ERDC/EL TR-22-15

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Birds of the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020

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September 2022

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Prepared for US Army Corps of Engineers
Washington, DC 20314-1000

Under Funding Account Code U4372823
AMSCO Code 086000

Abstract

This report presents the results of a long-term trend analyses of seasonal bird community data from a monitoring effort conducted on the Craney Island Dredged Material Management Area (CIDMMA) from 2008 to 2020, Portsmouth, VA. The USACE Richmond District collaborated with the College of William and Mary and the Coastal Virginia Wildlife Observatory, Waterbird Team, to conduct year-round semimonthly area counts of the CIDMMA to examine species presence and population changes overtime. This effort provides information on the importance of the area to numerous bird species and bird species' groups and provides an index to those species and group showing significant changes in populations during the monitoring period. We identified those species regionally identified as Highest, High, and Moderate Priority Species based on their status as rare, sensitive, or in need of conservation attention as identified by the Atlantic Coast Joint Venture (ACJV), Bird Conservation Region (BCR), New England/Mid-Atlantic Bird Conservation Area (BCR 30). Of 134 ranked priority species in the region, the CIDMMA supported 102 of 134 (76%) recognized in the BCR, including 16 of 19 (84%) of Highest priority ranked species, 47 of 60 (78.3%) of High priority species, and 39 of 55 (71%) of Moderate priority species for BCR 30. All bird count and species richness data collected were fitted to a negative binomial (mean abundance) or Poisson distribution (mean species richness) and a total of 271 species and over 1.5 million birds were detected during the monitoring period. Most all bird species and species groups showed stable or increasing trends during the monitoring period. These results indicate that the CIDMMA is an important site that supports numerous avian species of local and regional conservation concern throughout the year.

Contents

Figures and Tables

Figures

Tables

Preface

This technical report (TR) was funded by the Dredging Operations Technical Support (DOTS) program, Dr. Burton Suedel, Program Manager; Funding Account Code U4372823, AMSCO Code 086000. Portions of the fieldwork were funded by the US Army Corps of Engineers, Norfolk District. This TR was completed by the Ecological Resources Branch (ERB) of the Ecosystem Evaluation and Engineering Division of the US Army Engineer Research and Development Center - Environmental Laboratory (ERDC-EL-EEE). At the time of publication, Mr. Joey Minter was Chief, ERB; and Dr. Mark Farr was Division Chief, EEE. The Deputy Director of ERDC-EL was Dr. Brandon Lafferty, and the Director was Dr. Edmond J. Russo, Jr.

COL Christian Patterson was Commander of ERDC, and Dr. David W. Pittman was the Director of ERDC.

This work represents more than 2,600 hours of observations by Ruth A. Beck, Bill Williams and the Waterbird Team of the Coastal Virginia Wildlife Observatory and others on 403 days in the field from May 2008 to August 2020. This report is dedicated to the life and career of Ruth A. Beck, who passed in 2015. During her tenure as a professor at the College of William and Mary, Williamsburg, VA, she, and her graduate students dedicated much of their time and effort to monitor and study the bird communities on the Craney Island Dredged Material Area (CIDMMA). It is due to her efforts that these data have been collected and made available for this report. Since Ruth's May 2015 passing, CIDMMA has been monitored weekly (weather permitting) by members of the Coastal Virginia Wildlife Observatory's Waterbird Team at their own expense. Those team members include Bill Williams (Team Leader), Robert Ake, Edward S. Brinkley, Andrew Hawkins, Alex Minarik, Lee Schuster, Brian Taber, and David Youker.

Executive Summary

This study compiled and analyzed data from regularly conducted bird community surveys performed largely by the Coastal Virginia Wildlife Observatory's Waterbird Team from May 2008 to August 2020 on the Craney Island Dredged Material Management Area (CIDMMA), Portsmouth, Virginia. Preliminary statistical analyses of population trend results are provided from seasonal monitoring of the bird communities using the CIDMMA. The Craney Island facility is a confined disposal facility (CDF), located at the confluence of the James and Elizabeth Rivers, near Hampton Roads, VA. This facility is approximately 2,500 acres (1,011 ha) and receives dredged material from US Army Corps of Engineers (USACE) maintenance dredging operations and new work in the Norfolk Harbor and adjacent waters. These maintenance operations stem from the construction and maintenance actions of private interests, municipalities, and government agencies on the federal navigation channels and overall maintenance and improvement for the US Navy and the Virginia Port Authority facilities. The Craney Island facility possesses approximately 8 miles (12.8 km) of primary containment dikes and 6 miles (9.7 km) of shoreline consisting of beaches, marshes, and hardened sections. The area is accessible through a perimeter road where the containment dikes meet the mainland.

To extend the life of the facility, the area was divided into three large subcontainment cells, where each alternatively receives dredged material on an annual basis. The dredged material is disposed into to the cells from the eastside of the facility by use of hydraulic pipelines from a cutterhead dredge. The dredged material is in a slurry form as deposited and moves from the east to the west side of a cell, where the sediment separates from fine-grained to course-grained material. As a result, large sandy berms form on sections of the cell, and lower portions of the cell maintain a shallow water depth with associated mud and sandy flats. In cells not receiving dredged material, heavy equipment is used to repurpose the dredged material for building and enhancing the perimeter containment dikes to increase capacity of a cell to receive continued dredged material for subsequent years.

It was soon recognized that the various open sandy, wetland, and mudflat habitats in the facility were attracting large numbers and species of coastal birds for use as foraging, roosting, and nesting sites. Spring and summer

bird communities were surveyed, and nesting birds were monitored during the nesting season from 1975 to the present. In 2012, a Long-Term Bird Management Plan (LTBMP) was drafted for implementation; however, adoption of the plan has not been formalized by the USACE Norfolk District. Many of the specific elements in the LTBMP have been ongoing since before the plan was written and continue to be implemented to this day. Specific elements of the plan include (1) continued regularly performed monitoring of the four seasons' (winter, spring, summer, and fall) bird communities occurring at least semimonthly, (2) monitoring of dredged material deposition operations and construction actions to ensure that nesting birds are not disturbed nor that eggs or nests are lost during these actions, (3) monitoring and management of water levels to ensure proper water depths for migrating shorebirds and overwintering waterfowl, (4) when necessary, predator control and management actions may be employed to promote successful nesting by birds, and (5) management and monitoring of road maintenance, and onsite mowing actions to ensure minimal or no birds or nests are disturbed or lost.

In this report, monitoring efforts are documented to have detected 271 species, including species with documented counts suitable for initial trend analyses. Total counts of these 271 species were greater than 1.5 million birds over the monitoring period. We focused results on those species regionally identified as Highest, High, and Moderate Priority Species based on their status as rare, sensitive, or in need of conservation attention as identified by the Atlantic Coast Joint Venture (ACJV), Bird Conservation Region (BCR), New England/Mid-Atlantic Bird Conservation Area (BCR 30). Of 134 ranked priority species in the region, the CIDMMA supported 102 of 134 (76%) recognized in the BCR, including 16 of 19 (84%) of Highest priority ranked species, 47 of 60 (78.3%) of High priority species, and 39 of 55 (71%) of Moderate priority species for BCR 30. These results indicate that the CIDMMA is an important site that supports numerous avian species of local and regional conservation concern throughout the year.

In addition, we provide preliminary results of seasonal mean abundance and species richness trend analyses. A more formal analyses for a future report or manuscript is planned. From this analyses, most all individual species showed stable non-significantly increasing or decreasing mean abundance trends. Increases in all seasons for the American Avocet, and for the Ring-billed Gull during the winter and spring are noticeable

exceptions. Similarly, significant decreases in mean abundance trends documented for the Black Tern and Least Sandpiper during the fall, and *Calidris* ssp. during the winter are also exceptions. Mean species richness increased significantly during the monitoring period for most groups, except decreases for shorebirds during the winter and thrush species during the fall; no changes occurred for woodpeckers during any season. In general, these results show that the Craney Island facility is important for attracting and maintaining stable seasonal populations for a wide diversity of local and regional avian species, including many Highest, High, and Moderate Priority Species in the New England/Mid-Atlantic Bird Conservation Region.

1 Introduction

1.1 Background

The US Army Corps of Engineers (USACE) is responsible for maintaining our coastal infrastructure, including ports, harbors, and shoreline stabilization features; and for maintaining the Intracoastal Waterway System (ICWW) (Environmental Protection Agency [EPA]/USACE 2007, Guilfoyle et al. 2019). Dredging operations are used regularly to maintain depths of navigation channel, ports and harbors sufficient to support international and national commerce. Natural coastal sedimentation processes are altered by maintenance dredging and shoreline armoring, both of which may reduce natural formation of coastal habitats, including beaches, sand spits, mud flats, marshes, and other wetland habitats (Guilfoyle et al. 2019). These changes can reduce or degrade important coastal habitat for local and regional floral and faunal species. In addition, maintenance dredging operations can yield significant amounts of sediment material that must be disposed locally, or at nearshore or offshore deposition sites. Dredged material from ports, harbors, and navigation channels can be deposited in confined disposal facilities (CDFs) that can also be managed to support seasonal bird communities (Guilfoyle et al. 2020a, b). Moreover, dredged material from ports and harbors in large urban areas may also be contaminated by urban and industrial pollutants, including heavy metals and other toxic chemicals used in industrial processes. Deposition of contaminated dredged material in CDFs is often required to reduce exposure to the human and wildlife populations and are designed to minimize contaminated discharge into the local environment (USACE and the EPA 2003).

Beneficial uses of dredged material for habitat and wetland creation often target improved habitat conditions for coastal and inland waterbirds and comprise an established feature of the USACE dredging operations program (Soots and Landin 1978; Fischer et al. 2004, 2010; Guilfoyle et al. 2006, 2007). Engineering operations providing environmental and other benefits are consistent with the USACE Engineering With Nature (EWN®) initiative, which seeks to integrate infrastructure development and environmental enhancements to advance science and engineering practices within the USACE (Banks et al. 2013; Bridges et al. 2018; Guilfoyle et al. 2020a).

Engineering operations and the use of dredged material to create habitat for native floral and faunal species have often been combined to mitigate the loss of habitat resulting from coastal engineering projects. However, the USACE can be proactive, as with the Craney Island facility, to provide environmental and other benefits through regular infrastructure maintenance activities (Bridges et al. 2018; Guilfoyle et al. 2020a). On the CIDMMA, a specific Long-term Bird Management Plan (Beck 2012) was developed to promote habitat for seasonal avian species, including many breeding species in the region. On the USACE Savannah District operations on the Savannah Harbor Navigation Project (SHNP), Dredged Material Containment Areas (DMCAs), the effort to ensure sufficient habitat for seasonal and nesting birds, provides a similar framework for the consistent availability of critical open water, sandy berms, wetland, and mudflat habitats for seasonal waterbirds (Calver et al. 2016; Guilfoyle et al. 2020a, b).

Urban and industrial ports and harbors often have significant impacts on the availability of coastal habitats, including open sandy beach, fresh and saltwater marshes, nondegraded estuaries, sand spits and extend mudflats. Such habitats are usually lost or degraded by large-scale changes from urban and industrial expansion and development, accumulated waste and pollution, sea-level rise, global climate change, and the modification of natural sedimentation processes that serve to shift sediment away from navigation channels. However, ecosystem restoration and mitigation actions are often limited in their application since results of these actions are not reported or evaluated outside of government bureaucracy and literature. Future efforts should work to include long-term monitoring of restoration and management plans and document success and limitations of these efforts (Calver et al. 2016; Guilfoyle 2019, 2020b).

In this effort, the circumstances of the SHNP DMCAs and the CIDMMA have numerous similarities. Both facilities have initiated long-term management plans to improve habitats for seasonal coastal waterbirds (and other birds) and both have made efforts to share their data and document the year-round benefits their actions have on local and regional birds of conservation concern (e.g., Calver et al. 2016; Guilfoyle et al. 2020a, b). This report serves to introduce issues, management actions, and current knowledge on the relative abundance, richness, and seasonal trends of bird communities on the CIDMMA in much the same way that

Calver et al. (2016) introduces management and monitoring of bird communities on the SHNP DMCAs.

1.2 National initiatives

1.2.1 The North American Bird Conservation Initiative

The North American Bird Conservation Initiative (NABCI) was established in 2000 and integrated efforts to manage multiple groups of birds (e.g., shorebirds, waterfowl, and landbirds) into a more effective and efficient approach to bird conservation (NABCI Committee 2000). This integration includes efforts for specific taxa within the NABCI including the North American Waterfowl Management Plan (US Fish and Wildlife Service [USFWS] 1998), Partner's in Flight (PIF) (Pashley et al. 2000), United States Shorebird Conservation Plan (Brown et al. 2001), North American Waterbird Conservation Plan (Fitzgerald and Pashley 2000), and Waterbird Conservation for the Americas (Kuslan et al. 2002), into an overall approach to conserve all bird species (US NABCI Committee 2000). Currently, the NABCI functions as a voluntary, international coalition of government agencies, conservation groups, academic institutions, private businesses, and citizens dedicated to the conservation of birds and their habitats through cooperative efforts in North America and the Neotropics.

The NABCI has built upon physiographic regions developed by PIF, into Bird Conservation Regions (BCRs) developed by the Atlantic Coast Joint Venture (ACJV) (2008). As with PIF, bird conservation plans have been developed for most BCRs. The purpose of these plans is to highlight those species in the region in most need of conservation. Individual species and associated habitats are described, along with recommendations and goals to build population sustainability within these regions. Using this approach, it is hoped that federal and state listed threatened and endangered species can eventually be delisted, or to minimize the probability that rare and sensitive species will be listed in the future. The plans identify the general habitat requirements of priority species at the site-level, and then identify the quantity and quality of habitat required by birds at the landscape scale. Most conservation plans for each BCR have been drafted and are available at the NABCI website https://nabci-us.org/resources/bird-conservation-regions-map/. The CIDMMA lies in the New England/Mid-Atlantic Region (BCR #30) and a full conservation plan for BCR 30 can be found at https://acjv.org/bcr-planning/.

The NABCI uses a species prioritization scheme developed by PIF to determine which species in each region are in most need of conservation attention (Carter et al. 2000; Pashley et al. 2000). The scheme ranks each species of North American breeding bird by BCR based upon seven measures of conservation "vulnerability." These factors include (1) relative abundance (interspecific); (2) size of breeding range; (3) size of non-breeding range; (4) threats to the species on the breeding grounds; (5) threats to the species on the wintering grounds; (6) current known population trends; and (7) relative density (intraspecific) in a given planning unit compared to the maximum reached within its range. While focus is generally on breeding birds, information for all birds, including Neotropical migrants, Nearctic migrants, and resident species are included in the measure of conservation vulnerability. For the New England/Mid-Atlantic BCR (Atlantic Coast Joint Venture 2008), birds have been grouped into three categories of priority levels, including, Highest, High, and Moderate. Species categorized as 'Highest Priority" are those continental or regional species in need of immediate management attention; 'High Priority' are continental or regional species in need of management attention; and 'Moderate Priority' are those continental or regional species where monitoring is recommended to ensure long-term persistence of extant populations (Atlantic Coast Joint Venture 2008).

1.2.2 Craney Island Long-term Bird Management Plan

A long-term Bird Management Plan (LTBMP) was written for the Craney Island facility by Beck (2012). Although not formally adopted by the USACE Norfolk District, this plan has been followed since its development. Moreover, through consultation with researchers at the College of William and Mary, and through contractors, much of the efforts to monitor and conserve coastal birds have been in operation since 1975. Primary actions are performed, in consultation and coordination with USACE Norfolk District, to conserve and protect avian populations (from Beck 2012):

1. **Seasonal monitoring.** Monitoring actions are used to document presence and use by avian populations, particularly federally and state listed species, plus local or regional species of concern (Figure 1-1). Monitoring includes regularly conducted surveys of the CIDMMA and monitoring of active nesting sites by coastal birds, particularly federal or state listed species. The effort provides information to ensure active

use areas or nesting sites will remain undisturbed by USACE facility operations.

Figure 1-1. A Black-necked Stilt chick on the Craney Island Dredged Material Management Area, Portsmouth, Virginia. This is one of many nesting species monitored and protected on the facility. (Photo credit: USACE Norfolk District).

2. **Management actions for dredged material placement operations.** This effort serves to ensure ongoing dredged material deposition does not flood or disturb nesting birds. The facility will be monitored to ensure that all back-ponded nesting sites will avoid flooding during large-scale inflow actions. Areas with high use by nesting birds, especially high sandy berms used by Least Terns, will be located and signs posted to maintain appropriate buffers from ongoing actions (Figure 1-2).

Figure 1-2. Signage on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, indicating an area closed to protect nesting birds. (Photo credit: S. J. Reinheimer, USACE Norfolk District).

3. **Management during borrow and dike construction activities.** Borrow and dike construction measures are actively employed to retain capacity of the facility to receive future dredged material (Figure 1-3). Generally, this action occurs on the eastern portion of a containment cell not currently receiving dredge material. Least Terns commonly use borrow sites for nesting; therefore, multiple borrow sites are constructed such that borrow sites without nesting terns can be used for source material to increase level of containment dikes. Heavy construction equipment is used during dike construction, and truck-haul operations are monitored to ensure nesting birds are not disturbed. Routes can be changed, or access restricted to protect nesting birds; when needed, all traffic along specific roads can be closed until after 1 August of that year.

Figure 1-3. On-site construction on the Craney Island Dredged Material Management Area, Portsmouth, Virginia. Efforts are made to ensure construction does not disturb nesting birds. (Photo credit: S. J. Reinheimer, USACE Norfolk District).

4. **Management of containment cell dewatering and pond water levels.** Water resources on the facility provide foraging ponds and mudflats for many migratory shorebirds and breeding wading birds, and deeper ponds provide important habitat for wintering waterfowl (Figure 1-4). The size, depth, and duration of these habitats often depend upon the hydraulic actions to deposit dredged material into the facility. Planned deposition can be performed to actively provide water levels to meet water quality requirements; however, many of these areas also meet the needs of shorebirds, waterfowl, and other species. A cell must be periodically dewatered to permit settling of the sediments and extend the life of the containment cell and the capacity of the facility to receive future deposition. Ponds, mudflats, and other water-based habitats can be created and/or maintained through significant precipitation, providing important foraging habitat for some species. Borrow sites often hold water for longer periods due to regular precipitation events. These deeper water holding sites can provide important habitat for over-wintering waterfowl and other coastal species.

Figure 1-4. Pond and mudflat habitats can be created, and water levels managed to provide habitat for migratory shorebirds and wintering waterfowl on the Craney Island Dredged Material Management Area, Portsmouth, Virginia. (Photo credit: S. J. Reinheimer, USACE Norfolk District).

