Chapter 4. Virginia's Mid-Atlantic Coastal Plain

Figure 4.1. The Mid-Atlantic Coastal Plain ecoregion.

4.1. Introduction

4.1.1. Description

The Mid-Atlantic Coastal Plain (Coastal Plain, Figure 4.1) corresponds to what other classification systems call the Coastal Plain (Table 4.1). The terrain is mostly flat. This province is bounded by the Southern Appalachian Piedmont to the west and the Chesapeake Bay and Atlantic Ocean to the east. The soils of the Coastal Plain are predominantly deep, moist Aquults and Aqualfs (McNab and Avers 1994). Rainfall in the region averages 110cm per year, and the average temperature ranges from 13 to 14°C (McNab and Avers 1994). The growing season generally lasts between 185 and 259 days (shortest in the northern portion, longest in the City of Virginia Beach, Woodward and Hoffman 1991). Forest cover is mostly loblolly pine-hardwood (McNab and Avers 1994), except the southernmost portion, which is mainly southeastern evergreen (longleaf and loblolly pine, Woodward and Hoffman 1991). Most streams are small to intermediate in size and have very low flow rates (McNab and Avers 1994).

Table 4.1. Names for the Mid-Atlantic Coastal Plain as used in other ecoregional schemes and planning efforts. The following at least roughly correspond to the same area as Mid-Atlantic Coastal Plain as used in this document.

Planning Effort/Regional Scheme	Name of Ecoregion	Reference
NABCI	Bird Conservation Regions (BCR) 27, Southeastern Coastal Plain, and 30, New England/Mid-Atlantic Coast [1]	NABCI 2000
PIF	Mid-Atlantic Coastal Plain (Physigraphic Region 44) [2]	Watts 1999

Planning Effort/Regional Scheme	Name of Ecoregion	Reference
United States Shorebird Conservation	Planning Region 29, Southern Coastal Plain/Piedmont [3]	Brown et al. 2001
Waterbird Conservation for the Americas	Southeast U.S. [4]	Kushlan et al. 2002
Freshwater Ecoregions	Ecoregion 41, Chesapeake Bay, and 40, South Atlantic [5]	Abell et al. 2000
TNC, Ecoregional Planning Units	Ecoregions 57, Mid-Atlantic Coastal Plain, and 58, Chesapeake Bay Lowlands [6]	Groves et al. 2000
Omernik's Ecoregions (Level III)	Ecoregions 63, Middle Atlantic Coastal Plain, and 65, Southeastern Plains [7]	Omernik 1987
Bailey's Ecoregions (Sections)	Section 232A, Middle Atlantic Coastal Plain	Bailey 1995

[1] Most of the Coastal Plain in Virginia falls within BCR27, with a small portion of northern Virginia and the Eastern Shore falling in BCR 30.
[2] Partners In Flight has recently adopted BCRs for its planning units.
[3] Planning Region 29 is made up of the land area that corresponds to the Piedmont and Coastal Plain as used in this document.
[4] Southeast U.S. is a large region including all of Virginia. The regional scheme used by Kushlan et al. (2002) is based on composites of the Bird Conservation Regions used by NABCI.
[5] Virginia's Coastal Plain is mostly within Ecoregion 41, but a portion of the southern Coastal Plain is within Ecoregion 40.
[6] Virginia's Coastal Plain is mostly within Ecoregion 58, but a portion of the southern Coastal Plain is within Ecoregion 57.
[7] A portion of Ecoregion 65 is within the Piedmont as used in this document.

Despite breeding and wintering habitat frequently being the subject of focus in conservation of migratory birds, stopover habitat is just as essential (Moore et al. 1995). Some concern exists that migratory habitat may be a limiting factor in some populations, rather than breeding or wintering habitat (Sherry and Holmes 1993). Habitat usage during migration is complicated by the inability of birds to search for the best site, due to time or energy restraints (Moore and Simons 1989). As a result, migration stopover habitat is likely based more on food availability to replenish fat stores than on specific plant community composition (Moore and Simons 1989). For instance, one study found a much higher than expected proportion of migrant birds in scrub-shrub habitat on a barrier island in the Gulf of Mexico (Moore et al. 1990). The crucial conservation issue here is simply that migration stopover habitat is critical, and areas identified as migration pathways must conserve these habitats. While it is recognized that stopover habitat is critical to all migratory species, habitat usage by some groups is better understood than that of other groups. Habitat use by waterbirds on migration is particularly poorly understood and is in need of a great deal of study (Kushlan et al. 2002). Stopovers for shorebirds are especially critical, due to the very long migrations that many of them undertake (BIAP 1996; Brown et al. 2001). All three major bird conservation plans (Brown et al. 2001; Kushlan et al 2002; Rich et al. 2004) recognize the importance of stopover habitat, and also recognize that in many cases habitat use during migration is poorly understood.

Due to its position in the middle of the East Coast, Virginia's coastline is critical to hundreds of species of migrant birds (Hill 1984). The Delmarva Peninsula, and Cape Charles in particular, is one of the most important areas for migratory bird staging in North America (Hill 1984; Watts and Mabey 1994). Cape Charles serves as a migration funnel for birds of many different groups that migrate along the East Coast. This includes waterbirds throughout the coastal area (Kushlan et al. 2002), shorebirds on the seaside beaches and barrier islands (Harrington and Perry 1996; BIAP 1996), songbirds at Cape Charles (Hill 1984; Watts and Mabey 1994), and raptors at Cape Charles (Hill 1984; BIAP 1996). Due to the reliance of bird

populations of continental importance on this area during migration, the importance of maintaining stopover habitat on the Delmarva Peninsula, especially in the Cape Charles area, cannot be overstated.

4.1.2. Land Cover Areas

Approximately two-thirds of the Coastal Plain's land area is considered submontane and the other third estuarine/marine, which includes areas around the Chesapeake Bay and Atlantic Ocean. Most of the land cover in the Coastal Plain is forest, followed by agriculture and open habitats and the wetlands (Figure 4.2). Almost 9% of the land area is within a Conservation Land and therefore has some degree of conservation protection (DCR 2003). Wetlands and water areas are protected in a higher proportion than they occur overall, while agriculture/open and forest land cover types are protected at a lower proportion (Figure 4.2).

4.1.3. Human Population in the Coastal Plain

The Coastal Plain is the second most populous ecoregion, containing 2.57 million people, 36% of Virginia's population (USCB 2003), in just over 20% of the land area. This region has by far the highest population density at 122.6 people per km^2. This is 56% higher than the Piedmont, the ecoregion with the second densest population. The major urban centers of eastern Fairfax County, the eastern City of

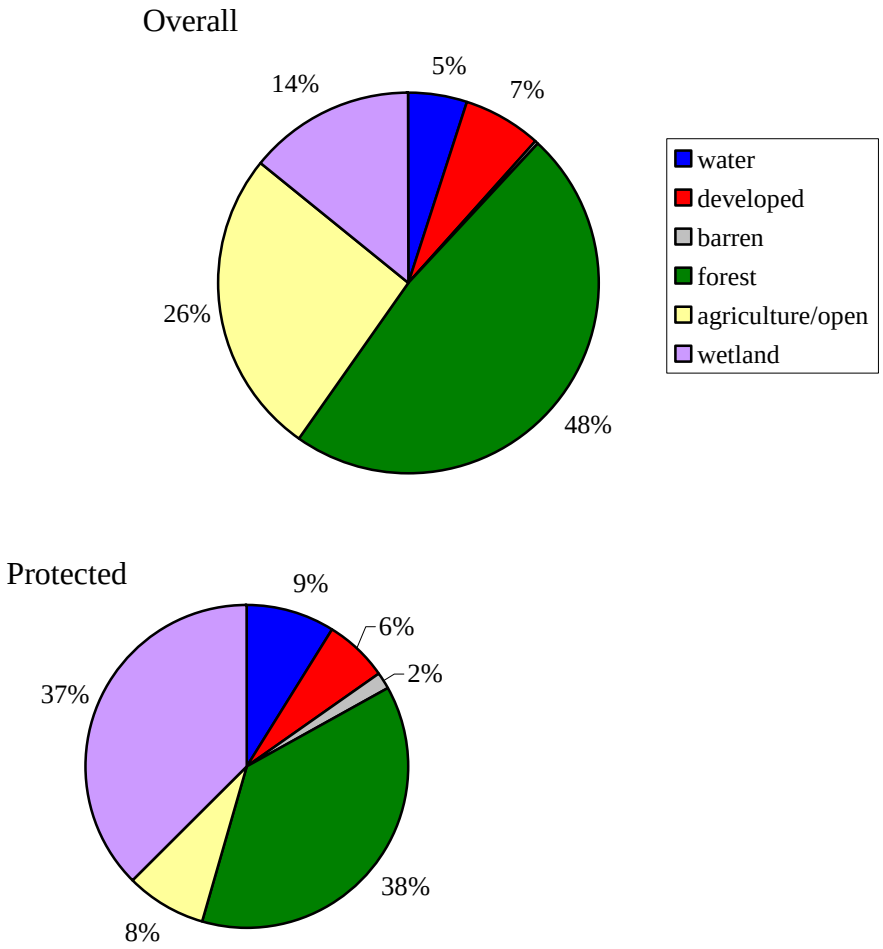

Figure 4.2. Proportional composition of land cover types within the overall Coastal Plain compared to proportion of land cover types within protected areas in the Coastal Plain (DGIF 2004a).

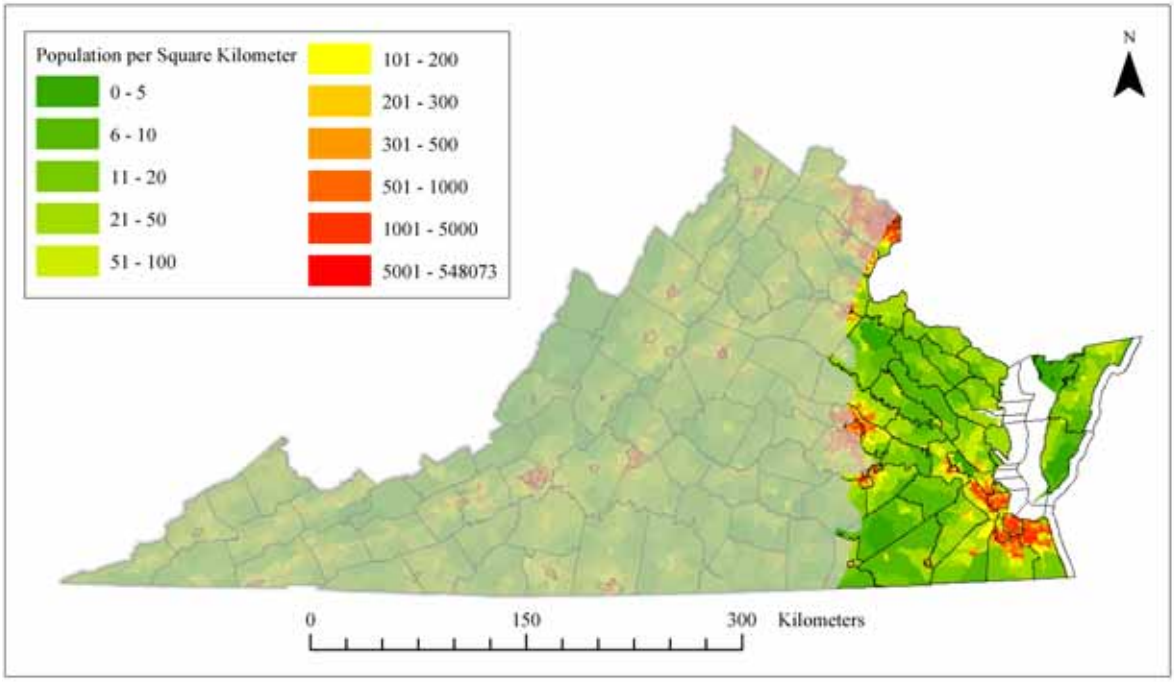

Figure 4.3. Population density from the 2000 census, highlighted for the Coastal Plain ecoregion.

Richmond metro area, and Tidewater (City of Norfolk, Virginia Beach and Hampton) account for the major areas of high population density. Between 2000 to 2009, the population in the Coastal Plain is expected to grow 8.5%, the second highest growth rate of any ecoregion (GeoLytics 2005).

Approximately 19% of the land in the Coastal Plain is within a high impact growth area (Figure 4.4). This is the second highest percentage of any ecoregion. High impact growth areas in this region include Prince William, Stafford, and Spotslyvania Counties south of Fairfax; Hanover, New Kent, and James City Counties east of Richmond; and Isle of Wight, Suffolk and Chesapeake Counties south and west of Norfolk.

4.2. Marine Conservation in Virginia

This section identifies and summarizes some of the existing marine wildlife conservation and management plans from federal and state agencies, non-government organizations, task forces, and commissions. The focus is on depleted species present in Virginia's coastal and marine waters, although this can be difficult to determine since many species pass through these waters during migration. Key conservation actions and the primary implementers of each management plan are included below. As detailed in Section 2.3.1, a tiered species conservation list was not developed for marine wildlife. A few general bay and ocean management plans are also discussed below. These include some wide-ranging actions to restore water quality and habitat.

These summaries provide a starting point for the next iteration of the CWCS, when Virginia's marine species will be integrated into the strategy. The objectives presented below for each management plan may not include all of the specifics listed in the primary documents. Further information, narrative descriptions, and documentation are available within the individual management plans, and these will be referenced in future CWCS efforts.

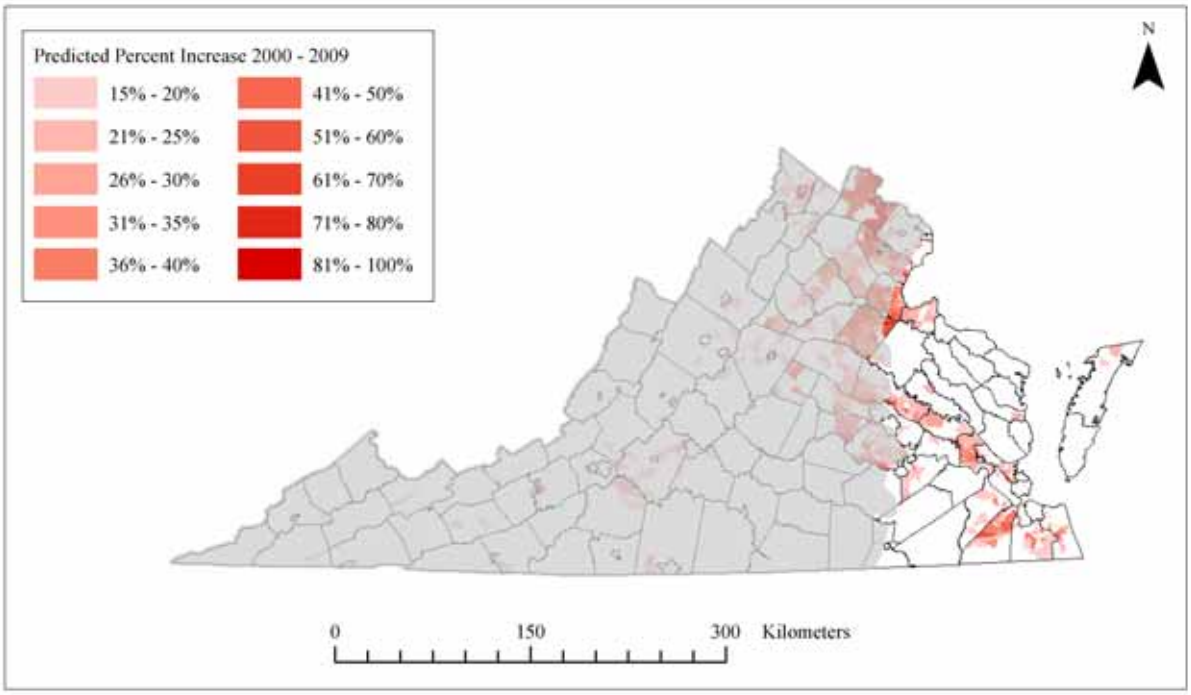

Figure 4.4. High impact growth areas, highlighted for the Coastal Plain. This figure contains demographic data from GeoLytics, East Brunswick, New Jersey (GeoLytics 2005).

4.2.1. Federal Agency Plans

The recovery plan for the loggerhead sea turtle *Caretta caretta* is not included in the summaries below (NMFS and USFWS 1991b). A more detailed description of the loggerhead can be found in its Tier I species account (Section 4.4.1.1).

4.2.1.1. Final Recovery Plan for the Humpback Whale, *Megaptera novaeangliae* (NMFS 1991a)

The primary goals of the recovery plan for the humpback whale are to increase populations to levels equivalent to 60% of their abundance prior to commercial hunting and to expand its distribution into its historical range. In the interim, NMFS has established a goal of doubling the population size by 2011 and completely delisting or downlisting the humpback whale to threatened from endangered.

Some specific actions toward that goal include various research, protection, and recovery efforts. Essential habitat needs to be defined, and the potential for repopulation of important historical habitats should be assessed. Sources and frequency of human-induced injury and mortality must be identified and reduced and, of course, the prohibition of commercial hunting must continue. There are several research needs, including estimates of historic population sizes, conducting systematic sampling to estimate population sizes, performing field surveys to assess population dynamics, status, and trends, and monitoring parasite and contaminant loads in whales and prey. There are also a number of administrative and coordination efforts that should be instituted. These include developing educational materials, improving the process of granting marine mammal research permits, developing partnerships at all levels of government, and encouraging international cooperation.

Primary Implementers: NMFS, USEPA, NOAA (National Ocean Service and Ocean Assessment Division), Minerals Management Service, IWC, USACE, U.S. Coast Guard, NPS

4.2.1.2. Final Recovery Plan for the Northern Right Whale, *Eubalaena glacialis* (NMFS 1991b)

This recovery plan is applicable to only the North Atlantic population of the northern right whale. Of the large whale species, it is the one most likely to go extinct in the near future. The ultimate goal is to increase the population to 7,000 individuals. In 1991, only about 600 individuals remained, with approximately 350 of those were in the Western North Atlantic population. One interim goal is to downlist the population to threatened when the number of animals reaches 6,000 animals. However, due to low population growth rates (about 2% per year), it may take 150 years to reach this goal.

Actions that NMFS (1991b) identifies include protecting important habitats, monitoring population size and trends, investigating the impacts of whale watching activities, increasing efforts to release entangled or stranded animals and gathering data from all specimens, researching and eliminating sources of human-induced injury or mortality, and coordinating all efforts across jurisdictions and private-public lines.

Primary Implementers: NMFS, Minerals Management Service, Canadian agencies, USACE, U.S. Coast Guard, USEPA, states (specific states not listed)

4.2.1.3. Florida Manatee Recovery (*Trichechus manatus latirostris*) Plan (USFWS 2001)

The goal set by USFWS (2001) is to assure the long-term viability of the Florida manatee through downlisting to threatened status and eventual delisting. Delisting may occur once reduction or elimination of certain threats occur and population size targets and other demographic measures are met.

Specific recovery actions fall into one of four categories: minimization of sources of disturbance, harassment, injury, and mortality; determination and monitoring of population status; habitat description, monitoring, and protection; and facilitation of recovery through increased public awareness and education. Some examples of more detailed actions include the review of state and federal permitted activities, enforcement of manatee-related regulations, reduction of manatee collisions with watercraft, identification of factors affecting the health and ecology of the manatee, and establishment and management of protected habitat areas.

Primary Implementers: USFWS, NMFS, NPS, USACE, USEPA, U.S. Coast Guard, Florida, Georgia

4.2.1.4. Recovery Plan for U.S. Population of Atlantic Green Turtle, *Chelonia mydas* (NMFS and USFWS 1991a)

The recovery goal for the Atlantic green turtle is delisting, which will occur when established recovery criteria are met. These criteria include increased nesting in Florida to 5,000 nests in each of six years; reduction of age class mortality as determined by numbers of individuals on foraging grounds; 25% or more of the nesting beaches in public ownership, representing at least 50% of total nesting activity; and the implementation of top priority tasks.

Some specific actions needed to reach recovery criteria include long-term habitat protection (nesting, marine, and foraging); population management and protection, including monitoring of nesting, distribution, abundance and status; implementation and enforcement of TED regulations; and establishment and maintenance of rehabilitation facilities. Goals include achieving a hatching success of at least 60%; increasing public outreach and education; and continuing international cooperative efforts.

Primary Implementers: USFWS, NMFS, NPS, USACE, USEPA, U.S. Virgin Islands, Puerto Rico, Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Texas, Virginia

4.2.1.5. Recovery Plan for Hawksbill Turtle, *Eretmochelys imbricata* (NMFS and USFWS 1993)

The goal of this plan is to delist the hawksbill turtle when the specific criteria described in the plan are met. These criteria include an increase in the number of female turtles; a significant positive trend in nest abundance on targeted beaches; at least 50% of the nesting habitat in the U.S. Virgin Islands and Puerto

Rico protected in perpetuity; numbers of individuals in all age classes are increasing; and Priority One tasks are completed. The anticipated date of recovery is 2020.

Recovery actions include long-term protection of critical nesting habitats; managing and protecting populations with research as needed; providing long-term protection of important marine habitats, including foraging areas; ensuring 75% or higher hatching success rate on major nesting beaches; determining distributional and seasonal movement patterns of all life stages; eliminating illegal exploitation; stopping international trade of hawksbill turtle products; increasing public education; and improving international cooperation.

Primary Implementers: NMFS, USFWS, NPS, USEPA, USACE, U.S. Coast Guard, Minerals Management Service, Puerto Rico, Virgin Islands, Florida

4.2.1.6. Recovery Plan for Kemp's Ridley Sea Turtle, *Lepidochelys kempii* (NMFS and USFWS 1992a)

Because of the nesting behavior, limited range, and continued threats to this species, full recovery may be impossible. Therefore, this recovery plan only discusses goals and actions pertaining to downlisting. Future revisions may include criteria and actions for delisting.

The criteria that must be met for downlisting include reaching a population of at least 10,000 nesting females; minimizing or eliminating mortality by requiring TEDs on fishing equipment; protecting nesting habitat and associated waters (primarily in Mexico); and continuing bi-national cooperation. Another criterion for downlisting is implementation of all Priority One tasks identified in the plan. In addition, a better understanding of distribution and habitat use during all life stages, information on critical mating and reproductive behaviors, and more data on physiology, survivorship and recruitment are essential to the recovery effort.

Since the principle nesting habitat is in Mexico, and most of the recovery actions focus on Mexican and Gulf of Mexico practices, this species may not play a large role in Virginia's CWCS. Virginia's contribution will most likely focus on marine ecosystem health and marine hazards, such as ships and fisheries practices, that are similar for other marine species.

Primary Implementers: NMFS, USFWS, USEPA, USACE, NPS, Minerals Management Service, U.S. Coast Guard, Mexico

4.2.1.7. Recovery Plan for Leatherback Turtles, *Dermochelys coriacea* (NMFS and USFWS 1992b)

The goal of this plan is to delist the leatherback turtle upon meeting the following recovery criteria: completion of all Priority One recovery tasks; a significant positive trend in the adult female population over a 25-year period (from 1992 to 2017); and at least 75% public ownership or protection of nesting habitat. Specific actions to meet these criteria include long-term protection of critical nesting beaches; at least 60% hatching success on significant nesting beaches; identification of distribution and seasonal migrations for all life stages; and minimizing the threats of pollution and commercial fishery by-catch.

Primary Implementers: NMFS, USFWS, USEPA, USACE, Minerals Management Service, U.S. Coast Guard, U.S. Navy, Puerto Rico, U.S. Virgin Islands, Florida, Georgia, South Carolina, North Carolina

4.2.2. State Agency Plans

4.2.2.1. 1997 Chesapeake Bay Blue Crab Fishery Management Plan (CBP 1997)

In 1989, the Chesapeake Bay Program initiated a unified management approach for the blue crab *Callinectes sapidus*. This plan was revised and updated in 1997. The goal of the plan is to manage the blue crab population in the Chesapeake Bay through conservation of the stock in the Bay, protection of its ecological importance, and creation of a plan for long-term utilization of the resource. Specific

recommendations include restoration, enhancement, and protection of habitat and water quality; maintenance of regulations to stabilize the fishery, restriction of access to the resource; estimation of recreational exploitation; monitoring of the commercial fishery; better enforcement of existing regulations; and assessment of socioeconomic data regarding the blue crab fishery. In addition, several actions should be taken to maintain or reduce the current rate of exploitation, including developing a means to assess stock status for long-term protection, collecting population data, and eliminating or reducing the harvest of small or recently shed crabs (buckrams).

Primary Implementers: USEPA, Virginia, Maryland, and Pennsylvania

4.2.2.2. 2004 Oyster Management Plan (CBP N.d.)

The 2004 Oyster Management Plan was adopted in January 2005 in an effort to fulfill the native oyster restoration commitment in the Chesapeake 2000 agreement (CBP N.d.). The plan provides a general framework and specific guidance for rebuilding and managing populations of the native oyster *Crassostrea virginica* in the Chesapeake Bay. Recommendations regarding habitat restoration, controlling fishing mortality, and promoting aquaculture are included. We attempted to obtain a copy of this report from USEPA's Chesapeake Bay Program Office, but it is not yet available to the public. Future iterations of Virginia's CWCS will incorporate this report's recommendations.

4.2.2.3. The State of the Chesapeake Bay and Its Watershed (CBP 2004)

This report highlights the importance and challenges of restoring the Chesapeake Bay. Several indicators were used to determine Bay health, including trends in sediment, nitrogen, and phosphorus levels. Data were analyzed for 14 tributary locations throughout the watershed and were flow adjusted to account for seasonal and annual variability. In most of the watersheds Bay-wide, sediment, nitrogen, and phosphorus concentrations have decreased from the 1980s to 2003. However, many areas in Virginia showed no significant trends, except in one tributary, where concentrations of nitrogen, phosphorus, and sediment all increased during this time. It appears that, despite increases in education, funding, and awareness of the Bay's value and status, Virginia's nutrient concentrations have not improved over the last 20 years.

The report states that water clarity improvements are needed in key habitats and shows that water quality has degraded in a majority of monitoring locations throughout the watershed. There are mixed trends in algal levels throughout the watershed, with improvements in some areas and degradation in others.

Oysters and blue crabs are still at low population levels or declining. Improvements in water quality, habitat, and harvest management would benefit both species. The population of striped bass in the Bay is considered stable, though concerns remain over disease, food, and spawning habitat availability. Migratory fish habitat has expanded through the removal of impediments in the watershed's rivers. The fish are gradually returning to these areas. In addition, dissolved oxygen levels are very low in summer. The extent and duration of these low oxygen levels varies greatly depending upon rainfall amounts, temperature, and pollution.

4.2.2.4. Management Plan for Sea Turtles and Marine Mammals in Virginia (Terwilliger and Musick 1995)

Species included in this plan are the loggerhead sea turtle *Caretta caretta*, Kemp's Ridley sea turtle *Lepidochelys kempii*, Atlantic green turtle *Chelonia mydas mydas*, leatherback sea turtle *Dermochelys coriacea*, fin whale *Balaenoptera physalus*, humpback whale *Megaptera novaengliae*, harbor porpoise *Phocoena phocoena*, bottlenose dolphin *Tursiops truncatus*, harbor seal *Phoca vitulina*, and common manatee *Trichechus manatus*. The goal of the plan is to contribute to the global recovery of these species through efforts to improve survival in Virginia's waters. Objectives of the plan include assessing the status, trends, and life history requirements of the species; identifying and reducing threats to habitats and populations; improving coordination of activities and responsibilities of the organizations affecting these species; and promoting public awareness and participation in conservation efforts.

Primary Implementers: VMRC, DGIF, VIMS, USFWS, NMFS

4.2.3. Non-profit and Non-governmental Organization Plans

4.2.3.1. 2004 State of the Bay Report (CBF 2004)

The Chesapeake Bay Foundation produces an annual "report card" for the Bay, based on indicators in three major categories (pollution, habitat, and fisheries). In 2004, the Bay scored 27 out of 100 points (a D on their grading scale). This overall score has not changed from 2003. The Foundation considers the Bay to be dangerously out of balance, despite the public resources and attention that have been devoted to the Bay over the last few decades. In terms of pollution, nitrogen, phosphorus, dissolved oxygen, and overall water quality each scored an F. Toxins received a D. Forested buffers scored a B+, submerged grasses received an F, wetlands received a C+ and resource lands received a D. Development continues to threaten sensitive habitats in the Bay. Fisheries show mixed trends: Striped bass scored an A+, but oysters, blue crabs, and shad each scored an F.

4.2.4. Commission and Task Force Plans

4.2.4.1. America's Living Oceans: Charting a Course for Sea Change (POC 2003)

The Pew Oceans Commission was established to assess the existing knowledge on the state of the U.S. oceanic waters and to make recommendations regarding needed improvements. The Commission's goal is to ensure healthy, productive, and resilient marine ecosystems. Their report details issues regarding threats to and recommendations for U.S. oceans, marine fisheries, marine aquaculture, coasts, and coastal waters. Within each category, they have made recommendations affecting a wide range of issues, including developing a new national ocean policy, restructuring and prioritizing government programs, addressing issues such as nonpoint source pollution and fisheries management at the appropriate scale, land use planning, and control of invasive species and pollution. They have also stressed the importance of working beyond the borders of the U. S. and developing a flexible structure in which to address new and developing threats.

4.2.4.2. Cost-Effective Strategies for the Bay (CBC 2004)

The Chesapeake Bay Commission estimated the cost of Bay restoration and compliance with the Chesapeake 2000 agreement at $19 billion (CBC 2003). Reaching water quality goals had the highest costs and the largest funding gaps. The most recent report (CBC 2004) tries to address some of these issues through an evaluation of 34 nutrient and sediment reduction practices and developed a short list of six practices that would be the most cost-effective in improving water quality. The Commission looked for practices that were cost effective and widely applicable, thereby yielding potentially large nutrient reductions.

The most cost-effective strategies identified include upgrading wastewater treatment plants; adjusting nitrogen and phosphorus formulations in poultry and livestock feed; developing and implementing enriched nutrient management plans; and expanding use of conservation tillage and cover crops.

4.2.4.3. Taking Action for the Blue Crab (CBC 2001)

Maryland and Virginia funded a two-year analysis of the blue crab *Callinectes sapidus* and its management. The study was conducted by the Chesapeake Bay Commission's Bi-State Blue Crab Advisory Committee. The Committee provided several recommendations to improve management of the resource and increase the blue crab population. Recommendations include the implementation of a harvest threshold that would ensure the future health of the stock; establishment of a minimum stock size threshold (set at the lowest stock biomass measured to date); improvement in data collection from commercial and recreational crabbers; identification, restoration and protection of important habitats; and identification of possible new management regimes through a targeted, stakeholder-driven process.

Primary Implementers: CBC, Blue Crab Technical Work Group, Maryland Department of Natural Resources, Potomac River Fisheries Commission, VMRC

4.2.4.4. Interstate Fishery Management Plan for American Eel (ASMFC 2000)

This plan (ASFMC 2000) establishes a goal to conserve and protect populations of the American eel *Anguilla rostrata* in inland and territorial waters while maintaining opportunities for sustainable use of the species. It identifies six objectives to meet this goal. These include improving understanding of eel harvest and utilization at all life stages; increasing research and monitoring of eel population dynamics; protecting eel habitat and enhancing abundance in watersheds in which it currently occurs; restoring eel populations to waters of historical distribution; assessing eel abundance at all life stages; and protecting and improving habitat for spawning, nurseries, and growth.

Primary Implementers: American Eel Management Board, USFWS, NMFS, ASMFC member states (including Virginia)

4.2.4.5. Interstate Fishery Management Plan for Atlantic Striped Bass (ASMFC 2003)

Due to the decline in harvest and poor recruitment of striped bass *Morone saxatilis* during the 1970s, the ASMFC developed and adopted the first version of this plan in 1981. It has been amended six times since then, with the most recent amendment in 2003. The Atlantic striped bass coastal migratory stock was declared recovered in 1995, and has since expanded to record levels. The summarized goals and objectives below are from ASMFC (2003) and are intended to prevent the depletion of this species.

The goals of ASMFC (2003) are to manage migratory stocks of striped bass through cooperative interstate fisheries management; to maintain commercial and recreational fisheries consistent with long-term viability of a wide age structure and self-sustaining spawning stock; and to facilitate the restoration and protection of essential habitat.

Several objectives were developed to aid in reaching this goal. These include management of the striped bass fishery to maintain stock size at or above target levels, and to maintain fishing mortality rates at or below the target exploitation rate. Fishing mortality should be managed for an age structure with adequate spawning potential to maintain long-term abundance. A management plan should be developed that provides for both coast-wide consistency of actions and flexibility within each state. The development of quality (and economically viable) recreational, for-hire, and commercial fisheries should be facilitated. Finally, a fishing mortality rate should be established that results in a net increase in fish aged 15yr and older in the population.

Primary Implementers: Atlantic Striped Bass Management Board, USFWS, NMFS, ASMFC member states (including Virginia)

4.2.4.6. Interstate Fishery Management Plan for Atlantic Sturgeon (ASMFC 1998)

The first ASMFC plan for Atlantic sturgeon *Acipenser oxyrhynchus* was developed in 1990. Despite the implementation of many of its recommendations, some Atlantic sturgeon stocks continued to deteriorate through 1996. In 1998, Amendment 1 to this plan (ASMFC 1998) was released to provide updated conservation measures and to meet current standards of the Atlantic Coastal Fisheries Cooperative Management Act. The goal of ASMFC (1998) is to restore Atlantic sturgeon spawning stocks to levels that allow for sustainable fisheries and ensure viable spawning populations.

Objectives toward that goal include closing the fishery for a period that allows for re-establishment of spawning stocks; establishing 20 protected year classes of females in the spawning stocks; eliminating bycatch of Atlantic sturgeon; identifying and protecting spawning habitats for each stock; opening access to historic spawning grounds; and conducting necessary research (such as defining unit stocks). Amendment 1 includes many recommendations to improve monitoring of Atlantic sturgeon stocks, including surveys, tagging, and reporting mechanisms.

Primary Implementers: Sturgeon Management Board, USFWS, NMFS, ASMFC member states (including Virginia)

4.2.4.7. Interstate Fishery Management Plan for Shad and River Herring (ASMFC 1999)

Drastic declines in commercial landings of shad and river herring led the ASMFC to develop a management plan in 1985, with a supplement published in 1988. Despite the implementation of this plan, the stocks continued to decline, and in 1994 ASMFC determined that this plan was no longer adequate for protecting and restoring these fishes. Amendment 1 (ASMFC 1999) was released to improve protection for these species.

The goal of ASMFC (1999) is to protect, enhance, and restore migratory spawning stocks of American shad *Alosa sapidissima*, hickory shad *A. mediocris*, and river herrings (blueback herring *A. aesitvalis* and alewife *A. pseudoharengus*) on the East Coast, achieving stock restoration and maintaining sustainable population levels. Objectives include constraining fishing mortality of American shad below F_{30} (female spawning potential of 30% of the maximum of an unexploited population). Stock recovery criteria need to be defined, target mortality rates identified, and schedules for enhancing American shad populations developed. Until stock assessments suggest otherwise, existing regulations should be maintained or strengthened for hickory shad and river herring. Degraded or historic habitat should be enhanced, including removing blockages to migration. Finally, evaluation of state compliance and procedures for plan implementation should be established.

