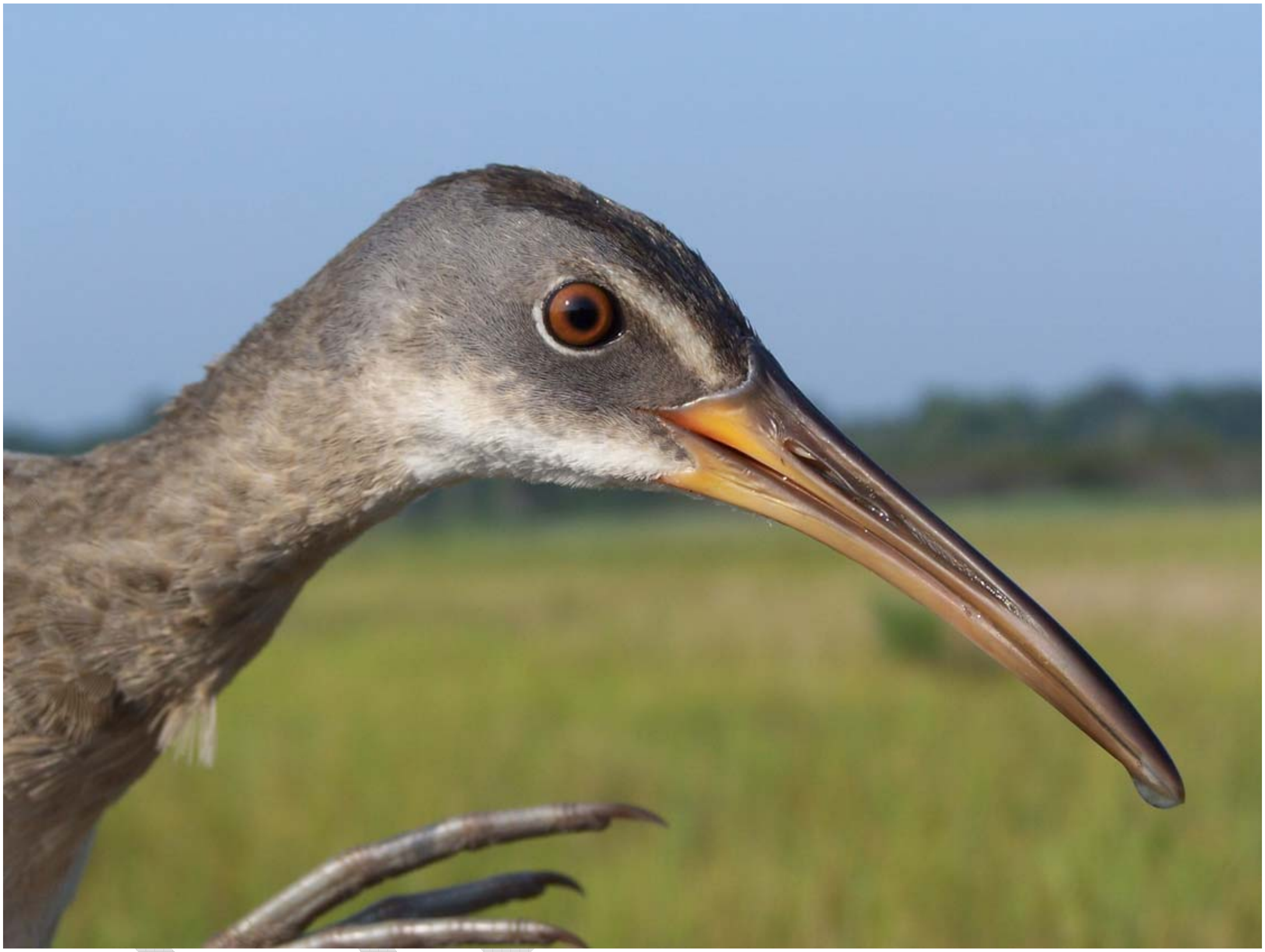
Tidal Marsh Birdwatch



Clapper Rail - M. A. Pepper

Protocol and Standard Operating Procedures for Monitoring Tidal Marsh Birds in the Bird Conservation Region 30

Draft Version 1.0 (December 2008)

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Draft Version 1.0

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SECTION 1: PROTOCOL NARRATIVE

I. Background and Objectives

Salt marsh breeding bird populations (rails, bitterns, sparrows, etc.) in eastern North America are high conservation priorities in need of site specific and regional monitoring designed to detect population changes over time. The present status and trends of these species are unknown but are thought to be declining and the majority of these species are listed as conservation priorities on Comprehensive Wildlife Plans throughout the eastern United States. National Wildlife Refuges and National Park Service units, as well as other wildlife conservation areas, provide important salt marsh habitat, but little is known about the abundance, population trends, or management needs of these breeding bird species. The entire breeding range of Saltmarsh Sharp-tailed and Coastal Plain Swamp sparrows are within BCR 30, providing an opportunity for designing surveys to estimate abundance and detect population trends through repeated surveys within the entire breeding ranges of two priority species. The primary purpose of this project is to develop a hierarchical sampling frame and monitoring protocol for salt marsh birds in Bird Conservation Region (BCR) 30 that will provide sample designs that could be implemented to detect species-specific estimates of abundance at several scales, including 1) specific sites (i.e. National Parks and National Wildlife Refuges), 2) within states or regions, and 3) within BCR 30.

<u>Rationale for Monitoring Tidal Marsh Birds</u>

Monitoring populations is the backbone of avian conservation and long-term, large-scale monitoring programs have provided the foundation for determining species priorities, identified guilds in greatest need of management actions, informed management of harvested populations, document species recoveries, and provide the scientifically credible information for listing and de-listing species. Without current, sound monitoring data, conservation efforts are likely to be misguided and inefficient. Presently, more than half of the species of continental importance are in need of improved monitoring information (Rich et al. 2004), and secretive marsh birds are no exception.

The amount of emergent wetland habitat in North America has declined sharply during the past century. Populations of many marsh birds that are dependent on emergent wetlands appear to be declining as well, but we currently lack adequate monitoring programs to determine status and estimate population trends. Rails and bitterns consume a wide variety of aquatic invertebrates and therefore, may be affected by accumulation of environmental contaminants in wetland substrates. Also, marsh birds are vulnerable to invasions of some invasive plant species, such as *Phragmites*. Hence, marsh birds may be good "indicator species" for assessing wetland ecosystem quality (DeLuca et al. 2004) and their presence may be considered one measure of success for wetland restoration efforts. In addition, marsh birds have a high recreational value among birders and several rails are considered game species in many states, yet we currently lack effective population surveys on which to base harvest limits. The development of a well coordinated tidal marsh bird monitoring program in BCR 30 will make significant progress towards addressing these issues.

Ecological Context

The focus of this monitoring effort is on historically brackish and saline marshes dominated by halophytic vegetation in BCR 30. Salt marshes are widely recognized as extremely productive ecosystems that perform many services valued by society. Numerous wildlife species are dependent on salt marshes as breeding, migrating, or wintering habitat. Unfortunately, there are few coastal salt marshes that remain in pristine condition. Most have experienced some form of anthropogenic alteration, such as changes in tidal flooding, channelization or drainage, chemical or mechanical mosquito control, salt hay farming, introduction of invasive species, and oil spills and other contaminant inputs. These alterations impact ecosystem integrity and the quality of habitat for the unique wildlife these systems support. In addition, salt marshes are threatened by accelerated rates of sea-level rise caused by global climate change. In some cases wetland building processes may not keep pace with rising sea level, and as salt marshes are inundated, upslope migration and creation of new marshes may be severely hampered by human development of adjoining lands (Titus and Richman 2001).

A Brief History of Marsh Bird Monitoring in the Region

Surveys of marsh birds have been conducted by state and federal agencies and other organizations for many years. Some of the earliest coordinated efforts to inventory marsh bird diversity and abundance in the Northeast began with the work of James Gibbs and Scott Melvin in Maine in the late 1980s. Through a series of multiple visits to several dozen wetlands, these authors refined techniques for call-response surveys, which formed the basis for methods that are widely used today. The Marsh Monitoring Program (MMP), of Bird Studies Canada and Environment Canada, initiated marsh bird surveys in States and Provinces around the Great Lakes in 1994.

A recent report compiled by National Audubon (Butcher and Niven 2007) analyzed CBC and BBS data from the last 40 years. American Bittern was one of the top 10 common birds in decline in North America, with a -59% population change during the study period. Data collected during MMP surveys, 1995-2001, detected statistically significant declining trends for American Coot, Black Tern, Pied-billed Grebe, Sora, Virginia Rail, and several other marsh birds, in the Great Lakes region.

Surveys for wetland birds, specifically those that inhabit tidal marshes, have also been done sporadically by individual agencies and organizations, often at a local scale (Table 1). In 1999 - 2001, The Massachusetts Audubon Society coordinated a large-scale effort to inventory tidal marsh bird occurrence and species richness in coastal wetlands from Southern Connecticut to New Hampshire and combined those data with information collected simultaneously in Maine. Scientists at the Smithsonian Institution have conducted bird surveys in Chesapeake and Delaware Bays and elsewhere in the mid-Atlantic Region including a volunteer Coastal Plain Swamp Sparrow survey (http://nationalzoo.si.edu/ConservationAndScience/MigratoryBirds/Research/Swamp_sparrow/Survey/Results/). Bombay Hook National Wildlife Refuge (DE) and Rachel Carson National Wildlife Refuge (ME) have perhaps the longest continuous datasets for monitoring tidal marsh birds, with 8 and 10 years of data, respectively. In most cases, tidal marsh bird surveys used passive point counts as the primary method of detection; therefore, observations of secretive tidal marsh species (e.g., rails) were incidental.