5. **Management actions for mowing, road, and site maintenance.** Roads are regularly maintained on the Craney Island facility. Damage from precipitation and storms must be repaired to maintain normal operations. Areas on the roads can be weak and susceptible to damage or washboard conditions due to use by heavy construction vehicles. Mowing also occurs regularly to maintain shoulders and to reduce invasive phragmites and other invasive plants. To protect nesting grassland birds, mowing is minimized from May 1 to July 15 every year.
6. **Management actions during military landing operations.** The US Navy has previously used the CIDMMA for specific training activities including helicopter touch-and-go and night-time training operations. These training operations were limited to facility sections that avoid nesting birds. Approaching flight paths and landing zones were also directed away from active nesting sites. These actions have not been permitted since 2013 and are not anticipated to be conducted in the future.
7. **Unavoidable impacts.** Occasionally, accidents, or specific planned actions occur that may disturb active nesting sites, or areas used by foraging or roosting birds. In such cases, the USACE will initiate formal consultations with the USFWS under the Endangered Species Act

(ESA) as needed. Collaborative partnerships with other federal agencies and contractors can help coordinate actions and minimize impacts to nesting, foraging, and roosting birds.

8. **Other Conservation Recommendations:**
    a. **Substrate augmentation:** The LTBMP recommends construction of a permanent nesting site for terns and American Oystercatchers on an area exterior to the containment cells. For comparison, a suite of nesting birds on the Hampton Roads Bridge Tunnel South Island is provided as an example of birds that could be attracted to such a site. Note that an American Oystercatcher pair produced at least one young at CIDMMA in 2020: this is the first recorded successful breeding of this species on the facility.
    b. **Pond management:** The LTBMP recommends the monitoring and synchronizing of water levels within the three existing cells (Figure 1-5) and a proposed fourth cell. Multiple species have specific water depth requirements that could be targeted. This effort would require implementation in a manner consistent with ongoing objectives for dredged material placement and future facility capacity.
    c. **Public awareness:** The LTBMP recommends regular updates to the CIDMMA website to inform the general public on ongoing plans for eastward expansion, updated satellite imagery, links to pages documenting nesting waterbirds, results of seasonal surveys, visits by local bird clubs (e.g., Audubon Society), links to nearby parks and refuges (e.g., Hoffler Creek Wildlife Preserve and the Great Dismal Swamp), and links to the VA Birding and Wildlife Trail sponsored by the Virginia Department of Wildlife Resources. This can become a challenging enterprise requiring thoughtful consideration by the USACE and CIDMMA staff. Currently, the facility is closed to all non-designated personnel.

Figure 1-5. Figure showing the North, Center, and South Cells on the Craney Island Dredged Material Management Area, Portsmouth, Virginia. Portsmouth, Virginia. (Photo credit: USACE Norfolk District).

1.3 Objectives

The objective of this study was to use long-term mean abundance and species richness trends of individual bird species and species groups using seasonal habitats to assess the value of habitats provided by the Craney Island facility for a variety of coastal bird species in the New England/Mid-Atlantic BCR. Ideally, monitoring and assessment of mitigation or ecosystem restoration efforts should be compared to regional reference sites, where the goal of the effort is to achieve comparable measures of biological metrics between the reference sites and newly created or restored areas. As with the SHNP DMCAs, the CIDMMA did not include the identification and monitoring of a reference site. Therefore, we have chosen to define the success or failure of the LTBMP on CIDMMA using the same approach as Guilfoyle (2020b): we use long-term mean abundance and species richness trends of individual bird species and species groups using seasonal habitats. Successful creation of habitats for seasonal bird communities is assessed by determining whether abundance and richness trends show statistically significant increasing trends, or presence but stable trends (not significantly increasing or decreasing) during one or more seasons for species identified by the New England/Mid-Atlantic Region as regional species of concern. Success of the effort could be described as moderate or poor if regionally identified

priority species are either absent, present in low numbers, or show seasonally significant decreasing abundance or richness trends during the monitoring period.

1.4 Approach

1.4.1 Procure and analyze population trends of the seasonal bird community

The first step in developing this report involved procuring, compiling, and analyzing existing data on population trends of the bird community at the Craney Island over time. Data collected by USACE Norfolk District personnel, the CVWO Waterbirds Team, contractors, and Ruth A. Beck and others associated with the College of William and Mary, Williamsburg, VA, were procured with permission from the Cornell Lab or Ornithology, online database, eBird (https://ebird.org/home). We used the identical statistical approach to analyzing mean abundance and species richness trends as Guilfoyle et al. (2020b). Preliminary results are presented in this report, however, further consideration to data error and uncertainty will likely require additional future analyses. For example, the large differences in survey efforts in 2008 versus subsequent years, may require data from 2008 be dropped from any future analysis. For presenting preliminary results, data from 2008 are included, but trend results should be interpreted with caution. Future statistical analyses will also include an analysis into the effects of habitat availability on mean abundance and richness trends (Guilfoyle et al. 2020b). As presented by Guilfoyle et al. (2020b), we use a Bayesian community generalized linear mixed model approach with bird and species group abundance fitted into a negative binomial distribution, and species richness for each species group fitted into a Poisson distribution. We used the 'jags UI' 1.4.2 package (Kellner 2016) in the R 3.1.1 program (R Core Team 2014) to test for significant increasing or decreasing trends during the monitoring period. Significant seasonal population trends for abundance and species richness, positive, negative, or non-significant, were determined based on overlap of the logarithmic means and confidence intervals.

1.5 Scope

This report targets USACE land managers or districts that manage or regulate coastal engineering projects or operations of various CDFs. However, the results of this effort may be of significant interest to all

biologists and land managers interested in habitat creation or restoration to benefit seasonal coastal waterbirds, shorebirds, waterfowl, and terrestrial landbirds. Results presented and methods described should be considered for monitoring on other USACE project lands or coastal engineering operations, and other state, federal, or private landowners with an interest and objectives to manage coastal lands for sustained seasonal use by populations of rare, sensitive, or regionally identified avian species of concern.

2 Study Area and Methods

2.1 Study area

The CIDMMA is located along the confluence of the James and Elizabeth Rivers, in the city of Portsmouth, just west of the city of Norfolk, Virginia (Figure 2-1). This CDF facility is a federally owned civil works project operated by the USACE, Norfolk District. This facility is the primary dredged material disposal facility in the Norfolk Harbor that receives dredged material during the dredging of navigation channels for the US Navy and the Virginia Port Authority. The facility is approximately 2,500 acres (1,011 ha) and extends from the mainland about 2 miles (3.2 km) north, 2 miles west, and 2 miles south. There are about 8 miles (12.9 km) of a primary containment dike serviced (additional containment dikes that separate the area into three subcontainment areas (Figure 2-1). The facility is surrounded by approximately 6 miles (9.7 km) of shoreline consisting of sand beaches, marshes, and hardened structures (Beck 2012).

Coastal habitats and vegetative communities on the Craney Island facility are likely very similar to conditions of coastal habitat measured in the city of Portsmouth (US Department of Commerce 1988). The most common type of habitat includes non-vegetated tidal wetlands that would include sand/mud mixed flats and sand or mud flats, and intertidal beach. Typical plants in these areas and emergent marsh areas would include saltmarsh chordgrass (*Spartina alterniflora*), saltbush (*Atriplex* ssp.), saltmeadow hay (*Spartina patens*), marsh fleabane (*Pluchea odorata*), saltmarsh aster (*Symphyotrichum subulatum*), waterhemp (*Amaranthus tuberculatus*), seaside goldenrod (*Solidago sempervirens*), reedgrass (*Calamagrostis* ssp.), black needlerush (*Juncus roemerianus*), saltmarsh bulrush (*Bolbolschoenus robustus*), and other rushes (*Juncus* ssp.). In addition to coastal wetland and beach areas, other areas have some scattered young forest and scrub areas. Typical plants in these areas include sycamore (*Platanus occidentalis*), red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), ash species (*Fraxinus* ssp.), honeysuckle (*Lonicera japonica*), trumpet creeper (*Campsis radicans*), poison sumac (*Toxicodendron vernix*), and bittersweet (*Celastrus scandens*). Other potential tree species include loblolly pine (*Pinus taeda*), oaks (*Quercus* ssp.), American holly (*Ilex opaca*), wax myrtle (*Myruca cerifera*), and redbud (*Ceris canadensis*) (US Department of Commerce 1988). Cell hillside slopes vegetated by scattered to dense stands of Groundsel

(*Baccharis halimifolia*) and the roadside along the Portsmouth Landfill entrance has a large stand of black locust (*Robinia pseudoacacia*). Upper perimeter and cross-dikes roadsides are vegetated by white sweet clover (*Melilotus albus*) and Cocklebur (*Xanthium strumarium*). Substantial common reed (*Phragmites australis*) stands exist throughout the facility, and interior areas of the cells will support fall aster (*Symphyotrichum* ssp), Queen Anne's Lace (*Daucus carota*), and Dog-fennel (*Eupatorium capillifolium*) (Hamilton and Hall 2013).

Figure 2-1. Overview of the Craney Island Dredged Material Management Area, Portsmouth, Virginia.

2.2 Seasonal bird community monitoring

From 2008 to 2014, regularly conducted seasonal surveys generally occurred semimonthly on the CIDMMA, but on occasion, no surveys were conducted in some months, and occasionally, three or more surveys were conducted in a single month (Table 2-1). Since 2015, these surveys have occurred weekly. These surveys include a complete count of the area, which corresponds to an area search (Guilfoyle and Fischer 2007), where all birds detected by sight or sound were recorded and start and stop time data were recorded to determine the length of time for all surveys. Since surveys were intended to represent complete counts of all birds present, total time required to conduct the surveys varied depending on time of the year, current weather conditions, and number of birds present, among other factors. Surveys began in the early morning hours (generally before civil sunrise) and ended circa 1300-1400 hrs. Surveys were conducted during periods of relatively good weather; no surveys were conducted on days with heavy wind, rain, or other precipitation. All surveys were performed with a minimum of four experienced birders; usually, one would be responsible to record all observations and enter all data. All birders used high quality field binoculars and spotting scopes as necessary.

A total of 403 surveys were conducted during the monitoring period, with approximately 2,667.3 survey hours completed (Table 2-1). All birds detected by sight or sound within the CIDMMA boundaries were counted, whether they were flying or stationary. Survey boundaries were judged to be the boundary of the perimeter containment dikes on the east, north, and west side of the facility; south boundary was judged to be the southern perimeter access road.

We also identified priority species listed in ACJV (2008) to identify those birds detected on CIDMMA recognized as Highest, High, and Moderate Priority species for the New England/Mid-Atlantic Coast BCR.

Table 2-1. Total number of survey days, and total survey hours for all birds detected on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008 to 2020.

Year	Total number of days surveyed	Total hours of surveys
2008	5	25.3
2009	22	104.6
2010	21	135.4
2011	30	187.5
2012	22	147.8
2013	38	248.6
2014	35	247.8
2015	38	259.8
2016	43	291.9
2017	47	330.1
2018	44	284.8
2019	45	310.4
2020	13	93.3
TOTAL	403	2,667.3

2.3 Initial mean abundance and species richness trends

2.3.1 Mean abundance trends

Surveys included in the analyses include 403 surveys (105 spring, 136 summer, 93 fall, and 69 winter). Seasons correspond to spring (March to May), summer (June - August), fall (September – November), and winter (December to February). These broad seasonal categories are intended to reflect specific seasonal changes in the seasonal life history phenology of these birds. The general seasonal pattern observed with most North American birds is that most species generally breed in the summer, migrate south during the fall (southward migration), and migrate north during the spring (northward migration) with several months generally spent in southern locations during the over-wintering season. This broad characterization can be highly variable within populations of many coastal waterbirds. Some may be migrating during February and March, breed in the spring, and begin their southward migration as early as July. Future efforts to analyze these data will attempt to correct the seasonal cut-off dates to reflect actual seasonal phenology of these birds more closely.

Also, in the current preliminary analyses, all birds are included, including birds identified only to species groups (e.g., Duck spp.) and identifications that may indicate a hybrid (e.g., Mallard X American Black Duck). Count data were only excluding for individual birds in which the identification could not be confirmed to species. Two exceptions include *Empidonax* ssp. and *Calidris* ssp., which represent a group of flycatchers and sandpipers, respectively, which can be difficult to identify in the field. In general, any species detected during fewer than 10% of surveys in any season will be eliminated in future analyses, as there simply are not enough data to estimate trends for those species. Therefore, the presented trend analyses only represent a preliminary analysis to provide broad-level trends on the CIDMMA, and results should be interpreted with caution.

The statistical trend analyses and associated equations are identical to the approach described in Guilfoyle et al. (2020b). For purposes of this report, and the preliminary nature of the trend analyses described, equations are not provided. For each species or species group in each season, a Bayesian community generalized linear mixed model was fixed with time treated as a fixed effect, and year as a random grouping variable. Bird abundance data were fitted to a negative binomial distribution. Community models estimate species-specific trends within a hierarchical framework where estimates are related through community-level hyperparameters (Kéry and Royle 2008; Zipkin et al. 2009). The full advantages of such an approach are detailed elsewhere (Kéry and Royle 2008; Royle and Dorazio 2008; Zipkin et al. 2009; Iknayan et al. 2014), but we chose this approach for two primary reasons. First, by borrowing information from more common species, the approach allows inclusion of rarer species in the analysis (Royle and Dorazio 2008; Zipkin et al. 2009; Iknayan et al. 2014). Second, we were interested in community hyperparameter estimates themselves to summarize overall group trends.

Trend significance was evaluated for individual species and species groups based on logarithmic values with 95% confidence intervals for each seasonal trend during the monitoring period. We determined significant trends based on whether the mean and confidence intervals overlapped with zero; those means and confidence intervals that are above zero indicate significantly increasing trends, while those means and confidence intervals below zero indicate significantly decreasing trends. Means and confidence intervals that overlap with zero indicate non-significant trends during the monitoring period (See Chapter 3 and Figures 3-10 – 3-27).

2.3.2 Mean species richness trends

The current analysis includes all 271 species recorded during the monitoring period that were then placed into one of 17 species groups (common names, scientific names, and 4-letter species codes for all birds detected in this effort are provided in Appendix A).

1. Blackbirds, Crows, and Jays
2. Dabbling Ducks
3. Diving and Sea Ducks
4. Flycatchers
5. Geese and Swans
6. Grassland Birds and Sparrows
7. Gulls, Terns, and Skimmers
8. Herons and Egrets
9. Other Nonpasserines
10. Other Passerines
11. Raptors and Vultures
12. Sandpipers and Plovers
13. Shorebirds
14. Swallows and Swifts
15. Thrushes
16. Warblers
17. Woodpeckers

For each species group, we fit a generalized linear mixed model where species richness values had a Poisson distribution, time was treated as a fixed effect, and year was a random grouping variable. The analysis was conducted in R 3.1.2 using the glmer() function in the lme4 package (Bates et al. 2015). A summary of all species groups detected over the course of the 12-yr monitoring period (2008 to 2020) is provided, focusing only on mean species richness. For clarity on species richness, we generally only used data on detections identified to species. As for mean abundance models, exceptions will include the designation of birds in the genus, *Empidonax* and *Calidris*. As with abundance trends, significance of species trends was determined based on the overlap of the logarithmic means and confidence intervals as described above for mean abundance models (see Chapter 3 and Figure 3-28).

3 Results

3.1 Seasonal survey monitoring results

Over 1.5 million detections of 271 species were recorded during survey efforts on the CIDMMA over the 12-yr survey period (Appendix A). Eighty-four species are wintering species that breed farther north during the spring and summer; 33 species are present largely during the fall and spring migrations seasons; 27 species were Neotropical migrants that breed in the area, but undergo a long-distance migration to Central and South America during the winter months; 88 species are residents that occur year-round and some likely breed near or on site; and 50 are spring/summer breeding species that winter likely south of the study area. An additional 22 species are rare transients known to have irregular or only occasional occupancy in the area during the breeding, wintering, or migration seasons (Appendix A).

Numerous high priority species identified by the New England/Mid-Atlantic BCR 30 (Atlantic Coast Joint Venture 2008) were documented on the CIDMMA (Table 3-1). Of 134 ranked priority species in the region, the CIDMMA supported 102 of 134 (76%) recognized in the BCR, including 16 of 19 (84%) of Highest priority ranked species, 47 of 60 (78.3%) of High priority species, and 39 of 55 (71%) of Moderate priority species for BCR 30. Represented of these priority species found on the CIDMMA are shown in Figures 3-1 – 3-9.

Over the 2008 to 2020 survey period, the most commonly recorded species was the High Priority Species, Semipalmated Sandpiper (261,500; total cumulative annual detections), followed by Moderate Priority Species, Ruddy Duck (179, 692), unranked Northern Shoveler (145,476), *Calidris* ssp. Sandpipers (96,986), Double-crested Cormorant (76,016), Dunlin (68,934), Mallard (50,072), Red-winged Blackbird (47,168), Green-winged Teal (44,743), Lesser Yellowlegs (40, 910), European Starling (38,888), Ring-billed Gull (38,036), Herring Gull (28,221), Laughing Gull (25,636), Least Tern (25,071), Canvasback (24,945), and the American Avocet (24,568) (Appendix A).

The Semipalmated Sandpiper was the most common Neotropical Migrant or Migrant, followed by the Least Tern, Semipalmated Plover (14,560), Short-billed Dowitcher (12,337), Western Sandpiper (9,813), Chimney

Swift (9,558), Blue-winged Teal (3,058), and Caspian Tern (2,966) (Appendix A). The Mallard was the most common occurring Resident or Year-Round species, followed by the Red-winged Blackbird, European Starling, Herring Gull, and Killdeer (11,189) (Appendix A). The Ruddy Duck (179,682) was the most common winter species, followed by the Northern Shoveler (145,476), Dunlin (68,934), Green-winged Teal (44,743), Ring-billed Gull (38,036), Canvasback (24,945), Red-breasted Merganser (19,396), and the Gadwall (19,323) (Appendix A).

During the survey period, the bird community was most diverse during the winter and most abundant during the summer: 164 wintering species constituted 21.4% of total bird counts (total counts = 335,419 individuals), while 81 spring species constituted 26.6% of total birds (counts = 411,948 individuals); 138 summer species constituted 30.4% of total birds (counts = 470,586 individuals), and 118 fall species constituted 21.6% of all birds (counts = 331,524 individuals).

Table 3-1. Total cumulative detections of the New England/Mid-Atlantic Coast Bird Conservation Region (BCR 30) Highest Priority, High Priority, and Moderate Priority Species of regional or local conservation concern (from Atlantic Coast Venture 2008) detected on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008 to 2020.