Primary Implementers: Shad and River Herring Management Board, USFWS, NMFS, ASMFC member states (including Virginia)

4.2.4.8. Other ASFMC Fishery Management Plans

Other species currently being conserved and managed under the coordination of ASMFC include the American lobster *Homarus americanus*, Atlantic croaker *Micropogonias undulatus*, Atlantic herring *Clupea harengus*, Atlantic menhaden *Brevoortia tyrannus*, black sea bass *Centropristis striata*, bluefish *Pomatomus saltatrix*, horseshoe crab *Limulus polyphemus***,** northern shrimp *Pandalus borealis*, red drum *Sciaenops ocellatus*, scup *Stenotomus chrysops*, Spanish mackerel *Scomberomorous maculatus*, spiny dogfish *Squalus acanthias* and other coastal sharks, spot *Leiostomus xanthurus*, spotted seatrout *Cynoscion nebulosus*, summer flounder *Paralichthyus dentatus*, tautog *Tautoga onitis*, weakfish *Cynoscion regalis*, and winter flounder *Pseudopleuronectes americanus* (ASMFC N.d.). Management of these marine species will be addressed in the next iteration of the CWCS.

4.2.4.9. Amendment 2 to the Monkfish Fishery Management Plan (MAFMC N.d.a)

The only document available on the MAFMC Web site is a public hearing document that outlines changes to the original Monkfish Fishery Management Plan (MAFMC N.d.a). An associated timeline indicates that the expected date for implementation of the revisions was May 2005. It is unclear if the amendment was accepted as is, so no further details will be included in this summary.

4.2.4.10. Atlantic Surfclam and Ocean Quahog Fishery Management Plan (MAFMC N.d.b)

The overall goal of this plan is the continued effective management of these species while preventing any future overfishing (MAFMC N.d.b.). More specific objectives were developed and include actions related to conservation, regulations, harvest, and adaptive management. One of the objectives indicates the need for conserving and replenishing both species through stabilization of annual harvest rates in an economically sound manner. The plan also indicates that regulations should be simplified to reduce costs to the public and private sectors for administration and compliance. In addition, the plan promotes finding the opportunity for industry to operate in an economically efficient manner that is consistent with the conservation of these species. Lastly, the plan calls for an adaptive and flexible management and regulatory framework that can respond to short-term events that is consistent with plan objectives and industry needs. The plan also defines overfishing for these species and essential habitat requirements.

4.2.4.11. Bluefish Fishery Management Plan (MAFMC N.d.c)

The goal of this plan is bluefish conservation along the Atlantic Coast (MAFMC N.d.c). Several major objectives were identified. One is to increase knowledge of the stock and the fishery. The second is to maintain, within limits, traditional uses of bluefish while providing high availability of bluefish to U.S. fishermen. Another objective is to facilitate cooperation among all parties (including coastal states, regional marine fishery councils, and federal agencies) to improve rangewide management of the bluefish. The final objectives include preventing recruitment overfishing and reducing waste in commercial and recreational fisheries.

4.2.4.12. Dogfish Fishery Management Plan (MAFMC N.d.d)

Recent data indicate that fishing pressure has increased and populations in the Northwest Atlantic have declined (MAFMC N.d.d). At the time of development of this plan, there were no harvest regulations pertaining to this species. The decrease in population size and the targeting of mature females for harvest made the development of a management plan critical to the species continued survival and success.

The overall goal of the plan is to conserve the spiny dogfish to the degree necessary to achieve optimum yield (MAFMC N.d.d). Several objectives were developed to meet this goal; these include: reducing fishing mortality to eliminate overfishing; contributing to the protection of biological diversity and intact ecosystems; promoting compatible management regulations between all jurisdictions; improving the consistent and efficient enforcement of regulations; minimizing necessary regulations while still achieving management objectives; and (where possible) managing this species in a manner that minimizes the impact of regulations on the prosecution of other fisheries.

4.2.4.13. Squid, Mackerel, Butterfish Fishery Management Plan (MAFMC N.d.e)

This management plan contains information on the definition of overfishing, essential habitat needs, adaptive management, and objectives (MAFMC N.d.e). One of its objectives is to enhance the probability of successful recruitment to the fisheries for all species. The measure for successful recruitment is the historical average. The plan also calls for promotion of growth of the U.S. commercial fisheries to include the fishery for export. Within the confines of the objectives of this plan, it is indicated that all harvesters should be given a large amount of freedom and flexibility. The plan also calls for the provision of recreational fishing opportunities with recognition of the economic impact of such activities on the national economy. Improving knowledge of the conditions of stocks and fisheries is also highlighted as an objective. Lastly, the plan calls for minimizing harvesting conflicts among U.S. commercial, U.S. recreational and foreign fishermen.

4.2.4.14. Summer Flounder, Scup, and Black Sea Bass Fishery Mangement Plan (MAFMC N.d. f)

The management plan for these species includes several objectives. To insure that overfishing does not occur, the plan calls for reducing fishing mortality in all three species (MAFMC N.d.f). To increase the biomass of the spawning stock, the fishing mortality on immatures of all three species should be reduced. The plan also calls for improvements in yield. Three objectives of the plan relate to regulations and include promoting compatible management regulations between jurisdictions (state and federal), promoting consistent and efficient enforcement, and minimizing regulations needed to achieve management objectives. The plan also defines overfishing for each species, describes essential habitat for each, and provides guidelines for regulation development.

4.2.4.15. Tilefish Fishery Management Plan (MAFMC N.d.g)

This plan covers the golden tilefish. The overall goal of the plan is to improve populations of tilefish to permit optimum yield (MAFMC N.d.g). Several objectives were established towards meeting this goal. These include preventing overfishing, replenishing populations to levels that support maximum sustainable yield, preventing overcapitalization, limiting new entrants to the fishery, locating and describing essential

habitat, and collecting the data necessary to monitor and assess all impacts (biological, economic, and social) of the recommended management measures.

4.2.4.16. Management Plan for the European Green Crab (ANSTF 2002)

The European green crab *Carcinus maenas* is an aquatic nuisance species that causes significant ecological and economic damage to several regions, including both North American coasts. It is a very successful invasive predator and has been present on the Atlantic coast for at least 180 years. The goal of ANSTF (2002) is to coordinate management of the green crab and to eradicate or reduce its population in U.S. waters.

There are four major categories of actions identified in the plan: prevention and containment; detection and forecasting; eradication, control, and mitigation; and information access and data management. Within "prevention and containment," invasion pathways need to be identified and with an assessment of risk levels. Management options to reduce the risk of each pathway need to be identified and an implementation plan developed to prevent invasion from each pathway. Within "detection and forecasting," actions to detect new invasions and range extensions, as well as forecast population explosions in already affected areas, are needed. "Eradication, control, and mitigation" includes making decisions as to whether to eradicate, control, or mitigate based on population size and stability. In "information access and data management," ANSTF (2002) recommends providing an up-to-date catalog of the research and management activities underway and their results, describing standardized protocols for research and management, and providing education and outreach.

Primary Implementers: ANSTF Green Crab Committee, NOAA, USFWS, ASMFC, Pacific States Marine Fisheries Commission, Sea Grant, Smithsonian Environmental Research Center, various states (including Virginia), British Columbia

4.2.4.17. An Ocean Blueprint for the 21st Century (USCOP 2004)

The U.S. Commission on Ocean Policy was established by the Oceans Act of 2000 to develop recommendations for a coordinated and comprehensive national ocean policy. This extensive report examines all aspects of ocean policy and management and proposes steps for the restoration and enhancement of U.S. ocean resources. The guiding principles it proposes are sustainability; stewardship; ocean-land-atmosphere connections; ecosystem-based and multi-use management; conservation of marine biodiversity; use of best available science and information; adaptive management; clear laws and decisions; participatory governance; timeliness; accountability; and international responsibility.

The Commission focuses on three themes—a coordinated framework to improve decision making; the translation of current data into clear and concise information for managers; and lifelong education related to marine resources—to create informed citizens with a strong stewardship ethic. Several specific objectives are cited, including managing coasts and their watersheds; protecting people and property against natural hazards; conserving and restoring coastal habitats, coral communities, marine mammals, and endangered marine species; managing sediment and shorelines; addressing coastal water pollution; supporting marine commerce and transportation; limiting vessel pollution while improving vessel safety; preventing the spread of invasive species; reducing marine debris; achieving sustainable fisheries; establishing sustainable marine aquaculture; connecting oceans and human health; managing offshore energy and other mineral resources; and promoting international ocean science and policy.

There are over 200 recommendations in this report. Organizations responsible for implementation include Congress, the President, Assistant to the President (a proposed position), the National Ocean Council (a proposed council), the President's Council of Advisors on Ocean Policy (proposed), Council on Environmental Quality, Office of Management and Budget, USDA, NOAA, NMFS, National Sea Grant College Program, USACE, U.S. Navy, Department of Health and Human Services, Departments of Homeland Security, Labor, and State, U.S. Coast Guard, USFWS, Minerals Management Service, USGS, USDOT, USEPA, NASA, NSF, various interagency groups, regional bodies, states, and others.

4.3. The Species of Greatest Conservation Need: Coastal Plain

Of the 235 species of greatest conservation need that occur in the Coastal Plain, 23 (10%) are in Tier I, 35 (15%) are in Tier II, 39 (17%) are in Tier III, and 138 (59%) are in Tier IV (Table 4.2).

Table 4.23. The species of greatest conservation need in Virginia's Coastal Plain.

Common Name	Scientific Name
Tier I	
Fishes	
Shortnose sturgeon	*Acipenser brevirostrum*
Blackbanded sunfish	*Enneacanthus chaetodon*
Bridle shiner	*Notropis bifrenatus*
Roanoke logperch	*Percina rex*
Amphibians	
None	
Reptiles	
Loggerhead turtle[1]	*Caretta caretta*
Wood turtle	*Glyptemys insculpta*
Chicken turtle	*Deirochelys reticularia*
Birds	
Bachman's sparrow	*Aimophila aestivalis*
Henslow's sparrow	*Ammodramus henslowii*
Piping plover	*Charadrius melodus*
Wilson's plover	*Charadrius wilsonia*
Wayne's black-throated green warbler	*Dendroica virens waynei*
Peregrine falcon	*Falco peregrinus*
Loggerhead shrike	*Lanius ludovicianus*
Black rail	*Laterallus jamaicensis*
Red-cockaded woodpecker	*Picoides borealis*
Gull-billed tern	*Sterna nilotica*
Mammals	
Eastern big-eared bat	*Corynorhinus rafinesquii macrotis*
Terrestrial Insects	
Arogos skipper	*Atrytone arogos arogos*
American burying beetle	*Nicrophorus americanus*
Other Terrestrial Invertebrates	
None	
Aquatic Mollusks	
None	
Crustaceans	

Common Name	Scientific Name
Phreatic isopod	*Caecidotea phreatica*
Lancaster County amphipod	*Crangonyx baculispina*
Northern Virginia well amphipod	*Stygobromus phreaticus*
Aquatic Insects	
None	
Other Aquatic Invertebrates	
None	
Tier II	
Fishes	
Atlantic sturgeon	*Acipenser oxyrhynchus*
Roanoke bass	*Ambloplites cavifrons*
Amphibians	
Mabee's salamander	*Ambystoma mabeei*
Tiger salamander	*Ambystoma tigrinum*
Oak toad	*Bufo quercicus*
Barking treefrog	*Hyla gratiosa*
Reptiles	
Canebrake rattlesnake	*Crotalus horridus*
Northern diamond-backed terrapin	*Malaclemys terrapin*
Eastern glass lizard	*Ophisaurus ventralis*
Birds	
Saltmarsh sharp-tailed sparrow	*Ammodramus caudacutus*
American black duck	*Anas rubripes*
American bittern	*Botaurus lentiginosus*
Cerulean warbler	*Dendroica cerulea*
Little blue heron	*Egretta caerulea*
American oystercatcher	*Haematopus palliatus*
Bald eagle	*Haliaeetus leucocephalus*
Swainson's warbler	*Limnothlypis swainsonii*
Yellow-crowned night-heron	*Nyctanassa violacea*
King rail	*Rallus elegans*
Black skimmer	*Rynchops niger*
Least tern	*Sterna antillarum*
Royal tern	*Sterna maxima*
Mammals	
Delmarva fox squirrel	*Sciurus niger cinereus*
Terrestrial Insects	
Precious underwing	*Catocala pretiosa pretiosa*
Northeastern beach tiger beetle	*Cicindela dorsalis dorsalis*

Common Name	Scientific Name
Rare skipper	*Problema bulenta*
Other Terrestrial Invertebrates	
Snowhill ambersnail	*Catinella hubrichti*
Hanging Rock threetooth	*Triodopsis pendula*
Aquatic Mollusks	
Dwarf wedgemussel	*Alasmidonta heterodon*
Green floater	*Lasmigona subviridis*
Crustaceans	
Dismal Swamp isopod	*Caecidotea attenuatus*
Rock Creek groundwater amphipod	*Stygobromus kenki*
Aquatic Insects	
Spieth's great speckled olive mayfly	*Siphloplecton costalense*
Other Aquatic Invertebrates	
Holsinger's groundwater planarian	*Sphalloplana holsingeri*
Bigger's groundwater planarian	*Sphalloplana subtilis*
Tier III	
Fishes	
Steelcolor shiner	*Cyprinella whipplei*
Amphibians	
Dwarf waterdog	*Necturus punctatus*
Carpenter frog	*Rana virgatipes*
Lesser siren	*Siren intermedia*
Reptiles	
Spotted turtle	*Clemmys guttata*
Glossy crayfish snake	*Regina rigida rigida*
Eastern box turtle	*Terrapene carolina*
Birds	
Nelson's sharp-tailed sparrow (winter)	*Ammodramus nelsoni*
Redhead (winter)	*Aythya americana*
Brant (winter)	*Branta bernicla*
Northern harrier	*Circus cyaneus*
Sedge wren (winter)	*Cistothorus platensis*
Tricolored heron	*Egretta tricolor*
Least bittern	*Ixobrychus exilis*
Black-crowned night-heron	*Nycticorax nycticorax*
Glossy ibis	*Plegadis falcinellus*
Common tern	*Sterna hirundo*
Barn owl	*Tyto alba pratincola*

Common Name	Scientific Name
Mammals	
Pungo white-footed mouse	*Peromyscus leucopus easti*
Southeastern fox squirrel	*Sciurus niger niger*
Terrestrial Insects	
Dusky roadside-skipper	*Amblyscirtes alternata*
Little metalmark	*Calephelis virginiensis*
Hessel's hairstreak	*Callophrys hesseli*
Dismal Swamp green stink bug	*Chlorochroa dismalia*
Dukes' skipper	*Euphyes dukesi*
Palatka skipper	*Euphyes pilatka*
Brimley's assassin bug	*Pnirontis brimleyi*
Sandpit alydid bug	*Stachyocnemus apicalis*
Other Terrestrial Invertebrates	
A millipede	*Pseudopolydesmus paludicolous*
Aquatic Mollusks	
Yellow lance	*Elliptio lanceolata*
Yellow lampmussel	*Lampsilis cariosa*
Chesapeake ambersnail	*Oxyloma subeffusum*
Crustaceans	
Chowanoke crayfish	*Orconectes virginiensis*
Tidewater interstitial amphipod	*Stygobromus araeus*
Tidewater amphipod	*Stygobromus indentatus*
Aquatic Insects	
Swamp forestfly	*Prostoia hallasi*
Coppery emerald	*Somatochlora georgiana*
Other Aquatic Invertebrates	
None	
Tier IV	
Fishes	
Mud sunfish	*Acantharcus pomotis*
Alewife	*Alosa pseudoharengus*
American shad	*Alosa sapidissima*
American eel	*Anguilla rostrata*
Swampfish	*Chologaster cornuta*
Banded sunfish	*Enneacanthus obesus*
Lake chubsucker	*Erimyzon sucetta*
Lined topminnow	*Fundulus lineolatus*
Least brook lamprey	*Lampetra aepyptera*
American brook lamprey	*Lampetra appendix*

Common Name	Scientific Name
Ironcolor shiner	*Notropis chalybaeus*
Logperch	*Percina caprodes*
Trout-perch	*Percopsis omiscomaycus*
Amphibians	
New Jersey chorus frog	*Pseudacris feriarum kalmi*
Striped southern chorus frog	*Pseudacris nigrita nigrita*
Little grass frog	*Pseudacris ocularis*
Eastern mud salamander	*Pseudotriton montanus*
Eastern spadefoot	*Scaphiopus holbrookii*
Greater siren	*Siren lacertina*
Many-lined salamander	*Stereochilus marginatus*
Reptiles	
Scarletsnake	*Cemophora coccinea*
Mudsnake	*Farancia abacura*
Rainbow snake	*Farancia erytrogramma*
Eastern hog-nosed snake	*Heterodon platirhinos*
Eastern slender glass lizard	*Ophisaurus attenuatus*
Queen snake	*Regina septemvittata*
Southeastern crowned snake	*Tantilla coronata*
Common ribbonsnake	*Thamnophis sauritus*
Yellowbellied slider	*Trachemys scripta scripta*
Birds	
Seaside sparrow	*Ammodramus maritimus*
Grasshopper sparrow	*Ammodramus savannarum*
Greater scaup (winter)	*Aythya marila*
Green heron	*Butorides striatus*
Dunlin (winter)	*Calidris alpina*
Red knot (winter)	*Calidris canutus*
Purple sandpiper (winter)	*Calidris maritima*
Chuck-will's-widow	*Caprimulgus carolinensis*
Whip-poor-will	*Caprimulgus vociferus*
Bicknell's thrush (migrant)	*Catharus bicknelli*
Chimney swift	*Chaetura pelagica*
Marsh wren	*Cistothorus palustris*
Yellow-billed cuckoo	*Coccyzus americanus*
Northern bobwhite	*Colinus virginianus*
Eastern wood-pewee	*Contopus virens*
Yellow rail (migrant)	*Coturnicops noveboracensis*
Prairie warbler	*Dendroica discolor*
Yellow warbler	*Dendroica petechia*
Gray catbird	*Dumetella carolinensis*
Willow flycatcher	*Empidonax traillii*
Rusty blackbird (winter)	*Euphagus carolinus*
Worm-eating warbler	*Helmitheros vermivorus*

Common Name	Scientific Name
Wood thrush	*Hylocichla mustelina*
Yellow-breasted chat	*Icteria virens*
Short-billed dowitcher (migrant)	*Limnodromus griseus*
Marbled godwit (migrant)	*Limosa fedoa*
Hudsonian godwit (migrant)	*Limosa haemastica*
Black-and-white warbler	*Mniotilta varia*
Whimbrel (migrant)	*Numenius phaeopus*
Kentucky warbler	*Oporornis formosus*
Northern parula	*Parula americana*
Rose-breasted grosbeak	*Pheuctitus ludovicianus*
Eastern towhee	*Pipilo erythrophthalmus*
Scarlet tanager	*Piranga olivacea*
Black-bellied plover (winter)	*Pluvialis squatarola*
Horned grebe (winter)	*Podiceps auritus*
Prothonotary warbler	*Protonotaria citrea*
Virginia rail	*Rallus limicola*
Clapper rail	*Rallus longirostris*
American woodcock	*Scolopax minor*
Ovenbird	*Seiurus aurocapillus*
Louisiana waterthrush	*Seiurus motacilla*
Brown-headed nuthatch	*Sitta pusilla*
Field sparrow	*Spizella pusilla*
Northern rough-winged swallow	*Stelgidopteryx serripennis*
Roseate tern (migrant)	*Sterna dougallii*
Forster's tern	*Sterna forsteri*
Eastern meadowlark	*Sturnella magna*
Brown thrasher	*Toxostoma rufum*
Eastern kingbird	*Tyrannus tyrannus*
Yellow-throated vireo	*Vireo flavifrons*
Mammals	
Least weasel	*Mustela nivalis*
Southeastern myotis	*Myotis austroriparius*
Cotton mouse	*Peromyscus gossypinus*
Dismal Swamp southeastern shrew	*Sorex longirostris fisheri*
Appalachian cottontail	*Sylvilagus obscurus*
Marsh rabbit	*Sylvilagus palustris*
Southern bog lemming	*Synaptomys cooperi*
Terrestrial Insects	
Barrens dagger moth	*Acronicta albarufa*
A cane moth	*Argillophora furcilla*
Frosted elfin	*Callophrys irus*
Orange-bellied tiger beetle	*Cicindela abdominalis*
Spectral tiger beetle	*Cicindela lepida*
A tiger beetle	*Cicindela limbalis*
Pink-streak moth	*Faronta rubripennis*

Common Name	Scientific Name
A cane moth	*Franclemontia interrogans*
A shield bug	*Galgupha denudata*
Buchholz's gray moth	*Hypomecis buchholzaria*
Lemmer's pinion moth	*Lithophane lemmeri*
Bronze copper	*Lycaena hyllus*
Yucca giant-skipper	*Megathymus yuccae*
A noctuid moth	*Meropleon titan*
A turtle bug	*Oncozygia clavicornis*
Long dash	*Polites mystic*
Southern Ptichodis moth	*Ptichodis bistrigata*
Yellow-edged Pygarctia moth	*Pygarctia abdominalis*
Other Terrestrial Invertebrates	
Slim snaggletooth	*Gastrocopta pellucida*
Fine-ribbed striate	*Striatura milium*
Pinhole threetooth	*Triodopsis messana*
Palmetto vertigo	*Vertigo oralis*
Swamp vertigo	*Vertigo teskeyae*
Aquatic Mollusks	
Triangle floater	*Alasmidonta undulata*
Alewife floater	*Anodonta implicata*
Carolina lance mussel	*Elliptio angustata*
Carolina slabshell mussel	*Elliptio congaraea*
Northern lance mussel	*Elliptio fisheriana*
Oblong ancylid	*Ferrissia parallelus*
Tidewater mucket	*Leptodea ochracea*
Eastern pondmussel	*Ligumia nasuta*
Ridged lioplax	*Lioplax subcarinata*
Sharp sprite	*Promenetus exacuous*
Creeper	*Strophitus undulatus*
Florida pondhorn	*Uniomerus caroliniana*
Crustaceans	
Ohio River shrimp	*Macrobrachium ohione*
Aquatic Insects	
Blackwater bluet	*Enallagma weewa*
Robust baskettail	*Epitheca spinosa*
Drake's water scorpion	*Ranatra drakei*
Treetop emerald	*Somatochlora provocans*
Laura's clubtail	*Stylurus laurae*
Other Aquatic Invertebrates	
None	

[1] Loggerhead turtle *Caretta caretta* is included in Section 4.4, since its habitat within Virginia is terrestrial (nesting beaches).

4.4. Terrestrial and Wetland Species in the Coastal Plain

4.4.1. Tier I Species in the Coastal Plain

4.4.1.1. Loggerhead sea turtle, *Caretta caretta*

Life History Summary

The loggerhead sea turtle is marine and is never found in freshwater. It can be found off the coast in the Atlantic Ocean, throughout the Chesapeake Bay, and around the barrier islands (Mitchell 1994). They will also use portions of large, tidal rivers (Bellmund et al. 1987). Hatchlings will inhabit mats of *Sargassum* sp. for 3-5yr (Ernst et al. 1994a). The Bay appears to be an important summer foraging area for subadults (5-15yr old) (Musick 1988). Loggerheads enter the Bay when water temperatures exceed 18°C and leave when temperatures drop below 18°C, generally from May to November. Virginia is the northern extent of its nesting range on the east coast of the U.S. In fact, there is no active nesting population in Virginia; however, individual females will nest on Virginia beaches every summer (Musick 1988). Horseshoe crabs make up the majority of the loggerhead diet. Numerous summaries of biological literature and data for loggerheads exist for reference (Dodd 1988; NMFS and USFWS 1991b; Terwilliger and Musick 1995). According to VA-GAP (DGIF 2004a), 17% of its statewide predicted potential habitat is protected.

Location

The map of habitat for the loggerhead sea turtle (Figure 4.5) includes barren areas from land cover (USGS 2001) and records from Collections (DGIF 2004b). For more details, see appendix D.

Description of Essential Habitat

Essential habitat for this species includes ocean-facing sand beaches above the mean high water mark, typically at the base of the primary dune (i.e. the berm). (R. Boettcher, DGIF, pers. comm.).

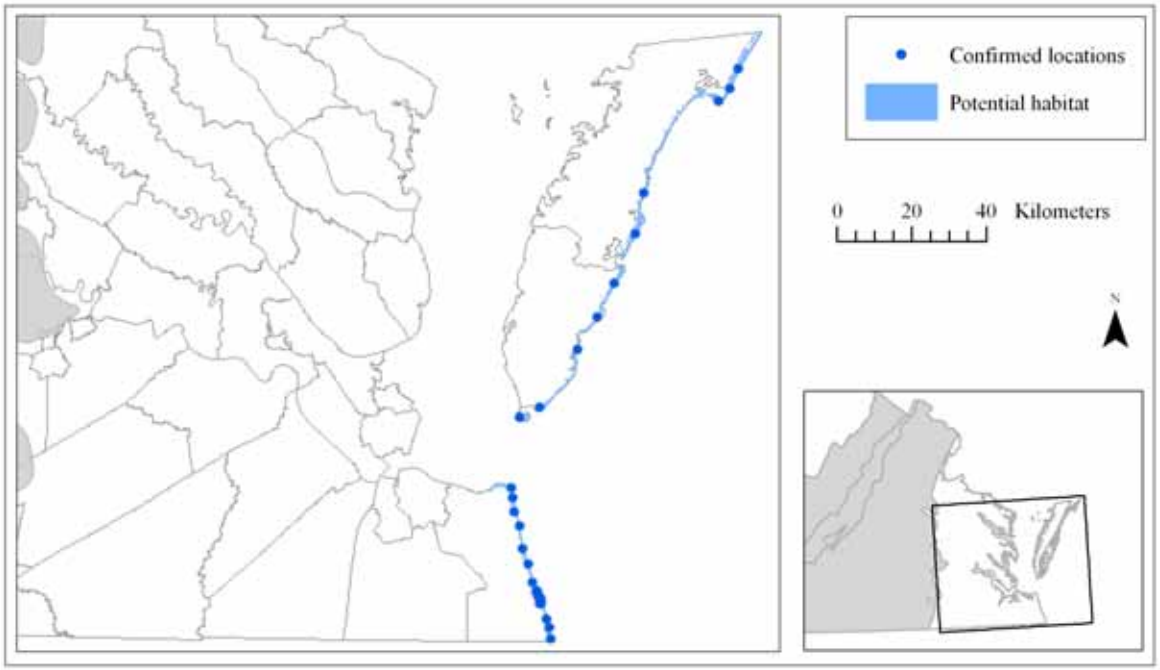

Figure 4.5. Distribution of loggerhead sea turtle nesting sites in Virginia.

Relative Condition of Habitat

Essential habitat and Collections observations of the loggerhead turtle occur along the Atlantic coast. There are 32 Collections locations, 18 of which occurred on a Conservation Land (DCR 2003; DGIF 2004b). Essential habitat totals 6,140ha, of which 3,460ha occur on Conservation Land (DCR 2003). However, other potential nesting sites are on well-developed and heavily used beaches. There is one DCR-NH Conservation Site for the loggerhead turtle (DCR-NH 2005). Most of the area within this site is mapped as essential habitat.

Specific Threats and Trends

The current main threats to this species include incidental take by commercial fishing and commercial and recreational boat traffic (Terwilliger and Musick 1995). Increased human development and disturbance of beach nesting habitats have and continue to contribute to the decline of this species. The recovery plan lists threats associated with the nesting and marine habitats separately (NMFS and USFWS 1991b). Nesting threats include beach armoring, erosion, and nourishment; artificial lighting; and nest loss to depredation or abiotic factors (NMFS and USFWS 1991b). Threats to the marine environment include oil and gas exploration, dredging, pollution, and commercial fisheries among others.

Herpetofauna TAC (2004) did not identify any specific threats for the loggerhead sea turtle; however, stresses and sources of stress were identified for the Coastal Plain aquatic species group in which this species was placed (Appendix H).

Conservation Actions and Strategies

Detailed conservation actions for both the nesting and marine habitats and populations have been provided in the NMFS and USFWS (1991b) recovery plan. They address the threats to nesting and marine habitats from development, fisheries, and other sources and recommend international cooperation for both immediate and long-term protection of this species.

Herpetofauna TAC (2004) did not identify any specific conservation actions for the loggerhead sea turtle; however, conservation actions were identified for the Coastal Plain aquatic species group in which this species was placed (Appendix I).

Research and Monitoring Needs

While much is already known about the loggerhead sea turtle, NMFS and USFWS (1991b) recommend several research and monitoring needs. These include several studies pertaining to nesting and hatchling success, ecology and life history studies in the marine environment, and monitoring and evaluation of threats.

4.4.1.2. Wood turtle, *Glyptemys insculpta*

Life History Summary

The wood turtle is known from the Potomac drainage in the Coastal Plain, Piedmont, Blue Ridge Mountains, and Northern Ridge and Valley ecoregions (Mitchell 1994). Its conservation is complicated by its requirement of clear streams and an adjacent terrestrial habitat (often fields, sometimes forests), because the turtle spends part of each year in each habitat (Mitchell 1994). Wood turtle is omnivorous, consuming a variety of vegetation and invertebrate prey, and occasionally vertebrates as well (Mitchell 1994). The wood turtle is legally protected, with the status of State threatened. While its correct accepted generic name is *Glyptemys*, this species is still listed as *Clemmys insculpta* in the Virginia Administrative Code (4 VAC 15-20-130). According to VA-GAP (DGIF 2004a), 7% of its statewide predicted potential habitat is protected.

Location

Potential habitat for the wood turtle includes areas that have certain terrestrial and aquatic components (Figure 4.6). For terrestrial habitat, potential areas were selected based on percent development within watersheds (DCR 2004) according to land cover data (USGS 1992). Potential aquatic habitat was determined using the DGIF aquatic habitat classification where attributes used were stream reach elevation, size and gradient. Confirmed locations are from Collections (DGIF 2004b). For more details on mapping potential habitat, see Appendix D.

Description of Essential Habitat

The wood turtle essentially uses riparian areas and streams in Frederick, Shenandoah, Loudoun, Fairfax and northern Rockingham counties (M. J. Pinder, DGIF, pers. comm.). It is found primarily in and near clear brooks and streams in deciduous woodlands in Virginia, but has been found in woodland bogs and marshy fields at more northern sites. It seems to use quite variable habitats, as long as some critical aquatic and terrestrial components are present. In all cases, it has been found utilizing wet and/or marshy meadows associated with floodplains. Although highly terrestrial, wood turtles must remain in moist habitats (Mitchell 1994).

Relative Condition of Habitat

Of the 260 statewide wood turtle Collections locations, three occur in the Coastal Plain within Fairfax County (DGIF 2004b). All observations are in a Conservation Land, two in a military instillation and the other in a county park (DCR 2003; DGIF 2004b). Approximately 45% of the predicted stream reaches flow through Conservation Lands (DCR 2003). However, this area of Fairfax County is heavily developed and growing rapidly. Most areas outside of a Conservation Land are unsuitable. There are three DCR-NH Conservation Sites for wood turtle in the Coastal Plain, two of which encompass a Collections record. One of the sites has a viability rating of "poor," and the other two sites are not rated (DCR-NH 2005).

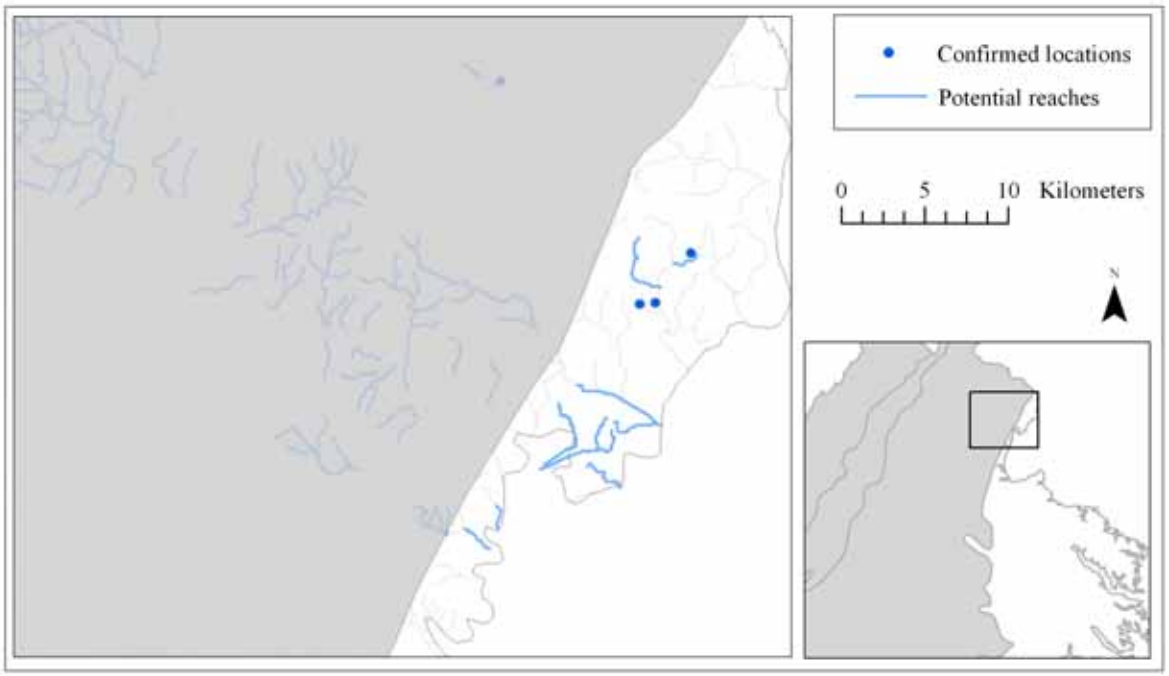

Figure 4.6. Distribution of the wood turtle in the Coastal Plain.

Specific Threats and Trends

The main threats to the wood turtle in Virginia are the illegal pet trade and habitat destruction, particularly as related to riparian zones and effects of siltation from construction (Mitchell 1994), forestry (Herpetofauna TAC 2004), and bank stabilization (NESWDTC 2004) (Table 4.3).

The wood turtle is declining across much of its range (Ernst et al. 1994b), though specific trend information is not currently available and would be difficult to acquire.

Table 4.3. Species-specific stresses on the wood turtle (Herpetofauna TAC 2004). For additional stresses on the wood turtle, please see stresses listed under its habitat groups (Appendix H).

Stress	Source of stress	Scope	Severity	Comments
Intentional take	Economic use of species	3	4	Pet trade
Shoreline alteration	Forestry	2	3	Forestry practices

Conservation Actions and Strategies

Species-specific actions that are necessary for wood turtle conservation include better enforcement and prosecution of capture laws (the wood turtle is protected from all unpermitted take by virtue of its State threatened status) (Herpetofauna TAC 2004). Protection of known populations and their habitat, and determination of current distribution and population viability in Virginia are critical (Ernst et al. 1994b; also see this source for additional conservation actions). Ernst et al. (1994b) state that the goal of recovery work for wood turtle is downlisting from State threatened to State special concern, but "the rate of habitat loss in northern Virginia and the lack of site(s) for establishment of historical populations...suggests that this objective may be unrealistic."

Research and Monitoring Needs

Like many reptiles, the basic life history and distribution of the wood turtle are poorly known. As such, research and monitoring needs include surveys to determine overall wood turtle distribution in Virginia; studies on wood turtle life history; and demographic studies, including population connectivity and gene flow (Ernst et al. 1994b; Herpetofauna TAC 2004; NESWDTC 2004).

4.4.1.3. Chicken turtle, *Deirochelys reticularia*

Life History Summary

The chicken turtle is known only from the Coastal Plain in Virginia, where it reaches the northern extent of its range (Ernst et al. 1994a). It occurs in the northern portion of the City of Virginia Beach (Mitchell 1994) and in Isle of Wight County (McCoy et al. 2000). The Virginia population is disjunct from the rest of the turtle's range. In Virginia, the chicken turtle utilizes freshwater cypress ponds (Mitchell 1994). In much of its range, it will use any still water, generally heavily vegetated with a soft bottom (Ernst et al. 1994a). The chicken turtle is omnivorous, consuming tadpoles, crayfish, and some aquatic vegetation (Mitchell 1994). The chicken turtle is legally protected, with the status of State endangered. According to VA-GAP (DGIF 2004a), 12% of its statewide predicted potential habitat is protected.

