WATERBIRDS OF THE CHESAPEAKE BAY: STATUS, ECOLOGICAL REQUIREMENTS, AND THREATS

CENTER FOR CONSERVATION BIOLOGY
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Waterbirds of the Chesapeake Bay: Status, Ecological Requirements, and Threats

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Front Cover: ***Great Black-backed Gull with chick. Photo by Bryan Watts.***

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EXECUTIVE SUMMARY

The Chesapeake Bay is one of the most productive aquatic ecosystems in the world and plays an important role in the life cycle of many bird species. Each year, the rich resources of the Bay attract millions of birds from throughout the western hemisphere. Dependency on the Bay varies from species that stopover for a few days during migration to species that live out their entire life cycle within a single tributary. Many species that depend on the Bay are of high international, national or regional conservation concern. For these species, the Bay is strategically important and may serve a vital role in the recovery of imperiled populations. Because many waterbirds are top consumers and collectively require a broad array of resources, they represent sensitive indicators of overall ecosystem health. Within the mid-Atlantic region, waterbirds also form the basis of a burgeoning ecotourism industry.

Effective conservation of waterbirds within the Chesapeake Bay requires that we have a clear understanding of species requirements and the role that the Bay plays in their annual cycle. This document presents a brief overview of the Chesapeake Bay setting and the habitats that are believed to be significant to birds that depend on the Bay's resources. The document then develops a conceptual model and ecological matrix that within a series of tables presents what is known about species-specific status and trends, phenology of occurrence, resource use and energetics, vital demographic rates, threats, and the importance of the Bay for waterbird species that use the Bay on an annual basis. This information is intended to provide a foundation of what is known and unknown for these species and the basis of a jumping off point for the development of a strategy to prioritize and collect critical information in the future.

The Chesapeake Bay provides habitat and resources to 124 species of waterbirds throughout the year. Relationships between these species and the Bay are species-specific and complex. Although it is possible to identify some populations for which the Bay is of critical importance, information is lacking for most species such that definitive assessments can not be made. Ongoing monitoring programs designed to evaluate population status and trends currently include a relatively small percentage of the overall community. Prominent groups lacking such programs include migratory and wintering seabirds, marshbirds, and migratory shorebirds. Marshbirds in particular stand out as a broad species group with eminent threats but for which we have little baseline data and no effective monitoring program. Information highlights the need for further assessment of monitoring programs and approaches that will result in the development of more comprehensive and coordinated efforts.

THE CHESAPEAKE BAY

Physical Characteristics

The Chesapeake Bay formed within the Coastal Plain Province during the Pleistocene period representing the past 1 million years (Fisher and Schubel 2001). The Pleistocene is characterized by alternating glacial periods that lasted approximately 100,000 years and interglacial periods that lasted approximately 10,000 years. During glacial periods the ice caps expanded resulting in a drop in sea level and the Susquehanna River extended out across the continental shelf receiving inputs from all of the other tributaries (Kutzbach and Webb 2001). As sea-level rose during interglacial periods the Susquehanna and its major tributaries was drowned by the encroachment of seawater. During some of the warmer cycles (as is the case presently) water filled the basin to the fall line and tributaries washed sediments into the Bay creating a shallow estuary. The current Bay and most of the major estuaries of the world was formed approximately 10,000 years ago following the end of the last glacial period and the global rise in sea levels.

The Chesapeake Bay is the largest estuary in the United States. The Bay's drainage basin covers 1.92 million square kilometers (74,000 square miles) an area larger than all of New England (Pritchard and Schubel 2001). More than 50 large tributaries empty into the Bay with headwaters in 6 states and the District of Columbia. A large estuary is formed by the interaction of these tributaries with the Atlantic Ocean. The estuary is bounded to the east by the Atlantic Ocean and to the west by the fall line. The fall line is an erosional scarp where the metamorphic rocks of the Piedmont meet the sedimentary rocks of the Coastal Plain. The geologic formations along this boundary frequently determine the landward extent of tidal influence. The estuary is 320 kilometers long with more than 9,000 kilometers of tidal shoreline and 11,600 square kilometers of water surface. The configuration of the Chesapeake Bay is unusual in having by far the highest drainage basin to water volume ratio of any of the world's major estuaries. This translates into a very shallow average depth of less than 7 meters (22 feet). An estimated 20% of the Bay is less than 2 meters deep. This shallow depth including more than 240,000 hectares (600,000 acres) of bottom that receives direct sunlight is one of the keys to the Bay's tremendous productivity.

Salinity varies widely throughout the Chesapeake Bay estuary and is one of the dominant drivers of species distribution. Annual discharge of freshwater into the Bay averages 71 cubic kilometers or nearly the standing volume of the estuary. However, inputs vary dramatically with annual values of 50% below or above the average during drought or rainy years respectively and single large storms may contribute a great deal to the annual total. Both the seasonality and distribution of discharge have an influence on the spatial pattern of salinity. More than 80% of freshwater inputs come from just 3 tributaries including the Susquehanna, Potomac, and James Rivers. All of the Eastern Shore tributaries combined account for less than 4% of the total. Like most of the mid-Atlantic rivers, average flows are highest in the spring and lowest in late summer and early fall. Throughout the Bay, salinity is highest near the mouth and along the bay side of the Delmarva Peninsula. Relatively higher salinities along the Eastern Shore reflect the Coriolis force and the lower fresh water inputs. Heavier, high-saline waters extend further up the tributaries during times of low flow. Variation in several factors (e.g. winds, tides, water temperature, fresh water discharge) influence salinity patterns over short time scales leading to

dynamic shifts in salinity. Mobile aquatic species that have narrow salinity tolerances and their consumers move to maintain favorable conditions. However, the distribution of fixed species such as marsh plants or less mobile bivalves reflect longer term salinity conditions.

Climate of the Chesapeake Bay is considered temperate humid and is controlled by proximity to warm Gulf Stream waters and the wind circulation over the North Atlantic (Kutzbach and Webb 2001). The Gulf Stream conveys warm tropical waters north along the coast and serves to moderate nearshore water temperatures between 15 and 25° C (60-75° F). Although the Labrador Current deflects the Gulf Stream offshore just south of the entrance to the Bay, its proximity has an influence on water temperatures. The subtropical high-pressure system centered over the North Atlantic circulates clockwise drawing tropical moisture up to the Bay from the south Atlantic and the Gulf of Mexico from April through September. Later in the fall this high-pressure system is positioned further south and its strength is diminished. From October through March the forces controlling the weather are the westerly winds of the mid-latitudes. These air masses are cooler and drier. The southern frontal boundary of polar air masses typically remains well to the north of the Bay such that the area experiences mild winters. Of additional interest is a steep gradient in the average number of days below freezing across the Bay. Just north of the Bay the number of days is up to 50% higher compared to in the southern reaches of the Bay. This sharp change has implications for range boundaries of many species.

The tidal Bay's wide salinity gradient, shallow water, and climate have made it one of the most productive aquatic ecosystems in North America with a mean primary productivity of 1,500 g/m^2/year. This compares to 125 g/m^2/year for the open ocean, 400 g/m^2/year for lakes and streams, and 650 g/m^2/year for cultivated lands. This extreme productivity is the basis of a complex food web that includes some 2,700 species.

Human Aspect

The Chesapeake Bay was the site of the first successful European settlement in North America and the natural landscape has been altered by European culture for more than four centuries. The human population within counties adjacent to the tidal reach of the Bay has increased from 1.63 million people in 1900 to 3.81 million people in 1950 to 8.06 million people in 2000 (http://www.census.gov). The human population within the broader watershed is predicted to swell to 17.4 million by the year 2020. The Chesapeake Bay landscape lies within the second largest mega-region (BoWash) in the world accounting for 2.2 trillion dollars in economic activity or 20% of the gross domestic product of the United States (Florida et al. 2008). This economic engine is spilling out across the landscape and consuming natural habitats at rates well beyond historical levels (Figure 1). Consumption of open land to fuel residential and industrial development across the Bay landscape has increased dramatically in recent decades (Gray et al. 1988) and is expected to reach 110 km^2/yr over the next 30 years (Goetz et al. 2004) resulting in a 60% increase in urban sprawl (Boesch and Greer 2003). Over the past decade the Bay appears to have reached a tipping point where moderate-sized population centers are gaining momentum and beginning to coalesce along major shorelines.

Habitats Important to Waterbirds

Upland Habitats

Bay Islands - The Chesapeake Bay supports more than 100 offshore islands that vary in size, geologic origin, isolation from the mainland and habitat composition (Wray 1992, Leatherman et al. 1995, Cronin 2005). The largest islands including approximately 30 surrounding Tangier Sound are vestiges of an earlier era in the geological history of the Bay that were isolated when the Bay was "drowned" by rising seas. Tangier and Smith Islands are the largest and most isolated islands, have the greatest diversity of habitats and support human communities. Many smaller islands exist closer to the western or eastern shores of the Bay and are of different origin. Small sandy islands are common around the mouths of large tributaries and have been formed by sediment transport by storms or the interaction between tributary outflow and long shore sediment transport. These islands vary in size and may support a diversity of habitats. Human-made islands are a growing presence within the Chesapeake Bay system and include islands created for the deposition of materials from channel dredging and islands created to support bridges and tunnels. Vegetation and associated habitats on these islands vary according to age, substrate and use.

Bay islands represent some of the most significant habitats for waterbirds within the Chesapeake Bay (Brinker et al. 2007, Williams et al. 2007, Erwin et al. 2011). The islands support many of the same habitats and bird communities found on the mainland but in addition support waterbirds that are sensitive to mainland predators. For some waterbird species, these islands support large portions of the entire breeding population found in the Bay region. Barrier beaches support populations of solitary nesters like American Oystercatchers (Wilke et al. 2007), as well as, colonial nesters like Royal Terns, Common Terns, Least Terns, and Black Skimmers (Brinker et al. 2007). High berms with shrub hummocks and grasses support American Black Ducks, Brown Pelicans, Double-crested Cormorants, and several long-legged waders such as Snowy Egrets and Glossy Ibis (Williams et al. 2007). Extensive marshes support populations of Seaside Sparrow, Marsh Wrens, and Clapper Rails. Forest patches support tree-nesting waterbirds such as Bald Eagle, Osprey, and Great Blue Herons. Because they are predator free, these islands support large numbers of birds foraging, roosting and loafing during migratory periods and the non-breeding season. Currently, very little is known about the role that these islands play during these seasons.

The use of offshore Bay islands by waterbirds depends on continued availability of predator-free habitats. Colonization of islands by ground predators such as raccoons (*Procyon lotor*), red fox (*Vulpes vulpes*), feral cats (*Felis catus*), or Norway rats (*Rattus norvegicus*) would make these locations unsuitable for nesting waterbirds (Erwin et al. 2003). In addition, continued expansion of the Herring and Great Black-backed Gull populations on these islands may be displacing other species or reducing reproductive rates. One of the greatest threats to these islands is loss to erosion. Dozens have been lost in the past few decades and most others have experienced reductions in size (Leatherman et al. 1995, Erwin et al. 2011). Protection of islands that support significant waterbird communities may require direct intervention (Erwin et al. 2007).

Nearshore Uplands - The natural state of nearshore uplands surrounding the tidal reach of the Chesapeake Bay is forest composed of a mixture of pine and hardwood species (Brush 2001). The relative contribution of these forest components shifts from the coast to the fall line such that pine-dominated forests are primarily on the outer Coastal Plain and hardwood-dominated forests are on the inner Coastal Plain. However, this natural gradient has been highly modified by the conversion of hardwoods to pine plantations and the suppression of fire within the outer Coastal Plain. Currently, nearshore habitats are highly dissected and include a mix of forest, agricultural fields, and an expanding footprint of residential and industrial development.

The distribution of several waterbird species that depend on the Chesapeake Bay are influenced by the character of the surrounding landscape. Some species such as Bald Eagles, Osprey, and Great Blue Herons require specific upland types for nesting or roosting substrate (Watts et al. 1993, Watts and Bradshaw 1994, Watts and Mojica 2012) to the extent that they may be absent from portions of the Bay due to the lack of these substrates. Other species groups such as migratory swallows and shorebirds depend on open fields as alternate foraging habitats and their distribution may be determined by the presence of these components in the landscape (Rottenborn 1996). Similarly, the distribution of wintering gulls along Bay tributaries appears to be greatly influenced by the distribution of active landfills in the surrounding uplands.

Exposed Banks - Shear, exposed banks occur throughout the Chesapeake Bay where flood waters erode the shoreline or in areas with exposure to long fetches. These banks vary in length from meters to kilometers and are disturbance-prone habitats that require regular erosion to prevent occlusion from succession. Concentrations of exposed banks occur where bluffs intersect with meanders on the upper reaches of tributaries or along high-energy shorelines. They are particularly common within topographic highs along the main stem of the Bay and along the Potomac, Rappahannock, and James rivers. A survey of all tidal tributaries of the Bay in the mid-1990s identified more than 1,400 open, shear banks greater than 2 m in height (Watts et al, unpublished data).

Exposed banks provide nesting habitat for the Belted Kingfisher, Rough-winged Swallow, and Bank Swallow (De Jong 1996, Garrison 1999, Kelly et al. 2009). All of these species excavate burrows in soft soil and require open, shear banks to prevent predators from accessing burrows. Belted Kingfishers are territorial and typically do not share banks with other pairs. Rough-winged Swallows often nest as single pairs but may form loose colonies or associate with Bank Swallows. Bank Swallows are highly colonial and typically nest in colonies of several dozen to several hundred pairs. Bank Swallow colonies within wild banks are increasingly rare within the Chesapeake Bay and are concentrated in the upper Eastern Shore of Maryland (Watts, unpublished data).

The greatest threat to exposed banks is destruction by residents for land protection. Throughout the Chesapeake Bay watershed, dynamic shorelines are often considered to be problematic. Engineering structures such as groins, jetties, and seawalls are used to stabilize erosional shorelines to protect associated uplands or to improve waterways (Hardaway and Byrne 1999). Without disturbance, exposed banks will proceed through succession rendering them unusable for burrow nesters. In addition, a commonly accepted practice designed to reduce sediment loading and hence improve water quality is the grading of exposed banks, bluff, and

cliffs. This practice shears off steep banks to reduce sediment input into waterways and is most often implemented on shorelines that have an erosion rate in excess of 1m/yr. Over the last several decades, expansion of the human population within waterfront areas and the desire to control shoreline erosion has greatly reduced the availability of wild banks.

Marshes

Emergent tidal marshes are one of the most characteristic features of the Chesapeake Bay region. These habitats form along low to medium energy shorelines where sediment deposits provide substrate for the colonization of hydrophytic vegetation (Cowardin et al. 1979). Marshes provide a boundary between uplands and open water, export energy to the broader Bay and provide habitat for many species. Three intertidal marsh types occur within the Chesapeake Bay including salt marsh, brackish marsh, and tidal fresh marsh. Types vary according to the associated salinity, vegetational composition, and position within the estuary (Wilson et al. 2007)

Salt Marsh - Salt marshes are characterized by the presence of plant communities tolerant of salinity values of 18-30 parts per thousand (ppt). Salt marsh is the most abundant marsh type in the lower Chesapeake Bay and covers approximately 7,163 ha (Stevenson *et al*. 2000). This marsh type is distributed along the main stem of the Bay but also extends up the lower reaches of major tributaries but ultimately gives way to brackish and tidal fresh wetlands within lower salinity waters. Elevation within the salt marsh determines inundation frequency and the associated vegetation. The low marsh is inundated daily by normal high tides and within the mid-Atlantic is dominated by smooth cordgrass (*Spartina alterniflora*) and black needlerush (*Juncus roemerianus*). The high marsh is inundated irregularly by spring tides and has a savannah-like structure. The high marsh zone is dominated by salt grass (*Distichlis spicata*) and salt meadow hay (*Spartina patens*) but also contains scattered shrubs (typically *Iva frutescens* or *Baccharis hamilifolia*) and is often fringed by maritime pine savanna.

Salt marshes of the Chesapeake Bay support a diverse bird community including several species that are obligate users during different seasons (Watts 1992, 1993, Wilson et al. 2007). The low marsh supports breeding Seaside Sparrows, Marsh Wrens, and Clapper Rails. One of the more threatened suites of bird species within the Chesapeake Bay depends on the high marsh for breeding. This suite includes a number of species that are considered endangered, threatened, or species of special concern within the state level. Breeding species include Black Rail, Sedge Wren, Henslow's Sparrow, Northern Harrier, American Black Duck and Willet. The known distribution of several high-marsh obligates appears to reflect species-specific area requirements. Some of these species require marshes that are greater than 50 ha with the most important factor being the size of high marsh area (Watts 1992, 1993). For example, along the western shore of the Chesapeake Bay, Sedge Wrens reached only a 50% incidence rate in marshes that were 60 ha in area (Watts 1992). Marshes of this size are spatially restricted and rare within the region. In coastal Virginia less than 2% of marsh patches exceed 50 ha in area (Watts 1993). The limitation of adequate marsh patches may partially explain the apparent patchy distribution of these species. During the winter months, both Nelson's and Saltmarsh Sparrows are restricted to saltmarsh habitat and the Chesapeake Bay supports a significant portion of their global populations.

Brackish Marsh - Brackish marsh occurs primarily within the mesohaline zone of tidal tributaries where salinity ranges from 5.0 to 18.0 ppt. Stevenson *et al.* (2000) estimates that brackish marshes cover approximately 43,953 ha in the Chesapeake Bay. Brackish marsh occurs throughout the upper Bay's main stem in Maryland and along all major tributaries of the lower Bay within appropriate salinity zones. This marsh type is dominated by dense stands of tall cordgrass (*S. cynosuroides*) with salt meadow hay, Olney's three-square (*Scirpus americanus*), and salt grass in the high marsh zone and may have a narrow fringe of saltmarsh cordgrass depending on salinity.

Brackish marshes are less structurally complex compared to salt marshes and in general support fewer bird species. Both Least Bittern and King Rail reach their highest breeding densities within this habitat and marshes of this type in the Chesapeake Bay are important for these species on a range-wide scale. Other breeding species include Common Moorhen, Marsh Wren and Red-winged Blackbird. Seaside Sparrows and Clapper Rails begin to decline in abundance within brackish marshes. Both of these species are found infrequently in marshes dominated by Tall Cordgrass. Populations of Clapper Rails and King Rails often overlap and hybridize within brackish marshes (Meanley and Weatherbee 1962). The overall frequency of occurrence and exact distribution of hybrids in the Bay are unknown. Little is known about the use of this marsh type within the nonbreeding season.

Oligohaline and Tidal Fresh Marsh - Oligohaline and freshwater marshes occur within the upper reaches of tributaries where freshwater inputs maintain salinities below 5 ppt. These marshes cover approximately 26,245 ha (Stevenson et al. 2000). Lower saline marshes support the highest diversity of plant species of all the marshes within the Chesapeake Bay (Odum *et al.* 1984). These marshes are often dominated by broad-leaved plants such as arrow-arum (*Peltandra virginica*) and pickerelweed (*Pontederia cordata*). Other common plants include marsh hibiscus (*Hibiscus spp.*), marsh mallow (*Kosteletzkya virginica*), shoreline sedge (*Carex hyalinolepis*), narrow-leaved cattail (*Typha angustifolia*), wild rice (*Ziania aquatica*), southern wild rice (*Zizaniopsis miliacea*), rice cutgrass (*Leersia oryzoides*), various sedges (*Carex spp*.) rushes (*Juncus spp*.) and cattails (*Typa spp*.). Spadderdock (*Nuphar advenum*) and yellow pond lily (*N. luteum*) can form extensive mats in areas that are inundated for long periods. marsh hibiscus (*Hibiscus spp.*) and marsh mallow (*Kosteletzkya virginica*), shoreline sedge (*Carex hyalinolepis*), narrow-leaved cattail (*Typha angustifolia*)

The freshwater/oligohaline marsh bird community in the Chesapeake Bay is characterized primarily by species such as the Pied-billed Grebe, American Black Duck, King Rail, Virginia Rail, Sora, American Bittern, Least Bittern, Marsh Wren, and the Coastal Plain Swamp Sparrow. Some of these species breed in higher saline marshes but reach their highest abundance within marshes of this type. The Chesapeake Bay is at or near the southern range limits for breeding Soras, American Bitterns, and Coastal Plain Swamp Sparrows. The Coastal Plain Swamp Sparrow is a geographically distinct subspecies of Swamp Sparrow that breeds exclusively in oligohaline marshes of the Chesapeake Bay and Delaware Bay (Bond and Stewart 1951; Beadell *et al.* 2005; Watts *et al*. 2008).

Although much less studied, lower salinity marshes play a significant role as staging habitat for some migratory populations. Wild rice marshes support large numbers of Bobolinks

where they were hunted for generations (Stewart and Robbins 1958). Tidal fresh marshes support large congregations of several swallow species during the late summer months (Watts, unpublished data) and appear to be the most important staging habitat for Soras (Haramis and Kearns 2007). During the winter months, soft vegetation within the marshes is sheared off exposing extensive mudflats until the next seasons growth. These mudflats appear to be significant staging areas for several shorebird species in the late winter and early spring (Watts, unpublished data).

Within the Chesapeake Bay an estimated 50% of wetland area was lost to urban, industrial, and agricultural development over the past 200 years (Tiner 1987, Dahl 1990). Loss rates have dramatically diminished following the passage of protective legislation (Dahl 1990). The dominant threats to marshes and the bird populations they support currently include loss of area and changes in inundation rates due to advancing sea-level rise, invasion by exotic species, degradation related to development of surrounding uplands, and the rise of ground predator populations. The Chesapeake Bay is undergoing a rise in sea-level at twice the global rate (Kearney 1996). Marshes unable to accrete sediments at the pace of sea-level rise risk becoming submerged. Tiner (1987) reported that 60% of the present day loss of coastal wetlands in the Chesapeake Bay was a result of sea-level rise. Much of the low lying Chesapeake Bay shoreline is considered extremely vulnerable to changes in sea level (Titus and Richman 2001) and at least 50% of the entire Chesapeake Bay marsh surface has been degraded (Kearney *et al*. 2002). The implications of sea-level rise to obligate marsh-breeding species in the Chesapeake Bay are dramatic and dominate all other factors (Wilson and Watts, unpublished manuscript). The rapid spread of common reed (*Phragmites australis*) has rendered vast areas of marsh unsuitable for many obligate bird species. This exotic species is particularly detrimental to the highest area in the marsh because it invades along the marsh-upland ecotone. Urbanization is a significant threat to all marsh birds. The Chesapeake Bay has one of the fastest growing human populations in the United States and marshes surrounded by urban development support lower marsh bird diversity and abundance (DeLuca *et al*. 2004; Shriver *et al.* 2004). The effect of nest predators on reproductive rates of marsh birds in the Chesapeake Bay is poorly known but its effects are believed to be significant. Nest predation is considered the leading factor for declines in American Black Ducks (Stotts 1987; Longcore *et al.* 2000) and remains a need of study for other species.

Unvegetated Intertidal

Mud and Sand Flats - Mud and sand flats are intertidal areas with unconsolidated bottoms that do not support root systems of vascular plants (Cowardin et al. 1979). These areas often support a diverse community of aquatic invertebrates that include marine worms, bivalves, crustaceans, and other important prey for waterbirds. Mud and sand flats are similar in structure but vary in sediment type from soft silt to sand. Unlike some of the outer coastal bays or other locations within the hemisphere that experience extreme tidal ranges, the Chesapeake Bay does not support extensive concentrations of flats. Tidal flats within the Chesapeake Bay have not been mapped or quantified. Thin ribbons of mud flats occur along most tide guts and marsh shorelines and collectively these patches are significant. Larger patches occur in silted bays. Concentrations of sand flats are distributed along high energy shorelines with beaches and adequate sand sources. Examples include the areas around Smith and Tangier Islands, the arc of

shoreline between Mathews and Hampton, Virginia, and the Susquehanna Flats around Havre de Grace, Maryland.

No investigations have been conducted on the use of Chesapeake Bay flats by waterbirds. A significant number of shorebirds move through the Chesapeake during both spring and fall migration that depend on intertidal flats (Watts 1992, Paxton and Watts 2002). However, because these habitats are widely dispersed, birds are not concentrated and consequently have not been brought to the attention of shorebird biologists. Flats are used extensively by several gull species for both foraging and loafing throughout the year but primarily during the winter months.

Sandy Beaches - Beaches represent intertidal zones with adequate sand sources where wave action occurs with enough energy to prevent vegetative growth (Cowardin et al. 1979). Active beach zones extend from low tide up to the level of spring tides and depending on the position may or may not include developed dune systems. Within the Chesapeake Bay, concentrated beaches occur around isolated Bay islands, along barriers within the lower Western Shore, around the mouths of large tributaries where the long-shore transport of sand is disrupted, and along the outer edges of extensive marshes. Although not as extensive as along the outer Atlantic Coast, dune systems do occur within the Chesapeake where historic or current wave and wind energies are high.

Beach habitats support a diverse community of birds throughout the year. During the breeding season, beaches support solitary nesting shorebirds and colonial nesting seabirds. Solitary nesters currently include American Oystercatcher, Willet, and Killdeer. Aside from beaches on Bay islands, beaches associated with the mainland and marshes support only a minor portion of the regional population of these species. Beaches of the lower Chesapeake Bay historically supported small numbers of Piping and Wilson's Plovers but these species are no longer known to breed within the Bay. Similar to the solitary nesters, most colonial nesters associated with beach substrates are now restricted to isolated Bay islands. An exception is the Least Tern that continues to nest sporadically on mainland or marsh beaches. In addition to their use during the breeding season, beaches represent important habitats for foraging shorebirds and roosting or loafing areas for many species. The primary shorebird species that use Chesapeake Bay beaches during winter or migration include Sanderling, Dunlin, Semipalmated Sandpiper, Semipalmated Plover, Ruddy Turnstone and Red Knot though many other species may be observed there. Significant numbers of gulls, terns, cormorants, pelicans, and waterfowl use beach habitats that are close to important foraging areas for roosting or loafing.