Highest Priority Species			
Species	**Cumulative Detections**	**Species**	**Cumulative Detections**
American Black Duck[1,2,3]	4,108	Prairie Warbler[1]	32
American Oystercatcher[1]	97	Red Knot[3]	74
American Woodcock[1,2,3]	4	Red-throat Loon[2,3]	1,992
(Atlantic) Brant[2,3]	13*	Ruddy Turnstone[3]	794
(Atlantic) Canada Goose[2,3]	11,235*	Saltmarsh Sparrow[1,2,3]	3
Blue-winged Warbler[1]	1	Sanderling[2,3]	8,053
Gull-billed Tern[1]	772	Whimbrel[3]	36
Piping Plover[1,2,e]	18	Wood Thrush[1]	1
High Priority Species			
American Golden Plover[3]	43	Least Tern[1]	25,071
Baltimore Oriole[1]	9	Long-tailed Duck[2,3]	4
Bay-breasted Warbler[3]	1	Mallard[1,2,3]	50,072
Black Scoter[2,3]	82	Marbled Godwit[3]	37
Black-and-white Warbler[1]	30	Marsh Wren[1]	95
Black-bellied Plover[2,3]	2,333	Northern Bobwhite[1,2]	81
Brown Thrasher[1]	942	Northern Flicker[1,2,3]	323
Buff-breasted Sandpiper[3]	20	Northern Gannet[2,3]	1,057
Bufflehead[1,2,3]	8,266	Prothonotary Warbler[1]	1
(North Atlantic) Canada Goose[2,3]	11,235*	Purple Sandpiper[2,3]	3
Canvasback[2,3]	24,945	Scarlet Tanager[1]	4

Chimney Swift[1]	9,558	Semipalmated Sandpiper[3]	261,500
Clapper Rail[1]	46	Short-billed Dowitcher[3]	12,337
Dunlin[2,3]	68,934	Solitary Sandpiper[3]	33
Eastern Kingbird[1]	618	Surf Scoter[1,2,3]	531
Eastern Towhee[1,2,3]	947	(Eastern) Tundra Swan[2,3]	885*
Field Sparrow[1,3]	331	White-rumped Sandpiper[3]	440
Foster's Tern[1,3]	661	White-winged Scoter[2,3]	6
Glossy Ibis[1]	145	Willet[1,2,3]	1,391
Great-crested Flyctcher[1]	279	Willow Flycatcher[1]	13
Greater Scaup[2,3]	41	Wilson's Pharlarope[3]	441
Greater Yellowlegs[2,3]	3,323	Wilson's Plover[1]	1
Horned Grebe[2,3]	9,246	Worm-eating Warbler[1]	1
Hudsonian Godwit[3]	9	Yellow-throated Warbler[1]	3
Moderate Priority Species			
American Avocet[3]	24,568	Northern Pintail[2,3]	4,161
American Bittern[1,2,3]	8	Red-necked Phalarope[3]	760
American Wigeon[2,3]	4,930	Red Phalarope[3]	14
Bald Eagle[1,2,3]	763	Red-breasted Merganser[2,3]	19,396
Black Skimmer[1]	569	Red-headed Woodpecker[1,2,3]	5
Black-crowned Night-Heron[1,2]	252	Royal Tern[1]	18,186
Brown-headed Nuthatch[1,2]	54	Ruddy Duck[2,3]	179,692
Common Goldeneye[1,2,3]	18	Seaside Sparrow[1,2,3]	39
Common Tern[1,3]	379	Sedge Wren[1,2,3]	1
Gadwall[1,2,3]	19,323	Semipalmated Plover[3]	14,560
Gray Catbird[1]	747	Short-eared Owl[2,3]	5
Green-winged Teal[1,2,3]	516	Snowy Egret[1,2]	3,453
Hooded Merganser[1,2,3]	44,743	Sora[1,3]	33
Killdeer[1,2,3]	11,189	Spotted Sandpiper[1,3]	2,267
King Rail[1,2]	1	Tricolored Heron[1]	75
Least Bittern[1]	29	Upland Sandpiper[1,3]	6
Least Sandpiper[3]	18,336	Western Sandpiper[3]	9,813
Lesser Yellowlegs[2,3]	40,910	Wood Duck[1,2,3]	41
Little Blue Heron[1,2]	10	Yellow-crowned Night-Heron[1,3]	107
Nelson's Sparrow[1,3]	4		

[1]Breeding population is designated or ranked for protection/conservation.
[2]Non-breeding or wintering population is ranked for protection/conservation.
3Migratory population is ranked for protection/conservation.
eSpecies is listed as federally endangered.
*Species not identified to subspecies; therefore, presence and/or number of potential identified Priority Subspecies is unknown.

3.2 Examples of priority species

3.2.1 Highest priority species

Figure 3-1. The American Oystercatcher is a species documented on the Craney Island Dredged Material Management Area that has been ranked as a Highest Priority Species in the New England/Mid-Atlantic Bird Conservations Region (Atlantic Coast Joint Venture 2008) (Photo Credit: Rhododentries, Wikimedia Commons).

Figure 3-2. The Ruddy Turnstone is a wintering species documented on the Craney Island Dredged Material Management Area that has been ranked as a Highest Priority Species in the New England/Mid-Atlantic Bird Conservations Region (Atlantic Coast Joint Venture 2008) (Photo Credit: Kate Perez, Wikimedia Commons).

Figure 3-3. The Piping Plover is a federally listed endangered species that has been documented on the Craney Island Dredged Material Management Area and has been listed as a Highest Priority Species in the New England/Mid-Atlantic Bird Conservation Region (Atlantic Coast Joint Venture 2008). (Photo Credit: Shutterglow.com, Wikimedia Commons).

3.2.2 High priority species

Figure 3-4. The Black-bellied Plover is a migratory species documented on the Craney Island Dredged Material Management Area that has been ranked as a High Priority Species in the New England/Mid-Atlantic Bird Conservation Region (Atlantic Coast Joint Venture) (Photo Credit: Public Domain, Wikimedia Commons).

Figure 3-5. The Northern Bobwhite is a species documented on the Craney Island Dredged Material Management Area that has been ranked as a High Priority Species in the New England/Mid-Atlantic Bird Conservation Region (Atlantic Coast Joint Venture 2008) (Photo Credit: Uatrok77, Wikimedia Commons).

Figure 3-6. The Semipalmated Sandpiper is a migratory species documented on the Craney Island Dredged Material Management Areas that has been ranked as a High Priority Species in the New England/Mid-Atlantic Bird Conservation Region (Atlantic Coast Venture 2008) (Photo Credit: USFWS Northeast Region, Wikimedia Commons).

3.2.3 Moderate priority species

Figure 3-7. The Royal Tern is a species documented on the Craney Island Dredged Material Management Areas that has been ranked as a Moderate Priority Species in the New England/Mid-Atlantic Region Bird Conservation Region (Atlantic Coast Joint Venture 2008) (Photo Credit: defaulder, Wikimedia Commons).

Figure 3-8. The Red-necked Phalarope is a migratory species documented on the Craney Island Dredged Material Management Areas that has been ranked as a Moderate Priority Species in the New England/Mid-Atlantic Bird Conservation Region (Atlantic Coast Joint Venture 2008) (Photo Credit: USFWS, Wikimedia Commons).

Figure 3-9. The Ruddy Duck is a wintering species documented on the Craney Island Dredged Material Management Area that has been ranked as a Moderate Priority Species in the New England/Mid-Atlantic Bird Conservation Region (Atlantic Coast Joint Venture 2008) (Photo Credit: Public Domain, Wikimedia Commons).

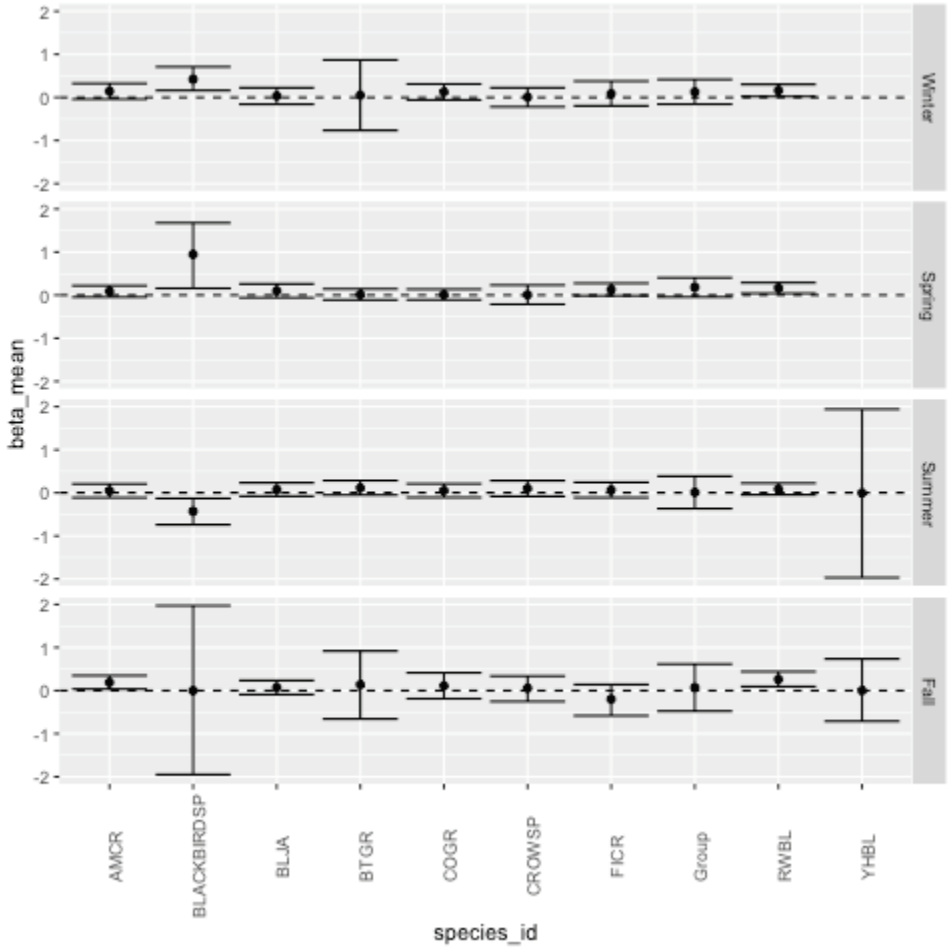
3.3 Annual trends for species and species groups

Monitoring of avian populations is an essential tool in determining population trends and the overall health of specific bird populations. Currently, the data collected on the CIDMMA will need to be analyzed more thoroughly to identify specific statistical trends for any species' groups or individual species. It is beyond the scope of this report to present such an analysis; however, we provide a preliminary view of trends for individuals and species groups to provide some idea of the variation and trends among seasons present in the dataset. In future analyses, trends will be correlated with annual habitat availability, especially in the context of CIDMMA management due to application of the LTBMP and to determine if habitat quality and/or quality provide any explanatory insights into why such trends may be occurring.

- Blackbirds/Crows/Jays:

  This group was stable for all seasons during the monitoring period with no significant increase or decreases; most all individual species also showed no significant trends except the Red-winged Blackbird that had significant increases during the winter, spring, and fall (Figure 3-10).

Figure 3-10. Seasonal mean abundance trends for Blackbirds, Crows and Jays on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020.



- Dabbling Ducks:

  This group was stable for all seasons during the monitoring period, with only the Gadwall showing significant increases in abundance trends during the winter and the Northern Shoveler showing significant increases during the summer (Figure 3-11).

- Diving and Sea Ducks:

  This group was stable for all seasons during the monitoring period, with only the Red-breasted Merganser showing significant increases in abundance trends during the winter and spring (Figure 3-12).

Figure 3-11. Seasonal mean abundance trends for Dabbling Ducks on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020.

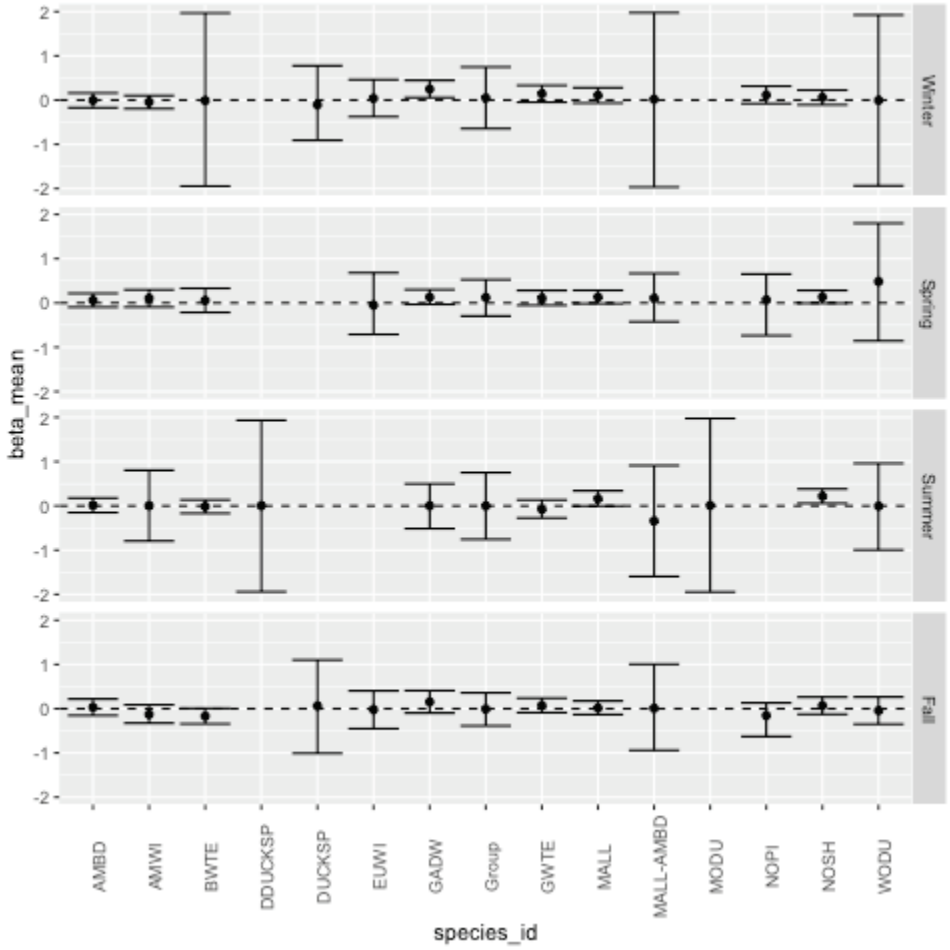
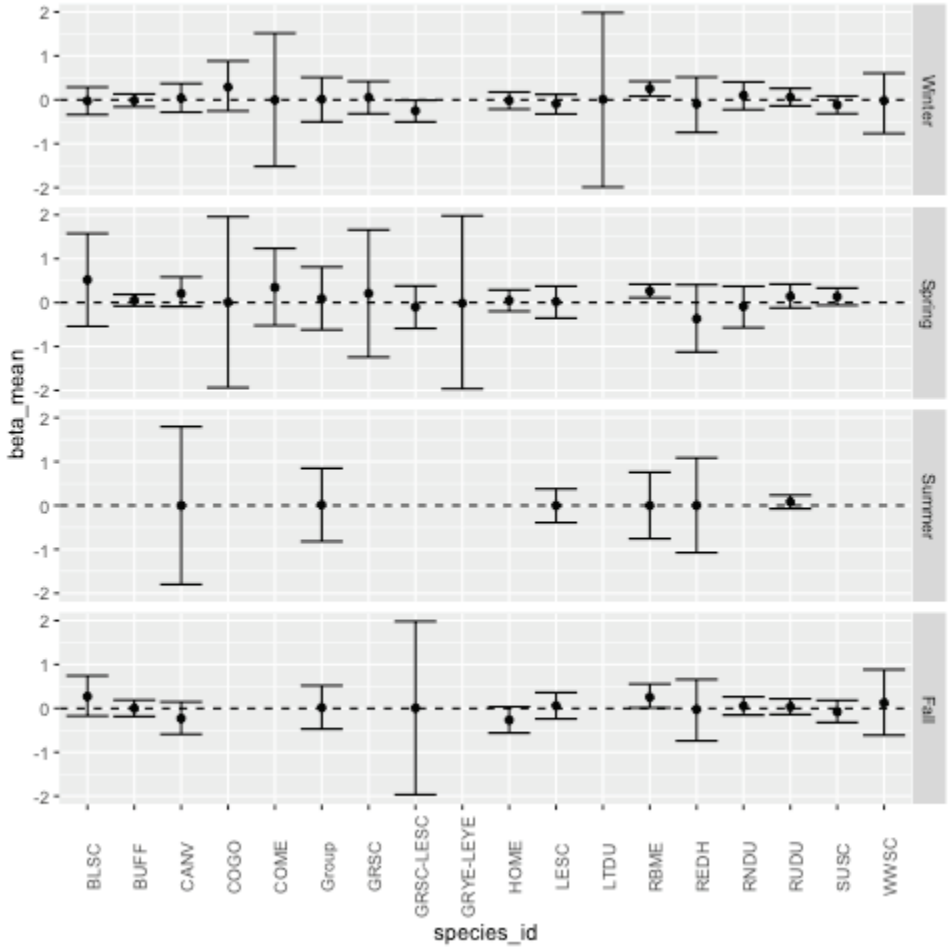


Figure 3-12. Seasonal mean abundance trends for Diving and Sea Ducks on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020.



- Flycatchers:

  No significant changes during the monitoring period for this group or any of the individual five species during any season (Figure 3-13).

- Geese and Swans:

  No significant changes during the monitoring period for this group or any individual eight species during any season (Figure 3-14).

- Grassland birds and Sparrows:

  No significant changes during the monitoring period for this group or 19 of 20 individual species during any season (Figure 3-15). The one exception includes the significant increase in abundance trends for the Savannah Sparrow during the fall (Figure 3-15).

Figure 3-13. Seasonal mean abundance trends for Flycatchers on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020.

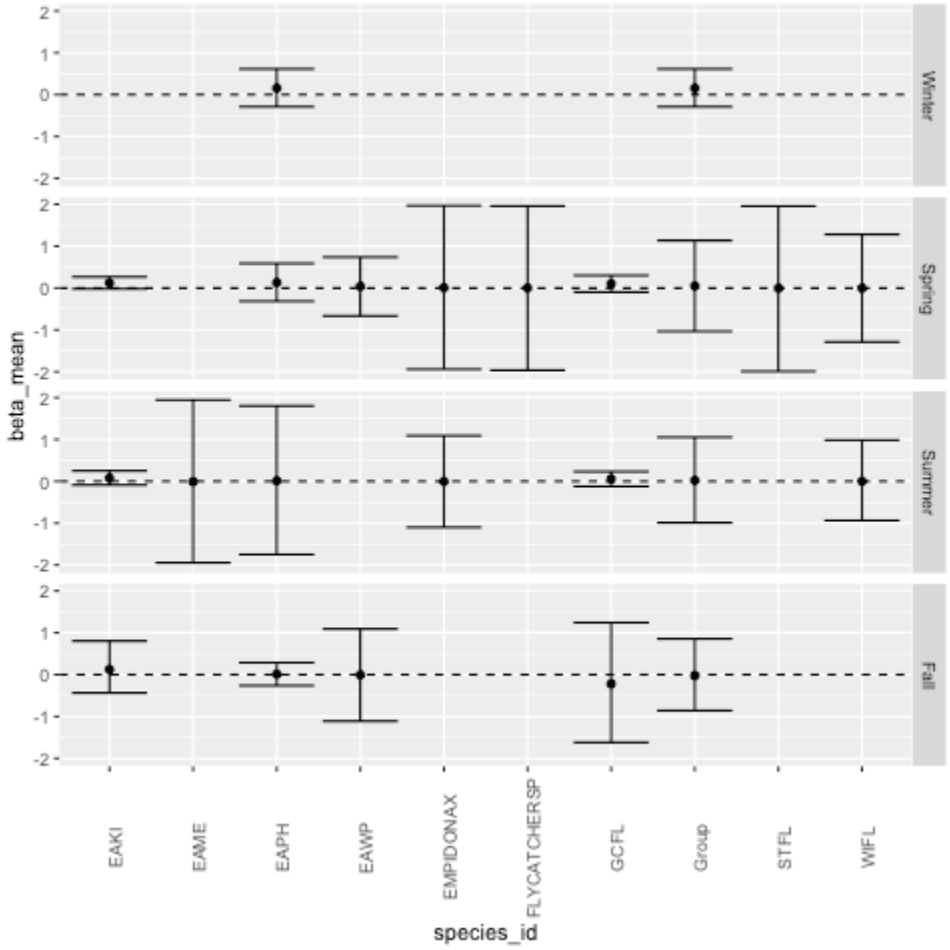


Figure 3-14. Seasonal mean abundance trends for Geese and Swans on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020.

