

CONSERVATION PLAN FOR THE WHIMBREL
(*NUMENIUS PHAEOPUS*)

Version 1.1
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NOTE about Version 1.1:

The only difference between Version 1.1 (February 2010) and Version 1.0 (November 2009) is the addition of a Spanish executive summary.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
RESUMEN EJECUTIVO	3
PURPOSE	6
STATUS AND NATURAL HISTORY	7
MORPHOLOGY	7
TAXONOMY	7
CONSERVATION STATUS	8
POPULATION ESTIMATE AND TREND	9
DISTRIBUTION AND ABUNDANCE	12
<i>Breeding Season: Breeders</i>	13
<i>Breeding Season: Nonbreeders</i>	16
<i>Nonbreeding Season</i>	17
MIGRATION	18
<i>Northbound: Western Population</i>	18
<i>Northbound: Eastern Population</i>	19
<i>Southbound: Western Population</i>	20
<i>Southbound: Eastern Population</i>	21
MAJOR HABITATS	22
<i>Breeding Range</i>	22
<i>Migration</i>	23
<i>Nonbreeding Range</i>	24
CONSERVATION SITES	25
MIGRATION SITES	26
<i>Northbound Migration</i>	26
<i>Southbound Migration</i>	28
NONBREEDING SITES	29
CONSERVATION THREATS	37
HABITAT LOSS AND DEGRADATION	37
CONTAMINANTS	39
HUMAN DISTURBANCE	40
HARVEST	41
CLIMATE CHANGE	41
CONSERVATION STRATEGIES AND ACTIONS	43
HABITAT PROTECTION AND PREVENTION OF LOSS	43
DISTURBANCE MANAGEMENT AT STAGING/STOPOVER AND WINTERING SITES	44
REDUCE HARVEST PRESSURE	44
RESEARCH AND MONITORING NEEDS	45
MIGRATION AND CONNECTIVITY	45
STOPOVER ECOLOGY	48
WINTERING ECOLOGY – ADULTS AND JUVENILES	49
MONITORING NEEDS	50
CONSERVATION TIMELINE	54
EVALUATION	55
LITERATURE CITED	57
APPENDIX I	69
APPENDIX II	70

EXECUTIVE SUMMARY

The Whimbrel (*Numenius phaeopus*) in the Western Hemisphere has received relatively little attention from shorebird biologists in recent decades except for having been identified as a species of high conservation concern in regional and national shorebird conservation plans. The purpose of this plan is to provide an overview of our current state of knowledge concerning the population status of the Whimbrel in the Western Hemisphere, to identify important conservation sites for the species, to recommend and prioritize conservation, research, and management needs, and to facilitate networking between parties interested in Whimbrel conservation.

The Whimbrel breeds in arctic, sub-arctic, and boreal regions around the globe. In the Western Hemisphere, breeding birds occur in Alaska, northwestern Canada, and west and south of Hudson Bay. During the nonbreeding season (boreal winter), Whimbrels occur throughout the coastal regions of Mexico and Central and South America, with smaller numbers along the Atlantic, Pacific, and Gulf of Mexico coasts of the United States.

The subspecies of Whimbrel breeding in North America (*Numenius phaeopus hudsonicus*) is generally thought to be comprised of two disjunct breeding populations that maintain separate migratory and wintering ranges: a western population in Alaska and northwestern Canada, and an eastern population west and south of Hudson Bay. Although recent evidence from satellite telemetry studies has highlighted the uncertainty behind this generalization, the two populations are still referred to as ‘western’ and ‘eastern’. The most recent population estimate for this subspecies is 66,000 individuals, including 26,000 from the western population and 40,000 from the eastern breeding population. We present alternative interpretations of survey data that suggest a range between 55,500 and 73,100 individuals as a population estimate. Population trend information for the subspecies is generally lacking, but limited information suggests possible declines of at least the eastern population in recent decades. Long-term, coordinated survey efforts within significant migratory staging and stopover areas are needed to provide better insight into population estimates and trends for the species.

N. p. hudsonicus nesting habitat encompasses a variety of open wetland and upland habitat throughout the sub-arctic and alpine tundra and taiga of Canada and Alaska. Detailed information on breeding distribution and abundance within the breeding range boundaries is lacking. Several recent research and monitoring efforts, however, highlight important breeding

areas on a more local scale which are important for establishing benchmark information with which future survey results may be compared.

We identified 57 important sites for the Whimbrel during north- and/or southbound migration, 27 of which are known to support at least 1% of the biogeographic population. We also identified four broad regions and three specific sites that, collectively, support 66% of the population during the boreal winter.

Our overview of threats to the Whimbrel and the highest priority conservation strategies and actions, as well as research and monitoring needs, are based on input and expertise from over 60 biologists throughout the Western Hemisphere. The five most important threats identified for the Whimbrel throughout its lifecycle include: 1) habitat loss and degradation, 2) contaminants, 3) disturbance, 4) harvest pressure, and 5) climate change. Aside from recommending direct, on-the-ground conservation actions to abate these threats, biologists emphasized that there are important information gaps for basic Whimbrel ecology that currently limit our collective ability to effectively address how to best manage and conserve this species. Recommended research actions include investigations of: 1) migration and connectivity, 2) stopover ecology, and 3) wintering ecology. Priority monitoring actions include: 1) better monitoring protocols to estimate population size and trends, 2) long-term monitoring of breeding populations, and 3) long-term monitoring of individually marked birds in order to establish important demographic parameters.

Finally, we present a Conservation Timeline and a list of metrics meant to outline and measure the progress of key steps towards effective conservation of the Whimbrel in the Western Hemisphere over the next decade. Our hope is that this plan will remain a living, changing document that summarizes what shorebird biologists and managers throughout the Western Hemisphere have categorized as the most important conservation actions for the Whimbrel. We further hope that this plan will help in prioritizing and focusing limited conservation dollars to maximize the effectiveness of those actions.

RESUMEN EJECUTIVO

La especie de ave playera *Numenius phaeopus* del Hemisferio Occidental ha recibido relativamente poca atención por los biólogos en las últimas décadas, excepto por haber sido identificado como una especie de alta preocupación para la conservación en planes regionales y nacionales de conservación de aves playeras. El objetivo de este plan es proporcionar un resumen de nuestro conocimiento actual sobre el estatus de la población del *N. phaeopus* en el Hemisferio Occidental; identificar sitios importantes para la conservación de esta especie; recomendar y dar prioridades a las necesidades de conservación, investigación, y gestión; y facilitar la creación de redes entre las partes interesadas en la conservación de *N. phaeopus*.

El *N. phaeopus* se reproduce en zonas del ártico, subárticas, y regiones boreales de todo el mundo. En el Hemisferio Occidental, la especie reproduce en Alaska, al noroeste de Canadá, y al oeste y sur de la Bahía de Hudson. Durante la época de no reproducción (invierno boreal), se encuentran los *N. phaeopus* a lo largo de las regiones costeras de México, Centroamérica, y Suramérica, con números más pequeños a lo largo de las costas del Pacífico, Golfo, y Atlántico de los Estados Unidos.

La subespecie que se reproduce en Norte América, *Numenius phaeopus hudsonicus*, esta se compone generalmente de dos poblaciones que se mantienen separadas en épocas de migración y en el invierno: la población occidental desde Alaska y noroeste Canadá, y otra población oriental al oeste y al sur de la Bahía de Hudson. Aunque la evidencia de recientes estudios de telemetría por satélite ha demostrado la incertidumbre de esta generalización, las dos poblaciones todavía se distinguen como las poblaciones “occidental” y “oriental”. La estimación más reciente de la población de esta subespecie (*N. p. hudsonicus*) es de 66.000 individuos, incluyendo 26.000 de la población occidental y 40.000 de la población oriental. Se presentan en este plan las interpretaciones alternativas de datos de censos que sugieren un rango entre 55.500 y 73.100 individuos como una estimación de la población. La información sobre las tendencias de la población de la subespecie es generalmente escasa, pero la información limitada sugiere posibles disminuciones de la población oriental por lo menos en las últimas décadas. Los coordinados esfuerzos para realizar censos de largo plazo en los sitios importantes para la preparación y paradas de migración son necesarios para proporcionar una mejor comprensión de las estimaciones y tendencias de las poblaciones de la especie.

El hábitat de anidación de *N. p. hudsonicus* abarca una gran variedad de humedales y altiplanos abiertos en toda la región subártica, tundra alpina, y taiga en Canadá y Alaska. La información detallada sobre la distribución de las aves que reproducen y sobre su abundancia dentro del rango de reproducción es escasa. Varios esfuerzos recientes de monitoreo e investigación, sin embargo, destacan las áreas importantes de reproducción a la escala local, cuales son importantes para establecer información de referencia con lo que los resultados de estudios futuros se pueden comparar.

Identificamos los 57 sitios importantes para el *N. phaeopus* durante la migración hacia el norte además el sur. De todos, se sabe que los 27 albergan al menos de 1% de la población biogeográfica. También identificamos cuatro grandes regiones y tres sitios específicos que en conjunto apoyan con el 66% de la población durante el invierno boreal.

Nuestro resumen de las amenazas para el *N. phaeopus* y las estrategias y acciones de conservación de alta prioridad, así como las necesidades para la investigación y monitoreo, se basan en el conocimiento y la experiencia de más de 60 biólogos de todo el Hemisferio Occidental. Las cinco amenazas más importantes identificadas para el *N. phaeopus* en todo su ciclo de vida son:

- 1) Pérdida y degradación de hábitat,
- 2) Contaminantes,
- 3) La perturbación humana,
- 4) Presión por cosechas, y
- 5) Cambio climático.

Además de recomiendo la implementación de acciones directas de conservación para mitigar estas amenazas, los biólogos también han destacado que hay vacíos de información importante de la ecología básica del *N. phaeopus* que actualmente limitan nuestra capacidad colectiva para abordar con eficiencia la cuestión de cómo manejar y conservar esta especie por la mejor manera. Las acciones de investigación recomendadas incluyen el estudio de:

- 1) la migración y la conectividad,
- 2) la ecología de paradas, y
- 3) la ecología de invernada.

Acciones prioritarias de monitoreo incluyen:

- 1) los protocolos mejores de monitoreo para estimar el tamaño y la tendencia de la población,
- 2) el monitoreo a largo plazo de las poblaciones de reproducción, y
- 3) el monitoreo a largo plazo de las aves marcadas individualmente con el fin de establecer parámetros demográficos importantes.

Por último, presentamos una Horario de Conservación y una lista de medidas con el fin a presentar y medir el progreso de los pasos claves hacia la conservación efectiva del *N. phaeopus* en el Hemisferio Occidental durante la próxima década. Nuestra esperanza es que este plan seguirá siendo un vivo y cambiante documento que resume lo que los biólogos y administradores en el Hemisferio Occidental han identificado como las acciones de conservación más importantes para el *N. phaeopus*. Además, esperamos que este plan ayudará hacer prioridades y centrar dólares limitados para la conservación para maximizar la eficacia de esas acciones.