Rocky Intertidal - The tidal reach of the Chesapeake Bay is wholly within the Coastal Plain physiographic province and does not have exposed rocky substrates. However, the establishment of artificial substrates such as groins, jetties, rock islands and seawalls is increasingly providing intertidal substrates that mimic those found along the North Atlantic. Some of these larger structures such as the islands of the Chesapeake Bay Bridge Tunnel have been colonized by marine communities and provide habitat for waterbirds.

Artificial rock substrates provide foraging habitat for a select group of shorebirds, nesting habitat for gulls and terns, and loafing habitat for many waterbird species. Although several

shorebird species may use this substrate the two most closely associated are Purple Sandpiper and Ruddy Turnstone that winter in the Chesapeake Bay. Both of these species feed on invertebrates on the rock surface and the Purple Sandpiper is a near-obligate rock user that has expanded its range southward and benefited from the establishment of rock substrates. Currently, Common Terns and Laughing Gulls both nest on the east tunnel island of the Hampton Roads Bridge Tunnel within rock substrate in a manner similar to natural rock substrates in New England. Many waterbird groups including shorebirds, gulls and terns, pelicans and cormorants, and waterfowl use these substrates for roosting and loafing.

Rocky intertidal substrates are expanding within the Chesapeake Bay as more of the shoreline is developed and more infrastructure is needed for bridges, shoreline stabilization, and the maintenance of navigational channels. No current estimates are available on the amount of this habitat that is available to waterbirds or for trend analysis.

Aquatic Habitats

Shallow-water Zone - The shallow-water zone is located adjacent to the shoreline of the Chesapeake Bay and extends out to water depths of approximately 3m (10ft). This depth represents the approximate limit of the level of light penetration needed for the growth of submerged aquatic vegetation (SAV) (White 1989). SAV that are commonly used by waterbirds include wild celery (*Vallisneria americana*) found in freshwater areas; sago pondweed (*Potamogeton pectinatus*) in freshwater and brackish areas; widgeon grass (*Rupia maritima*) in brackish areas; and eel grass (*Zostera marina*) and sea lettuce (*Ulva lactuca*), found in brackish to salty areas. Fish, bivalves, crustaceans and other aquatic invertebrates that are important for waterbirds are abundant within these vegetated zones and within the shallow water generally.

Due to the abundance and accessibility of prey resources within the shallow-water zone, many waterbird groups focus much of their foraging within this area. Great Blue Herons, Great Egrets, Little Blue Herons, Snowy Egrets and other long-legged waders forage on larval fish along the upland edge of this zone. Least Terns, Common Terns, and Black Skimmers primarily feed over shallow water. Bald Eagles and Osprey also do most foraging within waters of less than 3-m depth. Waterfowl species that feed on bivalves, invertebrates, or vegetation on the floor of the Bay are depth limited and feed within this zone. In addition, many of the species that feed on fish within the deepwater zone are also observed regularly feeding within shallow water. Although all of the wintering gulls may be observed in waters of all depths throughout the Bay, most reach their highest densities within shallow water.

Deep-water Zone - The deep-water zone includes areas with water depths of greater than 3 m. This includes a great deal of the main stem of the Bay and major tributaries, as well as, channels along many minor tributaries. Deep-water portions of the Bay support the truly pelagic schooling fish such as Atlantic Menhaden (*Brevoortia tyrannus*) and Bay Anchovy (*Anchoa mitchilli*) that are key to the open-water food chain.

Use of the deep-water zone by birds has been relatively little studied within the Chesapeake Bay. Breeding species that use deeper waters and are capable of exploiting pelagic fish populations include Brown Pelican, Royal Tern, Caspian Tern, and Double-crested

Cormorants. However, most of the use of these resources comes during spring and fall migration when the Bay receives large numbers of consumers such as Northern Gannets, Common and Red-throated Loons, the large tern species, some open-water gulls, and fish-eating seaducks. Although some of these species are resident within the Bay for only a brief period, the Bay appears to play an important role in their annual cycle.

ECOLOGICAL MATRIX FOR CHESAPEAKE BAY WATERBIRDS

The avifauna of the Chesapeake Bay is diverse reflecting the geographic position of the Bay and the wide range of available habitats. In many ways, the Bay is an area of faunal interchange containing a mix of species centered in the southeast or northeast and a passage area for the Atlantic Flyway. Due to the latitude of the Bay and its location within a climate transition, it lies within an area of shifting migratory strategies. Many populations to the north migrate south for the winter, many populations to the south do not migrate, and populations within the Bay exhibit variable migratory status. The Bay is also an area of convergence for species along the Atlantic Coast. Some species migrate to the Bay for the winter months, other species migrate north to the Bay to spend the summer months, while still others oversummer in the Bay as nonbreeding juveniles. For many passage populations, the Bay serves as a significant staging area during either spring or fall migration. Relationships between waterbirds and the Chesapeake Bay are species-specific and complex. In order to describe these relationships we have constructed a conceptual model for the purpose of organizing pertinent information (Figure 1). We have stratified information within several geographic scales including global, continental, bird conservation region, and within Chesapeake Bay (Figure 2).

The ecological model describes interactions of waterbird populations with the environment. This conceptual model provides an outline through which changes in population sizes can be understood. Populations of each species are dependent upon habitats used for breeding, roosting and foraging. Foraging is an important mechanism by which populations interact with their environment, which is measured in terms of diet and energy demands. Rates of energy acquisition from food resources define the quality of foraging habitats. The quantity and quality of all habitats influence reproductive and survival rates, which in turn affect the size of the population that the Chesapeake Bay can support. Threats faced by waterbirds alter interactions of elements in the ecological model, affect reproduction and survival, and reduce habitat quality.

Organization of Materials

Information that forms the ecological matrix is presented in a series of data tables (Appendix A, Tables A.1 – A.7). Table A.1 includes taxonomy (including scientific names of birds) and population status. Table A.2 describes population sizes and trends at different spatial scales and distribution within Chesapeake Bay for each species. We present data on timing of activities (phenolgy, Table A.3), resource use (Table A.4), demography (Table A.5), and threats (Table A.6) for each species relevant to their use of the Chesapeake Bay. These data provide insight into the importance of the Chesapeake Bay to each population of waterbird (Table A.7) and provide baseline data from which future monitoring efforts will be developed.

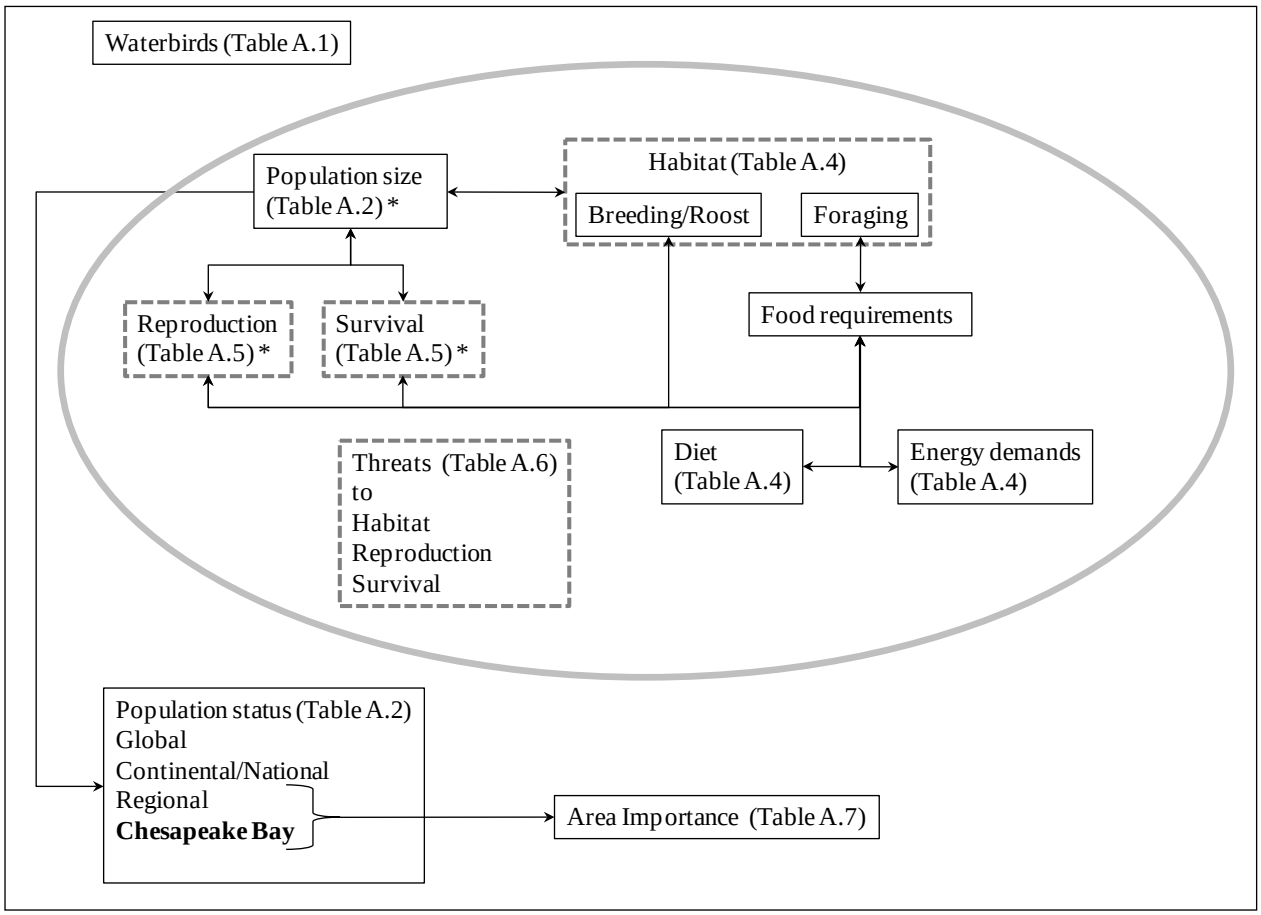

Figure 1. The ecological model (oval) includes data collated for waterbirds of the Chesapeake Bay as well as population status and area importance. Elements in boxes are provided in the ecological matrix (Appendix A).

Species List and Status (Table A.1)

We define a waterbird as a bird whose life history depends upon habitat types that are influenced by tidal flow of water in the Chesapeake Bay. We include species that are present in the bay every year. By this definition, waterbirds include 124 species that fall into several groups or guilds including 30 waterfowl, 8 pelagic waterbirds, 27 colonial waterbirds, 4 raptors, 25 marshbirds, 26 shorebirds, and 4 others waterbirds. The conservation status or rankings of these species were provided on a global, national, and state level as they have been determined by agencies or organizations operating at these respective scales.

Population Estimates (Table A.2)

Estimates of population size were taken from various literature sources. Most of these estimates were not the result of systematic surveys with known error rates but were compiled opportunistically and so vary in quality and time frame. Where possible and as appropriate, estimates are provided for populations using the Chesapeake Bay. Global and continental estimates are provided for context. Estimates from the various sources were often presented in

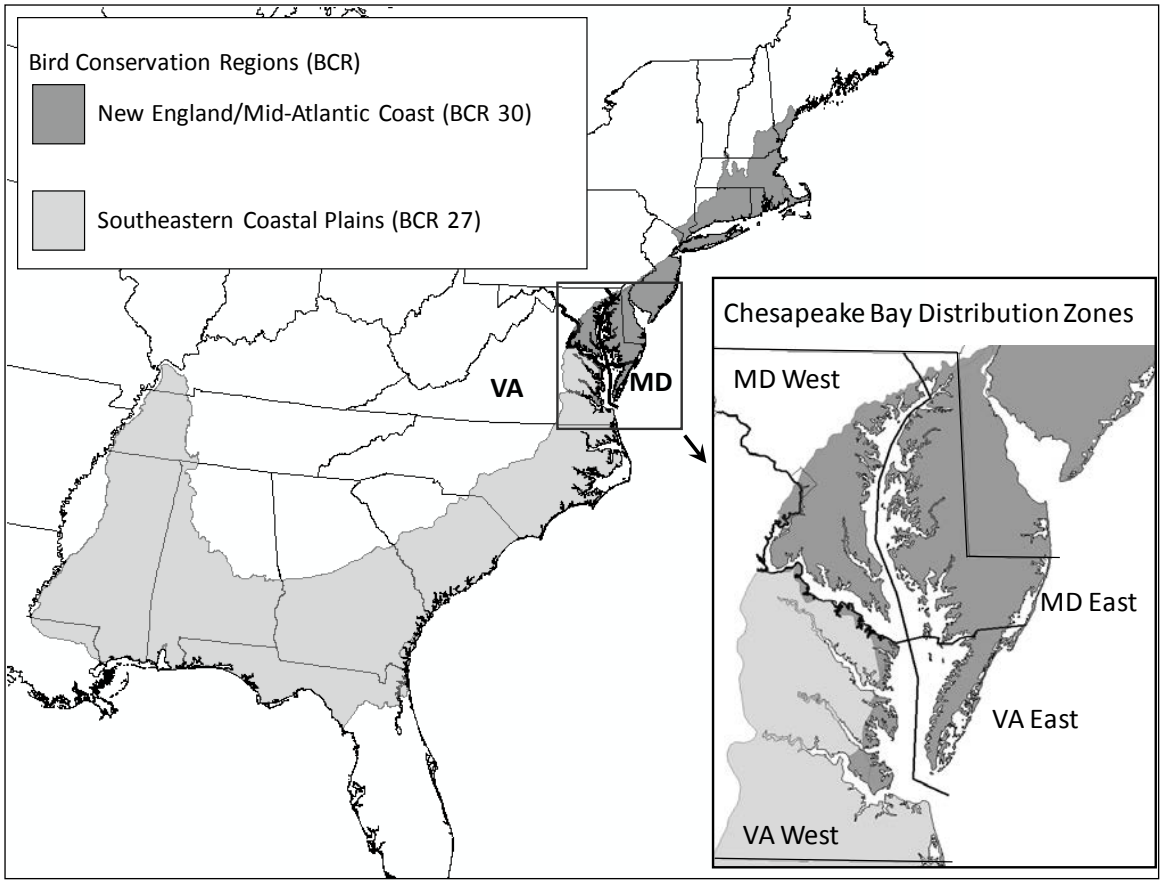

Figure 2. a) Two Bird Conservation Regions (The New England/Mid-Atlantic Coast and Southeastern Coastal Plains) meet along the shorelines of the Chesapeake Bay. Together, these BCRs constitute the region used for the Ecological Model. b) The Chesapeake Bay is divided into 4 zones (MD West, MD East, VA West, and VA East) that are used to describe distribution of each species of waterbird within the Chesapeake Bay.

different units. For example, in the waterbird plan (Kushlan et al. 2002) population estimates are presented in units of breeding adults reflecting the fact that majority of these estimates were made from surveys of breeding pairs. By comparison, the shorebird plan (Brown et al 2001) presents estimates as total individuals. Although units are reported along with estimates, there has been no attempt here to convert estimates from breeding adults to total individuals.

Phenology (Table A.3)

The relationship of populations to the Chesapeake Bay is species-specific and complex. Seasonality of occurrence is an indicator of the ecological role that a location plays in the life cycle of a species and waterbirds vary widely in their occurrence within the Chesapeake Bay. Information on seasonality of occurrence was compiled from available literature sources. Information is presented in two-week intervals on the occurrence of nonbreeding individuals, migratory individuals, and breeding individuals. Information on the timing of breeding was further subdivided into breeding stages including singing, breeding, and the presence of eggs.

Resource Use and Energetics (Table A.4)

Patterns of resource use define the specific set of services that a location provides to a species. Such information is critical to understanding how a species depends on the location. Information was compiled from available literature sources on patterns of habitat use, food requirements, and energetic demand. Because habitat and food requirements were obtained from published sources they should not be considered complete assessments of the full range of resources used by these species in the Chesapeake Bay. Estimates of metabolic demand varied widely in techniques used, units reported, and season of estimate. Estimates were presented as reported with no attempt to standardize across studies.

Demography (Table A.5)

Demographic parameters provide the balance sheet for understanding population trends over time. A broad range of vital rates was compiled from the literature including age-specific survival, age to first reproduction, clutch size, breeding success and reproductive rate. Field and estimation techniques varied widely across these sources and no effort was made to standardize values. In addition to vital rates, information on development period including incubation time, age to fledging, and age to independence was provided. When possible, local estimates were provided. However, for most species local estimates have not been made and for many species no estimates exist.

Threats (Table A.6)

Effective conservation depends on identifying and ameliorating the threats that populations are experiencing. Three categories of threats to waterbird species were compiled from literature sources including threats to habitat, threats to reproduction, and threats to survival. Because these threats were compiled from available literature sources they do not represent the full range of threats that these species are experiencing. Similarly, because these sources span a broad time window, these threats may not be currently operating within the Bay or may not be relevant to the focal species.

Importance of the Bay (Table A.7)

Management plans for birds have defined regional importance based upon densities or population sizes relative to other regions and larger spatial scales (Watts 1999, Clark et al. 2000, Hunter 2002, North American Waterfowl Management Plan - Plan Committee 2004, Hunter et al. 2006, MANEM Waterbird Working Group 2006). We summarized these values for the region such that *Very important* included published categories of extremely and very important (shorebirds and waterbirds), high importance (waterfowl), and relative densities of 4-5 with greater than 20% of the global population in the region (landbirds). We defined *Important* as regional categories of important, moderately high and moderate importance, and relative densities of 4-5 with less than 20% of the global population in the region. Birds were considered *Present* when they are found within the region at some time during the year.

OVERVIEW OF THREATS TO WATERBIRDS

Four generalized threat categories were examined with respect to the waterbird community that depends on the Chesapeake Bay. Threats include factors that may impact the services that the Bay provides to populations or may impact species directly through demographic perturbations. Most of the indirect threats are mediated through critical habitats. Threats considered include habitat loss and degradation, invasive species, human disturbance, and predation.

Habitat Loss and Degradation

Loss and degradation of habitat used by waterbirds is the greatest long-term threat to their populations. Once habitat is altered, restoration becomes extremely costly and the habitat may never provide resources in the same capacity as unaltered areas. Habitat loss represents the total removal of ecological services to bird communities that once used a specific area, while degradation is the partial removal of services. With such loss and degradation, the capacity of the Chesapeake Bay to support populations is reduced. The loss of Bay islands and marshes is an example of ongoing habitat loss.

For some species, not just the type of habitat but the size of habitat patches is an important attribute that determines use. Several marshbirds in the Chesapeake Bay are area sensitive such that the number of species found in a patch of marsh decreases with size (Watts 1992, Watts 1993, Shriver et al. 2004, Wells et al. 2008). The majority (74 species or 60%) of waterbirds from the Chesapeake Bay face threats due to habitat loss, degradation and fragmentation. Effected species belong to all waterbird guilds, although species in some guilds are more affected than others. These include 80% of waterfowl and marshbirds, 75% of other waterbirds, and 63% of colonial waterbird. Raptors (50%), shorebirds (27%), and pelagic waterbirds (13%) are much less affected by habitat loss and degradation. The single most important habitat type that is threatened with continued loss is marshes, accounting for threats faced by 59 species. An additional 10 species of waterfowl are faced with degradation of habitat in shallow- and deep-water zones, which are manifested as reductions in SAV coverage and bivalve populations.

Invasive species

Invasive or exotic species often results in degradation of habitat. A number of examples of this in the Chesapeake Bay impact waterbirds including the expansion of common reed in tidal marshes, impacts of introduced Mute Swans on SAV, and impact of nutria on marsh vegetation. Common reed expansion in salt marshes decreases the abundance and diversity of birds as dense stands of this plant crowd out native species (Benoit and Askins 1999). Common reed has been identified as a threat to 18 species of waterbirds, including 16 (64%) marshbirds, 1 shorebird, and 1 colonial waterbird. Expansion of the Mute Swan population has decreased coverage of SAV, especially in areas where non-breeding flocks congregate (Perry 2004). Species are threatened by reduced availability of SAV include 12 (40%) species of waterfowl that depend on this food resource.

Human Disturbance

The behavior of many species of waterbirds is influenced by presence of humans. This influence can range from the presence of boats in foraging areas for waterfowl (Perry et al. 2007), disturbance adjacent to nesting areas of colonial waterbirds (Wiese 1978), or presence of people in foraging and breeding areas of shorebirds (Dinsmore et al. 1998, Burger et al. 2004). Human disturbance can decrease foraging rates, prevent use of high-quality foraging areas, and increase energy expended by birds to avoid people. During the breeding season, disturbance can reduce time that waterbirds incubate eggs, and brood or feed young, thereby reducing overall reproductive performance. A total of 49 species face threats due to human disturbance. The most affected group is colonial waterbirds (25 species, 93%), which are prone to reduced productivity when people enter breeding colonies. Other groups that face this threat include waterfowl (13 species, 43%), shorebirds (6 species, 23%), and marshbirds (5 species, 20%).

Predation

Most waterbirds that breed within the Chesapeake Bay are vulnerable to ground predators and historically breeding has been restricted to locations isolated from predator populations. Ground predators that access nesting grounds consume eggs and young and may kill adults. Increases in predator populations and associated dispersal to isolated habitats pose an increasing threat to breeding areas. Predator species that are of greatest concern include raccoons (Procyon lotor), red fox (Vulpes vulpes), and feral cats (Felis catus) but also include growing populations of Great Black-backed Gulls. Waterbird guilds potentially affected include colonial waterbirds (20 species, 74%), shorebirds (7 species, 27%), marshbirds (4 species, 16%), and waterfowl (1 species, 3%).

CONCLUSIONS

The Chesapeake Bay provides habitat and resources to 124 species of waterbirds throughout the year. Existing knowledge of the waterbirds allows us to identify a few species for which the Chesapeake Bay is important to their populations. Those ranked highest include the American Black Duck, Brown Pelican, Great Blue Heron, Great Egret, Snowy Egret, Tricolored Heron, Glossy Ibis, Osprey, Bald Eagle, Black Rail, King Rail, Forester's Tern and Coastal Plain Swamp Sparrow. The size of this list reflects our lack of knowledge about a large number of species and the services the Bay provides during their annual cycle. Filling these knowledge gaps should be a high priority.

Only a very small group of waterbirds are monitored with enough frequency in the Chesapeake Bay to assess population trends. These programs combine counts of breeders with assessment of breeding productivity for Bald Eagles, American Oystercatchers and American Black Ducks. Other waterbirds that are covered by programs include guilds that are relatively easy to monitor. Waterfowl and colonial waterbirds are seasonally concentrated during winter and breeding seasons, respectively. Birds in these guilds are also large and conspicuous, which makes them relatively easy to count. Most waterbirds are not covered by existing monitoring programs, including the majority of species in guilds of pelagic waterbirds, marshbirds, raptors, shorebirds, and other waterbirds. Monitoring programs have been developed for other

waterbirds, such as secretive marshbirds (Conway 2008); however, such programs have not been implemented widely within the Chesapeake Bay.

By taking into account habitat use, threats, and existing monitoring programs, we can identify waterbird guilds for which developing monitoring programs should be a high priority. Birds that are primarily dependent upon marshes face the greatest threats, including habitat loss, predation, and invasive species. Habitat loss alone threatens 59 (48%) waterbirds in marshbird, waterfowl, shorebird, and raptor guilds. These threats suggest that populations of many marshbirds have already undergone population declines. It appears that Black Rails have nearly disappeared from the Chesapeake Bay (Brinker et al. 2002, Wilson et al. 2009). Additional declines and loss of species may go unnoticed without having programs in place to monitor these populations. Threats faced by birds that use marshes highlight the importance of developing flexible monitoring programs that are based on habitat types. These threats are not specific to individual species or guilds, but affect most species present in that environment.

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APPENDIX A. ECOLOGICAL MATRIX

Contents

Table A.1. Taxonomy and population status of waterbirds of the Chesapeake Bay.

