and widespread in South Carolina. Key waterfowl habitats, known locally as focus areas, have been protected in efforts under the NAWMP through Atlantic Coast Joint Venture (ACJV) projects. Over 2.25 million hectares (5.56 million acres) have been identified within focus area boundaries targeted for priority landscape conservation through voluntary easements, gift or fee-title purchase. Approximately 162,000 hectares (400,000 acres) have already been protected in perpetuity through these efforts (USFWS 2003; SCDNR 2003).

Coastal focus areas in South Carolina are part of the South Atlantic Migratory Bird Initiative (SAMBI). Currently, plans written by SAMBI address goals and objectives identified as multi-state/federal/non-governmental conservation priorities. SAMBI seeks to provide a secure future for a wide variety of wetland dependent species including dabbling ducks and migratory diving waterbirds. SAMBI is a mechanism to integrate and coordinate various bird conservation efforts to meet habitat conservation goals as identified for the South Atlantic Coastal Plain.

A thorough database has been maintained for several decades documenting wintering dabbling duck populations that utilize traditional habitats in South Carolina. In many years, these data illustrate that up to 40 percent of the dabbling ducks in the Atlantic Flyway use habitats in South Carolina.

Outreach efforts include establishment of expanded waterfowl information on the agency website. Specific information on satellite-telemetry of mallards and northern pintails is included on the SCDNR website.

CONSERVATION RECOMMENDATIONS

Dabbling Ducks

- Conserve and enhance additional dabbling duck habitat and associated species partnership efforts in concert with the NAWMP and ACJV focus areas.
- Develop and implement expanded mid-winter surveys in non-traditional wintering areas to better document the possible redistribution of wintering dabbling ducks into newly created habitats.

- Continue examining banding data to further determine the migration dynamics of mallards wintering in the state.
- Eradicate invasive species, such as common reed, to protect key dabbling duck habitat.
- Complete comprehensive mapping, monitoring, control and follow-up efforts to evaluate the effects of invasive plant species on dabbling ducks.
- Conduct additional winter banding of priority waterfowl species that utilize habitats in South Carolina in concert with additional spatial analysis of band return data in order to further identify correlations between origin and winter termini.
- Increase public outreach efforts with improved website information, presentations, news releases and special publications.

Common Loons and Horned Grebes

- Explore opportunities to limit the use of toxic materials as fishing sinkers
- Perform baseline investigations to determine life history characteristics for wintering common loons and horned grebes in South Carolina. Topics to include:
 - winter energetics of common loons or horned grebes
 - precise wintering distribution and abundance of common loons and horned grebes
 - ecological requirements and social structure of wintering common loons and horned grebes including winter site preferences, mobility and mortality during winter, effects of winter weather on these species or impacts to these and other diving waterbirds from commercial fishing activities

MEASURES OF SUCCESS

Increases in populations of dabbling ducks and allies in concert with the goals provided in the NAWMP, SAMBI and ACJV plans will provide adequate measures of success for proposed conservation actions. Establishment of a reliable MWI to include inventory of newly created waterfowl wintering habitats and production of a comprehensive mapping and monitoring plan would also be noteworthy as additional conservation accomplishments. Finally, establishment of baseline data regarding South Carolina wintering common loons and horned grebes would assist in future management of these species.

LITERATURE CITED

- Ballard, B.M., M.T. Merendino, R.H. Terry and T.C. Tacha. 2001. Estimating abundance of mottled ducks in Texas. *Wildlife Society Bulletin*. 29:1186-1192.
- Bellrose, F.C. 1980. *Ducks, geese and swans of North America*. Third edition. Stackpole Books. Harrisburg, Pennsylvania. 540 pp.
- Bellrose, F.C. and R.D. Crompton. 1970. Migrational behavior of mallards and black ducks as determined by banding. *Illinois Natural History Survey Bulletin*. 30:167-234.
- Bildstein, K.L., G.T. Bancroft, P.J. Dugen, D.H. Gordon, R.M. Erwin, E. Nol, L.X. Payne and S.E. Senner. 1991. Approaches to the conservation of coastal wetlands in the western hemisphere. *Wilson Bull.* 103:218-254.

