

Temperate Non-Breeding Surveys – A Key to Shorebird Conservation¹

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Abstract

Completion of the United States and Canadian shorebird conservation plans recently identified and prioritized shorebird monitoring, management, and conservation needs in the Western Hemisphere. We present an emerging approach to monitor shorebird use of temperate non-breeding areas under the Program for Regional and International Shorebird Monitoring (PRISM). This program provides a single, comprehensive blueprint for implementing the monitoring component of both the U.S. and Canadian plans. The main goals of PRISM are to estimate the size of breeding populations, monitor population trends, evaluate the magnitude of use of stopover locations, and assist local managers with conservation goals. The primary goal of temperate non-breeding surveys is to produce an accurate estimate of the average number of shorebirds using stopover sites during the spring and fall migration in Canada and the United States. At a regional level, this effort will provide local or regional resource managers with quantitative information on shorebird use of key locations allowing them to more effectively manage and conserve shorebirds at the local and flyway scale. In coordination with the Biological Resources Division, US Geological Service, the Pacific Region of the US Fish and Wildlife Service is identifying and evaluating a network of monitoring sites along the Oregon Coast. This includes prioritizing focal species, evaluating potential biases in conducting surveys, defining survey methodology, and developing a strategy to coordinate volunteer efforts. This program seeks to build upon and advance citizen science initiatives such as the International Shorebird Survey, the Maritimes Shorebird Survey in the Atlantic Provinces of Canada, and the Western Shorebird Survey.

Key words: conservation, migration, monitoring, shorebird, surveys, temperate.

Monitoring Nonbreeding Shorebirds – A Multinational Priority

The U.S. and Canadian shorebird conservation plans acknowledge that data from long-term monitoring is the basis for establishing conservation goals, evaluating management activities, and identifying research needs. One of the highest priorities identified in the U.S. Shorebird Conservation Plan was the development of a comprehensive monitoring strategy with the following goals: (1) assures statistically valid monitoring of long-term species-specific population trends, (2) provides precise estimates of the size of species' populations, (3) monitors shorebird use of major staging, migration and wintering areas in the U.S. and Canada and, (4) ensures that shorebird population information is integrated into bird conservation planning and implementation.

The Program for Regional and International Shorebird Monitoring (PRISM) was developed by the Canada-U.S. Shorebird Monitoring and Assessment Committee, formed in 2001 by the Canadian Shorebird Working Group and the U.S. Shorebird Council, to meet these goals. It provides a single, comprehensive blueprint for implementing monitoring goals under both the Canadian and U.S. shorebird conservation plans. PRISM outlines a four-part approach to monitoring shorebirds throughout their annual cycle; this paper describes the rationale and procedure for implementing temperate non-breeding surveys. Further details on other components of PRISM are provided in this volume (see Bart et. al., this volume).

Temperate Non-Breeding Surveys

Temperate non-breeding surveys meet three of the five goals of PRISM including: (1) monitoring the use of stopover sites, (2) defining habitat relationships during the spring and fall migration, and (3) providing resource managers with quantitative population and habitat information to assist them in planning and implementing shorebird conservation measures. In addition, these surveys have the potential to provide an early warning signal of population declines that will prompt more intensive monitoring on the breeding grounds. The primary goal of temperate non-breeding surveys is to produce an accurate estimate of the average number of shorebirds using stopover sites during migration in Canada and the United States

At a regional level, this effort will provide local or regional resource managers with quantitative population and habitat information to assist them in the man-

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agement and conservation of shorebirds. Of particular importance, is their ability to form comprehensive migratory bird management strategies with Joint Ventures, private land initiatives, and other bird conservation plans. For instance, habitat requirements for shorebirds during migration can be extrapolated from these data for use in building comprehensive habitat enhancement, protection, and acquisition plans. This survey could (1) provide a baseline for evaluation of management techniques, (2) monitor shorebird use of areas with invasive species issues and document the need for management, or (3) provide data on the use of stopover sites adjacent to populated coastal communities for purposes of mitigation.

Every effort is being made to develop and use statistically valid survey techniques that will accurately reflect population declines while minimizing bias and maximizing precision. The resulting data will be analyzed, at the species level, for accuracy before the data are used in trend analysis. At present, there are three sources of bias that could potentially produce erroneous trends: regional selection, site selection, and measurement bias (see definition provided by Bart, et. al. this volume). If the potential for bias exists within the study area, pilot studies are proposed to determine if the bias can be eliminated, minimized, or if the study area should be discontinued.