Guild	Common name	Scientific name		Population status[a]			
		Genus	Species	Global	National	Maryland	Virginia
Waterfowl	Snow Goose	*Chen*	*caerulescens*	5 (507)[b]	5B, 5N (507)	4N (507)	NrN (507)
Waterfowl	Canada Goose	*Branta*	*canadensis*	5 (507)	5B, 5N (507)	4B, 5N (507)	3-4 (507)
Waterfowl	Brant	*Branta*	*bernicla*	5 (429)	5B, 5N (507)	3N, GCN (429, 507)	SGCN Tier III (755)
Waterfowl	Mute Swan	*Cygnus*	*olor*	5 (507)	N/A (507)	N/A (507)	N/A (507)
Waterfowl	Trumpeter Swan	*Cygnus*	*buccinator*	4 (507)	4B, 4N (507)	XN (507)	XN (507, 637)
Waterfowl	Tundra Swan	*Cygnus*	*columbianus*	5 (507)	5B, 5N (507)	4N (507)	NrN (507)
Waterfowl	Wood Duck	*Aix*	*sponsa*	5 (507)	N5B, N5N (507)	S5N, S3B (507)	S5 (507)
Waterfowl	Gadwall	*Anas*	*strepera*	5 (507)	5B, 5N (507)	2B, 4N (507)	2B, 3N (507, 637)

Guild	Common name	Scientific name		Population status[a]			
		Genus	Species	Global	National	Maryland	Virginia
Waterfowl	American Wigeon	*Anas*	*americana*	5 (507)	5B, 5N (507)	4N (507)	NrN (507)
Waterfowl	American Black Duck	*Anas*	*rubripes*	5 (507)	5B, 5N (507)	4B, 5N, GCN (429, 507)	4, SGCN Tier II (507, 755)
Waterfowl	Mallard	*Anas*	*platyrhynchos*	5 (507)	5B, 5N (507)	N/A (507)	4 (507)
Waterfowl	Blue-winged Teal	*Anas*	*discors*	5 (507)	5B, 5N (507)	2B, 3-4N (507)	1B, 2N (507, 637)
Waterfowl	Northern Shoveler	*Anas*	*clypeata*	5 (507)	5B, 5N (507)	2N (507)	NrN (507)
Waterfowl	Green-winged Teal	*Anas*	*crecca*	5 (507)	5B, 5N (507)	4N (507)	U (507)
Waterfowl	Northern Pintail	*Anas*	*acuta*	5 (507)	5B, 5N (507)	4N (507)	1 (507)
Waterfowl	Canvasback	*Aythya*	*valisineria*	5 (507)	5B, 5N (507)	3-4N, GCN (429, 507)	NrN (507)
Waterfowl	Redhead	*Aythya*	*americana*	5	5B, 5N	2N	SGCN Tier III

Guild	Common name	Scientific name		Population status[a]			
		Genus	Species	Global	National	Maryland	Virginia
				(507)	(507)	(507)	(755)
Waterfowl	Ring-necked Duck	*Aythya*	*collaris*	5	5B, 5N	2N	NrN
				(507)	(507)	(507)	(507)
Waterfowl	Greater Scaup	*Aythya*	*marila*	5	5B, 5N	4N	SGCN Tier IV
				(507)	(507)	(507)	(755)
Waterfowl	Lesser Scaup	*Aythya*	*affinis*	5	5B, 5N	4N	NrN
				(507)	(507)	(507)	(507)
Waterfowl	Surf Scoter	*Melanitta*	*perspicillata*	5	5B, 5N	4N	NrN
				(507)	(507)	(507)	(507)
Waterfowl	White-winged Scoter	*Melanitta*	*fusca*	5	5B, 5N	3N	NrN
				(507)	(507)	(507)	(507)
Waterfowl	Black Scoter	*Melanitta*	*nigra*	5	5B, 5N	3N	NrN
				(507)	(507)	(507)	(507)
Waterfowl	Long-tailed Duck	*Clangula*	*hyemalis*	5	5B, 5N	4N	NrN
				(507)	(507)	(507)	(507)
Waterfowl	Bufflehead	*Bucephala*	*albeola*	5	5B, 5N	5N	NrN
				(507)	(507)	(507)	(507)
Waterfowl	Common Goldeneye	*Bucephala*	*clangula*	5	5B, 5N	5N	NrN
				(507)	(507)	(507)	(507)

Guild	Common name	Scientific name		Population status[a]			
		Genus	Species	Global	National	Maryland	Virginia
Waterfowl	Hooded Merganser	*Lophodytes*	*cucullatus*	5 (507)	5B, 5N (507)	1B, 2N (430, 507)	4N (507)
Waterfowl	Common Merganser	*Mergus*	*merganser*	5 (507)	5B, 5N (507)	3N (507)	1B, 4N (507, 637)
Waterfowl	Red-breasted Merganser	*Mergus*	*serrator*	5 (507)	5B, 5N (507)	3N (507)	NrN (507)
Waterfowl	Ruddy Duck	*Oxyura*	*jamaicensis*	5 (507)	5B, 5N (507)	3N, GCN (429, 507)	NrN (507)
Pelagic Waterbird	Red-throated Loon	*Gavia*	*stellata*	5 (507)	5B, 5N (507)	3-4N, GCN (429, 507)	NrN (507)
Pelagic Waterbird	Common Loon	*Gavia*	*immer*	5 (507)	4B, 5N (507)	4N, GCN (429, 507)	NrN (507)
Marshbird	Pied-billed Grebe	*Podilymbus*	*podiceps*	5 (507)	5B, 5N (507)	2B, 3N, GCN (429, 430, 507)	1-2B, 3N (507, 637)
Pelagic Waterbird	Horned Grebe	*Podiceps*	*auritus*	5 (507)	5B, 5N (507)	4N, GCN (429, 507)	SGCN Tier IV (755)

Guild	Common name	Scientific name		Population status[a]			
		Genus	Species	Global	National	Maryland	Virginia
Pelagic Waterbird	Red-necked Grebe	*Podiceps*	*grisegena*	5 (507)	5B, 5N (507)	N/A (507)	NrN (507)
Pelagic Waterbird	Eared Grebe	*Podiceps*	*nigricollis*	5 (507)	5B, 5N (507)		
Pelagic Waterbird	Wilson's Storm-Petrel	*Oceanites*	*oceanicus*	5 (507)	5N (507)	N/A (507)	NrN (507)
Pelagic Waterbird	Northern Gannet	*Morus*	*bassanus*	5 (507)	N/A (507)	ZN, GCN (429)	NrN (507)
Colonial Waterbird	Brown Pelican	*Pelecanus*	*occidentalis*	4 (507)	4B, 4N (507)	1B, GCN (429, 430, 507)	2B, 3N, SC (507, 637)
Colonial Waterbird	Double-crested Cormorant	*Phalacrocorax*	*auritus*	5 (507)	5B, 5N (507)	1B, 3-4N (507)	2B, 4-5N (507)
Marshbird	American Bittern	*Botaurus*	*lentiginosus*	4 (507)	5B, 5N (507)	1-2 B, 1N, INC, GCN (429, 430, 507)	1B, 2N, SGCN Tier II (507, 637, 755)
Marshbird	Least Bittern	*Ixobrychus*	*exilis*	5	5B, 5N	2-3B, INC, GCN	3B, 3N, SGCN Tier III

Guild	Common name	Scientific name		Population status[a]			
		Genus	Species	Global	National	Maryland	Virginia
				(507)	(507)	(429, 430, 507)	(507, 637, 755)
Colonial Waterbird	Great Blue Heron	*Ardea*	*herodias*	5	5B, 5N	4B, 3-4N, GCN	3B, 4N
				(507)	(507)	(429, 507)	(507)
Colonial Waterbird	Great Egret	*Ardea*	*alba*	5	5B, 5N	4B, GCN	2-3B, 3N, SC
				(507)	(507)	(429, 507)	(507, 637)
Colonial Waterbird	Snowy Egret	*Egretta*	*thula*	5	5B, 5N	3-4B, GCN	2B, 3N, SC
				(507)	(507)	(429, 507)	(507, 637)
Colonial Waterbird	Little Blue Heron	*Egretta*	*caerulea*	5	5B, 5N	3B, GCN	2B, 3N, SC, SGCN Tier II
				(507)	(507)	(429, 430, 507)	(507, 637, 755)
Colonial Waterbird	Tricolored Heron	*Egretta*	*tricolor*	5	5B, 5N	3B, GCN	2B, 3N, SC, SGCN Tier III
				(507)	(507)	(429, 430, 507)	(507, 637, 755)
Colonial Waterbird	Cattle Egret	*Bubulcus*	*ibis*	5	5B, 5N	3-4B	N/A
				(507)	(507)	(507)	(507)
Colonial Waterbird	Green Heron	*Butorides*	*virescens*	5	5B, 5N	5B	5, SGCN Tier IV
				(507)	(507)	(507)	(507, 755)

Guild	Common name	Scientific name		Population status[a]			
		Genus	Species	Global	National	Maryland	Virginia
Colonial Waterbird	Black-crowned Night-Heron	*Nycticorax*	*nycticorax*	5 (507)	5B, 5N (507)	3B, 2N, GCN (429, 507)	3B, 4N, SGCN Tier III (507, 755)
Colonial Waterbird	Yellow-crowned Night-Heron	*Nyctanassa*	*violacea*	5 (507)	5B, 5N (507)	2B, GCN (429, 430, 507)	2-3B, 3N, SC, SGCN Tier II (507, 637, 755)
Colonial Waterbird	White Ibis	*Eudocimus*	*albus*	5 (507)	5B, 5N (507)	nl	1B (507, 637)
Colonial Waterbird	Glossy Ibis	*Plegadis*	*falcinellus*	5 (507)	4B, 4N (507)	4B, GCN (429, 507)	2B, 1N, SC, SGCN Tier III (507, 637, 755)
Raptor	Osprey	*Pandion*	*haliaetus*	5 (507)	5B, 4N (507)	4B (507)	4 (507)
Raptor	Bald Eagle	*Haliaeetus*	*leucocephalus*	5 (507)	5B, 5N (507)	2-3B, 3N, GCN, T (429, 430, 507)	2-3B, 3N, T, SGCN Tier II (507, 637, 755)

Guild	Common name	Scientific name		Population status[a]			
		Genus	Species	Global	National	Maryland	Virginia
Raptor	Northern Harrier	*Circus*	*cyaneus*	5 (507)	5B, 5N (507)	2B, 4N, GCN (429, 430, 507)	1-2B, 3N, SC, SGCN Tier III (507, 637, 755)
Marshbird	Yellow Rail	*Coturnicops*	*noveboracensis*	4 (507)	3B, 4N (507)	nl	SGCN Tier IV (755)
Marshbird	Black Rail	*Laterallus*	*jamaicensis*	4 (507)	3-4B, 3-4N (507)	1, E, GCN (429, 430)	2B, 2N, SGCN Tier 1 (507, 637, 755)
Marshbird	Clapper Rail	*Rallus*	*longirostris*	5 (507)	5B, 5N (507)	3-4B, 3N (507)	5, SGCN Tier IV (507, 755)
Marshbird	King Rail	*Rallus*	*elegans*	4 (507)	4B, 4N (507)	3-4B, 2N, GCN (429, 430, 507)	2B, 3N, SGCN Tier II (507, 637, 755)
Marshbird	Virginia Rail	*Rallus*	*limicola*	5 (507)	5B, 5N (507)	4B, 4N (507)	2B, 3N, SGCN Tier IV (637, 755)

Guild	Common name	Scientific name		Population status[a]			
		Genus	Species	Global	National	Maryland	Virginia
Marshbird	Sora	*Porzana*	*carolina*	5 (507)	5B, 5N (507)	1B, 2N (430, 507)	1B, 2N (507, 637)
Marshbird	Common Moorhen	*Gallinula*	*chloropus*	5 (507)	5B, 5N (507)	2B, AN, INC, GCN (429, 430, 507)	1B, 1N, SC (507, 637)
Marshbird	American Coot	*Fulica*	*americana*	5 (507)	5B, 5N (507)	3N (507, 507)	1B, 5N (507, 637)
Shorebird	Black-bellied Plover	*Pluvialis*	*squatarola*	5 (507)	5B, 5N (507)	S3N, GCN (429, 507)	SNRN, SGCN Tier IV (507, 755)
Shorebird	Wilson's Plover	*Charadrius*	*wilsonia*	5 (507)	4B, NrN (507)	1B, E, GCN (429, 430, 507)	1B, E, SGCN Tier I (507, 637, 755)
Shorebird	Semipalmated Plover	*Charadrius*	*semipalmatus*	5 (507)	5B, 5N (507)	N/A (507)	N/A (507)
Shorebird	Piping Plover	*Charadrius*	*melodus*	3 (507)	3B, 3N, T (507, 739)	1B, AN, E, GCN (429, 430,	2B, 1N, T, SGCN Tier I (507, 637,

Guild	Common name	Scientific name		Population status[a]			
		Genus	Species	Global	National	Maryland	Virginia
						507)	755)
Shorebird	Killdeer	*Charadrius*	*vociferus*	5 (507)	5 (507)	5B, 4N (507)	5 (507)
Shorebird	American Oystercatcher	*Haematopus*	*palliatus*	5 (507)	5B, 5N (507)	3B, AN, GCN (429, 430, 507)	3B, 3N, SGCN Tier II (507, 637, 755)
Shorebird	Black-necked Stilt	*Himantopus*	*mexicanus*	5 (507)	5B, 5N (507)	nl	1B (507, 637)
Shorebird	Greater Yellowlegs	*Tringa*	*melanoleuca*	5 (507)	5B, 5N (507)	1N, GCN (429, 507)	NrN (507)
Shorebird	Lesser Yellowlegs	*Tringa*	*flavipes*	5 (507)	5B, 5N (507)	1N (507)	N/A (507)
Shorebird	Solitary Sandpiper	*Tringa*	*solitaria*	5 (507)	4B, 5N (507)	ZN, GCN (429, 507)	N/A (507)
Shorebird	Willet	*Tringa*	*semipalmata*	5 (507)	5B, 5N (507)	3-4B, GCN (429, 507)	4 (507)
Shorebird	Spotted Sandpiper	*Actitis*	*macularius*	5 (507)	5B, 5N (507)	3-4B (430, 507)	2B (507, 637)

Guild	Common name	Scientific name		Population status[a]			
		Genus	Species	Global	National	Maryland	Virginia
Shorebird	Whimbrel	*Numenius*	*phaeopus*	5 (507)	5B, 5N (507)	ZN, GCN (429, 507)	SGCN Tier IV (755)
Shorebird	Marbled Godwit	*Limosa*	*fedoa*	5 (507)	5B, 5N (507)	N/A (507)	SGCN Tier IV (755)
Shorebird	Ruddy Turnstone	*Arenaria*	*interpres*	5 (507)	5B, 5N (507)	1N, GCN (429, 507)	NrN (507)
Shorebird	Red Knot	*Calidris*	*canutus*	4 (507)	3N, 4B (507)	ZN, GCN (429, 507)	1N, SGCN Tier IV (507, 755)
Shorebird	Sanderling	*Calidris*	*alba*	5 (507)	4B, 5N (507)	3N, GCN (429, 507)	NrN (507)
Shorebird	Semipalmated Sandpiper	*Calidris*	*pusilla*	5 (507)	5B (507)	ZN, GCN (429, 507)	NrN (507)
Shorebird	Western Sandpiper	*Calidris*	*mauri*	5 (507)	5B, 5N (507)	N/A (507)	NrN (507)
Shorebird	Least Sandpiper	*Calidris*	*minutilla*	5 (507)	5B, 5N (507)	N/A (507)	N/A (507)

Guild	Common name	Scientific name		Population status[a]			
		Genus	Species	Global	National	Maryland	Virginia
Shorebird	Purple Sandpiper	*Calidris*	*maritima*	5 (507)	5N (507)	2N, GCN (429, 507)	NrN, SGCN Tier IV (507, 755)
Shorebird	Dunlin	*Calidris*	*alpina*	5 (507)	5B, 5N (507)	3N, GCN (429, 507)	NrN, SGCN Tier IV (507, 755)
Shorebird	Short-billed Dowitcher	*Limnodromus*	*griseus*	5 (507)	5B, 5N (507)	ZN, GCN (429, 507)	SGCN Tier IV (755)
Shorebird	Long-billed Dowitcher	*Limnodromus*	*scolopaceus*	5 (507)	5B, 5N (507)	N/A (507)	NrN (507)
Shorebird	Wilson's Snipe	*Gallinago*	*delicata*	5 (507)	5B, 5N (507)	2N, GCN (429, 507)	NrN (507)
Shorebird	American Woodcock	*Scolopax*	*minor*	5 (507)	5B, 5N (507)	4B, 4N, GCN (429, 507)	5, SGCN Tier IV (507, 755)
Pelagic Waterbird	Bonaparte's Gull	*Larus*	*philadelphia*	5 (507)	5B, 5N (507)	2N (507)	NrN (507)
Colonial Waterbird	Laughing Gull	*Larus*	*atricilla*	5 (507)	5B, 5N (507)	1B, 4N, GCN (429, 430,	3-4 (507)

Guild	Common name	Scientific name		Population status[a]			
		Genus	Species	Global	National	Maryland	Virginia
						507)	
Colonial Waterbird	Ring-billed Gull	*Larus*	*delawarensis*	5 (507)	5B, 5N (507)	5N (507)	nl
Colonial Waterbird	Herring Gull	*Larus*	*argentatus*	5 (507)	5B, 5N (507)	5B, 5N (507)	4N (507)
Colonial Waterbird	Lesser Black-backed Gull	*Larus*	*fuscus*	5 (507)	2-3N (507)	N/A (507)	N/A (507)
Colonial Waterbird	Great Black-backed Gull	*Larus*	*marinus*	5 (507)	5B, 5N (507)	4B, 4N (507)	4 (507)
Colonial Waterbird	Gull-billed Tern	*Gelochelidon*	*nilotica*	5 (507)	4B, 4N (507)	1B, E, GCN (429, 430)	S2B, T, SGCN Tier I (637, 755)
Colonial Waterbird	Caspian Tern	*Hydroprogne*	*caspia*	5 (507)	4-5B, 4N (507)	N/A (507)	1B, 2N, SC (507, 637)
Colonial Waterbird	Royal Tern	*Thalasseus*	*maximus*	5 (507)	5B, 5N (507)	1B, E, GCN (429, 430, 507)	2B, SGCN Tier II (507, 637, 755)
Colonial Waterbird	Sandwich Tern	*Thalasseus*	*sandvicensis*	5 (507)	4B, 4N (507)	1B, GCN (429, 430, 507)	1B, SC (507, 637)

Guild	Common name	Scientific name		Population status[a]			
		Genus	Species	Global	National	Maryland	Virginia
Colonial Waterbird	Forster's Tern	*Sterna*	*forsteri*	5 (507)	5B, 5N (507)	4B, GCN (429, 507)	3B, 3N, SGCN Tier IV (507, 755)
Colonial Waterbird	Common Tern	*Sterna*	*hirundo*	5 (507)	5B (507)	4B, GCN (429, 507)	3B, SGCN Tier III (507, 755)
Colonial Waterbird	Roseate Tern	*Sterna*	*dougallii*	4T3 (507)	E, 2N, 3B (507, 739)	HB, AN, X, GCN (429, 430, 507)	HB, E, SGCN Tier IV (507, 637, 755)
Colonial Waterbird	Least Tern	*Sternula*	*antillarum*	4 (507)	4B (507)	2B, T, GCN (429, 430, 507)	2B, SGCN Tier II (507, 637, 755)
Colonial Waterbird	Black Skimmer	*Rynchops*	*niger*	5 (507)	5B, 5N (507)	E, 1B, GCN (429, 430)	2B, 1N, SGCN Tier II (507, 755)
Raptor	Short-eared Owl	*Asio*	*flammeus*	5 (507)	5B, 5N (507)	1B, 2N, E, GCN (429, 430, 507)	1B, 2N (637)

Guild	Common name	Scientific name		Population status[a]			
		Genus	Species	Global	National	Maryland	Virginia
Other Waterbird	Belted Kingfisher	*Ceryle*	*alcyon*	5 (507)	5B, 5N (507)	5B, 4N (507)	2B, 1N (637)
Marshbird	Purple Martin	*Progne*	*subis*	5 (507)	5B (507)	5B (507)	5 (507)
Marshbird	Tree Swallow	*Tachycineta*	*bicolor*	5 (507)	5B, 5N (507)	4B (507)	5 (507)
Other Waterbird	Northern Rough-winged Swallow	*Stelgidopteryx*	*serripennis*	5 (507)	5B, 5N (507)	4B (507)	5, SGCN Tier IV (507, 755)
Other Waterbird	Bank Swallow	*Riparia*	*riparia*	5 (507)	5B (507)	3-4B, GCN (429, 430, 507)	3B (507, 637)
Other Waterbird	Cliff Swallow	*Petrochelidon*	*pyrrhonota*	5 (507)	5B (507)	3-4B (507)	3-4B (507, 637)
Marshbird	Sedge Wren	*Cistothorus*	*platensis*	5 (507)	4B, 5N (507)	1B, E, GCN (429, 430, 507)	1B, 1-2N, SC, SGCN Tier III (507, 637, 755)
Marshbird	Marsh Wren	*Cistothorus*	*palustris*	5	5B, 5N	4B, 2N, GCN	4B, SGCN Tier IV

Guild	Common name	Scientific name		Population status[a]			
		Genus	Species	Global	National	Maryland	Virginia
				(507)	(507)	(429, 507)	(507, 755)
Marshbird	Henslow's Sparrow	*Ammodramus*	*henslowii*	4 (507)	3B, 4N (507)	1-2B, T, GCN (429, 430, 507)	1B, T, SGCN Tier I (507, 637, 755)
Marshbird	Nelson's Sparrow	*Ammodramus*	*nelsoni*	5 (507)	3B, 5N (507)	nl	SGCN Tier III (755)
Marshbird	Saltmarsh Sparrow	*Ammodramus*	*caudacutus*	4 (507)	4B, 4N (507)	3B, 1N, GCN (429, 430, 507)	2B, 3N, SC, SGCN Tier II (507, 507, 637, 755)
Marshbird	Seaside Sparrow	*Ammodramus*	*maritimus*	4 (507)	4 (507)	4B, 2N, GCN (429, 507, 507)	4B, SGCN Tier IV (507, 507, 755)
Marshbird	Swamp Sparrow	*Melospiza*	*georgiana*	5 (507)	5B, 5N (507)	4B, 5N (507)	1B, 4-5N (507, 637)
Marshbird	Coastal Plain Swamp Sparrow	*Melospiza*	*georgiana nigrescens*	3 (507)	Nr (507)	2B, ZN, INC, GCN (429, 430, 507)	nl
Marshbird	Bobolink	*Dolichonyx*	*oryzivorus*	5 (507)	5B (507)	3-4B (429, 507)	1B (507)

Guild	Common name	Scientific name		Population status[a]			
		Genus	Species	Global	National	Maryland	Virginia
Marshbird	Red-winged Blackbird	*Agelaius*	*phoeniceus*	5 (507)	5 (507)	5 (507)	5 (507)
Marshbird	Rusty Blackbird	*Euphagus*	*carolinus*	4 (507)	4B, 4N (507)	2-3N (507)	3N, SGCN Tier IV (507, 755)
Marshbird	Boat-tailed Grackle	*Quiscalus*	*major*	5 (507)	5 (507)	3-4, GCN (429, 507)	4 (507)

[a] (1) Critically Imperiled, (2) Imperiled, (3) Vulnerable, (4) Apparently Secure, (5) Secure, (A) Accidental, (B) Breeding, (E) Endangered, (GCN) Greatest conservation need, (INC) In need of conservation, (N) Nonbreeding, (N/A) Not applicable, (nl) Not listed, (Nr) Not ranked, (SC) Special concern, (SGCN) Species of greatest conservation need (Tier I – most imperiled, Tier IV – least imperiled), (T) Threatened, (U) Unrankable, (X) Presumed extirpated, (Z) Species would not greatly benefit from protection because of transient nature.

[b] References are given in parentheses below data.

Table A.2. Population sizes, trends, and distribution of waterbirds of the Chesapeake Bay.