Table 1. Current surveys and monitoring programs for tidal marsh birds in the Northeast

Program	Organization(s)
CT, ME, MA, MD, NH, NJ, NY, VA Marsh Bird Surveys/Monitoring	State Agencies and/or NGO partners
National Wildlife Refuge Marsh bird Monitoring	US Fish and Wildlife Service
NH Audubon Saltmarsh Bird Monitoring	Audubon Society of New Hampshire
Rachel Carson Saltmarsh Bird Monitoring	US Fish and Wildlife Service
Galilee Bird Sanctuary Monitoring	University of Rhode Island, Department of Natural Resources
Connecticut Saltmarsh Sparrow Monitoring	University of Connecticut
Delaware Coastal Plain Swamp Sparrow Survey	Delmarva Ornithological Society and Smithsonian Migratory Bird Center
Delaware Black Rail Playback Survey	Delaware Department of Natural Resources and Environmental Conservation
Bombay Hook National Wildlife Refuge – salt-marsh bird surveys	US Fish and Wildlife Service

Salt marsh integrity monitoring protocol development	USGS / US Fish and Wildlife Service

BCR 30 Tidal Marsh Management Issues

The New England/Mid-Atlantic Coast Bird Conservation Region (BCR 30) is approximately 9,885,700 hectares in size and extends from southern coastal Maine through coastal Virginia, encompassing several major estuaries, including Chesapeake Bay. Specifically, the BCR includes a small portion of the coast of Maine, the southeast corner of New Hampshire, eastern Massachusetts, most of Connecticut, all of Rhode Island, southern New York, including Long Island, most of New Jersey, all of Delaware, eastern Maryland, the District of Columbia, and all of coastal Virginia (with the exception of Back Bay). The BCR also includes marine habitats out to the continental shelf (BCR 30 PLAN http://www.acjv.org/BCR_30/BCR30_June_23_2008_final.pdf). The extensive saltmarsh habitats within BCR 30 support the regional stronghold of rails and saltmarsh sparrows, such as Clapper and Black rails and Saltmarsh Sharp-tailed and Coastal Plain Swamp sparrows.

Climate change and sea level rise threaten coastal habitats within BCR 30. During the last century sea level in the mid-Atlantic was 5-6 inches more than the global average (IPCC 2007). The salt marshes that occur in BCR 30 are particularly vulnerable to rising sea level because they are generally within a few feet of sea level. Higher temperatures are expected to further raise sea level by expanding ocean water and melting polar ice caps and glaciers. The Interpanel Government on Climate Change has estimated globally the average sea level will rise between 0.6 and 2 feet in the next century (IPCC 2007). A two foot rise in sea level would eliminate coastal lands equal in size to Massachusetts and Delaware (10,000 miles^2). This is important to consider within BCR 30 as we target lands to sustain bird populations into the future. As the sea rises, the outer boundary of the wetlands within BCR 30 will erode, and new wetlands will form inland as previously dry areas are flooded by the higher water levels. New wetlands will only form in areas that are not protected by bulkheads, dikes and other water maintenance structures (http://www.epa.gov/climatechange/effects/coastal/index.html#ref).

Invasive exotic species are a threat to biodiversity within BCR 30. The spread of exotic or introduced species is degrading habitats and leading to competition for resources for species like American Black Ducks and Black Rails. Exotic species, including Phragmites, are another significant threat to estuarine emergent wetlands that must be managed immediately to sustain the quality and quantity of remaining marshes within the BCR. Once invasive species are established in an area, it becomes very difficult to recover the native biodiversity. Most invasive plants reduce the availability and quality of native habitats, and these can have major impacts on priority bird species. In BCR 30, *Phragmites* control takes many resources and must be implemented year after year. Even with many ongoing efforts to eradicate *Phragmites* from public lands, the plant continues to spread to new wetlands.

Mosquito control efforts and contaminants from agricultural and residential runoff into marsh habitats can be a problem for bird species dependent upon marshes for breeding. Many of the marshes within BCR 30 have been ditched and their hydrology altered for mosquito control. There have been efforts to restore the hydrology to some of these systems – with varying degrees of success.

Other stressors or management activities to tidal marsh habitats include, grazing, fire, development, direct human disturbance, and nutrient loading (Table 2).

Table 2. Principle stressors associated with tidal marsh management and condition within each sub-region.

Stressor	Sub - Region						
	Chesapeake Bay	Coastal Delmarva	Delaware Bay	Coastal NJ	Long Island	Southern New England	Cape Cod – Casco Bay
Fire	XXX						
Altered topography	XXX		XXX	XXX			
Invasive spp.	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Marsh loss/sea level rise	XXX	XXX	XXX				
Contaminants	XXX	XXX	XXX	XXX			
Mosquito managed	XXX	XXX	XXX	XXX			
Ungulate grazing		XXX					
Development – loss of habitat	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Direct human disturbance	XXX	XXX	XXX	XXX	XXX	XXX	
Impoundment management			XXX				
Salt hay harvest			XXX				
Oil spills			XXX				XXX
Nutrient loading					XXX	XXX	XXX
Ditch plugging					XXX	XXX	XXX
Tidal restrictions					XXX	XXX	XXX

<u>Sub- Regions and Landbird Focus Areas within tidal marshes of BCR 30</u>

We defined 7 sub-regions within BCR 30 (Conway and Droege 2006). Regions were defined based on geography, similarity of tidal marsh habitat, zones of inference, and logistical purposes (Fig. 1). Landbird Focus Areas are based on the BCR 30 plan.

- Chesapeake Bay
    - Landbird Focus Areas = Rappahannock River, Old Hams, Upper Chesapeake Eastern Shore Marsh, Mid-Chesapeake Eastern Shore Marsh, Delmarva – Southern Tip.

- Coastal Delmarva
    - Landbird Focus Area = Great Marsh and Cape Henlopen

- Delaware Bay
    - Landbird Focus Area = Delaware Bay

- Coastal NJ
    - Landbird Focus Area = Jersey Shore

- Long Island
    - Landbird Focus Areas = Jamaica Bay, Great South Bay, Moriches Bay, Shinnecock Bay

- Southern New England

- Landbird Focus Areas = East Connecticut Coast, Rhode Island Salt Ponds, Nantucket Coastal Bay, Monomoy NWR

- Cape Cod – Casco Bay
  - Landbird Focus Areas = Parker River/Great Marsh Complex, Great Bay, S. Maine Salt Marshes, Scarborough Marsh, Spurwink