Survey dates for each study area will be determined from available scientific literature and local experts to ensure that each focal species is potentially represented in the survey. It is important to note that this effort will not use peak counts, but rather estimates of the mean number of birds present during the study period. This provides flexibility in the timing of surveys with less emphasis on catching peak shorebird concentrations that may vary by year, weather, conditions on the breeding grounds, and other potential factors.

Much like the Breeding Bird Survey, this initiative will be based on a volunteer, “Citizen Science” effort. It seeks to build and improve upon several successful shorebird migration monitoring programs such as the International Shorebird Survey (Howe et. al. 1989), the Maritimes Shorebird Survey in the Atlantic provinces of Canada, and the Western Shorebird Survey (Howe et. al. 2000). Each of these efforts will remain as separate initiatives, yet for purposes of statistical analysis, site selection and data collection will be standardized and a common database developed.

Regional Temperate Non-Breeding Surveys – A Case Study in Oregon

In coordination with US Geological Survey – Biological Resource Division, the US Fish and Wildlife

Service, Pacific Region is identifying and prioritizing a network of migration monitoring sites on the Oregon coast, and prioritizing focal species and survey periods for monitoring the spring and fall migration. The initial tasks of site selection and focal species designation were recently completed. Site assessments are ongoing. Each regional assessment is a working document, continually revised as the process is refined. Below I outline methods for the development of bird monitoring regions and zones therein, selecting sites and focal species, survey methods, and potential measurement error and bias associated with each of these. I present particular examples encountered during my work on the Oregon assessment (S. Thomas, unpubl. data).

Bird Monitoring Regions

Canada and the United States were sub-divided into “Bird Monitoring Regions” by overlaying Bird Conservation Regions (BCR) with Provincial and State boundaries. Each Bird Monitoring Region (e.g. Northern Pacific Coast, BCR-5 in Oregon) was then geographically sub-divided into domains. Domains were delineated for ease of presentation and organizational purposes; their borders do not have any particular statistical significance or unique habitat representation. Domains were then sub-divided into zones that consist of one or two habitat types (e.g., rocky shorelines) that require a unique sampling plan.

Site Selection

Site selection relied heavily on areas identified in the *US National Shorebird Management Plan: Northern Pacific Coast Working Group Regional Management Plan* (Drut and Buchanan 2000) and the Western Shorebird Survey (*fig. 1*). Each site was then reviewed to determine if 80 percent of the shorebird days (equivalent to a shorebird spending 24 hours in the study area) for each focal species occur in that area. This analysis prioritizes survey effort so that migration monitoring will accurately reflect the importance of stopover sites within the Pacific Flyway.

Focal Species Designation

Focal species designation relied heavily on information provided by Paulson (1993), Nehls (1994), Drut and Buchanan (2000), and local expertise. Focal species were chosen based on the region’s significance to the species in question [Regional Conservation Scores taken from <http://shorebirdplan.fws.gov/U.S.Shorebird/downloads/BCRSCORES3.xls> and Drut and Buchanan (2000)], whether 80 percent of the flyway population moves through the BCR, abundance of adults, and whether the species was monitored by other survey programs, (*table 1*). Temperate breeding species were not included because they are best monitored during

the breeding season. Also, species that require special surveys (i.e., off shore migrants) were not included in this monitoring program.

Site specific information such as access and associated issues, period of use, and long-term change in use were collated from conversations with members of the Northern Pacific Coast Regional Shorebird Management Plan Working Group, local shorebird experts, and landowners.

After the initial tasks of selecting focal species, delineating the bird monitoring region into domains and identifying sites or “zones” of interest, a more detailed analysis of each zone was initiated to determine the level of effort necessary to effectively monitor shorebird use within the region. The following information was provided for each zone.

Zone Description

Each zone description included information on the boundaries of the zones, information regarding the best

tidal conditions and time of day to survey, historical occurrence of species and specific concentration areas within the zone. Ownership, access, and safety issues were also described. A description of a rocky shoreline zone (fig. 2), might call for surveys on an evening high tide to take advantage of the sun low in the west, as the majority of rocky shoreline in this zone faces west.