Location

Potential habitat for the chicken turtle (Figure 4.7) was determined using land cover data (USGS 2001) and aerial photography (VGIN 2002). Confirmed locations are from Collections (DGIF 2004b). For more details on mapping potential habitat, see Appendix D.

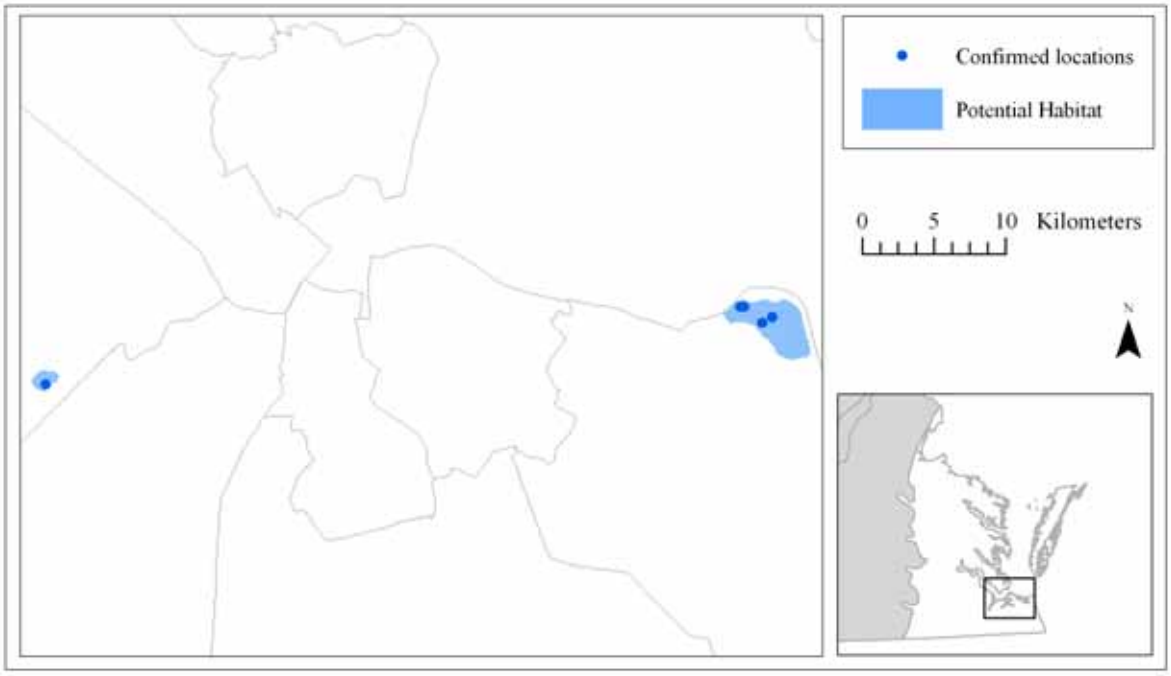

Figure 4.7. Distribution of the chicken turtle in the Coastal Plain.

Description of Essential Habitat

Essential habitat for this species includes freshwater cypress ponds, mostly interdunal. The population in the City of Virginia Beach inhabits interdunal swales that have seasonal water fluctuations (Buhlmann 1995). It requires aquatic vegetation. Isolated wetlands and surrounding landscape are the most critical habitat (J. C. Mitchell, UR, pers. comm.).

Relative Condition of Habitat

Essential habitat and Collections observations of the chicken turtle occur at only two sites. Five of the six collections are on Fort Story Military Reservation and Seashore State Park (DGIF 2004b). Only approximately 20% of its original habitat is protected around Seashore State Park, the rest destroyed by development (Buhlman 1995). This area is afforded some protection by virtue of its public ownership (Department of Defense). The other collection is on private property (DGIF 2004b). The essential habitat areas total 1,500ha. DCR-NH Conservation Sites overlap with the two locations of essential habitat and Collection records. These sites received estimated viability ratings of "fair/poor" for the Seashore State Park site and as "poor" for other site (DCR-NH 2005).

Specific Threats and Trends

No young or juvenile chicken turtles have been observed at the City of Virginia Beach site (Mitchell 1994). Therefore, it remains unclear whether any recruitment occurs in this population, making the future of chicken turtle in Virginia uncertain. In addition, despite being common in the 1970s, only nine adults were captured during the early 1990s (Mitchell 1994), which lends credence to the idea that no recruitment occurs. Herpetofauna TAC (2004) did not identify any species-specific threats; however, stresses on its habitat can be found in Appendix H.

Conservation Actions and Strategies

Control of the chicken turtle's major predators (snapping turtles *Chelydra serpentina* and raccoon *Procyon lotor*) from Seashore State Park may be an important first step in recovering Virginia's population of this

species (Mitchell 1994). Herpetofauna TAC (2004) did not identify any species-specific conservation actions; however, those for its habitat can be found in Appendix I.

Research and Monitoring Needs

Mitchell (1994) suggests that the chicken turtle in Virginia should be "frequently monitored." Little is known about long-range movement or thermal ecology (thermoregulation and torpor) (Ernst et al. 1994a). Both the City of Virginia Beach and Isle of Wight locations should be surveyed to update status of populations (J. C. Mitchell, UR, pers. comm.; D. J. Schwab, USFWS, pers. comm.).

4.4.1.4. Bachman's sparrow, *Aimophila aestivalis*

Life History Summary

Bachman's sparrow occurs in the southeastern portion of Virginia's Piedmont and Coastal Plain (Ridd 1991). A population on Fort A. P. Hill Military Reservation represents the northernmost population (Watts 2000). It prefers dry, open-canopy pine woods with little woody understory, but a dense grass/forb layer such as pine savannah (Ridd 1991; Dunning 1993). It also uses old fields and pine clearcuts. Artillery ranges and other areas kept open on military bases seem to support Bachman's sparrow in Virginia. It seems to associate strongly with broomsedge *Andropogon virginicus*. Its main foods include ground-dwelling insects and seeds, especially grass seeds of the genus *Panicum* (Ridd 1991; Dunning 1993). Important threats include loss of habitat to intensification of pine plantations and suppression of fire regimes (Ridd 1991; Dunning 1993). Bachman's sparrow is legally protected in Virginia, both under MBTA and with the status of State threatened. According to VA-GAP (DGIF 2004a), 7% of its statewide predicted potential habitat is protected.

Location

Shown in the map of Bachman's sparrow habitat (Figure 4.8) are Collections (DGIF 2004b) and a Conservation Site (DCR-NH 2005). We do not have spatial data depicting recent clearcuts (due to their ephemeral nature), which are important habitat for this species (M. D. Wilson, CCB, pers. comm.).

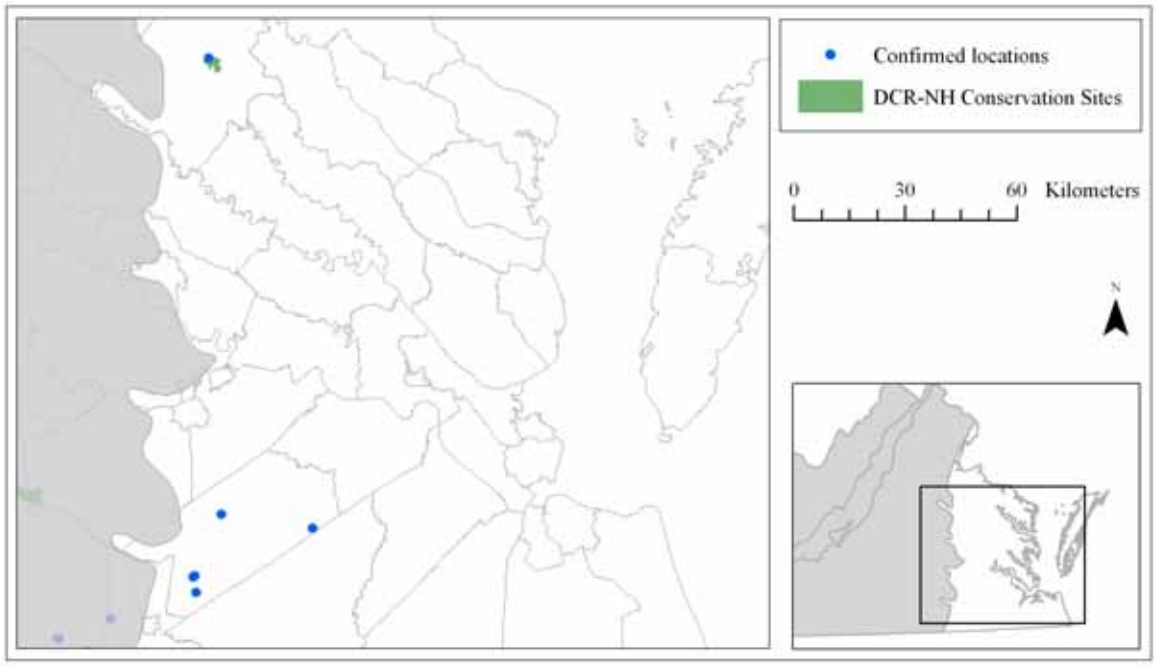

Figure 4.8. Distribution of Bachman's sparrow in the Coastal Plain.

Description of Essential Habitat

This species primarily uses open-canopy pine woods/pine savannah, with a thick herbaceous layer and little shrub. They are also found in oak scrub and recent clearcuts. Frequently burned pine is perfect, and areas maintained for red-cockaded woodpeckers work well (Dunning 1993; Watts 2000; D. J. Schwab, USFWS, pers. comm.; M. D. Wilson, CCB, pers. comm.). However, Watts (1999) reports that understory within red-cockaded woodpecker management areas may not be adequate for Bachman's sparrow unless also specifically managed to meet their requirements.

Relative Condition of Habitat

Due to the ephemeral nature of the habitat for this species, it is difficult to determine the total area and status of available habitat. There are six known locations in Collections within the Coastal Plain (14 statewide, DGIF 2004b). There are two DCR-NH Conservation Sites, totaling over 950ha (DCR-NH 2005). There are three corresponding Collections records within those Conservation Sites. One of the Collections and corresponding Conservation Site, encompassing 886ha, occurs at Fort A.P. Hill Military Reservation. The Conservation Site on Fort A.P. Hill has a viability rating of "poor." The other site is rated "fair/poor" (DCR-NH 2005).

Specific Threats and Trends

Bachman's sparrow has suffered a range-wide decline of > 50% over the last 30 years (Rich et al. 2004). Within Virginia, Rosenberg (2004) reports the same decline, while Bird TAC (2004) reports a stable or undetected trend.

While no species-specific stresses have been identified for Bachman's sparrow (Bird TAC 2004), its savannah habitat is under many stresses, as outlined in Appendix H. A particularly severe stress is the intensification of pine plantations in the Coastal Plain. An important consideration when restoring habitat is that Bachman's sparrows are limited in dispersal due to their stringent habitat requirements: Restored or created habitat that is not adjacent to currently-occupied areas is unlikely to be colonized by Bachman's sparrows through natural dispersal (Dunning et al. 1995; Liu et al. 1995).

Conservation Actions and Strategies

While no species-specific conservation actions were proposed by Bird TAC (2004), many habitat actions were listed, and appear in Appendix I. All involve the restoration and protection of savannah habitat. Especially important is thinning of plantations, along with frequent burns to suppress underbrush and encourage grasses (Dunning 1993). Dunning et al. (1995) showed that connectivity is an important factor in this species' ability to colonize habitat patches. Liu et al. (1995) suggested that clustered harvest of timber at a South Carolina site could be best for this species, as it allows dispersing juveniles to easily find suitable habitat. However, this species is also found in regenerating pine clearcuts from 2-6 years old of all sizes, and can be common in these situations if managed properly (Krementz and Christie 2000).

Research and Monitoring Needs

Little is known about basic life history in this species, including breeding densities, life span and survivorship, and population regulation (Dunning 1993). Hurricanes can be important to this species, as it often breeds in coastal areas, but long-term effects of hurricane damage are not clear (Dunning 1993).

4.4.1.5. Henslow's sparrow, *Ammodramus henslowii*

Life History Summary

Henslow's sparrow occurs in both the Coastal Plain and in the Piedmont of Virginia. In the Coastal Plain, Henslow's sparrow occasionally uses dry to wet fields with dense vegetation but no woody plants, such as early-successional old fields, but mainly high marsh (Brindza 1991; Watts 1999; Herkert et al. 2002).

During the breeding season, Henslow's sparrow eats mostly crickets, grasshoppers and beetles (Brindza 1991; Herkert et al. 2002). Important threats to this bird in the Coastal Plain include loss of habitat to exotic plants (largely *Phragmites* spp.) and habitat conversion to residential or industrial uses (Brindza 1991; Herkert et al. 2002). Henslow's sparrow is legally protected in Virginia, both under MBTA and with the status of State threatened. According to VA-GAP (DGIF 2004a), 12% of its statewide predicted potential habitat is protected.

Location

The map of Henslow's sparrow habitat (Figure 4.9) consists of Collections locations (DGIF 2004b), and high marsh, areas mapped using Tidal Marsh Inventory Data (CCRM 1992). This map does not include upland components of its habitat, since this type of habitat cannot accurately be depicted with spatial data. For more details on mapping potential habitat, see Appendix D.

Description of Essential Habitat

Essential habitat for populations of Henslow's sparrow in the Coastal Plain includes high marsh areas (Watts 1999). Black needlerush *Juncus roemerianus* communities with a high percentage saltmeadow hay *Spartina patens* and salt grass *Distichlis spicata* are good descriptors (M. D. Wilson, CCB, pers. comm.). They also may inhabit large grassland patches (> 40ha), with high litter depth, low forb cover and low bare ground exposure. This species prefers grassland with infrequent disturbance, and dense tall grass (up to 80cm tall) (Swanson 1996; J. L. Cooper, DGIF, pers. comm.).

Relative Condition of Habitat

Essential habitat for Henslow's sparrow in the Coastal Plain has been mapped. There are 15,600ha of potential essential habitat in this ecoregion. Over 5,800ha, more than 35% of the potential essential habitat, are protected in a Conservation Land. There are two known locations in Collections within the Coastal Plain (10 statewide, DGIF 2004b). Both of these locations occur on a Conservation Land, one on DGIF's Saxis WMA. There is one Conservation Site for Henslow's sparrow in the Coastal Plain. This site, on private land, has an estimated viability rating of "fair" (DCR-NH 2005).

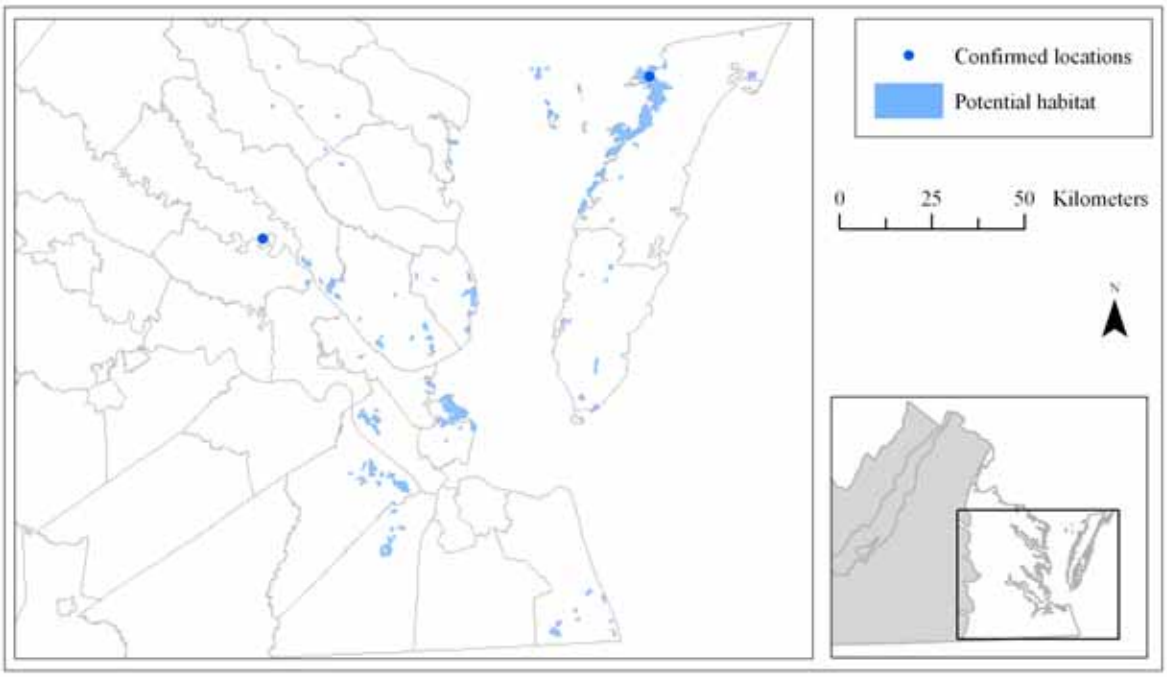

Figure 4.9. Distribution of Henslow's sparrow in the Coastal Plain.

Specific Threats and Trends

Henslow's sparrow has suffered a range-wide decline of > 50% over the last 30 years (Rich et al. 2004). Within Virginia, both Rosenberg (2004) and Bird TAC (2004) report the same trend.

While no species-specific stresses have been identified for Henslow's sparrow (Bird TAC 2004), both its grassland and marsh habitats are under many pressures, as outlined in Appendix H. In fact, Herkert et al. (2002) report that "loss of suitable habitat (is) probably (the) major threat to Henslow's sparrow."

Conservation Actions and Strategies

While no species-specific conservation actions were proposed by Bird TAC (2004), many habitat actions were listed and appear in Appendix I. Herkert et al. (2002) and Kearney (2003) point out that CRP and similar programs are likely to benefit an entire suite of grassland birds like Henslow's sparrow.

Research and Monitoring Needs

No species-specific research or monitoring needs were identified by Bird TAC for Henslow's sparrow in Virginia (Bird TAC 2004). Targeted surveys for this species should be conducted, though they are probably not adequately detected by many standard survey methods, so new protocols may need to be designed (NESWDTC 2004). Herkert et al. (2002) report that, like many secretive grassland and marsh birds, little is known about the natural history of Henslow's sparrow, such as reproductive success and effort. In addition, while abundance related to habitat management has been studied, the relationship of reproductive success to various management regimes has not been (Herkert et al. 2002).

4.4.1.6. Piping plover, *Charadrius melodus*

Life History Summary

The piping plover shares habitat with another Tier I species, Wilson's plover *Charadrius wilsonia*, as well as a Tier II species, the least tern *Sterna antillarum*. In Virginia, the piping plover utilizes barrier islands exclusively. Nests are built as a scrape on sand or shell beaches, lined with shell, near clumps of vegetation and dunes (Haig 1992). Its food includes invertebrates and eggs of marine organisms that wash ashore, as well as some terrestrial invertebrates (Haig 1992). Major threats include human disturbance and introduced mammalian predators. The piping plover is legally protected, both under MBTA and with the status of Federal and State threatened. According to VA-GAP (DGIF 2004a), 17% of its statewide predicted potential habitat is protected.

Location

The map for the piping plover (Figure 4.10) includes potential habitat in the form of barren areas (USGS 2001), with confirmed locations from Collections (DGIF 2004b). For more details on mapping potential habitat, see Appendix D.

Description of Essential Habitat

Essential habitat for the piping plover includes beaches near dunes and elevated areas, particularly barrier islands (DeGraaf et al. 1995). Absence of mammalian predators is critical.

Relative Condition of Habitat

The potential essential habitat of the piping plover is the same as that of Wilson's plover. The potential essential habitat totals approximately 4,500ha, with just over 2,500ha of potential habitat within a Conservation Land (DCR 2003). Over 78% (3,550ha) of potential habitat has been confirmed as used by piping plovers (DGIF 2004b). There are 725 Collections records for this species, reflecting the high degree of effort in research and monitoring (DGIF 2004b). Of these observations, 314 occur on a Conservation

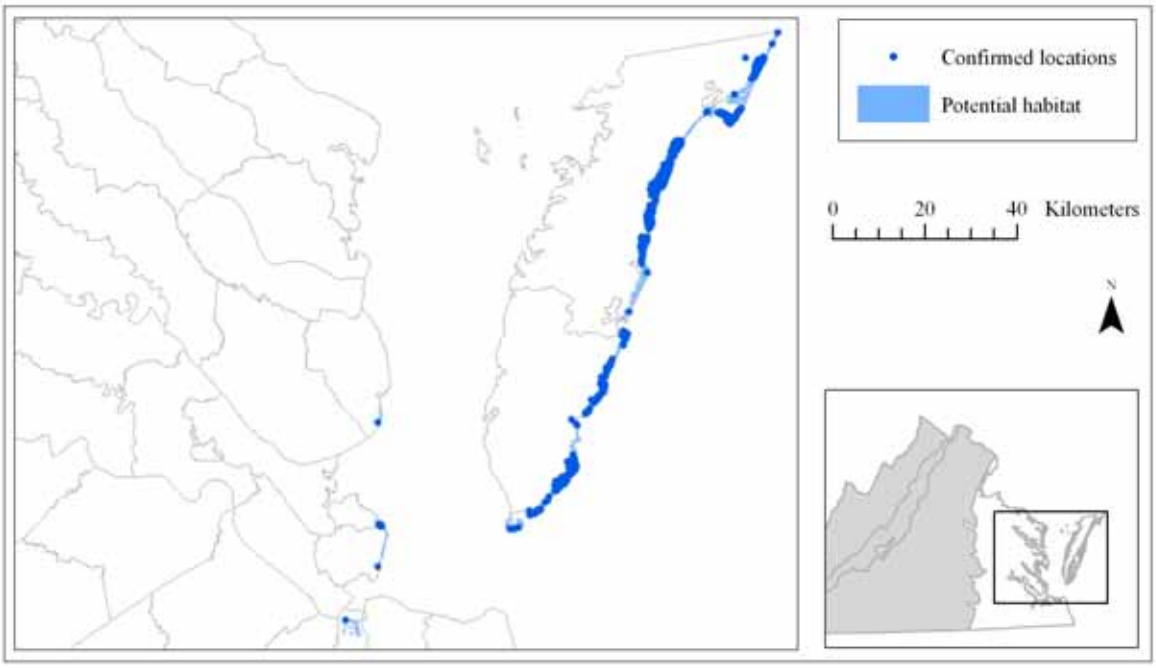

Figure 4.10. Distribution of the piping plover in the Coastal Plain.

Land (DCR 2003). There are 16 DCR-NH Conservation Sites, which overlap with locations of essential habitat and Collection records. These Sites consist of 22 DCR-NH Element Occurrences. The estimated viability of these EOs are as follows: five "excellent," five "good," nine "fair," and three "poor" (DCR-NH 2005).

Piping plover habitat is being continually degraded throughout most of its range by dune stabilization and residential development. In Virginia, these stresses are not as important, since all of Virginia's piping plovers nest on the essentially undeveloped barrier islands, which are largely owned by TNC and government agencies.

Specific Threats and Trends

Disturbance during nesting is a serious threat due to the exposure of the eggs to predation and the elements (Haig 1992). In addition, mammalian predators are a significant problem for all barrier island-nesting water and shorebirds. On the barrier islands of Virginia, these predators include introduced red foxes *Vulpes vulpes*, raccoons *Procyon lotor*, and feral cats *Felis catus*. In addition, many avian predators, including herring gulls *Larus argentatus*, fish crows *Corvus ossifragus*, and grackles *Quiscalus* spp., as well as ghost crabs *Oncypoda* spp., will take eggs or young plovers (Cross 1991).

Watts (1999) reports an estimate of 500 piping plovers throughout the PIF Mid-Atlantic Coastal Plain. Surveys performed by DGIF indicate approximately 152 pairs of piping plovers in Virginia in 2004, with a stable to slight upward trend over the last 19 years (R. Boettcher, DGIF, unpubl. data). Unprecedented productivity occurred in 2004, due in part to habitat creation by Hurricane Isabel; if nesting conditions are good in 2005, this could signal another increase, solidifying the upward trend (R. Boettcher, DGIF, pers. comm.). While Bird TAC did not indicate any species-specific stresses for piping plover in Virginia, it shares stresses with other barrier island birds (Bird TAC 2004, Appendix H).

Conservation Actions and Strategies

Watts (1999) indicates a goal of 300 piping plovers throughout the PIF Mid-Atlantic Coastal Plain, with half of that number to occur in Maryland and Virginia. The goal issued by USFWS (1988) was 1200 pairs

throughout the entire Atlantic coast, updated to 2000 pairs in 1996 (USFWS 1996). The goal for the southern portion of the region (Delaware, Maryland, Virginia and North Carolina) is 400 pairs (USFWS 1996). Bird TAC (2004) reports a goal of maintaining or increasing 2004 population levels.

Since most of the barrier island habitat used by this species is already protected through ownership by TNC and government agencies, habitat acquisition is not as important as for many other species. However, management and protection of these islands in terms of their geology (ensuring sediment flow to prevent their loss) and their use by humans is still of utmost importance (Watts 1999). In addition, management of predators, particularly introduced mammalian predators, is crucial to continuing the recovery of the piping plover in Virginia. Bird TAC (2004) suggested that creation of additional dredge spoil islands would provide predator-free habitat. Detailed management needs are discussed in the recovery plan (USFWS 1988, 1996). This species also shares conservation actions with other barrier island birds, which may be found in Appendix I.

Research and Monitoring Needs

Annual population surveys should be continued, including productivity (Watts 1999). Effects of avian predators on its population dynamics should also be investigated (Watts 1999). Habitat use and population dynamics, including demographic information such as adult survivorship, are not well understood (USFWS 1988). Methodologies for more efficient and effective surveying would be useful (USFWS 1988). Disturbances on the wintering grounds are poorly understood and may affect the dynamics of the population (Haig 1992).

4.4.1.7. Wilson's plover, *Charadrius wilsonia*

Life History Summary

Wilson's plover shares habitat with another Tier I species, piping plover *Charadrius melodus*, as well as a Tier II species, least tern *Sterna antillarum*. In Virginia, Wilson's plover utilizes barrier islands exclusively. Nests are built as a scrape on sand or shell beaches, on the beach side or behind primary dunes (Corbat and Bergstrom 2000), but away from vegetation (Bergstrom 1991). Its food is largely crab, with some insects taken (Corbat and Bergstrom 2000). Major threats include human disturbance and introduced mammalian predators. Wilson's plover is legally protected, both under MBTA and with the status of State endangered. According to VA-GAP (DGIF 2004a), 19% of its statewide predicted potential habitat is protected.

Location

The map for Wilson's plover (Figure 4.11) includes potential habitat in the form of barren areas (USGS 2001), along with Collections (DGIF 2004b). For details on mapping potential habitat, see Appendix D.

Description of Essential Habitat

Essential habitat for this species includes beach areas and margins of coastal pools (DeGraaf et al. 1995). All Wilson's plovers in Virginia occur on barrier islands.

Relative Condition of Habitat

There are 166 Wilson's plover Collections records (DGIF 2004a), 72 of which fall within a Conservation Land (DCR 2003). There are approximately 4,500ha of potential habitat, 25% of which are confirmed as used by Wilson's plovers (DGIF 2004a). Just over 2,500ha of potential habitat are within a Conservation Land (DCR 2003). There are 12 DCR-NH Conservation Sites, which overlap with locations of essential habitat and Collections records. These Sites consist of 16 DCR-NH Element Occurrences. The estimated viability of these EOs are as follows: one "excellent," five "good," five "fair," and five "poor" (DCR-NH 2005).

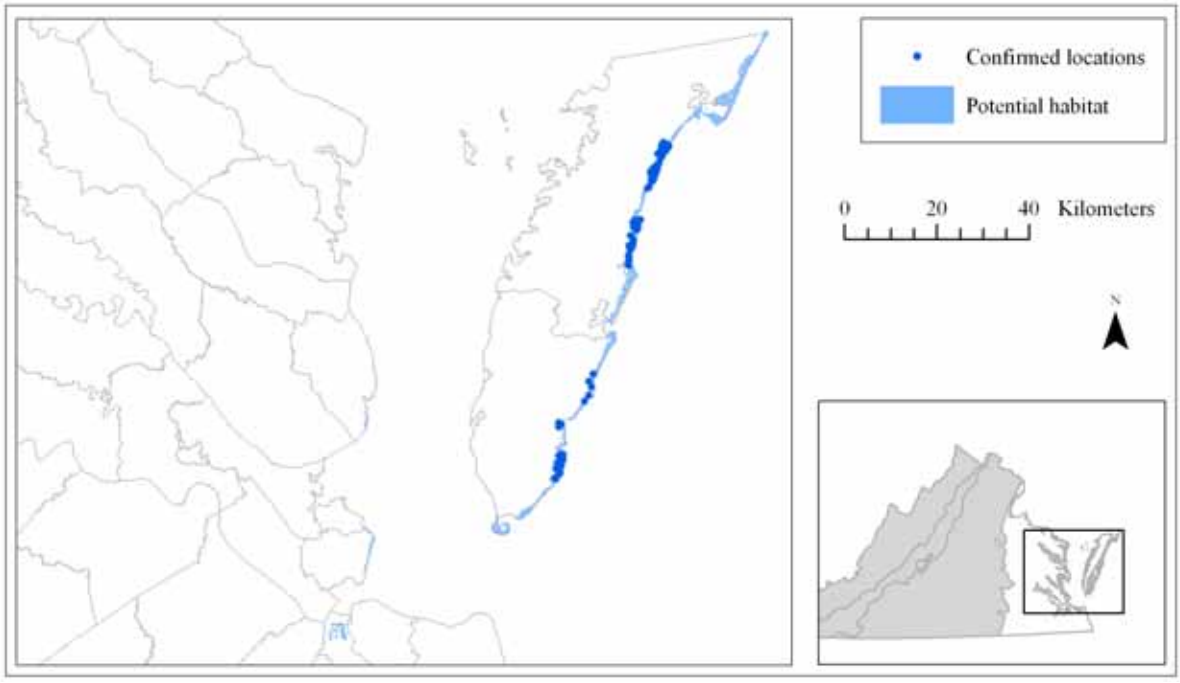

Figure 4.11. Distribution of Wilson's plover in the Coastal Plain.

Specific Threats and Trends

Plovers do not return to their nests rapidly when disturbed, so disturbance during nesting is a serious threat due to exposure of the eggs to predation and the elements (Corbat and Bergstrom 2000). In addition, mammalian predators are a highly significant problem for all barrier island-nesting water and shorebirds. On the barrier islands of Virginia, these predators include introduced red foxes *Vulpes vulpes* and raccoons *Procyon lotor*. Many avian predators, including herring gulls *Larus argentatus* and great black-backed gulls *L. marinus*, will also take eggs or young plovers (Bergstrom 1991).

Watts (1999) reports an estimate of <100 Wilson's plovers throughout the PIF Mid-Atlantic Coastal Plain. Surveys performed by DGIF indicate approximately 27 pairs of Wilson's plovers in Virginia in 2004, with a basically stable trend over the last 17 years (23-50 pairs per year, R. Boettcher, DGIF, unpubl. data). Due to the cryptic nature of this species, these numbers may be a slight underestimate (R. Boettcher, DGIF, pers. comm.). While Bird TAC did not indicate any species-specific stresses for Wilson's plover in Virginia, it shares stresses with other barrier island birds (Bird TAC 2004, Appendix H).

Conservation Actions and Strategies

Bergstrom et al. (1991) declared a primary objective of 60 breeding pairs of Wilson's plover in Virginia. Watts (1999) indicates a goal of 300 piping plovers throughout the PIF Mid-Atlantic Coastal Plain, with the assumption that this will supply habitat for a stable population of Wilson's plover as well. Since most of the barrier island habitat used by this species is already protected through ownership by TNC and government agencies, habitat acquisition is not as important as for many other species. However, management and protection of these islands in terms of their geology (ensuring sediment flow to prevent their loss) and their use by humans is still of utmost importance (Watts 1999). In addition, management of predators, particularly introduced mammalian predators, is crucial to continuing the recovery of Wilson's plover in Virginia, as is prevention of human and pet disturbance (Bergstrom et al. 1991). Bird TAC (2004) suggested that creation of additional dredge spoil islands would provide predator-free habitat. A detailed step-down management model is given in Bergstrom et al. (1991). Additional conservation actions that it shares with other barrier island birds can be found in Appendix I.

Research and Monitoring Needs

Annual population surveys should be continued (Bergstrom 1991), including collection of productivity data. In addition, the population dynamics of this species should be investigated (Bergstrom 1991). Effects of avian predators on its population dynamics should also be investigated (Watts 1999). Habitat assessments of areas that are not currently occupied by Wilson's plovers are important in determining what habitat management is necessary to increase the population (Bergstrom et al. 1991).

4.4.1.8. Wayne's black-throated green warbler, *Dendroica virens waynei*

Life History Summary

Wayne's warbler is a subspecies of the black-throated green warbler. This is a northern species; the *waynei* subspecies is known only from coastal cypress swamps in Virginia and the Carolinas (Morse 1993). In Virginia, it inhabits cypress swamps in and around Great Dismal Swamp NWR (Morse 1993). It also inhabits swamps containing a large portion of red maple (M. D. Wilson, CCB, pers. comm.). Its diet includes mostly caterpillars, preferring non-hairy species (Morse 1993). The rest of its diet is made up of other insects, gleaned from small branches, and some berries (especially poison ivy berries on migration, Morse 1993). Its habitat within the NWR is apparently secure; outside the Refuge, cypress logging is a potential threat. Wayne's warbler is legally protected under MBTA. This subspecies was not considered by VA-GAP, so no percentage of habitat protection is available (DGIF 2004a).

Location

The map for Wayne's warbler (Figure 4.12) includes potential habitat selected as NWI palustrine forested wetlands (USFWS 1995). For more details on mapping potential habitat, see Appendix D.

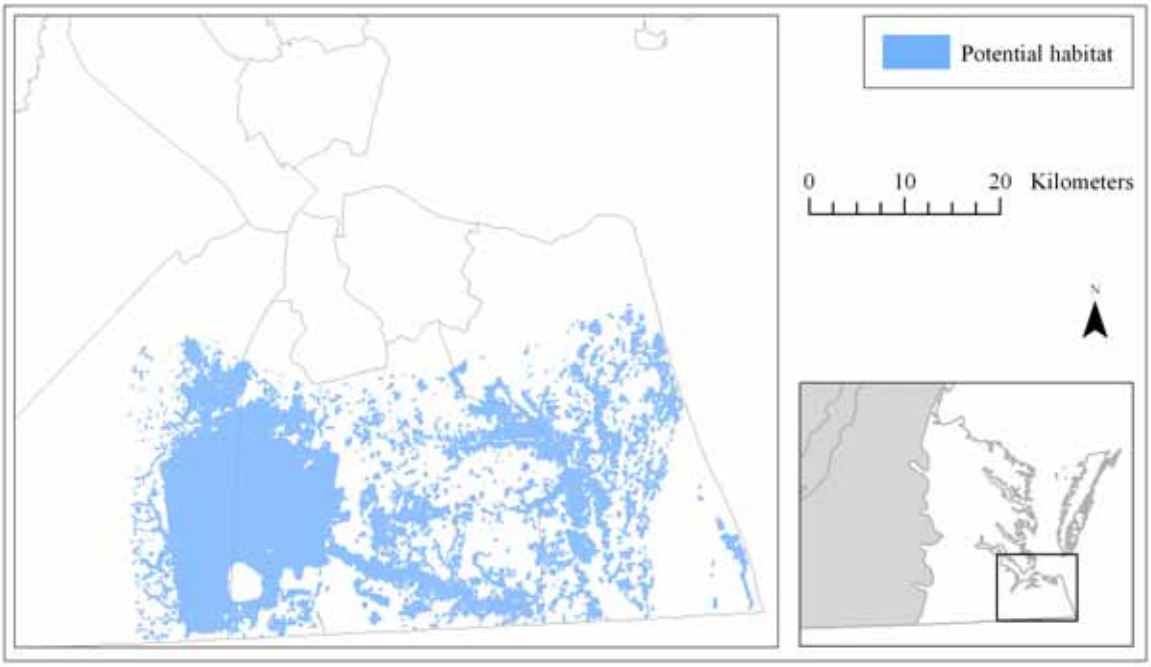

Figure 4.12. Potential habitat of Wayne's black-throated green warbler in the Coastal Plain.