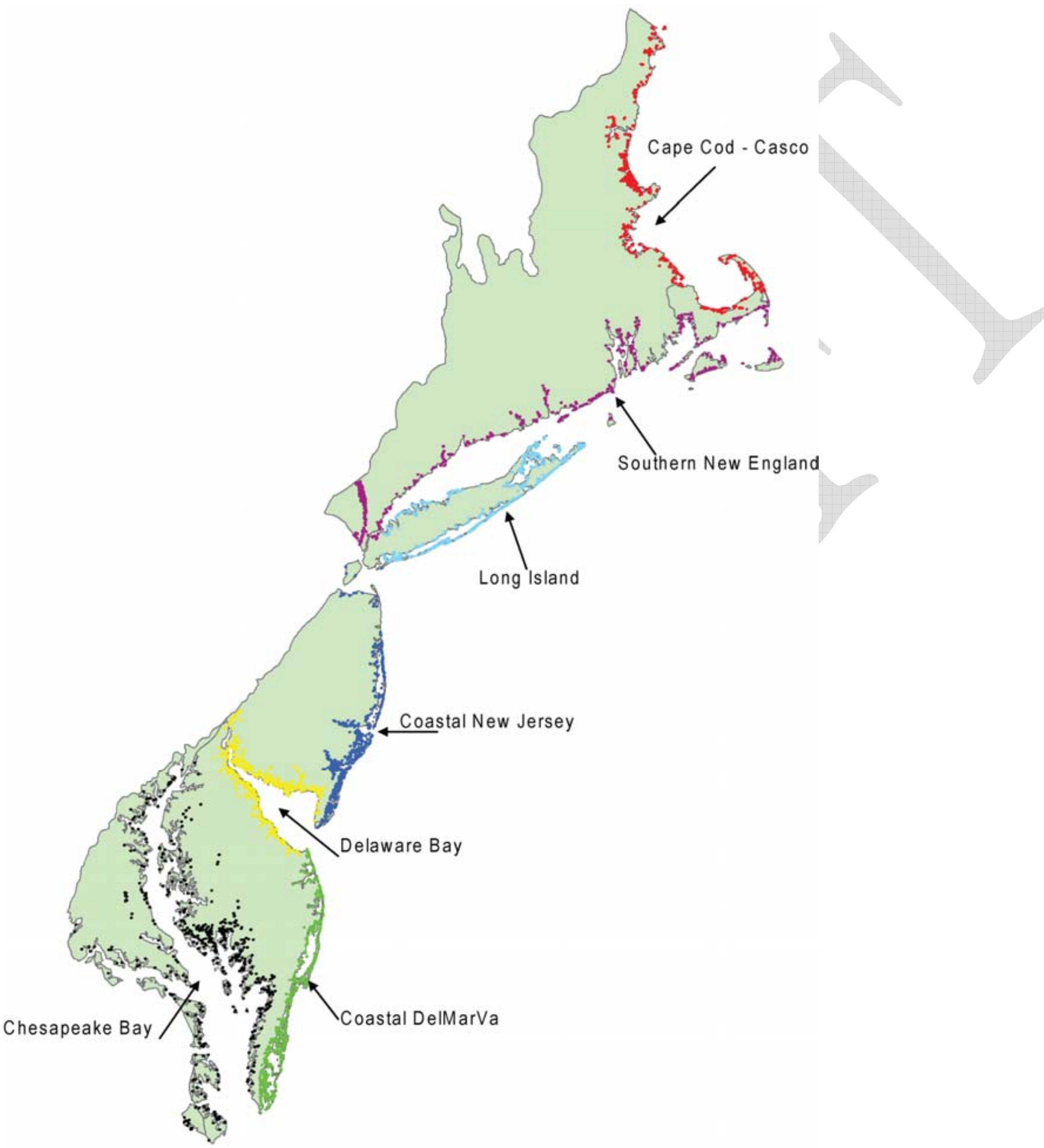

Figure 1. Tidal marsh bird monitoring sub-regions within BCR 30.

Target Species

The marsh bird group of target species includes a broad array of wetland-dependent birds (Table 2). A few are freshwater marsh obligates (e.g., Pied-billed Grebe), whereas, several others are tidal marsh obligates (Saltmarsh Sharp-tailed Sparrow, Clapper Rail, Seaside Sparrow). A few species are found in both habitats (Least Bittern, Virginia Rail).

Table 3. Species included in the BCR 30 tidal marsh bird monitoring program. Broadcast species are those that should be sampled using call-broadcasts. Sample sizes will be appropriate to detect pre-determined changes in abundance (or occupancy) for priority monitoring species (grey fill).

	Common Name	**Scientific Name**	**AOU Code**
Broadcast Species	Sora	*Porzana carolina*	SORA
	Virginia Rail	*Rallus limicola*	VIRA
	Clapper Rail	*Rallus longirostris*	CLRA
	King Rail	*Rallus elegans*	KIRA
	Black Rail	*Laterallus jamaicensis*	BLRA
	Yellow Rail	*Coturnicops noveboracensis*	YERA
	American Coot	*Fulica americana*	AMCO
	Common Moorhen	*Gallinula chloropus*	COMO
	Purple Gallinule	*Porphyrio martinica*	PUGA
	Pied-billed grebe	*Podilymbus podiceps*	PBGR
	American Bittern	*Botaurus lentiginosus*	AMBI
	Least bittern	*Ixobrychus exilis*	LEBI
Non-broadcast Species	Green Heron	*Butorides virescens*	GRHE -
	Great Blue Heron	*Ardea herodias*	GBHE -
	Glossy Ibis	*Plegadis falcinellus*	GLIB -
	Canada Goose – Atl Pop	*Branta canadensis*	CAGO
	American Black Duck	*Anas rubripes*	ABDU
	American Oystercatcher	*Haematopus palliatus*	AMOY
	Greater Yellowlegs	*Tringa melanoleuca*	GRYE
	Willet	*Catoptrophorus semipalmatus*	WILL -
	Wilson's Snipe	*Gallinago delicata*	WISN -
	Forster's Tern	*Sterna forsteri*	FOTE -
	Belted King Fisher	*Megaceryle alcyon*	BEKI -
	Alder Flycatcher	*Empidonax alnorum*	ALFL -
	Willow Flycatcher	*Empidonax traillii*	WIFL -
	Marsh Wren	*Cistothorus palustris*	MAWR-
	Common Yellow Throat	*Geothlypis trichas*	COYE -
	Yellow Warbler	*Dendroica petechia*	YEWA -
	Saltmarsh Sharp-tailed Sparrow	*Ammodramus caudacutus*	SSTS -
	Nelson's Sharp-tailed Sparrow	*Ammodramus nelsoni*	NSTS -
	Swamp Sparrow	*Melospiza georgiana*	SWSP -
	Savannah Sparrow	*Passerculus sandwichensis*	SAVS -
	Seaside Sparrow	*Ammodramus maritimus*	SESP -
	Red-winged Blackbird	*Agelaius phoeniceus*	RWBL -

Tidal Marsh Birdwatch Goals and Measurable Objectives

This group of bird species, by nature of their secretive habits and remote habitat, remains poorly understood. Therefore, objectives for this group of birds span a broad set of needs ranging from basic status monitoring, to trend estimation, to monitoring the effects of several management issues (as well as natural changes) on habitat quality and availability. After review and guidance from the NE Coordinated Bird Monitoring Program (September 2007) the marsh bird workgroup leader decided to specifically state both monitoring and management objectives in an attempt to clarify the needs for this focal group.

Bird monitoring, to be effective, must be conducted at multiple spatial and temporal scales (U.S. North American Bird Conservation Initiative Monitoring Subcommittee 2007) with broad based (surveillance monitoring) providing a context for identifying more intensive and targeted research projects, identifying specific areas or regions that should be prioritized for conservation (i.e. the greatest concentration of least bitterns in the northeast, the relative importance of Delaware Bay to the global breeding population of Saltmarsh Sparrows), and tracking how large-scale environmental changes influence the distribution and abundance of focal species (sea-level rise, surface temperature changes on wetland hydrology). Designing monitoring programs to estimate the occupancy, abundance, and/or changes in these parameters over time requires setting specific monitoring objectives that clearly define the spatiotemporal scales and time frames and effect sizes for assessing changes in monitoring parameters.

Developing monitoring programs that address specific management actions and help define management objectives requires designing programs that establish hypotheses regarding the potential effects of the action on the focal species *a priori* and selecting sample sites and defining sampling intensity to adequately test the stated hypotheses. These targeted monitoring programs are critical to determining management effectiveness and are an integral component of any adaptive management program. Given the scope and the scale of the NECBM effort we think it is valuable and necessary to establish and implement both types of monitoring approaches (Holthausen et al. 2005), especially in a coordinated framework such that data are comparable throughout the region and can provide the necessary information to better understand, conserve, and manage for marsh birds in the Northeast. The lack of institutional and fiscal support for such efforts may presently be lacking (Nichols and Williams 2006) but this can not be the primary justification for selecting one type of monitoring over the other.

Monitoring Goal 1: To measure the annual population status of target species in terms of distribution, abundance/density, and occupancy

Objectives

a) To produce site-specific occurrence information that can be aggregated to map the distribution of each target species within the survey area

b) To produce estimates of density and abundance for target species identified within each sub-region with coefficients of variation (CV) ≤ 0.40

c) To produce an estimate of occupancy for each target species with a 95% confidence interval width ≤ 0.20

Monitoring Goal 2: To measure changes in the population status of target species over time

Objectives

a) To document changes in the distribution of target species within the survey area

b) To achieve 80% power to detect a 5% annual change in target tidal marsh breeding bird abundance over 10 years (2010 – 2020) at a significance level of 0.1.

c) To document changes in target species occupancy through estimates of site colonization and extinction rates

Monitoring Goal 3: To relate population status and trend information to biotic and abiotic variables that may affect the target species

Objectives

a) To determine which of the following factors explain variations in the abundance of target species

b) To determine which of these factors explain probability of occupancy and rates of colonization and extinction

c) To determine which factors best explain variations in the abundance and occupancy of target species associated with habitats designed to enhance the habitat quality for waterfowl or shorebirds.

d) To evaluate the effects of management actions that alter marsh hydrology for mosquito control on secretive marsh bird abundance and occupancy.

e) To determine the effects of invasive species cover and control efforts on breeding secretive marsh bird occupancy, relative abundance, and reproductive success

Monitoring Goal 4. To use the information from the broad-scale monitoring to inform landscape conservation strategies (e.g., conservation design) at the state and local levels by identifying which habitats (or habitat patches) warrant conservation or regulatory protection.

Monitoring Goal 5. To determine the distribution, intensity, and additive nature of hunting pressure on secretive marsh bird occupancy and abundance by species and state

Monitoring Goal 6. To estimate the global population of Saltmarsh Sharp-tailed Sparrow.

Monitoring Goal 7. To provide additional tools and data to support conservation decision-making in tidal marsh bird habitat.

Measurable Objectives

a) To make observational data (date, location, count, etc.) and associated metadata publicly available for visualization and download through the Avian Knowledge Network and the USGS Marsh Bird Point Count Database. Data from each breeding season will be downloadable by the end of the same calendar year.

b) To produce a tidal marsh bird condition assessment that incorporates the avian community into an index of tidal marsh integrity (DeLuca et al. 2004).

c) To project effects of sea-level rise on tidal marsh occupancy by target species under multiple sea-level rise models.