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
			Region[a]					
	Global	North America	BCR 30	BCR 27	Chesapeake Bay	Region	Chesapeake Bay	
Snow Goose		4,045,000 (529)[c]				Increasing (741)		All (342, 647)
Canada Goose	5,377,000 (741)	5,377,000 (741)			24,273 bp (157)	Increasing (breeding) - Stable (winter) (741)	Increasing (157)	All (342, 647)
Brant		318,000 (741)				Increasing (741)		All (342, 647, 706)
Mute Swan					>4000 (157)		Increasing (157)	All (342, 647)
Trumpeter Swan		23,600 (529)			Extirpated			All (30, 352)
Tundra Swan		205,000 (741)				Increasing (741)		All (342, 647, 706, 709)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a] BCR 30	Region[a] BCR 27	Chesapeake Bay	Region	Chesapeake Bay	
Wood Duck	10,000 - 1,000,000 (507)	4,600,000 (529)			15,343 bp (157)	Stable (741)	Decreasing (157)	All (342, 647, 706)
Gadwall		3,900,000 (529)				Stable (741)		All (342, 469, 647, 706)
American Wigeon		3,100,000 (529)				Decreasing (741)		All (342, 647, 706)
American Black Duck		910,000 (529)			3,658 bp (157)	Decreasing (741)	Decreasing (157)	All (342, 647, 706)
Mallard		13,000,000 (529)	664,000 b (741)		43,575 bp (157)	Decreasing (741)	Stable (157)	All (342, 470, 647)
Blue-winged Teal		7,240,000 (529)				Stable (741)		All (342, 468, 647, 706)
Northern Shoveler		3,800,000 (529)				Stable (741)		All (342, 647, 706)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a]		Chesapeake Bay	Region	Chesapeake Bay	
			BCR 30	BCR 27				
Green-winged Teal		3,900,000 (529)				Stable (741)		All (342, 647, 706)
Northern Pintail		3,600,000 (529)				Decreasing (741)		All (342, 647, 706)
Canvasback		740,000 (529)				Decreasing (741)	Stable (573)	All (342, 647, 706)
Redhead		1,200,000 (529)			282 (573)	Stable (741)	Stable (573)	All (342, 647, 706)
Ring-necked Duck		2,000,000 (529)				Increasing (741)	Increasing (573)	All (342, 504, 706)
Greater Scaup		800,000 (529)						All (342, 706, 708)
Lesser Scaup		4,400,000 (529)						All (342, 647, 706)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a]		Chesapeake Bay	Region	Chesapeake Bay	
			BCR 30	BCR 27				
Surf Scoter		600,000 (529)					Decreasing (573)	All (342, 647, 706)
White-winged Scoter		600,000 (529)					Decreasing (573)	All (342, 647, 706)
Black Scoter		400,000 (529)					Decreasing (573)	All (342, 647, 706)
Long-tailed Duck		1,000,000 (529)				Decreasing (741)	Decreasing (573)	All (342, 647, 706)
Bufflehead		1,400,000 (529)				Increasing (741)	Increasing (573)	All (342, 647, 706)
Common Goldeneye		1,345,000 (529)				Decreasing (741)	Decreasing (573)	All (342, 647, 706)
Hooded Merganser		350,000 (529)				Increasing (741)	Increasing (573)	All (342, 504, 647, 706)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a] BCR 30	Region[a] BCR 27	Chesapeake Bay	Region	Chesapeake Bay	
Common Merganser		1,000,000 (529)				Stable (741)	Increasing (573)	All (342, 647, 706)
Red-breasted Merganser		250,000 (529)					Increasing (573)	All (342, 647, 706)
Ruddy Duck		1,102,000 (529)					Increasing (573)	All (342, 504, 706)
Red-throated Loon	490,000 - 1,500,000 (424)	375,000 (424)	100,000 nb (424)		14,000 nb Forsell 1994 as cited by (251)			All (342, 647, 706)
Common Loon	580,000 - 639,000 (237, 424, 809)	575,000-634,000 (237, 424)	9,970 b (424)			Decreasing (424)		All (342, 647, 706)
Pied-billed Grebe	>110,000-130,000 (424)	North America 125,000 (424)		1,333 bp (340)		Stable - Increasing (340, 424)		All (84, 647)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a] BCR 30	Region[a] BCR 27	Chesapeake Bay	Region	Chesapeake Bay	
Horned Grebe	160,000-1,200,000 (424)	>100,000 (424)						All (342, 647)
Red-necked Grebe	150,000 - 370,000 (424)	45,000 (424)						All (342, 647, 706)
Eared Grebe		3.5 - 4.1 million (390)						All (342, 647)
Wilson's Storm-Petrel	6,000,000 (424)							All (342, 647, 706)
Northern Gannet	530,000 (424)	155,000 (424)	107,000 (424)			Increasing (340, 424)		All (342, 647)
Brown Pelican		191,000 - 194,000 (424)	1,008 b (424)	14,600 bp (340)	1,272 bp (82, 781, 787)	Increasing (340, 424)	Stable - Increasing (82, 781, 787, 830)	All (82, 342, 647, 779, 781)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a] BCR 30	Region[a] BCR 27	Chesapeake Bay	Region	Chesapeake Bay	
Double-crested Cormorant	1,100,000 - 2,200,000 (424)	>740,000 (424)	29,708 b (424)	2,060 bp (340)	3,232 bp (82, 781, 787)	Increasing (424, 839)	Increasing (82, 781, 787)	All (82, 135, 342, 777, 779, 781)
American Bittern	3,000,000 (424)	3,000,000 (424)				Decreasing (271, 340)		All (84, 342, 647)
Least Bittern	>130,000 (424)	128,000 (424)		3,333 bp (340)		Likely decreasing (340)		All (84, 342, 735)
Great Blue Heron		83,000 b (424)	30,570 b (424)	26,700 bp (340)	13,374 bp (780, 781, 833)	Stable - Increasing (340, 424)		All (82, 224, 449, 706, 779, 781)
Great Egret	550,000 - 1,900,000 (424)	>180,000 b (424)	9,142 b (424)	28,244 bp (340)	1,878 bp (780, 781, 833)	Increasing (340, 424)	Increasing (833)	All (82, 224, 342, 449, 779, 781)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a] BCR 30	Region[a] BCR 27	Chesapeake Bay	Region	Chesapeake Bay	
Snowy Egret		>143,555 b (424)	15,402 b (424)	6,800 bp (340)	1,470 bp (781, 787, 833)	Decreasing - Increasing (340, 424, 787)	Stable (787)	All (82, 224, 779, 781)
Little Blue Heron		200,000 - 300,000 b (424)	3,546 b (424)	7,650 bp (340)	328 bp (82, 781, 787)	Decreasing - Increasing (340, 424)	Stable (787)	MD East, MD West, VA East (82, 224, 342, 779, 781)
Tricolored Heron		<194,000 b (424)	4,216 b (424)	6,422 bp (340)	517 bp (781, 787, 833)	Increasing (340, 424)	Stable (787)	MD East, MD West, VA East (82, 224, 779, 781)
Cattle Egret	3,800,000 - 6,700,000 (424)	>750,000 - 1,500,000 (424)	10,328 b (424)	56,826 bp (340)	268 bp (781, 787, 833)	Decreasing (424)	Stable (787)	All (82, 224, 779, 781)
Green Heron			408b (424)	75,900 bp (340)	>60 bp (780, 781, 787)	Decreasing (340)		All (224, 450, 779, 781)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a] BCR 30	Region[a] BCR 27	Chesapeake Bay	Region	Chesapeake Bay	
Black-crowned Night-Heron	430,000 - 3,600,000 (424)	>50,000 b (424)	10,388 b (424)	1,333 bp (340)	364 bp (781, 787, 833)	Decreasing (424)	Stable (787)	MD East, MD West, VA East (82, 224, 779, 781)
Yellow-crowned Night-Heron	85,000 - 160,000 (424)	50,000 - 100,000 b (424)	1,620 b (424)	1,200 bp (340)	447 bp (780, 781, 833)	Increasing (424)	Stable (787)	All (82, 224, 779, 781)
White Ibis	150,000 (424)	>100,000 b (424)	6 b (424)	54,370 bp (340)	(781, 787, 833)	Stable - Increasing (340, 424, 658)		
Glossy Ibis	1,100,000 - 3,300,000 (424)	13,000 - 15,000 b (424)	11,006 b (424)	1,500 bp (340)	563 bp (781, 787, 833)	Increasing (424)	Stable (787)	MD East, MD West, VA East (82, 224, 779, 781, 804)
Osprey	500,000 (616)	200,000 (616)	6,800 (556)	9,600 (556)	3473 bp (784)	Increasing (772)	Increasing (784)	All (321, 784)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a] BCR 30	Region[a] BCR 27	Chesapeake Bay	Region	Chesapeake Bay	
Bald Eagle	300,000 (616)	300,000 (616)	400 (556)	800 (556)		Increasing (740)	Increasing (785, 789)	All (98, 764, 782)
Northern Harrier	1,300,000 (616)	400,000 (616)	200 (556)	130 (556)		Increasing (772)		VA East, VA West (788)
Yellow Rail	10,000 - 25,000 (424)	10,000-25,000 (424)				Decreasing (424)		All (342, 647)
Black Rail		35,000-110,000 (424)		7,230 bp (340)		Decreasing (340, 424)	Decreasing (84)	All (84, 182, 647, 706, 815)
Clapper Rail				17,707 bp (340)	61,270 (837)	Unknown, Possibly Decreasing (340, 424)	Suspected decline based upon habitat losses (135)	All (59, 84)
King Rail				831 bp (340)	19,805 (837)	Decreasing (340, 424, 585)	Decreasing (60, 84)	All (60, 564, 647)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a] BCR 30	Region[a] BCR 27	Chesapeake Bay	Region	Chesapeake Bay	
Virginia Rail					24,452 (837)	Stable (424)	Decreasing (84)	All (83, 84, 816)
Sora						Decreasing (424)	Stable (breeding) - Decreasing (migration) (84, 424, 706)	MD East, MD West (84, 184, 647)
Common Moorhen	1.7-3.3 million (424)			2,767 bp (340)		Stable (424)		MD East, MD West, VA West (84, 647, 704)
American Coot	6.0 million (424)	6.0 million (424)		898 pb (340)		Increasing (424)		VA West, MD East, MD West (467, 647)
Black-bellied Plover	498,000 (488)	200,000 (91, 487, 488)		50,000 (339)				All

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a] BCR 30	Region[a] BCR 27	Chesapeake Bay	Region	Chesapeake Bay	
Wilson's Plover	6,000-30,000 (144, 339, 488)	6,000-30,000 (91, 144, 339, 488)	23-50 (66, 772, 778)	5,000 (339)	(772, 778)	Stable (66, 772, 778)	Decreasing - Former breeder (66)	formerly VA West, currently none
Semipalmated Plover	150,000 (488)	150,000 (91, 488)	>8000 (144)	50,000 (339)				All (342, 647)
Piping Plover	5,913 (488, 583)	5913-6,200 (91, 488, 583)	2,270 (144)	3,000 (339)	<10, currently 0 (66, 772, 778)	Previously decreased then stable, currently increasing (65, 66, 305, 772, 778)	Decreasing - Former breeder (66)	formerly VA West; currently none (66)
Killdeer	>1,000,000 (488)	1,000,000-2,000,000 (91, 488)		300,000 (339)		Stable (657)		All (246, 342, 735)
American Oystercatcher	>58,850 (488)	7,500 - 9,000 (91, 527)		3,900 (339)	120 (825)	Increasing (66, 81, 825)		All (66, 81, 342, 826)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a] BCR 30	Region[a] BCR 27	Chesapeake Bay	Region	Chesapeake Bay	
Black-necked Stilt	>850,000 (488)	150,000 (91, 488)		15,000 (339)			Increasing (183, 647)	All (142, 342)
Greater Yellowlegs	100,000 (488)	100,000 (91, 488)	3,000 (144)	33,000 (339)				All (135, 342)
Lesser Yellowlegs	500,000 (488)	500,000 (91, 488)		165,000 (339)				All (342, 647, 706)
Solitary Sandpiper	25,000 (488)	25,000 (91, 488)		33,000 (339)				All (342, 647)
Willet	250,000 (488)	250,000 (91, 488)		125,000 (339)				All (342, 357, 531)
Spotted Sandpiper	150,000 (488)	150,000 (91, 488)		50,000 (339)				All (142, 342, 627, 647)
Whimbrel	>797,000 (488)	57,000 (91, 488)		19,000 (339)		Decreasing (135)		All (342, 647)
Marbled Godwit	171,000 (91, 339, 488)	171,000 (91, 339, 488)		1,700 (339)				All (342, 647)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a] BCR 30	Region[a] BCR 27	Chesapeake Bay	Region	Chesapeake Bay	
Ruddy Turnstone	449,000 (488)	235,000 (91, 488)	127,600 Clark and Niles as cited in (144)	24,000 (339)				All (647, 706)
Red Knot	1,291,000 (488)	400,000 (91, 488)		20,000 (339)				All (342, 647)
Sanderling	643,000 (488)	300,000 (91, 488)	37,771 (144)	100,000 (339)				All (342, 647)
Semipalmated Sandpiper	3,500,000 (488)	3,500,000 (91, 488)		2,100,000 (339)				All (135, 342, 647)
Western Sandpiper	3,500,000 (488)	3,500,000 (91, 488)		350,000 (339)				All (342, 647, 706)
Least Sandpiper	600,000 (488)	600,000 (91, 488)		150,000 (339)				All (342, 647, 706)
Purple Sandpiper	65,000 (488)	15,000 (91, 488)		1,500 (339)				All (342, 357)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a]		Chesapeake Bay	Region	Chesapeake Bay	
			BCR 30	BCR 27				
Dunlin	1,000,000; >3,934,000 (144, 488)	83,000; 1,525,000 (91, 144, 488)		210,000 (339)				All (342, 647, 706)
Short-billed Dowitcher	320,000 (488)	320,000 (91, 488)		160,000 (339)				All (342, 647)
Long-billed Dowitcher	500,000 (488)	500,000 (91, 488)	>1000 (144)	5,000 (339)				All (342, 647)
Wilson's Snipe		2,000,000 (91, 488)		660,000 (339)				All (342)
American Woodcock	5,000,000 (488)	5,000,000 (488)			Decreasing (155)	Decreasing (155, 362, 659)		All (342, 432, 647, 706)
Bonaparte's Gull	260,000 - 530,000 (424)	255,000 - 525,000						All (342, 647, 706)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a]		Chesapeake Bay	Region	Chesapeake Bay	
			BCR 30	BCR 27				
Laughing Gull	810,000 - 840,000 (424)	528,000 - 538,000 b (424)	202,646 b (424)	46,116 bp (340)	3,912 bp (82, 781, 787)	Increasing (340, 424)	Stable - Increasing (82, 787)	MD East, VA West, VA East (82, 779, 781)
Ring-billed Gull	2,600,000 (424)	1,700,000 b (424)				Increasing (424)		All (342, 647)
Herring Gull	2,600,000 - 3,000,000 (424)	>286,000 b (424)	90,734 b (424)	910 bp (340)	2,243 bp (82, 781, 787)	Increasing (340)	Decreasing (82, 787)	All (82, 224, 779, 781)
Lesser Black-backed Gull	680,000 - 750,000 (424)							All (342, 647)
Great Black-backed Gull	630,000 - 720,000 (424)	160,430 b (424)	37,372 b (424)	181 bp (340)	703 bp (82, 781, 787)	Increasing (340, 424)	Increasing - Stable (82, 781, 787)	All (82, 224, 779, 781)
Gull-billed Tern	79,000-310,000 (424)	6,000-8,000 b (390, 424)	2,418 b (424)	525 bp (340)	16 bp (82, 780, 781)	Decreasing (340, 424, 831)	Decreasing (82, 787, 831)	VA West, VA East (647, 779, 781)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a]		Chesapeake Bay	Region	Chesapeake Bay	
			BCR 30	BCR 27				
Caspian Tern	180,000 - 320,000 (424)	66,000 - 70,000 b (424)	24 b (424)	272 bp (340)	2 bp (82, 781, 787)	Increasing (424)		VA East (779)
Royal Tern	280,000 - 310,000 (424)	100,000 - 150,000 b (424)	6,343 b (424)	29,141 bp (340)	985 bp (82, 781, 787)	Decreasing - Stable (340, 424)	Decreasing - Stable (82, 787)	VA East (779, 781)
Sandwich Tern	460,000 - 500,000 (424)	75,000 - 100,000 b (424)	62 b (424)	5,676 bp (340)	7 bp (82, 780, 781, 787)	Decreasing (340)	Stable (82)	
Forster's Tern	120,000 (424)	120,000 (424)	16,690 b (424)	1,091 bp (340)	2,039 bp (82, 781, 787)	Stable (340, 424)	Stable - Increasing (82, 787)	MD East, VA East (82, 224, 779, 781)
Common Tern	1,100,000 - 4,500,000 (424)	300,000 b (424)	83,834 b (424)	1,226 bp (340)	1,794 bp (82, 781, 787)	Increasing - Decreasing (340, 424)	Decreasing (82, 787)	All (82, 224, 779, 781)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a] BCR 30	Region[a] BCR 27	Chesapeake Bay	Region	Chesapeake Bay	
Roseate Tern	78,000 - 82,000 (424)	16,000 b (424)	6,400 b (424)	0 (340)	0 (82, 780, 781)	Increasing (424)	Former breeder (518, 519)	MD East (82)
Least Tern	65,000 - 70,000 (424)		16,018 b (424)	10,600 bp (340)	1,062 bp (82, 781, 787)	Stable - Decreasing (340, 424)	Stable - Increasing (82, 787)	All (82, 224, 781)
Black Skimmer	120,000 - 210,000 (424)	65,000 - 70,000 b (424)	10,058 b (424)	2,869 bp (340)	213 bp (82, 781, 787)	Stable - Decreasing (340, 424)	Decreasing - Stable (82, 787)	MD East, VA East, VA West (82, 224, 779, 781)
Short-eared Owl	2,000,000 (616)	700,000 (616)						All (342, 647, 706)
Belted Kingfisher	2,000,000 (616)	2,000,000 (616)	5,200 (557)	67,000 (557)	416 bp (774)	Unknown - Decreasing (557)		All (342, 706, 790)
Purple Martin	11,000,000 (616)	10,000,000 (616)	150,000 (557)	2,800,000 (557)		Increasing (772)		All (376, 647)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a] BCR 30	Region[a] BCR 27	Chesapeake Bay	Region	Chesapeake Bay	
Tree Swallow	20,000,000 (616)	20,000,000 (616)	3,000 (557)	86,000 (557)		Unknown - Increasing (557)		All (342, 647, 706)
Northern Rough-winged Swallow	15,000,000 (616)	5,100,000 (616)	23,000 (557)	320,000 (557)	1,703 bp (774)	Decreasing (557)		All (774)
Bank Swallow	46,000,000 (616)	13,800,000 (616)	20,000 (557)	500 (557)	2,313 bp (774)	Unknown (557)		MD East, MD West, VA West (342, 647, 706, 774)
Cliff Swallow	89,000,000 (616)	81,880,000 (616)	2,000 (557)	50,000 (557)		Unknown (557)		All (560, 647, 706, 783)
Sedge Wren	6,500,000 (616)	6,500,000 (616)				Decreasing (557)	Decreasing (61)	All (342, 647, 706, 769)
Marsh Wren	8,000,000 (616)	8,000,000 (616)				Decreasing (557, 772)		All (342, 647, 706)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a] BCR 30	Region[a] BCR 27	Chesapeake Bay	Region	Chesapeake Bay	
Henslow's Sparrow	80,000 (616)	80,000 (616)	30 (557)	3,000 (557)		Unknown - Decreasing (557)	Decreasing (837)	All (342, 647)
Nelson's Sparrow	500,000 (616)	500,000 (616)						All (342, 647)
Saltmarsh Sparrow	250,000 (616)	250,000 (616)					Stable (135)	All (371, 531, 647, 706, 769, 775)
Seaside Sparrow	110,000 (616)	110,000 (616)	20,000 (557)	20,000 (557)				All (532, 647)
Swamp Sparrow	9,000,000 (616)	9,000,000 (616)	17,000 (557)					All (342, 647)
Coastal Plain Swamp Sparrow	28,000 (36)	28,000 (36)				Decreasing (36)	Decreasing (36)	MD East, MD West, VA West (68, 299, 765)
Bobolink	11,000,000 (616)	11,000,000 (616)	38,000 (557)					All (342, 647, 706)

Common name	Population size					Population trend		Chesapeake Bay Distribution[b]
	Global	North America	Region[a]		Chesapeake Bay	Region	Chesapeake Bay	
			BCR 30	BCR 27				
Red-winged Blackbird	210 million (616)	190 million (616)	970,000 (557)	3,400,000 (557)		Unknown - Increasing (557)		All (342, 647)
Rusty Blackbird	2,000,000 (616)	2,000,000 (616)				Decreasing (300)		All (342, 504, 647)
Boat-tailed Grackle	4,000,000 (616)	4,000,000 (616)	40,000 (557)	200,000 (557)		Increasing (557, 772)	Increasing (530, 647)	All (342, 647, 706)

[a] Regional population size given for BCR 30 Mid-Atlantic/New England Maritimes and 27 Southeastern Coastal Plain (**Error! Reference source not found.**).

[b] Distribution given for western (mainland) and eastern (Delmarva Peninsula) shores of Maryland and Virginia (**Error! Reference source not found.**).

[c] References are given in parentheses below data.

Table A.3. Phenology[a] for waterbirds of the Chesapeake Bay given by 2 week intervals for each month.

Common name	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4
Snow Goose	■	■	■	■♦	■♦	□◊	□◊												□◊	□◊	■♦	■♦	■♦	■
(342, 499, 647, 706)																								
Canada Goose	■	■	■◊	■♦	■♦	♦	♦	◊										◊	♦	♦	■♦	■◊	■	■
							◘○	◙●	◙●	◙●	◙○	◙	◙	◙	◙	◘								
(142, 342, 422, 647, 706)																								
Brant	■	■	■◊	■♦	■♦	■♦	■♦	□◊	◊										□◊	■♦	■♦	■♦	■♦	■◊
(342, 647, 706)																								
Mute Swan	■	■	■	■	■	■	□										□	■	■	■	■	■	■	■
					○	◘○	◙●	◙●	◙●	◙○	◙○	◙○	◙	◙	◙	◙	◙	◘	◘	◘				
(142, 342, 608, 647)																								
Trumpeter Swan	■	■	■♦	■♦	◊																	◊	■♦	■♦
(30)																								
Tundra Swan	■	■	■◊	■♦	■♦	□♦	□♦	□◊	□											♦	■♦	■◊	■◊	■
(342, 647, 706)																								
Wood Duck	□	□	□	□◊	♦	♦	◊									◊	♦	□♦	□♦	□♦	□♦	□	□	□
					◙○	◙●	◙●	◙●	◙●	◙●	◙●	◙●	◙●	◙○	◙	◙	◙							
(142, 342, 647, 706)																								
Gadwall	■	■	■	■	■◊	■♦	■♦	□♦	◊							◊	□◊	□◊	□♦	■♦	■♦	■◊	■	■
								◘	◘○	◙●	◙●	◙●	◙●	◙○	◙	◙	◙	◘						
(142, 342, 647, 706)																								

Common name	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4
American Wigeon	■	■	■	■	■♦	■♦	■♦	◊	◊								◊	◊	■♦	■♦	■♦	■♦	■♦	■◊
American Black Duck (342, 647, 706)	■	■	■◊ ◘○	■♦ ◘○	■♦ ◙○	■♦ ◙●	□◊ ◙●	□◊ ◙●	◙●	◙●	◙●	◙○	◙○	◙○	◙○	◙○	□◊ ◘	□◊ ◘	□◊ ◘	■♦ ◘	■♦	■♦	■◊	■
Mallard (142, 342, 382, 647, 706, 713)	■	■	■◊	■♦	■♦ ◘○	■♦ ◙●	◊ ◙●	◊ ◙●	◊ ◙●	◙●	◙●	◙○	◙○	◙○	◙○	◙○	◊ ◘	◊ ◘	◊ ◘	■♦ ◘	■♦ ◘	■♦ ◘	■♦	■◊
Blue-winged Teal (142, 342, 382, 470, 647, 706)	□	□	□	□	□	□♦	♦	♦ ◙●	♦ ◙●	◊ ◙●	◙●	◙○	◙○	◙	◙	◊ ◙	♦ ◘	■♦ ◘	■♦	■◊	■◊	■◊	■	■
Northern Shoveler (142, 342, 647, 706)	■	■	■	■	■◊	□♦	□♦	□♦	◊						◊		◊	□♦	□♦	□♦	□♦	■◊	■◊	■
Green-winged Teal (342, 647, 706)	■	■	■	■◊	□♦	□♦	□♦	□♦	◊						◊		◊	◊	□♦	□♦	□♦	□♦	■◊	■
Northern Pintail (342, 647, 706)	■	■◊	■◊	□♦	□♦	□♦	◊	◊	◊						◊		◊	◊	□♦	□♦	□♦	□♦	□♦	■◊
Canvasback (342, 647, 706)	■	■	■	■◊	□♦	□♦	□♦	◊	◊											◊	◊	□♦	□♦	■◊
Redhead (342, 647, 706)	■	■	■	■	■◊	□♦	□♦	□♦	□◊	□									◊	◊	□♦	□♦	□♦	■◊

Common name	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4
Ring-necked Duck (342, 647, 706)	■	□	□◊	□♦	□♦	□♦	□♦	□	◊	◊									◊	□♦	□♦	□♦	■◊	■
Greater Scaup (342, 647, 706)	■	□	□	□	□◊	□♦	□♦	□♦	◊	◊									◊	□♦	□♦	□♦	■◊	■
Lesser Scaup (342, 647, 706)	■	□	□	□♦	□♦	□♦	□♦	□♦	◊	◊								◊	◊	□♦	□♦	□♦	□♦	■◊
Surf Scoter (342, 647, 706)	■	■	□	□◊	□♦	□♦	□♦	□♦	◊										◊	□♦	□♦	□♦	■◊	■
White-winged Scoter (342, 647, 706)	■	□	□	□	□◊	□♦	□♦	□♦	◊										◊	□♦	□♦	□♦	□♦	■
Black Scoter (342, 647, 706)	■	□	□◊	□♦	□♦	□♦	□♦	□♦	◊								◊	◊	□♦	□♦	□♦	■◊	■	■
Long-tailed Duck (342, 647, 706)	■	■	□	□	□◊	□♦	□♦	◊												◊	□♦	□♦	□♦	■◊
Bufflehead (342, 647, 706)	■	□	□	□	□◊	□♦	□♦	◊												◊	□♦	□♦	■◊	■◊
Common Goldeneye (342, 647, 706)	■	□	□	□♦	□♦	□♦	□♦	◊												◊	□♦	□♦	□♦	■◊

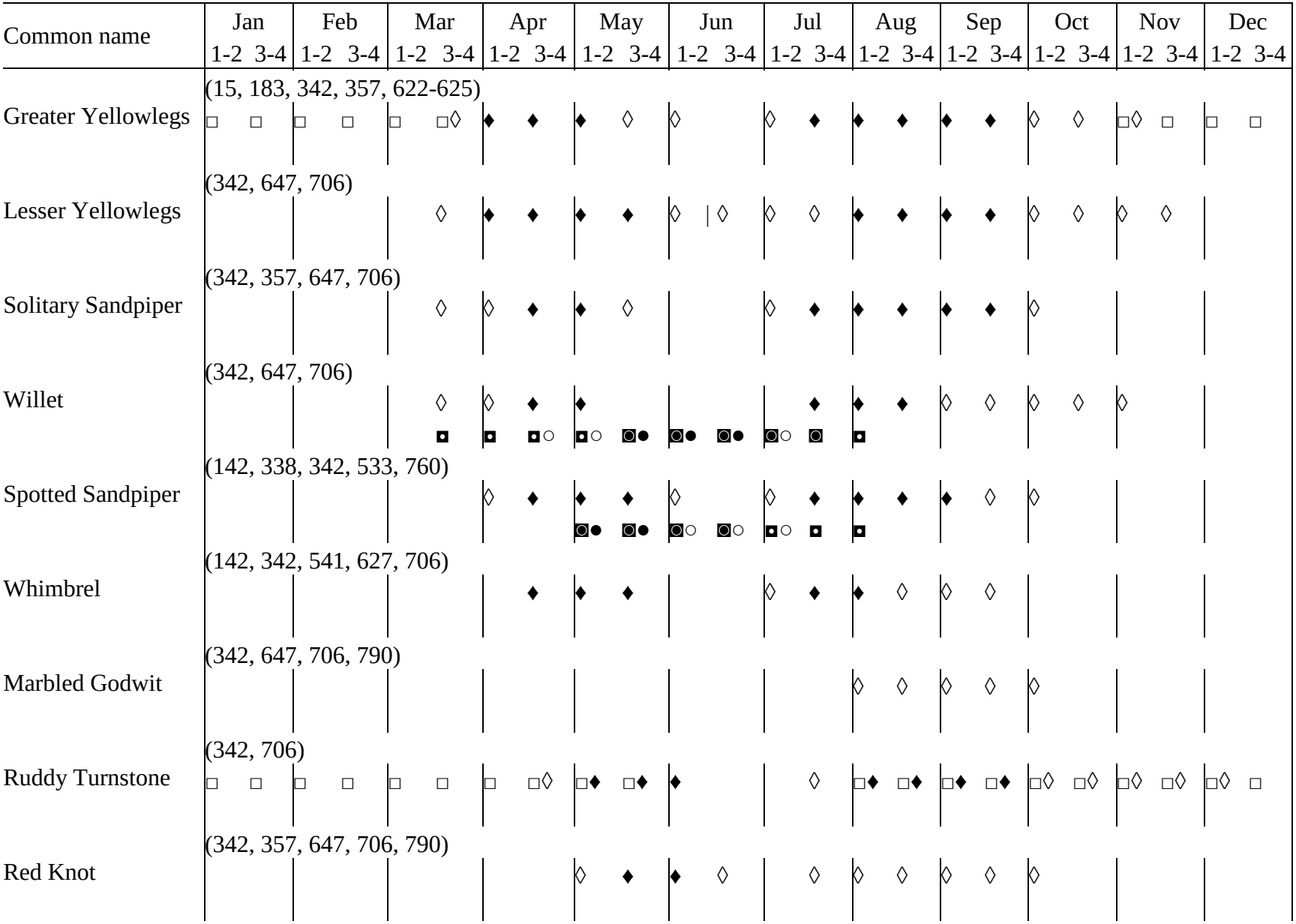
Common name	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4
Hooded Merganser	(342, 647, 706)																							
	■	■	■	■◊	♦	♦	♦	◊	◊								□	□◊	□◊	□◊	■♦	■♦	■◊	■
					◘○	◙●	◙●	◙○	◙○	◙	◙	◙	◙	◙	◘	◘								
Common Merganser	(142, 342, 441, 647, 706)																							
	■	□	□	□◊	□♦	□♦	□♦	□◊	◊										◊		◊	□♦	□♦	□♦
Red-breasted Merganser	(342, 647, 706)																							
	■	■	■	■	■◊	□♦	□♦	□♦	□◊	□◊	□								◊		□♦	□♦	■◊	■◊
Ruddy Duck	(342, 647, 706)																							
	■	■	■	■	■◊	□♦	□♦	□♦	◊	◊								◊	◊	□♦	□♦	□♦	■◊	■
Red-throated Loon	(342, 647, 706)																							
					◊	□♦	□♦	■◊	■	■	■	■	■	■	■	■	■	■	■	■◊	□♦	□♦	□♦	◊
Common Loon	(342, 647, 706)																							
	■	■	■	■	■	■◊	■♦	■♦	■♦	□◊	□	□	□	□	□	□	□◊	□◊	■♦	■♦	■♦	■♦	■♦	■
Pied-billed Grebe	(342, 647, 706) Spitzer in (448)																							
	■◊	■	■	■◊	■◊	□♦	□♦	□♦	◊						◊	□◊	□♦	□♦	□♦	□♦	□♦	□♦	□♦	■◊
					◘	◘	◘○	◙○	◙○	◙●	◙●	◙●	◙○	◙○	◙	◘	◘	◘	◘					
Horned Grebe	(80, 142, 342, 626, 647, 706)																							
	■	■	■	■	■♦	■♦	□♦	□♦	□♦	□◊	□◊	□	□	□	□	□	□	□◊	□♦	□♦	□♦	□♦	■♦	■◊
Red-necked Grebe	(342, 647, 706)																							
		□	□	□◊	□♦	□♦	□♦	◊	◊										◊		□♦	□♦	□♦	□◊