Zone Classification

Zones were classified into three types (i.e., 1, 2 and 3) based on the number of shorebirds historically observed in the area. Historic use was based on available literature and confirmation by local experts. Type 1 zones are areas where shorebirds are present in substantial numbers and surveys are conducted annually. Type 2 zones are areas where shorebirds are present, but in small numbers and surveys are conducted periodically (e.g., every 5 years) to assure shorebird use of the zone has not changed. Type 3 zones are areas considered to have virtually no shorebirds and where surveys are not conducted unless warranted by changing shorebird use.

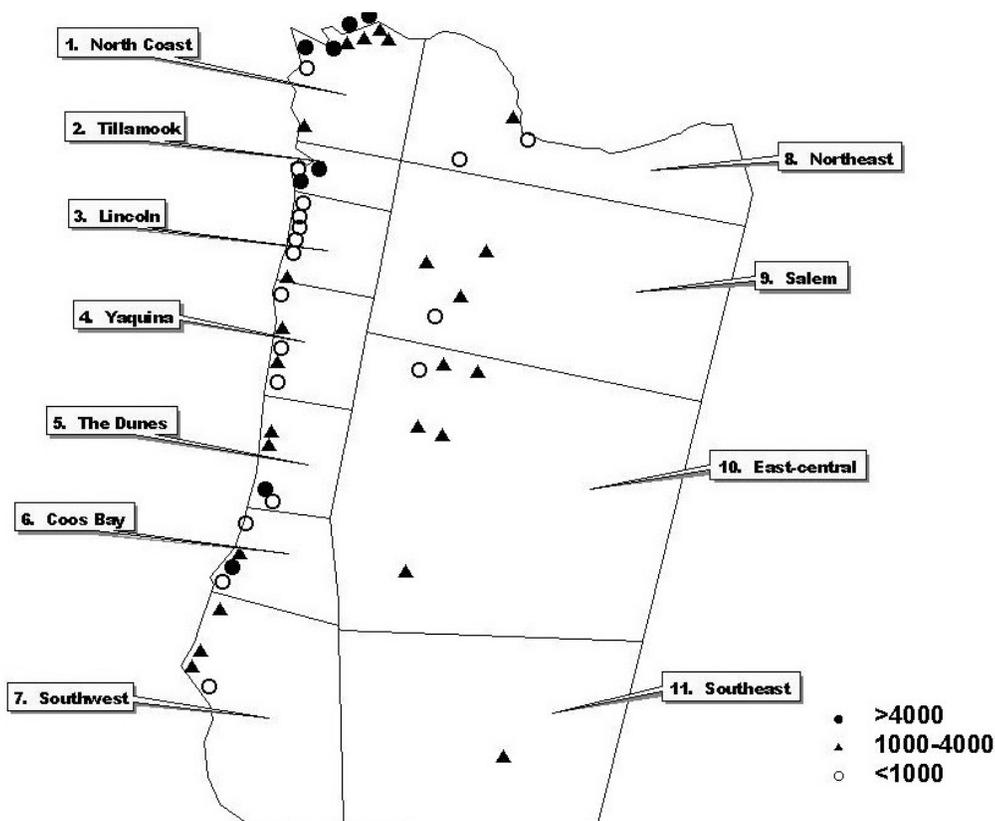


Figure 1—Shorebird concentration sites and domain boundaries in shorebird monitoring region Oregon-BCR5.

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Table 1—Preliminary Focal Species for temperate non-breeding surveys of shorebirds regularly occurring in shorebird monitoring region Oregon-BCR5 (Northwest Pacific Rainforest).

Species	Regional Conservation Score ¹	National Conservation Score ²
Black-bellied Plover	3	3
Semipalmated Plover	3	2
Black Oystercatcher	4	4
Greater Yellowlegs	4	3
Lesser Yellowlegs	2	3
Whimbrel	4	4
Ruddy Turnstone	3	3
Black Turnstone	4	4
Wandering Tattler	3	3
Surfbird	3	4
Rock Sandpiper	5	3
Red Knot	4	4
Sanderling	3	4
Dunlin	3	3
Western Sandpiper	3	4
Least Sandpiper	3	3
Short-billed Dowitcher	4	4
Long-billed Dowitcher	3	2

¹Conservation Score – represents population status, trend and comparative importance of BCR5 to the species (5 – Highly Imperiled, 4 – Species of High Concern, 3 – Species of Moderate Concern, 2 – Species of Low Concern, 1 – Species Not at Risk). This score is considered along with the relative abundance of adults during migration and absence of other survey programs that adequately monitor the species. Taken from the U.S. National Shorebird Management Plan: Northern Pacific Coast Working Group Regional Management Plan.