PURPOSE

The Western Hemisphere Shorebird Reserve Network (WHSRN), a program of Manomet Center for Conservation Sciences, has been collaborating with shorebird experts throughout the Western Hemisphere to develop species-specific conservation plans for our most at-risk shorebird species. The purpose of these documents is to outline what is known about a species (ecology, threats, etc.) and to identify the more immediate conservation, research, and management efforts needed for the species over the next 10–15 years. For many species, the conservation plan represents the first time that a concerted effort has been made to compile this type of information on the hemispheric scale needed to effectively address the long-term conservation of highly migratory species.

The Whimbrel (*Numenius phaeopus*) in the Western Hemisphere has received relatively little attention from shorebird biologists in recent decades except for having been identified as a species of high conservation concern in the U.S. and Canadian Shorebird Conservation Plans (Brown *et al.* 2001, Donaldson *et al.* 2000). Although several research efforts focusing on the Whimbrel have been initiated in recent years, we are still faced with significant gaps regarding basic information on the species's abundance, distribution, migratory patterns, habitat requirements, and population demographics. The purpose of this plan, within the scope of the Western Hemisphere, is to:

1. Provide an overview of our current state of knowledge concerning the Whimbrel's population status;
2. Identify and outline important conservation sites for the species throughout its life cycle;
3. Outline the primary threats affecting the Whimbrel;
4. Recommend and prioritize conservation, research, and management efforts most likely to have a direct and timely effect on the conservation of the species;
5. Facilitate networking between individuals, agencies, and organizations involved with Whimbrel conservation throughout its range; and
6. Provide a framework with which interested parties can develop a comprehensive conservation strategy for the Whimbrel over the next decade.

The plan was developed in part by soliciting input and expertise from shorebird biologists throughout the Western Hemisphere. Overall we received feedback, data, and assistance from over 60 biologists, researchers, resource managers and academics. Our hope is that the plan will

remain a living document and, with periodic updates, revisions, and additions, and will continue to provide a concise yet complete guiding framework for the conservation of the Whimbrel throughout the Western Hemisphere.

STATUS AND NATURAL HISTORY

MORPHOLOGY

The Whimbrel is a medium-size curlew with a median crown stripe and dark eye line. The Nearctic form, *N. p. hudsonicus*, is distinct from Palearctic forms in having a dark rump with little contrast to the back and a characteristic buffy ventor. All forms are sexually dimorphic with females generally larger than males but with considerable overlap (Prater *et al.* 1977, Cramp and Simmons 1983). For *N. p. hudsonicus* adults measured near Hudson Bay, females were significantly larger in mass (mean = 403.9 vs. 354.8 grams), wing chord (242.1 vs. 229.4 millimeters), culmen length (90.8 vs. 82.8 mm), and tail length (93.8 vs. 89.9 mm)(Skeel 1982). Mass varies throughout the annual cycle, with sharp pre-migratory peaks that may reach 40% above lean mass (Cramp and Simmons 1983, Piersma and Van Brederode 1990). Heaviest pre-migratory birds handled in Britain were believed to carry an estimated 250 grams of fat. The heaviest bird captured in Virginia during fall migration in 2008 was 688 grams (CCB and TNC, unpubl. data). The heaviest bird captured on Chiloé Island, Chile, in February 2007 was 689 grams (Johnson *et al.* 2007a). In comparison, birds weighed on the breeding grounds ranged between 310 grams and 459 grams (Skeel 1982).

TAXONOMY

Whimbrel taxonomy has been in flux for several decades. Four subspecies have been described: the nominate form *N. p. phaeopus* <Linnaeus 1758> that breeds in northern Europe, western Siberia, Iceland, and Scotland east to Taymyr; *N. p. alboaxillaris* <Lowe 1921> that breeds east of lower Volga and south of the Urals; *N. p. variegatus* <Scopoli 1786> that breeds in northeast Siberia west to the Yana Basin; and *N. p. hudsonicus* <Latham 1790> that breeds in North America. *N. p. hudsonicus* has two disjunct breeding populations: a western population in Alaska and northwestern Canada, and an eastern population west and south of Hudson Bay

(northeastern Canada) (Godfrey 1986, A.O.U. 1998). The two populations show consistent variation in size (Skeel and Mallory 1996).

Prior to 1957, the New World form was considered to be a separate species (Hudsonian Curlew) distinct from the three Eurasian forms (A.O.U. 1931, 1957). This earlier delineation may be justified, as recent mtDNA evidence suggests strong differentiation between *N. p. hudsonicus* and *N. p. variegatus* that likely rises to the species level (Zink *et al.* 1995). These two forms differ in plumage and are geographically isolated. Differences of similar magnitude between *N. p. phaeopus* and *N. p. variegatus* suggest the possibility of three distinct species within the complex, though genetic differentiation has yet to be evaluated.

Recent literature describes further investigation into the taxonomy of the Whimbrel. For example, Tomkovich (2008) describes a new subspecies that breeds in central Siberia, *N. p. rogachevae*. In the Western Hemisphere specifically, further investigation of Whimbrel morphology by Engelmoer and Roselaar (1998) describes the two disjunct breeding populations in the Western Hemisphere as separate races, and *N. p. rufiventris* (western) and *N. p. hudsonicus* (eastern). For the purposes of this plan however, we will defer to the taxonomic classification as written in the latest edition of the American Ornithologists' Union (1998) and will refer to the two populations simply as 'western' and 'eastern' populations of *N. p. hudsonicus*, as described above.

CONSERVATION STATUS

Globally, *N. phaeopus* is considered a species of Least Concern because of its wide range, large global population, and because it does not appear to meet population decline thresholds set by the International Union for Conservation of Nature (IUCN) Red List (BirdLife International 2008). In the Western Hemisphere, however, *N. p. hudsonicus* qualifies as a species of conservation concern on a number of levels. Both the U.S. and Canadian Shorebird Conservation Plans designate the species as one of high conservation concern driven mostly by declining population trends and low relative abundance of at least the eastern population (Brown *et al.* 2001, Donaldson *et al.* 2000, USSCP 2004). It is also considered a Species of Conservation Concern by the U.S. Fish and Wildlife Service (2008) and an Audubon Alaska Watchlist species (Stenhouse and Senner 2005).

POPULATION ESTIMATE AND TREND

Recent population estimates for the Whimbrel in the Western Hemisphere are based on the assumption that the migratory pathways of the western and eastern breeding populations are separate and there is little overlap between the two (Skeel and Mallory 1996, Morrison *et al.* 2001b, 2006). Therefore, combinations of counts from different stages of the species's lifecycle along both coasts have been used to estimate overall abundance. The most recent estimate is 66,000 individuals, including 26,000 from the western population and 40,000 from the eastern breeding population (Morrison *et al.* 2006). This is derived primarily from a post-breeding season estimate from western Alaska and a maximum estimate of 40,000 birds during spring migration at one stopover site along the Atlantic Coast (Morrison *et al.* 2006). The previously published estimate of 57,000 individuals for the Western Hemisphere population from Morrison *et al.* (2001b) was derived from a combination of a post-breeding season estimate from western Alaska (39,000) and boreal winter estimates along the Atlantic coasts of South America (18,000) (Morrison *et al.* 2001b).

The difference between the estimates in 2001 and 2006 result from a re-evaluation of how the earlier estimate was derived for the western population and the results of 3 years of survey data from one stopover location on the Atlantic Coast—not observed changes in population numbers. The authors of these studies recognize that, in fact, little information has become available regarding the abundance of the Whimbrel in the Western Hemisphere since 2001, and the accuracy rating for both of these estimates is low (Morrison *et al.* 2001b, 2006). Furthermore, recent work with satellite telemetry has highlighted the uncertainty behind the assumption that the western and eastern breeding populations maintain separate migratory paths (Watts *et al.* 2008). It also brings into question the utility of combining counts from the Eastern Pacific Coast and the Western Atlantic Coast during different seasons to estimate overall abundance for the Western Hemisphere.

We offer two additional compilations of survey results to estimate overall abundance of the Whimbrel in the Western Hemisphere. Many of the available estimates are derived from multiple survey efforts with varying time frames and methodologies, and many are over 20 years old; however, we present them as additional population estimates for *N. p. hudsonicus* for the reader to interpret. First, we offer an update to the estimate from Morrison *et al.* (2006) using a more recent estimate for the Eastern Pacific population during the boreal winter from Andres *et*

al. (2009). Based on the assumption that the western and eastern breeding populations maintain separate migratory pathways and are segregated by coastline during the boreal winter, we can combine the estimate of 33,150 for the Eastern Pacific boreal winter population from Andres *et al.* (2009) with the minimum estimate of 40,000 for the Atlantic Coast during migration (Morrison *et al.* 2006, B. Watts and B. Truitt, unpubl. data) for a total of 73,150.

Second, we present a summary of the most recent published or reported estimates for the species throughout its range during only the boreal winter for an alternative estimate of 55,530 (Table 1). These data represent estimates of the population from surveys during the boreal winter when large-scale movements by birds are limited and the complications of teasing out the western and eastern populations' relationship, and how they mix during migration and post-breeding, are reduced. All estimates presented here fall within the 25,000–100,000 range published by Rose and Scott (1997).

Table 1. Summary of existing population estimates, by country and/or region, for the Whimbrel (*N. p. hudsonicus*) during the boreal winter in the Western Hemisphere.