Common name	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4
Eared Grebe (342, 647, 706)	□	□	□	□◊	□♦	□♦	□♦	□◊	□◊							□	□	□	□	□	□	□	□	□
Wilson's Storm-Petrel (342, 647)								□	□	■	■	■	■	■	□	□	□	□						
Northern Gannet (342, 647, 706)	■	■	■◊	□♦	□♦	□♦	□♦	□♦	□♦										◊	□♦	□♦	□♦	■♦	■
Brown Pelican (342, 647, 706)	□	□	□	□	□	□	□														□	□	□	□
							◘	◙	◙○	◙○	◙●	◙●	◙○	◙○	◙○	◙○	◙○	◙	◙	◙	◘	◘		
Double-crested Cormorant (142, 342-344, 679, 773, 830)	■	■	■	■	■	■◊	♦	♦	◊							◊	■♦	■♦	■♦	■♦	■♦	■◊	■	■
							◘○	◙●	◙●	◙●	◙●	◙○	◙○	◘	◘									
American Bittern (135, 142, 745)	■	■	■	■	■◊	■♦	■♦	□♦	◊							□	■◊	■♦	■♦	■♦	■♦	■♦	■◊	■
									◘○	◙●	◙●	◙○	◙	◙	◙	◘								
Least Bittern (80, 142, 342, 706)								◘	◙●	◙●	◙●	◙●	◙○	◙○	◘○	◘	■	■	□	□	□			
Great Blue Heron (80, 142, 342, 647, 706)	■	■	■	□◊	□◊	□♦	□♦	□♦	□◊	□	□	□	□	□◊	□♦	■♦	■♦	■♦	■♦	■♦	■♦	■◊	■◊	■
				◘○	◘○	◙●	◙●	◙●	◙●	◙○	◙○	◙○	◙	◙	◙	◘	◘	◘						
Great Egret (129, 142, 342, 438, 593, 647, 706, 749, 801)					◊	♦	◊				◊	◊	◊	♦	♦	♦	♦	◊	◊	◊	◊			
							◘○	◘○	◙●	◙●	◙●	◙○	◙	◙	◙	◘								

Common name	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4
Snowy Egret	(142, 342, 647, 706)																							
					♦		♦							◊	♦	♦	♦	♦	♦	◊	◊			
					◘		◘	◙●	◙●	◙○	◙○	◙○	◙○	◘○	◘○	◘	◘							
Little Blue Heron	(142, 233, 342, 647, 706, 745)																							
	□	□	□	□	□	♦	♦					◊	♦	♦	♦	□♦	□♦	□♦	□♦	□◊	□◊	□◊	□	□
							◘	◙○	◙●	◙●	◙○	◙○	◙	◘	◘									
Tricolored Heron	(142, 342, 647, 706, 745)																							
							♦	♦						♦	♦	♦	◊	◊	◊					
								◘	◙○	◙●	◙●	◙○	◙	◘	◘									
Cattle Egret	(142, 342, 647, 706, 745)																							
					◊		◊	♦									♦	♦	◊					
									◙●	◙●	◙○	◙○	◘○	◘○	◘	◘								
Green Heron	(142, 342, 647, 745)																							
							◊	♦								♦	♦	♦	◊	◊	◊	◊		
								◘○	◘○?	◙●	◙●	◙○?	◘○	◘○	◘○									
Black-crowned Night-Heron	(142, 342, 647, 706, 745)																							
	■	■	■◊	■◊	■◊	■♦										■◊	■◊	■♦	■◊	■	■	■	■	■
			◘	◘	◘	◘	◙○	◙●	◙●	◙●	◙○	◘○	◘	◘	◘									
Yellow-crowned Night-Heron	(142, 342, 647, 706)																							
					◊		♦									♦	♦	♦	♦	♦	◊	◊		
					◘		◙○	◙●	◙●	◙●	◙●	◙○	◙○	◙	◙	◘	◘							
White Ibis	(142, 181, 342, 766)																							
												□	□	□	□	□	□	□	□					
Glossy Ibis	(342)																							
								◊	♦						♦	◊	◊	◊	◊	◊	◊			
								◘○	◘●	◘●	◙●	◙●	◙○	◙	◙	◘								

Common name	Jan 1-2	Jan 3-4	Feb 1-2	Feb 3-4	Mar 1-2	Mar 3-4	Apr 1-2	Apr 3-4	May 1-2	May 3-4	Jun 1-2	Jun 3-4	Jul 1-2	Jul 3-4	Aug 1-2	Aug 3-4	Sep 1-2	Sep 3-4	Oct 1-2	Oct 3-4	Nov 1-2	Nov 3-4	Dec 1-2	Dec 3-4
Osprey	(342, 629, 745, 804, 828, 829, 832)				◊	♦	♦	♦	◊								◊	♦	♦	◊	◊			
						◘○	◘○	◙●	◙●	◙●	◙○	◙○	◙○	◘	◘	◘								
Bald Eagle	(142, 342, 609, 706)																							
	■	■	■	■	■	■	□	□	□	□	■	■	■	■	■	■	■	□	□	□	□	□	□	■
	◙	◙○	◙●	◙●	◙●	◙●	◙●	◙○	◙	◙	◙	◙	◘								◘	◘	◘	◙
Northern Harrier	(1, 98, 142, 706)																							
	■	■	■	■	■◊	■♦	■♦	■♦	◊						◊	◊	◊	◊	■♦	■♦	■♦	■◊	■	■
								◘○	◙●	◙●	◙●	◙○	◙	◙	◙	◘								
Yellow Rail	(142, 342, 647, 706)																							
					◊	◊	◊	◊	◊										◊	◊	◊	◊	◊	◊
Black Rail	(341, 647)																							
	□	□	□	□	□	□	□◊	◊	◊	◊								◊	◊	□◊	□	□	□	□
								◘♪	◘♪	◙♫○	◙♫○	◙♫○	◙♪○	◙○	◘	◘	◘	◘	◘					
Clapper Rail	(142, 218, 342, 607, 630, 647, 802)																							
	□	□	□	□	□	□◊	□◊									◊	◊	□◊	□◊	□◊	□	□	□	□
							◘♪○	◙♫○	◙♫○	◙♫●	◙●	◙○	◙○	◙○	◘○	◘	◘							
King Rail	Hand in (712), (131, 142, 462, 647, 707)																							
	□	□	□	□	□	□♦	♦	◊								□	□♦	□♦	□◊	□◊	□◊	□	□	□
							◘	◘○	◙○	◙●	◙●	◙●	◙○	◙	◘									
Virginia Rail	(80, 142, 460, 585, 706, 729)																							
	■	■	■	■	■◊	■◊	■♦	♦	♦							◊	■◊	■◊	■◊	■◊	■◊	■◊	■◊	■◊
							◘	◙	◙○	◙●	◙●	◙●	◙○	◙○	◙○	◙	◘							
Sora	(80, 142, 460, 706, 816)																							
	□	□	□	□			◊	♦	♦						◊	♦	□♦	□♦	□◊	□◊	□◊	□◊	□	□
					◘	◘	◘	◘○	◙●	◙●	◙	◙	◘	◘	◘	◘								

Common name	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4
Common Moorhen	(80, 458, 460, 706)																							
	□						◊	♦	♦									♦	♦	□◊	□◊	□◊	□	□
									◙●	◙●	◙○	◙○	◙○	◙	◙	◘	◘	◘						
American Coot	(142, 342, 647, 706)																							
	■	■	■	■	■◊	■♦	♦	♦	◊	◊								◊	◊	♦	■♦	■♦	■◊	■
									◙●	◙●	◙	◙	◙	◙	◙									
Black-bellied Plover	(80, 142, 342, 647, 706)																							
	■	■	■	■	■	■	■	■◊	□♦	□♦	□◊	□	□	□	□	□◊	□◊	■♦	■♦	■♦	■♦	■◊	■◊	■
Wilson's Plover	(342, 647, 742, 790)																							
							♦										♦							
							◘	◙○	◙●	◙●	◙●	◙●	◙○	◙	◘	◘	◘							
Semipalmated Plover	Terwilliger as cited in (51), (48, 142, 332, 342, 647, 706)																							
	□	□	□	□	□	□	□◊	□◊	□♦	□♦	□◊	□	□	□◊	□♦	□♦	□♦	□◊	□◊	□◊	□◊	□◊	□	□
Piping Plover	(342, 357, 504, 646, 706)																							
			◊	◊	♦	♦	◊	◊								◊	♦	♦	♦	◊	◊			
						◘	◘	◙○	◙●	◙●	◙●	◙●	◙●	◙○	◘	◘	◘	◘	◘					
Killdeer	(142, 168, 169, 220, 342, 647, 706)																							
	■	■	■	■◊	■◊	♦	◊								■◊	■◊	■◊	■◊	■♦	■♦	■◊	■◊	■◊	■
			◘	◘	◙○	◙○	◙●	◙●	◙●	◙●	◙●	◙●	◙○	◙○	◘	◘								
American Oystercatcher	(142, 246, 342, 760)																							
	■	■	■	■◊	■♦	□♦	◊						◊	♦	□♦	□♦	■◊	■	■	■	■	■	■	■
						◘	◙●	◙●	◙●	◙●	◙○	◙○	◙○	◘	◘	◘								
Black-necked Stilt	(81, 142, 342, 525)																							
							◊	◊	◊	◊	◊					◊	◊	◊						
									◘	◘○	◘○	◘○	◘○	◘	◘									


Common name
Jan 1-2 3-4
Feb 1-2 3-4
Mar 1-2 3-4
Apr 1-2 3-4
May 1-2 3-4
Jun 1-2 3-4
Jul 1-2 3-4
Aug 1-2 3-4
Sep 1-2 3-4
Oct 1-2 3-4
Nov 1-2 3-4
Dec 1-2 3-4
(15, 183, 342, 357, 622-625)
Greater Yellowlegs
(342, 647, 706)
Lesser Yellowlegs
(342, 357, 647, 706)
Solitary Sandpiper
(342, 647, 706)
Willet
(142, 338, 342, 533, 760)
Spotted Sandpiper
(142, 342, 541, 627, 706)
Whimbrel
(342, 647, 706, 790)
Marbled Godwit
(342, 706)
Ruddy Turnstone
(342, 357, 647, 706, 790)
Red Knot

Common name	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4
Sanderling	(342, 647, 790)																							
	■	■	■	■	■	■	■	■♦	♦	♦	♦	◊ |	◊	♦	♦	♦	♦	♦	◊	■◊	■	■	■	■
Semipalmated Sandpiper	(342, 357, 647, 706, 790)																							
								◊	♦	♦	♦	◊ |	◊	♦	♦	♦	♦	♦	◊	◊	◊			
Western Sandpiper	(342, 647, 706)																							
	□◊	□	□	□	□	□	□	□	□◊	□◊	□◊	□	□◊	□♦	□♦	□♦	□♦	□♦	□♦	□◊	□◊	□◊	□◊	□◊
Least Sandpiper	(342, 357, 647, 706)																							
	□							◊	♦	♦	◊		◊	♦	♦	♦	♦	♦	◊	◊	◊	◊	□	□
Purple Sandpiper	(342, 647, 706)																							
	■	■	■	■	■	■	■	■	■	□											□	■	■	■
Dunlin	(342, 357, 647, 706)																							
	■	■	■	■	■	■◊	■◊	■◊	■♦	□♦	◊		◊	□◊	□◊	□◊	□◊	□◊	□◊	□♦	□♦	■♦	■◊	■
Short-billed Dowitcher	(342, 647, 706, 790)																							
						◊	◊	◊	♦	♦	◊		◊	♦	♦	♦	♦	◊	◊	◊	◊	◊		
Long-billed Dowitcher	(342, 647, 706)																							
						◊	◊	◊	◊						◊	◊	◊	◊	♦	♦	♦	♦	◊	
Wilson's Snipe	(342, 647)																							
	■	■	■	■◊	■◊	■♦	■♦	■♦	□◊	□◊							□◊	□◊	■♦	■♦	■♦	■♦	■♦	■◊

Common name	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4
American Woodcock	(342, 647, 706)																							
Bonaparte's Gull	(142, 342, 432, 647, 706)																							
Laughing Gull	(342, 647, 706)																							
Ring-billed Gull	(142, 342, 647, 706)																							
Herring Gull	(342, 647, 706)																							
Lesser Black-backed Gull	(142, 226, 342, 706)																							
Great Black-backed Gull	(342, 647)																							
Gull-billed Tern	(142, 226, 342, 647)																							
Caspian Tern	(142, 342, 647, 831)																							

Common name	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4
Royal Tern (142, 342, 647, 706)					◊		◊	♦	♦ ◘○	◘○	◙●	◙●	◙●	◊ ◙●	◊ ◙○	♦ ◙	♦ ◙	♦ ◘	♦	♦	♦	◊	◊	◊
Sandwich Tern (93, 142, 342, 706)									◊ ◘○	◘○	◘○	◘○	◘○	◘	◘	◘	◊	◊	◊					
Forster's Tern (142, 342)	◘	◘			◊		♦	♦	◊ ◘○	◙●	◙●	◙●	■ ◙○	■◊ ◙○	■♦ ◙○	■♦ ◘	■♦ ◘	■♦ ◘	■♦	■♦	◘◊	◘	◘	◘
Common Tern (142, 342, 647, 706)					◊		◊	♦	♦ ◘○	♦ ◙●	◙●	◙○	◙○	◊ ◙○	♦ ◙○	♦ ◘	♦ ◘	♦ ◘	♦	◊	◊	◊	◊	
Roseate Tern (142, 342, 647, 689, 706)							□	□	□	□	□	□	□	□	□	□	□	□	□					
Least Tern (342, 647, 706)								◊	♦ ◘○	♦ ◘○	◙●	◙●	◊ ◙●	◊ ◙○	♦ ◙○	♦ ◙	◊ ◘	◊ ◘	◊	◊	◊			
Black Skimmer (142, 342, 647, 706)	□						◊	♦	♦ ◙	♦ ◙●	◙●	◙○	◙○	◙○	◊ ◙○	◊ ◙○	♦ ◙	□♦ ◘	□♦	□♦	□♦	□◊	□	□
Short-eared Owl (142, 227, 342, 647, 689, 706)	■	■	■	■♦	■♦	□◊	□◊	□◊	□◊										□◊	□◊	□◊	■♦	■♦	■
Belted Kingfisher (342, 647, 706)	■	■	■◊	■◊	■♦	◘	◙○	◙●	◙●	◙●	◙○	◙	◙	◙	◘	■◊	■♦	■♦	■♦	■♦	■♦	■◊	■	■

Common name	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4	1-2	3-4
Purple Martin (5, 142, 307, 342, 647, 706)					◊	◊	♦	♦	◊	◊			◊	♦	♦	♦	◊	◊	◊					
								◘	◙○	◙●	◙●	◙●	◙○	◙	◘	◘								
Tree Swallow (142, 342, 647, 706)	□	□	□	□	□	□◊	♦	♦	♦					◊	◊	♦	♦	♦	♦	♦	■◊	■	■	■
								○	◘○	◙●	◙●	◙●	◙○	◙	◘	◘								
Northern Rough-winged Swallow (142, 342, 564, 647, 706)						◊	♦	♦	♦			◊	♦	♦	♦	♦	♦	◊	◊	◊	◊			
								◘○	◘○	◙●	◙●	◙○	◙	◙	◘									
Bank Swallow (142, 342, 647, 706)					◊	◊	◊	♦	♦	♦			◊	♦	♦	♦	♦	◊	◊					
								◘	◙●	◙●	◙○	◙○	◘	◘										
Cliff Swallow (58, 142, 342, 706)								◊	♦	◊			♦	♦	♦	♦	♦	◊	◊	◊	◊	◊		
									◘○	◙●	◙●	◙●	◙●	○										
Sedge Wren (142, 342, 647, 706)	■	■	■	■	■	■	■	■	♦	♦	◊						■	■	■	■	■◊	■	■	■
												◙●	◙●	◙○	◙○	◘	◘							
Marsh Wren (342, 706, 769)	■	■	■	■	■	■	■	■♦	■♦	◊							◊	■♦	■♦	■◊	■◊	■	■	■
								◘○	◘○	◘○	◙●	◙●	◙●	◙●	◙○	◙	◘							
Henslow's Sparrow (142, 342, 647, 706)						◊	◊	◊	◊							◊	◊	◊	◊	◊	◊			
									○	◙●	◙●	◙○	◙	◘										
Nelson's Sparrow (142, 342, 647, 706)	□	□	□	□	□	□	□	□	□	□	□						□	□	□	□	□	□	□	□

Common name	Jan 1-2	Jan 3-4	Feb 1-2	Feb 3-4	Mar 1-2	Mar 3-4	Apr 1-2	Apr 3-4	May 1-2	May 3-4	Jun 1-2	Jun 3-4	Jul 1-2	Jul 3-4	Aug 1-2	Aug 3-4	Sep 1-2	Sep 3-4	Oct 1-2	Oct 3-4	Nov 1-2	Nov 3-4	Dec 1-2	Dec 3-4
Saltmarsh Sparrow (342, 647)	■	■	■	■	■	■	■	■◊	♦	♦	♦	◊				◊	♦	□♦	□♦	□♦	□♦	□◊	□	□
									◘○	◙●	◙●	◙●	◙●	◙●	◙○	◙○	◘							
Seaside Sparrow (142, 647, 769, 775, 822)	■	■	■	■	■	■	■	■♦	♦								♦	♦	■♦	■	■	■	■	■
									◘○	◙●	◙●	◙●	◙○	◙○	◙	◘	◘							
Swamp Sparrow (142, 342, 647, 706)	■	■	■	■	■	■◊	■◊	■♦	□♦	◊								□◊	■♦	■♦	■◊	■◊	■	■
Coastal Plain Swamp Sparrow (299, 342, 706)									◊	♦						◊	♦	♦	◊					
										◘○	◙●	◙●	◙	◙	◙									
Bobolink (299, 342, 807)								◊	♦	♦				◊	◊	♦	♦	♦	◊					
Red-winged Blackbird (342, 647, 706)	■	■	■	■♦	■♦	■♦	■◊	□◊	□◊					◊	□◊	□◊	■♦	■♦	■♦	■♦	■♦	■◊	■◊	■
								◘○	◘○	◙●	◙●	◙○	◙○	◙	◘○	◘								
Rusty Blackbird (142, 342, 459, 706)	■	■	■	■◊	■◊	■♦	■♦	◊	◊								◊	◊	◊	♦	■♦	■◊	■◊	■
Boat-tailed Grackle (342, 647, 706)	■	■	■	■	■	■	■	■	□	□	□	□	□	□	□	■	■	■	■	■	■	■	■	■
								○	◙●	◙●	◙○	◙○	◙○	◘	◘									

[a] Non-breeding (□■), and migration (◊♦) given on top line and song/mating call (♪♫), breeding (◘◙), and eggs in nest (○●) are given on bottom line for each species. Symbols are darker or larger for peak times.

[b] References are given in parentheses below data.

Table A.4. Resource use by waterbirds of the Chesapeake Bay.

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
Snow Goose	Saltwater, Brackish, Freshwater Marshes, Shallow-water Zone (547, 647, 706)[a]	Saltwater, Brackish, Freshwater Marshes, Shallow-water Zone (547, 647, 706)	Plants (158, 708)	BMR = 139 kcal/day (7)
Canada Goose	Saltwater, Brackish, and Freshwater marshes (92, 564, 706)	Saltwater, Brackish, and Freshwater marshes, Shallow-water Zone, Upland (92, 564, 706)	Plants, Seeds (92, 266, 503, 708)	525 - 715 kcal/day (266)
Brant	Shallow-water Zone, Saltwater areas (603, 706)	Shallow-water Zone, Saltwater areas (603, 706)	Plants, Algae, Seeds (159, 603, 691)	BMR = 94 kcal/day
Mute Swan	Brackish Marshes (608, 719)	Brackish Marshes (608, 719)	Plants (571)	BMR = 365 kcal/day (7)
Trumpeter Swan	Freshwater Marshes (30)	Freshwater Marshes (30)	Plants, Aquatic Invertebrates (30)	2578 kJ/day (392)
Tundra Swan	Shallow-water Zone, Brackish and Freshwater Areas (401, 706, 709)	Shallow-water Zone, Brackish and Freshwater Areas, Upland (70, 401, 706, 709)	Plants, Aquatic Invertebrates (503, 708, 709)	M I = 2157 - 2319 kJ/day, A = 2639 - 2856 kJ/day; F I = 1984 - 2233, A = 2172 - 2557 (70)

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
Wood Duck	Upland, Freshwater and Brackish Marshes, Forested Wetland, Shallow-water Zone (564, 706, 708)	Freshwater and Brackish Marsh, Forested Wetland, Shallow-water Zone (564, 706, 708)	Seeds, Plants, Aquatic Invertebrates (393, 394, 708)	female BMR = 270 kJ/day, Total Energy = 5996 kJ over 18 day egg formation period (201)
Gadwall	Upland, Freshwater, Brackish, and Saltwater Marshes, Shallow-water Zone (149, 203, 551, 563, 706)	Freshwater, Brackish, and Saltwater Marshes, Shallow-water Zone (149, 203, 551, 563, 706)	Plants, Aquatic Invertebrates, Seeds, Algea (13, 394, 503, 673, 708)	BMR = 54 kcal/day (7)
American Wigeon	Brackish, Freshwater, and Saltwater Marshes (149, 706, 708)	Brackish, Freshwater, and Saltwater Marshes (149, 706, 708)	Plants, Seeds (394, 503, 708)	BMR = 57 kcal/day (7)
American Black Duck	Freshwater, Brackish and Saltwater Marshes, Upland (149, 313, 490, 551, 564, 713)	Freshwater, Brackish and Saltwater Marshes, Shallow-water Zone (149, 313, 490, 551, 564, 706, 713)	Seeds, Plants, Aquatic Invertebrates, Fish (394, 503, 708)	6.80 kcal/hour daytime, 7.07 kcal/hour nighttime (490)
Mallard	Freshwater and Brackish Marshes (706, 708)	Freshwater and Brackish Marshes, Upland (706, 708)	Seeds, Plants, Aquatic Invertebrates (394, 503, 503, 708)	BMR = 91.1 kcal/W^0.744/day (690)

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
Blue-winged Teal	Saltwater, Brackish and Freshwater Marshes (551, 706, 708)	Saltwater, Brackish and Freshwater Marshes (551, 706, 708)	Seeds, Plants, Aquatic Invertebrates (394, 503, 708)	Summer = 66.138 - 0.621*T; Fall, Winter, Spring = 105.676 - 1.695*T (T = temp in C); 341 kJ/day (545, 726)
Northern Shoveler	Freshwater and Brackish Marshes (706, 708)	Freshwater and Brackish Marshes (706, 708)	Seeds, Aquatic Invertebrates, Plants (394, 708)	BMR = 48 kcal/day (7)
Green-winged Teal	Brackish and Saltwater Marshes (149, 564, 706, 708)	Brackish and Saltwater Marshes (149, 564, 706, 708)	Seeds, Plants, Aquatic Invertebrates (394, 503, 708)	BMR = 31 kcal/day (7)
Northern Pintail	Brackish and Saltwater Marshes (706, 708)	Brackish and Saltwater Marshes, Uplands (706, 708)	Seeds, Plants, Aquatic Invertebrates (394, 503, 708)	146 - 254 kcal/day; 613 - 1,180 kJ/day (22, 476, 726)
Canvasback	Shallow-water Zone, Freshwater and Brackish (706, 708)	Shallow-water Zone, Freshwater and Brackish (706, 708)	Aquatic invertebrates, Seeds, Plants (310, 412, 503, 572, 573, 708, 725)	184 kcal/day (310)
Redhead	Shallow-water Zone, Brackish, Freshwater, and Saltwater (706, 708)	Shallow-water Zone, Brackish, Freshwater, and Saltwater (706, 708)	Plants, Seeds (503, 573, 708)	M = 160-164 kcal/day, F = 137-139 kcal/day (25)