²Taken from <http://shorebirdplan.fws.gov>.

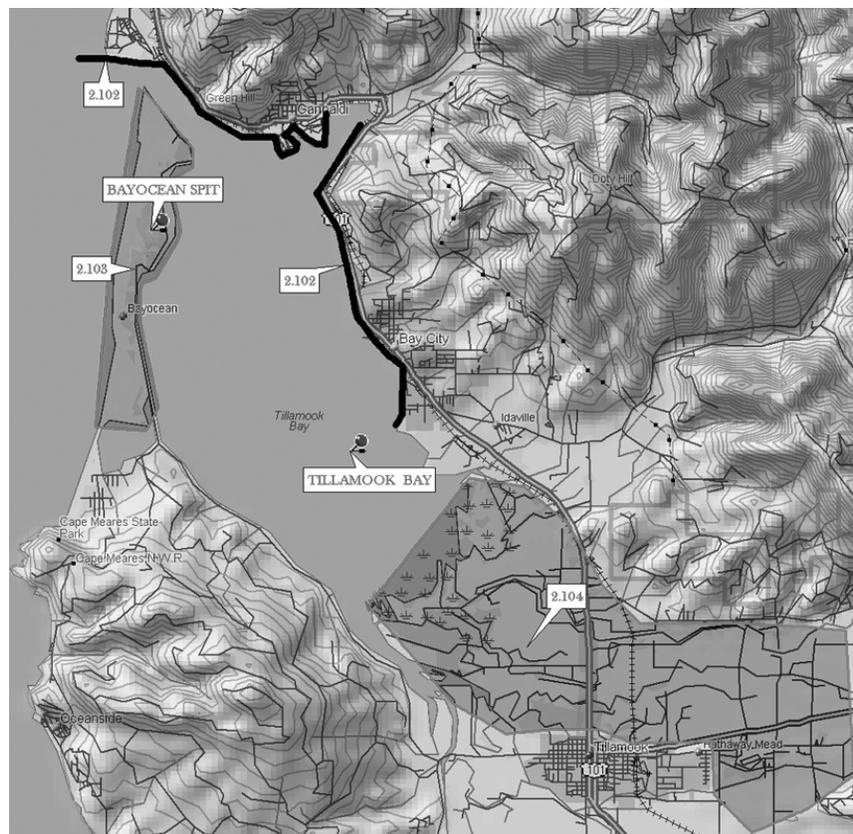


Figure 2—Rocky shoreline zone 2.102 in Domain 2, Tillamook Bay, shorebird monitoring region Oregon-BCR5.

The classification of zones into different types is an iterative process that can change as new information becomes available. For example, if a previously unsuitable zone, classified as Type 3, has become suitable, it can be included in the survey plan for reassessment at that time. Local shorebird experts or biologists are encouraged to identify Type 3 zones that should be reclassified based on change in use. The survey plan for the entire domain will be reassessed every five to ten years, by evaluating recent aerial surveys to assure changes in access or habitats have not caused previously unidentified biases or safety issues. This is particularly relevant in dynamic estuary environments and areas that are heavily managed. In the example above, rocky shorelines are considered a Type 1 zone.

Survey Methods

This section consists of initial suggestions on how and when to conduct surveys within each zone. We focus on conducting surveys during high tides to reduce the chance of double counting between zones. For example, Black-bellied Plovers (*Pluvialis squatarola*) often congregate along the outer shore during high tide and within the estuary during low tide. Surveys in these two zones without regard to tides could over-represent this species. The amount of time spent in each zone is also important in dynamic estuarine environments. In some areas with steep gradients, tidal heights can change considerably within 30 min. The rocky shoreline appears to be best surveyed using a shallow-bottomed boat such as a Zodiac to minimize hazards associated with walking on slippery, wave tossed jetties and access issues along the rocky shoreline. In addition, boats may cause fewer disturbances than ground-based surveys. Visibility would be particularly poor using aerial surveys in this habitat as cryptic sandpipers such as Surfbirds (*Aphriza virgata*), Rock Sandpipers (*Calidris ptilocnemis*), Wandering Tattlers (*Heteroscelus incanus*), and Black Turnstones (*Arenaria melanocephala*) could be significantly undercounted.