Description of Essential Habitat

Essential habitat for this species includes cypress and white-cedar swamps in southeastern Virginia (Curson et al. 1994). However, it currently occupies areas that have been converted to contain a large portion of red maple (M. D. Wilson, CCB, pers. comm.).

Relative Condition of Habitat

No confirmed records of this species exist in Collections (DGIF 2004b). There are 57,800ha of potential habitat in Virginia. Over 33,300ha are within a Conservation Land, mostly in Great Dismal Swamp NWR.

Specific Threats and Trends

Schwab and Gwynn (1999) report that this subspecies is declining in Virginia, but that Fussell (1994) reports it as common in North Carolina's part of Great Dismal Swamp NWR. Logging of old growth cypress was historically a threat to Wayne's warbler, but the establishment of Great Dismal Swamp NWR in 1975 has hopefully alleviated that stress (Via 1979). Watts (1999) reports its population at an estimated 1,000 individuals throughout PIF's Physiographic Area 44. Bird TAC (2004) reports a goal of increasing the Dismal Swamp NWR population, while surveying adjacent areas to determine the extent of its range.

Conservation Actions and Strategies

Bird TAC (2004) reported that restoration of Atlantic white cedar *Chamaecyparis thyoides* is an important conservation action for Wayne's warbler. Watts (1999) proposes a goal of 500 breeding pairs of Swainson's warblers in PIF's Physiographic Area 44 (largely in Great Dismal Swamp NWR), with the assumption that reaching this goal would also secure the Wayne's warbler population.

Research and Monitoring Needs

The behavior of this subspecies is poorly known at this time. Bird TAC (2004) reported that our knowledge of the distribution of Wayne's warbler would benefit from targeted surveys for it, due to its dense habitat and nervous, active nature. Its viability in swamps converted from cypress to maple should be investigated (M. D. Wilson, CCB, pers. comm.). Its distribution outside Great Dismal Swamp NWR (if it occurs outside the Refuge) is unknown.

4.4.1.9. Peregrine falcon, *Falco peregrinus*

Life History Summary

The peregrine falcon occurs most frequently in the Coastal Plain, but it is regularly observed statewide. They occur year-round in Virginia (Watts 1999). This falcon eats mainly birds, ranging in size from hummingbirds to sandhill cranes (White et al. 2002), but focusing on prey 100-500g (Johnsgard 1990). Its main nesting habitat is cliff faces, but in the Coastal Plain, it frequents human structures of two types. It will nest on bridges and buildings, which mimic its natural habitat of cliff faces. In addition, it occupies towers on Virginia's Eastern Shore that have been constructed for use by these falcons. Young falcons are removed from nests in the Coastal Plain and "hacked," or transplanted, to areas in the mountains, with the hope that these birds will return to their historic mountain range. The peregrine falcon is legally protected, both under MBTA and with the status of State threatened. According to VA-GAP (DGIF 2004a), 20% of its statewide predicted potential habitat is protected.

Location

The map of peregrine falcon habitat (Figure 4.13) includes nest locations (Watts et al. 2003). Potential habitat for this species is difficult to map because the specific requirements.

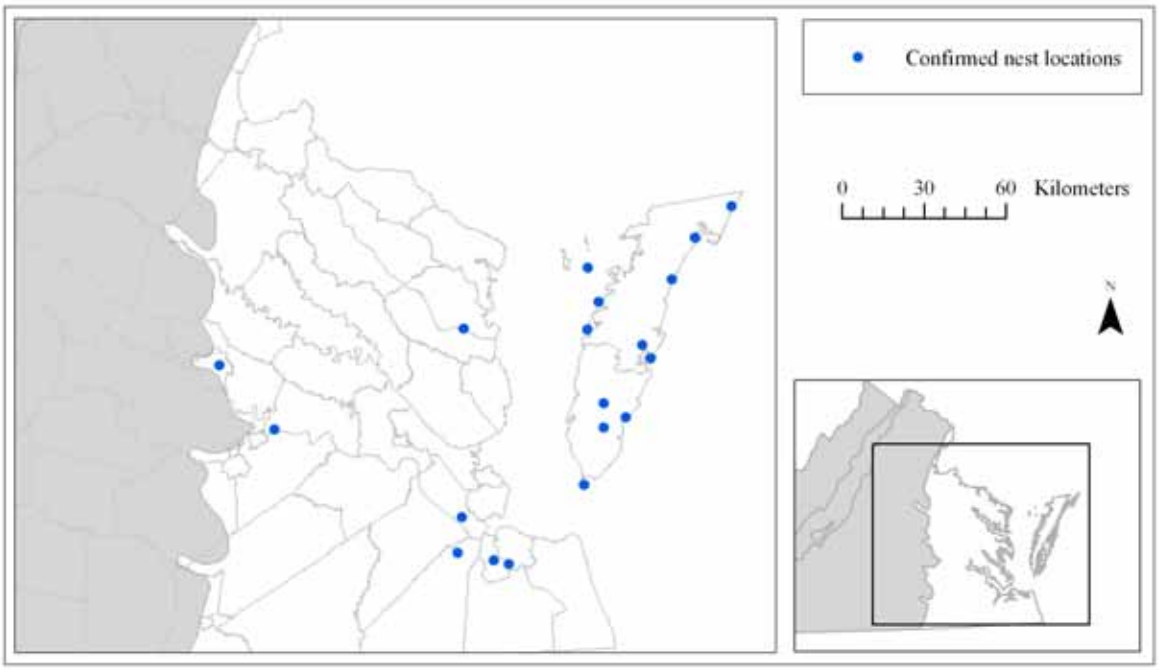

Figure 4.13. Distribution of the peregrine falcon in the Coastal Plain.

Description of Essential Habitat

Essential habitat for the peregrine falcon in the Coastal Plain includes artificial structures such as bridges, towers or nesting platforms near water.

Relative Condition of Habitat

There are 19 known nest locations in Collections within the Coastal Plain (DGIF 2004b). Five of these nests fall within a Conservation Land, including lands managed by DGIF, DCR, USFWS, and NPS (DCR 2003; DGIF 2004b). The nest sites include managed nest towers on the Eastern Shore, a nest box in downtown Richmond, and several bridges. There are 14 DCR-NH Conservation Sites for peregrine falcons in the Coastal Plain, eight of which overlap with Collections records (DCR 2003; DGIF 2004b). Thirteen of these sites have DCR-NH Element Occurrences rated for estimated viability. These consist of four "excellent," four "good," two "fair," and three "poor" viability ratings (DCR-NH 2005).

There are 19 known nest locations in Collections within the Coastal Plain (DGIF 2004b). Five of these nests fall within a Conservation Land, including lands managed by DGIF, DCR, USFWS, and NPS (DCR 2003; DGIF 2004b). The nest sites include managed nest towers on the Eastern Shore, a nest box in downtown Richmond, and several bridges. There are 18 DCR Conservation Sites representing peregrine falcon occurrences, eight of which overlap with Collections records (DCR 2003; DGIF 2004b).

Specific Threats and Trends

The peregrine falcon is recovering range-wide since the pesticide DDT was banned in the U.S. (Johnsgard 1990; Rich et al. 2004). In Virginia, the breeding population is small but undergoing active management. Its biggest threats in the Coastal Plain include habitat destruction and collisions with human structures.

Conservation Actions and Strategies

Bird TAC (2004) reported a goal of population maintenance in the Coastal Plain while increasing the population in the mountains of Virginia. Reduction of organochlorine pesticide contamination is important

in continuing the peregrine's recovery (White et al. 2002). Protection of nesting areas from disturbance and destruction is important (White et al. 2002).

Research and Monitoring Needs

Little is known of nesting populations and success in the mountain population (R. J. Reynolds, DGIF, pers. comm.). Specific sublethal effects of toxins on peregrines are poorly known (Bird TAC 2004). Monitoring of the recovery of all populations and the dynamics of these recovering populations should be continued (White et al. 2002).

4.4.1.10. Loggerhead shrike, *Lanius ludovicianus*

Life History Summary

The loggerhead shrike occurs most frequently in the Blue Ridge Mountains and Northern Ridge and Valley, but also occurs sporadically in the southern and northern portions of Virginia's Piedmont and Coastal Plain (Fraser 1991). Watts (1999) reports that this species has probably never been anything but a rare breeder in the Coastal Plain. It occurs year-round in Virginia (Yosef 1996). It prefers open habitats with occasional shrubs, such as large grazed pastures (Fraser 1991). The loggerhead is a predator, taking mostly invertebrates but also some vertebrate prey, such as lizards, birds or rodents (Yosef 1996). It is well-known for its habit of impaling its prey on spines of vegetation or barbed wire. Important threats include conversion from pasture to other uses and excessive use of pesticides (Fraser 1991; Yosef 1996). Loggerhead shrike is legally protected, both under MBTA and with the status of State threatened. According to VA-GAP (DGIF 2004a), 14% of its statewide predicted potential habitat is protected.

Location

The map for the loggerhead shrike (Figure 4.14) includes Collections only (DGIF 2004b). Only confirmed locations are shown because of the ephemeral nature of this species' essential habitat.

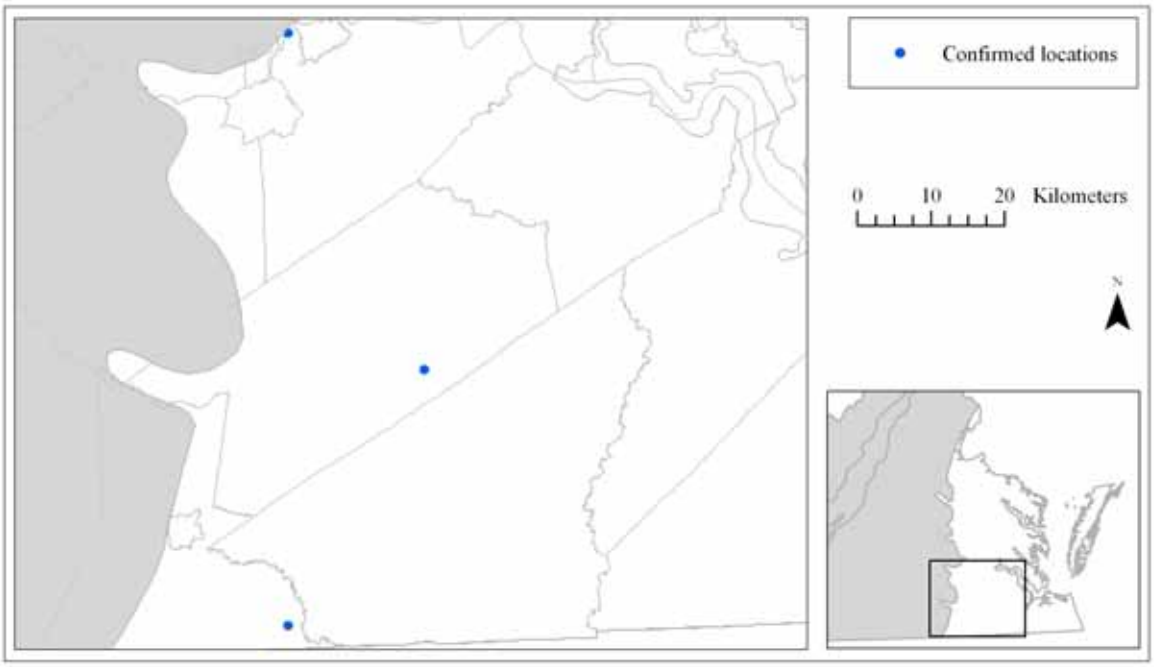

Figure 4.14. Distribution of the loggerhead shrike in the Coastal Plain.

Description of Essential Habitat

Essential habitat for the loggerhead shrike includes open fields with scattered shrubs, small trees and/or hedges (DeGraff and Rappole 1995). In Virginia, the highest-quality breeding habitat consists of short grass, particularly active pastures with many perches (Luukkonen 1987).

Relative Condition of Habitat

Due to the ephemeral nature of habitat for this shrike, it is difficult to determine the total area and the status of available habitat. There are three locations in Collections within the Coastal Plain (124 statewide, DGIF 2004b). None of these observations are within a Conservation Land. The loggerhead shrike does not seem to be habitat-limited (that is, habitat exists, both in Virginia and range-wide, that is not utilized by shrikes) (Bird TAC 2004; Fornes 2004).

Specific Threats and Trends

The loggerhead shrike has declined > 50% over the last 30 years range-wide (Rich et al. 2004). Rosenberg (2004) and Bird TAC (2004) report a similar trend in Virginia. A decline of 87% in the northeast (which includes Virginia) is reported by NESWDTC (2004).

The reasons for the decline of the loggerhead shrike range-wide are unclear (Yosef 1996; Bird TAC 2004). Threats to its preferred habitat are great, and enumerated in Appendix H; however, as mentioned above, this species does not seem to be habitat-limited. Yosef reports (1996) that the decline of this species corresponded with the increase in organochlorine pesticide use, and these substances are found in the birds in high concentrations. However, the decline also seems to correspond with the decline of pasturelands across its range (Bird TAC 2004). Bird TAC (2004) reports a conservation goal of increasing the population, while continuing inventory work to determine the current population levels. This species shares stresses with other grassland and early successional birds (Bird TAC 2004, Appendix H).

Conservation Actions and Strategies

The primary, species-specific action necessary for the loggerhead shrike conservation in Virginia is a concerted, targeted survey effort to determine distribution of the species within the state (Bird TAC 2004) and throughout its breeding range in the northeast U.S. (NESWDTC 2004). This could include following the success of every individual nest (NESWDTC 2004). Other conservation actions are habitat-related and can be found in Appendix I and generally involve grassland management. Yosef (1996) points out that mid-successional grasslands are often overlooked in habitat restoration in favor of grasslands without the shrubby vegetation that shrikes require for nesting and perching.

Research and Monitoring Needs

Little is known about historical distribution of the loggerhead shrike in Virginia, and such information would be useful if compiled (Bird TAC 2004). In addition, due to its spotty distribution across the state, targeted surveys should be considered to determine its true distribution and habitat usage across Virginia (Bird TAC 2004). The cause for the species' decline, both in Virginia and throughout its range, is unclear and needs further research (Yosef 1996; Bird TAC 2004). Certainly, the role of pesticides in the decline of this species needs to be better understood.

4.4.1.11. Black rail, *Laterallus jamaicensis*

Life History Summary

The black rail is the smallest rail in North America (Eddleman et al. 1994). It is also very poorly known, with much of its life history remaining to be studied (Eddleman et al. 1994). It inhabits high saltmarsh in Virginia, where it eats mostly small invertebrates and seeds (Eddleman et al. 1994). Little is known about habitat use during, or timing of, migration (Eddleman et al. 1994). Little is known about reproduction in

this species. Nests are built in clumps of vegetation over very shallow water, and generally contain about six eggs (Eddleman et al. 1994). The black rail is legally protected under MBTA. According to VA-GAP (DGIF 2004a), 11% of its statewide predicted potential habitat is protected.

Location

The map of potential black rail habitat (Figure 4.15) consists of high marsh areas mapped using Tidal Marsh Inventory Data (CCRM 1992). Confirmed habitat includes Saxis WMA (R. Boettcher, DGIF, pers. comm.). For more details on mapping potential habitat, see Appendix D.

Description of Essential Habitat

Essential habitat includes high coastal marshes, brackish or salt, with dense vegetative cover (DeGraaf et al. 1995).

Relative Condition of Habitat

There are 15,600ha of potential essential habitat for the black rail, of which 2,783ha are confirmed essential habitat, all within Saxis WMA (DGIF 2004b). Approximately 30 % (5800ha) of potential essential habitat falls within a Conservation Land (DCR 2003). DCR-NH also identifies the area around a portion of Saxis WMA as the only Conservation Site for the black rail. This Site contains an Element Occurrence with an estimated viability rating of "excellent/good" (DCR-NH 2005). Much of its habitat is degraded by invasive common reed *Phragmites* spp. and is threatened (Watts 1999; Bird TAC 2004).

Specific Threats and Trends

Watts (1999) reports that threats to the black rail are not well defined. However, its high marsh habitat has many threats, including sea-level rise and common reed *Phragmites* spp. incursion (Watts 1999; Bird TAC 2004). High marsh is uncommon and restricted in distribution, so pressure on any portion of this habitat type is important. Additional threats to black rail habitat can be found in Appendix H.

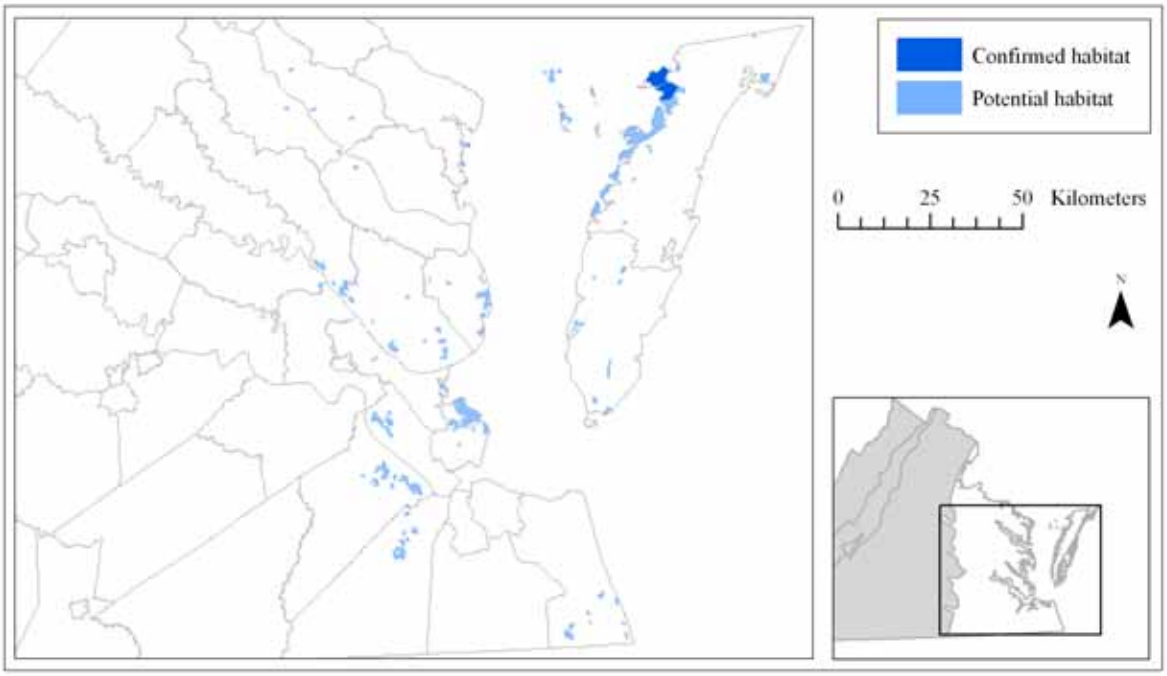

Figure 4.15. Distribution of the black rail in the Coastal Plain.

Conservation Actions and Strategies

While there exist no species-specific conservation actions for the black rail in Virginia, it shares those of other coastal marsh birds (Appendix I). These include maintenance of maritime forest at the edge of the marsh to reduce water quality problems, and the control of invasive plants, especially *Phragmites* spp. (Bird TAC 2004). Watts (1999) estimates 500 black rails in the PIF Mid-Atlantic Coastal Plain, which includes portions of Virginia, Maryland, Delaware, Pennsylvania, and New Jersey. The PIF conservation goal for high marsh in the Coastal Plain is to provide enough habitat to support 200 pairs of Henslow's sparrows *Ammodramus henslowii*. As such, areas of high marsh > 50ha must be identified, and a monitoring and management plan needs to be developed (Watts 1999). Bird TAC's goal for the black rail in Virginia is to increase the population until more is known about its status (Bird TAC 2004).

Research and Monitoring Needs

Eddleman et al. (1994) indicates that "Information (is) needed on nearly all aspects of...this species." As a secretive marsh bird, the black rail is not well-represented on the BBS, and so requires targeted survey efforts to determine status and distribution (Watts 1999; Bird TAC 2004). In addition, research on the effects of sea-level rise on this species and its habitat is needed (Watts 1999). The black rail also shares research needs with other coastal marsh species (Appendix J).

4.4.1.12. Red-cockaded woodpecker, *Picoides borealis*

Life History Summary

The red-cockaded woodpecker is one of the most critically endangered birds in Virginia, known to occur at only one location in the state. It is unusual in that it is one of roughly 3% of avian species known to have a cooperative breeding system, in which mature birds defer reproduction and help rear offspring that are not their own (Emlen 1991). Red-cockaded woodpeckers live in groups that typically consist of 2 to 5 individuals, including the breeding pair and their helpers. Because of this system, the breeding potential of a woodpecker population is determined by the number of groups rather than by the number of mature individuals. This species is a year-round resident of general-purpose territories containing a set of cavity trees, known as the cavity tree cluster (Walters 1990). Each group member roosts in its own cavity (Jackson 1994). The species requires overmature pine forest (generally longleaf *Pinus palustris* and/or loblolly *P. taeda*, but also shortleaf *P. echinata* and Virginia *P. virginiana*) with a very open understory. Historically, this habitat type was maintained in the Coastal Plain and Piedmont by frequent natural fires during summer (every 1-5 years, Jackson 1994). This frequency tends to reduce the number of standing snags; therefore, the red-cockaded woodpecker is the only species of North American woodpecker that routinely excavates cavities in living pines (Conner 1995). This is especially important because the resin excreted by living pines forms a protective barrier for the cavity that deters snake predation (Conner et al. 1998). One of the most important limiting factors in the number of trees available for cavity excavation is that trees must be old enough to contain enough heartwood to form the main nesting chamber, and also old enough to be infected with red heart fungus *Phellinus pini* (Conner 1995). The rotting heartwood eases cavity excavation (Rudolph et al. 1995). Cavity excavation in unoccupied habitat establishing new territories is rare (Hooper 1983; Conner et al. 2001). In fact, the rate of new territory formation as a whole is extremely low and most new territories form through territorial budding (Walters 1990, Conner et al. 2001), a process by which an existing territory and its cavities are divided (Hooper 1983). The main foods of red-cockaded woodpecker are arthropods, gleaned from the surface or just below the surface of the bark on pines (Jackson 1994). Major threats include logging of large pines, fire suppression, natural disasters such as hurricanes, and predation and competition from southern flying squirrels *Glaucomys volans*. The red-cockaded woodpecker is legally protected, both under MBTA and with the status of Federal and State endangered. According to VA-GAP (DGIF 2004a), 12% of its statewide predicted potential habitat is protected.

Location

Red-cockaded woodpecker locations (Figure 4.16) include Piney Grove Preserve (TNC 2003) and Collections (DGIF 2004b). Piney Grove is the only location where red-cockaded woodpeckers currently

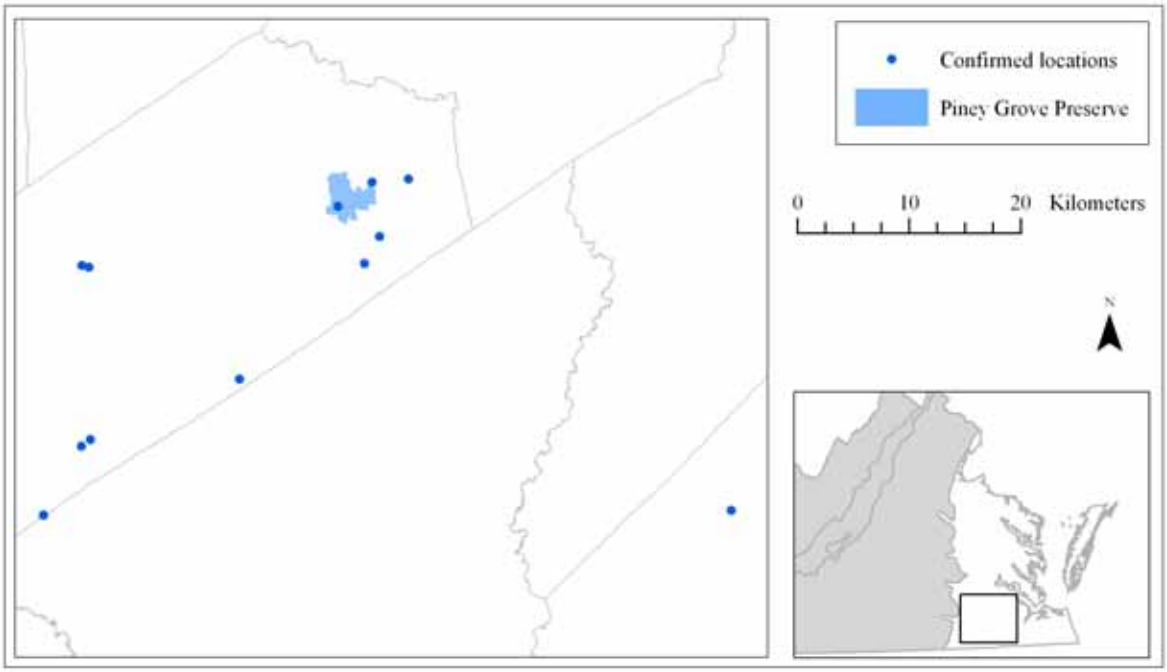

Figure 4.16. Distribution of red-cockaded woodpecker in the Coastal Plain.

exist in Virginia. Not shown on the map are areas that will be managed for this species within the Great Dismal Swamp NWR (D. J. Schwab, USFWS, pers. comm.).

Description of Essential Habitat

Essential habitat for this species includes pine savannah: open loblolly or longleaf pine woodlands with overmature trees and little hardwood invasion (Bradshaw 1995).

Relative Condition of Habitat

There are 15 Collections locations for the red-cockaded woodpecker (DGIF 2004b). Of these records, one is Piney Grove Preserve, owned by TNC. Another occurrence is located within Fort A. P. Hill. There are six DCR-NH Conservation Sites for the red-cockaded woodpecker, all of which have a viability rating of "fair" (DCR-NH 2005). Several of these Sites overlap with Collections records. Three areas in Virginia have active or planned habitat management. These include Piney Grove Preserve, Antioch Pines State Natural Area Preserve, and parts of Great Dismal Swamp NWR.

Habitat at the only current Virginia location (Piney Grove Preserve) is actively managed for red-cockaded woodpeckers. However, statewide, habitat meeting the stringent requirements of this species is exceedingly rare.

Specific Threats and Trends

From 1977 to 1992, the red-cockaded woodpecker in Virginia declined from 47 birds at 23 sites to just 12 adults at five sites (Bradshaw 1995). In 1998, 14 birds were present (Watts 1999), with 17 birds by 2000 (USFWS et al. 2000). While 32 individuals used the Piney Grove property during 2003 (Bradshaw and Watts 2003), the current population stands at 20 birds in five active clusters (B. van Eerden, TNC, pers. comm.). This increase is due in part to natural reproduction and in part to translocated birds from North Carolina. The biggest threat to the red-cockaded woodpecker is current logging practices, which manage for pulpwood and therefore harvest trees before they are old enough for use by this species (Beck 1991; Bird TAC 2004). In addition, this forest management regime does not use fire to control underbrush, so

forests with the open, park-like structure that these birds require is rapidly dwindling throughout its range (Kulhavy et al. 1995). Within PIF's Physiographic Area 44, the recovery goal is 60-80 birds (Watts 1999). The entire known population of this physiographic area is within one county in Virginia, and the goal is only likely to be met in Virginia. The dynamics of the cavity population is critical to the management of the woodpecker, because the number of woodpecker groups in a population depends directly on the number of existing clusters with suitable cavities (Walters 1991). Bird TAC (2004) provided a conservation goal of 10 breeding clusters at Piney Grove, and an additional 10 at Great Dismal Swamp NWR. The red-cockaded woodpecker shares threats with other pine savannah birds (Bird TAC 2004, Appendix H).

Conservation Actions and Strategies

The most important conservation action for the red-cockaded woodpecker is an alteration of forestry methods in the Coastal Plain (Bird TAC 2004). Management for sawtimber (uneven-aged harvest) benefits this species. Frequent summertime burning or herbicide application in mature forest is critical to controlling the underbrush (Jackson 1994; Bird TAC 2004). In pine plantations, thinning should be practiced rather than clearcutting (Bird TAC 2004), allowing some trees to reach the age at which they become useful to this species (approximately 90 years, Beck 1991). Management for red-cockaded woodpecker is consistent with the habitat needs of many other tiered species, including oak toad, eastern slender glass lizard, Bachman's sparrow, and brown-headed nuthatch.

In the short term, snake excluders and removal of competing flying squirrels are important techniques (Jackson 1994), though snake traps have killed red-cockadeds as well (Samano et al. 1998). Translocation of young birds from other populations ensures genetic diversity in Virginia's isolated population, especially in the face of a complete lack of natural movement corridors. This takes the place of natural dispersal, which helps to prevent the considerable costs of inbreeding (Daniels and Walters 2000). The advent of artificial cavity construction techniques has allowed managers to compensate for cavity loss and abandonment and to induce population expansion, including the formation of new groups in previously uninhabited areas (Jackson 1994). However, artificial nest cavities, predator control and exclusion, and translocation of young birds from larger populations are tools that are necesary in recovery of the species in the short-term, but they should not be confused with a long-term solution to the forestry problem, as these methods are expensive and time-consuming (Jackson 1994). See Watts (1999) and the USFWS Recovery Plan (2003) for detailed strategies to reach this species' recovery goals.

One of the most important developments for Virginia's red-cockaded woodpeckers is the Safe Harbor Agreement between TNC and USFWS (USFWS et al. 2000). This program establishes a baseline for red-cockaded woodpeckers on the TNC property, and they are not responsible for any individuals or habitat beyond that initial baseline. Safe Harbor agreements are becoming more popular for conservation on private lands, as the "no surprises" clause eases landowner concerns about financial loss while enhancing or protecting habitat for federally-listed species on their lands (USFWS 2002).

Research and Monitoring Needs

Virginia's red-cockaded woodpeckers are carefully monitored, as they are currently only known to occur in one location. As such, every bird in the population is known and every completed and non-completed cavity is tracked. Continued monitoring is, of course, essential. As additional habitat is acquired or managed in a manner consistent with red-cockaded woodpeckers, monitoring should be expanded to include these areas. In addition, statewide assessment should be carried out in areas that are within their historic range that have never been surveyed (M. D. Wilson, CCB, pers. comm.).

4.4.1.13. Gull-billed tern, *Sterna nilotica*

Life History Summary

The gull-billed tern was historically a marsh-nesting bird, like Forster's tern *Sterna forsteri*. However, most pairs now nest on sandy barrier islands, often among common terns *Sterna hirundo* and black skimmers *Rynchops niger* (Parnell et al. 1995). Where they nest in marshes, nests are constructed of mats of dead

vegetation (Parnell et al. 1995) or on shell piles (Erwin et al. 1999). Chicks raised in marshes have higher growth rates than those from islands (Erwin et al. 1999); however, hatch rates seem to be higher on islands than in marshes (Eyler et al. 1999). On beaches, nests are scrapes surrounded by bits of shell or small stones, with or without twigs or other vegetation (Parnell et al. 1995). It rarely plunge dives for fish like most of Virginia's terns. Instead, it hawks invertebrates from the water's surface (similar to the black tern *Chlidonias niger*), only occasionally taking fish and other vertebrates (Parnell et al. 1995). Erwin et al. (1998a) indicate that gull-billed terns in Virginia take a predominance of marine invertebrates, especially fiddler crabs *Uca* spp., along with fish and terrestrial insects. As with most barrier-island nesting waterbirds, major threats include human disturbance and introduced mammalian predators. The gull-billed tern is legally protected, both under MBTA and with the status of State threatened. According to VA-GAP (DGIF 2004a), 11% of its statewide predicted potential habitat is protected.

Location

The map of potential habitat for the gull-billed tern (Figure 4.17) includes emergent wetland and barren areas from land cover data (USGS 2001). Confirmed locations are from DGIF (2004b) and Watts (2004). For more details on the selection of potential habitat, see Appendix D.

Description of Essential Habitat

Essential habitat for this species includes beaches and marshes above high tide (DeGraaf et al. 1995; M. D. Wilson, CCB, pers. comm.). An absence of mammalian predators appears to be critical.

Relative Condition of Habitat

There are 67 Collections locations (DGIF 2004b) and 27 records from the 2003 CWB survey (Watts 2004). Of these, only nine Collections and one CWB record occur in a Conservation Land (DCR 2003). There are 33,900ha of potential essential habitat for the gull-billed tern. Almost 12,000ha of potential habitat have confirmed use by gull-billed terns (DGIF 2004b). Approximately 15,300ha of potential habitat are within

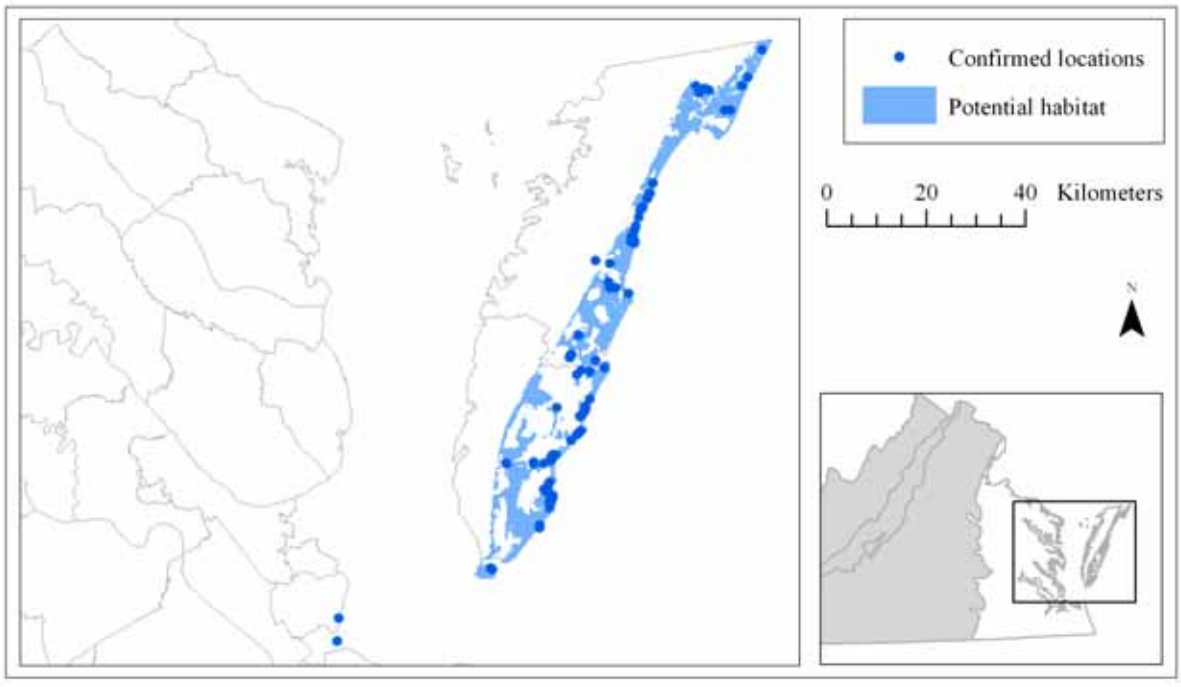

Figure 4.17. Distribution of the gull-billed tern in the Coastal Plain.