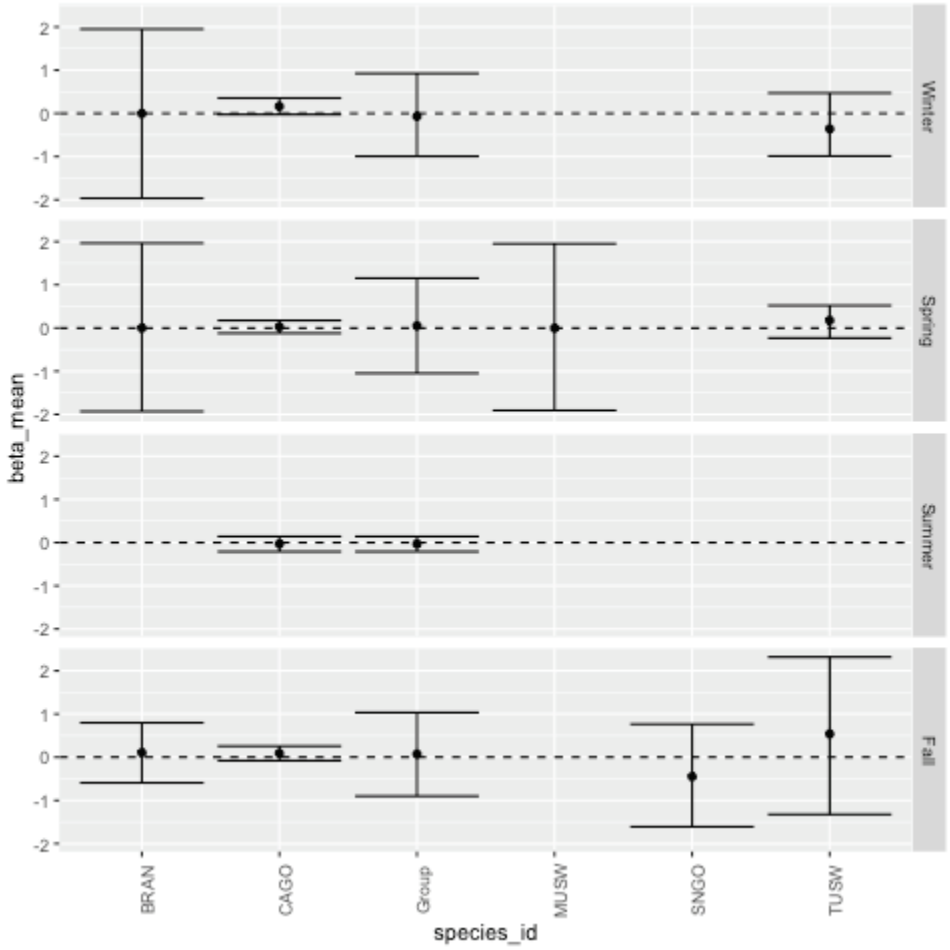
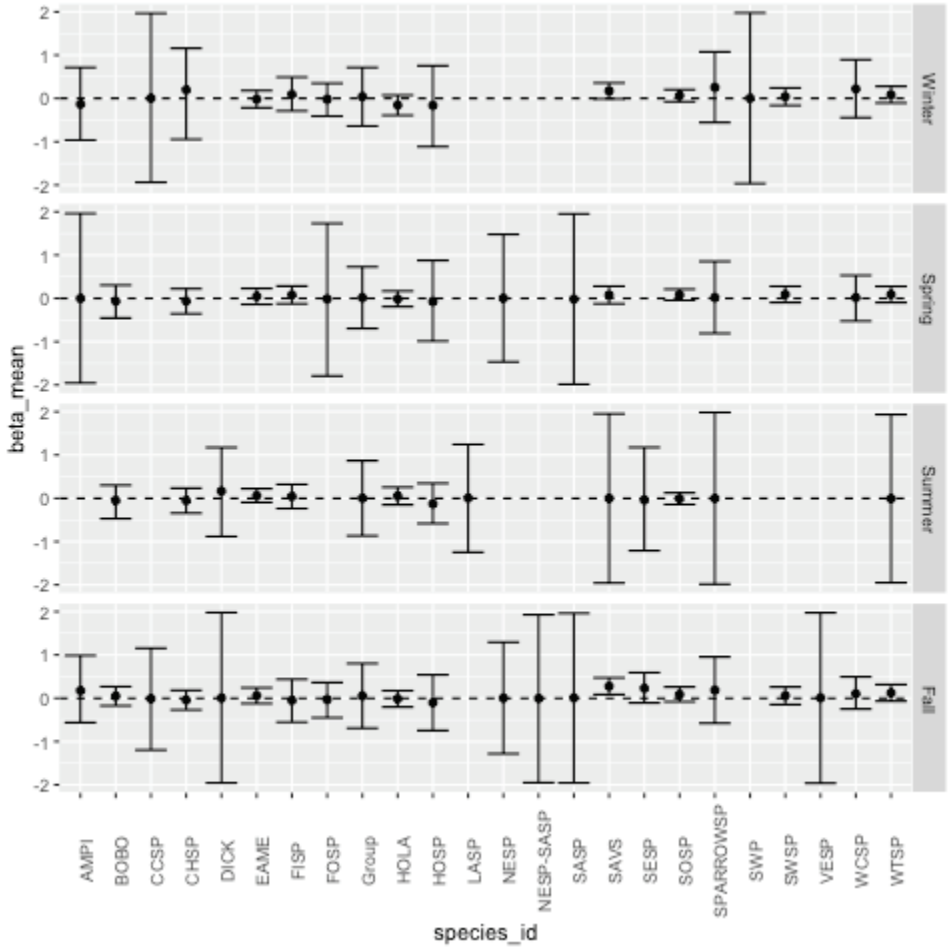


Figure 3-15. Seasonal mean abundance trends for Grassland Birds and Sparrows on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020.



- Gulls/Terns/Skimmers:

  No significant changes during the monitoring period for this group and 15 of 17 species; exceptions include a significant increase in abundance trends for the Ring-billed Gull during the winter and spring, and a significant decrease in trends for the Black Tern during the fall (Figure 3-16).

- Herons and Egrets:

  No significant changes during the monitoring period for this group or for 10 of 11 individual species during any season; the one exception includes a significant increase for the Snowy Egret in the spring (Figure 3-17).

Figure 3-16. Seasonal mean abundance trends for Gulls, Terns and Skimmers on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020.

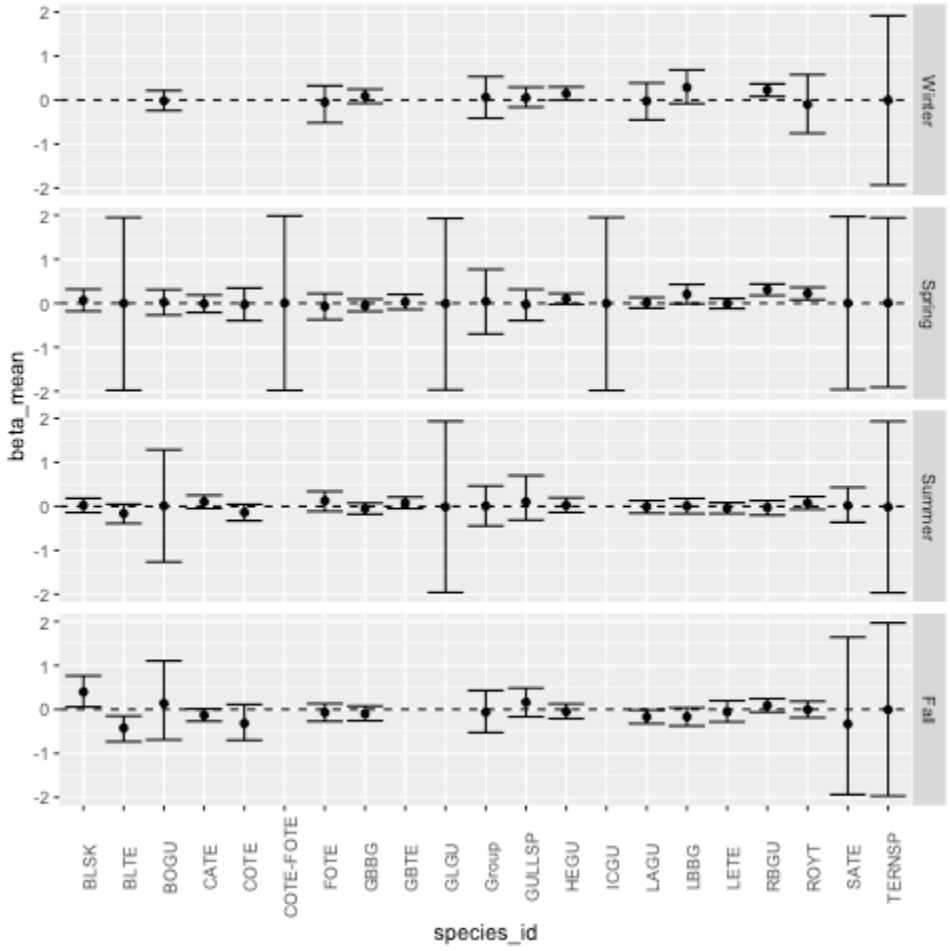
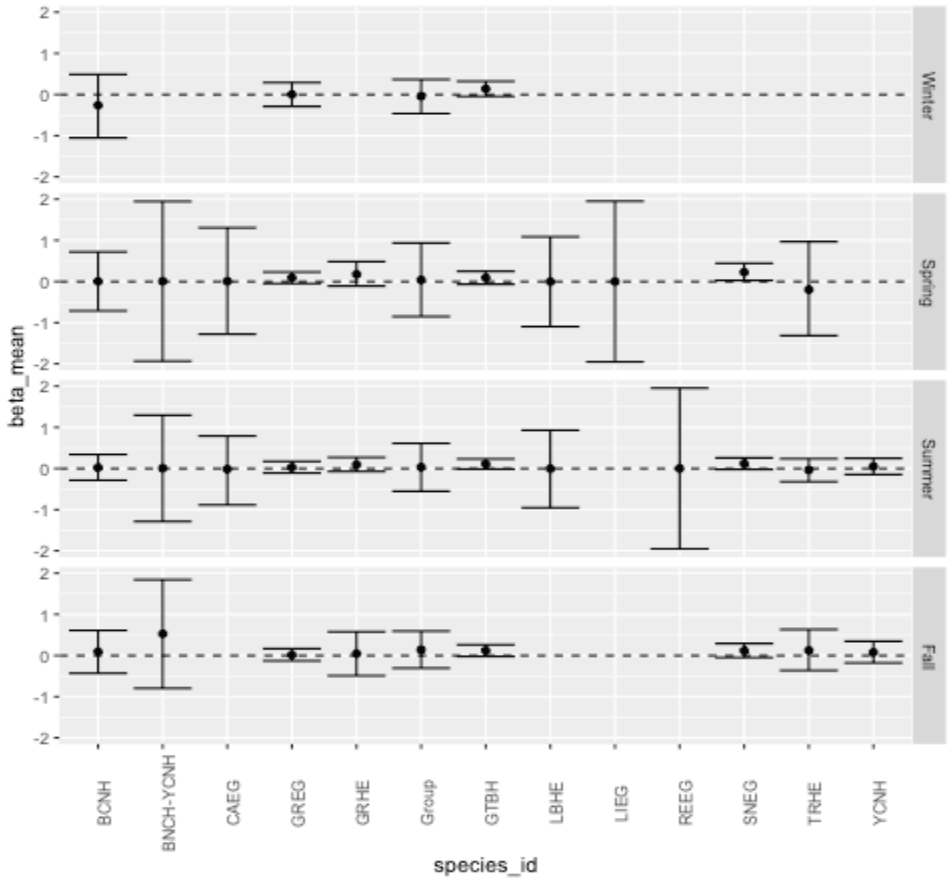


Figure 3-17. Seasonal mean abundance trends for Herons and Egrets on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020.



- Other Nonpasserines:

  No significant changes during the monitoring period for this group or for 30 of 31 individual species during any season; the lone exception includes a significant decrease for the Northern Gannet in the winter (Figure 3-18).

- Other Passerines:

  No significant changes during the monitoring period for this group or for 43 individual species; however, some of the 95% confidence intervals fall right on the 0-line (Figure 3-19).

- Pelicans and Cormorants:

  No significant changes during the monitoring period for this group or for 3 of 4 individual species during any season; the Double-crested Cormorant is an exception showing significant increases in abundance trends during the winter and spring (Figure 3-20).

Figure 3-18. Seasonal mean abundance trends for Other Nonpasserines on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020.

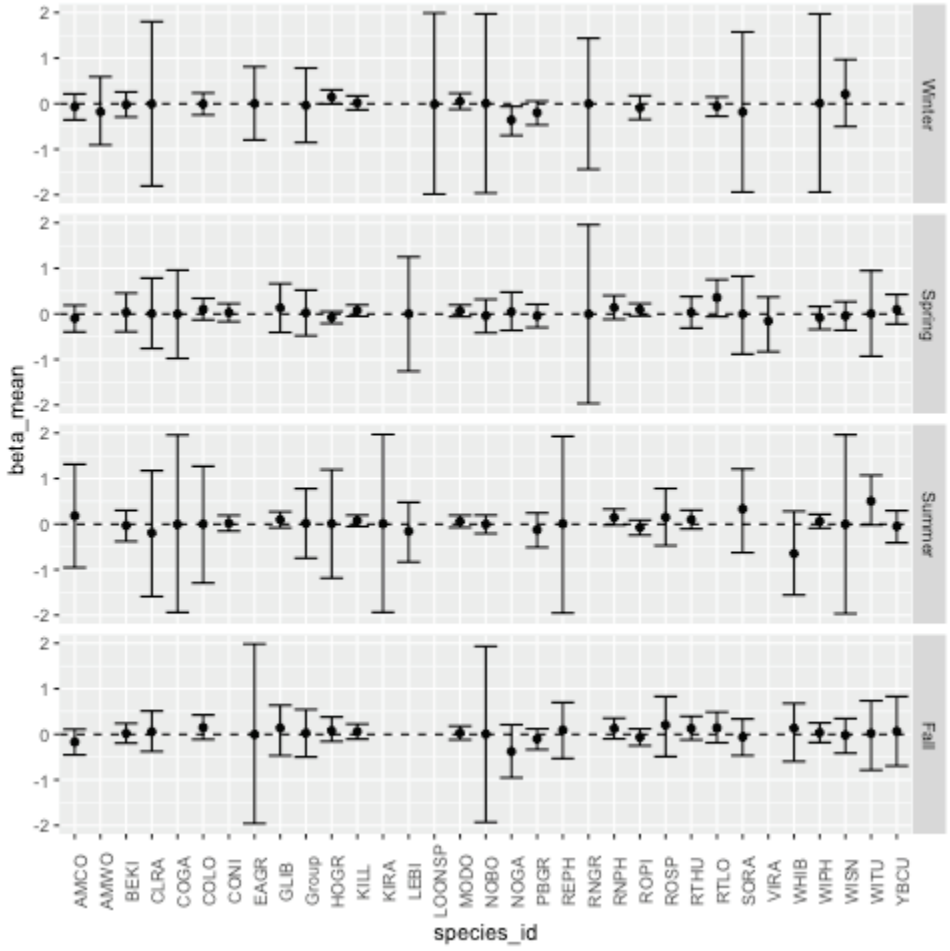


Figure 3-19. Seasonal mean abundance trends for Other Passerines on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020.