Measurement Error and Measurement Bias

Measurement error/bias could occur if some of the birds in the study area are not recorded. Some species are more prone to measurement error/bias than others. For example, because Least Sandpipers (*Calidris minutilla*), use the vegetated borders of mudflats to varying degrees; it is possible to record a different proportion of the birds during each survey and or year thereby producing a biased trend for this species over the long term. Certain areas are also prone to measurement error/bias. Disturbance issues from heavy human use of the zone could affect the survey one day and not the next. For example, humans use the south jetty of the Colum-

bia River intensively during spring; this greatly influences the movement of shorebirds throughout the area with as many as 70 percent of the individuals flying past the survey areas (M. Patterson, pers. comm.). These situations are considered when designing surveys, delineating habitats, and classifying zones.

Access and Selection Bias

Access and selection bias are encountered if suitable areas within the zone cannot be surveyed because the site is inaccessible to an observer. This may occur if an area is privately owned or becomes available due to recent management actions (i.e., the site was not previously considered for monitoring). For example, an active management program designed to eradicate invasive species may significantly improve habitat for shorebirds in an area that had not been included in the original survey plan thereby inducing biased counts. Conversely, invasive species could render a previously important stopover site virtually unsuitable as is the case in Willapa Bay with *Spartina* encroachment. The availability of new areas and the use of old areas will be reevaluated every 5 to 10 years to assess the potential for bias due to changes in each zone.

Pilot Studies

If the potential for bias in survey counts exist, pilot studies are designed to determine if the bias can be eliminated, minimized, or if the study area should be discontinued. Pilot studies may include preliminary aerial surveys of each zone during the migration period. Aerial surveys may help to further delineate the boundaries of each zone; pinpoint concentration points and assist in defining the best time of day to monitor birds. Aerial surveys may also identify previously unknown high tide roosts such as sandy islands in the middle of a bay or suitable pastures adjacent to an estuary. As pilot studies, one advantage aerial surveys have over ground surveys is that adjacent zones can be assessed virtually simultaneously. This is particularly important when assessing the potential for double counting in a zone. Ground and water-based pilot studies may prove beneficial when assessing concentration points for smaller and cryptic shorebirds; determining the length of time necessary to fully cover a zone; and pinpointing absolute tide heights to cover the zone. A pilot study for the rocky shoreline zone might consist of boat surveys to confirm concentration sites along the shore; pinpoint absolute tide heights and time of day to cover the zone, determine the most appropriate method to count birds and whether the zone can be effectively sampled.

Future tasks necessary to complete regional evaluations on the Oregon coast include: (1) conducting a thorough GIS spatial analysis of each Type 1 zone to assess the

interaction of tidal heights, gradient, access, and habitat type, (2) conducting the necessary pilot studies to complete the description of each zone, and (3) assessing volunteer skills and coordination needs.

This is a multi-national effort that should be expanded throughout the Western Hemisphere in the near future. Coordinators are needed to develop regional assessments and monitoring networks in other bird monitoring regions.

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Literature Cited

- Bart, J., A. Manning, S. Thomas, and C. Wightman. This volume. **Preparation of regional shorebird monitoring plans.**
- Drut, M. and J. B. Buchanan. 2000. **U.S. National Shorebird Management Plan: Northern Pacific Coast Working Group regional management plan.** Portland, OR: Fish and Wildlife Service, U.S. Department of the Interior.
- Howe, M. A., P. H. Geissler, and B. A. Harrington. 1989. **Population trends of North American shorebirds based on the International Shorebird Survey.** *Biological Conservation* 49: 185-199.
- Howe, M. A., J. Bart, S. Brown, C. Elphick, R. Gill, B. Harrington, C. Hickey, G. Morrison, S. Skagen, and N. Warnock, editors. 2000. **A comprehensive monitoring program for North American shorebirds.** Unpublished Report. Arlington, VA: Fish and Wildlife Service, U.S. Department of the Interior.
- Nehls, H. 1994. **Oregon shorebirds their status and movements.** Report to the Oregon Department of Fish and Wildlife, Wildlife Diversity Division. Technical Report #94-1-02. Salem, OR.
- Paulson, D. 1993. **Shorebirds of the Pacific Northwest.** Seattle, WA: University of Washington Press; 406 p.