Conservation Lands (DCR 2003). There are 14 DCR-NH Conservation Sites for gull-billed tern. Nine of these are at least partial protected by a Conservation Land or TNC ownership (DCR 2003). Within these 14 sites there are 19 DCR-NH Element Occurrences with the following estimated viability ratings: two "excellent," six "good," one "good/fair," six "fair," and four "poor"" (DCR-NH 2005).

The barrier islands that this species uses in Virginia are largely owned by TNC and government agencies, so the habitat is relatively protected from development. Mammalian predators are rampant on many of these islands, seriously degrading the usefulness of the islands for nesting. In addition, populations of great black-backed and herring gulls increase predation pressure on gull-billed tern eggs and offspring.

Specific Threats and Trends

Watts (1999) reports that counts of gull-billed terns along the barrier islands of Virginia have declined from approximately 2200 individuals to fewer than 100 in the period between 1978 and 1998. Surveys indicate that the 2004 population was approximately 558 individuals (R. Boettcher, DGIF, pers. comm.). Akers (1979) points out that pesticides may have a larger impact on this species than on other terns, due to its heavy reliance on insects. Human disturbance while nesting is likely one of the most important conservation concerns (Parnell et al. 1995). Disturbance exposes chicks and eggs to the elements and to predators, especially gulls and other aerial predators (Parnell et al. 1995; Erwin et al. 1998b). Bird TAC (2004) suggested that predation is the main factor limiting this species in Virginia. In addition, it shares stresses with other barrier island birds (Bird TAC 2004, Appendix H).

Conservation Actions and Strategies

Watts (1999) gives a population objective of 1,000 breeding pairs throughout PIF physiographic area 44. Maintenance of both active nesting sites and alternate, unused sites is important, since this species (like many marsh- or beach-nesting colonial birds) will shift colonies to these alternate sites in the face of disturbance (whether human or weather-related) (Parnell et al. 1995). Bird TAC (2004) points out that this low colony site fidelity makes habitat management a challenge. Watts (1999) reports that gull-billed tern colonies are shifting from the barrier islands to sand bars and dredge spoil islands, likely due to predation pressure. Watts (1999) and Bird TAC (2004) suggest that creation of additional dredge spoil islands is likely to provide additional predator-free nesting substrate for this and other colonial waterbirds. In addition, Bird TAC (2004) listed the control of avian predators (gulls) at the Hampton Roads Bridge-Tunnel colony site as a species-specific conservation action. This is in addition to those habitat-related actions found in Appendix I.

Research and Monitoring Needs

Effects and intensity of predation on gull-billed terns in Virginia are unclear (Williams 1991). Due to their reliance on insects and propensity for foraging over agricultural fields, gull-billed tern should be monitored for organic contaminants (Akers 1979; Parnell et al. 1995). Regular monitoring of the Virginia population can indicate the health of the overall population (Parnell et al. 1995), because Virginia is at the northern edge of its breeding range (Parnell et al. 1995; Watts 1999). Bird TAC (2004) indicates that productivity on the barrier islands and shell rakes should be measured to determine the relative habitat quality and management implications of these areas.

4.4.1.14. Eastern big-eared bat, *Corynorhinus rafinesquii macrotis*

Life History Summary

The eastern big-eared bat is one of two subspecies to occur in Virginia. The other, *C. r. rafinesquii*, occurs only in three counties in southwestern Virginia, whereas *C. r. macrotis* occurs in the southern Coastal Plain (Jones 1977). It prefers forested wetlands (Clark et al. 1990; Handley and Schwab 1991). Historically it roosted in hollow trees, but most known sites extant in Virginia are houses and other, often abandoned, buildings (Clark et al. 1990; Handley and Schwab 1991). Its main foods, like most big-eared bats, are moths (Whitaker and Hamilton 1998). Threats are not well understood, but likely include loss of habitat;

specifically, decline of abandoned buildings in the face of past forestry practices that have reduced trees of appropriate age and size to contain hollow areas (Clark et al. 1990). The eastern big-eared bat is legally protected in Virginia with the status of State endangered. While its accepted generic name is *Corynorhinus*, this species is still listed as *Plecotus rafinesquii* in the Virginia Administrative Code (4 VAC 15-20-130). According to VA-GAP (DGIF 2004a), 6% of its statewide predicted potential habitat is protected.

Location

The map of eastern big-eared bat habitat (Figure 4.18) includes Collections (DGIF 2004b) and Conservation Sites (DCR-NH 2005). Potential habitat for this species is more specific than what can be depicted with existing spatial data.

Description of Essential Habitat

Essential habitat for this species includes hollow trees or buildings in wooded areas, mature hardwood floodplain forest, and caves or mines (Whitaker and Hamilton 1998). Confirmed sites in Virginia are from abandoned buildings near gum-cypress swamps (Schwab, USFWS, pers. comm.).

Relative Condition of Habitat

There are 155 Collections locations for the eastern big-eared bat (DGIF 2004b). Only nine of these records occur on a Conservation Land (DCR 2003). There are 27 DCR-NH Conservation Sites, 19 of which correspond to a Collections record. Of these sites, four are significantly covered by a Conservation Land, including the majority of Great Dismal Swamp NWR. Element Occurrences within these Sites have the following estimated viability ratings: one "good," three "fair," 22 "poor," and one was not rated (DCR-NH 2005).

Specific Threats and Trends

Several threats to the eastern big-eared bat were identified by Mammal TAC (2004, Table 4.4). Its current main threat combines loss of bottomland forest and roost trees with the decline of availability of abandoned

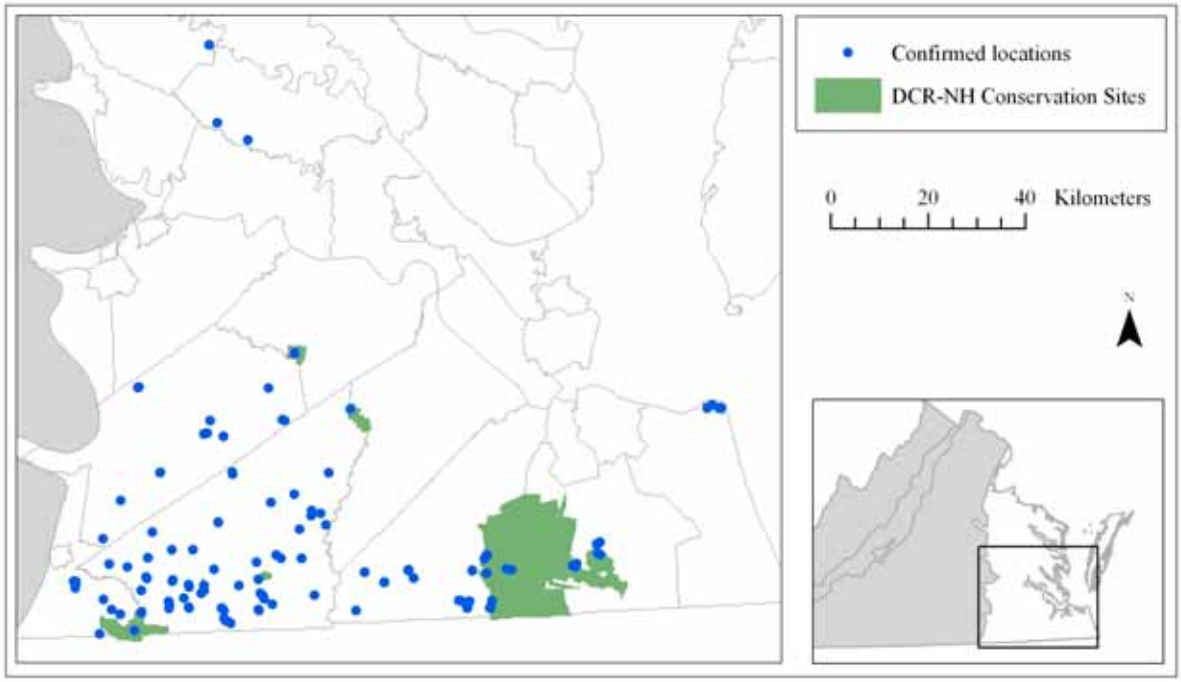

Figure 4.18. Distribution of the eastern big-eared bat in the Coastal Plain.

buildings in the region (Clark et al. 1990; Mammal TAC 2004). It is very sensitive to disturbance, which may play a role in roost abandonment (NESWDTC 2004).

Table 4.4. Species-specific stresses on the eastern big-eared bat (Mammal TAC 2004).

Stress	Source	Scope	Severity	Comments
Habitat Destruction	Municipal Development	3	3	
Habitat Destruction	Forestry	3	3	Loss of large roost trees
Toxins (General)	Municipal Development	3	3	Magnification through food chain
Insecticides	Agriculture	3	3	May affect food availability; bioaccumulation hazard
Metals	Atmospheric Deposition	3	3	May affect reproductive success

Conservation Actions and Strategies

Important conservation actions include: long-term forest management to allow forests to age, for roost trees to occur; maintenance, preservation, and creation of abandoned buildings and alternative roost sites in likely areas; and reduction or elimination of heavy metals and pesticide contamination (Mammal TAC 2004).

Research and Monitoring Needs

Research needs identified include extensive surveys to locate maternity colonies; possible effects of wind turbines on this species; and the extent and effects of insecticide contamination and bioaccumulation in wild populations (Mammal TAC 2004). Mammal TAC (2004) also recommended a standardized, year-round monitoring program specifically for this species.

4.4.1.15. Arogos skipper, *Atrytone arogos arogos*

Life History Summary

This subspecies of *Atrytone arogos* occurs along the Gulf and Atlantic coast, and is very rare. It is listed as state historical in Virginia by NatureServe (2004), and Roble et al. (1999) report that the single record from Virginia's Coastal Plain (within Great Dismal Swamp NWR) is almost certainly an error, since this species' habitat does not exist at the site of the reported collection. The nearest known population is in North Carolina, but it has never been observed or collected in northeastern North Carolina (that is, adjacent to its purported sighting in Virginia, Roble et al. 1999). Its larval food plant is little bluestem *Andropogon scoparius*, which occurs almost exclusively in native grasslands. Its main threats include habitat loss to pine plantation, and mortality due to poorly-timed or too-extensive prescribed fire, which can kill large numbers of larvae (NatureServe 2004). It is not listed in Virginia, but it has the status of Federal species of concern (which is not a legal designation and provides no Federal protection).

Location

No specific locations are known.

Description of Essential Habitat

Essential habitat for this species is not entirely known, but generally includes grasslands and wet savannahs in coastal areas (NatureServe 2004). Native grasslands are likely a key feature (S. M. Roble, DCR-NH, pers. comm.).

Relative Condition of Habitat

Native grassland is one of the rarest habitat types in Virginia.

Specific Threats and Trends

This species is likely extirpated from Virginia (Roble et al. 1999). It is declining range-wide, due largely to habitat loss and poor management (NatureServe 2004).

Conservation Actions and Strategies

No specific conservation actions are known at this time. If this species does still occur in Virginia, restoration of large tracts of native grasses that will support many small, frequent burns may be necessary to ensure its survival.

Research and Monitoring Needs

It is not known if this species still exists in Virginia. Surveys in likely grass/savannah habitats in the southern Coastal Plain may reveal a population.

4.4.1.16. American burying beetle, *Nicrophorus americanus*

Life History Summary

This carrion beetle was historically common throughout the eastern U.S. However, it is currently restricted to one stable population on an island in Rhode Island of approximately 500 individuals, and another, much smaller, population in three counties in eastern Oklahoma (USFWS 1991). It may persist in Kentucky, Missouri, Arkansas, and Nebraska, where it was observed in the 1970s and 1980s (USFWS 1991). It seems to be limited by occurrences of appropriately-sized carcasses rather than by habitat *per se*. This species was recorded in both Maryland and North Carolina during the 1940s, and Tennessee in the 1950s; no date is given for Virginia records (USFWS 1991). The life history of this beetle is interesting in many ways. A pair can move a 200g carcass up to a meter to find suitable burying conditions, and it exhibits the strongest parental care known among the Coleoptera, including feeding and defense of young (USFWS 1991). It appears to be an annual species, reproducing the summer following its first winter, then dying (USFWS 1991). This species has declined rangewide from the early 1900s to the present, with no cause for this decline being known, especially since many other species in the genus *Nicrophorus* remain very common (USFWS 1991). This species has been protected as Federal endangered since 1991.

Location

There are no known populations of this species in Virginia.

Description of Essential Habitat

This species does not appear to be habitat-limited. Its extant populations occur in a variety of habitats, from old field situations to mixed forest. It seems to prefer forest-field ecotones with a good detritus layer over well-drained soils (USFWS 1991). The Rhode Island site is free of scavenging mammals, which may reduce competition for carcasses (USFWS 1991).

Relative Condition of Habitat

All of the extant populations (except one Oklahoma subpopulation) occur on private land. However, this species does not appear to be habitat-limited. No known populations occur in Virginia, but this does not appear to be due to a lack of habitat.

Specific Threats and Trends

The current hypothesis as to the decline of this species relates to habitat fragmentation, and the concomitant increase in edge (USFWS 1991). This increase in edge can drive up populations of scavenging vertebrates, as well as possibly driving down reproductive success of the appropriately-sized prey items for this beetle.

However, very little is known about the reasons for this species' decline, especially since several congeners remain common (USFWS 1991).

Conservation Actions and Strategies

Short of reintroduction, none are known at this time.

Research and Monitoring Needs

Surveys for this species could be important, since even the historic range within Virginia is not well-known (USFWS 1991). One of the Oklahoma populations was discovered during surveys preceding the Federal listing process, so it is conceivable that this species could be found in Virginia (USFWS 1991).

4.4.2. Forest Species of Greatest Conservation Need in Virginia's Coastal Plain

4.4.2.1. Species of Greatest Conservation Need by Forest Type

Of the 62 tiered species that occur in Coastal Plain forest, 29 are generalists that occur in all forest types (Table 4.5). Of the remaining 32 species, 17 occur in deciduous forest (Table 4.6), 16 occur in coniferous forest (Table 4.7), and 17 occur in mixed forest (Table 4.8).

Table 4.5. Forest generalist species of greatest conservation need in the Coastal Plain. "Open woods," throughout Tables 4.6-4.9, indicates mature, closed canopy, open understory forest, and not open canopy, shrubby understory forests, such as shelterwood cuts (unless otherwise indicated).

Common Name	Scientific Name	Tier	Special Habitat Needs
Dismal Swamp southeastern shrew	*Sorex longirostris fisheri*	IV	Damp areas
Oak toad	*Bufo quercicus*	II	Savannah
Bald eagle	*Haliaeetus leucocephalus*	II	Large trees near large rivers, lakes or sea
Barking treefrog	*Hyla gratiosa*	II	Vernal pools or ponds in flat woods
Carpenter frog	*Rana virgatipes*	III	Standing water with abundant vegetation
Southeastern fox squirrel	*Sciurus niger niger*	III	Open woods
Eastern box turtle	*Terrapene carolina*	III	Forest generalist
Green heron	*Butorides striatus*	IV	Near streams or wetlands
Chuck-will's-widow	*Caprimulgus carolinensis*	IV	Open woods
Northern bobwhite	*Colinus virginianus*	IV	Open woods
Eastern wood-pewee	*Contopus virens*	IV	Open second-growth to mature woods
Prairie warbler	*Dendroica discolor*	IV	Open woods
Worm-eating warbler	*Helmitheros vermivorus*	IV	Thick understory near water
Eastern hog-nosed snake	*Heterodon platirhinos*	IV	Forest ecotones with sandy soils
Yellow-breasted chat	*Icteria virens*	IV	Open shrubby woods
Black-and-white warbler	*Mniotilta varia*	IV	Forest generalist
Least weasel	*Mustela nivalis*	IV	Habitat generalist
Southeastern myotis	*Myotis austroriparius*	IV	In snags or buildings near water
Kentucky warbler	*Oporornis formosus*	IV	Thick understory, closed canopy near water
Northern parula	*Parula americana*	IV	Damp or wet woods near water
Cotton mouse	*Peromyscus gossypinus*	IV	Wet woods
Eastern towhee	*Pipilo erythrophthalmus*	IV	Shrubby openings and edges
Little grass frog	*Pseudacris ocularis*	IV	Grasses or sedges near water

Common Name	Scientific Name	Tier	Special Habitat Needs
Eastern spadefoot	*Scaphiopus holbrookii*	IV	Forest with sandy or otherwise loose soils
Ovenbird	*Seiurus aurocapillus*	IV	Open mature woods
Many-lined salamander	*Stereochilus marginatus*	IV	Swamps or ponds within forest
Southern bog lemming	*Synaptomys cooperi*	IV	Habitat generalist
Brown thrasher	*Toxostoma rufum*	IV	Shrubby clearcuts

Table 4.6. Deciduous forest species of greatest conservation need in the Coastal Plain.

Common Name	Scientific Name	Tier	Special Habitat Needs
Wood turtle	*Glyptemys insculpta*	I	Clear streams
American black duck	*Anas rubripes*	II	Near emergent or wooded wetlands
Canebrake rattlesnake	*Crotalus horridus*	II	Mature forest with downed logs and humus
Cerulean warbler	*Dendroica cerulea*	II	Mature forest with complex canopy structure
Swainson's warbler	*Limnothlypis swainsonii*	II	Non-flooding bottomland hardwoods
Whip-poor-will	*Caprimulgus vociferus*	IV	Open woods near fields
Chimney swift	*Chaetura pelagica*	IV	Large snags or houses with chimneys
Yellow-billed cuckoo	*Coccyzus americanus*	IV	Open canopy woods with dense understory
Gray catbird	*Dumetella carolinensis*	IV	Dense thickets in forest openings or edges
Willow flycatcher	*Empidonax traillii*	IV	Shrubby willow or alder near water
Wood thrush	*Hylocichla mustelina*	IV	Mature upland forest with undergrowth
Scarlet tanager	*Piranga olivacea*	IV	Mature forest, min size 10-12ha
Prothonotary warbler	*Protonotaria citrea*	IV	Near water
New Jersey chorus frog	*Pseudacris feriarum*	IV	Vernal pools, ponds, or ditches
American woodcock	*Scolopax minor*	IV	Moist or wet woods near wetlands
Louisiana waterthrush	*Seiurus motacilla*	IV	Near water
Yellow-throated vireo	*Vireo flavifrons*	IV	Tall forest with partially open canopy

Table 4.7. Coniferous forest species of greatest conservation need in the Coastal Plain.

Common Name	Scientific Name	Tier	Special Habitat Needs
Bachman's sparrow	*Aimophila aestivalis*	I	Savannah
Chicken turtle	*Deirochelys reticularia*	I	Freshwater interdunal cypress ponds
Wayne's black-throated green warbler	*Dendroica virens waynei*	I	Coastal cypress swamps
Red-cockaded woodpecker	*Picoides borealis*	I	Savannah
Mabee's salamander	*Ambystoma mabeei*	II	Shallow acidic ponds
Tiger salamander	*Ambystoma tigrinum*	II	Shallow pools in pine savannah
Eastern glass lizard	*Ophisaurus ventralis*	II	Maritime pine forests
Delmarva fox squirrel	*Sciurus niger cinereus*	II	Mature open woods
Bicknell's thrush (migrant)	*Catharus bicknelli*	IV	Migrant only; no specific habitat need known
Scarletsnake	*Cemophora coccinea*	IV	Sandy forests; largely subterranean
Rainbow snake	*Farancia erytrogramma*	IV	Waterways within woods
Eastern slender glass lizard	*Ophisaurus attenuatus*	IV	Open woods/savannah
Striped southern chorus frog	*Pseudacris nigrita*	IV	Cypress ponds or other pools in pine woods

Common Name	Scientific Name	Tier	Special Habitat Needs
Brown-headed nuthatch	*Sitta pusilla*	IV	Savannah
Southeastern crowned snake	*Tantilla coronata*	IV	Dry forest with decaying logs
Yellow-throated vireo	*Vireo flavifrons*	IV	Tall forest with partially open canopy

Table 4.8. Mixed forest species of greatest conservation need in the Coastal Plain.

Common Name	Scientific Name	Tier	Special Habitat Needs
Mabee's salamander	*Ambystoma mabeei*	II	Shallow acidic ponds
Tiger salamander	*Ambystoma tigrinum*	II	Shallow pools in pine savannah
Canebrake rattlesnake	*Crotalus horridus*	II	Mature forest with downed logs and humus
Delmarva fox squirrel	*Sciurus niger cinereus*	II	Mature open woods
Whip-poor-will	*Caprimulgus vociferus*	IV	Open woods near fields
Bicknell's thrush (migrant)	*Catharus bicknelli*	IV	Migrant only; no specific habitat need known
Chimney swift	*Chaetura pelagica*	IV	Large snags or houses with chimneys
Yellow-billed cuckoo	*Coccyzus americanus*	IV	Open-canopy woods with dense understory
Gray catbird	*Dumetella carolinensis*	IV	Dense thickets in forest openings or edges
Rainbow snake	*Farancia erytrogramma*	IV	Waterways within woods
Wood thrush	*Hylocichla mustelina*	IV	Mature upland forest with undergrowth
Scarlet tanager	*Piranga olivacea*	IV	Mature forest, min size 10-12ha
Prothonotary warbler	*Protonotaria citrea*	IV	Near water
New Jersey chorus frog	*Pseudacris feriarum*	IV	Vernal pools, ponds, or ditches
American woodcock	*Scolopax minor*	IV	Moist or wet woods near wetlands
Louisiana waterthrush	*Seiurus motacilla*	IV	Near water
Southeastern crowned snake	*Tantilla coronata*	IV	Dry forest with decaying logs

4.4.2.2. Status of Forested Habitats

The 2001 FIA reported 1.12 million acres (0.453 million ha) of coniferous forest, 1.38 million acres (0.56 million ha) of deciduous forest, 0.50 million acres (0.20 million ha) of mixed forest, and 4.09 million acres (1.66 million ha) of non-forested land in the Coastal Plain (USFS 2001).

4.4.2.3. Trends in Forested Habitats

According to USDA (2000), non-federal forestland in the Coastal Plain decreased by > 100,000 acres (> 60,000ha) during the period between 1982 and 1997. Forest trends by type are not available at the ecoregional level. Please see Section 3.2.3.1 for statewide status and trends in forested habitats.

4.4.3. Open Vegetated Habitat Species of Greatest Conservation Need in Virginia's Coastal Plain

4.4.3.1. Species of Greatest Conservation Need by Open Vegetated Habitat Type

Of the 50 tiered species that occur in open habitats in the Coastal Plain, 21 are generalists that occur in all open vegetated habitat types (Table 4.9). Of the remaining 29 species, 23 occur in herbaceous open habitats (Table 4.10), and five occur in scrub-shrub (Table 4.11).

Table 4.9. Open vegetated habitat generalist species of greatest conservation need in the Coastal Plain.

Common Name	Scientific Name	Tier	Special Habitat Needs
Henslow's sparrow	*Ammodramus henslowii*	I	Native warm season grasses or saltmarsh
Loggerhead shrike	*Lanius ludovicianus*	I	Scattered perches over short vegetation
Northern harrier	*Circus cyaneus*	III	Damp to wet fields with few trees/shrubs
Pungo white-footed mouse	*Peromyscus leucopus easti*	III	Thickets at the edge of marshes
Eastern box turtle	*Terrapene carolina*	III	Dense groundcover, some shrubs
Whip-poor-will	*Caprimulgus vociferus*	IV	Forages over open fields
Bicknell's thrush (migrant)	*Catharus bicknelli*	IV	Migrant only; no specific habitat need known
Northern bobwhite	*Colinus virginianus*	IV	Grassy fields with shrubby cover, also agricultural fields (active and fallow)
Eastern wood-pewee	*Contopus virens*	IV	Woodland openings of all kinds for foraging
Prairie warbler	*Dendroica discolor*	IV	Open habitat with some trees and shrubs
Eastern hog-nosed snake	*Heterodon platirhinos*	IV	Ecotonal areas with sandy soils
Yellow-breasted chat	*Icteria virens*	IV	Dense tall vegetation
Least weasel	*Mustela nivalis*	IV	Habitat generalist
Eastern towhee	*Pipilo erythrophthalmus*	IV	Dense tall vegetation
American woodcock	*Scolopax minor*	IV	Fields in winter and for foraging
Dismal Swamp southeastern shrew	*Sorex longirostris fisheri*	IV	Damp areas
Field sparrow	*Spizella pusilla*	IV	Weedy fields with scattered shrubs
Southern bog lemming	*Synaptomys cooperi*	IV	Habitat generalist
Brown thrasher	*Toxostoma rufum*	IV	Dense tall vegetation
Eastern kingbird	*Tyrannus tyrannus*	IV	Scattered perches (shrubs, trees, fences)

Table 4.10. Herbaceous habitat species of greatest conservation need in the Coastal Plain.

Common Name	Scientific Name	Tier	Special Habitat Needs
Bachman's sparrow	*Aimophila aestivalis*	I	Old fields
Arogos skipper	*Atrytone arogos arogos*	I	Little bluestem *Andropogon scoparius*
Wood turtle	*Glyptemys insculpta*	I	Clear streams
Canebrake rattlesnake	*Crotalus horridus*	II	Cane fields and glades near swamps
Eastern glass lizard	*Ophisaurus ventralis*	II	Damp grassy areas
Brant (winter)	*Branta bernicla*	III	May forage in fields
Barn owl	*Tyto alba pratincola*	III	Dense grass near human structures
Grasshopper sparrow	*Ammodramus savannarum*	IV	Fields with short grass (pastures)
Purple sandpiper (winter)	*Calidris maritima*	IV	May forage in fields
Chuck-will's-widow	*Caprimulgus carolinensis*	IV	Forages over fields near pine forest
Rusty blackbird (winter)	*Euphagus carolinus*	IV	Croplands in winter
Rainbow snake	*Farancia erytrogramma*	IV	Dry sandy fields
Short-billed dowitcher (migrant)	*Limnodromus griseus*	IV	May forage in fields
Marbled godwit (migrant)	*Limosa fedoa*	IV	May forage in fields
Hudsonian godwit (migrant)	*Limosa haemastica*	IV	May forage in fields
Whimbrel (migrant)	*Numenius phaeopus*	IV	May forage in fields

Common Name	Scientific Name	Tier	Special Habitat Needs
Eastern slender glass lizard	*Ophisaurus attenuatus*	IV	Sunny grassland with few trees
Black-bellied plover (winter)	*Pluvialis squatarola*	IV	May forage in fields
Little grass frog	*Pseudacris ocularis*	IV	Grasses or sedges near water
Queen snake	*Regina septemvittata*	IV	Open riparian areas
Northern rough-winged swallow	*Stelgidopteryx serripennis*	IV	Stream banks in open areas
Eastern meadowlark	*Sturnella magna*	IV	Fields with short grass (pastures)

Table 4.11. Scrub-shrub species of greatest conservation need in the Coastal Plain.

Common Name	Scientific Name	Tier	Special Habitat Needs
Yellow-billed cuckoo	*Coccyzus americanus*	IV	Dense shrubby thickets
Gray catbird	*Dumetella carolinensis*	IV	Ecotonal thickets and shrubby clearings
Willow flycatcher	*Empidonax traillii*	IV	Willow or alder thickets near water
Wood thrush	*Hylocichla mustelina*	IV	Shrubby clearings within deciduous forest
Black-and-white warbler	*Mniotilta varia*	IV	Sapling stage of forest clearings

4.4.3.2. Status of Open Habitats

The 1997 NRI reports 0.94 million acres (0.38 million ha) of cultivated cropland and 166,000 acres (67,000ha) of noncultivated cropland, CRP, and pasture (USDA 2000). These totals do not count 289,000 acres (117,000)ha of federal land in the ecoregion (USDA 2000).

4.4.3.3. Trends in Open Habitats

According to USDA (2000), during the period from 1982 through 1997, cultivated cropland decreased by > 100,000 acres (> 40,000ha) and pastureland, CRP, and non-cultivated cropland increased by > 40,000 acres (> 16,000ha) in the Coastal Plain. These totals do not include 289,000 acres (117,000ha) of federal land in the ecoregion. Please see Section 3.2.3.2 for statewide status and trends in open habitats for Virginia.

4.4.4. Barren Habitat Species of Greatest Conservation Need in Virginia's Coastal Plain

4.4.4.1. Species of Greatest Conservation Need by Barren Habitat Type

Of 34 tiered species that occur in barren or developed habitats in the Coastal Plain, 14 occur primarily in developed residential areas (Table 4.12). Of the remaining species, 19 occur on beaches (Table 4.13), while 11 have more specialized barren habitat requirements (mostly mudflats, Table 4.14).

Table 4.12. Developed habitat generalist species of greatest conservation need in the Coastal Plain.

Common Name	Scientific Name	Tier	Special Habitat Needs
Peregrine falcon	*Falco peregrinus*	I	Nests on building ledges and platforms
Eastern big-eared bat	*Corynorhinus rafinesquii macrotis*	I	Abandoned buildings near wooded wetlands
Mabee's salamander	*Ambystoma mabeei*	II	Occurs in residential areas
Canebrake rattlesnake	*Crotalus horridus*	II	Occurs in residential areas
Eastern box turtle	*Terrapene carolina*	III	Occurs in residential areas

Common Name	Scientific Name	Tier	Special Habitat Needs
Chuck-will's-widow	*Caprimulgus carolinensis*	IV	Occurs in residential areas
Chimney swift	*Chaetura pelagica*	IV	Occurs in residential areas
Yellow-billed cuckoo	*Coccyzus americanus*	IV	Occurs in residential areas
Eastern wood-pewee	*Contopus virens*	IV	Occurs in residential areas
Gray catbird	*Dumetella carolinensis*	IV	Occurs in residential areas
Least weasel	*Mustela nivalis*	IV	Habitat generalist
Northern rough-winged swallow	*Stelgidopteryx serripennis*	IV	Sandpits
Brown thrasher	*Toxostoma rufum*	IV	Occurs in residential areas

Table 4.13. Beach species of greatest conservation need in the Coastal Plain.

Common Name	Scientific Name	Tier	Special Habitat Needs
Piping plover	*Charadrius melodus*	I	Predator-free barrier islands
Wilson's plover	*Charadrius wilsonia*	I	Predator-free barrier islands
Peregrine falcon	*Falco peregrinus*	I	Man-made nesting towers
Gull-billed tern	*Sterna nilotica*	I	Predator-free barrier islands
Northeastern beach tiger beetle	*Cicindela dorsalis*	II	Wide Chesapeake Bay beaches
American oystercatcher	*Haematopus palliatus*	II	Predator-free barrier islands
Northern diamond-backed terrapin	*Malaclemys terrapin*	II	Barrier islands
Black skimmer	*Rynchops niger*	II	Predator-free barrier islands
Least tern	*Sterna antillarum*	II	Predator-free barrier islands
Royal tern	*Sterna maxima*	II	Predator-free barrier islands
Tricolored heron	*Egretta tricolor*	III	Predator-free barrier islands
Glossy ibis	*Plegadis falcinellus*	III	Predator-free barrier islands
Common tern	*Sterna hirundo*	III	Predator-free barrier islands
Red knot (migrant)	*Calidris canutus*	IV	Migrant; forages on beaches
Purple sandpiper (winter)	*Calidris maritima*	IV	Winter; rocky beaches and breakwaters
Short-billed dowitcher (migrant)	*Limnodromus griseus*	IV	Migrant; forages on beaches
Marbled godwit (migrant)	*Limosa fedoa*	IV	Migrant; forages on beaches
Roseate tern (migrant)	*Sterna dougallii*	IV	Migrant; occurs mainly offshore
Forster's tern	*Sterna forsteri*	IV	Predator-free barrier islands

Table 4.14. Other barren habitat species of greatest conservation need in Virginia's Coastal Plain.

Common Name	Scientific Name	Tier	Special Habitat Needs
Piping plover	*Charadrius melodus*	I	Forages on mudflats
Wilson's plover	*Charadrius wilsonia*	I	Forages on mudflats
Tricolored heron	*Egretta tricolor*	III	Forages on mudflats
Glossy ibis	*Plegadis falcinellus*	III	Forages on mudflats
Sandpit alydid bug	*Stachyocnemus apicalis*	III	Sandpits
Dunlin (winter)	*Calidris alpina*	IV	Winter; forages on mudflats
Red knot (migrant)	*Calidris canutus*	IV	Migrant; forages on mudflats
Purple sandpiper (winter)	*Calidris maritima*	IV	Winter; forages on mudflats
Short-billed dowitcher (migrant)	*Limnodromus griseus*	IV	Migrant; forages on mudflats

Common Name	Scientific Name	Tier	Special Habitat Needs
Marbled godwit (migrant)	*Limosa fedoa*	IV	Migrant; forages on mudflats
Northern rough-winged swallow	*Stelgidopteryx serripennis*	IV	Sandpits

Balds species of greatest conservation need in the Coastal Plain

Balds do not occur in the Coastal Plain of Virginia.

4.4.4.2. Status of Barren Habitats

The 1997 NRI reports 692,000 acres (280,000ha) of urban and built-up land and 78,000 acres (31,000ha) of rural transportation infrastructure in the Coastal Plain (USDA 2000). This does not include 289,000 acres (117,000ha) of federal lands in the ecoregion (USDA 2000).

Most of the beaches and mudflats used by these species are on the barrier islands, which are largely protected from development. It could be argued, however, that the reason they occur only on these islands is that mainland development has displaced them. See Chapter 3 for a discussion on statewide trends in beaches (most of which occur in this ecoregion).

4.4.4.3. Trends in Barren Habitats

Trends for most barren areas are not available at any scale. However, the NRI (USDA 2000) does track developed areas. Developed areas in the Coastal Plain increased by > 200,000 acres (> 100,000ha) during the period 1982-1997. Please see Section 3.2.3.3 for statewide status and trends of barren and developed areas in Virginia.

4.4.5. Wetland Species of Greatest Conservation Need in Virginia's Coastal Plain

4.4.5.1. Species of Greatest Conservation Need by Wetland Type

Of the 84 tiered species that occur in Coastal Plain wetlands, 17 are generalists that may occur in either wetland type (Table 4.15). Of the remaining 67 species, 29 occur primarily in emergent wetlands (Table 4.16), 35 occur in wooded wetlands (Table 4.17), and six utilize open water (Table 4.18).

Table 4.15. Wetland generalist species of greatest conservation need in the Coastal Plain.

Common Name	Scientific Name	Tier	Special Habitat Needs
Wood turtle	*Glyptemys insculpta*	I	Clear streams
American black duck	*Anas rubripes*	II	Any wetland
Bald eagle	*Haliaeetus leucocephalus*	II	Large trees for nesting
King rail	*Rallus elegans*	II	Brackish or freshwater marsh
Spotted turtle	*Clemmys guttata*	III	Shallow wetlands
Black-crowned night-heron	*Nycticorax nycticorax*	III	Nest in any vegetated wetland
Carpenter frog	*Rana virgatipes*	III	Vegetated water
Green heron	*Butorides striatus*	IV	Nests in wooded wetlands, forages in any wetland but avoids open water
Willow flycatcher	*Empidonax traillii*	IV	Willow thickets near water
Rainbow snake	*Farancia erytrogramma*	IV	Access to American eel prey
Southeastern myotis	*Myotis austroriparius*	IV	In snags or buildings near water
Little grass frog	*Pseudacris ocularis*	IV	Grasses or sedges near water
Eastern spadefoot	*Scaphiopus holbrookii*	IV	Vernal/temporary pools with sandy soil

Common Name	Scientific Name	Tier	Special Habitat Needs
Dismal Swamp southeastern shrew	*Sorex longirostris fisheri*	IV	Early- to mid-successional wetlands
Marsh rabbit	*Sylvilagus palustris*	IV	Densely vegetated wetlands
Southern bog lemming	*Synaptomys cooperi*	IV	Habitat generalist
Common ribbonsnake	*Thamnophis sauritus*	IV	Access to semi-permanent or permanent water bodies

Table 4.16. Emergent wetland species of greatest conservation need in Virginia's Coastal Plain.