Region	Estimate
Eastern Pacific	
USA ¹	710
Mexico ¹	2,820
Guatemala through Costa Rica ¹	1,870
Panama ²	1,490
Colombia ³	7,390
Ecuador and Peru ¹	1,490
Chile ¹	21,450
Western Atlantic/Gulf of Mexico	
USA ⁴	<500
Mexico ⁵	60
Panama ²	90
Western Atlantic	
Columbia through Guyana ⁶	490
Suriname ⁷	5,500
French Guiana ⁶	460
Brazil ⁶	11,070
Uruguay and Chile ⁶	140
TOTAL	55,530

¹ Andres *et al.* 2009 and references therein, Morrison and Ross 1989

² Morrison *et al.* 1998

³ Johnston-González *et al.* 2009

⁴ Dodd and Spinks 2001, Sprandel *et al.* 2000, NAS 2002

⁵ Morrison and Ross 2008

⁶ Morrison and Ross 1989

⁷ Scott and Carbonell 1986

Observations from the early 20th century suggest that hundreds of thousands of Whimbrels passed through South Carolina on the Atlantic coast of the United States during the second week in May (Bent 1929). Compared to recent estimates along the southeast coast of the United States, this suggests that Whimbrel numbers at least on the Atlantic coast of the Western Hemisphere have decreased tremendously. However, little is known about more recent, overall population trends for *N. p. hudsonicus*, and most existing information is based only on the eastern population. The 2004 update to the U.S. Shorebird Conservation Plan (USSCP) lists the species in “apparent population decline” (USSCP 2004). The initial conservation assessment presented in 2001 listed the species in “significant decline,” primarily based on data collected along the U.S. east coast during International Shorebird Survey (ISS) efforts between 1974 and 1983 (Howe *et al.* 1989, Brown *et al.* 2001). Analysis of that data by Howe *et al.* (1989) suggested a significant 8.3% annual decrease in the number of Whimbrels detected on the surveys. In contrast, a similar analysis of the Maritime Shorebird Surveys (MSS) in Canada between 1974 and 1998 suggested a 4.4% annual increase in Whimbrels detected along the maritime provinces of Canada (Morrison *et al.* 2001a). More recently, Bart *et al.* (2007) presented an updated analysis of the ISS and MSS fall migration survey data combined. The analysis detected a negative but not significant 2% trend in the number of Whimbrels along the maritime provinces of Canada and the eastern United States between 1974 and 1998 (Bart *et al.* 2007). It is important to note, however, that the significance of the decline reported by Howe *et al.* (1989) may be an anomaly due to small sample size (Skeel and Mallory 1996). The same caution must be used when interpreting the updated trend information presented by Bart *et al.* (2007).

Long-term, coordinated survey efforts within significant migratory staging and stopover areas, considered collectively, will most likely provide better insight into population trends for the species, particularly since Whimbrels seem to migrate within a narrow temporal window in the spring. For example, aerial surveys along the Virginia coast in spring 2008 documented a 50% decline in the peak number of Whimbrels detected compared to similar surveys conducted during the springs of 1994–1996 (B. Watts and B. Truitt, unpubl. data). In contrast, peak counts

of Whimbrels during aerial surveys of the Upper Bay of Panama during southbound migration were higher in 2008 compared to 1997 (Watts 1998, B. Watts, unpubl. data). Overall, our understanding of the actual population trend for the Whimbrel is limited. The need for coordinated surveys throughout the species's range in order to better assess population status and trends is discussed in subsequent sections of this plan.

DISTRIBUTION AND ABUNDANCE

A range map of Whimbrel distribution within the Western Hemisphere depicts the general occurrence of the species year-round (Figure 1). Details of Whimbrel distribution and abundance are provided in the following sections of this plan, with the exception of vagrant records.

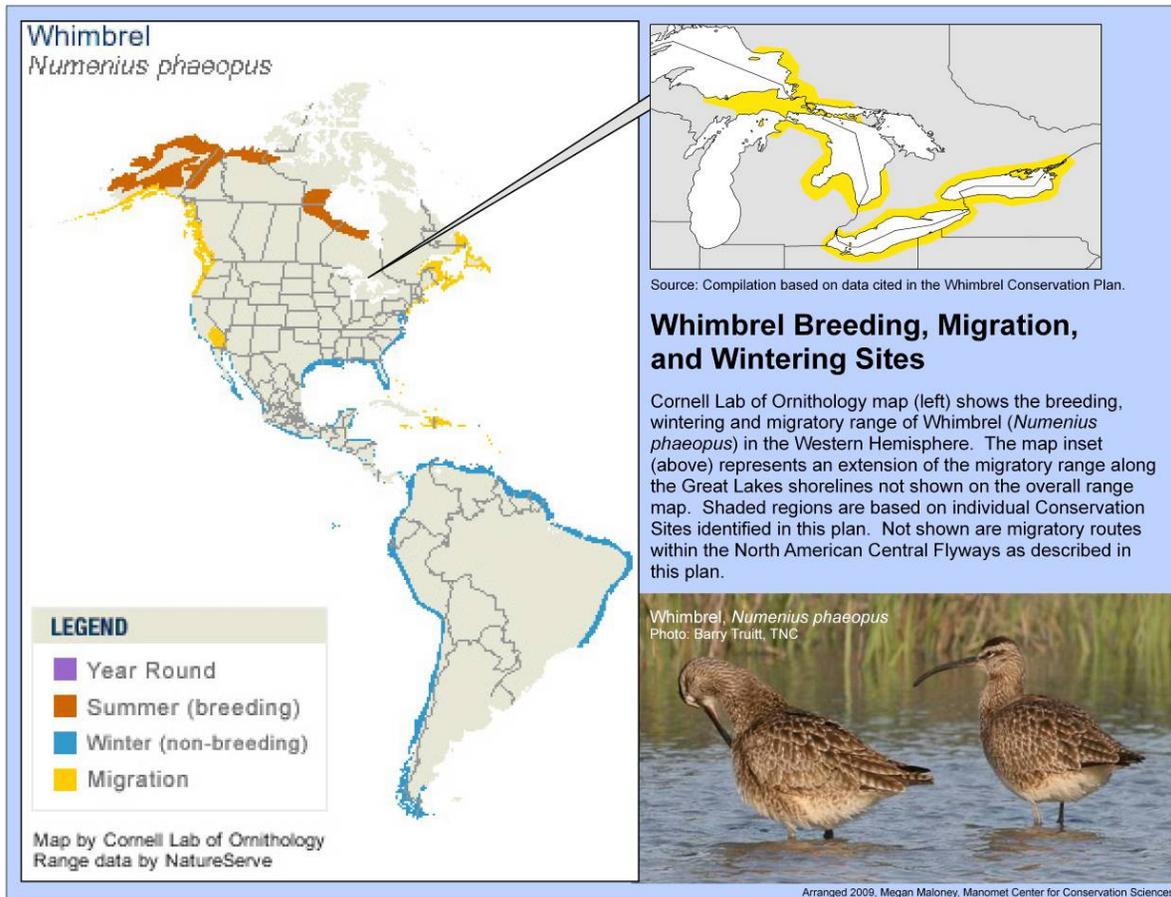


Figure 1. Map of Whimbrel (*Numenius phaeopus hudsonicus*) distribution within the Western Hemisphere. (Image arranged by Megan Maloney, Manomet Center for Conservation Sciences)

Breeding Season: Breeders

The Whimbrel breeds in arctic, sub-arctic, and boreal regions around the globe (Skeel and Mallory 1996). *N. p. hudsonicus* is thought to have two disjunct breeding populations. The western population breeds from northern Alaska east through the northern Yukon to the northwest portion of the district of Mackenzie in the Northwest Territories of Canada and south to western and central Alaska and the southwestern portions of the Yukon in Canada (Godfrey 1986, Skeel and Mallory 1996, AOU 1998, Sinclair *et al.* 2003). The eastern population is confined to Canada and breeds west of Hudson Bay in Manitoba from southern Keewatin south to the northwestern coastline of James Bay, Ontario (Skeel and Mallory 1996, AOU 1998).

Overall, detailed information on breeding distribution and abundance within these broader boundaries is lacking because of widely dispersed breeding pairs, inaccessibility of habitats, and difficulty of detection—issues common to all arctic and sub-arctic breeding shorebird surveys (Johnson *et al.* 2007b). However, even though detailed information on numbers and locations of breeding pairs is not available over a broad geographic scale, several recent research and monitoring efforts highlight important breeding areas on a more local scale. These areas are important for establishing benchmark information with which future survey results may be compared. Some of these areas are described below:

Canada: Hudson Bay/Churchill, Manitoba — The region surrounding Churchill, Manitoba, along the western coast of Hudson Bay, offers relatively easy access to 15 species of breeding shorebirds and has played an important role in advancing our knowledge of the breeding biology and population status of many of them (Jehl and Lin 2001). Breeding Whimbrels are found evenly distributed across the Hudson Bay coastal tundra areas, with fewer found to the east along the northern part of the James Bay coastline (Ross *et al.* 2003). The Whimbrel is considered a relatively common breeding bird in Churchill (E. Nol, pers. comm.), and Jehl (2004) describes how the region was noted as a “hot spot” for the Whimbrel in the 1930s through the 1960s. Several studies of Whimbrel breeding ecology have been conducted in the region since the late 1970s and have provided local abundance and/or density estimates. Skeel (1983) documented density values ranging from 0.028– 0.11 pairs per hectare, with higher densities in hummock taiga habitat compared to sedge tundra and heath tundra habitats. More recently, Jehl and Lin (2001) estimated 105–110 pairs in the immediate Churchill area in 1997.

Ballantyne (2009) documented up to 49 breeding pairs in 2007 and 2008 in the Churchill region with surveys that covered approximately 78 and 58 km² in each year, respectively, and documented densities ranging from zero to 3 pairs/km² (Ballantyne 2009). Although these numbers and those from additional studies are not directly comparable because of differences in the geographic scopes of the studies, Jehl and Lin (2001) suggest a probable decrease from ‘abundant’ to ‘common’ in the region since the 1930s. In addition, a recent study documented a change in distribution with lower use of hummock-bogs near the treeline, and seemingly greater use of fen, sedge-meadow, and lichen-heath tundra habitats closer to the coast (Ballantyne 2009, E. Nol, pers. comm.).

Canada: Ontario Breeding Bird Atlas — Evidence of breeding Whimbrels was documented along the Hudson Bay coastline between the Pen Islands and Cape Henrietta Maria in most 100-kilometer survey blocks covered for the second edition of the Ontario Breeding Bird Atlas (Cadman *et al.* 2007). Records were mostly restricted to within 40 kilometers of the coastline, but it is noted that Whimbrels do breed further inland in lower densities (Cadman *et al.* 2007). Evidence of breeding Whimbrels was also documented on Akimiski Island; those records extend the southern breeding limit for the species by 250 kilometers (Cadman *et al.* 2007). The distribution documented during the second edition of the atlas is noted as having changed little since Whimbrels were first documented breeding in the province.

Canada: Mackenzie River Delta, Northwest Territories — Whimbrels have been documented breeding throughout the Mackenzie River Delta within the Arctic Coastal Plain in northwest Canada (*e.g.* Dickson *et al.* 1989, Gratto-Trevor 1994, Canadian Wildlife Service, unpubl. data). The region is characterized by a mosaic of low-lying alluvial islands dominated by wetlands with relatively saturated soils, as well as areas of dry upland habitat (Pirie 2008). Since the 1980s, several studies have focused on Whimbrels breeding in this region with a particular focus on the Kendall Island Bird Sanctuary (L. Pirie, pers. comm.). Two sites of importance are highlighted within the sanctuary—Taglu Island and Fish Island—as well as the Storm Hills/Parsons Lake region outside of the sanctuary and further inland. Most recently, research conducted by the Canadian Wildlife Service (CWS) has investigated and described the distribution and abundance of nesting Whimbrels throughout the delta—an area encompassing over 1.5 million hectares (Pirie and Johnston in prep.). Density estimates for breeding Whimbrels

obtained through aerial surveys throughout the delta were 0.24 ± 0.10 and 1.09 ± 0.30 birds/km², respectively, for two separate areas defined as the Outer and Middle deltas; these estimates were extrapolated to yield population estimates of $789 \pm 1,070$ and $5,054 \pm 4,562$ Whimbrel for the same areas (Pirie and Johnston in prep.). Breeding density on Taglu and Fish Islands in 2008 were reported as 4.17 and 2.85 pairs/ km², respectively (Pirie and Johnston in prep.). Pirie and Johnston (in prep.) provide further details on density and population estimates for the Mackenzie River Delta including a comparison of results from aerial survey techniques and standard Program for Regional and International Shorebird Monitoring (PRISM) techniques.