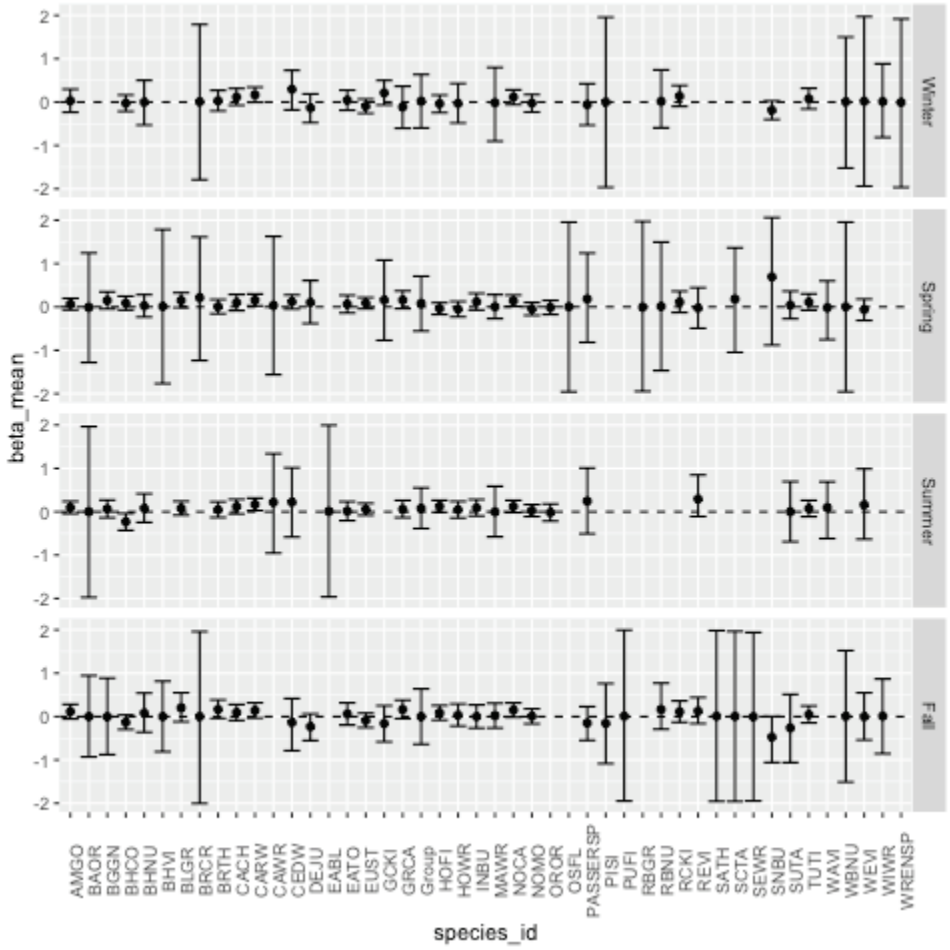
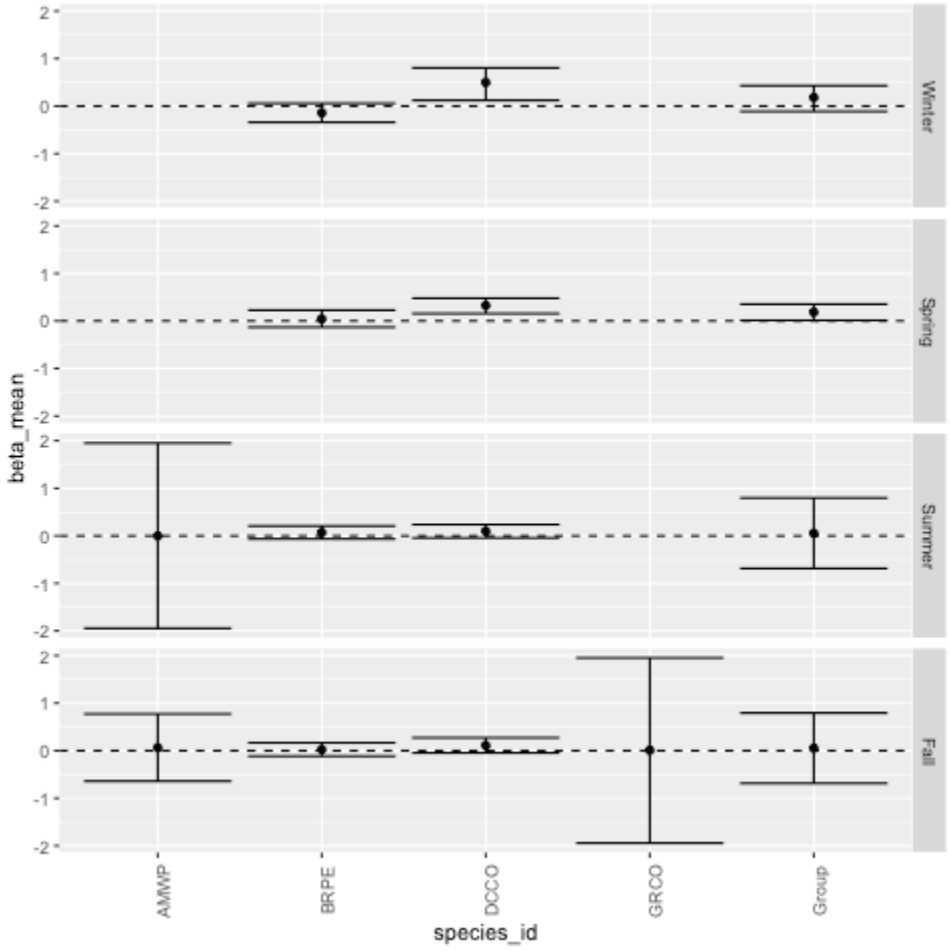


Figure 3-20. Seasonal mean abundance trends for Pelicans and Cormorants on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020.



- Raptors and Vultures:

  No significant changes during the monitoring period for this group or for 17 individual species during any season (Figure 3-21).

- Sandpipers and Plovers:

  No significant changes during the monitoring period for this group or for 21 of 23 individual species during any season; exceptions include a significant decrease in abundance trends for *Calidris* ssp. during the winter, and a decrease for the Least Sandpiper during the fall (Figure 3-22).

Figure 3-21. Seasonal mean abundance trends for Raptors and Vultures on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020.

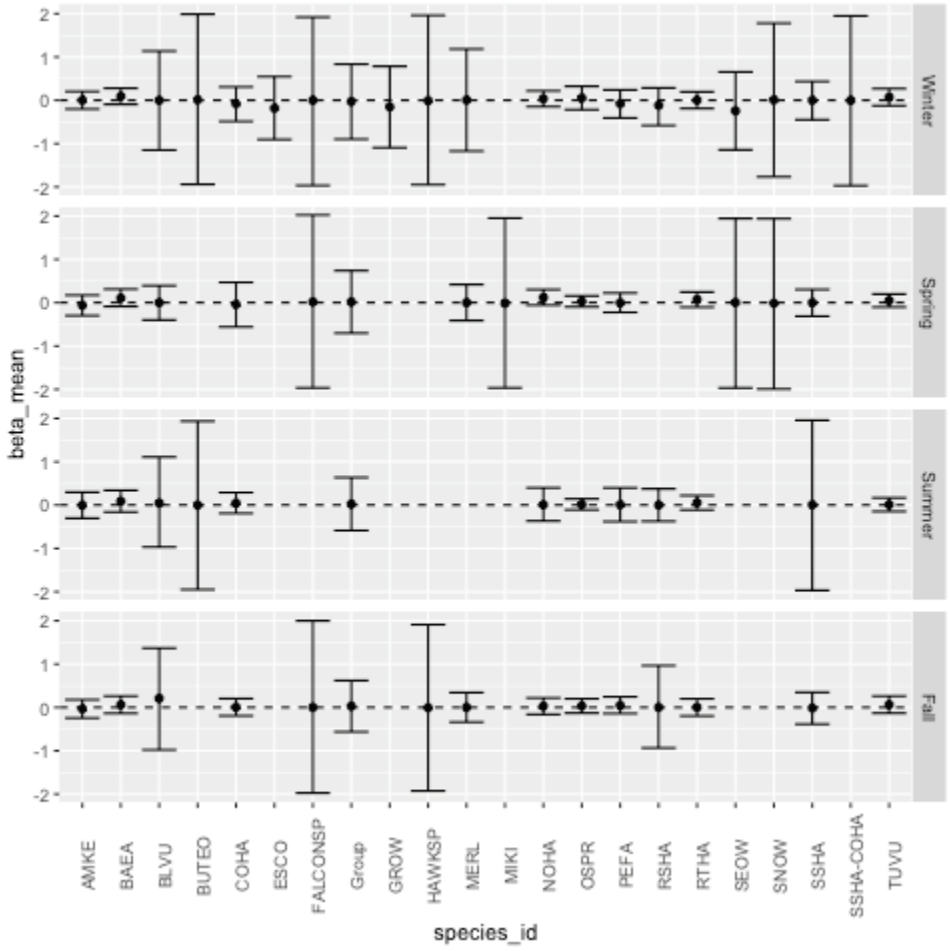
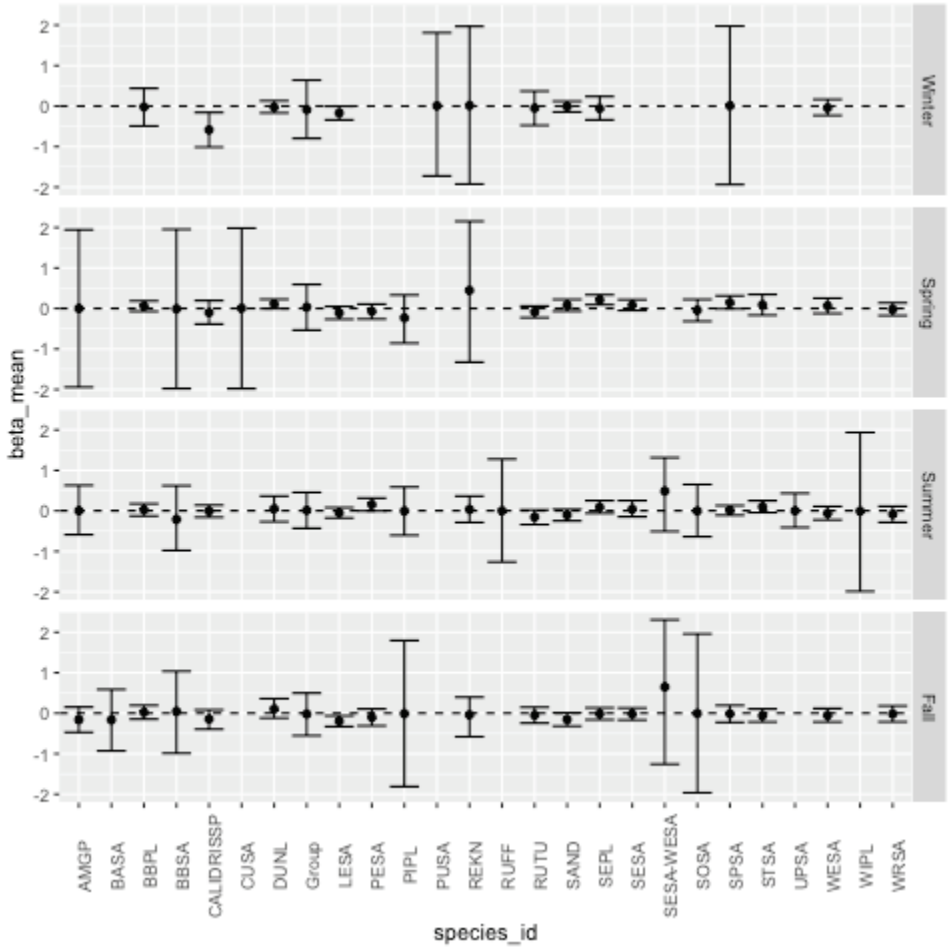


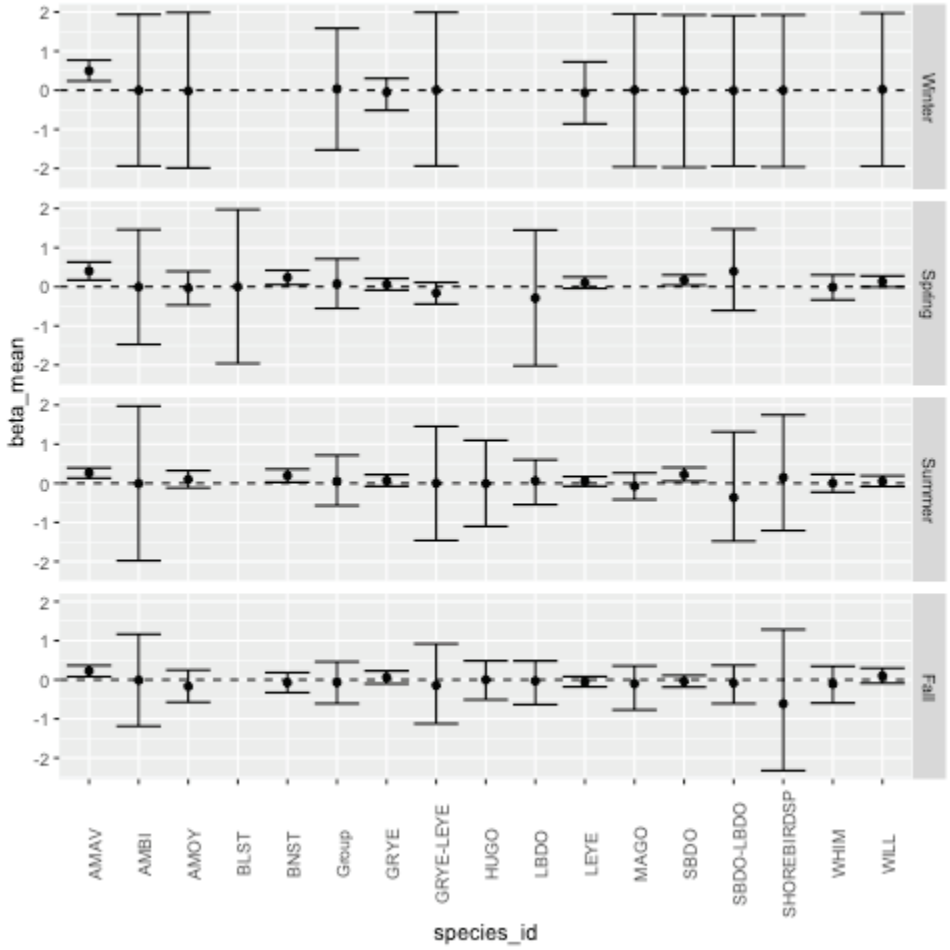
Figure 3-22. Seasonal mean abundance trends for Sandpipers and Plovers on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020.



- Shorebirds:

  No significant changes during the monitoring period for this group or for 11 of 13 individual species during any season; the American Avocet is an exception showing weak (just barely above the 0-line) significant increases in abundance trends during all four seasons, and the Short-billed Dowitcher showing increases during the spring and summer (Figure 3-23). There has been a clear increase in the number of breeding pairs of Black-necked Stilt at CIDMMA. This facility is one of two known breeding sites for this species in Virginia.

Figure 3-23. Seasonal mean abundance trends for Shorebirds on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020.



- Swallows and Swifts:

  No significant changes during the monitoring period for this group or for 7 of 9 individual species during any season; exceptions include a significant increase in abundance trends for Chimney Swift during the summer and fall, and a borderline decline for Cliff Swallow during the summer (Figure 3-24).

- Thrushes:

  No significant changes during the monitoring period for this group or for six individual species during any season (Figure 3-25).

Figure 3-24. Seasonal mean abundance trends for Swallows and Swifts on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020.

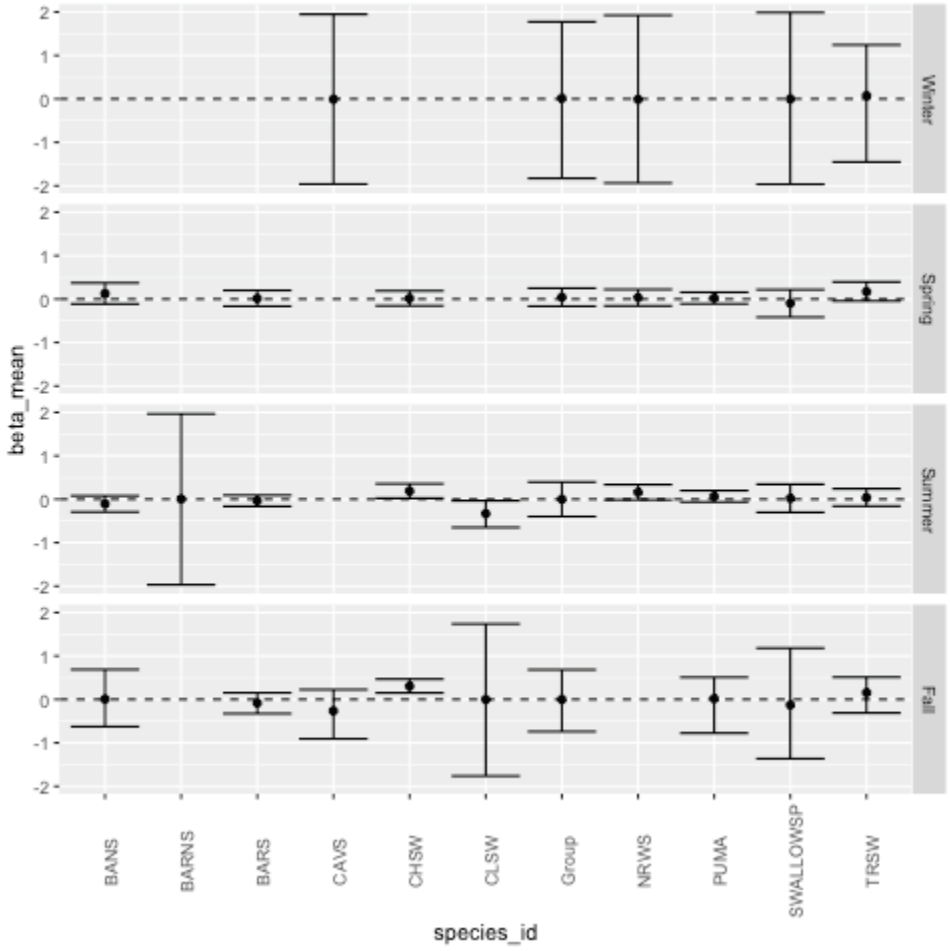
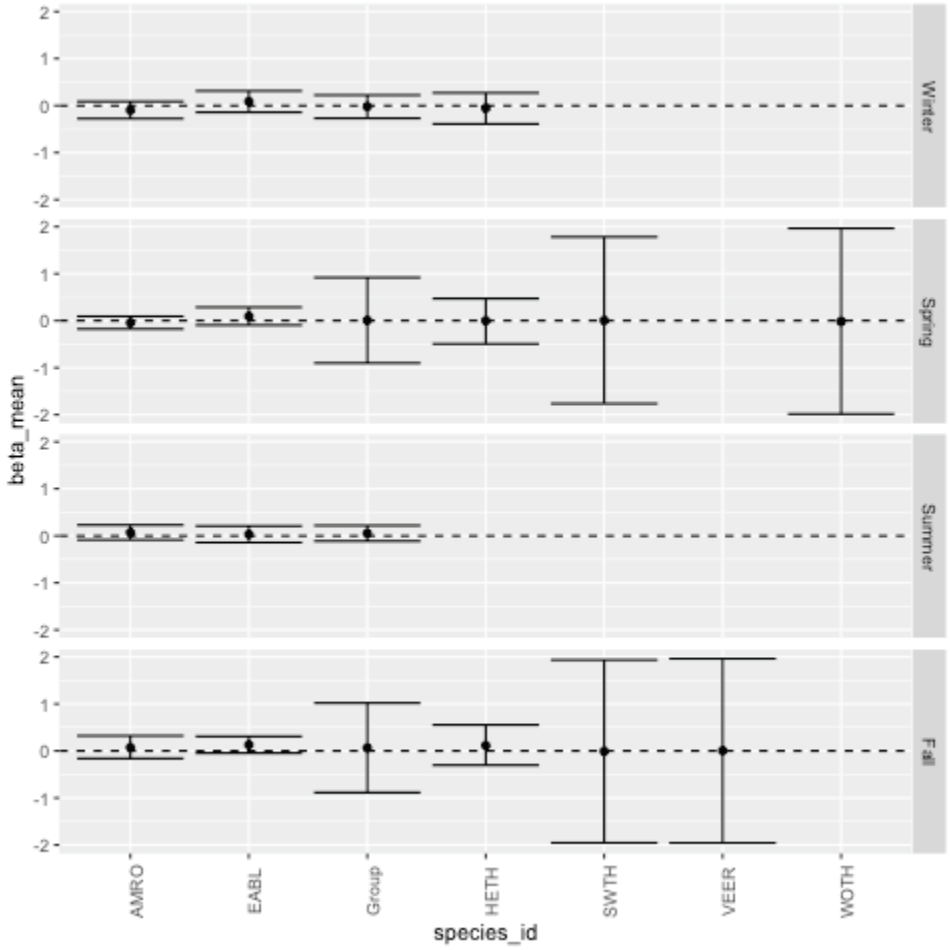


Figure 3-25. Seasonal mean abundance trends for Thrushes on the Craney Island Dredged Material Management Areas, Portsmouth, Virginia, 2008-2020.