II. Sampling Design: Generalized Random Tessellation Stratified (GRTS)

<u>Selecting Sites and Locating Sampling Stations</u>

To establish the sampling universe, we first acquired GIS-based data layers for BCR 30 (New England / Mid-Atlantic Coast) including; National Wetlands Inventory Data, federal and other protected lands, and roads (Fig. 2). We used GIS coverages of National Wetlands Inventory data (http://wetlandsfws.er.usgs.gov/ NWI/download.html), hydrographic data (http://nhd.usgs.gov/data.html), conservation and public lands (http://www.consbio.org/cbi/projects/PAD/index.htm), and road data (http://www.esri.com/ data/download/census2000_tigerline/index.html). These data layers were compiled to generate continuous coverages within BCR 30. We next generated a 400 m x 400 m grid over all tidal wetland habitats within BCR 30 to create the sampling universe (Fig. 2). We defined strata within BCR 30 at 2 spatial scales; regions and federal lands.

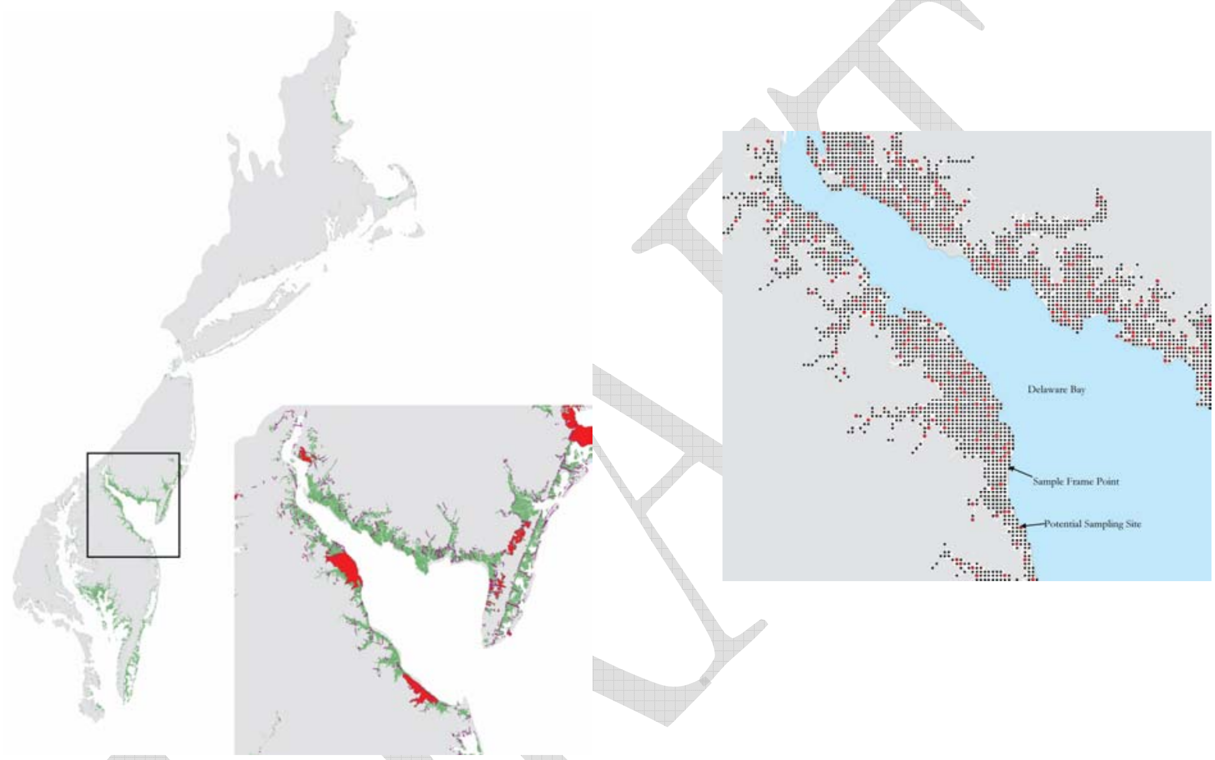

Figure 2. Tidal marsh, roads, federal lands, and the 400 x 400 grid used to develop the BCR 30 tidal marsh bird sampling frame.

We will use a Generalized Random Tessellated Stratification (GRTS) sampling approach to generate a probabilistic sample for tidal marsh bird in BCR30 (Stevens and Olsen 1999, Stevens and Olsen 2003). Given the 400 x 400 m tidal marsh grid, we exported the coordinates for all points within each region and used SDraw (http://www.west-inc.com/computer.php) to generate a GRTS sample with 500 potential sample locations per region (Fig. 3). One logistical challenge with selecting a sample using GRTS is the requirement that samples be included based on the order in which they were selected. This can lead to major implementation hurdles over large spatial scales (i.e. BCR's) where the next sample point in the design may be hundreds of kilometers away. To avoid this logistical hurdle we will draw a GRTS sample within each sub-region, creating a GRTS draw ordered within the region making implementation more realistic. We will also include a substantial "oversample" in the initial draw for each region by selecting more locations than are actually necessary. During the initial year (or two) of implementation, sites will need to be ground-truthed to determine if 1) they are actually in wetland habitat and 2) if they can be accessed. The flexibility of GRTS allows for site to be excluded that do not meat pre-defined criteria as long as you follow the order in which the sample was drawn. Following the order of the GRTS sample maintains the spatial balance and randomness of the sample.

Rationale for Selecting GRTS

A GRTS sample design provides a flexible alternative to random sampling and systematic sampling (Stevens and Olsen 2004). It incorporates randomization in site selection, but avoids clustering of sites or gaps in coverage. In addition to spatial balance and a foundation in probabilistic design, GRTS offers the opportunity to intensify sampling within certain strata (e.g., management units) without deviation from the regional design. As a result, inferences can be made at multiple spatial scales. With GRTS, it is also possible to add new sites over time.

PSU Selection Protocol

To follow recent efforts to develop a North American Marsh Bird Monitoring Framework, we will integrate a two-stage cluster sample into the design of the BCR 30 Tidal Marsh Bird Monitoring Program (Johnson et al. 2008). Selection protocols will be implemented within each of the sub-regions (Fig. 1), with the same general sampling design employed in each stratum. The sampling design has two selection protocols, consistent with the two sizes of sampling units, the Primary Sampling Unit (PSU) and the Secondary Sampling Unit (SSU). The cluster sampling in each stratum involves PSUs and SSUs within PSUs. Primary sampling units will be land areas, such as EPA hexagons, and will be selected using GRTS. Sample sizes for PSUs will affect the precision of estimators, will be limited by available survey effort, and likely will vary greatly among strata and regions.

SSU Selection Protocol

Secondary sampling units will be wetlands or portions of wetlands in the PSUs. SSUs will be selected by a randomized spatially balanced procedure such as GRTS. For each SSU, on-the-ground observers will locate an accessible spot well-suited for detecting marsh birds and record its position with a Global Positioning System (GPS) unit, so that observers can revisit the same spots on subsequent occasions.

The SSU selection protocol depends on whether the PSU contains only small and discrete wetlands, only large extensive wetlands, or a mixture of both discrete and extensive wetlands. Wetlands may stretch across PSU boundaries, thus wetlands are defined as being within a PSU if the wetland's centroid, as determined from the frame information, falls within the PSU. All discrete (and accessible) wetlands within the PSU will be listed. If the PSU contains only discrete wetlands, the number of discrete wetlands sampled in each PSU will be a maximum of 10. If fewer than 10 discrete wetlands are present in a PSU, all of them will be sampled. If more than 10 discrete wetlands are present in a PSU, a GRTS protocol will be used to select 10 SSUs from all wetlands present.

If the PSU contains only extensive wetlands, the GRTS protocol applied to a continuous spatial domain will be used to select a sample of point locations in accessible, extensive wetlands within the PSU. The number of points selected in a PSU depends on the area of extensive wetland within the PSU (the area of extensive wetland determined from the frame information).

Accessibility should be determined during ground-truthing of selected points prior to actual survey, and adjustments due to accessibility (addition or deletion of SSUs) are made using an oversample generated during GRTS point selection.

The protocols for selecting the SSUs are such that discrete wetlands in different PSUs will not be sampled with the same inclusion probabilities, and points in extensive wetlands of different PSUs will not be sampled with the same inclusion densities. This unequal probability structure can be accounted for by the Horvitz-Thompson estimator (Horvitz and Thompson 1952), which incorporates weights based on the inverse of the inclusion probabilities for discrete wetlands or inclusion densities for extensive wetlands.

Sample Size Requirements

Minimum sample sizes will be calculated for each of the survey objectives and the highest value will be used for the monitoring program. If the sample size required to meet one objective (e.g., modeling occupancy) are significantly lower than for another (e.g., estimating abundance), then count protocols may be simplified accordingly (e.g., by carrying out occupancy methods on a subset of counts only).

Power analyses – Sharp-tailed Sparrows
We used data from 121 50 m and 100 m radius circular plots on 9 salt marshes surveyed at Rachel Carson National Wildlife Refuge to estimate variability and conduct power analyses for both sparrow species. We used MONITOR (Gibbs 1995) to conduct power analyses to determine the number of survey years necessary to detect a decline in sparrow populations over 10 years. We estimated power to detect declining trends in sparrow populations at RCNWR using multiple survey scenarios to assess the trade-offs between survey effort and trend detection. We first calculated the power to detect a declining trend in sparrow populations by varying the number of surveys over a 10 year period (4-10 total surveys). We estimated the power of detecting trends in sparrow populations using confidence level alpha = 0.10. We calculated an average Coefficient of Variation (CV) within each distance radius (0-50 m and 0-100 m) and time period (0-3 min, 0-5 min, and 0-10 min) to estimate variability.