USA: Alaska–Arctic Coastal Plain — Johnson *et al.* (2007b) conducted ground surveys at 625 sites in the Arctic Coastal Plain of Alaska between 1998 and 2004. The Whimbrel was characterized as a rare to uncommon breeder with a disjunct distribution in the proximity of major rivers as well as in the Brooks Range foothills region, primarily within the National Petroleum Reserve–Alaska boundaries (Johnson *et al.* 2007b). The authors concluded that the distribution of breeding Whimbrels in the study area was “much more restricted” than what is described by Skeel and Mallory (1996). Brown *et al.* (2007) estimated 4,598 Whimbrels within the upland-dominated portion of the Arctic National Wildlife Refuge. This estimate, however, was based on only 4 individuals detected during rapid surveys and has a 95% confidence interval of 0–11,862 (Brown *et al.* 2007).

USA: Alaska–National Park Service Inventory and Monitoring Program — The National Park Service’s Inventory and Monitoring Program within Alaska, launched in 1998, has resulted in several recent advances in our knowledge of the distribution of breeding shorebirds within the Arctic and Southwest Networks of National Parks in Alaska (http://alaska.usgs.gov/science/biology/shorebirds/inventory_nesting.html). The Whimbrel was identified as one of the most numerous shorebird species detected during 2001–2003 surveys in the Arctic Network of National Parks (not including the Bering Land Bridge National Preserve, one of the five parks that make up the network) (Tibbitts *et al.* 2005). Whimbrels were characterized as having a widespread occurrence at Cape Krusenstern National Monument and Noatak National Preserve, with lower relative abundance at Gates of the Arctic National Park and no detections from Kobuk Valley National Park (Tibbitts *et al.* 2005). Overall, 286 Whimbrels were detected within 42% of the plots surveyed. Tibbitts *et al.* (2005) also

summarized earlier surveys conducted in Bering Land Bridge National Preserve that documented Whimbrels at all seven point-count locations between 1988 and 1989.

Fewer Whimbrels were detected within the Southwest Network, including Katmai and Lake Clark National Parks; the species was characterized as a common breeder in Katmai and uncommon in Lake Clark (Ruthrauff *et al.* 2007). Ruthrauff *et al.* (2007) notes Kukaklek Lake in Katmai National Park as an important area with most of the Whimbrel detections in the park occurring here. The only location in Lake Clark National Park where Whimbrels were detected was the Twin / Turquoise / Telaquana Lake Highlands (Ruthrauff *et al.* 2007). Maps and the full reports referenced here can be found at <http://science.nature.nps.gov/im/units/akro/index.cfm>.

Additional studies — McCaffery (1996) studied breeding Whimbrels within the Yukon Delta National Wildlife Refuge between 1987 and 1991. The mean number of breeding pairs within a 5 km² area at Curlew Lake between 1988 and 1991 was five (McCaffery 1996). Breeding Whimbrels occupy dozens to hundreds of square kilometers of similar breeding habitat adjacent to the area studied, and reported density estimates may be representative of the larger area, although this supposition has not been confirmed (B. McCaffery, pers. comm.).

A local population of breeding Whimbrels was discovered in 2008 in the boreal forest ecosystem of Kanuti National Wildlife Refuge, in the northern interior of Alaska (Harwood 2008). Whimbrel were detected at 20 point-count locations within a 5 km² area of tundra south-southeast of Kanuti Lake, with 10–11 pairs total suspected (Harwood 2008). Nineteen nests were found during the 2009 breeding season in the same general area (C. Harwood, pers. comm.).

Breeding Season: Nonbreeders

Nonbreeding birds spend the boreal summer in small numbers throughout the species's boreal winter range (see below), particularly along the Atlantic and Gulf coasts of the United States from North Carolina south; on the Pacific coast of the United States; the Pacific coast of South America; the Caribbean coast of the West Indies (AOU 1998, Skeel and Mallory 1996, Janzen 2003, Buchanan 2005); and more rarely, on the southwest coast of British Columbia (Butler and Campbell 1987, Campbell *et al.* 1990). For example, counts during the boreal summer at Chiloé Island, Chile, between 2000 and 2004 ranged from 70 to 900 individuals (L. Espinoza, pers. comm.). An aerial survey of the upper Bay of Panama on 15 August 1997

recorded more than 2,500 individuals that were assumed to be “oversummering” birds (Watts 1998).

Nonbreeding Season

During the boreal winter (nonbreeding season), Whimbrels occur throughout the coastal regions of Mexico and Central and South America, with smaller numbers along the Pacific, Atlantic, and Gulf of Mexico coasts of the United States (Skeel and Mallory 1996, AOU 1998). Several important wintering sites have been identified in South America that support large proportions of the estimated total population in the Western Hemisphere. Whimbrels are also found at several other smaller concentration areas, particularly along the Pacific coast of South America. Here, we summarize the nonbreeding distribution of the Whimbrel, with more detailed abundance information presented in subsequent sections of the plan.

On the Atlantic Coast, Whimbrel are found primarily along the north coast of South America during the nonbreeding season. They are common from Colombia to Brazil, including Dutch Antilles and Trinidad and Tobago, with main concentration areas identified on the coast of Suriname and the northwest coast of the State of Maranhão in northern Brazil (Morrison and Ross 1989, Andres *et al.* 2009). Very few birds occur along the eastern coast of Brazil south to Argentina and Chile (Table 1) (Morrison and Ross 1989). The species’s distribution along the Atlantic and Gulf coasts of the United States, Mexico, and Central America is sporadic with low numbers (Table 1) (Skeel and Mallory 1996). Combined Christmas Bird Count data from the U.S. Gulf Coast states (Texas, Louisiana, Mississippi, and Florida) and Georgia have been below 200 since the late 1950s, with the exception of two years (1965/66 and 1994/95) when counts from Texas totaled 3,124 and 1,154 birds, respectively (NAS 2002). Whimbrels are regular visitors in Jamaica and Bermuda (BirdLife International 2008), as well as in the Malvinas and Falkland Islands (BirdLife International 2009).

On the Pacific Coast, the distribution of Whimbrel during the boreal winter extends along almost the entire length of the coastlines of Mexico and Central and South America. Chiloé Island, off the coast of southern Chile, is the main concentration area for the species on this coast (Morrison and Ross 1989, Andres *et al.* 2009), with significant numbers also found on the Pacific coast of Colombia (Johnston-González *et al.* 2009). The species is rare to casual during the boreal winter on the Pacific coast of Canada and the United States, as far north as the

southwest coast of British Columbia and within the Fraser River Delta (Butler and Campbell 1987, Cadman *et al.* 1990); it is a regular winter resident in very small numbers as far north as Washington and Oregon (Janzen 2003, Buchanan 2005). More substantial numbers occur along the southern coast of California (Paulson 1993, Skeel and Mallory 1996).

MIGRATION

Skeel and Mallory (1996) provide a thorough overview of what was known about the timing and routes of Whimbrel migration in the Western Hemisphere when the Birds of North America account was written. Much of this section has been excerpted from that account and supplemented with new and updated information where appropriate. Excerpted material taken directly from Skeel and Mallory (1996) is in quotations; words originally abbreviated are spelled out.

Northbound: Western Population

“Birds from west coast of South America migrate along Pacific Coast; some take transoceanic route from about Ecuador, bypass Central America, and rejoin coastal route in Mexico or California (Schneider and Mallory 1982, Morrison and Myers 1987); others may cross isthmus of Panama and Caribbean to southeast United States (Taverner 1942). Migrants pass through Peru in March and April (Johnson 1972); influx occurs along Central American coast mid-March to early May (Stiles and Skutch 1989), sometimes as early as February (Delgado and Butler 1993).”

“Transient along coast of California in March, April, and early May; large flocks in interior California in late April; in coastal northwest United States and southern British Columbia, numbers build in mid-April, peak in mid-May (Campbell *et al.* 1990, Harrington and Page 1992, Paulson 1993, Lehman 1994).” Between 6,000 and 9,000 individuals were documented during spring surveys of the Central Valley of California, with numbers concentrated in the Tulare Basin in April (Shuford *et al.* 1998). The mean abundance of Whimbrels documented along 40 beaches, totaling approximately 45 kilometers, in Humboldt County, California, between January and April 1996 did not exceed 1.6 birds (Colwell and Sundeen 2000). Low numbers of Whimbrels observed migrating along the coastal strand of California during spring migration may partially be a result of inadequate surveys and survey

techniques, since Whimbrels may be migrating just off shore and may not be captured in shorebird surveys of important coastal wetland sites (L. Stenzel, pers. comm.). In Washington, Whimbrels are found in lowland fields and agricultural areas generally near marine waters. They are conspicuous but numerically uncommon at Grays Harbor and Willapa Bay (Herman and Bulger 1981, Paulson 1993, Buchanan 2005). “From there [Pacific northwest], birds fly directly to Gulf of Alaska, especially Cook Inlet, where they are common in mid-May; however, scattered observations along intervening coast (Gibson 1970, Campbell *et al.* 1990, West 1993).” Annual totals observed on the Yakutat Forelands in southeastern Alaska were 119–441 in 1996 and 1997, respectively (Andres and Browne 1998). “[They] presumably fly over mountains to northern Alaska and Mackenzie River Delta (Kessel and Cade 1958, Irving 1960). A few records in interior British Columbia and southwestern Northwest Territories suggest small inland migration.”

Northbound: Eastern Population

“Route of birds from southeastern coast of South America unknown. Likely fly across interior following major north-south rivers; not recorded in coastal Brazil from Salvador north to Parnaíba River. Interior route documented for other shorebird species (Antas 1983). Tierra del Fuego birds likely join Pacific Coast migrants (Sick 1993). Large wintering population from north coast of South America (peaking November–January), and migrants from farther south, fly over Caribbean (but regularly a few records for Bermuda and West Indies) to coastal southeastern United States; common there from March to mid-May (Harrington and Page 1992). Birds from eastern Central America follow coast or cross Caribbean to United States.”