- Warblers:

  No significant changes during the monitoring period for this group or for 27 of 28 individual species during any season; the lone exception is a weak significant increase in abundance trends for the Pine Warbler during the spring (Figure 3-26).

- Woodpeckers:

  No significant changes during the monitoring period for this group or for 7 individual species during any season (Figure 3-27).

Figure 3-26. Seasonal mean abundance trends for Warblers on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020.

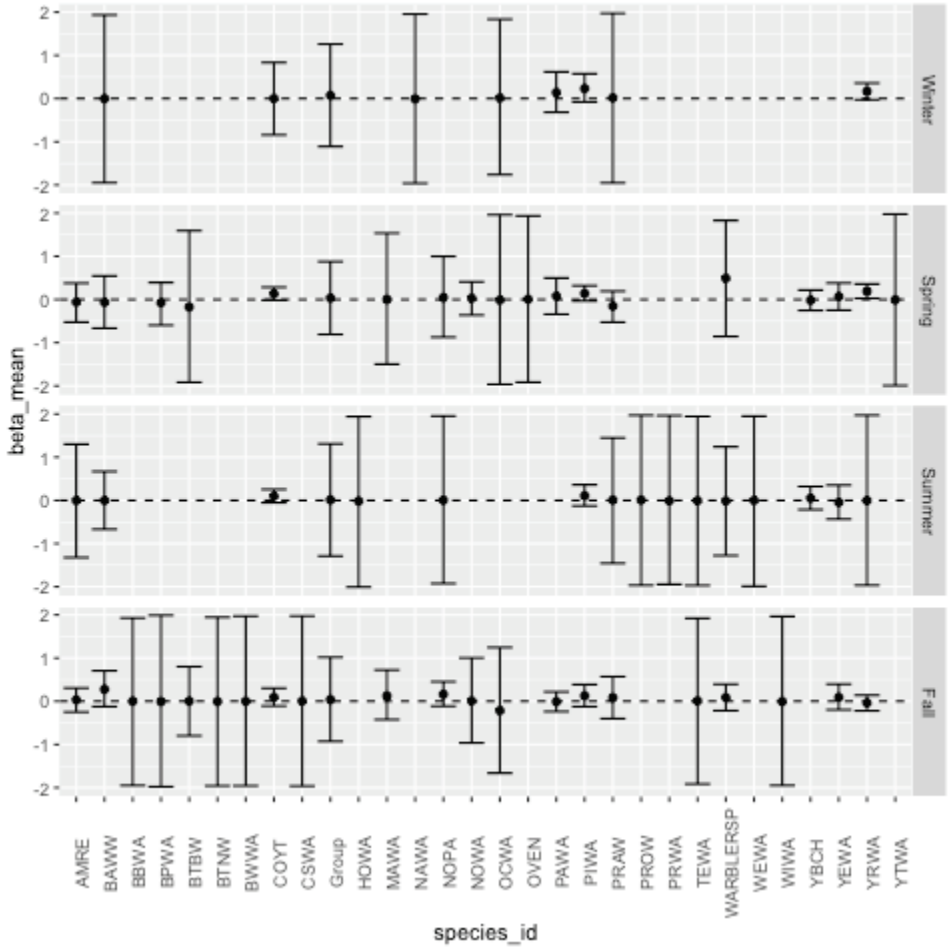
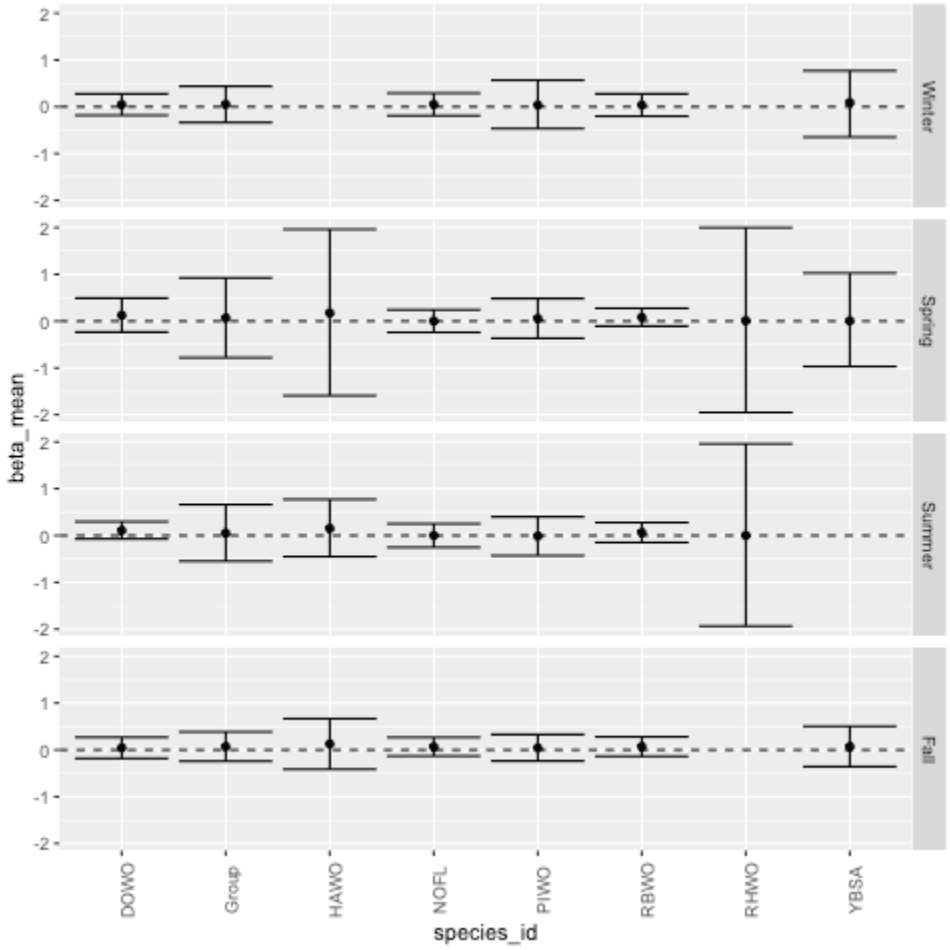


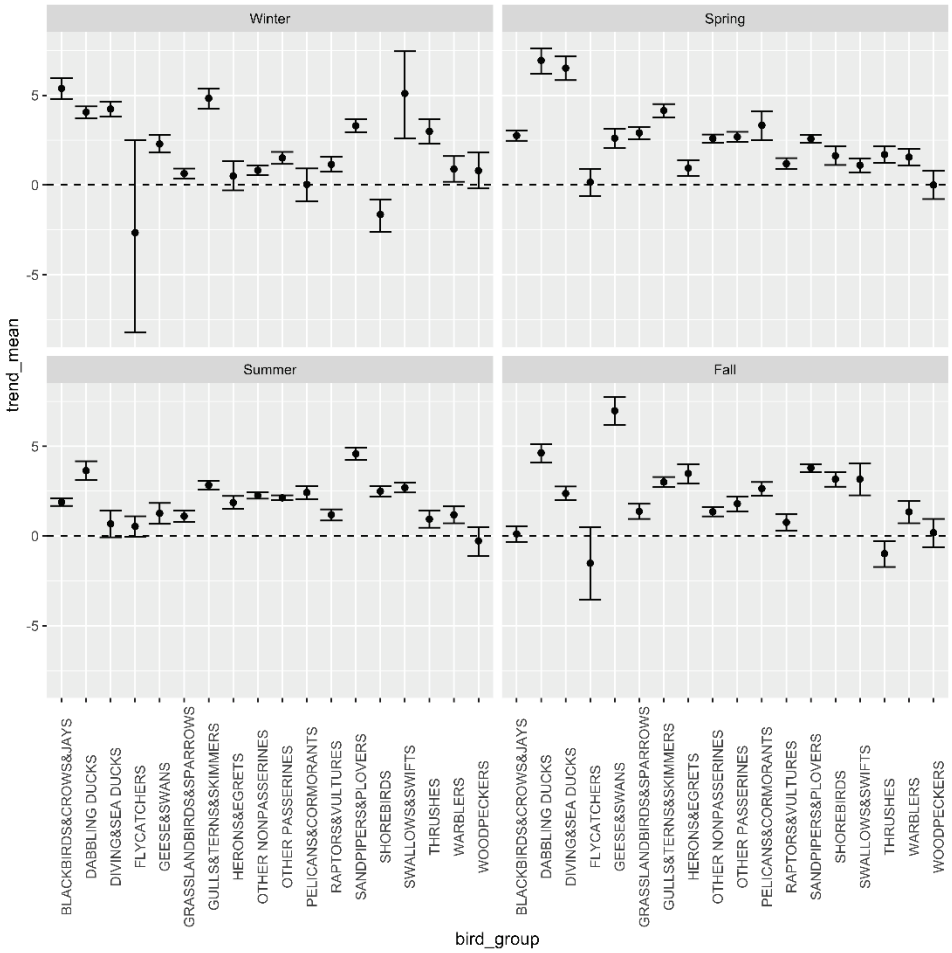
Figure 3-27. Seasonal mean abundance trends for Woodpeckers on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020.



3.4 Species richness

During the monitoring period, most of the 17 species groups showed significant increases in mean species richness trends during all seasons, except the Flycatchers and Woodpeckers, which showed no significant changes during any season, and Shorebirds and Thrushes that showed significant decreases in mean species richness trends during the winter and fall, respectively (Figure 3-28).

Figure 3-28. Seasonal mean species richness for avian species groups on the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020.



4 Discussion

The CIDMMA supports a significant number and diversity of birds and bird species year-round. This report summarizes long-term monitoring of the CIDMMA for the approximately 12-yr period from 2008 to 2020. These data support prior research that shows habitats created from dredged material are often important for coastal bird species, and in some cases, such habitats may support a disproportionate proportion of a species' continental or regional population (Soots and Landin 1978, Guilfoyle et al. 2006, 2007). Confined Disposal Facilities in particular, have a long history of supporting large numbers of birds, even in largely urban and industrial ports and harbors (Guilfoyle et al. 2020a, b). In such cases, habitats created with dredged material may not just be beneficial but may be essential in the long-term persistence of a species. Currently, the USACE Norfolk District continues to perform dredged material deposition in the CIDMMA according to the LTBMP and personnel and contractors are continuing the regularly conducted seasonal monitoring efforts.

Results of this effort continue to show the importance of the CIDMMA for regional bird populations, including many species ranked at Highest Priority and High Priority by the New England/Mid-Atlantic Bird Conservation Region (Atlantic Coast Joint Venture 2008). During the monitoring period documented in this report, several species ranked as Highest Priority were observed on the CIDMMA in large numbers, including the American Black Duck, Red-throated Loon, and Sanderling. During the winter, the CIDMMA is also used in large numbers by the Ruddy Duck and the Northern Shoveler. The CIDMAA may occasionally be used by the endangered Piping Plover, including breeding individuals in 1989-1991 (Beck 2006). The CIDMMA also supports large numbers of High Priority species, including the Semipalmated Sandpiper, Mallard, and Dunlin. Large numbers of Moderate Priority Species have been detected on the CIDMMA, with counts of many species, including the American Avocet, Red-breasted Merganser, Royal Tern, Killdeer, Semipalmated Plover, Least Sandpiper, and Lesser Yellowlegs, numbering in the tens of thousands over the monitoring period. Not only are such areas important for many regional priority species, but by supporting moderately rare and/or sensitive species, areas such as the CIDMMA may act as critical links that serve to buffer populations from becoming critically rare in the future.

In addition, dredged material deposited on the CIDMMA creates sandy berms that constitute important breeding areas for several priority species listed by the Atlantic Coast Joint Venture (2008). Verified breeding efforts have been documented by species designated as Highest Priority species, including Piping Plover (last nested in 1997 [Beck 2006]), and the American Black Duck (presence of broods suggestive of breeding by this species onsite [Beck 2012]; High Priority Species, including the Least Tern and Mallard, and Moderate Priority Species, including the American Avocet (one nesting attempt in the 1970's), Bald Eagle and Killdeer. Non-ranked species, including the Black-necked Stilt and Osprey have also nested on or near the facility. Although Brown Pelicans have continued to increase in numbers at the facility, no nesting has been recorded to date.

Additional nesting by other species have been documented on other sites relatively close to the CIDMMA, which include Grandview Nature Preserve and the Hampton Road Bridge Tunnel South Island. Birds nesting at these sites include the following: Laughing Gull, Herring Gull, Great Black-backed Gull, Common Tern, Gull-billed Tern, Sandwich Tern, Royal Tern, Black Skimmer, and American Oystercatcher. These sites also manage and protect nesting birds by vegetation control, predator control, and placement of chick shelters to shield hatchlings from predators and mid-day heat. The proposed eastward expansion of the Craney Island facility provides an opportunity to build a permanent nesting area for birds outside the containment cells as proposed by Beck (2012). With proper management and monitoring, such a site would likely attract a similar suite of nesting birds to the Craney Island facility as observed at the Hampton Road Bridge Tunnel South Island. In addition, creation of areas with suitable access to shoreline and/or moist soil foraging site, or removal of riprap added to the Craney facility in 1997 (Beck 2006), may attract breeding Piping Plovers that have not nested on Craney Island since 1997.

Included in this report is a preliminary statistical seasonal mean abundance and species richness trend analysis for 271 species and 17 species groups. In general, these results reveal largely stable, unchanging mean abundance trends for most species groups and individual species. Some species show significant increases during some seasons, and very few reveal decreasing abundances in any season (see Figures 3-10 – 3-27). These results also reveal most species groups had significant increasing species richness for most seasons during the monitoring period (Figure 3-

28). These trend analyses, plus the documentation of site utilization by ranked priority species in the New England/Mid-Atlantic Bird Conservation Region on the Craney Island facility, show that the site is likely an important area that contributes to the local and regional stability of seasonal coastal bird populations. With the recent documentation of significant declines of North American birds (Rosenberg et al. 2019), including coastal shorebirds and sea birds, creation, management and monitoring of such sites becomes even more important for building long-term sustainable coastal bird populations. The USACE can play an important role contributing to supporting coastal bird populations through proactive management of CDFs (Calver et al. 2016; Guilfoyle et al. 2020a, b) and by employing best management practices during coastal engineering activities (Guilfoyle et al. 2019). Current management practices at the CIDMMA are consistent with EWN principles, providing benefits including enhancing habitat quality sufficient for multiple bird species and for recreational birding activities. Moreover, in these actions, the USACE can accrue benefits under the ESA Section 7(A)(1) conservation planning USFWS to lower costs of compliance, capitalize on collaborations and partnerships, and provide demonstrable benefits to listed species, regionally ranked priority species and other rare and sensitive species (Hartfield et al. 2017; Guilfoyle et al. 2022).

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Acronyms and Abbreviations

Term	Definition
ACJV	Atlantic Coast Joint Venture
BCR	(Southeastern Coastal Plain) Bird Conservation Region
CDF	Confined Disposal Facility
CIDMMA	Craney Island Dredged Material Management Area
CVWO	Coastal Virginia Wildlife Observatory
DMCA	Dredged Material Containment Areas
EL	Environmental Laboratory
ERDC	Engineer Research and Development Center
ESA	U.S. Endangered Species Act
EST	Eastern Standard Time
EWN®	Engineering With Nature
ICWW	Intracoastal Waterway System
LTBMP	Long-Term Bird Management Plan
NABCI	North American Bird Conservation Initiative
PIF	Partners In Flight
SHNP	Savannah Harbor Navigation Project
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

Unit Conversion Factors

Multiply	By	To Obtain
acres	4,046.873	square meters
acre-feet	1,233.5	cubic meters
angstroms	0.1	nanometers
atmosphere (standard)	101.325	kilopascals
cubic feet	0.02831685	cubic meters
cubic inches	1.6387064 E-05	cubic meters
cubic yards	0.7645549	cubic meters
degrees Fahrenheit	(F-32)/1.8	degrees Celsius
feet	0.3048	meters
hectares	1.0 E+04	square meters
inches	0.0254	meters
miles (U.S. statute)	1,609.347	meters
square feet	0.09290304	square meters
square inches	6.4516 E-04	square meters
square miles	2.589998 E+06	square meters
square yards	0.8361274	square meters
yards	0.9144	meters

Appendix A: Table of Counts of Birds Detected During Seasonal Surveys on the Craney Island Dredged Material Management Area, USACE Norfolk District, Portsmouth, Virginia, 2008-2020

Bird Species	Scientific Name	Species Code	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Snow Goose[W]	*Anser caerulescens*	SNGO	0	0	0	0	0	0	5	0	0	1	0	0	0
Brant[W]	*Branta Bernicia*	BRAN	0	0	0	1	0	0	0	0	5	3	0	4	0
Canada Goose[R]	*Branta canadensis*	CAGO	0	231	1,756	417	203	213	1,442	827	1,770	982	1,434	1,431	521
Tundra Swan[W]	*Cygnus columbianus*	TUSW	0	0	0	10	4	308	155	43	137	25	28	175	0
Mute Swan[T]	*Cygnus olor*	MUSW	0	0	0	1	0	0	0	0	0	0	0	0	0
Wood Duck[YR]	*Aix sponsa*	WODU	0	0	6	0	0	3	0	2	5	7	18	0	0
Mallard[R]	*Anas platyrhynchos*	MALL	29	1,210	2,559	2,770	1,465	2,741	6,578	6,290	7,741	8,027	4,264	4,569	1,829
Mottled Duck[T]	*Anus fulvigula*	MODU	0	0	0	0	0	0	0	0	0	0	2	0	0
American Black Duck[W]	*Anas rubripes*	AMBD	2	83	158	392	149	295	295	480	890	472	350	328	214
Gadwall[W]	*Mareca strepera*	GADW	0	23	135	367	229	512	781	1,749	4,665	4,034	2,262	2,511	2,055
Green-winged Teal[W]	*Anas crecca*	GWTE	0	522	955	1,138	729	544	2,699	3,095	13,271	10,234	3,306	5,544	2,706
American Wigeon[W]	*Mareca Americana*	AMWI	0	82	231	311	242	473	392	784	723	682	463	270	278
Eurasian Wigeon[W]	*Anas penelope*	EUWI	0	0	2	0	0	9	12	13	5	6	4	1	3
Northern Pintail[W]	*Anas acuta*	NOPI	0	39	7	59	2,640	102	245	114	592	265	34	31	33
Northern Shoveler[W]	*Spatula clypeata*	NOSH	42	3,260	1,397	10,802	9,693	9,218	8,392	12,668	21,983	34,944	20,962	8,067	4,048
Blue-winged Teal[M]	*Spatula discors*	BWTE	1	718	40	267	463	252	79	168	560	290	147	38	36
Canvasback[W]	*Aythya valisineria*	CANV	0	31	17	333	229	5,935	1,963	4,200	2,912	3,490	4,108	1,001	726
Redhead[W]	*Aythya americana*	REDH	0	0	0	1	0	2	15	23	1	3	2	5	0
Ring-necked Duck[W]	*Aythya colaris*	RNDU	0	0	18	12	6	83	21	36	114	45	33	113	2
Greater Scaup[W]	*Aythya marila*	GRSC	0	0	0	0	0	6	1	0	0	1	5	26	2
Lesser Scaup[W]	*Aythya affinis*	LESC	0	8	5	32	23	446	90	99	39	38	66	62	3
Long-tailed Duck[T]	*Clangula hyemalis*	LTDU	0	0	0	0	0	0	0	0	0	0	0	1	0
Surf Scoter[W]	*Melanitta perspicillata*	SUSC	0	0	21	79	13	104	55	28	22	40	7	143	19
Black Scoter[W]	*Melanitta Americana*	BLSC	0	0	0	1	2	11	8	4	1	1	47	5	2