The proportion of the individuals detected at each time and distance interval at RCNWR survey points differed for the 2 species assuming that 100% of the individuals were detected in 100 m after 10 minutes of sampling (Table 4). Both species had the highest proportion of individuals detected in the 100 m, 5 minute point count (Table 4). Nelson's Sparrows cumulative detection increased more with distance while Saltmarsh Sparrows increased with time (Table 4). The number of Nelson's Sparrow individuals detected in the 50 m radius point count increased 27% from the 3 minute survey to the 10 minute survey with 57% of the total detected after 10 minutes (Table 4). Seventy-five percent of the total number of Nelson's Sparrow individuals was detected in the 100 m point counts surveyed for 5 minutes, a 28% increase from the number detected within 50 m for 5 minutes (Table 4). Seventy-five percent of the total number of Saltmarsh Sparrow individuals was detected in the 100 m point counts surveyed for 5 minutes, an 18% increase from the number detected within 50 m for 5 minutes (Table 4). Saltmarsh Sparrows had a greater proportion of the total number of individuals detected in the 50 m radius points than did Nelson's Sparrows (Table 4).

Estimated CV's for Nelson's sparrows were lowest (CV = 0.55) for the 50 m radius 0-3 min time interval and greatest (CV = 0.83) for the 100 m radius 0-10 min time interval (Table 4). Saltmarsh sparrow CV's showed the same pattern with lowest values (CV = 0.62) for the 50 m radius 0-3 min time interval and greatest (CV = 0.80) in the 100 m radius 0-10 min time interval (Table 4). We chose to use the 0-50 m 0-10 min CV for both species in the power analysis. Because these salt marsh bird surveys are used to detect more than sparrows and to maintain survey consistency across year, observers will likely remain at a point for 10 min of sampling. By using the estimated count CV for 0-50 m and 0-10 min the resulting power analyses are likely conservative estimates as these CV values are on the higher end of the scale.

The power to detect a declining trend in sparrow populations at RCNWR differed with the number of surveys over a 10 yr period, the confidence level, and the number of repeat visits to points within a survey year (Tables 6-7). Nelson's Sparrows required more surveys in a 10 year period to detect the same magnitude of annual decline than Saltmarsh Sparrows for all possible monitoring program scenarios (Tables 6-7). At a minimum, it would take 9 survey years in a 10 yr period to detect an annual decline in the number of Nelson's Sparrows of 10% or greater given 2 repeat visits to 121 sample points at RCNWR (Table 6). The same magnitude of decline could be detected with 7 surveys in a 10 yr period for Saltmarsh Sparrows (Table 7). A sparrow monitoring program with 3 repeat visits to the 121 points at RCNWR could detect an 8% decline in the Nelson's Sparrow population after 8 surveys (Table 6) and a 9% decline in the Saltmarsh Sparrow population after 6 surveys (Table 7). This design would also detect smaller annual population declines as the number of survey yrs increases (Table 6 and 7). A 6% annual decline in the Nelson's Sparrow population (Table 6) and a 4% annual decline in the Saltmarsh Sparrow population (Table 7) could be detected with power > 0.90 after 10 yrs of surveys.

Table 4. Percent of inds. Detected at each time and distance

	Nelson's			Saltmarsh		
Count Duration	0-50 m	0-100 m	% increase	0-50 m	0-100 m	% increase
0-3 min	30.2	47.5	17.3	33.3	45.1	11.8
0-5 min	47.3	75.1	27.8	56.1	74.6	18.5
0-10 min	56.9	100	43.1	71.3	100	28.7

Table 5. Estimated CV at each time and distance

	Nelson's		Saltmarsh	
Count Duration	0-50 m	0-100 m	0-50 m	0-100 m
0-3 min	0.55	0.65	0.62	0.70
0-5 min	0.68	0.81	0.71	0.76
0-10 min	0.72	0.83	0.76	0.80

Table 6. Power to detect a decline in the Nelson's Sparrow population at 9 marshes within Rachel Carson NWR using **3 repetitions** to 121 50 m radius points per survey year (CV = 0.72, ***P* = 0.10**). Power estimates > 0.90 are shown in bold and indicate that annual surveys for 10 yrs can detect a 6% annual decline in the Nelson's Sparrow population.

Annual population decline	Number of survey years during a 10 year period						
	4	5	6	7	8	9	10
10%	0.50	0.69	0.82	0.88	**0.95**	**0.97**	**0.98**
9%	0.47	0.65	0.78	0.87	**0.93**	**0.96**	**0.97**
8%	0.38	0.54	0.71	0.83	**0.92**	**0.94**	**0.98**
7%	0.34	0.49	0.65	0.79	0.85	**0.91**	**0.94**
6%	0.31	0.44	0.56	0.72	0.81	0.87	**0.94**
5%	0.23	0.35	0.50	0.61	0.71	0.81	0.88
4%	0.20	0.24	0.40	0.53	0.58	0.75	0.81
3%	0.14	0.21	0.30	0.34	0.51	0.56	0.61
2%	0.11	0.14	0.19	0.26	0.30	0.37	0.38
1%	0.08	0.13	0.12	0.15	0.17	0.19	0.24
0%	0.09	0.10	0.09	0.09	0.12	0.10	0.09

Table 7. Power to detect a decline in the Saltmarsh Sparrow population at 9 marshes within Rachel Carson NWR using **3 repetitions** to 121 50 m radius points per survey year (CV = 0.76, ***P* = 0.10**). Power estimates > 0.90 are shown in bold and indicate that annual surveys for 10 yrs can detect a 4% annual decline in the Saltmarsh Sparrow population.

Annual population decline	Number of survey years during a 10 year period						
	4	5	6	7	8	9	10
10%	0.67	0.85	**0.92**	**0.96**	**0.97**	**0.99**	**0.98**
9%	0.62	0.82	**0.90**	**0.96**	**0.98**	**0.99**	**0.98**
8%	0.56	0.78	0.86	**0.93**	**0.96**	**0.99**	**0.98**
7%	0.52	0.65	0.79	**0.92**	**0.94**	**0.97**	**0.98**
6%	0.42	0.60	0.71	0.85	**0.94**	**0.96**	**0.98**
5%	0.33	0.45	0.64	0.80	0.87	**0.93**	**0.96**
4%	0.25	0.34	0.52	0.68	0.81	0.86	**0.92**
3%	0.21	0.28	0.37	0.51	0.62	0.71	0.83
2%	0.14	0.20	0.26	0.28	0.40	0.48	0.62
1%	0.10	0.11	0.13	0.16	0.19	0.21	0.25
0%	0.10	0.10	0.09	0.10	0.08	0.08	0.11

ADD OTHER SPECIES AND SAMPLE SIZE RECOMMENDATIONS PER SUB-REGION

Frequency and Timing of Sampling

At least three surveys should be conducted. Repeat surveys should be conducted at least 10 days apart. Tidal Marsh bird surveys should be conducted in the morning, 30 minutes before sunrise and end when birds cease calling.

III. Field Methods

Field Season Preparations, Field Schedule, and Equipment Setup

TBD

Documenting Survey Locations

The survey locations will be plotted in GIS and the GPS coordinates provided to observers. During the program's first year, hired technicians will use permanent landmarks and digital photos to document each survey location in the field. Point descriptions and a field map will be provided to observers to facilitate location of the same survey locations from year to year. Observers will be strongly encouraged to scout their route prior to conducting the survey for the first time at a given site.

The Use of Call Broadcasts (from Johnson et al. 2008)

Most avian monitoring programs rely on birds to reveal themselves to observers by sight or through spontaneous vocalizations. Because secretive marsh birds often remain concealed in dense vegetation and vocalize only infrequently, many monitoring programs for these birds have used broadcasts of recorded calls to elicit responses (Glahn 1974, Marion et al. 1981, Johnson and Dinsmore 1986, Manci and Rusch 1988, Gibbs and Melvin 1993). The call broadcast survey method (also called tape-playback, playback, or acoustic-lure survey methods) essentially exploits avian communication systems by mimicking (usually) a conspecific bird newly arrived at a site to stimulate an aggressive response from a resident bird. The call broadcast method has been central to several proposals for a marsh bird monitoring program for North America (Ribic et al. 1999) Bart 2006, (Conway 2008).

Several studies (Gibbs and Melvin 1993, Lor and Malecki 2002, Allen et al. 2004) have shown that call broadcasts increase, often dramatically, detection rates for a variety of species. Whether they improve count precision is less clear. A meta-analysis (Conway and Gibbs 2005) of simultaneously collected passive and call broadcast data provided insight on the contribution of call broadcast-derived data to both robustness and precision of marsh bird counts. This synthesis of data from more than 16,000 point counts contributed by 15 cooperators using call-broadcast methods for 12 species revealed that broadcasting calls does indeed lead to greater detectability (increased the mean number of responses and the proportion of sites with a response) and generally increased precision (by decreasing the variance in response rates). Although those authors endorsed the use of call broadcasts for monitoring marsh bird populations, they did not recommend relying entirely on the method because calling activity by some species was depressed by the broadcast of other species' calls. For this reason, Conway and Gibbs (2005) recommended that the combination of passive and broadcast call survey methodologies previously employed in many marsh bird survey efforts be continued is included in the standardized protocol for monitoring marsh bird across the continent (Conway 2008).