“Stage along Gulf and Atlantic Coasts north to New Jersey; regularly a few farther north (Harrington and Page 1992). Numbers build from March to early April in the southern United States, and mid-April to mid-May from the Carolinas north.” Whimbrels along Georgia’s coast arrive at the end of March, and most birds depart the area by 22 May (B. Winn, pers. comm.). In South Carolina, Whimbrel numbers peak between late April and early May (Dodd and Spinks 2001). Migrants in coastal North Carolina arrive in April and peak in May with very few remaining in June (Dinsmore *et al.* 1998). Peak numbers in Virginia occur in early May with most Whimbrels leaving the area during the third week in May (Watts and Truitt, unpubl. data). “No evidence of migration through interior from Gulf or southern Atlantic states. From mid-

Atlantic states, birds fly to eastern Arctic via Great Lakes; in late May many seen on northern coasts of Lakes Erie and Ontario, and at James Bay (Bull 1974, Speirs 1985).” Large numbers of Whimbrels are noted passing over and/or roosting along the shorelines of Lakes Ontario, Michigan, Erie, and Huron on or about 24 May, with peak arrival dates varying only by 4 days from observations between 1976 and 2005 (W. Renaud, pers. comm.).

Recent efforts to satellite-tag migrating Whimbrels in coastal Virginia have documented the routes used by birds leaving the mid-Atlantic coast of the United States. Five Whimbrels satellite-tagged in coastal Virginia during northbound migration in 2009 all flew to the James Bay and Hudson Bay coastal regions (CCB and TNC, unpubl. data). Two of the five birds did not pass over the Great Lakes region and instead flew further east, likely driven by storms, before arriving on the eastern shorelines of Hudson and James Bay, then moving to the western shoreline of James Bay (CCB and TNC, unpubl. data). Another bird tagged in spring 2008 flew over the Great Lakes and continued across the continent until reaching the Mackenzie River Delta in Canada and subsequently moving to presumed breeding grounds in northern Alaska (Watts *et al.* 2008). Additionally, one of the five birds tagged in 2009 continued to travel northwest across the continent similar to the migration route described by Watts *et al.* (2008). All five birds are still being tracked as this plan is finalized.

Although Skeel and Mallory (1996) suggest that there is no evidence of interior migration by Whimbrels from the Gulf Coast, survey numbers during spring migration suggest that at least a small number of birds may use interior flyways. Surveys of Whimbrels flying into roosts at Anahuac National Wildlife Refuge, Texas, documented 735–3,070 individuals between 15 April and 2 May during 2005–2008 (M. Whitbeck, pers. comm.). Additionally, Norling *et al.* (unpubl. data) documented a total of 785 Whimbrel using rice-field habitats in coastal Texas and Louisiana during spring migration, with the assumption that these birds were continuing their northbound migration via interior flyways. Finally, Skagen *et al.* (1999) classified the Whimbrel as a “widespread, intermediate distance migrant” within midcontinental North America and summarized counts of between 32 and 160 individuals at sites north of 35 degrees latitude.

Southbound: Western Population

“Birds in western Arctic stage from mid-July to late August (nonbreeders from late June) in coastal Alaska from Kotzebue Sound to Alaska Peninsula (Handel and Dau 1988); some on

Bering Sea Island and Kenai Peninsula (West 1993). Flocks up to 1,000 birds forage on mudflats of Alaska Peninsula (Gill and Handel 1981).” Peak numbers of birds occur at Naknek, Bristol Bay, from late-June to early August with mean maximum annual counts of 600 birds (during 2003–2008) and a maximum daily count of 1,100 birds between 23–30 July 2008 (J. Johnson pers. comm., J. Johnson and R. Russell, unpubl. data). “Birds then cross Pacific to coastal British Columbia and northwest United States (R. Gill pers. comm.); peak late June to mid-August, but extend into October (Paulson 1993).” Fall counts of Whimbrels along the coasts of Oregon and Washington tend to be smaller and more consistently found in coastal areas as opposed to more inland agricultural areas used during spring migration (Paulson 1993, J. Buchanan, pers. comm.). “Migrants pass through southern California in July and August (Lehman 1994); appear on Pacific coast of Costa Rica in August and September (Stiles and Skutch 1989), in southwestern Peru from September to November (Johnson 1972).” Unlike during spring migration, very few Whimbrels were documented within the Central Valley of California during fall migration (Shuford *et al.* 1998).

Southbound: Eastern Population

“Birds leave eastern Arctic crossing Ungava Peninsula or northeastern Manitoba from early July to August (Todd 1963, MAS); peak at Churchill, Manitoba (MB), in last two weeks of August, after which rare (Jehl and Smith 1970). Various routes from Ungava and James Bay to Atlantic Coast.” First arrivals on Akimiski Island, Nunuvut, around 26 July with a peak on 10 August and none left after 25 August (L. Pollock, pers. comm.). “Abundant in coastal Labrador, Newfoundland, and Gulf of St. Lawrence from early July through August (Peters and Burleigh 1951, Morrison *et al.* 1994a); less common in other maritime areas and New England from mid-July through September (Morrison 1984, Harrington and Page 1992).” Considered common in the Bay of Fundy region in the fall (Hicklin 1987). “Occasionally sighted in Great Lakes from mid-July to mid-October (Bull 1974, Speirs 1985).”

“From coastal Canada and New England, many birds fly directly over Atlantic to Caribbean and South America (Morrison 1984).” One bird satellite-tagged in coastal Virginia in fall 2008 flew over the Atlantic to the Bahamas before continuing on to Guyana (CCB and TNC, unpubl. data). “Regular in Bermuda primarily from mid-August through late September (Amos 1991). Some move south along eastern U.S. coast and U.S. Gulf coast: through mid-Atlantic

states from mid-July to mid-August; in the Carolinas from mid-July to mid-September; in Georgia, Florida, and Alabama from mid-July to mid-October; and in Louisiana and Texas from mid-September to mid-October (Harrington and Page 1992).” Fall migrants in North Carolina arrive in July, their abundance peaks in July and August, and nearly all leave the area by September (Dinsmore *et al.* 1998). “Birds wintering farther south fly over Caribbean or along Gulf Coast, arriving in Central and South America in August and September (Stiles and Skutch 1989, Rodrigues 1993); occasionally seen in Bahamas, Trinidad, and Tobago in September and October (Herklots 1961, Brudenell-Bruce 1975). Route to southeastern coastal areas of South America unknown; from Salvador Bay, Brazil, appear to take overland shortcut (Antas 1983).”

MAJOR HABITATS

Breeding Range

The Whimbrel’s nesting habitat encompasses a variety of open wetland and upland habitats throughout the sub-arctic and alpine tundra and taiga (Skeel and Mallory 1996). Skeel (1976, 1983) described occupied habitat around Churchill, Manitoba, as variable with nests found predominantly in hummocky taiga bogs, as well as in wet, flat sedge tundra and upland dry flat heath tundra. Recent study has documented a change in nesting distribution in the same area, with much lower use of hummock-bogs near functional tree lines, and seemingly greater use of fen, sedge-meadow, and lichen-heath tundra habitats (Ballantyne 2009).

General descriptions of Whimbrel nesting habitat in the Yukon Territory of Canada include: dry knolls in tundra, “tussock tundra, tussock-heath tundra, semi-moist tundra, dry upland tundra, dry sedge tundra, and moss mounds in low-centered polygons with wet centers” (Sinclair *et al.* 2003). Several studies have described Whimbrel breeding habitat in the Mackenzie River Delta, Northwest Territories, Canada. Habitats used include wet-sedge low-centered polygon habitat; wet tussock upland tundra habitats; wet sedge tundra; dwarf shrub-heath; high-centered polygon upland habitats; and willow-sedge (see summaries in Skeel and Mallory 1996, Pirie 2008). Recent studies within the Mackenzie River Delta (Taglu and Fish Islands) found Whimbrels nesting almost exclusively in wet-sedge low-centered polygon habitat, with smaller numbers in dry upland tundra habitats (Pirie 2008).

Throughout Alaska, nesting Whimbrels are described as using “tundra meadows including dwarf shrub meadows, salt grass meadows, wet meadows, and grass fields” (Alaska

Shorebird Plan 2008). In western Alaska, Whimbrels use moist, flat, dwarf-shrub tundra, and dry dwarf-shrub ridges with steep slopes (Skeel and Mallory 1996), all characterized by abundant berry-producing shrubs; in some areas of western Alaska, they are particularly common in meadows dominated by tussock-forming cottongrass (*Eriophorum*). Surveys across the Arctic Coastal Plain of Alaska found Whimbrels nesting predominantly in upland habitats (Brown *et al.* 2007, Johnson *et al.* 2007b). Throughout the Arctic Network of National Parks, nesting Whimbrels are affiliated with low-elevation habitats (less than 550 meters) and associated with herbaceous-tussock habitat (Tibbitts *et al.* 2005). In Katmai and Lake Clark National Parks, nesting Whimbrels are found in low elevation regions (100–350 meters) and are associated with dwarf shrub and herbaceous habitats (Ruthrauff *et al.* 2007).

Migration

Whimbrels are known to use a wide variety of coastal and terrestrial habitats during both north- and southbound migrations (Skeel and Mallory 1996). The species is often referred to as a primarily coastal migrant, however its varied habitat use also includes agricultural wetlands, berry-rich upland habitats, pastures, meadows, and fields adjacent to coastal migration routes or staging sites (Bent 1929, Skeel and Mallory 1996, B. McCaffery, pers. comm.). Watts (1998) noted the broad range of habitats used by the Whimbrel in the Upper Bay of Panama during southbound migration compared to other shorebird species. Those habitats included intertidal zones, grass patches, and wetland habitats, as well as the roost sites within the mangroves lining the bay shorelines (Watts 1998).

The Whimbrel's varied habitat use is seen with north- and southbound birds along the Pacific Coast. In Alaska, southbound post-breeding Whimbrels use vast areas of coastal tundra and mudflats as staging areas (Handel and Dau 1988, J. Johnson pers. comm.). The berry-rich upland region between the Johnson and Kuskowkim Rivers regularly supports small post-breeding flocks as well (B. McCaffery, pers. comm.). In California, shallow-water habitats in the Central Valley appear to provide habitat for the largest numbers of Whimbrels during northbound migration. The highest concentrations are in agricultural fields, with smaller numbers in managed wetlands, agricultural evaporation ponds, sewage ponds, and other wetland habitats (Shuford *et al.* 1988). Smaller numbers are documented along the sandy beaches and embayments of California's coastline (Neuman *et al.* 2008), and may occur more regularly in

these habitats than has been documented with formal surveys (L. Stenzel, pers. comm.). In Oregon and Washington during both migration periods, Whimbrels are most commonly found within coastal estuarine mudflats and sandy ocean beaches, with smaller numbers also occurring on rocky beaches, pastures, and inland fields or mudflats (Paulson 1993, Janzen 2003).