White-winged Scoter[W]	*Melanitta fusca*	WWSC	0	0	0	0	2	0	0	0	0	0	1	3	0
Bufflehead[W]	*Bucephala albeola*	BUFF	0	112	118	489	303	911	556	840	1,063	1,418	983	985	488
Common Goldeneye[W]	*Bucephala clangula*	COGO	0	0	0	0	0	2	0	0	3	2	3	8	0
Hooded Merganser[W]	*Lophodytes cucullatus*	HOME	0	4	4	58	131	76	15	117	108	128	118	101	41
Common Merganser[W]	*Mergus merganser*	COME	0	0	0	0	0	0	0	5	0	3	0	4	0
Red-breasted Merganser[W]	*Mergus serrator*	RBME	0	125	28	169	638	403	396	851	1,936	5,334	877	4,750	3,889
Ruddy Duck[W]	*Oxyura jamaicensis*	RUDU	8	458	2,417	7,852	5,325	14,160	11,702	22,600	45,652	29,003	23,227	15,388	1,900
Northern Bobwhite[R]	*Colinus virginianus*	NOBO	0	1	3	13	7	7	7	3	8	2	15	14	1
Wild Turkey[YR]	*Meleagris gallopavo*	WITU	0	0	1	0	0	0	6	0	11	7	13	12	13
Pied-billed Grebe[R]	*Podilymbus podiceps*	PBGR	0	3	19	24	71	15	121	43	42	45	12	21	6
Horned Grebe[W]	*Podiceps auritus*	HOGR	0	97	300	185	269	560	356	603	1,005	2,093	1,659	1,321	798
Eared Grebe[T]	*Podiceps nigricollis*	EAGR	0	0	0	0	2	0	5	0	0	0	0	1	0
Red-necked Grebe[W]	*Podiceps grisegena*	RNGR	0	0	0	0	0	1	5	1	0	0	0	0	0
Rock Pigeon[YR]	*Columba livia*	ROPI	18	35	224	422	178	266	142	235	94	243	267	98	18
Mourning Dove[R]	*Zenaida macroura*	MODO	46	426	667	900	760	1,535	1,351	999	1,297	1,099	1,309	1,879	298
Yellow-billed Cuckoo[N]	*Coccyzus americanus*	YBCU	0	0	4	1	0	3	1	4	9	3	12	10	0
Common Nighthawk[N]	*Chordeiles minor*	CONI	8	5	6	4	12	60	12	7	33	65	25	20	3
Chimney Swift[M]	*Chaetura pelagica*	CHSW	5	92	264	227	111	214	953	733	1,162	2,063	1,149	2,547	38
Ruby-throated Hummingbird[S]	*Archilochus colubris*	RTHU	0	1	12	7	5	17	20	16	0	26	51	42	11
Sora[SB]	*Porzana Carolina*	SORA	0	0	0	3	4	1	11	2	4	5	0	1	5
Clapper Rail[YR]	*Rallus lingirostris*	CLRA	0	0	0	1	1	1	0	0	8	19	12	4	0
King Rail[YR]	*Rallus elegans*	KIRA	0	0	0	0	0	0	1	0	0	0	0	0	0
Virginia Rail[YR]	*Rallus limicola*	VIRA	0	0	0	0	1	0	0	0	0	0	3	1	0
Common Galinule[S]	*Gallinula galeata*	COGA	0	0	0	0	0	0	0	0	0	0	0	1	0

American Coot[R]	*Fulica Americana*	AMCO	0	0	26	20	25	3	117	46	70	40	2	23	0
Black-necked Stilt[SB]	*Himantopus mexicanus*	BNST	3	37	67	310	208	384	612	609	1,090	1,126	791	594	257
American Avocet[R]	*Recurvirostra americana*	AMAV	37	364	221	473	292	376	1,304	1,512	2,603	6,412	8,538	1,696	740
American Oystercatcher[YR]	*Haematopus palliates*	AMOY	0	11	4	9	1	10	9	16	7	4	7	1	18
Black-bellied Plover[W]	*Pluvialis squatarola*	BBPL	27	116	60	100	74	212	116	746	253	331	179	106	13
American Golden Plover[M]	*Pluvialis dominica*	AMGP	0	0	1	10	4	5	5	2	10	4	0	2	0
Killdeer[R]	*Charadrius vociferous*	KILL	63	338	597	730	509	1,138	1,221	933	1,218	1,846	967	1,258	371
Wilson's Plover[T]	*Charadrius wilsonia*	WIPL	0	0	1	0	0	0	0	0	0	0	0	0	0
Semipalmated Plover[M]	*Charadrius semipalmatus*	SEPL	27	597	767	415	374	850	1,775	1,725	2,337	2,750	1,142	1,421	380
Piping Plover[S]	*Charadrius melodus*	PIPL	0	0	0	0	1	3	1	1	5	4	2	1	0
Upland Sandpiper[M]	*Bartramia longicauda*	UPSA	0	1	1	0	2	0	1	0	0	0	1	0	0
Whimbrel[W]	*Numenius phaeopus*	WHIM	3	0	0	0	0	8	1	6	1	3	4	4	1
Hudsonian Godwit[M]	*Limosa haemastica*	HUGO	1	0	0	0	3	0	0	1	4	0	0	0	0
Marbled Godwit[W]	*Limosa fedoa*	MAGO	2	1	0	7	0	7	9	3	6	1	0	1	0
Ruddy Turnstone[W]	*Arenaria interpres*	RUTU	17	46	86	92	68	104	60	67	42	72	98	40	2
Purple Sandpiper[W]	*Calidris maritima*	PUSA	0	0	0	8	0	0	0	0	0	0	2	1	0
Calidris spp.	*Calidris spp.*	CALIDRIS	0	6,636		8,109	3,211	2,751	10,622	11,468	33,087	13,318	4,580	1,119	2,085
Red Knot[M]	*Calidris canutus*	REKN	0	2	0	2	4	0	2	13	38	0	1	1	2
Sanderling[W]	*Calidris alba*	SAND	89	462	311	848	246	819	412	923	1,138	899	795	691	425
Semipalmated Sandpiper[M]	*Calidris pusilla*	SESA	3,135	3,391	7,843	21,572	30,015	31,634	35,371	19,992	13,447	27,468	38,671	23,869	5,092
Western Sandpiper[M]	*Calidris mauri*	WESA	25	1,743	107	591	271	640	2,457	1,039	729	715	480	935	81
Least Sandpiper[W]	*Calidris minutilla*	LESA	545	1,790	2,645	1,685	1,267	1,279	1,134	1,379	3,129	1,526	666	641	649

White-rumped Sandpiper[M]	*Calidris fuscicollis*	WRSA	0	23	6	55	54	32	34	45	50	63	41	13	7
Baird's Sandpiper[T]	*Calidris bairdii*	BASA	0	0	0	0	0	2	0	3	2	1	0	0	2
Dunlin[W]	*Calidris alpine*	DUNL	113	2,607	1,369	2,447	1,293	5,465	3,869	5,504	8,923	14,790	15,297	4,439	2,818
Curlew Sandpiper[T]	*Calidris ferruginea*	CUSA	0	0	0	0	0	0	1	0	0	0	0	0	0
Stilt Sandpiper[M]	*Calidrius himantopus*	STSA	12	260	60	99	127	97	452	541	150	390	585	123	109
Pectoral Sandpiper[M]	*Calidris melanotos*	PESA	1	84	21	28	27	28	20	70	117	68	22	19	69
Buff-breasted Sandpiper[T]	*Calidris subruficollis*	BBSA	0	1	0	0	0	1	0	0	10	6	0	0	0
Ruff[T]	*Calidris pugnax*	RUFF	0	0	0	0	0	0	1	0	0	1	0	0	0
Short-billed Dowitcher[M]	*Limnodromus griseus*	SBDO	35	348	239	120	138	339	3,047	2,887	1,862	1,034	1,295	522	471
Long-billed Dowitcher[W]	*Limnodromus scolopaceus*	LBDO	0	0	1	3	0	0	0	42	14	5	6	6	0
Wilson's Snipe[W]	*Gallinago delicate*	WISN	0	0	2	0	1	13	4	4	14	17	7	7	1
American Woodcock[W]	*Scolopax minor*	AMWO	0	0	0	0	0	3	0	0	0	0	0	0	1
Spotted Sandpiper[SB]	*Actitis macularius*	SPSA	34	99	123	144	211	232	218	137	349	227	261	181	51
Solitary Sandpiper[M]	*Tringa solitaria*	SOSA	0	0	9	3	0	5	2	0	5	4	1	1	0
Willet[R]	*Tringa semipalmata*	WILL	17	35	77	91	62	121	133	141	98	250	217	114	35
Greater Yellowlegs[W]	*Tringa melanoleuca*	GRYE	15	93	120	212	157	383	133	409	512	617	333	295	44
Lesser Yellowlegs[W]	*Tringa flavipes*	LEYE	483	2,200	2,350	2,183	1,566	1,973	4,838	3,149	5,301	7,402	5,371	3,076	1,018
Wilson's Phalarope[M]	*Phalaropus tricolor*	WIPH	0	19	22	24	34	36	37	67	55	91	22	21	10
Red-necked Phalarope[M]	*Phalaropus lobatus*	RNPH	13	30	15	51	13	16	43	34	376	143	14	0	12
Red Pharalope[W]	*Phalaropus fulicarius*	REPH	0	0	0	0	0	0	1	1	4	9	0	0	0
Bonaparte's Gull[W]	*Chroicocephalus Philadelphia*	BOGU	0	0	0	4	35	5	30	3	12	12	11	38	6
Laughing Gull[R]	*Leucophaeus atricilla*	LAGU	388	2,273	1,399	5,059	870	1,272	1,281	5,178	2,042	3,807	1,108	586	373
Ring-billed Gull[W]	*Larus delawarensis*	RBGU	22	543	660	1,138	581	2,379	1,665	2,343	2,849	2,680	2,920	9,351	10,905
Herring Gull[YR]	*Larus argentatus*	HEGU	134	1,319	1,029	2,468	759	1,610	1,740	1,679	3,833	3,334	3,173	1,614	5,529

Iceland Gull[T]	*Larus glaucoides*	ICGU	0	0	0	0	0	0	0	0	2	0	0	0	0
Glaucous Gull[W]	*Larus hyperboreus*	GLGU	0	0	0	8	0	0	0	0	0	0	0	0	0
Lesser Black-backed Gull[W]	*Larus fuscus*	LBBG	2	49	4	56	24	32	55	35	56	38	45	39	86
Great Black-backed Gull[W]	*Larus marinus*	GBBG	60	1,098	670	631	305	632	699	474	559	685	529	424	254
Least Tern[N]	*Sternula antillarum*	LETE	309	1,877	2,213	4,143	1,772	2,874	1,978	2,071	1,511	2,545	1,484	1,827	467
Black Tern[M]	*Childonias niger*	BLTE	1	227	1	638	17	49	49	44	40	102	4	7	0
Common Tern[M]	*Sterna hirundo*	COTE	26	11	9	70	124	7	14	22	81	9	3	2	1
Forster's Tern[W]	*Sterna forsteri*	FOTE	0	16	12	80	19	46	123	116	74	85	30	12	48
Gull-billed Tern[SB]	*Gelochelidon nilotica*	GBTE	18	24	52	73	61	58	14	35	72	156	101	88	20
Sandwich Tern[SB]	*Thalasseus sandvicensis*	SATE	0	0	2	4	0	2	33	8	2	0	0	2	1
Royal Tern[SB]	*Thalasseus maximus*	ROYT	159	1,170	714	358	426	2,142	2,144	1,145	2,502	1,665	1,632	3,537	592
Caspian Tern[M]	*Hydroprogne caspia*	CATE	54	500	184	226	204	494	145	249	190	100	310	150	160
Black Skimmer[SB]	*Rynchops niger*	BLSK	1	40	38	9	5	33	27	203	47	96	40	24	6
Red-throated Loon[W]	*Gavia Stellata*	RTLO	0	21	2	5	28	38	115	186	87	291	1,195	10	14
Common Loon[W]	*Gavia immer*	COLO	0	0	6	7	12	35	20	50	49	40	60	65	8
Northern Gannet[W]	*Morus bassanus*	NOGA	0	3	0	0	21	238	611	45	51	41	19	10	253
Great Cormorant[T]	*Phalacrocorax carbo*	GRCO	0	0	0	0	0	0	0	0	2	0	0	0	0
Double-crested Cormorant[R]	*Phlacorcorax auritus*	DCCO	45	607	1,037	1,706	434	2,085	5,447	3,781	13,804	26,085	5,469	7,018	8,498
American White Pelican[YR]	*Pelecanus erythrorhynchos*	AWPE	0	14	0	0	0	0	0	0	6	0	0	0	0
Brown Pelican[R]	*Pelecanus occidentalis*	BRPE	32	1,416	138	606	269	526	475	914	1,013	1,567	1,016	825	192
American Bittern[W]	*Botaurus lentiginosus*	AMBI	0	0	0	0	0	0	3	2	2	1	0	0	0
Least Bittern[SB]	*Ixobrychus exilis*	LEBI	0	0	0	0	0	0	16	0	1	9	2	1	0

Great Blue Heron[R]	*Ardea herodias*	GBHE	16	110	67	162	129	144	118	282	352	476	405	460	82
Cattle Egret[B]	*Bubulcus ibis*	CAEG	0	0	0	1	1	0	0	2	1	0	0	0	0
Snowy Egret[R]	*Egretta thula*	SNEG	6	156	31	249	35	51	19	722	387	844	540	357	56
Little Egret[T]	*Egretta garzetta*	LIEG	0	0	0	0	0	0	0	0	0	0	0	1	0
Great Egret[R]	*Ardea alba*	GREG	29	519	153	372	227	220	144	769	785	630	535	369	0
Tricolored Heron[YR]	*Egretta tricolor*	TRHE	0	0	0	7	0	1	2	33	5	6	14	6	0
Little Blue Heron[R]	*Egretta caerulea*	LBHE	0	0	0	0	0	0	0	2	2	2	3	1	0
Reddish Egret[T]	*Egretta rufescens*	REEG	1	0	0	0	0	0	0	0	0	0	0	0	0
Green Heron[SB]	*Butorides virescens*	GRHE	1	1	15	9	5	8	4	17	31	41	58	39	10
Black-crowned Night-Heron[R]	*Nycticorax nycticorax*	BCNH	0	0	0	0	3	2	1	34	36	79	58	34	5
Yellow-crowned Night-Heron[SB]	*Nyctanassa violacea*	YCNH	5	5	0	7	2	3	6	25	8	13	23	10	0
Glossy Ibis[S]	*Plegadis falcinellus*	GLIB	0	3	3	5	3	7	16	23	44	11	4	21	5
White Ibis[M]	*Eudocimus albus*	WHIB	0	1	0	0	2	0	0	64	10	1	4	0	0
Roseate Spoonbill[T]	*Platalea ajaja*	ROSP	0	8	0	0	0	0	0	0	0	0	45	0	0
Turkey Vulture[YR]	*Cathartes aura*	TUVU	7	23	46	76	59	71	70	129	89	119	144	130	32
Black Vulture[YR]	*Coragyps atratus*	BLVU	0	0	0	3	0	2	4	5	3	12	0	2	2
Osprey[R]	*Pandion haliaetus*	OSPR	45	124	195	151	121	206	170	245	310	334	356	333	43
Mississippi Kite[N]	*Ictinia mississippiensis*	MIKI	0	0	0	0	0	0	0	0	0	2	0	0	0
Bald Eagle[YR]	*Haiaeetus leucocephalus*	BAEA	0	5	13	24	22	56	55	56	76	75	100	215	56
Northern Harrier[W]	*Circus hudsonius*	NOHA	0	5	20	80	43	81	69	105	116	162	126	144	53
Sharp-shinned Hawk[W]	*Accipiter striatus*	SSHA	1		2	3	2	3	4	3	5	5	4	5	2
Cooper's Hawk[S]	*Accipiter cooperii*	COHA	2	3	7	12	6	30	19	24	32	30	20	31	2
Red-shouldered Hawk[YR]	*Buteo lineatus*	RSHA	0	1	1	1	0	1	4	1	11	6	6	4	1
Red-tailed Hawk[YR]	*Buteo jamaicensis*	RTHA	0	34	48	81	114	145	120	142	131	154	123	177	46

Short-eared Owl[W]	*Asio flammeus*	SEOW	0	0	0	1	0	0	1	0	0	0	0	1	0
Great Horned Owl[R]	*Bubo virginianus*	GHOW	0	0	0	0	0	2	0	0	0	0	1	0	0
Snowy Owl[W]	*Bubo scandiacus*	SNOW	0	0	0	0	0	3	3	0	0	0	0	0	0
Eastern Screech-Owl[YR]	*Megascops asio*	EASO	0	0	0	0	0	3	0	0	0	0	0	0	1
Belted Kingfisher[YR]	*Megaceryle alcyon*	BEKI	0	4	5	13	15	21	10	13	24	47	32	21	7
Red-headed Woodpecker[YR]	*Melanerpes erythrocephalus*	RHWO	0	0	0	0	0	0	0	0	0	0	0	5	0
Red-bellied Woodpecker[R]	*Melanerpes carolinus*	RBWO	0	4	18	28	30	49	61	64	78	74	81	135	17
Yellow-bellied Sapsucker[W]	*Sphyrapicus varius*	YBSA	0	0	1	0	0	1	0	4	1	2	4	7	0
Hairy Woodpecker[YR]	*Dryobates villosus*	HAWO	0	0	0	0	1	1	0	0	2	0	12	6	2
Downy Woodpecker[YR]	*Dryobates pubescens*	DOWO	0	6	1	10	14	39	42	66	54	52	76	124	28
Northern Flicker[YR]	*Colaptes auratus*	NOFL	0	5	0	17	11	22	18	43	25	36	47	68	24
Pileated Woodpecker[YR]	*Dryocopus pileatus*	PIWO	0	0	1	2	3	6	7	19	16	21	18	20	2
American Kestrel[WR]	*Falco sparverius*	AMKE	0	12	7	30	11	35	31	27	21	27	29	44	13
Merlin[W]	*Falco columbarius*	MERL	0	1	0	1	0	6	2	2	2	4	7	4	0
Peregrine Falcon[W]	*Falco peregrinus*	PEFA	1	11	3	12	12	17	21	26	29	30	22	14	2
Olive-sided Flycatcher[T]	*Contopus cooperi*	OSFL	0	0	0	0	0	0	0	0	0	0	0	1	0
Eastern Wood-Pewee[N]	*Contopus virens*	EWPE	0	0	0	0	0	2	0	1	1	2	0	4	0
Empidonax spp.[N]	*Empidonax spp.*	EMPIDONAX	0	0	0	0	1	0	0	0	1	0	0	1	0
Willow Flycatcher[N]	*Empidonax traillii*	WIFL	3	0	0	0	0	0	11	0	0	1	0	1	0
Eastern Phoebe[W]	*Sayornis phoebe*	EAPH	0	2	0	0	3	4	2	8	10	20	12	21	5
Great Crested Flycatcher[N]	*Myiarchus crinitus*	GCFL	5	1	10	9	11	16	31	27	35	33	43	51	12
Eastern Kingbird[N]	*Tyrannus tyrannus*	EAKI	5	7	30	27	36	79	62	44	80	80	61	96	11