End-of Season Procedures

All field equipment will be maintained and repaired or replaced prior to storage in a secure location.

Procedures for data transcription, entry, and verification are described below.

IV. Data Handling, Analysis, and Reporting

Overview of Database Design

Upon finalization of field protocols and data forms, we will build a geographically referenced database to archive and manage survey results, with standardized fields aligned with the Avian Knowledge Network (AKN). AKN (www.avianknowledge.net) is the data management system for the Northeast Coordinated Bird Monitoring Partnership. It features a secure, persistent data archive with owner-specified access and innovative data display capabilities (spreadsheets, tables, charts and maps). The AKN is also building tools for exploratory analysis of observational data via data mining and machine-learning techniques. These tools reveal spatial and temporal patterns of avian distribution and abundance based on the query of millions of bird records and hundreds of environmental, climatic, and human demographic variables. The opportunity to retrieve and explore the data will enable land stewards to make informed decisions. It will also help maintain the interest and commitment of volunteer observers.

Tidal Marsh Birdwatch will also use the USGS Marsh Bird Point Count Database designed based on the North American Marsh Bird Monitoring Protocol fields. The database is presently being used by NWR's and other projects monitoring tidal marsh birds. The database is composed of tables containing information on: observers; route-level and point-level geographic, habitat, and climate variables; count results ("presence-absence" information, simple counts, and time-of-detection data); survey information; and species information.

Metadata Procedures

Tidal Marsh Birdwatch metadata will be created for the database in compliance with standards of the USGS National Biological Information Infrastructure and AKN. This detailed explanation of program goals, scope, and methodology will be available through the AKN website.

Data Transcription, Entry, and Verification

Data verification is necessary to ensure that values recorded on the field datasheets are entered into the database correctly. Several steps will be taken prior to, during, and after data entry to verify data, including visual review at the time of data entry, visual review after data entry, and the development of summary queries and tallies in the database. Additionally, the database entry form itself will incorporate features that reduce data entry errors, such as dropdown menus for site name, observer, weather, and species codes. These values may also be entered using the keyboard, but must conform to the codes listed in related tables.

Data Archival Procedures

The USGS Marsh bird Database and the Avian Knowledge Network will house these data on secure servers. Survey timing, location, species, and count data will be uploaded annually.

Recommendations for Statistical Analysis

The count protocol was designed to permit estimates of abundance through a variety of analytical approaches, which account for various aspects of detectability, including: P_p = probability of bird being present in sample area during the count, P_a = probability of bird being available for detection, and P_d = probability of bird being detected given availability (Table 8). The flexibility is designed to enable comparisons among different abundance estimation techniques and to maintain the opportunity to apply analyses that will be developed in the future.

Table 8. Detectability functions addressed by count protocols.

Method	Citation	Included in the detection function
Simple counts (index method)	(Bart et al. 2004)	-
Repeated "presence-absence" surveys	(Royle and Nichols 2003)	P_a, P_d
Repeated simple counts	(Kery et al. 2005)	P_p, P_a, P_d
Time-of-removal	(Farnsworth et al. 2002)	P_a, P_d
Time-of-detection	(Alldredge et al. 2007)	P_a, P_d
Distance sampling	(Rosenstock et al. 2002)	P_d
Time-removal and distance sampling combined	(Farnsworth et al. 2005)	P_a, P_d

The appropriate statistical procedure will depend on several factors, including: the goals of the analysis, the length of the time series, the number of missing values, the distribution of count data, and the temporal and spatial scales of interest. Another consideration is the strength of underlying assumptions regarding inference (statistical and biological) and independence. Two basic modeling approaches are expected to meet most of Tidal Marsh Bird Watch information needs which are hierarchical models to estimate trend (Link and Sauer 2002) and single-species, multiple-season occupancy models to estimate occupancy, colonization, and extinction (MacKenzie et al. 2006).

Recommended Reporting and Evaluation Procedures

TBD

V. Personnel Requirements and Training

Roles and Responsibilities

Implementation of the BCR 30 Tidal Marsh Bird Monitoring Plan will differ among sub-regions and will be the focus on the protocol development team in 2009. Optimally, this effort needs a program manager that can oversee operations and coordinate this monitoring program.

Qualifications

The program manager must be proficient at or contract with others to: (1) train observers, (2) hire and supervise paid technicians, (3) implement the study protocol in the field, (4) supervise data entry and conduct quality assurance, (5) analyze the data, (6) report results, (7) give public lectures, and (8) secure funding.

Field technicians must be able and willing to spend extended periods of time in remote areas. They must be able to identify the common high-elevation birds by sight and sound. Technicians should be comfortable working in extreme conditions. They should have prior experience taking vegetation measurements in the field and be able to navigate with a GPS, map, and compass.

All observers must be physically capable of hiking in remote locations and able to identify the ten target species by sight and sound. Observers should also be able to record field observations accurately and legibly.

Training Procedures

Training procedures for volunteer observers and paid technicians will be detailed in SOP #2. All observers will be provided an audio training guide to assist in learning the sounds of the target species and other common high-elevation birds. The manual will include instructions on how to conduct the survey, use a map and compass, and identify tidal marsh birds. Public lectures and training sessions will provide an opportunity for observers to review the protocol and ask questions.

VI. Annual Workload and Schedule

Annual Workload

Successful implementation of Tidal Marsh Bird Watch will require program managers to dedicate up to 50% of their time to volunteer coordination and training, survey implementation, data management, and communication with key audiences. Grant writing, data analysis and publications could demand another 50% full-time equivalency, depending on the role of collaborators in this work. Technicians hired to collect baseline bird and habitat data will work full-time during the month of June. Volunteer observers will spend approximately 10 hours driving and hiking to their adopted route and conducting the survey, plus another two hours transcribing and error-checking data.

VII. Next steps….

2009

Feb	Confirm and formalize protocol development team with representatives from each state, federal partners, interested NGO’s, academia to increase inter-regional coordination. Identify potential funding sources and implementation strategies within each state or sub-region.
Feb – March	Revise and complete protocol and SOP’s
April – May	Prepare for field season in locations where implementation can be supported Identify potential sampling locations, develop maps, distribute field sampling materials
May – Aug	Implement sampling
Aug – Sept	QA / QC and submit data to the AKN and USGS Marsh Bird monitoring database Coordinate meeting at the American Ornithologists Union Conference, Philadelphia, PA
Sept – Dec	Continue to identify funding sources and draft proposals to support a Tidal Marsh Bird Monitoring Coordinator

VIII. Acknowledgments

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Note: these sections will depend on how the BCR 30 Tidal Marsh Bird Monitoring Program is implemented. Most of what is presented here came from the North American Marsh Bird Monitoring Protocol (Conway 2008)

SECTION 2: STANDARD OPERATING PROCEDURES

Tidal Marsh Bird Watch Monitoring Protocol

SOP #1: Field Season Logistics

This Standard Operating Procedure provides regional program managers and observers with a list of preparations to make prior to the field season.

I. Program Manager ???

II. Observers

SOP #2: Recruiting and Training Observers

Version 1.0
December 2008

This Standard Operating Procedure provides recommendations for program managers to aid in recruiting and retaining volunteer observers. It also provides instruction on training observers in proper identification of the focal species, survey techniques, and navigation to the field survey locations.

I. Recruiting Volunteer Observers ??

II. Volunteer Retention ??

III. Visual and Auditory Identification of Birds

All observers should have the ability to identify all common calls of focal and non-focal marsh bird species in their local area. Regularly listening to the recorded calls used for surveys can help you learn calls, but observers should also practice call identification at marshes (outside the intended survey area if necessary) where the focal species are frequently heard calling.

Annual training workshops occur, and observers are strongly encouraged to participate in training workshops. All observers should also be trained to accurately determine distance to calling marsh birds, and to identify the common species of wetland plants within the survey area.

Methods for training observers to accurately estimate distance include:

1) place a CD player in the marsh at an known distance and have observers estimate distance,
2) choose a piece of vegetation in the marsh where the bird is thought to be calling from and use a rangefinder to determine distance,
3) have an observer estimate the distance to a bird that is calling with regularity and is near a road or marsh edge, then have a second observer walk along the road/edge until they are adjacent from that calling bird, and then measure this distance (by pacing or use of a GPS) and see how accurate the observer was at estimating distance.

Hearing tests
Surveyors are strongly encouraged to have a hearing test (audiogram) at a qualified hearing or medical clinic before, during, or immediately after the survey season each year. We encourage surveyors or potential surveyors to discuss the results of their hearing with their doctor and with their supervisor (or the Program Coordinator) to determine whether the quality of the data they collect may be compromised. Remember, ~90% of marsh bird detections are aural and many calls are very faint. These data could be included as a covariate and would help control for observer bias in trend analyses.