Common Name	Scientific Name	Tier	Special Habitat Needs
Henslow's sparrow	*Ammodramus henslowii*	I	High marsh
Black rail	*Laterallus jamaicensis*	I	High marsh
Saltmarsh sharp-tailed sparrow	*Ammodramus caudacutus*	II	Brackish to salt marsh
American bittern	*Botaurus lentiginosus*	II	Dense emergent vegetation
Northern diamond-backed terrapin	*Malaclemys terrapin*	II	Saltmarsh
Eastern glass lizard	*Ophisaurus ventralis*	II	Wet meadows, needs grassy cover
Nelson's sharp-tailed sparrow (winter)	*Ammodramus nelsoni*	III	Brackish to salt marsh
Redhead (winter)	*Aythya americana*	III	Winter; submerged aquatic vegetation
Brant (winter)	*Branta bernicla*	III	Winter; submerged aquatic vegetation
Northern harrier	*Circus cyaneus*	III	Fresh or brackish marshes
Sedge wren (winter)	*Cistothorus platensis*	III	Brackish to fresh marsh
Least bittern	*Ixobrychus exilis*	III	Dense emergent vegetation
Pungo white-footed mouse	*Peromyscus leucopus easti*	III	Thickets at the edge of marshes
Common tern	*Sterna hirundo*	III	Small islands within marsh
Seaside sparrow	*Ammodramus maritimus*	IV	Brackish to salt marsh
Dunlin (winter)	*Calidris alpine*	IV	May forage in shallow emergent wetlands
Red knot (migrant)	*Calidris canutus*	IV	May forage in shallow emergent wetlands
Purple sandpiper (winter)	*Calidris maritime*	IV	May forage in shallow emergent wetlands
Marsh wren	*Cistothorus palustris*	IV	Large marshes with tall emergent vegetation
Yellow warbler	*Dendroica petechia*	IV	Willow thickets near water
Short-billed dowitcher (migrant)	*Limnodromus griseus*	IV	May forage in shallow emergent wetlands
Marbled godwit (migrant)	*Limosa fedoa*	IV	May forage in shallow emergent wetlands
Hudsonian godwit (migrant)	*Limosa haemastica*	IV	May forage in shallow emergent wetlands
Whimbrel (migrant)	*Numenius phaeopus*	IV	May forage in shallow emergent wetlands
Black-bellied plover (winter)	*Pluvialis squatarola*	IV	May forage in shallow emergent wetlands
Horned grebe (winter)	*Podiceps auritus*	IV	Large bodies of salt water
Virginia rail	*Rallus limicola*	IV	Shallow water, dense emergent vegetation
Clapper rail	*Rallus longirostris*	IV	Shallow water, dense emergent vegetation
Forster's tern	*Sterna forsteri*	IV	Extensive vegetated marshes

Table 4.17. Wooded wetland species of greatest conservation need in Virginia's Coastal Plain.

Common Name	Scientific Name	Tier	Special Habitat Needs
Chicken turtle	*Deirochelys reticularia*	I	Cypress swamps
Wayne's black-throated green warbler	*Dendroica virens waynei*	I	Cypress or white cedar swamps
Mabee's salamander	*Ambystoma mabeei*	II	Cypress swamps or wetlands near pine
Tiger salamander	*Ambystoma tigrinum*	II	Vernal pools in pine woods/savannah
Oak toad	*Bufo quercicus*	II	Vernal pools over sandy soils
Canebrake rattlesnake	*Crotalus horridus*	II	Mature forest with downed logs and humus
Cerulean warbler	*Dendroica cerulea*	II	Mature bottomland forest
Little blue heron	*Egretta caerulea*	II	Hardwoods at water's edge
Barking treefrog	*Hyla gratiosa*	II	Low wet woods and cypress swamps
Swainson's warbler	*Limnothlypis swainsonii*	II	Dense river swamp
Yellow-crowned night-heron	*Nyctanassa violacea*	II	Wooded wetland with open understory
Tricolored heron	*Egretta tricolor*	III	Low thick trees or wooded islands
Dukes' skipper	*Euphyes dukesi*	III	Wooded swamps containing sedges
Glossy ibis	*Plegadis falcinellus*	III	Wooded thickets in coastal wetlands
Eastern box turtle	*Terrapene carolina*	III	Forest generalist
Yellow-billed cuckoo	*Coccyzus americanus*	IV	Dense thickets in deciduous bottomland
Eastern wood-pewee	*Contopus virens*	IV	Seasonally-flooded bottomland forest
Gray catbird	*Dumetella carolinensis*	IV	Dense shrubs near water
Rusty blackbird (winter)	*Euphagus carolinus*	IV	Trees near marshes or wooded swamps
Mudsnake	*Farancia abacura*	IV	Wooded swamps
Worm-eating warbler	*Helmitheros vermivorus*	IV	Thick understory near water
Wood thrush	*Hylocichla mustelina*	IV	Mature forest
Black-and-white warbler	*Mniotilta varia*	IV	Hardwood swamps and bottomlands
Kentucky warbler	*Oporornis formosus*	IV	Dark, wooded swamps
Northern Parula	*Parula americana*	IV	Wooded swamps with tree moss present
Cotton mouse	*Peromyscus gossypinus*	IV	Wooded floodplains and bottomlands
Scarlet tanager	*Piranga olivacea*	IV	Mature bottomland forest
Prothonotary warbler	*Protonotaria citrea*	IV	Open wooded swamps with snags
New Jersey chorus frog	*Pseudacris feriarum*	IV	Vernal pools, ponds, or ditches
Eastern mud salamander	*Pseudotriton montanus*	IV	Wooded swamps
Queen snake	*Regina septemvittata*	IV	Water with overhanging branches
American woodcock	*Scolopax minor*	IV	Moist or wet woods near wetlands
Louisiana waterthrush	*Seiurus motacilla*	IV	Wooded streams or wooded swamps
Many-lined salamander	*Stereochilus marginatus*	IV	Swamps or ponds within forest
Yellow-throated vireo	*Vireo flavifrons*	IV	Wooded swamps

Table 4.18. Open water species of greatest conservation need in Virginia's Coastal Plain.

Common Name	Scientific Name	Tier	Special Habitat Needs
American black duck	*Anas rubripes*	II	Open water primarily in winter
Northern diamond-backed terrapin	*Malaclemys terrapin*	II	Estuaries
Redhead (winter)	*Aythya americana*	III	Submerged aquatic vegetation
Brant (winter)	*Branta bernicla*	III	Submerged aquatic vegetation
Greater scaup (winter)	*Aythya marila*	IV	Submerged aquatic vegetation
Horned grebe (winter)	*Podiceps auritus*	IV	Winter; usually inshore saltwater

4.4.5.2. Status and Trends of Wetlands

According to the 1992 NLCD (USGS 1992), the Coastal Plain contains nearly 220,000ha of forested or shrubby wetlands and nearly 85,000ha of emergent wetlands.

Trends in wetlands are not currently available at an ecoregional level for Virginia. Please see Section 3.2.3.4 for statewide status and trends of wetlands in Virginia.

4.5. Aquatic Species in the Coastal Plain

4.5.1. Coastal Plain-Chowan EDU

The Chowan drainage is comprised of three major rivers, the Blackwater, the Meherrin and the Nottoway. The Blackwater lies entirely within the Coastal Plain, while the Nottoway and Meherrin straddle the Piedmont and Coastal Plain. The Nottoway and Blackwater converge at the border with North Carolina to form the Chowan mainstem. The biogeography of the Chowan has been described as very similar to the Roanoke (Jenkins and Burkhead 1994).

The Coastal Plain-Chowan EDU (Figure 4.19) is part of the South Atlantic freshwater ecoregion, which is considered "globally outstanding" in terms of biological distinctiveness (Abell et al. 2000). The South Atlantic freshwater ecoregion is home to 48 endemic aquatic species (fish, mussels, and amphibians).

4.5.1.1. Tier I Species in the Coastal Plain-Chowan EDU

4.5.1.1.1. Blackbanded sunfish, *Enneacanthus chaetodon*

Life History Summary

The blackbanded sunfish is only known from this EDU in Virginia. It typically inhabits pools of streams, vegetated ponds and swamps (Jenkins and Burkhead 1994). In Virginia, it is found in small impoundments

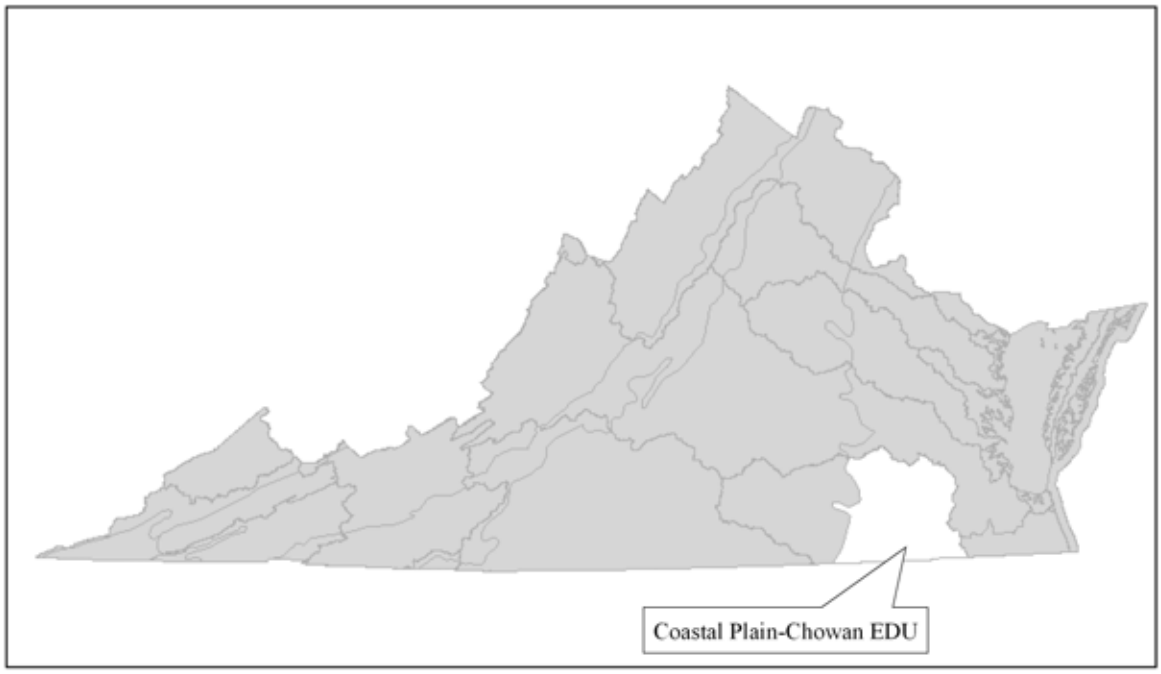

Figure 4.19. Location of the Coastal Plain-Chowan EDU.

with abundant submerged vegetation (Smith et al. 2001). Smith et al. (2001) also found statistically significant positive relationships between the presence of blackbanded sunfish and the percent cover or submergent and floating aquatic vegetation, demersal and surface temperature, Secchi depth, and water body type. There was a negative relationship between conductivity and the presence of blackbanded sunfish. In other portions of its range, they are known to eat plant-associated macroinvertebrates (Schwartz 1961; Wujtewicz 1982). Nests are saucer-shaped and often cleared and shaped by the males. This species is legally protected with the status of State endangered.

Location

The potential habitat for the blackbanded sunfish is somewhat difficult to map using the DGIF habitat classification because of its preference for dense vegetation and other microhabitat variables (Figure 4.20). The habitats identified are likely an overestimation of potential habitat for this species. Confirmed reaches are based on Collections data (DGIF 2004b). Potential habitat was determined using size, gradient, reach elevation and waterbody type. For more details on the selection of potential habitat, see Appendix D.

Description of Essential Habitat

Essential habitat for this species includes densely vegetated rivers, swamps, beaver ponds and small impoundments of the Coastal Plain (Smith et al. 2001) (Table 4.19).

Table 4.19. DGIF aquatic habitat types used by the blackbanded sunfish in the Coastal Plain-Chowan EDU.

Aquatic Habitat Type	**Number of Reaches**
Very low gradient small stream connected to another small stream (wetland, pond, or impoundment)	8
Very low gradient headwater connected to another headwater (wetland, pond or impoundment)	4
Very low gradient small stream connected to another small	2
Low gradient headwater connected to a small stream (wetland, pond or impoundment)	1

Relative Condition of Habitat

All but one of the habitats containing this species are impaired (DEQ and DCR 2004). The impairments are dissolved oxygen, fecal coliform, and pH with either natural or unknown sources.

This is the only tiered fish species in Virginia that thrives in impoundments. Recent Hurricanes Dennis and Floyd negatively impacted the impounded habitats of the blackbanded sunfish in Virginia (Smith et al. 2001). The dam at Game Refuge Lake owned by DGIF was largely breached by extensive flooding. Repair and restoration work is planned at this location (M.J. Pinder, DGIF, pers comm.).

Specific Threats and Trends

Habitat losses through the draining of ponds and swamps and water contamination with herbicides and pesticides have been identified as threats to this species (Burkhead and Jenkins 1991). Intentional take for the pet industry is also a potential threat.

Fish TAC (2004) did not identify any specific threats for blackbanded sunfish. However, they identified several threats to its habitat (Appendix H).

Conservation Actions and Strategies

Burkhead and Jenkins (1991) recommend working with landowners to conserve the few known populations. This would involve relatively simple actions such as establishing biocide-free zones around

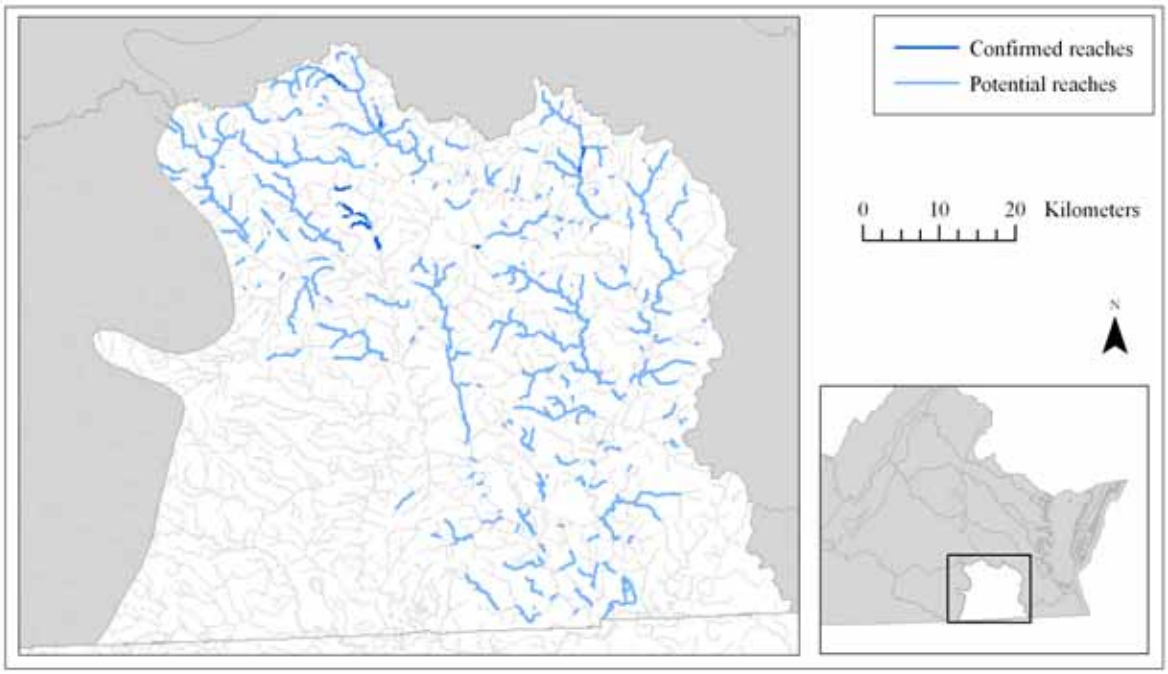

Figure 4.20. Location of confirmed and potential blackbanded sunfish habitat in the Coastal Plain-Chowan EDU.

these water bodies. Maintenance of impoundments with extant populations is also recommended (Smith et al. 2001). Education of game wardens to aid in the identification of this species and subsequent enforcement of existing regulations is also recommended. Reintroduction to habitats within their historic range has also been recommended (Jenkins and Burkhead 1994; Smith et al. 2001). Prior to these efforts, a reintroduction policy should be developed (Smith et al. 2001).

Fish TAC (2004) identified a suite of conservation actions for the habitat of the blackbanded sunfish (Appendix I).

Research and Monitoring Needs

Fish TAC (2004) identified several research or monitoring needs for the habitat of the blackbanded sunfish (Appendix J). They did not identify anything specific to blackbanded sunfish.

4.5.1.1.2. Bridle shiner, *Notropis bifrenatus*

Life History Summary

The bridle shiner is thought to be a sight predator. Main prey items include invertebrates associated with open water, plants, or benthos (Burkhead and Jenkins 1991). Spawning occurs primarily between mid-May and mid-June in pools over submerged aquatic vegetation. This species has been designated a State special concern species.

Location

The map of bridle shiner habitat (Figure 4.21) includes confirmed reaches based on known locations in Collections (DGIF 2004b). We were not able to determine potential habitat for this species because of few confirmed reaches and the importance of aquatic vegetation, which we cannot identify with existing datasets.

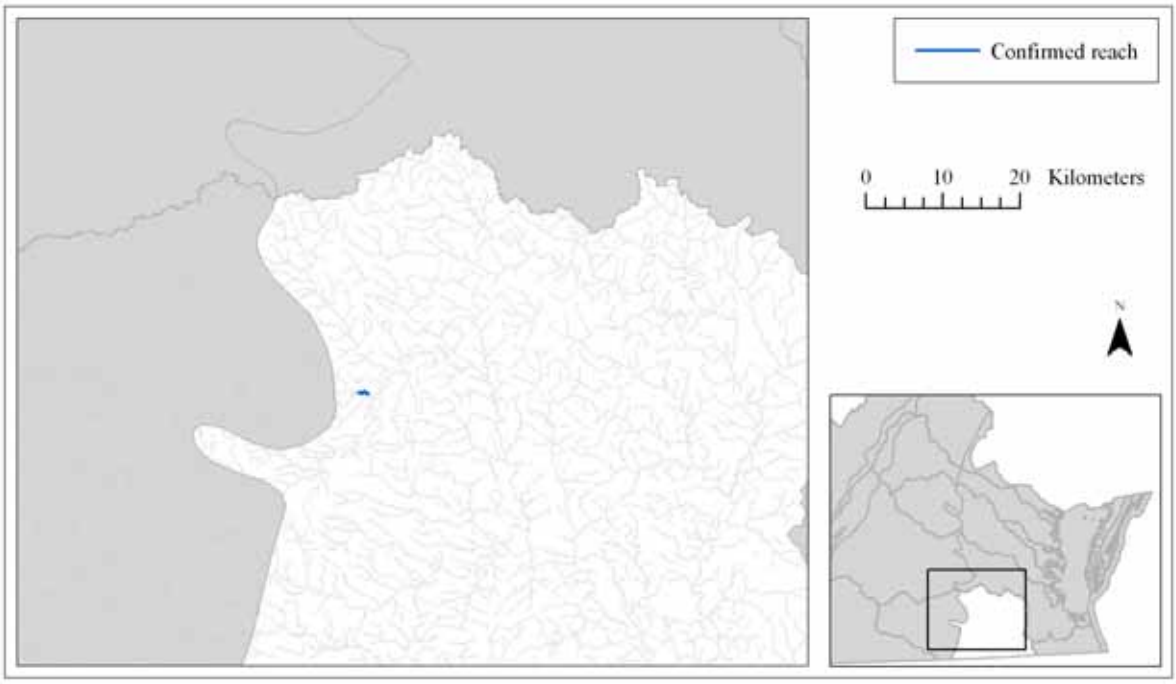

Figure 4.21. Location of confirmed bridle shiner habitat in the Coastal Plain-Chowan EDU.

Description of Essential Habitat

This is a slackwater shiner, found in quiet pools in streams and creeks (Table 4.20). It is also found in ponds and lakes, where it prefers slow current but not standing water. This species occurs over mud, silt or detritus-covered bottoms, usually in association with aquatic vegetation. It will rarely enter tidal fresh and brackish water (Jenkins and Burkhead 1994). Many upland and lowland records are from large marshes or marsh-fringed shores. In such areas, the bridle shiner's specific affiliation may be with submerged vegetation. It is a freshwater oligohaline fish with a propensity for clear water (Burkhead and Jenkins 1991). It tolerates salinity levels generally < 2ppt and is not believed to be acid tolerant, preferring water with pH > 7.0 (Jenkins and Burkhead 1994).

Table 4.20. DGIF aquatic habitat types used by the bridle shiner in the Coastal Plain-Chowan EDU.

Aquatic Habitat Type	**Number of Reaches**
Very low gradient large stream connected to another large stream (wetland, pond, or impoundment)	1

Relative Condition of Habitat

There is only one known location of bridle shiner in this EDU. That river reach is impaired by coliform bacteria and pH from unknown sources (DEQ and DCR 2004).

Specific Threats and Trends

Burkhead and Jenkins (1991) list increased turbidity and sedimentation as the primary threats to this species. These stresses affect the sight feeding abilities of this species and reduce populations of submerged aquatic vegetation. Agricultural pollution may also be a threat to this species. Fish TAC (2004) did not

identify any specific threats to the bridle shiner; however, stresses and sources of stress were identified for the Chowan River drainage (Appendix H).

Conservation Actions and Strategies

Fish TAC (2004) did not identify any specific conservation strategies for the bridle shiner; however, conservation actions were identified for the Chowan River drainage (Appendix I).

Research and Monitoring Needs

Burkhead and Jenkins (1991) recommend that the existing populations of the bridle shiner be monitored and that surveys be completed to determine the range of the species in Virginia. Research and monitoring needs were identified for the Chowan River drainage species group (Appendix J).

4.5.1.1.3. Roanoke logperch, *Percina rex*

Life History Summary

The Roanoke logperch is a Federal and State endangered species found only in the Roanoke and Nottoway river systems of Virginia (Figure 4.22). It is usually rare or uncommon. The populations are disjunct, separated by large stretches of unsuitable river habitat or impoundments (Burkhead and Jenkins 1991). It feeds on immature benthic invertebrates and exhibits a feeding behavior of flipping rocks to expose prey items (Jenkins and Burkhead 1994). The Roanoke logperch spawns in spring and early summer. Recent work by Rosenberger and Angermeier (2003) revealed that throughout its life, the Roanoke logperch inhabits a changing and varied array of habitats. An overall preference for relatively silt-free substrates and its restricted distribution have made it vulnerable to extinction. This species is legally protected with the status of Federal and State endangered.

Location

The map of habitat for the Roanoke logperch includes confirmed and potential reaches selected using size, connectivity and gradient variables based on known locations in DGIF's Aquatic Habitat Classification (Figure 4.22). Confirmed reaches are based on Collections (DGIF 2004b). For more details on the selection of potential habitat, see Appendix D.

Description of Essential Habitat

This species prefers silt free conditions. Roanoke logperch adults and subadults are found primarily in deep, low-velocity pools and runs with sand and gravel substrate (Rosenberger and Angermeier 2003). Here they are only occasionally found in riffles and runs, which is different from habitat preferences observed in the Roanoke River (Table 4.21). Rosenberger and Angermeier (2003) found that ontogenetic shifts in habitat use (differential habitat use in different life stages) were less pronounced in the Nottoway than in the Roanoke River.

As many of these requirements cannot easily be determined from existing map datasets, the location of potential essential habitat was determined using the following attributes in the DGIF aquatic habitat classification: stream size, connectivity, and gradient (see Appendix D for details of the mapping attributes). These attributes were chosen based on observed patterns in the attributes of stream reaches containing Roanoke logperch. The DGIF aquatic habitat classification was also used to identify the diversity of habitat types used by Roanoke logperch and to assess patterns of distribution (Table 4.21). Neither headwaters nor large rivers were used by the Roanoke logperch. Most of the specimens were collected from reaches characterized as large streams to small rivers, with very low gradient across the length of the reach. Nine reaches within impoundments or other lentic habitats were found to contain this species; however, this is not believed to be a part of the species' core habitat.

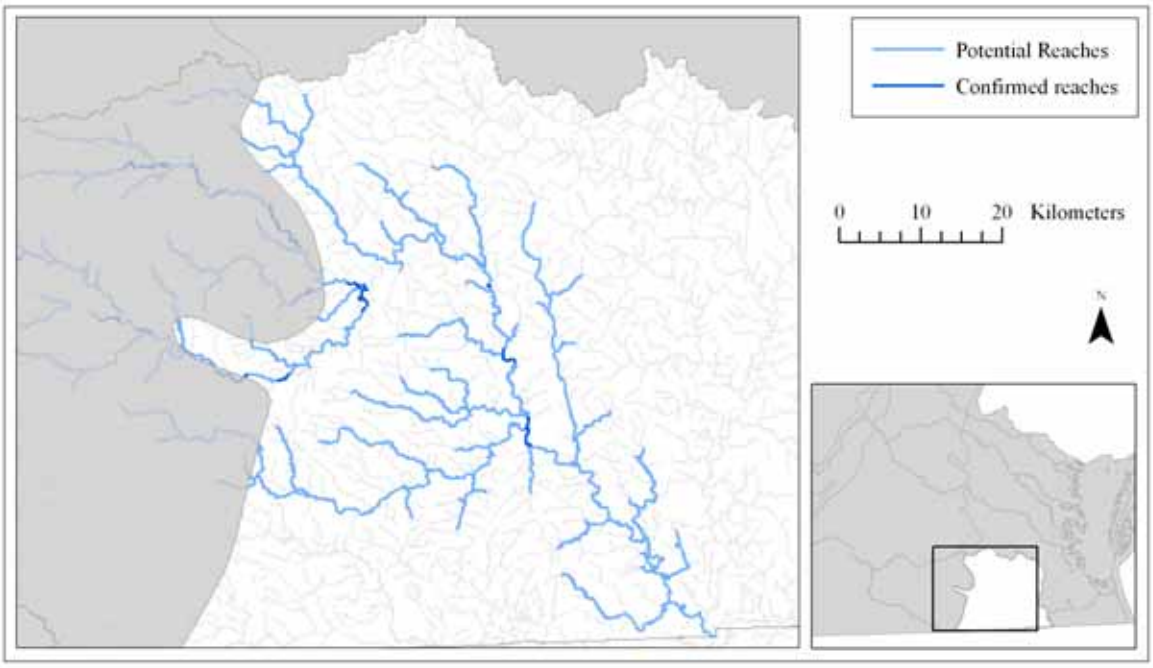

Figure 4.22. Confirmed and potential Roanoke logperch habitat in the Coastal Plain-Chowan EDU.

Table 4.21. DGIF aquatic habitat types used by the Roanoke logperch in the Coastal Plain-Chowan EDU.

Aquatic Habitat Type	**Number of Reaches**
Very low gradient small river connected to another small river	14
Very low gradient large stream connected to another large stream	5
Very low gradient small stream connected to another small stream	3
Very low gradient large stream connected to another large stream (impoundment)	2
Very low gradient small stream connected to a small river	1

Relative Condition of Habitat

All of the confirmed reaches for the Roanoke logperch in this EDU are impaired or are downstream of impaired reaches (DEQ and DCR 2004). All of the reaches are impaired by fecal coliform from unknown sources. One 8km stretch of Stony Creek is also impaired by pH from unknown sources.

Specific Threats and Trends

Burkhead and Jenkins (1991) list channelization, siltation, chronic pollution of various types, catastrophic chemical spills, impoundment and dewatering as major stresses to this species. No species-specific threats were listed by Fish TAC (2004) for the Roanoke logperch. A summary of the stresses and sources of stress identified for the Chowan River drainage is available in Appendix H.

Conservation Actions and Strategies

Burkhead and Jenkins (1991) list several specific conservation actions and generally recommend long-term bank stabilization and better monitoring and enforcement of regulations regarding silt control in construction projects to reduce sedimentation. They also recommend the review of discharge permits to evaluate cumulative concentration of effluents in the Roanoke drainage. The USFWS identified four actions needed to meet the recovery objectives listed in this species' recovery plan (USFWS 1992). They include: using existing legislation to protect it; developing educational programs and other resources to

inform the public about the species and its status; determining feasibility of re-establishing populations where appropriate; and implementing measures to reduce sedimentation and other identified threats. More conservation actions related to threats to its habitat were identified by Fish TAC (2004) (Appendix I).

Research and Monitoring Needs

Three research or monitoring activities were identified by USFWS to meet the recovery objectives listed in this species' recovery plan (USFWS 1992). These include surveys for additional populations and habitats for possible reintroduction; characterization of the species habitat requirements and population viability including monitoring of threats; and surveys to monitor population levels and habitat conditions.

4.5.1.2. Aquatic SGCN by Habitat Group: Coastal Plain-Chowan EDU

There are 29 tiered species in the Coastal Plain-Chowan EDU: thirteen fish, twelve mussels, two snails, and two crustaceans. Four habitat groups were identified in this EDU (Tables 4.22-4.25). There are several species in the unknown or generalist group that, with more sampling, would probably be shown to be part of one of these defined groups (Table 4.26).

Table 4.22. Aquatic species of greatest conservation need with migratory habits. These species use a range of habitats from large tidal rivers to small streams.

Common Name	Scientific Name	Tier
Alewife	*Alosa pseudoharengus*	IV
American shad	*Alosa sapidissima*	IV
American eel	*Anguilla rostrata*	IV

Table 4.23. Aquatic species of greatest conservation need in very low gradient small rivers connected to other small rivers (DGIF Classification type 441 and 441w).

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of Types of DGIF Aquatic Classification Used
Roanoke bass	*Ambloplites rupestris*	II	85	4
Yellow lampmussel	*Lampsilis cariosa*	III	100	1 (5 occurrences)
Carolina slabshell mussel	*Elliptio congaraea*	IV	100	2 (6 occurrences)
Eastern pondmussel	*Ligumia nasuta*	IV	100	1 (5 occurrences)

Table 4.24. Aquatic species of greatest conservation need in very low gradient small streams connected to other small streams (DGIF Classification type 221 and 221w).

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of Types of DGIF Aquatic Classification Used
Lined topminnow	*Fundulus lineolatus*	IV	65	11

Table 4.25. Aquatic species of greatest conservation need using wetland, pond or impoundment habitats (DGIF Classification types with "w").

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of Types of DGIF Aquatic Classification Used
Blackbanded sunfish	*Enneacanthus chaetodon*	I	86	4

Swampfish	*Chologaster cornuta*	IV	72	10
Banded sunfish	*Enneacanthus obesus*	IV	71	10

Table 4.26. Aquatic species of greatest conservation need: generalists and those with unknown habitat requirements based on DGIF habitat classification.

Common Name	Scientific Name	Tier	Number of Types of DGIF Aquatic Classification Used
Bridle shiner	*Notropis bifrenatus*	I	1 (1 occurrence)
Roanoke logperch	*Percina rex*	I	5 (56% in small rivers)
Dwarf wedgemussel	*Alasmidonta heterodon*	II	1 (1 occurrence)
Dismal Swamp isopod	*Caecidotea attenuatus*	II	NA
Yellow lance	*Elliptio lanceolata*	III	2 (4 occurrences)
Chowanoke crayfish	*Orconectes virginiensis*	III	NA
Mud sunfish	*Acantharcus pomotis*	IV	18 (56% wetland or pond-related)
Triangle floater	*Alasmidonta undulata*	IV	2
Alewife floater	*Anodonta implicata*	IV	1
Carolina lance mussel	*Elliptio angustata*	IV	1
Northern lance mussel	*Elliptio fisheriana*	IV	1
American brook lamprey	*Lampetra appendix*	IV	6
Tidewater mucket	*Leptodea ochracea*	IV	1 (1 occurrence)
Ridged lioplax	*Lioplax subcarinata*	IV	NA
Ironcolor shiner	*Notropis chalybaeus*	IV	9
Sharp sprite	*Promenetus exacuous*	IV	NA
Creeper mussel	*Strophitus undulatus*	IV	1
Florida pondhorn	*Uniomerus caroliniana*	IV	NA

4.5.1.2.1. Relative Condition of Habitat

In the Coastal Plain-Chowan EDU, approximately 1255km of stream are impaired. This represents approximately 3% of the riverine habitat in this EDU. Causes of the listings were largely dissolved oxygen, pH, and fecal coliform (DEQ and DCR 2004). Sources of these contaminants were listed as natural conditions, unknown, or non-point source agriculture. An assessment of the disturbed land cover within this EDU indicates that about 2% of the area is developed, and 30% is agriculture (USGS 2001). Across EDUs statewide, agricultural land cover ranges from 2 to 41%, and developed land use ranges from 0.4 to 15% (USGS 1992).

Threats, conservation actions, and research and monitoring needs for the Tier II through Tier IV species are available in Appendix H. Mussel TAC (2004) and Fish TAC (2004) provided this information within habitat groups selected at the workshops. The level of detail within these groups do not correspond to that used in the DGIF aquatic habitat classification.

4.5.2. Coastal Plain-James EDU

The James River drainage occurs almost wholly within Virginia and covers over 25% of the land area of the state (Jenkins and Burkhead 1994). It crosses the Ridge and Valley, Blue Ridge, Piedmont, and Coastal Plain. The Coastal Plain-James EDU (Figure 4.23) is found within the Chesapeake Bay freshwater ecoregion (Abell et al. 2000). As its name implies, this ecoregion encompasses all of the drainages of the Chesapeake Bay. This freshwater ecoregion supports four endemic mussel species and seven endemic fish species, including roughhead shiner *Notropis semperasper* found only in the headwaters of the James River. It is also home to several migratory fish, including American shad *Alosa sapidissima*, alewife *A. pseudoharengus*, and American eel *Anguilla rostrata*. Abell et al. (2000) list the Chesapeake Bay freshwater ecoregion as "continentally outstanding" in terms of biological distinctiveness.

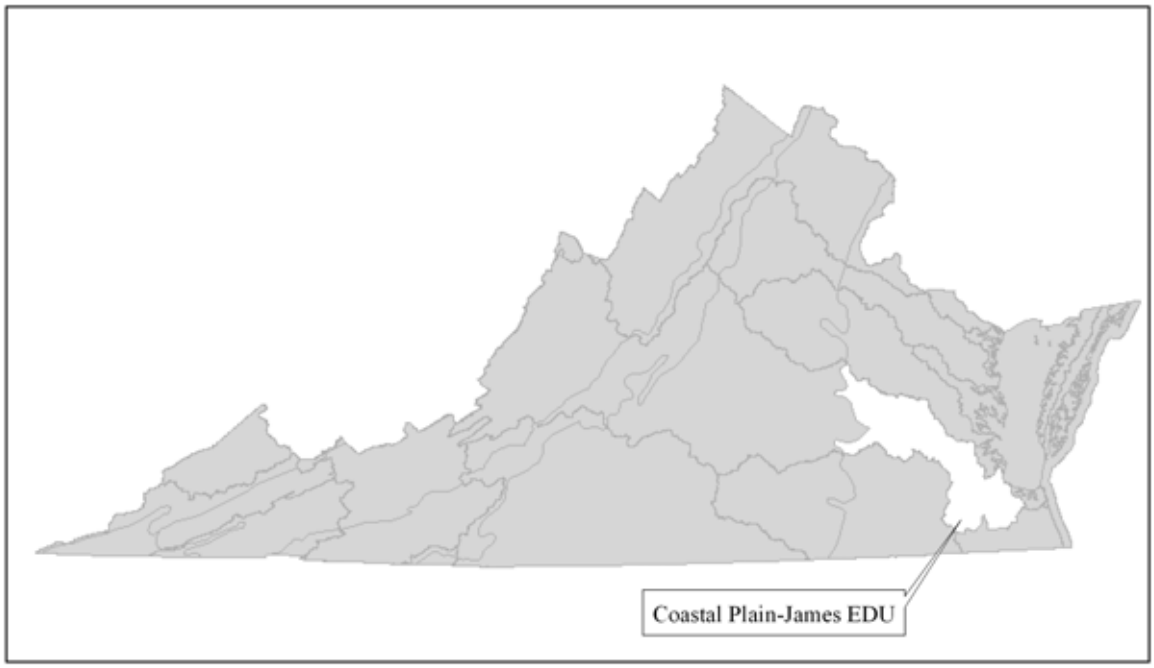

Figure 4.23. Location of the Coastal Plain-James EDU.