Along the Atlantic Coast, Whimbrels also use a variety of habitats. In the United States, migrating Whimbrels use habitats such as intertidal sand- and mudflats, salt pans, tidal creeks and marsh edges, barrier beaches, sand spits, sandbars and other outer beach habitats, and oyster shell mounds (Winn *et al.*, unpubl. data, B. Watts and B. Truitt, unpubl. data, S. Cameron, pers. comm., Dodds and Spinks 2001). In Canada, southbound migrants seem to use the “berry-laden barrens” in the Gulf of St. Lawrence after departing their breeding grounds (Bent 1929).

Along the Gulf Coast of the United States and within midcontinental North America, northbound Whimbrel have been generally characterized as using bare to sparsely vegetated substrates with water depths less than 12 centimeters (Skagen *et al.* 1999). A more detailed study of shorebird habitat along the Gulf Coast documented that the extensive rice prairies just inland from the Gulf of Mexico coasts of Texas and Louisiana support northbound Whimbrels for foraging (Norling *et al.* unpubl. data) with birds possibly moving closer to the coastal marshes to seek out roosting areas (M. Whitbeck, pers. comm.).

Nonbreeding Range

Whimbrel occur in a wide variety of coastal habitats throughout their range during the boreal winter. Their tendency to shift to more terrestrial habitats, such as meadows and fields, for roosting or foraging during periods of high tide (when intertidal areas are submerged) expands the range of potential occupied habitat. In the Upper Bay of Panama they are found in areas with extensive intertidal mudflats bordered by mangrove forests or rocky/sand beaches (Mallory 1981). Habitat use here during the boreal winter likely encompasses the broad range of habitats noted by Watts (1998) for Whimbrels during the southbound migration period. Along the northern Atlantic coasts of Brazil and Suriname, as well as the Pacific coast of Colombia, Whimbrels are associated with extensive intertidal flats and mangroves, particularly areas with hard mud banks (Morrison and Ross 1989). Along the Pacific coast of South America, they are mostly associated with marsh deltas or wetlands, as well as ocean beaches (Morrison and Ross 1989). In the Chiloé Island region on the southwestern coast of Chile, Whimbrels occur in all

coastal habitats including sandy, gravel, and rocky shorelines, as well as estuarine meadows (Andres *et al.* 2009). Over 50% of the Whimbrels documented during aerial flights of coastal Mexico were found along the beaches of open coastlines, 20% in coastal lagoons and estuaries, and less than 10% in coastal wetlands with mud and mangroves (Morrison and Ross 2008).

CONSERVATION SITES

The mission of the Western Hemisphere Shorebird Reserve Network is “...to conserve shorebirds and their habitats through a network of key sites across the Americas” (WHSRN 2009). The success of this mission depends on our collective ability to identify those key sites based on the best information available regarding shorebird distribution and abundance in all stages of their lifecycle. In previous sections of this plan, we have described several Whimbrel breeding sites of importance in the Western Hemisphere. The focus on those breeding sites, however, is primarily a result of their greater accessibility and/or previous or current research and monitoring activity. It is not based on information that suggests these sites are of higher importance to breeding Whimbrels relative to other sites across the arctic, sub-arctic, and boreal regions. Identification of these areas is important, however, for guiding future research and monitoring activities on the breeding grounds, and hopefully sets the stage for building a larger, more detailed database of Whimbrel distribution during the breeding season.

Here we attempt to identify sites of conservation importance for the Whimbrel throughout the Western Hemisphere with a focus on migratory staging or stopover sites (Table 2) and nonbreeding sites (boreal winter) (Table 3). In order to generate this list, we compiled survey data from the published literature, unpublished reports, and online databases; from shorebird experts throughout the Western Hemisphere; and from sites that meet WHSRN’s minimum criteria for designation (i.e., sites that support at least 1% of the biogeographic population of a species). We considered the most recent published population estimate of 66,000 for the Whimbrel in the Western Hemisphere when evaluating sites (Morrison *et al.* 2001b) and therefore included any site known to support at least 600 individuals during migration or during the boreal winter. Additionally, we included sites known to support approximately 0.5% (300 individuals) of the Whimbrel population in the Western Hemisphere as a conservative effort to account for the lack of information on turnover rates at important stopover and staging sites

(Fernandez *et al.* 2006, Senner 2007) and for the tendency for Whimbrels to be somewhat widely distributed in sometimes relatively small groups during migration.

In some cases, we have identified broad regions, areas, or wetland complexes, instead of specific sites, that are known to support significant numbers of Whimbrels. In addition, we have included sites for which we were unable to obtain specific survey data but that have been identified by shorebird experts as important to Whimbrels. We caution the reader to consider these variations in geographic scale and quality of information when interpreting numbers, and to consult listed references for more information or clarification when needed.

Finally and most importantly, we acknowledge that this list is by no means a comprehensive inventory of sites of importance for supporting Whimbrel populations throughout the annual cycle. Further, the omission of particular sites may be due to a lack of available data or simply our failure to include the data. We also recognized that the challenges of summarizing such a wide variety of information sources and databases inevitably result in inconsistencies in the format and scale of information presented. We have compiled a larger database that includes Whimbrel observations during the annual cycle, from one bird up to the 300-bird threshold considered here (database available upon request). Our hope is that, with continued expert input, this preliminary list of conservation sites as well as the larger database will be expanded and refined as more information becomes available for the key sites that support this species throughout the Western Hemisphere.

MIGRATION SITES

Northbound Migration

Pacific Coast: It is thought that many Whimbrels leave the Pacific coast of South America and bypass Central America entirely before joining the coast again during northbound migration (Skeel and Mallory 1996). Only three of the spring migration sites that met the threshold for inclusion in this preliminary list are located outside of Canada and the United States: Bahia Magdalena, Estero Río Colorado, and Bahía de Santa Maria—all along the Pacific coast of Mexico and designated as WHSRN Sites of Regional, International, and Hemispheric Importance, respectively. There are likely other important sites along the Pacific coast of Central America, and even the southwestern coast of Mexico.

North of the Pacific coast of Mexico, we have identified conservation sites along the coastlines of California, Oregon, Washington, and the southwestern coast of British Columbia, Canada. From the northernmost of these points, it is thought that Whimbrels fly nonstop to the Gulf of Alaska (Skeel and Mallory 1996). Along the coastal strand of California, only one site met the criteria for inclusion as an important conservation site—Monterey Bay. The importance of the coastal strand to migrating Whimbrels is noted in the South Pacific Shorebird Conservation Plan (Hickey *et al.* 2003), but detailed survey data for migrating shorebirds along this coastal region are lacking (L. Stenzel, pers. comm.). Other sites of conservation importance located along the outer coasts include Tillamook Bay, Oregon; Padilla Bay/Skagit Flats, Ocean Shores, and Grayland Beach, Washington; and Tofino, Canada.

Several interior wetlands and agricultural areas were identified as well. A larger proportion of Whimbrels appear to use these interior sites during spring migration when compared to fall migration (J. Buchanan, pers. comm.). For example, the Central Valley of California is known to support large numbers of migrating Whimbrels, with concentrations in the Tulare Basin as well as in the Sacramento Valley (Shuford *et al.* 1998). Moreover, Shuford *et al.* (1998) note that species that use both wetland and upland habitats (like the Whimbrel) were most likely underestimated during their spring surveys of the Central Valley between 1992 and 1994. Large flocks are seen during spring migration in areas like the Chehalis River Valley in Washington (Paulson 1993).

Atlantic Coast: Important conservation sites for northbound Whimbrel were identified along the U.S. Atlantic coast from Georgia north to New Jersey. Very little information on migrating Whimbrels is available from Florida. Lack of habitat most likely precludes large numbers from occurring along the State's Atlantic coast and survey data is lacking from the State's panhandle region. Historical accounts suggest that Whimbrel were rare during spring migration north of New Jersey (Bent 1929). Surveys in coastal New Jersey suggest that few Whimbrels occur there during spring migration (Clark *et al.* 1993). These results, however, may underestimate the number of Whimbrels along the New Jersey coast due to the surveys being limited to outer beaches. The less-surveyed but extensive marshes of coastal New Jersey likely support larger numbers of Whimbrels in the spring (B. Allen, pers. comm.); we have identified two sites of conservation importance in coastal New Jersey based on recent birding records

found online. Additional surveys of marsh habitat along the Atlantic Coast north through New Jersey are needed during spring migration.

Gulf Coast: The five specific conservation sites identified along the Gulf Coast represent a broad region of that coastline important for the Whimbrel during spring migration. While specific survey data are lacking outside of what is presented here, particularly for the outer coast, other areas in Texas are noted for their importance to the Whimbrel during spring migration: Bolivar Flats, Oso Bay Mudflats, Galveston, and Corpus Christi (Norling *et al.* unpubl. data).

Great Lakes: Six conservation sites were identified along the shorelines of four of the five Great Lakes. Large numbers of Whimbrels are known to pass over the Great Lakes region but the details of how these birds use the lake shorelines during their northbound migration are unknown. These few sites may be representative of many sites along the lake shorelines that the birds depend on during migration. Additional studies and surveys are needed in order to document how Whimbrels are using the lake shorelines and what the most important threats are to these sites.

Southbound Migration

Pacific Coast: Along the Pacific Coast, Whimbrels are thought to use essentially the same coastal migration route during the fall as in the spring (Taverner 1942). The pattern differs, however, in terms of the number of staging areas that are used in coastal Alaska, as well as the relative proportion of coastal versus more interior sites that are used along the Pacific coast of Washington, Oregon, and California. Several important staging areas are identified in coastal Alaska including Kvichak and Egegik Bays within Bristol Bay, Norton Sound, the Yukon-Kuskokwim River Delta, and Nelson Lagoon. Recent satellite telemetry data suggest that the Yukon-Kuskokwim River Delta represents a staging area for southbound Whimbrels from both the western and eastern breeding populations (Watts *et al.* 2008, B. McCaffery, pers. comm.). Current surveys for southbound migrants throughout the coastal tundra of Alaska are limited to sites within Bristol Bay, but these areas appear to support among the highest concentrations of Whimbrels within the State (J. Johnson, pers. comm.). Further south, there is overlap with important sites used by northbound and southbound Whimbrels along the coasts of Washington

and Oregon, although birds are noted to use coastal areas in higher numbers in the fall compared to interior river valley agricultural areas, like the Chehalis River Valley, in the spring (Paulson 1993, J. Buchanan, pers. comm.). Even further south, much of the Pacific coast of Panama stands out as supporting large numbers of Whimbrels during southbound migration (Watts *et al.*, unpubl. data). Most likely this area supports similar numbers of birds during spring migration, but survey data are lacking.