SOP #3: Delineating the Sample Frame and Establishing Survey Points

Version 1.0
December 2008

This Standard Operating Procedure describes the sample frame and sampling procedure for a standardized high-elevation songbird monitoring protocol that encompasses the breeding range of Bicknell's Thrush.

I. Delineating an International Sampling Frame

To establish the sampling universe, we first acquired GIS-based data layers for BCR 30 (New England / Mid-Atlantic Coast) including; National Wetlands Inventory Data, federal and other protected lands, and roads (Fig. 2). We used GIS coverages of National Wetlands Inventory data (http://wetlandsfws.er.usgs.gov/ NWI/download.html), hydrographic data (http://nhd.usgs.gov/data.html), conservation and public lands (http://www.consbio.org/cbi/projects/PAD/index.htm), and road data (http://www.esri.com/ data/download/census2000_tigerline/index.html). These data layers were compiled to generate continuous coverages within BCR 30. We next generated a 400 m x 400 m grid over all tidal wetland habitats within BCR 30 to create the sampling universe (Fig. 2). We defined strata within BCR 30 at 2 spatial scales; regions and federal lands.

II. Selecting Sample Units

A GRTS sample design provides a flexible alternative to random sampling and systematic sampling (Stevens and Olsen 2004). It incorporates randomization in site selection, but avoids clustering of sites or gaps in coverage. In addition to spatial balance and a foundation in probabilistic design, GRTS offers the opportunity to intensify sampling within certain strata (e.g., management units) without deviation from the regional design. As a result, inferences can be made at multiple spatial scales. With GRTS, it is also possible to add new sites over time.

<u>PSU Selection Protocol</u>

To follow recent efforts to develop a North American Marsh Bird Monitoring Framework, we will integrate a two-stage cluster sample into the design of the BCR 30 Tidal Marsh Bird Monitoring Program (Johnson et al 2008). Selection protocols would be implemented within each of the sub-regions Fig. 1), with the same general sampling design employed in each stratum. The sampling design has two selection protocols, consistent with the two sizes of sampling units, the Primary Sampling Unit (PSU) and the Secondary Sampling Unit (SSU). The cluster sampling in each stratum involves PSUs and SSUs within PSUs. Primary sampling units will be land areas, such as EPA hexagons, and will be selected using GRTS. Sample sizes for PSUs will affect the precision of estimators, will be limited by available survey effort, and likely will vary greatly among strata and regions.

<u>SSU Selection Protocol</u>

Secondary sampling units will be wetlands or portions of wetlands in the PSUs. SSUs will be selected by a randomized spatially balanced procedure such as GRTS. For each SSU, on-the-ground observers will locate an accessible spot well-suited for detecting marshbirds and record its position with a Global Positioning System (GPS) unit, so that observers can revisit the same spots on subsequent occasions.

The SSU selection protocol depends on whether the PSU contains only small and discrete wetlands, only large extensive wetlands, or a mixture of both discrete and extensive wetlands. Wetlands may stretch across PSU boundaries, thus wetlands are defined as being within a PSU if the wetland's centroid, as determined from the frame information, falls within the PSU. All discrete (and accessible) wetlands within the PSU will be listed. If the PSU contains only discrete wetlands, the number of discrete wetlands sampled in each PSU will be a maximum of 10. If fewer than 10 discrete wetlands are present in a PSU, all of them will be sampled. If more than 10 discrete wetlands are present in a PSU, a GRTS protocol will be used to select 10 SSUs from all wetlands present.

If the PSU contains only extensive wetlands, the GRTS protocol applied to a continuous spatial domain will be used to select a sample of point locations in accessible, extensive wetlands within the PSU. The number of points selected in a PSU depends on the area of extensive wetland within the PSU (the area of extensive wetland determined from the frame information).

Accessibility should be determined during ground-truthing of selected points prior to actual survey, and adjustments due to accessibility (addition or deletion of SSUs) are made using an oversample generated during GRTS point selection.

The protocols for selecting the SSUs are such that discrete wetlands in different PSUs will not be sampled with the same inclusion probabilities, and points in extensive wetlands of different PSUs will not be sampled with the same inclusion densities. This unequal probability structure can be accounted for by the Horvitz-Thompson estimator, which incorporates weights based on the inverse of the inclusion probabilities for discrete wetlands or inclusion densities for extensive wetlands.

III. Sample Size

Minimum sample sizes will be calculated for each of the survey objectives and the highest value will be used as the sample size for the monitoring program. If the sample size required to meet one objective (e.g., modeling occupancy) are significantly lower than for another (e.g., estimating abundance), then count protocols may be simplified accordingly (e.g., by carrying out occupancy methods on a subset of counts only).

IV. Establishing Survey Points in the Field

Once the survey stations are selected in GIS and given a unique identification number, field personnel will establish and ground truth the points in the field. Technicians will use GPS units to navigate to the designated waypoints and ensure separation of points by 400 m. Coordinates for each point will be verified, a detailed written description of each point will be recorded using enduring features, and photos will be taken to aid in relocating points in the future (see SOP #5 for details). Because many survey point will be located on upland, roadside, or open water edges, surveyors should record whether each point is:

1) along a ditch, dike, or berm with tidal marsh on both sides,
2) along a ditch, dike, or berm with tidal marsh on one side,
3) along a public road with tidal marsh on both sides,
4) along a public road with tidal marsh on one side,
5) along an upland/ tidal marsh edge (record type of upland: grassland, scrub-shrub, or forest),
6) along an open water/ tidal marsh edge,
7) within a narrow water channel or tidal creek with tidal marsh on both sides,

8) within a contiguous patch of tidal marsh (also record distance from edge), or
9) other (and provide description of point placement).

References:

SOP #4: Conducting the Bird Survey

Version 1.0
April 2008

This Standard Operating Procedure describes the survey protocol to be followed by the observer in the field. It should be reviewed carefully before conducting the survey.

I. Overview of Count Protocol

II. Population Being Monitored

Eight bird species that occur in tidal marshes are proposed for this program based on conservation concern, degree of habitat specialization and range restriction. The target species are: Clapper Rail, King Rail, Black Rail, Willet, Saltmarsh Sharp-tailed Sparrow, Nelson's Sharp-tailed Sparrow, Coastal Plain Swamp Sparrow, and Seaside Sparrow.

III. Sampling Frequency and Replication

Time of day for surveys (Conway 2008)
Observers can conduct either morning or evening surveys on a route as long as each survey route is surveyed during the same period (morning or evening) consistently every year (once a route is designated an evening route, it will always be an evening route in perpetuity). Morning surveys begin 30 minutes before sunrise (dawn) and should be completed 3 hours after sunrise. Evening surveys should begin 2 hours before sunset and must be completed by dark (30 minutes after sunset). When conducting evening surveys, surveyors should start their survey route such that they finish the last point when it's getting too dark to see their datasheet. The half hour between sunset and complete darkness is often when detection probability is highest.

Number of surveys per year and seasonal timing of surveys
Conduct at least 3 surveys annually during the presumed peak of the marsh bird breeding season within each sub-region.

15 April – 31 May
- Chesapeake Bay
- Coastal Delmarva
- Delaware Bay
- Coastal NJ

1 May – 15 June
- Long Island
- Southern New England
- Cape Cod – Casco Bay

Tides

When possible, surveys in tidal marshes should always be conducted at a similar tidal stage for each replicate survey both within and across years. The tidal stage within which to conduct local marsh bird surveys should be based on when highest numbers of marsh birds are likely to be detected in your area; optimal tidal stage for surveys may vary among regions.

Many salt marsh passerines are forced to renest during the peak spring high tide, and detection probability is highest during the week after a high spring tide. If no local data is available on optimal tidal stage for conducting marsh bird surveys, participants should try to conduct surveys on days when high or low tide does **not** fall within the morning (or evening) survey window (i.e., conduct surveys when tides are coming in or out).

Record the following: 1) time of the closest high tide (either the high tide before or after the survey - whichever is closer) for each survey point, and 2) tidal amplitude (difference in water level in meters between the highest and lowest tide on that day) on the day of the survey.