- Blandin, W.W. 1992. Population characteristics and simulation modeling of black ducks. U. S. Fish and Wildlife Service. Fish and Wildlife Research 11. 200 pp.
- Center for Wildlife Law. 1996. Saving Biodiversity: A status report on state laws, policies and programs. New Mexico Center for Wildlife Law, University of New Mexico. Albuquerque, New Mexico. Accessed online on April 28, 2005 at <http://www.defenders.org/pb-bst00.html>
- Conroy, M.J., M.W. Miller and J.E. Hines. 2002. Identification and synthetic modeling of factors affecting American black duck populations. Wildlife Society Bulletin Number 150. 63 pp.
- Cowardin, L.M., V. Carter, F.C. Golet and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. US Fish and Wildlife Service FWS/OBS-79/31. 103 pp.
- Derksen, D.V. and W.D. Eldridge. 1980. Drought-displacement of pintails to the Arctic coast plain, Alaska. Journal of Wildlife Management. 44:224-229.
- Dixon, J.A. and P.B. Sherman. 1990. Economics of protected areas: A new look at Benefits and Costs. Island Press. Washington, DC. 234 pp.
- Field, D.W., A.J. Reyer, P.V. Genovese and B.D. Shearer. 1991. Coastal wetlands of the United States: an accounting of a valuable national resource. NOAA/USFWS. Washington, DC. 59 pp.
- Gordon, D.H., B.T. Gray, R.D. Perry, M.P. Prevost, T.H. Strange and R.K. Williams. 1989. South Atlantic coastal wetlands. *In*: Habitat Management for Migrating and Wintering Waterfowl in North America, L.M. Smith, R.L. Pedersen and R.M. Kaminski, eds. Texas Tech University Press, Lubbock, TX. 574 pp.
- Grado, S.C., R.M. Kaminski, I.A. Munn and T.A. Tullos. 2001. Economic impacts of waterfowl hunting on public lands and at private lodges in the Mississippi Delta. Wildlife Society Bulletin. 29:846-855.
- Handford, B. and K. Kirschbaum. 2001. *Podiceps auritus* (on line) Animal Diversity Web. Accessed on April 28, 2005 at <http://animadiversity.ummz.umich.edu>.
- Hestbeck, J.B. 1995. Response of northern pintail populations to drought, 1961-92. Journal of Wildlife Management. 59:9-15.
- Johnson, D.H. and J.W. Grier. 1988. Determinants of breeding distribution of ducks. Wildlife Monographs Number 100. 37 pp.

- Johnson, F.A. and F. Montalbano, III. 1989. Southern lakes and reservoirs. *In: Habitat Management for Migrating and Wintering Waterfowl in North America*, L.M. Smith, R.L. Pedersen and R.M. Kaminski, Eds. Texas Tech University Press. Lubbock, Texas. 574 pp.
- _____, F. Montalbano, III and T. C. Hines. 1984. Population dynamics and status of the mottled duck in Florida. *J. Wildl. Manage.* 48:1137-1143.
- Kaufman, K. 1996. *Lives of North American Birds*. Houghton Mifflin Co. Boston, Massachusetts. 675 pp.
- Kirby, R.E. 1988. American black duck breeding habitat enhancement in the Northeastern United States: A review and synthesis. U. S. Fish and Wildlife Service, Biological Report 88(4). 50 pp.
- Langner, L.L. and C.H. Flather. 1994. Biological diversity: Status and Trends in the United States. USDA Forest Service General Technical Report RM-244. 25 pp.
- Lewis, J.C. and R.L. Garrison. 1984. Habitat suitability index models: American black duck (wintering). U. S. Fish and Wildlife Service. FWS/OBS-82/10.68. 16 pp.
- McIntyre, J. and J. Barr. 1997. Common loon (*Gavia immer*). *In: The Birds of North America*, A. Poole and F. Gill, Eds. (online). Academy of Natural Science, Philadelphia, Pennsylvania and American Ornithologists Union, Washington, D.C. Accessed on April 28, 2005 at <http://bna.birds.cornell.edu/BNA/>
- McKenzie, M.D., J.V. Miglares, B.S. Anderson and L.A. Barclay, Eds. 1980. Ecological characterization of the Sea Island coastal region of South Carolina and Georgia. Vol. II: Socioeconomic features of the characterization area. U. S. Fish and Wildl. Serv., Off. Biol. Serv., Washington, DC. FWS/OBS-79-41. 321 pp.
- Miller, M.R. and D.C. Duncan. 1999. The northern pintail in North America: status and conservation needs of a struggling population. *Wildlife Society Bulletin.* 27:788-800.
- Moorman, T.E. and P.N. Gray. 1994. Mottled duck (*Anas fulvigula*). *In: The Birds of North America*, A. Poole and F. Gill, Eds. (online). Academy of Natural Science, Philadelphia, Pennsylvania and American Ornithologists Union, Washington, D.C. Accessed on April 28, 2005 at <http://bna.birds.cornell.edu/BNA/>
- Morton, J.M., R.L. Kirkpatrick, M.R. Vaughan and D.F. Stauffer. 1989. Habitat use and movements of American black ducks in winter. *Journal of Wildlife Management.* 53:390-400.
- Munro, R.E. and C.F. Kimball. 1982. Population ecology of the mallard: VII. Distribution and derivation of the harvest. U. S. Fish and Wildlife Service Resource Publication 147. 127 pp.