Atlantic Coast: Records of concentrations of Whimbrels during southbound migration along the James Bay coast (Canada) and at Monomoy Island, Massachusetts (USA), illustrate the slightly different migratory route that Whimbrels appear to take on their southbound route on the Atlantic Coast compared to their northbound route. Fewer conservation sites are identified along the Atlantic Coast during southbound versus northbound migration in part because survey efforts during the fall migration season have been less intensive. While some birds most likely fly directly to South America from points in New England and north, significant staging areas for Whimbrels bound for South America may be distributed along the Canadian and U.S. Atlantic coast from the Gulf of St. Lawrence (Taverner 1942) south through Georgia.

Gulf Coast: Even though no conservation sites were identified in the Gulf Coast region for southbound migration, migrants do move through it, some of which remain for the winter (Harrington and Page 1992). As on the Atlantic Coast, more intensive survey efforts along the Gulf Coast are needed to document areas of importance for migrating shorebirds.

NONBREEDING SITES

While nonbreeding Whimbrels during the boreal winter are somewhat restricted to a relatively small number of regions or sites, predominantly in South America, the distribution of significant concentrations of birds is somewhat more dispersed when compared to other medium- and large-bodied shorebirds. Based on the most recent published population estimate for the Whimbrel in the Western Hemisphere of 66,000 birds (Morrison *et al.* 2001b), we identified four broad regions and three specific sites that, collectively, support 66% of the population during the boreal winter. Each of these regions or sites is known to support over 1% of the biogeographic population (~600 individuals) of Whimbrels during the boreal winter. We caution the reader again that in this preliminary list of important conservation sites, the geographic scope of the

regions and sites varies dramatically and to consider this when interpreting this summary. Along the Atlantic coast of South America, regions and sites identified include the north-central coast of Brazil (approximately 300 linear miles) and five regions along the approximately 200-linear-mile coast of Suriname. On the Pacific Coast, Chiloé Island off the southwest coast of Chile, as well as the surrounding mainland (Gulf of Ancud and Gulf of Corcovado), together support 30% (over 20,000 individuals) of the estimated Western Hemisphere population of the Whimbrel (Andres *et al.* 2009). Of the twelve sites identified north of Chiloé Island to the Bay of Panama, three are known to meet the 1% threshold including Rio Lluta in Chile, Sanquianga National Park in Colombia, and the Bay of Panama.

Table 2. List of important **migratory stopover/staging sites or regions** for the Whimbrel in the Western Hemisphere, arranged alphabetically by country. Sites listed are known to support **at least 300 Whimbrels** during northbound or southbound migration (0.5% of the Western Hemisphere population). Numbers given represent individuals. Site Designation acronyms: WHSRN – Western Hemisphere Shorebird Reserve Network (H – Hemispheric, I – International, R – Regional); IBA – Important Bird Area; RAMSAR – Ramsar Wetland of International Importance; NWR – U.S. Fish and Wildlife Service National Wildlife Refuge; TNC – The Nature Conservancy; NAP – Natural Area Preserve.

Site Name	Country	State/Province	Latitude	Longitude	Site Designation	North Migration	South Migration	Boreal Winter	Source	Notes/Count Dates
Gulf of Maranhão	Brazil	Maranhão	-2.43	-44.05	WHSRN - H; RAMSAR	147	415	1,342	Rodrigues 2000	WHSRN Site Reentrancias Maranhenses
Cleland Island	Canada	British Columbia	49.17	-126.09	BCParks Ecological Reserve		750		Paulson 1993	23 July 1982
Tofino	Canada	British Columbia	49.10	-125.90		475; 700			Paulson 1993	13 May 1976; 28 April 1978
Hudson/James Bay	Canada	Ontario	54.86	-82.5696			large numbers		Ross <i>et al.</i> 2003	
Lagune du Havre aux Basques et plage de l'Ouest	Canada	Quebec	47.28	-61.95	IBA	200–999			Important Bird Areas of Canada	http://www.bsc-eoc.org/iba/site.jsp?siteID=QC003 ; No information on season.
Long Point Peninsula and Marshes	Canada	Ontario	42.58	-80.33	IBA	600			Important Bird Areas of Canada	http://www.bsc.eoc.org/iba/site.jsp?siteID=ON001
Rondeau, Lake Erie	Canada/United States	Ontario	42.27	-81.85	Provincial Park	300+			D. Ewert, pers. comm.	Representative site for northern coastline of Lake Erie
Presqui'île Provincial Park, Lake Ontario	Canada/United States	Ontario	43.98	-77.73	IBA	up to 1,000			Chesky 1999	Representative site for northern coastline of Lake Ontario
Nicoya peninsula	Costa Rica	Guanacaste, Puntarenas	9.90	-85.38	IBA	200–999			Birdlife International 2009a	No information on season
Nicoya Gulf mangroves and coastal areas	Costa Rica	Guanacaste, Puntarenas	10.07	-85.15	IBA	200–999			Birdlife International 2009b	No information on season
Estero Río Colorado	Mexico	Baja California/Sonora	31.70	-114.70	WHSRN - I	350	284	9; 25	Mellink <i>et al.</i> 1997, Morrison and Ross 2008	Migration - 1993/1994; Boreal winter - Jan 1992
Bahía Magdalena	Mexico	Baja California Sur	24.63	-111.96	WHSRN – R	392			WHSRN 2009, unpubl. Data	Monthly maximum number of individuals
Ensenada de la Paz	Mexico	Baja California Sur	24.1	-110.42	WHSRN - R		574		WHSRN database	July 1997
Bahía de Santa María	Mexico	Sinaloa	25.07	-108.17	WHSRN - H	1,000		300	Engilis <i>et al.</i> 1998	Migration - April 2003; Boreal winter - 1993/1994
Golfo de Chiriqui/BahiaMuerto	Panama	Chiriqui	8.26	-82.26			406		Watts <i>et al.</i> unpubl. data. 2008	October 2008

Site Name	Country	State/Province	Latitude	Longitude	Site Designation	North Migration	South Migration	Boreal Winter	Source	Notes/Count Dates
Bahia de Parita	Panama	Cocle/Herrera	8.14	-80.46			2,419		Watts <i>et al.</i> unpubl. data. 2008	October 2008
Golfo de San Miguel	Panama	Darien	8.32	-78.31			5,890		Watts <i>et al.</i> unpubl. data. 2008	October 2008
Bahía de Chame	Panama	Panama	8.64	-79.77			862		Watts <i>et al.</i> unpubl. data. 2008	October 2008
Upper Bay of Panama	Panama	Panama	9.01	-79.40	WHSRN - H; RAMSAR		6,300		Watts <i>et al.</i> unpubl. data. 2008	October 2008
Golfo de Montijo	Panama	Veraguas	7.77	-81.13	RAMSAR		816		Watts <i>et al.</i> unpubl. data. 2008	October 2008
Puerto Viejo	Peru	Lima	-12.32	-76.45	WHSRN – H; RAMSAR		322		Wetlands International 2008	17 July 2005
West Coast Mudflats	Trinidad & Tobago		10.48	-61.48	State Park	500–1,000			Birdlife International 2009c	No information on Season
Copper River Delta	United States	Alaska	60.38	-145.22	WHSRN - H; IBA	5,000	several thousand		P. Mickelson, unpubl. data 1990; Handel and Dau 1988	North - WHSRN database, 1990; South – Isleib and Kessel 1972
Kvichak and Bristol Bay, Naknek River	United States	Alaska	58.88	-157.06	WHSRN - R; IBA		900		Ruthrauff <i>et al.</i> unpubl. data.	18 July 2008
Egegik Bay, Bristol Bay - Big Creek	United States	Alaska	58.18	-157.48	IBA		350		Ruthrauff <i>et al.</i> unpubl. data.	20 July 2008
Yakutat Forelands	United States	Alaska	59.19	-138.83		119; 441			Andres and Browne 1998	1996/1997
Yukon-Kuskokwim River Delta	United States	Alaska	62.61	-164.87	WHSRN - H; IBA		few to several thousand		Handel and Dau 1988; Alaska Shorebird Working Group 2000	
Norton Sound, Seward Peninsula	United States	Alaska	64.50	-162.02	IBA		less than a few thousand		Alaska Shorebird Working Group 2000	
Nelson Lagoon	United States	Alaska	55.98	-161.29	IBA		4,000		Handel and Dau 1988	
Sacramento Valley	United States	California	39.41	-122.13	WHSRN - I; IBA	3,305			PRBO, unpubl. data 1994	WHSRN database, April 1994
Central Valley	United States	California	38.23	-121.34	WHSRN - I; IBA (Sacramento Valley/Grasslands)	9, 337	3–8	0	Shuford <i>et al.</i> 1998	1992–1994. Numbers concentrated in Tulare Basin.

Site Name	Country	State/Province	Latitude	Longitude	Site Designation	North Migration	South Migration	Boreal Winter	Source	Notes/Count Dates
Monterey Bay - sandy beaches	United States	California	36.78	-121.93		566		54	Neuman <i>et al.</i> 2008; PRBO, unpubl. data.	Migration – November 2002 - May 2003
Saint Catherine's Bar, Liberty County	United States	Georgia	31.70	-81.12	IBA	5,000			Winn <i>et al.</i> unpubl data	4 April – 28 May; 1991–1999
Ogeechee River Bar	United States	Georgia	31.84	-81.05		unk			B. Winn, pers. comm.	
Wolf Island Bar (Altamaha Delta)	United States	Georgia	31.31	-81.25	WHSRN - R; IBA	unk			B. Winn, pers. comm.	WHSRN site Altamaha River Delta
Monomoy National Wildlife Refuge	United States	Massachusetts	41.60	-69.99	WHSRN - R; IBA; NWR		360 – 858		Heil and Nikula 1999; Harrington and Nikula 1999; Bailey 1991, 1993, 1994, 1997; Harrington 1998, 1999, 2000	Multiple counts – July-August
Whitefish Point, Lake Superior	United States	Michigan	46.74	-84.97		300+			C. Putnam, pers. comm.	
St. Vital Point, Lake Michigan	United States	Michigan	45.96	-84.03		500+			D. Ewert, pers. comm..	
Tawas Point, Lake Huron	United States	Michigan	44.32	-83.36		300+			C. Putnam, pers. comm.	
Nummy Island	United States	New Jersey	39.04	-74.79		300			www.birdcapemay.org	26 April 2006
Edwin B. Forsythe National Wildlife Refuge	United States	New Jersey	39.47	-74.46	WHSRN – R; IBA; NWR	300			www.birdcapemay.org	13 May 2008
Outer Banks - North Core Banks to Bodie Island	United States	North Carolina	35.34	-75.50	National Seashore; IBA	474	250	0	Dinsmore <i>et al.</i> 1998	1992/1993
Elk River Meadows/Langlois	United States	Oregon	42.79	-124.52		>1,000; 2,150			Janzen 2003	18 May 1999; 11 May 2002
Tillamook Bay	United States	Oregon	45.51	-123.91		350			Paulson 1993	5 May 1989
Cape Romain Region	United States	South Carolina	33.02	-79.44	WHSRN - I; NWR; IBA	507	163	4	Dodd and Spinks 2001	1997/1998
Anahuac NWR	United States	Texas	29.57	-94.48	WHSRN - I; NWR	2,233 – 3,070			M. Whitbeck, pers. comm.	Mutiple counts - April–May 2005–2008
Chambers County	United States	Texas	29.70	-94.60		1,224	2		Skagen <i>et al.</i> 1999.	
Texas Mid-Coast NWR Complex	United States	Texas	29.08	-95.25	WHSRN - I; NWR	635			R. Speer 1993, unpubl. data	WHSRN database, April 1993
North of Winnie	United States	Texas	29.90	-94.40		300			Skagen <i>et al.</i> 1999.	