4.5.2.1. Tier I Species in the Coastal Plain-James EDU

4.5.2.1.1. Bridle shiner, *Notropis bifrenatus*

Life History Summary

The bridle shiner is thought to be a sight predator. Main prey items include invertebrates associated with open water, plants, or benthos (Burkhead and Jenkins 1991). Spawning occurs primarily between mid-May and mid-June in pools over submerged aquatic vegetation. The bridle shiner has been designated a State special concern species.

Location

The map of bridle shiner habitat (Figure 4.24) includes confirmed reaches based on known locations in Collections (DGIF 2004b). We were not able to determine potential habitat for this species because of few confirmed reaches and the importance of aquatic vegetation, which we cannot identify with existing datasets.

Description of Essential Habitat

This is a slackwater shiner, found in quiet pools in streams and creeks (Table 4.27). It is also found in ponds and lakes, where it prefers slow current but not standing water. This species occurs over mud, silt or detritus-covered bottoms, usually in association with aquatic vegetation. It will rarely enter tidal fresh and brackish water (Jenkins and Burkhead 1994). Many upland and lowland records are from large marshes or marsh-fringed shores. In such areas, the bridle shiner's specific affiliation may be with submerged vegetation. It is a freshwater oligohaline fish with a propensity for clear water (Burkhead and Jenkins 1991). It tolerates salinity levels generally < 2ppt and is not believed to be acid tolerant, preferring water with pH > 7.0 (Jenkins and Burkhead 1994).

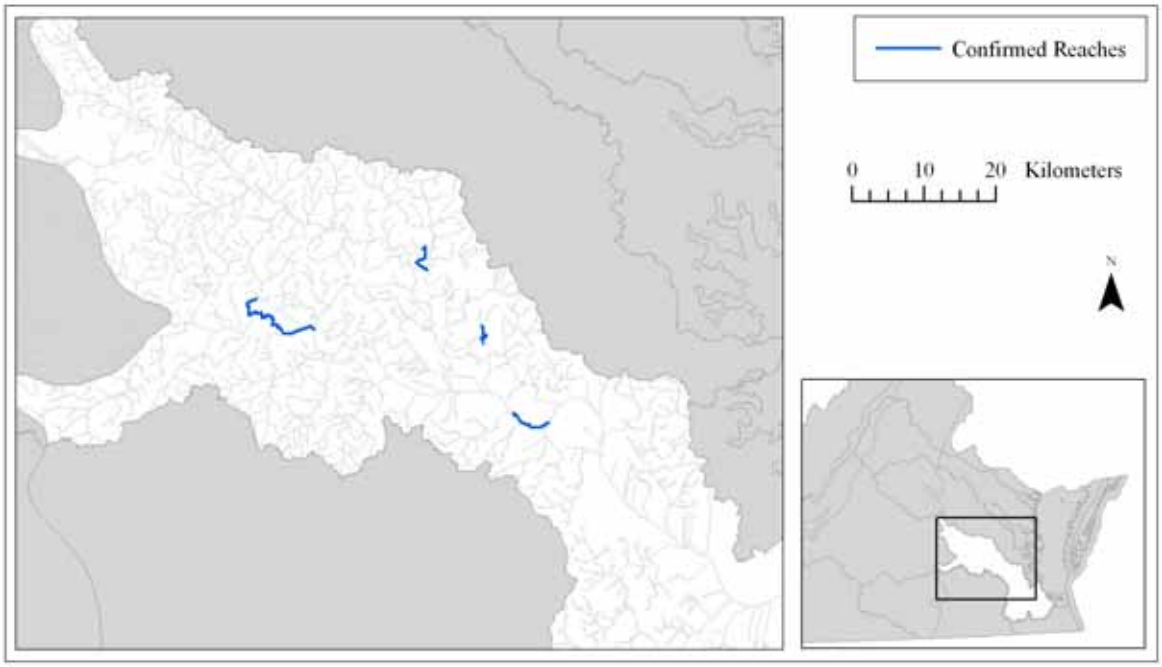

Figure 4.24. Location of confirmed habitat for the bridle shiner in the Coastal Plain-James EDU.

Table 4.27. DGIF aquatic habitat types used by the bridle shiner in the Coastal Plain-James EDU.

Aquatic Habitat Type	Number of Reaches
Very low gradient large river connected to another large river	3
Very low gradient headwater connected to another headwater (pond or impoundment)	2
Very low gradient large stream connected to another large stream	1
Very low gradient small stream connected to another small stream	1

Relative Condition of Habitat

None of the reaches containing the bridle shiner have been identified as impaired (DEQ and DCR 2004). However, two of the seven reaches are downstream of impaired waters.

Specific Threats and Trends

Burkhead and Jenkins (1991) list increased turbidity and sedimentation as the primary threats to this species. These stresses affect the sight feeding abilities of this species and reduce populations of submerged aquatic vegetation. Agricultural pollution may also be a threat to this species. Fish TAC (2004) did not identify any specific threats to the bridle shiner; however, stresses and sources of stress were identified for the James River drainage (Appendix H).

Conservation Actions and Strategies

Fish TAC (2004) did not identify any specific conservation strategies for the bridle shiner; however, conservation actions were identified for the James River drainage (Appendix I).

Research and Monitoring Needs

Burkhead and Jenkins (1991) recommend that the existing populations of the bridle shiner be monitored and that surveys be completed to determine the range of the species in Virginia. Research and monitoring needs were identified for the James River drainage species group (Appendix J).

4.5.2.2. Aquatic SGCN by Habitat Group: Coastal Plain-James EDU

There are 21 tiered species in the Coastal Plain-James EDU. Twelve are fish; seven are mussels, and two are snails. Only two habitat groups could be identified for this EDU (Table 4.28-29). For most species there were insufficient data to make conclusions about patterns in habitat use (Table 4.30).

Table 4.28. Aquatic species of greatest conservation need with migratory habits. These species use a range of habitats from large tidal rivers to small streams.

Common Name	Scientific Name	Tier
Atlantic sturgeon	*Acipenser oxyrhynchus*	II
Alewife	*Alosa pseudoharengus*	IV
American shad	*Alosa sapidissima*	IV
American eel	*Anguilla rostrata*	IV

Table 4.29. Aquatic species of greatest conservation need found mostly in small impoundments, ponds, and wetlands with some occurrences in very low gradient small streams connected to other small streams (DGIF aquatic classification types: headwater and small sized "w" reaches and 221).

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of DGIF Aquatic Classification Types Used
Mud sunfish	*Acantharcus pomotis*	IV	88	6
Banded sunfish	*Enneacanthus obesus*	IV	100	3 (4 occurrences)
Least brook lamprey	*Lampetra aepyptera*	IV	75	8

Table 4.30. Aquatic species of greatest conservation need: generalists and those with unknown habitat requirements based on DGIF habitat classification.

Common Name	Scientific Name	Tier	Number of Types Used (DGIF Aquatic Classification)
Bridle shiner	*Notropis bifrenatus*	I	4
Green floater	*Lasmigona subviridis*	II	NA
Yellow lance	*Elliptio lanceolata*	III	NA
Triangle floater	*Alasmidonta undulata*	IV	NA
Swampfish	*Chologaster cornuta*	IV	1 (1 occurrence)
Carolina lance mussel	*Elliptio angustata*	IV	1 (2 occurrences)
Northern lance mussel	*Elliptio fisheriana*	IV	NA
Atlantic spike	*Elliptio producta*	IV	1 (1 occurrence)
Lined topminnow	*Fundulus lineolatus*	IV	2 (2 occurrences)
American brook lamprey	*Lampetra appendix*	IV	3 (4 occurrences)
Ridged lioplax	*Lioplax subcarinata*	IV	NA
Ironcolor shiner	*Notropis chalybaeus*	IV	5 (6 occurrences)
Sharp sprite	*Promenetus exacuous*	IV	NA
Creeper mussel	*Strophitus undulatus*	IV	1 (1 occurrence)

4.5.2.2.1. Relative Condition of Habitat

Approximately 12%, or 415km, of the riverine habitat in this EDU is impaired (DEQ and DCR 2004). Most causes of impairment are fecal coliform, pH, and *Escherichia coli* from non-point source urban, natural conditions, and unknown sources. Agricultural land cover in this EDU is 17% of the total, while developed land use is at the highest for the state, 15% (USGS 2001). This EDU contains the metropolitan areas of Richmond and the Tidewater area, and the mainstem is the mouth of a very large watershed that drains several metropolitan areas and abundant agricultural land.

Threats, conservation actions, and research and monitoring needs for the Tier II through Tier IV species are available in Appendices H-J. Mussel TAC (2004) and Fish TAC (2004) provided this information within habitat groups decided upon at the workshops. The level of detail within these groups do not correspond to that used in the DGIF aquatic habitat classification

4.5.3. Coastal Plain-York EDU

The York River drainage occurs entirely within Virginia. It drains the Piedmont and Coastal Plain. The mainstem of the York River is formed by the confluence of the Mattaponi and Pamunkey Rivers. The Mattaponi River has been identified by TNC as "the heart of the most pristine freshwater complex on the Atlantic Coast" (American Rivers 1999).

The Coastal Plain-York EDU (Figure 4.25) is found within the Chesapeake Bay freshwater ecoregion (Abell et al. 2000). As its name implies, this ecoregion encompasses all of the drainages of the Chesapeake Bay. This freshwater ecoregion supports four endemic mussel species and seven endemic fish species, including roughhead shiner *Notropis semperasper* found only in the headwaters of the James River. It is also home to several migratory fish, including American shad *Alosa sapidissima*, alewife *A. pseudoharengus*, and American eel *Anguilla rostrata*. Abell et al. (2000) list the Chesapeake Bay freshwater ecoregion as "continentally outstanding" in terms of biological distinctiveness.

4.5.3.1. Tier I Species in the Coastal Plain-York EDU

There are currently no documented Tier 1 species in the Coastal Plain-York EDU.

4.5.3.2. Aquatic SGCN by Habitat Group: Coastal Plain-York EDU

There are a total of 17 tiered species in the Coastal Plain-York EDU. Nine are fish and eight are mussels. There were three habitat groups identified in this EDU (Tables 4.31-4.33). The groups consist of only one species in each. Additional data may assist in the identification of more group members and/or more groups from those that remain undetermined (Table 4.34).

4.5.3.2.1. Relative Condition of Habitat

Just under 10% (304km) of the riverine habitat in this EDU is impaired (DEQ and DCR 2004). The vast majority of impairments are for pH, fecal coliform, and dissolved oxygen from natural or unknown sources.

Approximately 21% of the land cover in this EDU is considered agricultural, and 2% is considered developed (USGS 2001). Across EDUs statewide, agricultural land cover ranges from 2 to 41%, and developed land use ranges from 0.4 to 15% (USGS 1992).

Table 4.31. Aquatic species of greatest conservation need with migratory habits. These species use a range of habitats from large tidal rivers to small streams.

Common Name	Scientific Name	Tier
Atlantic sturgeon	*Acipenser oxyrhynchus*	II
Alewife	*Alosa pseudoharengus*	IV
American shad	*Alosa sapidissima*	IV
American eel	*Anguilla rostrata*	IV

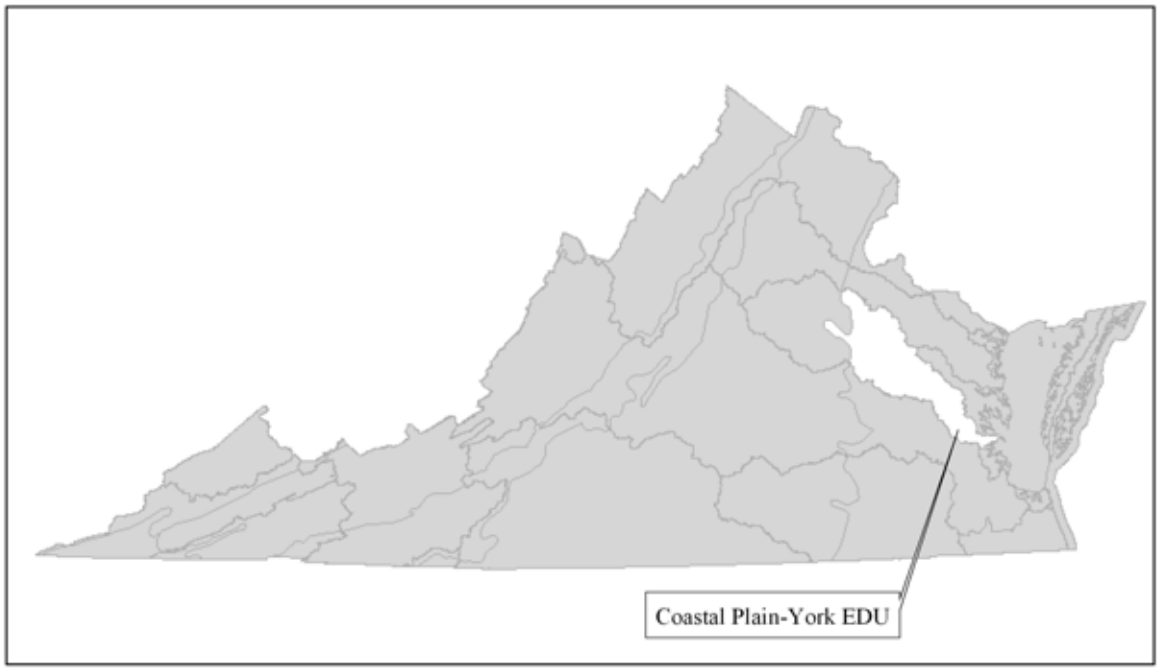

Figure 4.25. Location of the Coastal Plain-York EDU.

Table 4.32. Aquatic species of greatest conservation need in very low gradient small rivers (DGIF aquatic classification type 441).

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of DGIF Aquatic Classification Types Used
American brook lamprey	*Lampetra appendix*	IV	78	4

Table 4.33. Aquatic species of greatest conservation need in reaches designated as wetlands or ponds (DGIF aquatic classification types with a "w").

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of DGIF Aquatic Classification Types Used
Banded sunfish	*Enneacanthus obesus*	IV	75	4

Table 4.34. Aquatic species of greatest conservation need: generalists and those with unknown habitat requirements based on DGIF habitat classification.

Common Name	Scientific Name	Tier	Number of DGIF Aquatic Classification Types Used
Dwarf wedgemussel	*Alasmidonta heterodon*	II	NA
Yellow lance	*Elliptio lanceolata*	III	NA
Mud sunfish	*Acantharcus pomotis*	IV	7 (14 occurrences)
Triangle floater	*Alasmidonta undulata*	IV	1 (1 occurrence)
Alewife floater	*Anodonta implicate*	IV	1 (1 occurrence)
Swampfish	*Chologaster cornuta*	IV	1 (1 occurrence)
Carolina lance mussel	*Elliptio angustata*	IV	4 (4 occurrences)
Northern lance mussel	*Elliptio fisheriana*	IV	NA
Least brook lamprey	*Lampetra aepyptera*	IV	7 (12 occurrences)

Common Name	Scientific Name	Tier	Number of DGIF Aquatic Classification Types Used
Yellow lampmussel	*Lampsilis cariosa*	IV	2 (2 occurrences)
Tidewater mucket	*Leptodea ochracea*	IV	1 (1 occurrence)
Creeper mussel	*Strophitus undulatus*	IV	NA

Threats, conservation actions, and research and monitoring needs for the Tier II through Tier IV species are available in Appendices H-J. Mussel TAC (2004) and Fish TAC (2004) provided this information within habitat groups selected at the workshops. The level of detail within these groups do not correspond to that used in the DGIF aquatic habitat classification.

4.5.4. Coastal Plain-Rappahannock EDU

The Rappahannock River drainage occurs entirely within the state of Virginia. The headwaters of the Rappahannock drain the Blue Ridge ecoregion and flow through the Piedmont and Coastal Plain. The Coastal Plain-Rappahannock EDU (Figure 4.26) is found within the Chesapeake Bay freshwater ecoregion (Abell et al. 2000). As its name implies, this ecoregion encompasses all of the drainages of the Chesapeake Bay. This freshwater ecoregion supports four endemic mussel species and seven endemic fish species, including roughhead shiner *Notropis semperasper* found only in the headwaters of the James River. It is also home to several migratory fish, including American shad *Alosa sapidissima*, alewife *A. pseudoharengus*, and American eel *Anguilla rostrata*. Abell et al. (2000) list the Chesapeake Bay freshwater ecoregion as "continentally outstanding" in terms of biological distinctiveness.

4.5.4.1. Tier I Species in the Coastal Plain-Rappahannock EDU

4.5.4.1.1. Shortnose sturgeon, *Acipenser brevirostrum*

Life History Summary

This species may be essentially extirpated from Virginia waters (Jenkins and Burkhead 1994). There are no known populations from any of the Chesapeake Bay tributaries. Only a few individual collections have been recorded in recent years. There is no evidence of a reproducing population in Virginia (Fish TAC 2004). Nineteen population segments are recognized for this species in the U.S; the Chesapeake Bay/Potomac River is the only one specific to Virginia (NMFS 1998). The shortnose sturgeon has a disjunct distribution across its range. According to Kynard (1997), there are no known populations between the Delaware River, New Jersey, and the Cape Fear River, North Carolina. It is likely that the sturgeon inhabited all of the waters in between these populations historically (Dadswell et al. 1984). This species is legally protected with the status of Federal and State endangered.

The shortnose sturgeon has been described as an opportunistic benthic forager. In fresh water, juveniles will prey upon insect larvae and small crustaceans, while adults will also feed on mollusks (Dadswell 1979; Dadswell et al. 1984). The shortnose sturgeon largely remains in freshwater and estuarine habitats close to natal waters, without much movement into truly marine habitats. This will make natural recolonization of historic habitats a slow process (Kynard 1997).

Several researchers have noted latitudinal differences in growth, spawning and anadromy (Dadswell et al. 1984; Kynard 1997). Age at maturity ranges from 2-6yr in Georgia to 10-13yr in St. John's River, Canada. First spawning occurs between 1-16 years after maturity with a typical hiatus of 1-3 years between spawnings. Spawning occurs in freshwater typically above tidal influence in areas with swift current and gravel or pebble bottom (Dadswell et al. 1984). Spawning is triggered by water temperatures between 9 and 12°C.

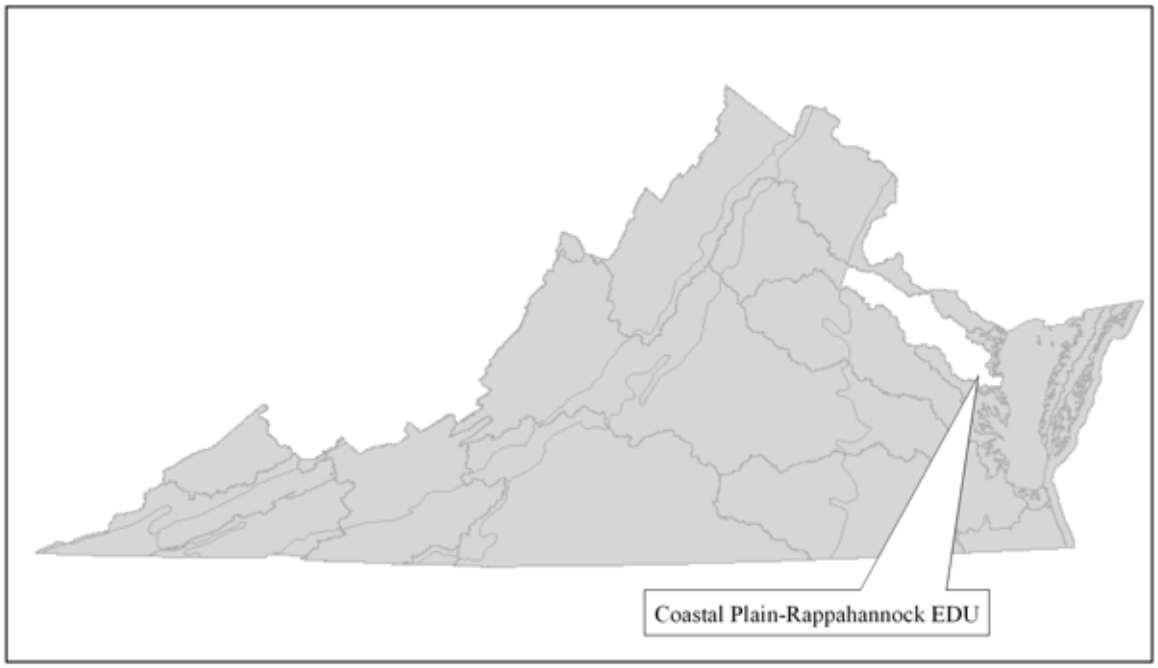

Figure 4.26. Location of the Coastal Plain-Rappahannock EDU.

Location

The map of shortnose sturgeon habitat (Figure 4.27) includes confirmed reaches based on Collections (DGIF 2004b). Because there is only one confirmed reach in this drainage we did not map potential habitat.

Description of Essential Habitat

As a migratory species, the shortnose sturgeon requires access to non-tidal freshwater areas to spawn and estuarine and sometimes marine habitats for the remaining life history stages (Table 4.35). Though the exact bottom type required for spawning varies across its range, it is typically gravel, pebble, or cobble substrate (NMFS 1998). Most populations spawn in main channels or swift moving sections of river, though unusually high water can interrupt spawning.

Table 4.35. DGIF aquatic habitat types used by the shortnose sturgeon in the Coastal Plain-Rappahannock EDU.

Aquatic Habitat Type	Number of Reaches
Very low gradient large river connected to the Chesapeake Bay	1

Relative Condition of Habitat

Because of the limited data on occurrences in Virginia, an assessment of habitat quality was not appropriate. However, as mentioned above, most of the Chesapeake Bay and its associated tidal tributaries are impaired (DEQ and DCR 2004).

Specific Threats and Trends

Pollution, dams, and overharvesting have contributed to the decline of the shortnose sturgeon (Jenkins and Burkhead 1994). Instream construction projects, dredging, and introduced species such as blue and flathead catfish may also contribute to the decline of this species (NMFS 1998). Nearly all estuarine habitat under

Figure 4.27. Confirmed habitat for the shortnose sturgeon in the Coastal Plain-Rappahannock EDU.

Virginia's jurisdiction is impaired (DEQ and DCR 2004). Fish TAC (2004) did not specifically indicate any threats to this species; however, they did provide a general list of stresses and sources of stress for species in the Rappahannock River drainage (Appendix H).

Conservation Actions and Strategies

Detailed conservation actions for recovery of the shortnose sturgeon have been developed by NMFS (1998). In general they refer to reducing impacts of commercial fishing (bycatch) and other anthropogenic stresses, restoring functional habitats for all life history stages, and assessing and implementing reintroduction/augmentation programs were appropriate. Fish TAC (2004) provided a suite of conservation actions for the Rappahannock River drainage, but nothing specific to this species (Appendix I).

Research and Monitoring Needs

Details on several monitoring needs for this species are provided by NMFS (1998). These include demographic studies including genetics, determination of minimum habitat requirements, and assessment of pollution impacts. Fish TAC (2004) provided some information on monitoring or research needs for the Rappahannock River drainage (Appendix J).

4.5.4.2. Aquatic SGCN by Habitat Group: Coastal Plain-Rappahannock EDU

There are 15 tiered species in the Coastal Plain-Rappahannock EDU. Nine are fish, and six are mussels. Only two habitat groups were identified in this EDU (Tables 4.36-4.37). Several species in this EDU are either generalists or have insufficiently known habitat needs (Table 4.38).

Table 4.36. Aquatic species of greatest conservation need with migratory habits. These species use a range of habitats from large tidal rivers to small streams.

Common Name	Scientific Name	Tier
Shortnose sturgeon	*Acipenser brevirostrum*	I
Atlantic sturgeon	*Acipenser oxyrhynchus*	II

Common Name	Scientific Name	Tier
Alewife	*Alosa pseudoharengus*	IV
American shad	*Alosa sapidissima*	IV
American eel	*Anguilla rostrata*	IV

Table 4.37. Aquatic species of greatest conservation need in headwater and small streams with very low or low gradient (DGIF aquatic classification types 111(w), 112(w), 122(w), 221(w), 222(w)).

Common Name	Scientific Name	Tier	Percent Occurrences in This Habitat Group	Number of DGIF Aquatic Classification Types Used
Mud sunfish	*Acantharchus pomotis*	IV	95	8
Least brook lamprey	*Lampetra aepyptera*	IV	96	9

Table 4.38. Aquatic species of greatest conservation need: generalists and those with unknown habitat requirements based on DGIF habitat classification.

Common Name	Scientific Name	Tier	Number of DGIF Aquatic Classification Types Used
Bridle shiner	*Notropis bifrenatus*	I	NA
Dwarf wedgemussel	*Alasmidonta heterodon*	II	NA
Green floater	*Lasmigona subviridis*	II	NA
Yellow lance	*Elliptio lanceolata*	III	NA
Triangle floater	*Alasmidonta undulate*	IV	NA
Carolina lance mussel	*Elliptio angustata*	IV	NA
Northern lance mussel	*Elliptio fisheriana*	IV	1
American brook lamprey	*Lampetra appendix*	IV	NA

4.5.4.2.1. Relative Condition of Habitat

Approximately 216km, or 9%, of the riverine habitat in this EDU are impaired (DEQ and DCR 2004). The vast majority of impairments are for pH from natural conditions. A few waters are listed for fecal coliform from unknown sources.

Approximately 24% of the land cover in this EDU is under agricultural use, and less than 2% is considered developed (USGS 2001). Across EDUs statewide, agricultural land cover ranges from 2 to 41%, and developed land use ranges from 0.4 to 15% (USGS 1992).

Threats, conservation actions, and research and monitoring needs for the Tier II through Tier IV species are available in Appendices H, I, and J. Mussel TAC (2004) and Fish TAC (2004) provided this information within habitat groups selected at the workshops. The level of detail within these groups do not correspond to that used in the DGIF aquatic habitat classification.

4.5.5. Coastal Plain-Potomac EDU

The Potomac River drainage covers a large area encompassing parts of Pennsylvania, Maryland, Virginia, and West Virginia. The watershed drains the Ridge and Valley, Blue Ridge, Piedmont, and the Coastal Plain. Several tributaries of the middle Potomac drain the eastern front of the Blue Ridge. The fall line, which occurs at the break between the Piedmont and Coastal Plain, is a natural barrier to most migratory fish. The Coastal Plain-Potomac EDU (Figure 4.28) is found within the Chesapeake Bay freshwater ecoregion (Abell et al. 2000). As its name implies, this ecoregion encompasses all of the drainages of the Chesapeake Bay. This freshwater ecoregion supports four endemic mussel species and seven endemic fish

species, including roughhead shiner *Notropis semperasper*, found only in the headwaters of the James River. It is also home to several migratory fish, including American shad *Alosa sapidissima*, alewife *A. pseudoharengus*, and American eel *Anguilla rostrata*. Abell et al. (2000) list the Chesapeake Bay freshwater ecoregion as "continentally outstanding" in terms of biological distinctiveness.

4.5.5.1. Tier I Species in the Coastal Plain-Potomac EDU

4.5.5.1.1. Shortnose sturgeon, *Acipenser brevirostrum*

Life History Summary

This species may be essentially extirpated from Virginia waters (Jenkins and Burkhead 1994). There are no known populations from any of the Chesapeake Bay tributaries. Only a few individual collections have been recorded in recent years. There is no evidence of a reproducing population in Virginia (Fish TAC 2004). Nineteen population segments are recognized for this species in the U.S.; he Chesapeake Bay/Potomac River is the only one specific to Virginia (NMFS 1998). The shortnose sturgeon has a disjunct distribution across its range. According to Kynard (1997) there are no known populations between the Delaware River, New Jersey, and the Cape Fear River, North Carolina. It is likely that the sturgeon inhabited all of the waters in between these populations historically (Dadswell et al. 1984). This species is legally protected with the status of Federal and State endangered.

The shortnose sturgeon has been described as an opportunistic benthic forager. In fresh water, juveniles will prey upon insect larvae and small crustaceans, while adults will also feed on mollusks (Dadswell 1979; Dadswell et al. 1984). Shortnose sturgeon largely remain in freshwater and estuarine habitats close to natal waters without much movement into truly marine habitats. This will make natural recolonization of historic habitats a slow process (Kynard 1997).

Several researchers have noted latitudinal differences in growth, spawning and anadromy (Dadswell et al. 1984; Kynard 1997). Age at maturity ranges from 2-6yr in Georgia to 10-13yr in St. John's River, Canada. First spawning occurs between 1-16 years after maturity with a typical hiatus of 1-3 years between

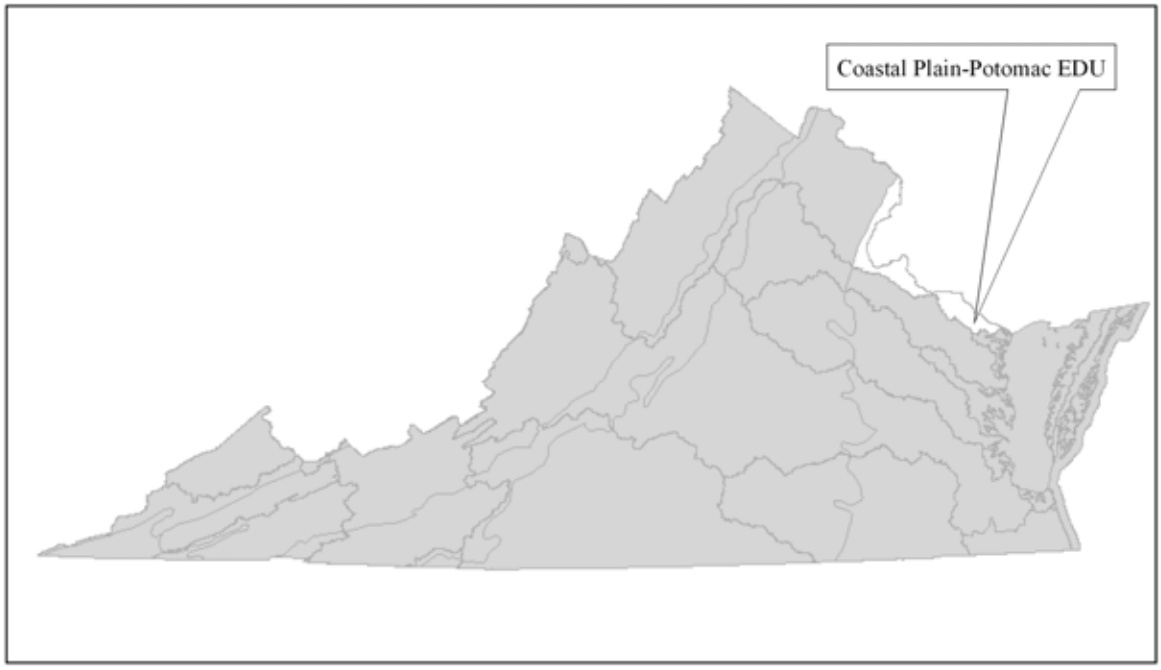

Figure 4.28. Location of the Coastal Plain-Potomac EDU.

spawnings. Spawning occurs in freshwater, typically above tidal influence in areas with swift current and gravel or pebble bottom (Dadswell et al. 1984). Spawning is triggered by water temperatures of 9 - 12°C.

Location

The map of shortnose sturgeon habitat (Figure 4.29) includes confirmed reaches based on information provided by the USFWS (M. Mangold, USFWS, unpubl. data).

Description of Essential Habitat

As a migratory species, the shortnose sturgeon requires access to non-tidal freshwater areas to spawn (Table 4.39) and estuarine and sometimes marine habitats for the remaining life history stages. Though the exact bottom type required for spawning varies across its range, it is typically gravel, pebble, or cobble substrate (NMFS 1998). Most populations spawn in main channels or swift moving sections of river, though unusually high water can interrupt spawning.

Table 4.39. DGIF aquatic habitat types used by the shortnose sturgeon in the Coastal Plain-Potomac EDU.

Aquatic Habitat Type	Number of Reaches
Very low gradient small stream connected to a large river	2
Very low gradient large river connected to the Chesapeake Bay	1

Relative Condition of Habitat

Because of the limited data on occurrences in Virginia and their migratory nature, an assessment of habitat quality was not appropriate. However, as mentioned above, most of the Chesapeake Bay and its associated tidal tributaries are impaired (DEQ and DCR 2004).

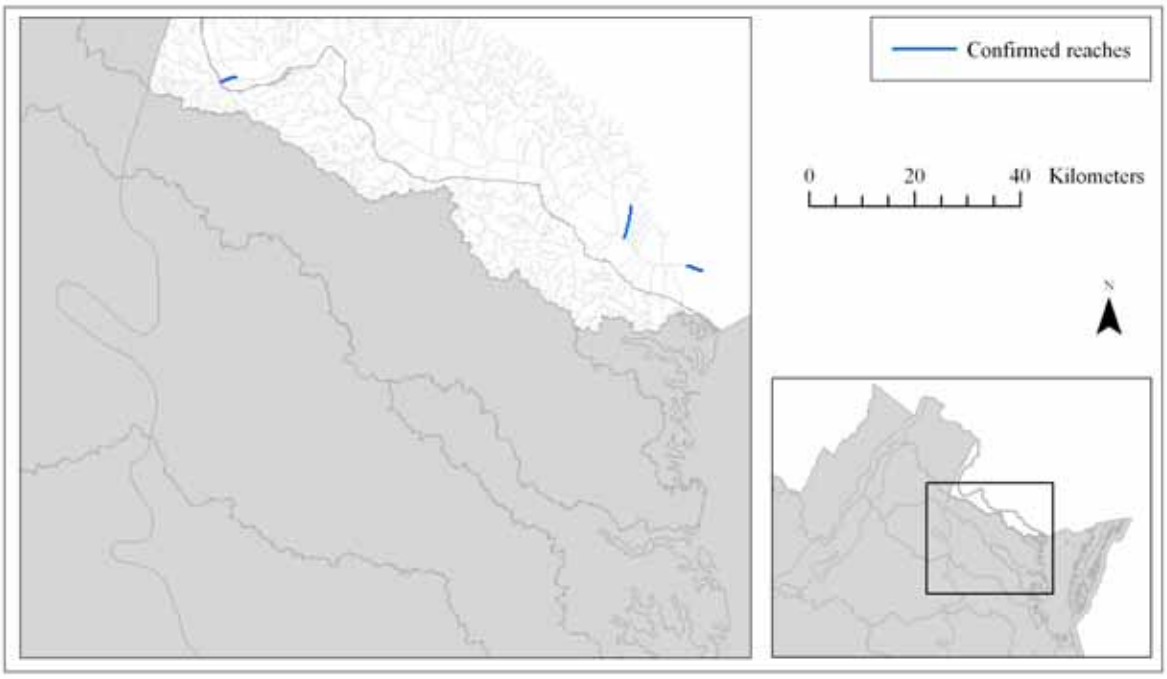

*Figure 4.29. S*shortnose sturgeon records in the Coastal Plain-Potomac EDU. Records at the mouth and in the Maryland tributary were provided by the M. Mangold, USFWS-Annapolis office (unpubl. data).