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
Ring-necked Duck	Shallow-water Zone, Freshwater and Brackish (706, 708)	Shallow-water Zone, Freshwater and Brackish (706, 708)	Aquatic Invertebrates, Plants, Seeds (394, 503, 573, 708, 725)	131 - 162 kcal/day (349)
Greater Scaup	Deep-water Zone, Shallow-water Zone, Brackish and Saltwater (706, 708)	Deep-water Zone, Shallow-water Zone, Brackish and Saltwater (706, 708)	Aquatic Invertebrates, Plants, Seeds (503, 573, 708)	BMR = 65 kcal/day (7)
Lesser Scaup	Deep-water Zone, Shallow-water Zone, Brackish and Saltwater (706, 708)	Deep-water Zone, Shallow-water Zone, Brackish and Saltwater (706, 708)	Aquatic Invertebrates, Plants, Seeds (394, 503, 573, 708, 725)	BMR = 54 kcal/day (7)
Surf Scoter	Deep-water Zone, Shallow-water Zone (706, 708)	Deep-water Zone, Shallow-water Zone (706, 708)	Aquatic Invertebrates, Plants (573)	BMR = 95 kcal/day (7)
White-winged Scoter	Deep-water Zone, Shallow-water Zone (706, 708)	Deep-water Zone, Shallow-water Zone (706, 708)	Aquatic Invertebrates (573)	BMR = 80 kcal/day (7)
Black Scoter	Deep-water Zone, Shallow-water Zone (706, 708)	Deep-water Zone, Shallow-water Zone (706, 708)	Aquatic Invertebrates (573)	BMR = 71 kcal/day (7)
Long-tailed Duck	Deep-water Zone	Deep-water Zone	Aquatic Invertebrates, Fish, Seeds, Plants	BMR = 54 kcal/day

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
	(706, 708)	(706, 708)	(573, 708)	(7)
Bufflehead	Deep-water Zone, Shallow-water Zone (706, 708)	Deep-water Zone, Shallow-water Zone (706, 708)	Aquatic Invertebrates, Seeds, Plants (503, 573, 708)	1176 kJ/day (451)
Common Goldeneye	Deep-water Zone, Shallow-water Zone (706, 708)	Deep-water Zone, Shallow-water Zone (706, 708)	Aquatic invertebrates, Seeds, Plants (503, 573, 708, 725)	BMR = 70 kcal/day (216)
Hooded Merganser	Brackish and Freshwater Marshes, Shallow-water Zone (706, 708)	Brackish and Freshwater Marshes, Shallow-water Zone (706, 708)	Fish, Aquatic invertebrates, Amphibians (160, 573, 708)	BMR = 48 kcal/day (7)
Common Merganser	Deep-water Zone, Shallow-water Zone, Brackish and Freshwater Marshes (706, 708)	Deep-water Zone, Shallow-water Zone, Brackish and Freshwater Marshes (706, 708)	Fish, Aquatic invertebrates, Frogs (160, 708, 812)	1939 kJ/day (241)
Red-breasted Merganser	Deep-water Zone, Shallow-water Zone, Saltwater Areas (706, 708)	Deep-water Zone, Shallow-water Zone, Saltwater Areas (706, 708)	Fish, Aquatic invertebrates (160, 573, 708)	BMR = 68 kcal/day (7)
Ruddy Duck	Deep-water Zone, Shallow-water Zone (706, 708)	Deep-water Zone, Shallow-water Zone (706, 708)	Aquatic invertebrates, Seeds (503, 573, 708, 725)	M = 89 - 165 kcal/day; F = 49 - 273 kcal/day (297)

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
Red-throated Loon	Shallow-water Zone, Deep-water Zone - Saltwater waters (643, 706)	Shallow-water Zone, Deep-water Zone - Saltwater waters (643, 706)	Fish, Aquatic invertebrates (49, 546)	
Common Loon	Shallow-water Zone, Deep-water Zone (447, 706)	Shallow-water Zone, Deep-water Zone (447, 706)	Fish, Aquatic invertebrates (32, 448)	363 kJ/h (32, 279)
Pied-billed Grebe	Freshwater marsh, Brackish marsh (136, 238, 286, 361, 475, 668, 706)	Freshwater marsh, Brackish marsh (238, 286, 361, 475, 668, 706)	Fish, Aquatic invertebrates, Frogs, Plants (49, 475, 810)	
Horned Grebe	Shallow-water Zone (699, 706)	Shallow-water Zone (699, 706)	Fish, Aquatic inbertebrates, Invertebrates (579, 810)	
Red-necked Grebe	Shallow-water Zone, Deep-water Zone (546, 647, 706, 714)	Shallow-water Zone, Deep-water Zone (546, 647, 706, 714)	Fish, Aquatic Invertebrates (558, 579, 810)	
Eared Grebe	Deep-water Zone, Shallow-water Zone (339)	Deep-water Zone, Shallow-water Zone (339)	Aquatic Invertebrates (170)	390.6 kJ/day (150)
Wilson's Storm-Petrel	Deep-water Zone	Deep-water Zone	Aquatic Invertebrates, Fish, Carcasses	Nestlings = 136.2 kJ/day, Adults = 157 kJ/day

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
	(546, 706)	(546, 706)	(40, 281, 596, 597)	(536, 537)
Northern Gannet	Deep-water Zone	Deep-water Zone	Fish, Aquatic Invertebrates	A = 4865 kJ/day
	(706)	(706)	(374, 484, 485)	(56)
Brown Pelican	Islands	Shallow-water Zone, Deep-water Zone	Fish, Aquatic Invertebrates	
	(135, 546, 777, 781)	(135, 546)	(62, 250, 546)	
Double-crested Cormorant	Islands	Shallow-water Zone, Deep-water Zone	Fish, Aquatic Invertebrates	J = 1,530 - 1958; SA = 1,421 - 3,195; A = 1,233 - 3,464 kJ/day
	(135, 209, 777, 781)	(135, 209)	(135, 209)	(209, 283)
American Bittern	Freshwater marsh, Brackish and Saltwater marsh, Upland	Freshwater, Brackish and Saltwater Marsh	Fish, Aquatic Invertebrates, Invertebrates, Amphibians, Reptiles, Small mammals, Birds	Adult basal metabolic rate= 92 cal/day/kg
	(204, 361, 595, 706)	(361, 595, 706)	(49, 160, 388, 660)	(43)
Least Bittern	Brackish, Saltwater and Freshwater Marsh, Uplands	Brackish, Saltwater and Freshwater Marsh	Aquatic Invertebrates, Invertebrates, Amphibians, Fish, Small mammals, Reptiles	
	(49, 409, 546, 564, 570, 595, 706, 796)	(49, 409, 546, 564, 706)	(49, 388, 546, 660, 796)	

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
Great Blue Heron	Upland, Forested wetland, Saltwater, Brackish, and Freshwater Marsh (2, 39, 555, 706, 818, 840)	Shallow-water Zone, Saltwater, Brackish, and Freshwater Marshes (706, 770, 827)	Fish, Aquatic invertebrates, Amphibians, Small mammals, Invertebrates, Birds (160, 333, 388, 598, 601, 827)	Nestlings 1,561 - 2,427 kJ/day, adults basal metabolic rate 73 cal/day/kg (43, 44)
Great Egret	Forested wetland, Saltwater and Brackish Marsh, Upland (2, 39, 108, 449, 706, 818)	Saltwater, Brackish, and Freshwater Marshes, Mudflats, Sandflats (174, 175, 706, 770, 827)	Fish, Amphibians, Reptiles, Aquatic Invertebrates, Invertebrates, Small mammals, Birds (34, 49, 333, 388, 587, 601, 720, 827)	
Snowy Egret	Forested wetland, Saltwater, Brackish marsh, Upland (2, 39, 108, 347, 555, 706, 818)	Saltwater, Brackish, and Freshwater Marsh, Mudflats, Sandflats, Uplands (174, 175, 347, 827)	Fish, Invertebrates, Aquatic invertebrates, Reptiles, Lizards (34, 95, 211, 347, 365, 388, 587, 601, 720, 827)	consumed 563 cal/min; 64 - 118 kcal/day (366)
Little Blue Heron	Forested wetland, Saltwater and Brackish marsh, Upland (2, 39, 108, 347, 555, 818)	Saltwater and Freshwater Marshes, Mudflats, Sandflats, Uplands (174, 196, 347, 827)	Fish, Aquatic invertebrates, Invertebrates, Amphibians, Reptiles (34, 196, 211, 365, 388, 455, 512, 587, 601)	consumed 881 cal/min; 58 - 112 kcal/day (366)

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
Tricolored Heron	Upland, Forested upland, Saltwater Marsh (39, 108, 347, 706, 818)	Saltwater and Freshwater Marshes, Mudflats, Sandflats (174, 175, 347, 706, 827)	Fish, Aquatic Invertebrates, Invertebrates, Amphibians, Reptiles (34, 365, 388, 587, 601, 827)	consumed 1117 cal/min; 59 - 101 kcal/day (366)
Cattle Egret	Forested wetlands, Uplands, Saltwater and Brackish Marshes (108, 347, 555, 818)	Uplands (174, 347)	Invertebrates, Aquatic invertebrates, Amphibians, Reptiles, Small mammals, Birds, Fish (211, 347, 348, 388, 587, 722, 745)	274 kcal/kg/day (685)
Green Heron	Forested wetland, Brackish and freshwater marsh, Upland (2, 546, 701, 811)	Forested wetland, Bank, Saltwater, Brackish and Freshwater Marshes (160, 358, 546, 770)	Fish, Aquatic invertebrates, Invertebrates, Amphibians, Small mammals, Reptiles (34, 160, 388, 411, 512, 601, 811)	
Black-crowned Night-Heron	Freshwater marsh, Forested wetland, Saltwater and Brackish marsh, Upland (2, 10, 39, 108, 361, 595, 818)	Saltwater and Freshwater Marshes, Mudflats (174)	Fish, Aquatic invertebrates, Invertebrates, Small mammals, Amphibians, Birds, Eggs, Reptiles (10, 34, 160, 211, 303, 333, 388, 587, 595, 720)	

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
Yellow-crowned Night-Heron	Upland, Forested wetland (198, 706, 768, 795, 818)	Saltwater and Brackish Marshes, Mudflats (174, 619, 767)	Aquatic invertebrates, Fish, Reptiles, Small mammals, Birds (160, 388, 512, 587, 619, 620, 767)	
White Ibis	Saltwater and Freshwater marsh, Islands (197, 258, 681)	Saltwater and Freshwater marsh, Mudflats, Sandflats, Uplands (54, 174, 389)	Aquatic invertebrates, Fish, Invertebrates, Amphibians, Reptiles (34, 197, 211, 388, 389, 575, 587, 720)	Juvenile basal metabolic rate 91 cal/day/kg, Juvenile Daily Energy Expenditure = 2,700 kcal to age 20, 8620 kcal age 20-40, Adult Daily Energy Expediture = 164.6 kcal/day (43, 386, 387)
Glossy Ibis	Upland, Saltwater and Brackish Marsh (35, 39, 108, 121, 555, 818, 829)	Saltwater, Brackish, and Freshwater Marshes (174)	Invertebrates, Aquatic invertebrates, Reptiles, Amphibians, (35, 388, 829)	
Osprey	Man-made Structures in Saltwater, Brackish, and Freshwater Areas, Uplands, Islands (321, 784)	Deep-water Zone, Shallow-water Zone (135, 285)	Fish (160, 285, 452)	male DEE = 1302 kJ/day; intake rates male = 1005 kJ/day, female 530 kJ/day, nestling 848 kJ/day (298)

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
Bald Eagle	Upland (12, 100, 101, 764)	Shallow-water Zone, Deep-water Zone, Saltwater, Brackish, and Freshwater Areas, Uplands (97, 101, 135, 138, 425)	Fish, Mammals, Turtles, Birds (146, 425, 472)	Roosting = 205 kcal/night (101)
Northern Harrier	Saltwater, Brackish and Freshwater marsh, Uplands (14, 204, 361, 706, 788)	Saltwater, Brackish and Freshwater marsh, Uplands (147, 706, 788)	Birds, Small Mammals, Reptiles (147, 788)	
Yellow Rail	Saltwater, Brackish, and Freshwater marsh (69)	Saltwater, Brackish, and Freshwater marsh (69)	Invertebrates, Aquatic invertebrates, Seeds (69, 631)	
Black Rail	Saltwater and Brackish marsh (367, 706, 802)	Saltwater and Brackish marsh (367, 706, 802)	Invertebrates, Aquatic invertebrates, Seeds (802)	
Clapper Rail	Saltwater and Brackish marshes (59, 457, 647, 705, 770)	Saltwater and Brackish marshes (59, 457, 647, 770)	Aquatic invertegrates, Invertebrates (457)	
King Rail	Freshwater marsh, Brackish marsh (460, 463, 564, 611, 706)	Freshwater marsh, Brackish marsh (460, 463, 564, 611, 706)	Aquatic invertegrates, Invertebrates, Fish, Seeds (456, 457, 460, 611)	
Virginia Rail	Freshwater, Brackish and Saltwater marsh	Freshwater, Brackish and Saltwater marsh	Invertebrates, aquatic invertebrates, seeds	

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
	(361, 564, 595, 706, 816)	(564, 706, 816)	(337, 586)	
Sora	Freshwater marsh, Brackish marsh (361, 706)	Freshwater marsh, Brackish marsh (706)	Seeds, invertebrates, aquatic invertebrates (337, 458, 586)	
Common Moorhen	Freshwater and Brackish marsh (73, 263, 320, 461, 590, 595, 706)	Freshwater and Brackish marsh (461, 500, 535, 706)	Plants, Seeds, Aquatic invertebrates (263, 500, 535)	
American Coot	Freshwater and Brackish Marshes, Shallow-water Zone (225, 262, 361, 461, 595, 706, 708)	Freshwater and Brackish marshes, Shallow-water Zone (225, 461, 706, 708, 725)	Plants, Seed, Aquatic invertebrates (200, 262, 708, 725)	I = 301 - 881 kJ/day, A = 962 - 1010 kJ/day (200)
Black-bellied Plover	Beach, Mudflat (106, 144, 407, 582, 602, 646)	Mudflat, Uplands, Beach, Saltwater Marshes (106, 144, 407, 582, 602, 646)	Aquatic Invertebrates (505, 562, 602)	
Wilson's Plover	Beach (52, 53)	Mudflat, Beach (52, 53)	Aquatic Invertebrates (52, 731)	DEE = 42.6-45.4 kJ/day (winter) (486)
Semipalmated Plover	Mudflats, Saltwater Marsh, Beach (106, 582, 706)	Mudflats, Uplands, Saltwater Marsh, Beach (106, 582, 602, 646, 706)	Aquatic Invertebrates, Invertebrates, Seeds (26, 505, 602, 736)	BMR = 47.4 kJ/day (incubation) (836)

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
Piping Plover	Beach (106, 168, 331, 582)	Mudflats, Beach, Saltwater Marshes (106, 168, 582)	Aquatic Invertebrates, Invertebrates (220, 738)	
Killdeer	Uplands, Islands, Freshwater and Brackish marsh (345, 361, 407, 564)	Uplands, Mudflat, Beach, Freshwater and Brackish marsh (345, 407, 564, 602, 646)	Invertebrates, Fish, Frogs, Seeds (239, 345, 648, 663, 806)	
American Oystercatcher	Beach, Islands, Saltwater Marsh, Mudflat (48, 106, 264, 396, 582, 706, 826)	Beach, Mudflats, Saltwater Marsh, Islands (106, 524, 582, 706, 826)	Aquatic Invertebrates, Invertebrates (524, 732)	
Black-necked Stilt	Mudflats; Saltwater, Brackish, and Freshwater Marshes, Banks, Islands (309, 636)	Mudflats; Saltwater, Brackish, and Freshwater Marshes (602, 636)	Aquatic Invertebrates, Invertebrates (309)	
Greater Yellowlegs	Freshwater, Brackish, and Saltwater Marshes, Uplands, Beaches (222, 407, 564, 582)	Uplands, Mudflats, Freshwater, Brackish, and Saltwater Marshes, Beaches (222, 407, 564, 582, 602)	Aquatic Invertebrates, Invertebrates, Fish, Seeds (47, 86, 87)	
Lesser Yellowlegs	Freshwater, Brackish, and Saltwater Marshes (564, 706)	Freshwater, Brackish, and Saltwater Marshes, Mudflat (564, 602, 706)	Aquatic Invertebrates, Invertebrates, Seeds (26, 86, 87, 648)	Nestling RMR = 10-0.11+1.18(mass g) kJ/day (834)

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
Solitary Sandpiper	Saltwater, Brackish, and Freshwater Marsh, Uplands (112, 135, 161, 698, 706)	Saltwater, Brackish, and Freshwater Marsh, Uplands (112, 135, 161, 698, 706)	Aquatic Invertebrates, Invertebrates, Frogs (161, 698)	
Willet	Mudflat, Freshwater, Saltwater and Brackish Marsh, Beach, Uplands (106, 338, 361, 407, 582, 602, 646, 702, 706, 770)	Mudflat, Saltwater and Brackish Marsh, Beach, Uplands (106, 338, 407, 582, 602, 646, 702, 706, 770)	Aquatic Invertebrates, Fish, Invertebrates, Seeds (48, 338, 505, 602, 702, 734)	
Spotted Sandpiper	Saltwater, Brackish and Freshwater Marshes, Uplands, Beaches (435, 542, 582, 706)	Saltwater, Brackish and Freshwater Marshes, Uplands, Beaches (435, 542, 582, 706)	Invertebrates, Aquatic Invertebrates (384, 435)	DEE Female 15.6-36.7 kcal/day, Male 11.2-16.3 kcal/day (435)
Whimbrel	Freshwater, Saltwater and Brackish Marshes, Mudflats, Beaches (135, 687, 706)	Freshwater, Saltwater and Brackish Marshes, Mudflats, Beaches (135, 687, 706)	Aquatic invertebrates, Invertebrates, Berries, Fish (410, 420, 687)	Nestling RMR = 10-0.73+1.42(mass g) kJ/day (834)
Marbled Godwit	Beaches, Mudflats, Saltwater Marsh, Freshwater marsh (361, 363, 706)	Beaches, Mudflats (602, 706)	Aquatic Invertebrates (602)	

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
Ruddy Turnstone	Saltwater and Brackish Marshes, Beaches, Mudflat (106, 122, 582, 706)	Saltwater and Brackish Marshes, Beaches, Uplands, Mudflat (106, 122, 143, 582, 602, 646, 706)	Aquatic Invertebrates, Eggs (6, 311, 505, 550, 736)	DEE = 364 kJ (sd = 62.2) breeding, Juvenile BMR = 0.94W (403, 404, 581)
Red Knot	Beaches, Mudflat, Saltwater Marshes (106, 122, 582, 706)	Beaches, Mudflat, Saltwater Marshes (106, 122, 143, 582, 602, 706)	Aquatic Invertebrates, Seeds (291, 311, 505, 696, 736)	BMR = 0.65-1.42 W (580, 793)
Sanderling	Beaches, Mudflat (106, 106, 122, 582)	Beaches, Mudflat, Saltwater Marsh (106, 122, 143, 582, 602)	Aquatic Invertebrates (505, 736)	Juvenile BMR = 0.53W (sd = 0.03), Adult BMR = 48.15 kJ/day, Adult DEE = 100-200 (133, 134, 403)
Semipalmated Sandpiper	Mudflats, Beaches, Saltwater Marshes (106, 122, 582, 706)	Mudflats, Beaches, Uplands, Saltwater Marshes (106, 122, 143, 582, 602, 646, 706)	Aquatic Invertebrates, Seeds, Invertebrates (26, 86, 87, 505, 736)	Juvenile BMR = 0.31 W (404)
Western Sandpiper	Mudflats, Upland, Beaches (106, 407, 706)	Mudflats, Beaches (106, 407, 434, 602, 706)	Aquatic Invertebrates, Invertebrates (602, 841)	

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
Least Sandpiper	Mudflats, Uplands, Saltwater, Brackish, and Freshwater Marshes, Beaches (407, 564, 582, 706)	Mudflats, Uplands, Saltwater, Brackish, and Freshwater Marshes (407, 564, 582, 602, 706)	Aquatic Invertebrates, Invertebrates, Seeds (26, 86, 87, 505, 602, 736)	Nestling RMR = 10-0.19+1.45(mass g) kJ/day, Juvenile BMR = 0.34 W (404, 834)
Purple Sandpiper	Rocky shoreline, mudflats (289, 746, 760)	Rocky shoreline, mudflats (289, 746, 760)	Aquatic Invertebrates, Invertebrates (180, 746)	Juvenile BMR = 0.70 W (404)
Dunlin	Mudflats, Uplands, Beaches, Brackish and Saltwater Marshes (122, 407, 564, 706)	Mudflats, Uplands, Beaches, Brackish and Saltwater Marshes (122, 143, 407, 564, 602, 646, 706)	Aquatic Invertebrates, Invertebrates, Seeds (26, 86, 87, 505, 602, 736)	Nestling RMR = 10-0.12+1.27(mass g) kJ/day, Juvenile BMR = 0.53W (sd = 0.05) (403, 834)
Short-billed Dowitcher	Mudflats, Beaches, Saltwater Marshes (106, 122, 582, 706)	Mudflats, Uplands, Beaches, Saltwater Marshes (106, 122, 143, 582, 646, 706)	Aquatic Invertebrates, Invertebrates, Seeds, Fish (26, 505, 696)	Nestling RMR = 10-0.02+1.07(mass g) kJ/day (834)
Long-billed Dowitcher	Freshwater Marshes, Mudflats (27, 277)	Freshwater Marshes, Mudflats (27, 277)	Aquatic Invertebrates, Seeds (27, 696)	

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
Wilson's Snipe	Uplands, Mudflats, Freshwater and Brackish Marshes (407, 564, 706)	Uplands, Mudflats, Freshwater and Brackish Marshes (407, 564, 706)	Aquatic Invertebrates, Invertebrates, Seeds, Fish (86, 87, 648, 696)	
American Woodcock	Uplands, Freshwater Marshes (302, 466, 696, 706)	Uplands, Freshwater Marshes (302, 466, 696, 706)	Aquatic Invertebrates, Invertebrates, Seeds (466, 696)	92.5 kJ/day (748)
Bonaparte's Gull	Deep-water Zone (647, 706)	Deep-water Zone, Mudflat, Beach (76, 77, 113, 647, 706)	Aquatic Invertebrates, Fish, Invertebrates (76, 77, 113, 698)	
Laughing Gull	Saltwater Marsh, Beaches (124, 232, 483, 706, 756)	Deep-water Zone, Upland, Mudflat, Beach (113)	Aquatic Invertebrates, Invertebrates, Garbage (113, 505, 561)	
Ring-billed Gull	Upland, Beaches, Islands, Brackish Marshes (564, 649, 706)	Deep-water Zone, Upland, Mudflat, Beach, Brackish Marshes (113, 564, 706)	Aquatic Invertebrates, Invertebrates, Fish, Garbage (113, 561)	
Herring Gull	Beach, Upland, Saltwater and Brackish Marsh, Islands (120, 226, 232, 564)	Deep-water Zone, Upland, Mudflat, Beach, Brackish Marshes (113, 564)	Offal, Fish, Invertebrates, Aquatic Invertebrates, Garbage, Vertebrates, Eggs (109, 113, 316, 318, 561, 578)	J = up to 306 kcal/day, A = 200 - 260 kcal/day (528)

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
Lesser Black-backed Gull	Islands, Beaches, Upland (647)	Deep-water Zone, Islands, Beaches, Upland (369, 383, 647)	Fish, Aquatic invertebrates, Garbage (369, 383)	
Great Black-backed Gull	Beaches, Islands (130, 226, 706)	Deep-water Zone, Upland, Mudflat, Beach (113, 706)	Garbage (113)	
Gull-billed Tern	Beach, Islands, Saltwater Marsh (234, 670)	Beach, Saltwater marsh, uplands (229)	Aquatic invertebrates, Fish, Invertebrates (231)	
Caspian Tern	Islands, Beaches (135, 416, 683)	Deep-water Zone (706)	Fish (416, 638, 683)	J = 19.2MJ (hatching to fledging), A = 1040 kJ/day (638)
Royal Tern	Islands, Beaches (93, 350, 756, 803)	Deep-water Zone, Saltwater marshes (93, 94, 228, 229, 443)	Fish, Aquatic invertebrates (63, 93, 94, 228, 443, 599)	
Sandwich Tern	Beaches, Islands (350, 674, 676, 756)	Deep-water Zone (443, 675)	Fish, Aquatic invertebrates (63, 443, 676, 677)	A = 361 kJ/day (79)
Forster's Tern	Saltwater and freshwater marsh (232, 595, 756)	Deep-water Zone, Saltwater marsh (605)	Fish (257)	