- NAWMP. 1998. Expanding the vision: 1998 update of the North American Waterfowl Management Plan (online). US Fish and Wildlife Service and Canadian Wildlife Service. 32 pp. Accessed on April 28, 2005 at <http://www.nawmp.ca/pdf/update-e.pdf>
- Nichols, J.D. and J.E. Hines. 1987. Population ecology of the mallard: Winter distribution patterns and survival rates of winter-banded mallards. US Fish and Wildlife Service Resource Publication 162. 154 pp.
- Perry, C. 1994. Lead sinker ingestion in avian species. US Fish and Wildlife Service, Division of Environmental Contaminants, Information Bulletin. 94-09-01.
- Perry, B., D. Harrigal and W. Rhodes. 2005. South Carolina Waterfowl Project Report 2003-04 and 2004-05. South Carolina Department of Natural Resources. Columbia, South Carolina. 46 pp.
- Raveling, D.G. and M.E. Heitmeyer. 1989. Relationships of population size and recruitment of pintails to habitat conditions and harvest. *Journal of Wildlife Management*. 53:1088-1103.
- Rhodes, W. 2004. Northern pintail satellite-telemetry project: 2004 progress report. SCDNR unpublished report. 7 pp.
- Ridgely, R.S., T.F. Allnutt, T. Brooks, D.K. McNicol, D.W. Mehlman, B.E. Young and J.R. Zook. 2003. Digital distribution maps of birds of the Western Hemisphere, Version 1.0. NatureServe. Arlington, Virginia.
- Rimmer, C.C. 1992. Common loon (*Gavia immer*): Species Management Abstract. The Nature Conservancy. Arlington, Virginia. 20 pp.
- Robb, J.R. 2002. Band recovery and recapture rates of American black ducks and Mallards. *Journal of Wildlife Management*. 66:153-161.
- Rodriguez, R. and K. Kirschbaum. 2002. *Gavia immer* (online) Animal Diversity Web. Accessed on April 28, 2005 at <http://animaldiversity.ummz.umich.edu>.
- Royle, J.A. and J.A. Dubovsky. 2001. Modeling spatial variation in waterfowl band-recovery data. *Journal of Wildlife Management*. 65:726-737.
- Sandifer, P.A., J.V. Miglarese and D.R. Calder, Eds. 1980. Ecological characterization of the Sea Island coastal region of South Carolina and Georgia. Vol. III: Biological features of the characterization area. U. S. Fish and Wildl. Serv., Off. Biol. Serv. Washington, DC. FWS/OBS-79/42. 620 pp.
- SCDNR. 1999. A survey of 1997-98 waterfowl stamp purchasers. South Carolina Department of Natural Resources Summary Report. 35 pp.

- SCDNR. 2003. South Carolina Focus Areas. South Carolina Department of Natural Resources. 66 pp.
- Sheaffer, S.E. and R.A. Malecki. 1996. Distribution and derivation of the 1990-94 mallard harvest in eastern North America. *Northeast Wildlife*. 53:45-54.
- Smith, G.W. and R.E. Reynolds. 1992. Effect of hunting on mallard survival, 1979-88. *Journal of Wildlife Management*. 56:306-316.
- Smith, R.I. 1970. Response of pintail breeding populations to drought. *Journal of Wildlife Management*. 34:943-946.
- Stedman, S. 2000. Horned grebe (*Podiceps auritus*). *In: The Birds of North America*, A. Poole and F. Gill, Eds. (online). Academy of Natural Science, Philadelphia, Pennsylvania and American Ornithologists Union, Washington, D.C. Accessed on April 28, 2005 at <http://bna.birds.cornell.edu/BNA/>
- Stutzenbaker, C. D. 1988. The mottled duck, its life history, ecology and management. Texas Parks and Wildl. Dept., Austin, TX.
- Thomas, V.G. 2003. Harmonizing approval of nontoxic shot and sinkers in North America. *Wildlife Society Bulletin*. 31:292-295.
- Tiner, R.W., Jr. 1984. Wetlands of the United States: current status and recent trends. US Fish and Wildlife Service National Wetlands Inventory. Washington, DC. 59 pp.
- U. S. Fish and Wildlife Service. 2001. Migratory bird hunting; approval of tungsten-nickel-iron shot as nontoxic for hunting waterfowl and coots. 50CFR part 20. US Fish and Wildlife Service, Washington, DC. *Federal Register*. 66:737-742.
- U. S. Fish and Wildlife Service. 2004. Waterfowl population status, 2004. US Department of the Interior, Washington, D.C. 53 pp.
- U. S. Fish and Wildlife Service. 2003. North American Waterfowl Management Plan Atlantic Coast Joint Venture Update. US Department of the Interior, Washington, D.C. 106 pp.
- Williams, B.K., M.D. Koneff and D.A. Smith. 1999. Evaluation of waterfowl conservation under the North American Waterfowl Management Plan. *Journal of Wildlife Management*. 63:371-440.