Specific Threats and Trends

Pollution, dams, and overharvesting have contributed to the decline of the shortnose sturgeon (Jenkins and Burkhead 1994). Instream construction projects, dredging, and introduced species such as blue and flathead catfish may also contribute to the decline of this species (NMFS 1998). Nearly all the estuarine habitat under Virginia's jurisdiction is impaired (DEQ and DCR 2004). Fish TAC (2004) did not specifically indicate any threats to this species; however, they did provide a general list of stresses and sources of stress for species in the Potomac River drainage (Appendix H).

Conservation Actions and Strategies

Detailed conservation actions for recovery of the shortnose sturgeon have been developed by NMFS (1998). In general, they refer to reducing impacts of commercial fishing (bycatch) and other anthropogenic stresses, restoring functional habitats for all life history stages, and assessing and implementing a reintroduction or augmentation program were appropriate. Fish TAC (2004) provided a suite of conservation actions for the Potomac River drainage, but nothing specific to this species (Appendix I).

Research and Monitoring Needs

Details on several monitoring needs for this species are listed in NMFS (1998). These include demographic studies including genetics, determination of minimum habitat requirements, and assessment of pollution impacts. Fish TAC (2004) provided some information on monitoring or research needs for the Potomac River drainage (Appendix J).

4.5.5.1.2. Bridle shiner, *Notropis bifrenatus*

Life History Summary

The bridle shiner is thought to be a sight predator. Main prey items include invertebrates associated with open water, plants, or benthos (Burkhead and Jenkins 1991). Spawning occurs primarily between mid-May and mid-June in pools over submerged aquatic vegetation. The bridle shiner has been designated a State special concern species.

Location

The map of bridle shiner habitat (Figure 4.30) includes confirmed reaches based on known locations in Collections (DGIF 2004b). We were not able to determine potential habitat for this species because of few confirmed reaches and the importance of aquatic vegetation, which we cannot identify with existing datasets.

Description of Essential Habitat

This is a slackwater shiner, found in quiet pools in streams and creeks (Table 4.40). It is also found in ponds and lakes, where it prefers slow current but not standing water. This species occurs over mud, silt or detritus-covered bottoms, usually in association with aquatic vegetation. It will rarely enter tidal fresh and brackish water (Jenkins and Burkhead 1994). Many upland and lowland records are from large marshes or marsh-fringed shores. In such areas, the bridle shiner's specific affiliation may be with submerged vegetation. It is a freshwater oligohaline fish with a propensity for clear water (Burkhead and Jenkins 1991). It tolerates salinity levels generally < 2ppt and is not believed to be acid tolerant, preferring water with pH > 7.0 (Jenkins and Burkhead 1994).

Relative Condition of Habitat

Approximately half of the known reaches in which the bridle shiner occurs are impaired (DEQ and DCR 2004). The causes of impairment are listed as "general benthic," meaning that the benthic macroinvertebrate population is diminished, and fecal coliform. Both are from unknown sources.

Figure 4.30. Locations of confirmed bridle shiner habitat in the Coastal Plain-Potomac EDU.

Table 4.40. DGIF aquatic habitat types used by the bridle shiner in the Coastal Plain-Potomac EDU.

Aquatic Habitat Type	Number of Reaches
Very low gradient small stream connected to another small stream	4
Low gradient headwater connected to another headwater	2
Moderate gradient headwater connected to another headwater	1
Very low gradient large river connected to another large river	1

Specific Threats and Trends

Burkhead and Jenkins (1991) list increased turbidity and sedimentation as the primary threats to this species. These stresses affect the sight feeding abilities of this species and reduce populations of submerged aquatic vegetation. Agricultural pollution may also be a threat to this species. Fish TAC (2004) did not identify any specific threats to the bridle shiner; however, stresses and sources of stress were identified for the Potomac River drainage (Appendix H).

Conservation Actions and Strategies

Fish TAC (2004) did not identify any specific conservation strategies for the bridle shiner; however, conservation actions were identified for the Potomac River drainage (Appendix I).

Research and Monitoring Needs

Burkhead and Jenkins (1991) recommend that the existing populations of the bridle shiner be monitored and that surveys be completed to determine the range of the species in Virginia. Research and monitoring needs were identified for the Potomac River drainage species group (Appendix J).

4.5.5.2. Aquatic SGCN by Habitat Group: Coastal Plain-Potomac EDU

There are 19 tiered species in the Coastal Plain-Potomac EDU: nine fish; eight mussels; and two snails. There was only one habitat group identified in this EDU (Table 4.41). This is a relatively small and urban EDU. Several species here are either generalists or have insufficiently known habitat needs (Table 4.42).

Table 4.41. Aquatic species of greatest conservation need with migratory habits. These species use a range of habitats from large tidal rivers to small streams.

Common Name	Scientific Name	Tier
Shortnose sturgeon	*Acipenser brevirostrum*	I
Atlantic sturgeon	*Acipenser oxyrhynchus*	II
Alewife	*Alosa pseudoharengus*	IV
American shad	*Alosa sapidissima*	IV
American eel	*Anguilla rostrata*	IV

Table 4.42. Aquatic species of greatest conservation need: generalists and those with unknown habitat requirements based on DGIF habitat classification.

Common Name	Scientific Name	Tier	Number of Types Used (DGIF Aquatic Classification)
Bridle shiner	*Notropis bifrenatus*	I	4 (8 occurrences)
Yellow lance	*Elliptio lanceolata*	III	NA
Yellow lampmussel	*Lampsilis cariosa*	III	NA
Triangle floater	*Alasmidonta undulata*	IV	NA
Alewife floater	*Amblema plicata*	IV	NA
Carolina lance mussel	*Elliptio angustata*	IV	NA
Northern lance mussel	*Elliptio fisheriana*	IV	NA
Oblong ancylid	*Ferrissia parallelus*	IV	NA
Least brook lamprey	*Lampetra aepyptera*	IV	2 (3 occurrences)
Tidewater mucket	*Leptodea ochracea*	IV	1 (1 occurrence)
Ridged lioplax	*Lioplax subcarinata*	IV	NA
Ironcolor shiner	*Notropis chalybaeus*	IV	1 (1 occurrence)
Logperch	*Percina caprodes semifasciata*	IV	1 (1 occurrence)
Creeper mussel	*Strophitus undulatus*	IV	NA

4.5.5.2.1. Relative Condition of Habitat

Approximately 10% (114km) of the riverine habitat in this EDU is impaired (DEQ and DCR 2004). The causes for listing are mostly fecal coliform from unknown sources and pH from natural condition. About 10% of the land cover in this EDU is developed. Agriculture accounts for 21% of the land cover (USGS 2001). Across EDUs statewide, agricultural land cover ranges from 2 to 41%, and developed land use ranges from 0.4 to 15% (USGS 1992).

Threats, conservation actions, and research and monitoring needs for the Tier II through Tier IV species are available in Appendices H, I, and J. Mussel TAC (2004) and Fish TAC (2004) provided this information within habitat groups selected at the workshops. The level of detail within these groups do not correspond to that used in the DGIF aquatic habitat classification.

4.5.6. Coastal Plain-Delmarva EDU

The Coastal Plain-Delmarva EDU (Figure 4.31) is found within the Chesapeake Bay freshwater ecoregion (Abell et al. 2000). However, it drains to both the Bay and the Atlantic Ocean. This freshwater ecoregion supports four endemic mussel species and seven endemic fish species, including roughhead shiner *Notropis semperasper*, found only in the headwaters of the James River. It is also home to several migratory fish, including American shad *Alosa sapidissima*, alewife *A. pseudoharengus*, and American eel *Anguilla rostrata*. Abell et al. (2000) list the Chesapeake Bay freshwater ecoregion as "continentally outstanding" in terms of biological distinctiveness. The Delmarva portion of this freshwater ecoregion contains relatively short streams with little spawning habitat for migratory fishes.

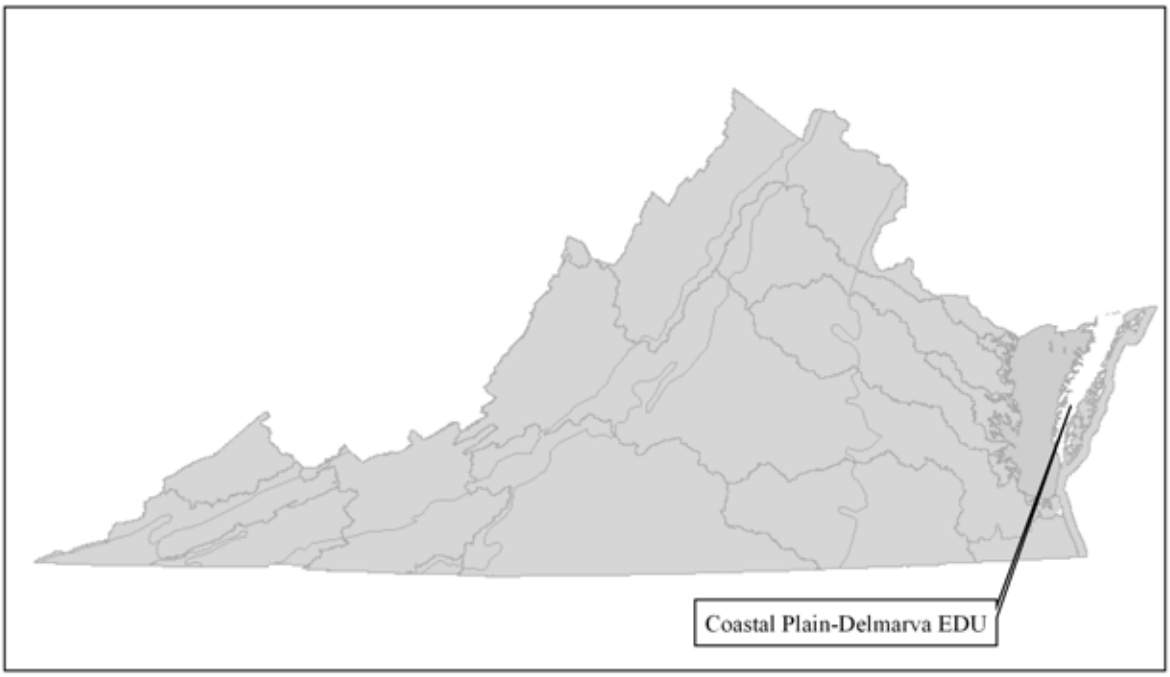

Figure 4.31. Location of the Coastal Plain-Delmarva EDU.

4.5.6.1. Tier I Species in the Coastal Plain-Delmarva EDU

There are no Tier I species in the Coastal Plain-Delmarva EDU.

4.5.6.2. Aquatic SGCN by Habitat Group: Coastal Plain-Delmarva EDU

There is little diversity in the aquatic habitats available and few tiered aquatic species on the Delmarva Peninsula. There also appears to be little survey work completed for this region. Therefore, we did not identify any aquatic habitat groups other than the migratory fishes for this EDU (Table 4.43). The remainder is listed in Table 4.44.

Table 4.43. Aquatic species of greatest conservation need with migratory habits. These species use a range of habitats.

Common Name	Scientific Name	Tier
Alewife	*Alosa pseudoharengus*	IV
American shad	*Alosa sapidissima*	IV
American eel	*Anguilla rostrata*	IV

Table 4.44. Aquatic species of greatest conservation need: generalists and those with unknown habitat requirements based on DGIF habitat classification.

Common Name	Scientific Name	Tier	Number of DGIF Aquatic Classification Types Used
Least brook lamprey	*Lampetra aepyptera*	IV	2 (4 occurrences)

4.5.6.2.1. Relative Condition of Habitat

Just over 5% of the riverine habitat in this EDU (52km) is impaired (DEQ and DCR 2004). The causes of impairment are general standard (benthic) and fecal coliform from largely unknown sources. A point source was listed as the source of a few of the impairments, including general standard and copper.

Threats, conservation actions, and research and monitoring needs for the Tier II through Tier IV species are available in Appendices H, I, and J. Mussel TAC (2004) and Fish TAC (2004) provided this information within habitat groups selected at the workshops. The level of detail within these groups do not correspond to that used in the DGIF aquatic habitat classification.

4.5.7. Coastal Plain-Chesapeake Bay EDU

There are several short direct tributaries to the Chesapeake Bay that drain the mainland. The longest of these is the Piankatank drainage. The Coastal Plain-Chesapeake Bay EDU (Figure 4.32) is found within the Chesapeake Bay freshwater ecoregion (Abell et al. 2000). This freshwater ecoregion supports four endemic mussel species and seven endemic fish species, including roughhead shiner *Notropis semperasper*, found only in the headwaters of the James River. It is also home to several migratory fish, including American shad *Alosa sapidissima*, alewife *A. pseudoharengus*, and American eel *Anguilla rostrata*. Abell et al. (2000) list the Chesapeake Bay freshwater ecoregion as "continentally outstanding" in terms of biological distinctiveness.

4.5.7.1. Tier I Species in the Coastal Plain-Chesapeake Bay EDU

There are no Tier 1 species documented in the Coastal Plain-Chesapeake Bay EDU. Musick (VIMS, pers. comm.) reported that bridle shiner (*Notropis bifrenatus*) occurs in the Piankatank drainage; however, we currently do not have documented locations for this species.

4.5.7.2. Aquatic SGCN by Habitat Group: Coastal Plain-Chesapeake Bay EDU

This is one of the areas of Virginia for which the aquatic habitat classification was not completed (see Chapter 3). We did not identify any aquatic habitat groups other than the migratory fishes for this EDU (Table 4.45); the remainder appears in Table 4.46.

Table 4.45. Aquatic species of greatest conservation need with migratory habits. These species use a range of habitats.

Common Name	Scientific Name	Tier
Alewife	*Alosa pseudoharengus*	IV
American shad	*Alosa sapidissima*	IV
American eel	*Anguilla rostrata*	IV

Table 4.46. Aquatic species of greatest conservation need with unknown habitat requirements based on DGIF habitat classification.

Common Name	Scientific Name	Tier	Number of DGIF Aquatic Classification Types Used
Bridle shiner	*Notropis bifrenatus*	I	NA
Mud sunfish	*Acantharcus pomotis*	IV	NA
Banded sunfish	*Enneachanthus obesus*	IV	NA
Least brook lamprey	*Lampetra aepyptera*	IV	NA
Ironcolor shiner	*Notropis chalybaesus*	IV	NA

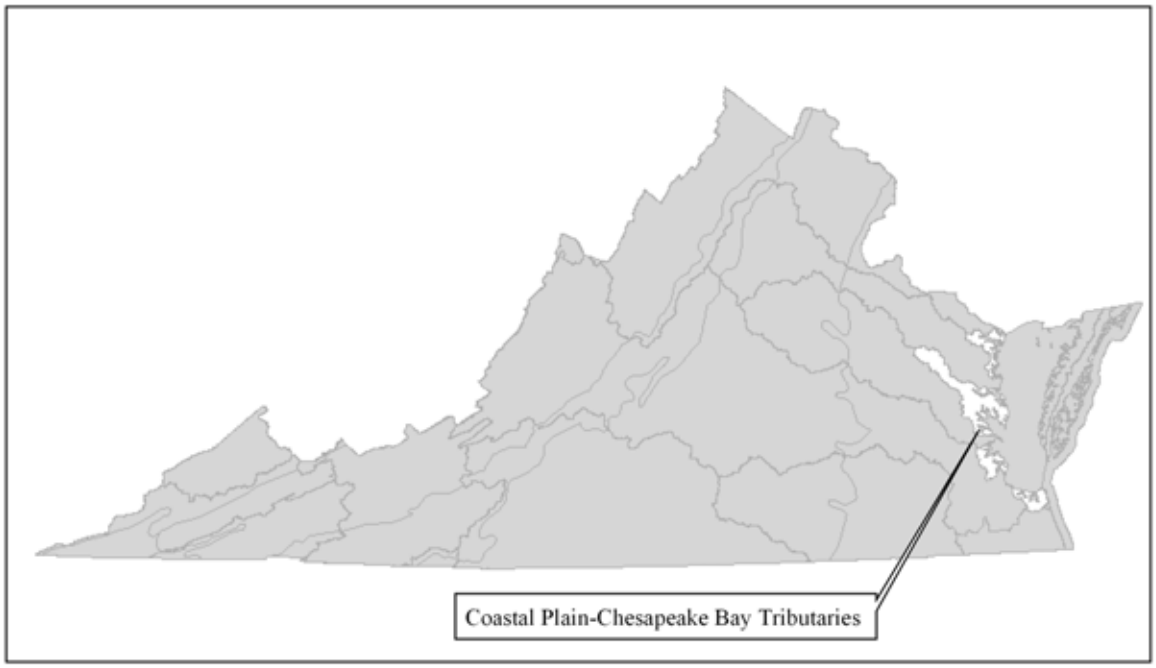

Figure 4.32. The location of the Coastal Plain-Chesapeake Bay tributaries EDU.

4.5.7.2.1. Relative Condition of Habitat

Just over 5% of the riverine habitat in this EDU is impaired (DEQ and DCR 2004). The causes of impairment are general standard (benthic) and fecal coliform from largely unknown sources. A point source was listed as the source of a few of the impairments, including general standard and copper.

Threats, conservation actions, and research and monitoring needs for the Tier II through Tier IV species are available in Appendices H, I, and J. Mussel TAC (2004) and Fish TAC (2004) provided this information within habitat groups selected at the workshops. The level of detail within these groups do not correspond to that used in the DGIF aquatic habitat classification.

4.5.8. Coastal Plain-Albemarle Sound EDU

This EDU drains far southeastern Virginia and empties into the Albemarle Sound in North Carolina (Figure 4.33). It includes Great Dismal Swamp NWR and Lake Drummond, one of two natural lakes in Virginia. This EDU also includes Back Bay and Northwest Landing River. There are extensive canals and ditches in this region, which complicated the application of the aquatic classification tools. Therefore, the classification for this region was not completed in time for this project.

The Coastal Plain-Albemarle EDU is part of the South Atlantic freshwater ecoregion, which is considered "globally outstanding" in terms of biological distinctiveness (Abell et al. 2000). The South Atlantic freshwater ecoregion is home to 48 endemic aquatic species, including fish, mussels, and amphibians.

4.5.8.1. Tier I Species in the Coastal Plain-Albemarle Sound EDU

There are no Tier 1 species documented in the Coastal Plain-Albemarle Sound EDU.

4.5.8.2. Aquatic SGCN by Habitat Group: Coastal Plain-Albemarle Sound EDU

This is one of the areas of Virginia for which the aquatic habitat classification was not completed (see Chapter 3). We did not identify any aquatic habitat groups other than the migratory fishes for this EDU (Table 4.47); the remaining tiered species appear in Table 4.48.

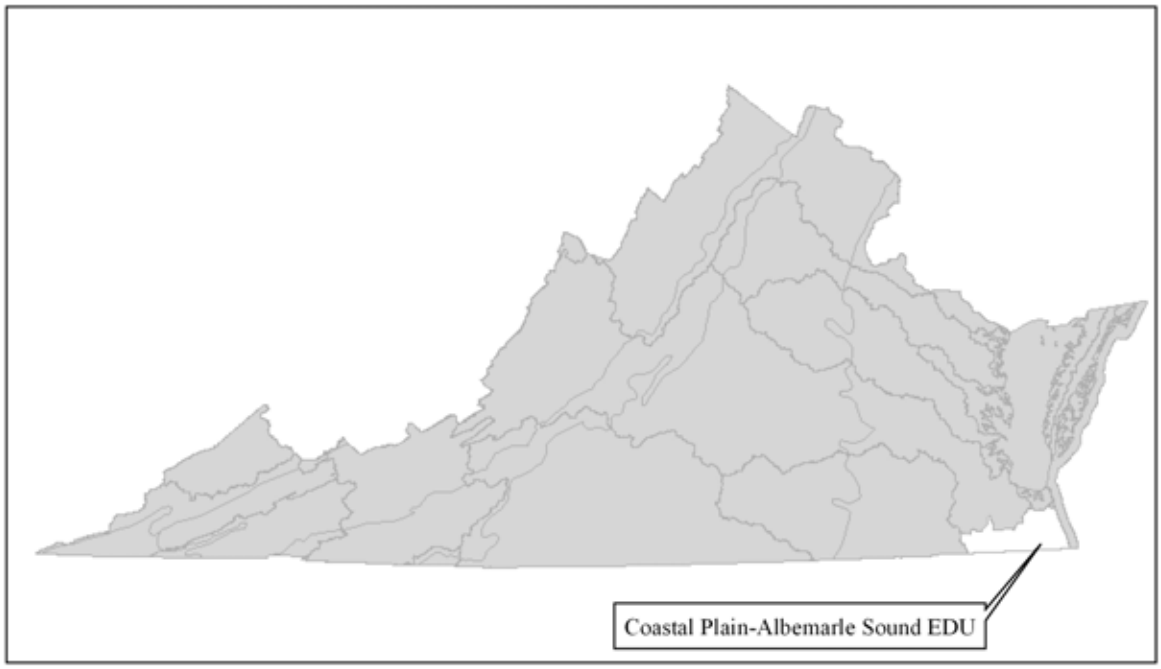

Figure 4.33. The location of the Coastal Plain-Albemarle Sound EDU.

Table 4.47. Aquatic species of greatest conservation need with migratory habits. These species use a range of habitats.

Common Name	Scientific Name	Tier
Alewife	*Alosa pseudoharengus*	IV
American shad	*Alosa sapidissima*	IV
American eel	*Anguilla rostrata*	IV

Table 4.48. Aquatic species of greatest conservation need with unknown habitat requirements based on DGIF aquatic habitat classification.

Common Name	Scientific Name	Tier	Number of DGIF Aquatic Classification Types Used
Mud sunfish	*Acantharcus pomotis*	IV	NA (24 records)
Swampfish	*Chologaster cornuta*	IV	NA (24 records)
Banded sunfish	*Enneachanthus obesus*	IV	NA (35 records)
Lake chubsucker	*Erimyzon sucetta*	IV	NA (3 records)

4.5.8.2.1. Relative Condition of Habitat

Over 160km of riverine habitat are impaired (DEQ and DCR 2004). Within this EDU, there is approximately 6% developed land use and 31% agricultural land use (USGS 2001). Across EDUs statewide, agricultural land cover ranges from 2 to 41%, and developed land use ranges from 0.4 to 15% (USGS 1992).

Threats, conservation actions, and research and monitoring needs for the Tier II through Tier IV species are available in Appendix H, I, and J. This EDU falls within the discussion of threats for the Chowan drainage (Fish TAC 2004; Mussel TAC 2004).

4.6. Subterranean Species in the Coastal Plain

4.6.1. Tier I Subterranean Species in the Coastal Plain

4.6.1.1. Phreatic isopod, *Caecidotea phreatica*

Life History Summary

Very little is known about this species. It inhabits groundwater pools and groundwater outlets, such as drain tiles, in the Hampton Roads area (DGIF 2004b; C. S. Hobson, DCR-NH, pers. comm.). This species has been designated a species of concern by the Virginia Field Office of USFWS.

Location

The map of phreatic isopod habitat (Figure 4.34) includes Conservation Sites only (DCR-NH 2005), because we are unable to depict the necessary habitat features (groundwater) for this species.

Description of Essential Habitat

Little is known about essential habitat for this species, but it is apparently restricted to shallow subterranean groundwaters in Coastal Plain sediments (J. R. Holsinger, ODU, pers. comm.).

Relative Condition of Habitat

There are three DCR-NH Conservation Sites with populations of phreatic isopod. None of these sites is within a Conservation Land, and none has a viability rating. Data reflecting the status of groundwater habitats are difficult to acquire.

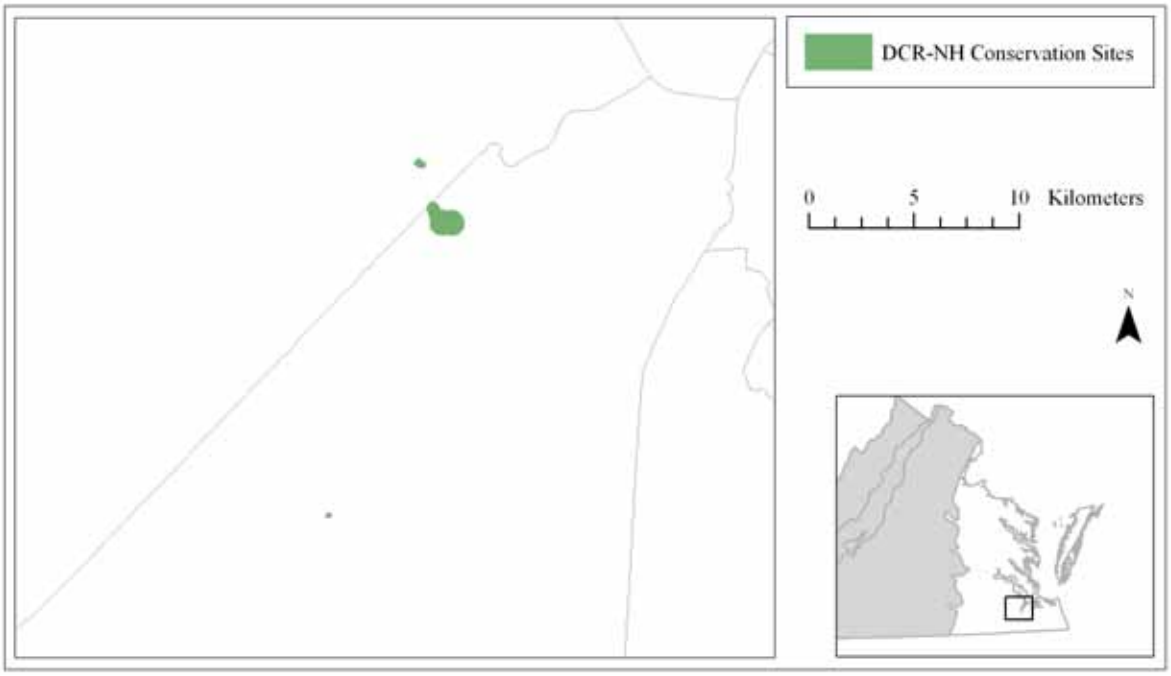

Figure 4.34. Distribution of the phreatic isopod in the Coastal Plain.

Specific Threats and Trends

No trend is known for this species (C. S. Hobson, DCR-NH, pers. comm.). Since it occurs in groundwater in an area that is one of the most heavily-populated areas of Virginia, as well as one of the fastest-growing, inferred threats may include water contamination/pollution and reduction of groundwater for human use.

Conservation Actions and Strategies

None are known at this time.

Research and Monitoring Needs

Since very little is known about this species, most aspects of its life history and distribution need to be investigated.

4.6.1.2. Lancaster County amphipod, *Crangonyx baculispina*

Life History Summary

The Lancaster County amphipod is a groundwater species. Beyond that, very little is known about this species. It is listed as *Crangonyx* sp. 5 in NatureServe (2004).

Location

No specific locations are known.

Description of Essential Habitat

Not much is known about essential habitat characteristics for this species, but it seems to have adapted to superficial groundwater habitats, as it is recorded from seeps, shallow wells and swamps (J. R. Holsinger, ODU, pers. comm.).

Relative Condition of Habitat

This species is known only from one collection at a shallow hand dug well in Lancaster county, which may have been destroyed by residential development (C. S. Hobson, DCR-NH, pers. comm.).

Specific Threats and Trends

No trend or specific threats are known for this species (C. S. Hobson, DCR-NH, pers. comm.).

Conservation Actions and Strategies

None are known at this time. However, groundwater protection and protection of specific sites where this species is confirmed in the future are important.

Research and Monitoring Needs

Very little is known about this species; any information on its distribution or life history would be useful.

4.6.1.3. Northern Virginia well amphipod, *Stygobromus phreaticus*

Life History and Essential Habitat Summary

Little is known about this species. It is a phreatobite, known only from three locations: a seep on Fort Belvoir, and two hand-dug wells in northern Virginia (C. S. Hobson, DCR-NH, pers. comm.). These wells

are historic locations (samples from them are dated 1921 and 1948), and scientists attempting to confirm the species in them have not been able to find the wells. This species has been designated a species of concern by the Virginia Field Office of USFWS.

Location of Confirmed Habitat

The map of locations (Figure 4.35) for the northern Virginia well amphipod consists of one Conservation Site (DCR-NH 2005). We do not know enough to identify and depict potential habitat for this species.

Description of Habitat Requirements

This species is only known from extreme northeastern Virginia, including Fairfax County and the City of Alexandria. It is known only from the Middle Potomac-Anacostia-Occoquan (02070010) watershed (Fitzpatrick 1983; NatureServe 2004). It has been recorded from well water in two localities and from a groundwater seep in a deep ravine. Essential habitat is apparently relatively deep groundwater aquifers (J. R. Holsinger, ODU, pers. comm.).

Relative Condition of Habitat

There is only one DCR-NH Conservation Site representing the Northern Virginia well amphipod. This site si located within Fort Belvoir Military Reservation. The occurrence is rated as having "fair-to-poor" viability. The seep location is badly eroded, and neither of the two historic well locations can be located (Holsinger 1991; C. S. Hobson, DCR-NH, pers. comm.).

Specific Threats and Trends

The trend for this species is likely declining, as the two well locations are historic and presumed lost (C. S. Hobson, DCR-NH, pers. comm.). Holsinger (1991) reports that the species is likely extinct, but this report apparently predates finding the species at the Fort Belvoir location.

Figure 4.35. Distribution of the northern Virginia well amphipod in the Coastal Plain.

Conservation Actions and Strategies

Surveys of groundwater seeps in the areas from which this species has been confirmed may unearth additional locations. If any individuals are found, habitat in that area should be protected (Holsinger 1979).

Research and Monitoring Needs

Simply finding this species extant would be considered important. If a population is found, careful monitoring and searches in adjacent areas for additional populations would be warranted.

4.6.2.1. Species of Greatest Conservation Need by Subterranean Habitat Type

All seven tiered species in subterranean habitats in the Coastal Plain occur in groundwater (there are no cave species of greatest conservation need in the Coastal Plain) (Table 4.49).

Table 4.49. Groundwater species of greatest conservation need in the Coastal Plain.

Common Name	Scientific Name	Tier	Special Habitat Needs
Phreatic isopod	*Caecidotea phreatica*	I	Shallow groundwater
Lancaster County amphipod	*Crangonyx baculispina*	I	Superficial groundwater
Northern Virginia well amphipod	*Stygobromus phreaticus*	I	Hand-dug wells and one seep
Holsinger's groundwater planarian	*Sphalloplana holsingeri*	II	Groundwater; otherwise unknown
Bigger's groundwater planarian	*Sphalloplana subtilis*	II	Groundwater; otherwise unknown
Rock Creek groundwater amphipod	*Stygobromus kenki*	II	Seeps and springs around Rock Creek Park
Tidewater interstitial amphipod	*Stygobromus araeus*	III	Seeps and springs, southeast Virginia
Tidewater amphipod	*Stygobromus indentatus*	III	Seeps and springs in Coastal Plain

4.6.2.2. Status of Subterranean Habitats

The status of these habitats is very difficult to ascertain, and so is not available at an ecoregional scale. For statewide status and trends of subterranean habitats, see Section 3.2.5.

4.7. Overview of Tier I Species Habitat in the Coastal Plain

To highlight geographic areas that are likely important for one or more Tier I species, potential and confirmed habitats for Tier I terrestrial, aquatic, and subterranean species were overlaid in one map (see Figure 4.34). Please note that potential habitat for many Tier I species could not be mapped and that areas containing habitat for only one or a few Tier I species are important for conservation. However, areas with a higher density of Tier I habitat may represent extraordinary conservation opportunities.

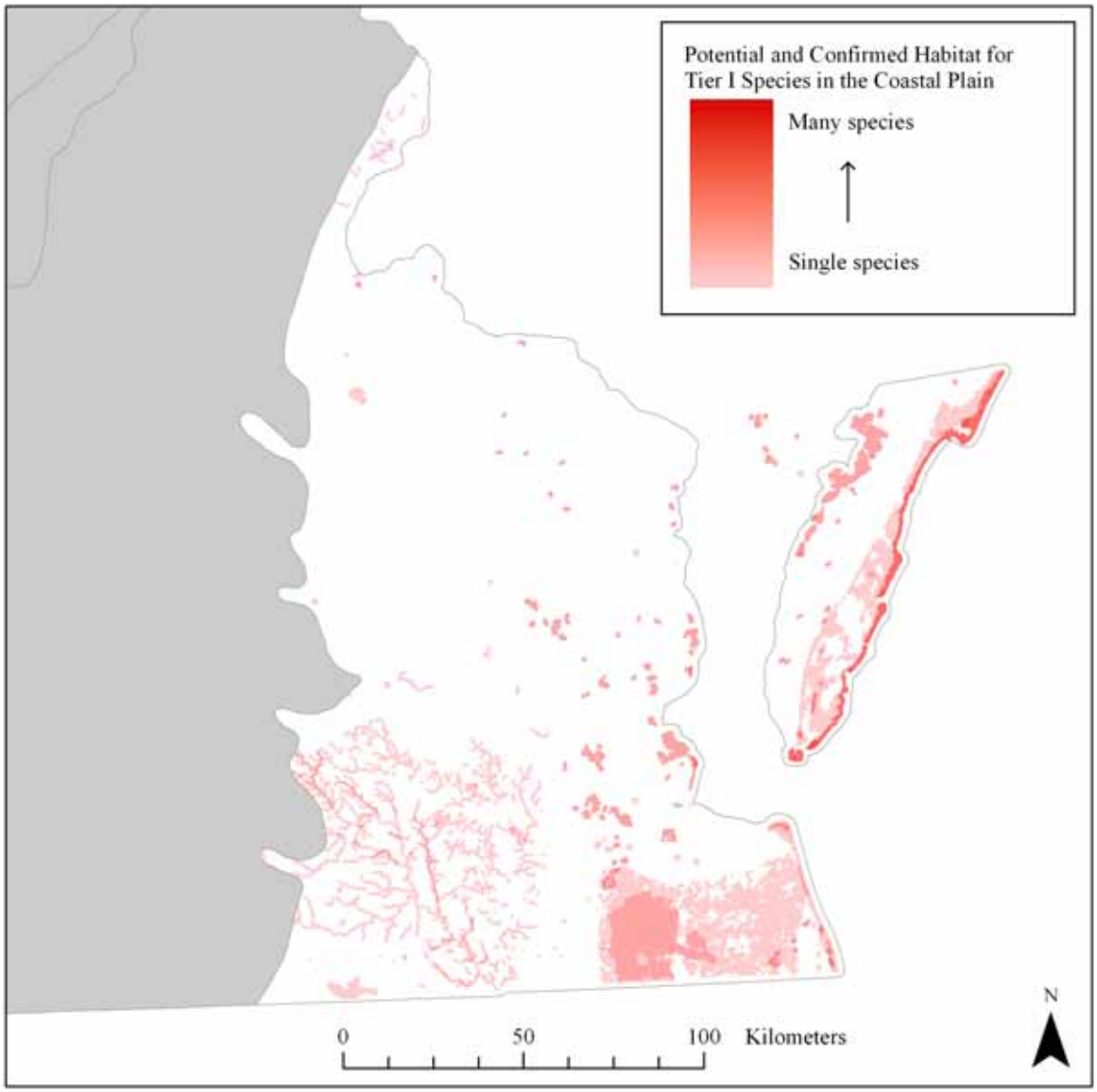

Figure 4.36. Potential and confirmed habitat for Tier I species in the Coastal Plain. Darker shades represent areas with a higher co-occurrence of these habitats.

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