Scissor-tailed Flycatcher[T]	*Tyrannus forficatus*	STFL	0	0	0	0	0	0	0	0	0	0	0	1	0
White-eyed Vireo[R]	*Vireo griseus*	WEVI	0	0	3	2	0	3	4	2	3	6	6	4	1
Blue-headed Vireo[W]	*Vireo solitaries*	BHVI	0	0	0	0	1	0	0	1	1	0	0	2	0
Red-eyed Vireo[N]	*Vireo olivaceus*	REVI	0	1	0	0	3	5	1	3	3	3	5	1	6
Warbling Vireo[N]	*Vireo gilvus*	WAVI	0	0	2	0	0	0	0	0	3	9	0	0	0
Blue Jay[YR]	*Cyanocitta cristata*	BLJA	3	44	94	128	86	188	179	250	242	243	217	353	62
Fish Crow[R]	*Corvus ossifragus*	FICR	5	6	50	42	36	323	70	651	198	172	277	133	28
American Crow[YR]	*Corvus brachyrhynchos*	AMCR	6	76	79	72	52	145	167	337	286	291	302	515	162
Horned Lark[YR]	*Eremophila alpestris*	HOLA	1	11	32	119	51	102	27	68	165	88	33	47	6
Purple Martin[N]	*Progne subis*	PUMA	15	82	132	159	95	122	146	94	182	227	276	167	45
Tree Swallow[W]	*Agelaius bicolor*	TRSW	0	29	39	66	21	955	244	2,483	407	630	238	232	7
Barn Swallow[S]	*Hirundo rustica*	BARS	89	565	1,965	1,088	345	1,052	971	698	834	1,491	609	480	129
Northern Rough-winged Swallow[N]	*Stelgidopteryx serripennis*	NRWS	2	3	7	21	2	33	19	35	33	51	68	49	1
Bank Swallow[S]	*Riparia riparia*	BANS	0	8	51	27	11	11	10	10	28	45	2	2	0
Cliff Swallow[M]	*Petrochelidon pyrrhonota*	CLSW	0	0	36	2	0	13	2	0	1	1	0	1	0
Cave Swallow[T]	*Petrochelidon fulva*	CASW	0	0	11	0	0	0	0	24	0	1	0	0	0
Tufted Titmouse[YR]	*Baeolophus bicolor*	TUTI	0	6	10	18	17	36	37	40	72	127	138	147	35
Carolina Chickadee[R]	*Poecile carolinensis*	CACH	0	10	49	78	57	123	137	168	200	249	255	335	58
Red-breasted Nuthatch[W]	*Sitta canadensis*	RBNU	0	0	1	0	4	1	0	0	0	1	3	3	0
White-breasted Nuthatch[YR]	*Sitta carolinensis*	WBNU	0	0	1	0	4	0	1	0	0	1	0	0	0
Brown-headed Nuthatch[YR]	*Sitta pusilla*	BHNU	0	1	4	3	2	6	16	5	3	2	4	6	2
Brown Creeper[W]	*Certhia Americana*	BRCR	0	0	0	0	0	0	0	0	0	2	5	5	0

House Wren[YR]	*Troglodytes aedon*	HOWR	2	10	20	6	11	26	30	27	38	26	33	69	8
Winter Wren[W]	*Troglodytes hiemalis*	WIWR	0	0	0	0	1	3	0	0	2	3	1	0	0
Carolina Wren[R]	*Thryothorus ludovicianus*	CARW	3	27	78	90	107	218	195	242	356	470	401	561	148
Marsh Wren[R]	*Cistothorus palustris*	MAWR	0	2	0	2	4	4	12	18	15	17	7	11	3
Sedge Wren[W]	*Cristothorus platensis*	SEWR	0	0	0	0	0	0	0	0	0	1	0	0	0
Blue-gray Gnatcatcher[SB]	*Polioptila caerulea*	BGGN	0	0	5	15	5	12	10	22	31	33	76	108	8
Golden-crowned Kinglet[W]	*Regulus satrapa*	GCKI	0	0	0	0	1	6	3	5	0	12	7	24	9
Ruby-crowned Kinglet[W]	*Regulus calendula*	RCKI	0		3	7	2	11	8	23	19	78	35	66	29
Eastern Bluebird[YR]	*Sialia sialis*	EABL	0	2	29	48	41	60	101	103	67	162	165	306	67
Gray-cheeked Thrush[M]	*Catharus minimus*		0	0	0	0	0	0	0	0	0	0	0	0	0
Veery[M]	*Catharus fuscescens*	VEER	0	0	0	0	0	0	0	0	0	1	0	0	0
Swainson's Thrush[M]	*Catharus ustulatus*	SWTH	0	0	0	0	0	0	1	0	0	1	1	0	0
Hermit Thrush[W]	*Catharus guttatus*	HETH	0	0	0	1	2	6	4	9	1	2	10	10	2
Wood Thrush[N]	*Hylocichla mustelina*	WOTH	0	0	0	0	0	1	0	0	0	0	0	0	0
American Robin[YR]	*Turdus migratorius*	AMRO	16	62	187	375	160	369	541	775	670	219	235	538	67
Gray Catbird[R]	*Dumetella carolinensis*	GRCA	1	3	11	12	17	80	86	98	84	121	69	153	13
Northern Mockingbird[R]	*Mimus polyglottos*	NOMO	13	66	115	171	159	231	159	149	0	160	154	225	44
Brown Thrasher[R]	*Toxostoma rufum*	BRTH	2	3	44	66	22	69	78	131	109	123	101	167	27
Sage Thrasher[T]	*Oreoscoptes montanus*	SATH	0	0	0	0	0	0	0	0	0	0	0	1	0
European Starling[YR]	*Sturnus vulgaris*	EUST	187	1,205	2,021	3,477	3,023	4,139	5,000	3,979	3,881	4,477	3,167	3,564	768
Cedar Waxwing[W]	*Bombycilla cedrorum*	CEDW	0	0	71	36	32	382	54	89	551	178	99	101	226
House Sparrow[YR]	*Passer domesticus*	HOSP	0	10	3	6	2	12	0	2	1	0	0	1	0
American Pipit[W]	*Anthus rubescens*	AMPI	0	0	0	2	0	0	1	1	0	3	0	0	0
Purple Finch[W]	*Haemorhous purpureus*	PUFI	0	0	0	0	0	0	0	1	0	0	0	0	0

House Finch[YR]	*Haemorhous mexicanus*	HOFI	9	25	79	171	104	168	144	101	164	134	278	283	52
Pine Siskin[W]	*Spinus pinus*	PISI	0	0	2	0	0	0	0	1	22	0	0	0	0
American Goldfinch[W]	*Spinus tristis*	AMGO	14	37	172	129	115	108	165	228	247	259	427	468	44
Snow Bunting[W]	*Plectrophenas nivalis*	SNBU	0	0	19	62	32	0	4	5	13	96	2	0	18
Ovenbird[M]	*Seiurus aurocapilla*	OVEN	0	0	1	0	0	0	0	0	0	0	0	0	0
Worm-eating Warbler[N]	*Helmitheros vermivorum*	WEWA	0	0	0	0	0	0	0	0	0	1	0	0	0
Northern Waterthrush[M]	*Parkesia noveboracensis*	NOWA	0	0	1	0	0	1	0	1	4	2	1	3	0
Blue-winged Warbler[M]	*Vermivora cyanoptera*	BWWA	0	0	0	0	0	0	0	0	0	0	1	0	0
Prothonotary Warbler[N]	*Protonoaria citrea*	PROW	0	0	0	0	0	0	0	0	0	0	0	1	0
Black-and-white Warbler[B]	*Mniotilta varia*	BAWW	11	0	0	0	1	0	2	5	4	7	2	6	3
Tennessee Warbler[M]	*Oreothlypis peregrine*	TEWA	0	0	0	0	0	1	0	0	0	0	0	1	0
Orange-crowned Warbler[W]	*Oreothlypis celata*	OCWA	0	0	0	0	0	0	0	0	3	7	0	2	0
Nashville Warbler[M]	*Oreothlypis ruficapilla*	NAWA	0	0	0	0	0	0	0	0	0	1	0	0	0
Common Yellowthroat[N]	*Geothlypis trichas*	COYT	2	13	67	70	36	72	86	95	187	185	184	233	38
Hooded Warbler[N]	*Setophaga citrina*	HOWA	0	0	0	0	0	0	0	0	0	0	0	0	1
American Redstart[N]	*Setophaga ruticilla*	AMRE	0		1			6	6	5	16	5	6	15	0
Northern Parula[YR]	*Setophaga Americana*	NOPA	0	0	1	0	2	1	0	5	5	15	8	25	0
Yellow Warbler[N]	*Setophaga petechial*	YEWA	0	0	3	0	0	14	2	8	27	9	4	9	0
Chestnut-sided Warbler[M]	*Setophaga pensylvanica*	CSWA	0	0	0	0	0	0	0	0	0	1	0	0	0
Magnolia Warbler[M]	*Setophaga magnolia*	MAWA	0	0	0	0	0	1	1	0	0	1	1	7	1
Black-throated Blue Warbler[M]	*Setophaga caerulescens*	BTBW	0	0	0	0	1	0	2	1	0	0	0	1	0
Yellow-rumped Warbler[W]	*Setophaga coronate*	YRWA	0	8	94	231	76	191	192	8	221	325	253	521	158

Black-throated Green Warbler[M]	*Setophaga virens*	BTNW	0	0	0	0	0	0	0	1	0	0	0	0	0
Bay-breasted Warbler[M]	*Setophaga castanea*	BBWA	0	0	1	0	0	0	0	0	0	0	0	0	0
Blackpoll Warbler[M]	*Setophaga striata*	BLPW	0	0	0	1	0	2	0	0	9	7	0	5	3
Pine Warbler[YR]	*Setophaga pinus*	PIWA	1	0	10	5	5	16	30	25	70	56	88	140	28
Yellow-throated Warbler[N]	*Setophaga dominica*	YTWA	0	0	0	1	5	0	0	0	0	0	0	3	0
Prairie Warbler[N]	*Setephaga discolor*	PRAW	0	0	1	4	0	3	2	3	3	2	5	1	1
Palm Warbler[W]	*Setephaga palmarum*	PAWA	0		1	25	16	1	8	10	41	60	22	125	31
Wilson's Warbler[T]	*Cardellina pusilla*	WIWA	0	0	0	0	0	0	0	0	0	0	0	1	0
Yellow-breasted Chat[N]	*Icteria virens*	YBCH	0	1	2	5	2	8	14	8	11	11	12	18	1
Eastern Towhee[R]	*Pipilo erythrophthalmus*	EATO	0	0	19	43	42	78	107	130	123	125	120	131	29
Field Sparrow[W]	*Spizella pusilla*	FISP	0	3	10	7	1	4	39	41	52	41	49	77	7
Chipping Sparrow[S]	*Spizella passerine*	CHSP	0	2	3	10	2	6	15	11	6	6	5	21	4
Clay-colored Sparrow[T]	*Spizella pallida*	CCSP	0	0	0	0	0	0	0	1	1	1	0	0	0
Vesper Sparrow[W]	*Pooecetes gramineus*	VESP	0	0	0	0	1	0	0	0	0	0	0	0	0
Lark Sparrow[T]	*Chondestes grammacus*	LASP	0	0	0	0	0	0	0	1	0	0	1	0	0
Savannah Sparrow[W]	*Passerculus sandwichensis*	SAVS	0	26	16	158	60	202	258	713	886	705	394	836	102
Saltmarsh Sparrow[W]	*Ammospiza caudacuta*	SALS	0	0	0	0	0	0	1	0	0	0	1	0	0
Nelson's Sparrow[W]	*Ammospiza nelsoni*	NESP	0	0	0	0	0	0	0	2	0	1	1	0	0
Seaside Sparrow[YR]	*Ammospiza maritima*	SESP	0	1	0	0	0	0	1	10	1	1	13	12	0
Song Sparrow[W]	*Melospiza melodia*	SOSP	21	130	224	384	241	460	311	443	559	655	535	931	290
Swamp Sparrow[W]	*Melospiza georgiana*	SWSP	0	0	21	53	16	40	26	83	90	103	88	162	37
Fox Sparrow[W]	*Passerella iliaca*	FOSP	0	0	0	2	1	1	3	17	0	5	3	9	3
White-throated Sparrow[W]	*Zonotrichia albicollis*	WTSP	0	0	23	75	25	103	45	219	213	188	191	449	100

White-crowned Sparrow[W]	*Zonotrichla leucophrys*	WCSP	0	1	0	0	25	3	4	1	4	4	1	23	22
Dark-eyed Junco[W]	*Junco hyemalis*	DEJU	0	0	6	13	12	6	1	8	4	14	4	4	0
Summer Tanager[N]	*Piranga rubra*	SUTA	0	0	1	1	0	2	6	3	2	1	6	2	0
Scarlet Tanager[M]	*Piranga olivacea*	SCTA	0	0	0	0	0	1	1	0	2	0	0	0	0
Northern Cardinal[R]	*Cardinalis cardinalis*	NOCA	9	34	102	154	114	204	183	266	375	338	445	564	110
Dickcissel[T]	*Spiz Americana*	DICK	0	0	0	0	0	2	1	0	0	3	0	0	0
Rose-breasted Grosbeak[M]	*Pheucticus ludovicianus*	RBGR	0	0	0	0	0	0	0	0	1	0	0	0	0
Blue Grosbeak[N]	*Passerina caerulea*	BLGR	0	0	57	48	38	84	62	74	81	112	141	141	23
Indigo Bunting[N]	*Passerina cyanea*	INBU	0	3	28	25	19	55	72	38	75	79	95	75	6
Eastern Meadowlark[W]	*Sturnella magna*	EAME	2	27	62	191	190	567	557	359	385	551	361	431	103
Bobolink[M]	*Dolichonyx oryzivorus*	BOBO	0	15	0	4	0	22	13	33	51	29	32	26	1
Red-winged Blackbird[R]	*Agelaius phoeniceus*	RWBL	76	748	1,322	2,090	1,552	3,488	3,622	4,074	5,928	7,806	6,611	6,590	3,261
Yellow-headed Blackbird[T]	*Xanthocephalus xanthocephalus*	YHBL	0	2	1	0	0	0	0	0	0	0	1	0	0
Common Grackle[R]	*Quiscalus quiscula*	COGR	38	43	146	243	142	260	188	347	370	494	296	627	103
Boat-tailed Grackle[YR]	*Quiscalus major*	BTGR	11	36	36	98	31	128	69	102	137	222	131	97	9
Brown-headed Cowbird[R]	*Molothrus ater*	BHCO	1	470	656	157	47	255	72	111	158	60	668	263	28
Orchard Oriole[N]	*Icterus spurius*	OROR	2	5	35	27	27	56	42	19	34	54	18	26	2
Baltimore Oriole[YR]	*Icterus galbula*	BAOR	0	0	0	0	0	0	0	3	3	1	0	2	0
TOTAL			6.8K	45.1K	46.1K	94.5K	78.6K	120.5K	140.3K	151.5K	236.5K	259.1K	193.4K	145.3K	73.1K
GRAND TOTAL = 1,590,674															

[B] = Breeds in the study area and is likely a short-distance migrant that winters elsewhere on the continent.
[N] = Long-distance Neotropical migrant that breeds in the study area, but winters in Central/South America.
[M] = Observed in the study area only during migration.
[R] = Occurs year-round and likely nests in the study area.

[T] = Transient with no record of regular occupancy during the breeding, wintering, or migration seasons.
[W] = Winters in the study area; likely a short-distance migrant that breeds north of the study area.
YR = Occurs year-round but no confirmed successful breeding in the study area.
WR = Winters in the study area and may breed occasionally.
RW = Rare, but has wintered in the study area.
S = Occurs only during the summer but no confirmed breeding on the study area.
RS = Rare, but has beed detected during the summer on the study area.
SB = Occurs in the study area during the summer and breeds; remains in the vicinity but moves out of the study area during the winter.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
September 2022	Final	

4. TITLE AND SUBTITLE

Birds of the Craney Island Dredged Material Management Area, Portsmouth, Virginia, 2008-2020

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

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5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

See reverse.

8. PERFORMING ORGANIZATION REPORT NUMBER

ERDC/EL TR-22-15

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

US Army Corps of Engineers
Washington, DC 20314-1000

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

Funding Account Code U4372823; AMSCO Code 086000

14. ABSTRACT

This report presents the results of a long-term trend analyses of seasonal bird community data from a monitoring effort conducted on the Craney Island Dredged Material Management Area (CIDMMA) from 2008 to 2020, Portsmouth, VA. The USACE Richmond District collaborated with the College of William and Mary and the Coastal Virginia Wildlife Observatory, Waterbird Team, to conduct year-round semimonthly area counts of the CIDMMA to examine species presence and population changes overtime. This effort provides information on the importance of the area to numerous bird species and bird species' groups and provides an index to those species and group showing significant changes in populations during the monitoring period. We identified those species regionally identified as Highest, High, and Moderate Priority Species based on their status as rare, sensitive, or in need of conservation attention as identified by the Atlantic Coast Joint Venture (ACJV), Bird Conservation Region (BCR), New England/Mid-Atlantic Bird Conservation Area (BCR 30). Of 134 ranked priority species in the region, the CIDMMA supported 102 of 134 (76%) recognized in the BCR, including 16 of 19 (84%) of Highest priority ranked species, 47 of 60 (78.3%) of High priority species, and 39 of 55 (71%) of Moderate priority species for BCR 30. All bird count and species richness data collected were fitted to a negative binomial (mean abundance) or Poisson distribution (mean species richness) and A ttotal of 271 species and over 1.5 million birds were detected during the monitoring period. Most all bird species and species groups showed stable or increasing trends during the monitoring period. These results indicate that the CIDMMA is an important site that supports numerous avian species of local and regional conservation concern throughout the year.

15. SUBJECT TERMS

Craney Island (Va.) – Bird communities
Craney Island (Va.) – Bird populations
Environmental management
Environmental monitoring

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER *(include area code)*
Unclassified	Unclassified	Unclassified	SAR	82	

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

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