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
Common Tern	Beaches, Saltwater marsh, Islands (118, 232, 670, 689)	Deep-water Zone, Shallow-water Zone, Saltwater marshes, Upland (228, 229)	Fish (76, 228, 653, 678)	Nestling = 200kJ / day, Adult (male) 434 kJ/day, Adult 343 kJ/day (265, 375, 617)
Roseate Tern	Islands, Beaches, Saltwater marsh (123, 676, 678, 695)	Deep-water Zone, Saltwater marshes (229, 675)	Fish (653, 676-678)	
Least Tern	Beaches, Islands, Roofs (111, 115, 292, 756)	Uplands, Saltwater marshes, Beaches (229)	Fish, Aquatic Invertebrates (698, 733)	
Black Skimmer	Beaches, Islands, Saltwater marsh (227, 232, 670, 689, 756)	Shallow-water Zone, Saltwater Marsh (228)	Fish (227, 228, 733)	
Short-eared Owl	Freshwater, Brackish, and Saltwater Marsh, Uplands (204, 706)	Freshwater, Brackish, and Saltwater Marsh, Uplands (706)	Small Mammals, Birds, Insects (145, 293, 336)	BMR = 87 kcal/kg/day; FMR = 522 kcal/kg/day (293)
Belted Kingfisher	Banks, Upland (307, 716)	Shallow-water Zone, Deep-water Zone (706)	Fish, Aquatic invertebrates, Amphibians (160, 812, 813)	Nestling = 65.5 kcal/day, A= 71.9 kcal/day (753)
Purple Martin	Upland, Marshes	Upland, Saltwater marshes	Invertebrates	Female = 39.9 - 43.9 kcal/day, Male = 31.2 - 34.2 kcal/day

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
	(706, 814)	(706, 769)	(38, 353, 759)	(744)
Tree Swallow	Saltwater, Brackish, and Freshwater Marshes, Uplands,	Saltwater, Brackish, and Freshwater marshes	Invertebrates, Berries	BMR = 66.8 mL Oxygen/hour
	(564, 647, 706)	(564, 647, 706)	(427, 792)	(125)
Northern Rough-winged Swallow	Banks		Invertebrates	
	(417)		(38, 417)	
Bank Swallow	Banks	Marshes, Upland, Beaches	Invertebrates, Aquatic invertebrates	Male DEE = 93.7 kJ/day, Female DEE = 90.0 kJ/day
	(58, 706)	(706)	(38, 223)	(805)
Cliff Swallow	Bridges, Upland	Uplands	Invertebrates	
	(295, 618, 783)	(618, 706)	(38)	
Sedge Wren	Saltwater and Brackish Marsh	Saltwater and Brackish Marsh	Invertebrates	
	(697, 706, 769)	(697, 706, 769)	(703)	
Marsh Wren	High marsh, Saltwater, Brackish and Freshwater marsh	High marsh, Saltwater, Brackish and Freshwater marsh	Invertebrates, Aquatic invertebrates	8.8 kcal/day
	(360, 361, 564, 595, 682, 706, 769, 770, 797, 798)	(360, 564, 682, 706, 769, 770, 797, 798)	(360, 798)	(360)
Henslow's Sparrow	Upland, Saltwater and Brackish Marshes	Upland, Saltwater and Brackish Marshes	Insects, Seeds	
	(647, 697, 837, 838, 845)	(647, 697, 837, 838, 845)	(193, 635)	

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
Nelson's Sparrow	Saltwater and Brackish Marshes (330, 682, 769)	Saltwater and Brackish Marshes (330, 682, 769)	Invertebrates, Aquatic invertebrates, Seeds (301)	
Saltmarsh Sparrow	Saltwater and Brackish Marsh (190, 531, 647, 682, 697, 706, 769, 770, 775, 822)	Saltwater and Brackish Marsh (190, 531, 647, 682, 697, 706, 769, 770, 775, 822)	Invertebrates, Aquatic invertebrates, Seeds (301)	
Seaside Sparrow	Saltwater and Brackish marsh (190, 426, 532, 592, 682, 697, 706)	Saltwater and Brackish marsh (190, 426, 532, 592, 682, 697, 706)	Invertebrates, Aquatic invertebrates (588, 592)	
Swamp Sparrow	Freshwater Marsh (797)	Freshwater Marsh (797)	Invertebrates, Seeds (427, 495)	
Coastal Plain Swamp Sparrow	Brackish and Freshwater Marshes (299, 765)	Brackish and Freshwater Marshes (299, 765)		
Bobolink	Brackish and Freshwater Marshes, Uplands (706)	Brackish and Freshwater Marshes, Uplands (706)	Seeds, Invertebrates (37)	24 - 32 kcal/day (276)
Red-winged Blackbird	Saltwater, Brackish and Freshwater Marsh, Uplands, Forested wetlands (361, 459, 564, 595, 682, 697, 770, 797)	Saltwater, Brackish and Freshwater Marsh, Uplands (195, 459, 564, 682, 697, 770, 797)	Seeds, Invertebrates, Aquatic Invertebrates (37, 195, 459, 633)	

Common name	Habitat use		Diet	Energy requirements
	Roost/breed	Forage		
Rusty Blackbird	Marshes, Forested Wetlands (46, 706)	Marshes, Uplands (46, 706)	Invertebrates, Aquatic Invertebrates, Seeds (37)	
Boat-tailed Grackle	Saltwater, Brackish, and Freshwater Marshes, Uplands (446, 589, 706, 770)	Saltwater, Brackish, and Freshwater Marshes, Uplands (589, 671, 706, 770)	Invertebrates, Aquatic Invertebrates, Seeds, Frogs, Fish (37, 446)	

[a] References are given in parentheses below data.

Table A.5. Demography of waterbirds of the Chesapeake Bay.

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Snow Goose	I, SA, A	A = 0.714 (754)[a]	-[b]	-	-	-	-	-	-
Canada Goose	I, SA1, SA2, A (154)	A = 0.66-0.76 (327)	Age 2-3 (154)	5.6 (74, 154)	0.75 (154)		27-28 days (74, 154)	8-9 weeks (547)	
Brant	I, SA1, SA2, SA3, A (603)	I = 0.29-0.72, SA1-A = 0.59-0.98 (373, 603)	-	-	-	-	-	-	-
Mute Swan	I, SA, A (610)		Age 3 (610)	6.2 (610)	0.58 (610)	1.2-3.9 (608, 610)	34-37 days (608)	120-145 days (608)	~ 1 year (141)
Trumpeter Swan	I, SA, A (30, 482)	A = 80-88% (11)	-	-	-	-	-	-	-
Tundra Swan	I, SA1, SA2, A	I male = 0.52, I female = 0.81, A = 0.92	-	-	-	-	-	-	-

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
	(42)	(511)							
Wood Duck	I, A	M I = 52.2%, A = 53.4%; F I = 43.4%, A = 43-70%	Age 1	9.5-12		5.2	29 days	8-10 weeks	39 days
	(325)	(71, 325)	(325)	(312, 471)		(442)	(312)	(42)	(442)
Gadwall	I, A	male A = 75%; female A = 54-79%; A (both) = 57%	Age 1	9.5-10.5		1.4-5.8	24-26 days	48-52 days	
	(406)	(17, 406, 717)	(406)	(203, 267, 406, 540)		(267, 406, 551)	(203, 240, 540)	(290)	
American Wigeon	I, A	I = 57%, A = 64%	-	-	-	-	-	-	-
	(496)	(17)							
American Black Duck	I, A	Female I = 46.1-57.9%, A = 56.0-61.0%; Male I = 50.9-64.9, A = 64.3-66.7	Age 1	9.1-9.7	0-20% (hatch success)	4.37	26.2 days	58-63 days	
	(713)	(254)	(713)	(382, 713)	(313)	(551)	(713)	(290)	
Mallard	I, A	I = 55-56%, A = 56-68%	Age 1	8.5-10.4	49-63%	1.5-5	24-28 days	52-60 days	
	(199,	(17, 406)	(199,	(382, 406,	(543,	(406,	(240, 547)	(290)	

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
	406)		406)	470, 543)	645)	543, 645)			
Blue-winged Teal	I, A (406)	I = 29%, A = 49-61% (17, 406)	Age 1 (406)	10.4-11 (179, 406)		5.25 (551)	23-24 days (179, 240)	35-44 days (290)	
Northern Shoveler	I, A (202)	I = 32%, A = 51% (17)	-	-	-	-	-	-	-
Green-winged Teal	I, A (42)	M = 49.5%, F = 44.3% (140)	-	-	-	-	-	-	-
Northern Pintail	I, A (22)	M = 67.3-78.0%, F = 57.1-59.8% (328)	-	-	-	-	-	-	-
Canvasback	I, A (497)	65.2-100% (402)	-	-	-	-	-	-	-
Redhead	I, A (843)	F I = 48.7%, A = 70.8% (16)	-	-	-	-	-	-	-

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Ring-necked Duck	I, A (334)	M I = 40.7%, A = 70.3%; F I = 32.8%, A = 47.1% (151)	-	-	-	-	-	-	-
Greater Scaup	I, A (368)	F = 76-86% (247)	-	-	-	-	-	-	-
Lesser Scaup	I, A (21)	F I = A = 57% (644)	-	-	-	-	-	-	-
Surf Scoter			-	-	-	-	-	-	-
White-winged Scoter	I, A (90)	F = 40-100% (90, 379, 791)	-	-	-	-	-	-	-
Black Scoter	I, A (548)	F I = 74.9%, A = 78.3% (253)	-	-	-	-	-	-	-
Long-tailed Duck	I, SA, A (632)	F A = 74-75% (632, 661)	-	-	-	-	-	-	-

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Bufflehead	I, SA, A (268)	M A = 67%; F A = 62-66%, I = 43% (269)	-	-	-	-	-	-	-
Common Goldeneye	I, SA, A (216)	F A = 61.2% (216)	-	-	-	-	-	-	-
Hooded Merganser	I, SA, A (210)	F A = 72% (568)	Age 2 (210)	9.8-11.4 (423, 489)	40-87% (hatch success) (364, 423, 441, 489)		33 days (489)	71 days (441)	
Common Merganser	I, SA, A (42)	M=F (all ages) 42-71% (569)	-	-	-	-	-	-	-
Red-breasted Merganser	I, SA, A (728)		-	-	-	-	-	-	-
Ruddy Duck	I, A (8)		-	-	-	-	-	-	-

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Red-throated Loon			-	-	-	-	-	-	-
Common Loon	I, SA2, SA3, A (478)	I = 0.70, S2-3 = 0.80, A = 0.92 (478)	-	-	-	-	-	-	-
Pied-billed Grebe			1 (421)	6.1-7.05 (136, 286, 408, 595, 668)	30.9-89.6% (136, 286, 408, 668)	4.4 (range 1-8) (136)	21-27 days (3, 49, 191, 501, 546)	35 days (372)	25-62 days (372, 501)
Horned Grebe	I, A (244)		-	-	-	-	-	-	-
Red-necked Grebe	I, SA, A (164, 546)		-	-	-	-	-	-	-
Eared Grebe			-	-	-	-	-	-	-
Wilson's		A = 90.8	-	-	-	-	-	-	-

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Storm-Petrel		(40)							
Northern Gannet	I, SA2, SA3, SA4, A (164, 508)	I = 0.35, SA1 = 0.90, SA2-A = 0.94 (498, 508)	-	-	-	-	-	-	-
Brown Pelican	I, SA2, SA3, A	I = 0.30-0.33, SA2 = 0.64-0.70, SA3-A = 0.80-0.80	3 +	2.6	78-82%	1.48, 1.6-2.7 (to day 21)	30-35 days	74-77 days	74-77 days
	(664, 667)	(322)	(664, 835)	(652, 666)	(652, 666)	(652, 666, 680)	(679, 680)	(665)	(665)
Double-crested Cormorant	I, SA2, SA3, A	J = 0.42 , SA = 0.77 , A = 0.79-0.89	2-3	2.7-4.1	50-75%	1.08	25-28 days	5-6 weeks	10 weeks
	(208)	(205, 207)	(206)	(317)	(317)	(135)	(317, 400, 465)	(747)	(465)
American Bittern				3.8-4.6 (204, 408, 595)	0.57 (204)		24-28 days (49, 126, 494, 752)		
Least Bittern				4.5-5.2 (67, 408, 796)	35-68% (67, 409)	75-77% of nestlings fledged (67)	17-20 days (796)	29 days (67)	

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Great Blue Heron	I, A	I = 0.29-0.31, Age2 = 0.64, A = 0.71-0.78	2	2.7-5	76-85%	0.85-3.1	25-29 days	49-69 days	2-3 weeks after fledging
	(129)	(322, 544)	(129)	(438, 594, 598, 749)	(436, 593)	(438, 555, 593, 594, 598, 749, 799, 801, 840)	(438, 593, 749)	(593, 749, 801)	(129, 593)
Great Egret	I, A	I = 0.24-0.44, A = 0.74	Age 1	2.3-4	14-100%	0.03-2.5	26-27 days	52 days	62-70 days
	(684)	(356, 672)	(684)	(173, 211, 215, 282, 436, 594, 720)	(215, 260, 587, 593)	(215, 260, 282, 593, 594, 817)	(176, 215, 436)	(817)	(817)
Snowy Egret		I = 0.13-0.28, A (AHY) = 0.40-0.69	Age 1-2	2.9-4.3	38-84%	0.60-2.6	22-24 days		53-55 days
		(651, 722)	(554)	(108, 173, 233, 347, 436, 553, 640, 720)	(260, 436, 587)	(108, 260, 347, 553, 640, 722)	(176, 347, 436)		(233)

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Little Blue Heron	I, SA, A	I = 0.259, A (AHY) = 0.667	Age 1-2 (Age 2 typical)	3.3-4.2	28-100%	0.44-2.9	21-23 days		>= 5 weeks
	(641)	(722)	(639, 641)	(108, 173, 211, 347, 436, 455, 555, 640)	(212, 260, 436, 455, 587)	(108, 212, 260, 347, 640, 722, 800)	(347, 436, 455, 698)		(642)
Tricolored Heron	I, SA, A	I = 0.207, A (AHY) = 0.684	Age 2	2.8-4.1	45-95%	1.7-2.8	23-24 days		59.2 days
	(259)	(722)	(259)	(108, 173, 347, 436, 640, 720)	(260, 436, 587)	(108, 260, 347, 640, 722)	(347, 436)		(261)
Cattle Egret		I = 0.196, A (AHY) = 0.323	Age 1	2.5-4.0	0-100%	0.5-3.0	22-26 days	29-35 days	45 days
		(722)	(684)	(108, 173, 211, 347, 436, 553, 555, 722, 745, 794)	(436, 587, 745)	(108, 347, 553, 722, 745, 794)	(347, 436, 722, 745, 794)	(354, 745)	(721)
Green Heron	I, A		Age 1	3.6-4	78-82%	3	20 days	21-23 days	estimated 30-35 days
	(473)		(473)	(211, 359, 473)	(359)	(473)	(473)	(473)	(473)

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Black-crowned Night-Heron	I, A (546, 595)	I = 0.31-0.39, A = 0.69-0.77 (322, 329)	Age 2-3 (10, 185, 546)	3.0-4.0 (172, 173, 211, 233, 553, 595, 720)	35-87% (172, 230, 587)	1.10-2.8 (172, 553)	23-24 days (10, 176)	6 weeks (546)	55-60 days (233)
Yellow-crowned Night-Heron	I, SA, A (771)		Age 2 (771)	2.9-4.1 (173, 211, 640, 766)	13-69% (181, 766)	0.62-3.06 (181, 640, 766)	25-28 days (181, 766)	34-37 days (181, 766)	42-57 days (181, 766)
White Ibis	I, SA, A (319)		Age 2 (319)	2.2-4 (211, 258, 386, 681, 720)	0-68% (258, 260, 587)	1.03-2.11 (260, 319, 386)	21 days (319, 386)	35-55 days (386, 656)	40-55 days (386, 656)
Glossy Ibis	I, SA, A (186, 474)	I = 0.40, A (AHY) = 0.59 (651)	Age 1-2 (186, 474)	2.1-3.2 (108, 173, 474, 553, 555, 829)	20-59% (474)	0.40-1.80 (108, 474, 553, 829)	21 days (35, 829)	28-42 days (35, 829)	6-7 weeks (35, 186)
Osprey	I, S1-2, A (584)	I = 0.49-0.60, S = A = 0.83-0.90 (324, 584)	Age 3-4 (370, 584)	2.7-2.9 (284, 609)	0.58 (609)	0.8-1.8 (284, 609, 786)	39 days (584, 700)	44-59 days (452, 584, 711)	65-103 days (711)

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Bald Eagle	I, S1-S3, A	I = 0.72-1.00, S1 = 0.85-0.92, S2 = 0.75-0.90, A = 0.82-0.83	Age 4-6	1-3, average 1930s = 2.35	44-82%	0.7-1.5	34-35 days	8-14 weeks	128 days
	(102)	(103, 270, 477)	(102, 270)	(1, 743)	(103, 789)	(103, 781, 789)	(326)	(102)	(477)
Northern Harrier	I, A	I = 0.41, A = 0.70	Age 1	3.7-4.1	65-73%	2.2-3.3	30-32 days	29-32 days	43-53 days
	(308)	(329)	(308)	(14, 204)	(204, 308)	(14, 308)	(78)	(55)	(55)
Yellow Rail	I, A (69)								
Black Rail	I, A		Age 1	7.6			17-20 d		
	(218)		(218)	(218)			(218, 248)		
Clapper Rail	I, A	A = 49-67%	Age 1	8-10, replacement clutch 5-6			20-28 d	10 weeks	5-6 weeks
	(219)	(217)	(219)	(377, 462, 705, 710)			(217, 377)	(4)	(4)
King Rail				10.5	69.5% laying to hatching		21-22 d	>9 weeks	24-30 days
				(611)	(611)		(460)	(460)	(456, 460)

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Virginia Rail	I, A	Annual survival = 0.526, daily survival = 0.998	Age 1	7.5-7.9	38-53%	4.2	18-20 d		15-21 d
	(586)	(152)	(586)	(152, 408, 586)	(152, 408)	(586)	(586, 628, 757):137		(351)
Sora	I, A	Non-breeding season survival (August-April) = 0.308, daily survival (non-breeding) = 0.996		7.4-11.5	43-83%, Daily = 97.8%, Egg success = 78%	4.9-7.7	14- 19 d	36 days	15-25 d
	(586)	(152)		(152, 408, 586, 758)	(152, 408)	(152, 586, 758)	(493, 586, 758)	(510)	(351, 586)
Common Moorhen	I, A		Age 1	6.5-10	0.68	3.6	20-24 days	60-65 days	52-99; average 72 days
	(576)		(576)	(73, 263, 314, 320, 320, 590)	(590)	(73)	(378, 842)	(842)	(842)
American Coot	I, A	I = 0.12-0.17, A = 0.39-0.43	Age 1	7.8-9.0	> 80%	5.1-6.9	23-27 days	75 days	80 days
	(167)	(128, 650)	(167)	(167, 262, 304, 595)	(9)	(167, 304)	(262, 304)	(304)	(85)

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Black-bellied Plover	I, A	I = 0.63, Age 2 = 0.91, A = 0.83 (236)	Age 1 (562)	-	-	-	-	-	-
Wilson's Plover				2.92 (sd = 0.047) 3, range 2-4 (51)	11-55% (51, 156)	ave = 1.60 range 1.40-1.82 (2004-2007) (64, 66, 824)	23-27 days (51) citations in (52)	24-27 days R. Beck as cited in (52)	
Semipalmated Plover	I, SA, A (249)	F = 0.56 (95%CI 0.51-0.61) , M = 0.61 (95% CI 0.56-0.66) (654)	Age 2-3 (249)	-	-	-	-	-	-
Piping Plover	I, A	I = 0.48, A = 0.74	Age 1	3.69 (SE = 0.60) to 3.96 (SE = 0.21)	46-64% average, range 9-84% by location	ave = 0.70-1.27, range by location 0.19-2.23	Average 28 (range 27-31) days	27-35 days	n/a

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
	(220)	(464)	(821)	(132, 169)	(169, 559)	(64, 66, 559, 824)	(132, 821)	(132, 821)	
Killdeer	I, A		Age 1	4	29-64%	0.16-1.6	Average 25 range 22-28 days	29-34 days	~39 days
	(345)		(345)	(104, 345)	(523, 662)	(399, 662)	(104, 662)	(399, 662)	(662)
American Oystercatcher	I, SA, A	A = 0.92	> Age 3	2.8 eggs (1st clutch), 2.4 eggs (2nd clutch)	5-86% range by island and year	0.61 (2006) 0.43 (2007) , range by island 0-1.26	24-28 days	35 days	> 60 days
	(445, 526)	(188)	(445)	(525)	(66)	(66, 824)	(526, 698, 730)	(526)	(526) also Palmer1967
Black-necked Stilt	I, SA, A	I = 0.53-0.60, Age 2 + = 0.81	Age 1-2	3.8 to 3.9 (sd = 0.4), range 2-5	11-100%	0.934 (SD = 0.431)	22-28 days	27-31 days	
	(346, 692)	Hawaiian stilt; (604)	(346, 692)	(294)	(636)	Hawaiian Stilt, USFWS unpublished data as cited by (636)	(294, 309)	(636)	

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Greater Yellowlegs			-	-	-	-	-	-	-
Lesser Yellowlegs			-	-	-	-	-	-	-
Solitary Sandpiper			-	-	-	-	-	-	-
Willet	I, SA, A (820)	A = 0.76-0.96 (338, 414)	Age 2-3 (820)	3.8 sd = 0.43 (531)	2-36% (338)	0.69 (734)	21-29 days (338, 698, 734)	1 month (338)	4-5 weeks (338)
Spotted Sandpiper	I, SA, A (542)	A > 0.63 (return rates) (606)	Age 1-2+ (542)	3.6 (sd = 0.26-0.90) (542, 627)	1.39, range 0.07-2.67 (542)	0.81, range 0-2.13 (542)	21 days, range 19-22 citations in (541)	16-19 days (510)	4 weeks (541)
Whimbrel	I, SA, A Skeel 1983 as cited by (687)		-	-	-	-	-	-	-

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Marbled Godwit		A = 0.87 (148)	-	-	-	-	-	-	-
Ruddy Turnstone		J = 0.44-0.77, SY =1.00, TY = 0.90, A = 0.66-0.89 (72, 236)	-	-	-	-	-	-	-
Red Knot		0.34-0.76 (315)	-	-	-	-	-	-	-
Sanderling		J = 0.82, SY = 0.89, A = 0.81 (236)	-	-	-	-	-	-	-
Semipalmated Sandpiper	J, SA, A (296)	A = 0.56-0.66 (614, 654, 655)	-	-	-	-	-	-	-
Western Sandpiper		A = 0.49-0.57; J = 0.45-0.61 (242, 615, 655)	-	-	-	-	-	-	-
Least Sandpiper	J, A (153)		-	-	-	-	-	-	-

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Purple Sandpiper	J, A (565)	J >= 0.18, A >= 0.75 (577)	-	-	-	-	-	-	-
Dunlin	J, A (762)	J = 0.33, A = 0.53-0.74 (761)	-	-	-	-	-	-	-
Short-billed Dowitcher			-	-	-	-	-	-	-
Long-billed Dowitcher			-	-	-	-	-	-	-
Wilson's Snipe	I, A (737)	0.488 (737)	-	-	-	-	-	-	-
American Woodcock	I, A (439)	male I = 0.202, A = 0.354; female I = .358, A = .491 (214)	Age 1 (439)	3-4 (302, 432, 439)	43-50% (302, 439)	~ 3.5 (extrapolated) (466, 823)	19-22 days (466)	18 days (466)	4-5 weeks (715)
Bonaparte's				-	-	-	-	-	-

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Gull									
Laughing Gull	I, SA, A (114)		Age 3 (114)	2.2-2.8 (114, 483, 666)	50-78% (114, 666)	1.1 (666)	24-25 days (110, 666)	32 days (110)	61 days (110)
Ring-billed Gull	I, SA, A (693)	I = 0.60, SA = 0.50-0.60, A = 0.12-0.13 (415, 649)							
Herring Gull	I, SA2-4, A (137)	I = 0.83, SA=A = 0.80-0.935 (137, 162, 355)	5-6 years (137)	2.2-2.9 (120, 137, 226, 318)	Overall = 42%, Age 5 = 23%, Age 6 = 32%, >Age 6 = 36% (137)	Overall = 1.03, Age 5 = 0.51, Age 6 = 0.71, >Age 6 = 0.99 (137)	28 days (318)	42 days (110)	63-90 days (110)
Lesser Black-backed Gull	I, S2-3, A (165)	average all ages = 0.80 (245)	-	-	-	-	-	-	-
Great Black-backed Gull		average all ages = 0.75	Age 4-5	2.7-2.8		0.47-2.11	28 days	45 days	85 days

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
		(245)	(165)	(130, 226)		(130, 226)	(110)	(110)	(110)
Gull-billed Tern	I, S2-S4, A		Age 3-5	2.0-2.1	0.008	0.02	21-23 days		
			(481)	(534, 670)	(534)	(534)	(670)		
Caspian Tern	I, S2-3, A	I = 0.56, SA = 0.74, A = 0.82-0.89	Age 3-4	2.4-2.8		0.5-1.61	26 days	6-8 weeks	up to 4-8 mos
		(329, 416)	(278, 416)	(416, 683)		(416, 683)	(416)	(416)	(391, 733)
Royal Tern			Age 5-6	1.01-1.4		0.36-0.44	30-31 days		Age 4-6 months
			Weske as cited in (96)	(63, 93, 599)		(63)	(96)		(19, 94, 733)
Sandwich Tern	I, S2-4, A	I = 0.54, S2-A = 0.78	Age 3-5	1-1.3		0.55-0.66	21-29 days	25-30 days	
	(433, 688)	(433)	(433, 688)	(63, 395, 674)		(395)	(395, 688)	(674, 688)	
Forster's Tern	I, SA, A		Likely Age 2	2.6	0-17%	0-1.6	25 days	4-5 weeks	
	(454)		(454)	(81)	(178)	(454)	(453)	(306)	