IV. Steps for Conducting the Count

See "Survey Methods" Conway 2008

List of the most common calls for marsh birds

Black Rail: *kik-kik-kerr* (primary breeding call), *grr, churt, ticuck*
Least Bittern: *coo-coo* (male advertisement), *kak-kak-kak*, *gack-gack* (given from nest), *ank-ank* (given when flushed)
Yellow Rail: *click-click*, *wheese* (female call), *descending cackle* (pair maintenance), *squeak* (given by retreating bird)
Sora: *whinny* (territorial defense and mate contact), *per-weep*, *kee* (aka *keep*; may be given to attract mates)
Virginia Rail: *grunt* (pair contact, territorial call), *tick-it* (male advertisement call), *kicker* (female advertisement call), *kiu* (sharp, piercing call), *squawk*
King Rail: *chac-chac* (pair communication), *kik-kik-kik* (mating call)
Clapper Rail: *clatter* (pair contact, territorial call), *kek* (male advertisement call), *kek-burr* (female advertisement call), *kek-hurrah ,hoo, squawk* (chase squeal), *purr*
American Bittern: *pump-er-lunk* (territorial/advertisement call), *chu-peep* (given during copulation ceremony), *kok-kok-kok* (given when flushed)
Common Moorhen: *cackle* (primary advertising call), *squawk, yelp, cluck*, *purr*
Purple Gallinule: *cackle* (primary advertising call), *squawk*, *grunt*
American Coot: *pow-ur* (crowing for territorial defense), *puhk-ut* (warning), *puhk-kuh-kuk* (crowing for territorial challenge), *puhlk*, *tack-tack* (cackling), *kerk* (sharp cough)
Pied-billed Grebe: 3-part gurgling song, *quaa-aaa-aaa* (wavering, guttural copulation call), *kwah* (alarm call), *ek-ek-ek* (rapid, staccato greeting call), *tshick-tshick*

V. After the Count

References:

SOP #5: Documenting Habitat and Climate Variables

Version 1.0
December 2008

NEEDS COMPLETED

Equipment Needed

Supplies needed for surveys

• surveyor flagging (to mark survey points)
• GPS receiver
• clipboard, datasheets, pencils
• CD (obtained from the program coordinator - see contact info below)
• CD player
• amplified speakers
• batteries for CD player and amplified speakers
• sound level meter with +5 dB precision (e.g., Radio Shack model #33-2050 for $34.99; or EXTECH sound level meter, $99 from Forestry Suppliers, Inc.)
• thermometer
• water gauge(s)
• salinity meter (e.g., Oregon Scientific Handheld Salinity Meter [ST228] for $25)

Batteries should be changed or re-charged frequently (before sound quality declines). Participants should routinely ask themselves if the quality of the broadcast sound is high. Request a new CD if quality declines. Observers should always carry replacement batteries on all surveys. A spare CD player should be kept close-by in case the primary unit fails to operate.

SOP #6: Data Submission

Version 1.0
December 2008

This Standard Operating Procedure outlines the procedure for observers to submit survey data.

I. Procedure for Submitting Data

SOP #7: Data Management

Version 1.0
December 2008

This Standard Operating Procedure explains the procedure for management and verification of bird monitoring data.

I. Database Design

II. Data Entry and Verification

III. Metadata Procedures

IV. Data Archival Procedures

SOP #8: Data Analysis and Reporting

Version 1.0
December 2008

This Standard Operating Procedure explains the procedure for data analysis and reporting. Effective communication and reporting is essential to transform field data into a format that is both useful and clearly understood by land managers, scientists, the public, and policy makers.

I. Data Analysis

II. Reporting Procedures and Format

Appendix A. Summary of the Standardized North American Marsh Bird Monitoring Protocols

From Conway, C. J. 2008. Standardized North American Marsh Bird Monitoring Protocols. Wildlife Research Report #2008-01. U.S. Geological Survey, Arizona Cooperative Fish and Wildlife Research Unit, Tucson, AZ.

Objectives:

1. Determine distribution of marsh birds within an area.
2. Estimate / compare density of marsh birds among management units, wetlands, or regions.
3. Estimate population trend for marsh birds at local or regional scale.
4. Evaluate incidental effects of management actions on marsh birds.
5. Document habitat types / conditions that may influence marsh bird abundance or occupancy.

Required Equipment: CD player, marsh bird CD, clip board, GPS, pencil, extra batteries & data sheet

Survey Protocols:

- At least three surveys should be conducted. Repeat surveys should be conducted at least 10 days apart.
- Marsh bird surveys should be conducted in the morning, 30 minutes before sunrise and end when birds cease calling.
- Observers should stand 2 meters to one side of speakers to avoid detection interference.
- Speakers should face the same direction, be positioned toward the center of the marsh, and should not to be moved during the survey. Please note the direction of the speakers so that future observers can remain consistent.
- Surveys should be conducted when wind speed is <20 km/hr (12 mph) and not during sustained rain or heavy fog.
- Always conduct surveys in same chronology.

Data Sheet – Recording Survey Conditions

- Enter start time for each survey and circle the tide and stage of tide.

- Record how the survey was conducted, whether on foot, by canoe, airboat etc. It is important to record type of boat used for a survey because it may affect vocalization probability.

- Record Ambient temperature, background noise (see codes), wind speed (see Beaufort numbers), wind direction, and sky condition (see U.S. Weather Bureau codes).

Background Noise Codes

0 – no noise
1 – faint noise
2 – moderate noise (probably can not hear birds beyond 100m)
3 – loud noise (probably can not hear birds beyond 50m)
4 – intense noise (probably can not hear birds beyond 25m)

Wind Speed Codes (use Beaufort Number on Data Sheet)

Beaufort Number	Wind speed indicators	Wind Speed mph / kmph
0	Smoke rises vertically	< 1 / < 2
1	Wind direction shown by smoke drift	1-3 / 2-5
2	Wind felt on face; leaves rustle	4-7 / 6-12
3	Leaves, small twigs in constant motion; light flag extended	8-12 / 13-19
4	Raises dust and loose paper; small branches are moved	13-18 / 20-29
5	Small trees in leaf sway; crested waves lets on inland waters	19-24 / 30-38

Sky Condition Codes – U.S. Weather Bureau Codes

0 – Clear or a few clouds
1 – Partly cloudy (scattered) or variable sky
2 – Cloudy (broken) or overcast
4 – Fog or smoke
5 – Drizzle
6 – Snow
8 – Showers

Data Sheet – Recording Species

- Record every individual bird that is a primary species on a separate line on the datasheet. Also record when in the survey sequence (Before, Pass 1, BLRA, etc) it vocalized, type of vocalization, and distance of the individual from survey point based on initial vocalization.

- Each time an individual primary species is heard, record a "1" in the appropriate column (regardless of how many times it called during that period) and record an "s" in the column if the bird was seen. If the individual is heard and seen then record "1s" in the column. If the individual is not detected in a time interval, then leave the column blank.

- Record secondary species (all birds using the marsh) on each row and keep track of the number of NEW individuals detected at each time interval. Record the species code and mark with an "x" the distance category (0-50m, 50-100m, or 100m+) in which the species was detected. As each new individual is detected, put a tick in the appropriate time interval column. Continue this for the entire survey. If you have a species that had individuals observed in two distance bands (i.e. SESP occurred in both 0 - 50m and 50 - 100m categories) then you will have two rows for that species on the data sheet.

Example 1: If a Virginia rail was heard 50 meters away doing the *kicker* call during the BLRA call sequence, the observer would record VIRA in the *Species* column, a "1" in the *BLRA* column, "kicker" in the *Call Type* column, and "50" in the *Distance* column. If the same individual calls during the CLRA vocalization and then flew, then record a "1s" in the *CLRA* column on the same line. If the bird called constantly throughout the survey, all columns would have a "1". If an unknown species is detected, write unknown in the *Species* column and take notes regarding the vocalization. If too many individuals of a species are calling at once, estimate the number and note the number is an estimate in the *Comments* column. Record any ancillary information that may have influenced bird detection in the *Comments* column.

Example 2: In this example there were 3 Willets detected in 0-50 m and 1 Willet detected in 100 m. There were also 4 Seaside Sparrows detected in the 0-50 m radius and 1 in the 50 - 100 m. A Clapper Rail, 75 m from the survey point, gave a kek call during the playbacks for KIRA and CLRA.

										Responded During												
Station#	Start Time (military)	Temp (F)	Sky	Wind (Beaufort)	Background noise	Species	0 - 50	50 - 100	100 +	Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA	VIRA	KIRA	CLRA	Outside survey period	Call Type(s)	Distance (meters)	Detected at a Previous Point
P1	0500	65	1	1	0	WILL	x			2		1										
						WILL			x		1											
						SESP	x			3			1									
						SESP		x							1							

						CLRA											x	x		kek	75	

Appendix B. National Marsh Bird Monitoring Program Survey Data Sheet

National Marsh Bird Monitoring Program Survey Data Sheet

Date *(eg 10-May-04)*: **Name of marsh or route :**

Observer(s) *(list all)*: **Survey method (if by boat, include type):**

Tide (circle one): (High) (High/Rising) (High/Falling)

(Low) (Low/Rising) (Low/Falling)

Station#	Start Time (military)	Temp (F)	Sky	Wind (Beaufort)	Background noise	Species	0 - 50	50 - 100	100 +	Responded During													Call Type(s)	Direction	Distance (meters)	Detected at a Previous Point	
										Pass 0-1	Pass 1-2	Pass 2-3	Pass 3-4	Pass 4-5	BLRA	LEBI	SORA	VIRA	KIRA	CLRA	AMBI	Outside survey period					
																								○			
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Background noise: 0 *no noise,* 1 *faint noise,* 2 *moderate noise (probably can't hear some birds beyond 100m),* 3 loud noise (probably can't hear some birds beyond 50m), 4 intense noise (probably can't hear some birds beyond 25m)

Beaufort scale: 0 *smoke rises vertically,* 1 *wind direction shown by smoke drift,* 2 *wind felt on face; leaves rustle* 3 *leaves, small twigs in constan motion; light flag extended,* 4 *raises dust and loose paper; small branches are moved,* 5 *small trees with leaves sway; crested wavelets on inland waters*

Sky: 0 *clear or a few clouds,* 1 *partly cloud or variable sky,* 2 *cloudy or overcast,* 4 *fog or smoke,* 5 *drizzle,* 6 *snow,* 8 *showers*