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Common Tern	I, S2-3, A (24)	J to Age 4 = 0.07-0.14; A = 0.88-0.92 (192, 514, 521)	Age 3-4 (24)	1.7-2.96 (397, 522, 534, 689)	≥2% (534)	0-2.10 (116, 397, 516, 534, 689)	21-28 days (163, 395, 515)	27-30 days (116)	1-3 weeks post-fledging (513)
Roseate Tern	I, S2-3, A (522)	A = 0.74-0.84 (694)	Age 3-4 (522)	1.0-1.9 (123, 395, 397, 520, 695)	0.7 (695)	0.64-1.5 (395, 397, 516, 520, 695)	22-23 days (395, 515)	22-27 days (519)	
Least Tern	I, SA, A (431)	A = 0.85 (613)	Age 2 (431)	1.7-2.3 (431, 534)	0.12 (534)	0.02-1.5 (111, 431, 534)	23 days (723)	20 days (723)	6 weeks (depart colony within 3 weeks after fledging) (431, 724)
Black Skimmer	I, S2-3, A (287)		Age 2-3 (287)	1.4-3.55 (227, 534, 689)	≥4% (534)	0.13-1.6 (227, 534, 689)	23 days (227)		≥ 2 weeks post-fledging (287)
Short-eared Owl	I, A (718)		-	-	-	-	-	-	-

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Belted Kingfisher				6.6-6.9 (5, 307)	82-93% (5, 307)	4.8-6.25 (5, 716)	22-23 days (5, 307)	27-29 days (5, 307)	3-4 weeks post-fledging (307, 813)
Purple Martin	I, A (243)	A = 0.55 (353)	Age 1 (243, 398)	4.7-4.9 (243)	50-94% (398)	2.5-3.4 (243, 353)	17 days (243)	27 days (243)	7-10 days (88)
Tree Swallow	I, A (75, 385)	females = 0.40-0.47 (171)	Age 1 (75, 385)	4.6-5.8 (23, 75, 385, 566)		3.9-5.1 (23, 75, 567)	14-16 days (23, 385, 566)	19-21 days (23, 385, 566)	
Northern Rough-winged Swallow	I, A (417)	unk	Age 1 (417)	6.1 (417)	0.65 (417)	3.7 (417)	16 days (417)	18-21 days (417)	
Bank Swallow	I, A (419)	0.349 (419)	Age 1 (419)	4.8 (574)		2.2-3.7 (223)	15 days (574)	18-20 days (41, 574)	
Cliff Swallow	I, A (437)		Age 1 (437)	3.3-3.9 (295, 506)	0.87 (437)	2.2-2.4 (295)	13.5-16 days (295, 437)	22-23 days (295, 437)	
Sedge Wren				5.2-7.6 (127, 166)	55-75% (127)	1.6-5.3 (127, 166)	14 days (127)	14 days (166)	

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Marsh Wren	I, A		Age 1	4.1-6.0		0.55-3.5	13-16 days	12-14 days	4 weeks
	(751)		(751)	(360, 750)		(360)	(360, 750)	(360, 750, 798)	(750)
Henslow's Sparrow				3.8-4.7 (634, 838)	29-55% (612, 634, 838)	1.6-2.0 (634, 838)	12 days (838)	9 days (838)	
Nelson's Sparrow			-	-	-	-	-	-	-
Saltmarsh Sparrow	I, A	I = 31%, A = 53-63%	Age 1	3.8-3.9	41-61%	4.03 young/ female/ year	12 days	8-11 days	15-20 days after fledge
	(301)	(301, 592)	(301)	(592)	(190, 280, 682)	(592)	(301)	(301)	(190)
Seaside Sparrow	I, A	A = 53-60%	Age 1	3.6-4.0	37-60%	3.5-4.5 young/ female/ year	12 days	9-12 days	
	(588)	(588, 592)	(588)	(426, 592)	(280, 426)	(426, 592)	(426)	(588)	

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Swamp Sparrow	I, A (221)		Age 1 (221)	3.6-4.6 (221, 299, 539)	28-45% (221)	1.1-1.5 (221)	12 days (221, 808)	10 days (221)	15-17 days post fledging (221)
Coastal Plain Swamp Sparrow				3.3-3.5 (299, 539)					
Bobolink	I, A (428)		-	-	-	-	-	-	-
Red-winged Blackbird	I, SA, A (335)	Males all ages = 42-54%, Females all ages = 40%-54% (669)	Age 1 (335)	3.4-4.1 (166, 633)		0.73-2.7 (166, 633)	11-13 days (509, 844)	9 days (509)	5-6 weeks (509)
Rusty Blackbird			-	-	-	-	-	-	-

Common name	Age groups	Survival by age group	Age of first breeding	Reproductive rates			Breeding data		
				Clutch size (eggs/nest)	Nest success	Fledging rate	Incubation period	Age at fledging	Age of independence
Boat-tailed Grackle	I, SA, A	A male = 86%, A female = 69%	Males Age 2, Females Age 1	2.75-2.92	48-78%	1.0-1.6	13-14 days	13-15 days	3 weeks after fledging
	(446)	(589)	(446, 671)	(29, 589, 591, 671)	(591)	(591)	(28, 29, 446)	(28, 29)	(589)

[a] References are given in parentheses below data.
[b] Dashes indicate data not applicable when waterbird is present on the Chesapeake Bay.

Table A.6. Threats to habitat, reproduction, and survival of waterbirds of the Chesapeake Bay.

Common name	Habitat	Reproduction	Survival
Snow Goose			
Canada Goose	Marsh area (89)[a]		
Brant	Habitat Degradation (20)		
Mute Swan			
Trumpeter Swan			Plume/fur trade (30)
Tundra Swan	Habitat Degradation (20, 503)		
Wood Duck	Habitat Loss (529)	Habitat Degradation (20)	
Gadwall	Marsh area (89)		
American Wigeon	Habitat Degradation (503)		
American Black Duck	Habitat Degradation (503)	Nest Predators (20)	Human disturbance (491)
Mallard	Marsh area (89)		
Blue-winged Teal	Marsh area, Marsh loss (89, 468)		

Common name	Habitat	Reproduction	Survival
Northern Shoveler	Marsh area (89)		
Green-winged Teal	Marsh area (89)		
Northern Pintail	Marsh area, Habitat Degradation (89, 503)		
Canvasback	Habitat Degradation (20, 310, 572)		
Redhead	Marsh area, Habitat Degradation (20, 89, 503, 573)		
Ring-necked Duck	Habitat Degradation, Human Disturbance (573)		
Greater Scaup	Habitat Degradation, Human Disturbance (573)		
Lesser Scaup	Habitat Degradation, Human Disturbance (573)		
Surf Scoter	Habitat Degradation, Human Disturbance (20, 573)		Gill nets and fishing gear (251)
White-winged Scoter	Habitat Degradation, Human Disturbance (573)		Gill nets and fishing gear (251)
Black Scoter	Habitat Degradation, Human Disturbance		Gill nets and fishing gear

Common name	Habitat	Reproduction	Survival
	(573)		(251)
Long-tailed Duck	Habitat Degradation, Human Disturbance (20, 573)		Gill nets and fishing gear (251)
Bufflehead	Habitat Degradation, Human Disturbance (503, 573)		
Common Goldeneye	Habitat Degradation, Human Disturbance (573)		
Hooded Merganser	Human Disturbance (573)	Habitat Degradation (20)	
Common Merganser	Human Disturbance (573)		
Red-breasted Merganser	Human Disturbance (573)		Gill nets and fishing gear (251)
Ruddy Duck	Marsh area (89)		
Red-throated Loon			Gill nets and fishing gear, Marine oil spills (251, 424)
Common Loon			Gill nets and fishing gear, Oil spills, Sinker ingestion, Mercury bioaccumulation (237, 251, 255, 256, 340, 424)
Pied-billed Grebe	Wetland loss, Marsh area (89, 275)	Flooding, Predation (286, 668)	

Common name	Habitat	Reproduction	Survival
Horned Grebe			Gill nets and fishing gear, Marine oil spills (251, 424)
Red-necked Grebe		Contaminants aquired on wintering and migration grounds (189, 252)	Gill nets and fishing gear, Marine oil spills (251, 424)
Eared Grebe			
Wilson's Storm-Petrel			
Northern Gannet		Formerly Contaminants (139, 552)	Gill nets and fishing gear, Marine oil spills (251, 340, 424)
Brown Pelican	Marsh degredatation (424)	Human Disturbance (666)	Fishing line entanglement, Sinker ingestion (256, 664)
Double-crested Cormorant	Human disturbance (424)	Nest predators (424)	Gill nets and fishing gear, Sinker ingestion (251, 256)
American Bittern	Wetland loss, Invasive species, Human disturbance, Marsh area (89, 273, 424)		Hunting (424)
Least Bittern	Wetland loss, Invasive species, Marsh area (89, 274, 340, 424)		

Common name	Habitat	Reproduction	Survival
Great Blue Heron	Human disturbance, Development, Vegetation degradation in colony, Marsh area (57, 424, 682, 686, 776, 801, 818)	Nest predators (424)	
Great Egret	Human disturbance, Coastal marsh degradation, Vegetation degradation in colony, Habitat fragmentation and loss, Marsh area (424, 682, 770, 818)	Nest predators, Disease (424, 819)	
Snowy Egret	Human disturbance, Coastal marsh degradation, Vegetation degradation in colony, Marsh area (424, 682, 818)	Nest predators, Interspecific competition, Disease (108, 424, 819)	
Little Blue Heron	Human disturbance, Coastal marsh degradation, Vegetation degradation in colony (424, 818)	Interspecific competition, Disease (108, 212, 800, 819)	
Tricolored Heron	Human disturbance, Coastal marsh degradation, Vegetation degradation in colony (424, 818)	Nest predators, Interspecific competition, Disease (108, 424, 819)	
Cattle Egret	Human disturbance, Vegetation degradation in colony (424, 818)	Nest predators (424)	
Green Heron	Human disturbance, Marsh area	Nest predators	

Common name	Habitat	Reproduction	Survival
	(358, 424, 682)	(424)	
Black-crowned Night-Heron	Human disturbance, Coastal marsh degradation, Vegetation degradation in colony, Marsh area (89, 424, 818)	Nest predators, Interspecific competition, Environmental Contaminants, Disease (108, 424, 538, 600, 819)	Sinker ingestion (256)
Yellow-crowned Night-Heron	Human disturbance, Coastal marsh degradation, Vegetation degradation in colony (424, 818)	Nest predators (424)	
White Ibis	Human disturbance, Coastal habitat degradation (340, 424)	Nest predators (424, 587)	
Glossy Ibis	Human disturbance, Wetland loss, Vegetation degradation in colony, Marsh area (424, 682, 818)	Interspecific competition (108)	
Osprey		Environmental Contaminants, Entanglement with fishing line (600, 786)	Collisions/Electrocution, Entanglement with monofilament fishing line (786)
Bald Eagle	Habitat Loss, Human Development (99, 764)	Human Disturbance, Environmental Contaminants, Hurricanes (600, 763, 764)	Electrocution (480)
Northern Harrier	Habitat loss and fragmentation (769)		

Common name	Habitat	Reproduction	Survival
Yellow Rail	Habitat loss, invasive species, human disturbance, water level changes (69, 424)		Collisions, Deaths recorded when fields hayed using scythe mowers (413, 424)
Black Rail	Habitat loss, Invasive species, Human disturbance, Water level changes (83, 340, 424)	Water level fluctations (248)	Collisions, Predation (feral cats common in marshes (802)) (424)
Clapper Rail	Invasive plants, Habitat degradation, fragmentation and loss (424, 682, 770)	Human disturbance, spring tides (49):278, (377, 424)	Collisions, Contaminants (424)
King Rail	Habitat loss and degradation, Invasive plants (339, 424, 585)	Flooding of nests (424)	Collisions, Predation (424, 507, 585)
Virginia Rail	Habitat loss, invasive species (424)	Human disturbance, Contaminants (424, 586)	Collisions, Contaminants (424)
Sora	Habitat loss, invasive species (424, 628)	Human disturbance, Water level manipulations (424, 586)	Collisions, Hunting (lead poisoning) (18, 424, 628)
Common Moorhen	Wetland loss, Invasive species (424)	Nest predators, Water level manipulations (424)	
American Coot	Invasive species, Marsh area (89, 424)	Water level manipulations (424)	

Common name	Habitat	Reproduction	Survival
Black-bellied Plover			
Wilson's Plover	Loss of nesting habitat (50, 52)	Human disturbance, Mammalian and Avian predation (50, 52)	
Semipalmated Plover		-	
Piping Plover	Habitat Loss, Human disturbance (168, 331)	Predation, Tidal Inundation, Parental Abandonment (66, 168, 559, 621)	Habitat quality (chicks) (405)
Killdeer		Predation (345)	
American Oystercatcher		Predation, Tidal Inundation, Human Disturbance (66, 187, 444)	
Black-necked Stilt		Predation , Flooding (636)	
Greater Yellowlegs	Habitat Loss and Degradation (222)		
Lesser Yellowlegs	Habitat Loss and Degradation (727)		
Solitary Sandpiper	Habitat Loss (492)		
Willet	Habitat fragmentation	Predation	

Common name	Habitat	Reproduction	Survival
	and loss, Marsh area, Invasive species (45, 682, 770)	(338)	
Spotted Sandpiper		Predation (542)	
Whimbrel			
Marbled Godwit			
Ruddy Turnstone	Human Disturbance (105)		
Red Knot	Human Disturbance (105)		
Sanderling	Human Disturbance, Development (105, 107, 194)		
Semipalmated Sandpiper			
Western Sandpiper			
Least Sandpiper			
Purple Sandpiper			
Dunlin			
Short-billed			

Common name	Habitat	Reproduction	Survival
Dowitcher			
Long-billed Dowitcher			
Wilson's Snipe			
American Woodcock	Human development of habitat (213)		Low quality of winter habitat (380, 381)
Bonaparte's Gull	Habitat degradation (117)		Marine oil spills (424)
Laughing Gull	Human disturbance (424)	Nest predators, Flooding (424, 483)	
Ring-billed Gull			
Herring Gull	Human disturbance (424)	Nest predators (424)	Fishing gear (424)
Lesser Black-backed Gull			
Great Black-backed Gull	Human disturbance (424)		
Gull-billed Tern	Habitat loss, Human disturbance, Coastal marsh degradation (424, 831)	Nest predation (235, 534, 831)	
Caspian Tern	Human disturbance, Coastal marsh degradation (424)	Nest predators, Human disturbance (683)	

Common name	Habitat	Reproduction	Survival
Royal Tern	Human disturbance (96, 424)	Nest predators (235, 424)	
Sandwich Tern	Human disturbance (424)		Marine oil spills (424)
Forster's Tern	Wetland loss, Coastal marsh degradation, Human disturbance, Marsh area (89, 424)	Nest predation (424)	
Common Tern	Human disturbance (424)	Nest predators, flooding (118, 119, 235, 316, 424, 534)	
Roseate Tern	Human disturbance, Habitat loss (288, 424)	Nest predators (424)	Marine oil spills, Collisions (424)
Least Tern	Invasive species, Human disturbance, Coastal marsh degradation (111, 424)	Nest predators, Human disturbance (111, 235, 424, 534)	
Black Skimmer	Human disturbance (424)	Nest predators (235, 424, 534)	
Short-eared Owl			
Belted Kingfisher	Habitat fragmentation (682)		
Purple Martin			
Tree Swallow			

Common name	Habitat	Reproduction	Survival
Northern Rough-winged Swallow			
Bank Swallow	Habitat degradation (58)		
Cliff Swallow	Habitat Loss (618)	Nest destruction (618)	
Sedge Wren	Habitat fragmentation, Marsh area, Marsh burning (769)		
Marsh Wren	Habitat fragmentation, burning, Marsh area, Invasive Species (89, 682, 769, 770, 797)		
Henslow's Sparrow	Sea-level Rise, Invasive Species (647, 837)		
Nelson's Sparrow	Habitat loss and fragmentation (682, 769)		
Saltmarsh Sparrow	Habitat loss and fragmentation, Environmental contamination, Invasive species (45, 531, 682, 769, 770, 822)	Pollution (822)	
Seaside Sparrow	Habitat fragmentation and loss, Invasive species (45, 682, 770)	Tidal Flooding (190)	

Common name	Habitat	Reproduction	Survival
Swamp Sparrow	Marsh area, Invasive Species (89, 797)		
Coastal Plain Swamp Sparrow	Marsh area, Invasive Species (89, 797)		
Bobolink			
Red-winged Blackbird			
Rusty Blackbird	Habitat loss and degradation (300)		
Boat-tailed Grackle	Habitat fragmentation and loss (770)		

[a] References are given in parentheses below data.

Table A.7. Importance of the Region and Chesapeake Bay to each species of Waterbird during breeding, wintering, and migration seasons.

Common name	Region[a]			Chesapeake Bay[b]		
	Breeding	Migration	Wintering	Breeding	Migration	Wintering
Snow Goose	(529)[d]	I[c]	I			
Canada Goose	I (529)	I	V			
Brant	N/A (529)	N/A	V			
Mute Swan	E	E	E	E	E	E
Trumpeter Swan	N/A (30)	HP	HP		HP	HP
Tundra Swan	N/A (529)	N/A	V			
Wood Duck	I (529)	I	I			
Gadwall	N/A (529)	N/A	I			
American Wigeon	N/A (529)	N/A	I			
American Black Duck	I (529)	N/A	V	V (157)	V	V
Mallard	P (529)	N/A	I	I (157)	I	I
Blue-winged Teal	N/A	N/A	I			

Common name	Region[a]			Chesapeake Bay[b]		
	Breeding	Migration	Wintering	Breeding	Migration	Wintering
	(529)					
Northern Shoveler	N/A (529)	N/A	I			
Green-winged Teal	N/A (529)	N/A	I			
Northern Pintail	N/A (529)	N/A	I			
Canvasback	N/A (529)	N/A	V	N/A (418)	N/A	I
Redhead	N/A (529)	N/A	V			
Ring-necked Duck	N/A (529)	N/A	I			
Greater Scaup	N/A (529)	N/A	V			
Lesser Scaup	N/A (529)	N/A	V			
Surf Scoter	N/A (529)	N/A	V			
White-winged Scoter	N/A (529)	N/A	V			
Black Scoter	N/A (529)	N/A	V			
Long-tailed Duck	N/A (529)	N/A	V			

Common name	Region[a]			Chesapeake Bay[b]		
	Breeding	Migration	Wintering	Breeding	Migration	Wintering
Bufflehead	N/A (529)	N/A	V			
Common Goldeneye	N/A (529)	N/A	I			
Hooded Merganser	N/A (529)	N/A	I			
Common Merganser	N/A (529)	N/A	P			
Red-breasted Merganser	N/A (529)	N/A	I			
Ruddy Duck	N/A (529)	N/A	V			
Red-throated Loon	N/A (33, 340, 424)	V	V		V	V
Common Loon	N/A (340, 424, 448)	V	V			
Pied-billed Grebe	P (340, 424, 502)	I	I	P	P	P
Horned Grebe	N/A (340, 424)	I	V			
Red-necked Grebe	N/A (424, 714)	N/A	I			
Eared Grebe	N/A (339)	P	P			
Wilson's Storm-Petrel						

Common name	Region[a]			Chesapeake Bay[b]		
	Breeding	Migration	Wintering	Breeding	Migration	Wintering
Northern Gannet	V (340, 424)	V	V			
Brown Pelican	V (340)	V	V	V	V	V
Double-crested Cormorant	I (82, 340, 424)	V	V	I	V	V
American Bittern	P (271, 340, 424)	I	V			
Least Bittern	V (272, 340, 424)	V	I			
Great Blue Heron	V (129, 340, 424)	V	V	V	V	V
Great Egret	V (340, 424, 440)	V	V	V	V	V
Snowy Egret	V (340, 424, 554)	V	V	V	V	V
Little Blue Heron	V (340, 424, 642)	V	V	P	P	P
Tricolored Heron	V (259, 259, 340, 424)	V	V	V	V	V
Cattle Egret	I (340, 424, 721)	I	I	P	P	P
Green Heron	V (340, 424)	V	V	P	P	P
Black-crowned Night-Heron	V (185, 340, 424)	V	V	I	I	I

Common name	Region[a]			Chesapeake Bay[b]		
	Breeding	Migration	Wintering	Breeding	Migration	Wintering
Yellow-crowned Night-Heron	I (340, 424)	I	I	I	I	I
White Ibis	V (340, 424)	V	V			
Glossy Ibis	V (340, 424)	V	V	V	V	V
Osprey	I (321, 549, 557, 616)	P	N/A	V (321, 323, 784)	I	
Bald Eagle	V (764)	V	V	V (479, 764)	V	V
Northern Harrier	P (549, 557)	P	P			
Yellow Rail	N/A (340)	V	I			
Black Rail	V (340, 424)	V	V	V (83)		
Clapper Rail	P (424)	P	P	I	I	I
King Rail	I (340, 424)	I	I	V (340, 424, 460, 585)	V	V
Virginia Rail	I (340, 424)	I	I			
Sora	I (340, 424)	I	I	P (339, 424, 706)	I	P
Common Moorhen	P (31, 340, 424)	P	P			

Common name	Region[a]			Chesapeake Bay[b]		
	Breeding	Migration	Wintering	Breeding	Migration	Wintering
American Coot	P (85, 340, 424)	P	P			
Black-bellied Plover	N/A (91, 144, 339)	V	V			
Wilson's Plover	V (91, 144, 339)	I	I	HP	HP	HP
Semipalmated Plover	N/A (91, 144, 339)	V	V			
Piping Plover	V (91, 144, 339)	V	V	HP	HP	HP
Killdeer	I (91, 144, 339)	P	V			
American Oystercatcher	V (91, 144, 187, 339, 527, 826)	V	V	P (826)	P	P
Black-necked Stilt	I (91, 339)	P	N/A			
Greater Yellowlegs	N/A (91)	V	I			
Lesser Yellowlegs	N/A (91, 144, 339)	V	I			
Solitary Sandpiper	N/A (91, 144, 339)	V	N/A			
Willet	V (91, 144, 339)	I	V			
Spotted Sandpiper	I (91, 144, 339)	V	I			

Common name	Region[a]			Chesapeake Bay[b]		
	Breeding	Migration	Wintering	Breeding	Migration	Wintering
Whimbrel	N/A (91, 144, 339)	V	P			
Marbled Godwit	N/A (91, 144, 339)	I	V			
Ruddy Turnstone	N/A (91, 144, 339)	V	I			
Red Knot	N/A (91, 144, 339)	V	V			
Sanderling	N/A (91, 144, 339)	V	I			
Semipalmated Sandpiper	N/A (91, 144, 339)	V	I			
Western Sandpiper	N/A (91, 144, 339)	I	I			
Least Sandpiper	N/A (91, 144, 339)	I	I			
Purple Sandpiper	N/A (91, 144, 339)	N/A	V			
Dunlin	N/A (91, 144, 339)	V	V			
Short-billed Dowitcher	N/A (91, 144, 339)	V	V			
Long-billed Dowitcher	N/A (91, 144, 339)	P	I			
Wilson's Snipe	I (91, 144, 339)	I	I			

Common name	Region[a]			Chesapeake Bay[b]		
	Breeding	Migration	Wintering	Breeding	Migration	Wintering
American Woodcock	V (91, 144)	V	V			
Bonaparte's Gull	N/A (117, 340, 424)	P	P			
Laughing Gull	V (340, 424)	V	V	P	P	P
Ring-billed Gull	N/A (340, 424, 649)	I	I			
Herring Gull	V (340, 424)	V	V	P	P	P
Lesser Black-backed Gull	N/A (424)	P	P	P	P	P
Great Black-backed Gull	V (340, 424)	V	V	P	P	P
Gull-billed Tern	V (424)	N/A	N/A	P	N/A	N/A
Caspian Tern	P (177, 340, 424)	P	I	P	P	P
Royal Tern	V (96, 340, 424)	V	V	I (82, 96)	N/A	N/A
Sandwich Tern	I (340, 424, 674)	I	I	P	P	P
Forster's Tern	V (340, 424, 454)	V	V	V	V	V
Common Tern	V (340, 424, 517)	V	I	I	I	P

Common name	Region[a]			Chesapeake Bay[b]		
	Breeding	Migration	Wintering	Breeding	Migration	Wintering
Roseate Tern	V (288, 424)	N/A	N/A	HP	N/A	N/A
Least Tern	V	N/A	N/A	I	N/A	N/A
Black Skimmer	V (287, 340, 424)	V	V	P	P	P
Short-eared Owl	P (549, 557)	P	P			
Belted Kingfisher	I (549, 557)	N/A	N/A	P	N/A	N/A
Purple Martin	V (549, 557)	V	N/A			
Tree Swallow	P (549, 557)	P	N/A			
Northern Rough-winged Swallow	I (549, 557)	I	N/A	P	P	N/A
Bank Swallow	P (549, 557)	P	N/A	P	P	N/A
Cliff Swallow	P (549, 557)	P	N/A			
Sedge Wren	P (549, 557)	P	P			
Marsh Wren	I (549, 557)	I	P			
Henslow's Sparrow	P (549, 557)	P	P			

Common name	Region[a]			Chesapeake Bay[b]		
	Breeding	Migration	Wintering	Breeding	Migration	Wintering
Nelson's Sparrow	P (549, 557)	P	P			
Saltmarsh Sparrow	V (549, 557, 616, 772)	V	V			
Seaside Sparrow	V (549, 557)	V	V			
Swamp Sparrow	P (549, 557)	P	P			
Coastal Plain Swamp Sparrow	V	N/A	N/A	V	N/A	N/A
Bobolink						
Red-winged Blackbird	P (549, 557)	P	P			
Rusty Blackbird		V	V			
Boat-tailed Grackle	P (549, 557)	P	P			

[a] Region includes BCR 30 Mid-Atlantic/New England Maritimes and 27 Southeastern Coastal Plain (Figure 2).

[a] Determined as outlined under Importance of the Chesapeake Bay in text.

[c] (V) Very important, (I) Important, (P) Present, (E) exotic or non-native, (HP) Historically present, (N/A) not applicable or not present during season, ( ) blanks represent not enough data for evaluation.

[d] References are given in parentheses below data.

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