Site Name	Country	State/Province	Latitude	Longitude	Site Designation	North Migration	South Migration	Boreal Winter	Source	Notes/Count Dates
Rice Prairies	United States	Texas/Louisiana	28.56 to 29.92	-96.49 to -91.57		36,346 – 109,038			Norling <i>et al.</i> unpubl. data.	Range extrapolated using estimates for length of stay times
Virginia Barrier island/lagoon system	United States	Virginia	37.90	-75.35	WHSRN - I; TNC Preserve; NWR; VA NAP; IBA	1,430 – 3,175			Watts and Truitt, unpubl. data	Multiple counts - 1994, 1995, 1996, 2008
Padilla Bay/Skagit Flats	United States	Washington	48.46	-122.47		832; 750			Buchanan 2005	3 May 1994; 5 May 1990
Ocean Shores	United States	Washington	46.99	-124.17		350	600 480 300		North migration - Buchanan 2005; South migration - Paulson 1993; WOSNews 96 (2005)	North migration - 26 April 1998; South migration - July 1988, 1987, 2004
Tokeland/Willapa Bay	United States	Washington	46.71	-123.97	IBA	250	195 – 950		North - WOSNews 76 (2002); South - Buchanan 2005, WOSNews 72 (2001), 78, 79, 80 (2002), 90 (2004), 96 (2005), 102 (2006), 108 (2007)	South migration, multiple counts - July/August 2000–2006
Chehalis River Valley (near Elma/Satsop)	United States	Washington	46.99	-123.40		90 – 450			WOSNews 82 (2003), 95 (2005), 107 (2007), 113 (2008); Buchanan 2005	Multiple counts - April/May 1991–2007
Grayland Beach	United States	Washington	46.77	-124.10	State Park	300			WOSNews 107 (2007)	
Leadbetter Point	United States	Washington	46.63	-124.06	State Park; IBA		400		South migration - Paulson 1993; Summer - Widrig 1978	

Table 3. List of important **nonbreeding (boreal winter) sites or regions** for the Whimbrel in the Western Hemisphere, arranged alphabetically by country. Sites listed are known to support **at least 300 Whimbrels** during the nonbreeding season (0.5% of the Western Hemisphere population). Numbers given represent individuals. Site Designation acronyms: WHSRN – Western Hemisphere Shorebird Reserve Network (H – Hemispheric, I – International, R – Regional); RAMSAR – Ramsar Wetland of International Importance; IBA – Important Bird Area.

Site Name	Country	State/Province	Latitude	Longitude	Site Designation	North Migration	South Migration	Boreal Winter	Source	Notes/Count Dates
North-central Coast of Brazil	Brazil	Maranhão	-2.43	-44.05	WHSRN - H; RAMSAR			10,880	Morrison and Ross 1989	
Río Lluta (des)	Chile	I (Tarapacá)	-18.23	-69.45				1,216	Wetlands International 2008	
Bahía Guanaqueros	Chile	IV (Coquimbo)	-30.09	-71.25				542	Wetlands International 2008	
Estero Cartagena/Río Maipo	Chile	V (Valparaiso)	-33.32	-71.36				364–700	Wetlands International 2008	
Río Aconcagua (des)	Chile	V (Valparaiso)	-32.55	-71.32				631	Wetlands International 2008	
Chile - mainland Golfo de Ancud to Golfo Corcovado (mainland around Chiloé Island)	Chile	X (Los Lagos)	-42.80	-72.75				5,060	Morrison and Ross unpubl. data; Andres <i>et al.</i> 2009	2006
Estero Huildad – Yaldad – Quellón (Chiloé Island)	Chile	X (Los Lagos)	-43.09	-73.54				997	Morrison and Ross unpubl. data; Andres <i>et al.</i> 2009	
Castro – Isla Quinchao – Península de Rilán (Chiloé Island)	Chile	X (Los Lagos)	-42.47	-73.49				4,123	Morrison and Ross unpubl. data; Andres <i>et al.</i> 2009	
Bahía de Ancud (Chiloé Island)	Chile	X (Los Lagos)	-41.86	-73.85				1,965	Morrison and Ross unpubl. data; Andres <i>et al.</i> 2009	
Seno de Reloncaví – east (Chiloé Island)	Chile	X (Los Lagos)	-41.68	-72.87				2,529	Morrison and Ross unpubl. data; Andres <i>et al.</i> 2009	
Parque Nacional Natural Sanquianga	Colombia	Nariño	2.56	-78.27	IBA			7,393	Johnston-Gonzalez <i>et al.</i> 2009	
Bocana de Iscuandé	Colombia	Nariño	2.66	-78.05	IBA, WHSRN - R			310	Ruiz-Guerra unpubl. data	Counts in fall 2009
Golfo de Guayaquil	Ecuador	Guayas	-2.66	-80.23	IBA			470	Morrison and Ross 1989	
Ciénaga de La Segua	Ecuador	Manabí	-0.70	-80.18	IBA			1,195	Birdlife International 2009d	
Littoral	French Guiana	Cayenne, Iracoubo, Kourou,	5.53	-53.33				7,000–10,000	Birdlife International 2009e	

Site Name	Country	State/Province	Latitude	Longitude	Site Designation	North Migration	South Migration	Boreal Winter	Source	Notes/Count Dates
		Macouria-Tonate, Rémire-Montjoly, Sinnamar								
Plaine Kaw & Pointe Béhague	French Guiana	Régina, Roura	4.70	-52.03				200–999	Birdlife International 2009f	
Bahía de Santa María	Mexico	Sinaloa	25.07	-108.18	WHSRN - H	1,000		300	Engilis <i>et al.</i> 1998	Migration - April 2003; Boreal winter - 1993/1994
Bay of Panama	Panama	Panama	9.01	-79.38	WHSRN - H; RAMSAR			1,050	Morrison <i>et al.</i> 1998	1993
Chimán Wetlands	Panama	San Blas	8.63	-78.63				2,008	Birdlife International 2009g	
Humedales de la Ensenada de Garachiné	Panama	Darién	8.10	-78.28				656	Birdlife International 2009h	
Coppenamebank	Suriname	Coronie	5.87	-56.24				1,000	Scott and Carbonell 1986	
Braamspunt, Marapica, Motkreek	Suriname	Commewijne	6.00	-54.97				1,000	Scott and Carbonell 1986	
Wia-Wia	Suriname	Marowijne	5.95	-54.51	WHSRN - H			1,000	Scott and Carbonell 1986	
Coppename River mouth	Suriname	Saramacca	5.99	-55.77	WHSRN - H			1,500	Scott and Carbonell 1986	WHSRN site Coppenamemonding
Bigi Pan	Suriname	Coronie/Nickerie	5.99	-56.85	WHSRN - H			1,726	Morrison and Ross 1989	

CONSERVATION THREATS

In this section of the plan, we attempt to identify the primary threats facing the Whimbrel throughout the Western Hemisphere during the breeding, migratory, and nonbreeding (wintering) seasons. Our goal is to outline and highlight the most important threats that may significantly affect the mortality and reproductive rates of the species. The scope of this plan does not allow for us to present comprehensive information on a local scale or even a country or regional scale; however, we do present several cases of current and imminent threats to the Whimbrel at known sites of conservation importance.

HABITAT LOSS AND DEGRADATION

Breeding Range

Habitat loss and degradation is likely the most serious threat to Whimbrel conservation throughout the Western Hemisphere during all life stages. Although much of the Whimbrel's breeding range is currently beyond the reach of encroaching development associated with residential, commercial, and recreational uses, pressure from expanding development associated with resource extraction activities is threatening several regions. Currently, there is a proposed project to develop a gas pipeline and supporting facilities within one of the known important breeding areas for the Whimbrel in the Kendall Island Bird Sanctuary in Northwest Territories, Canada. The Mackenzie Gas Pipeline Project, if approved, will result in a processing facility on Taglu Island, which will impact a large portion of available breeding habitat for Whimbrels on the island (Pirie 2008). The underground pipeline would pass through a second Whimbrel breeding site, Fish Island, and may also result in degradation of preferred breeding habitat (Pirie 2008). Finally, several other indirect impacts of the pipeline are of concern such as potential ground subsidence from the natural gas extraction, contamination due to spills, and increased human disturbance (Pirie 2008). Similarly, expanding oil development within the Arctic coastal plain of Alaska threatens to result in cumulative negative effects to all shorebird species using this habitat during the breeding season (Johnson *et al.* 2007b). To the east, future industrial development of the Hudson and James Bays' coastlines, including wind power, may be an important threat to breeding Whimbrels, although no imminent threats have been identified (K. Abraham, pers. comm.).

Increasing populations of Lesser Snow Goose (*Chen caerulescens caerulescens*) and Ross's Goose (*C. rossii*) along the Hudson Bay coastlines have played a role in altering vegetation and landscape structure, as well as soil conditions (Handa *et al.* 2002) with potentially negative impacts to shorebird breeding habitat (Jehl and Lin 2001). The dramatic and rapid population increases documented since the early 1990s are thought to be primarily human induced; management actions are focused on increasing harvest to reduce population growth and ultimately facilitate vegetation recovery (Batt 1997, CWSWC 2008). There is some recent evidence that suggests populations of certain tundra-nesting species in this region have not declined at the landscape scale in response to these habitat changes (Sammler *et al.* 2008), but the effects on Whimbrel breeding habitat and breeding numbers are unknown.

Migration and Wintering Range

Throughout the migratory and wintering portions of the species's range, loss and degradation of habitat to encroaching residential, commercial, and recreational uses, as well as to changing agricultural practices, are important threats. On the Pacific coast of Washington and Oregon, where Whimbrels are thought to use agricultural fields particularly during spring migration, the conversion of these habitats to other uses could pose a significant threat (J. Buchanan, pers. comm.). Similarly, the continued loss of wetland habitats and the future of changing agricultural practices within the Central Valley of California may result in the loss of important migratory habitat for the Whimbrel (Shuford *et al.* 1998). On the Atlantic coast of the United States, encroaching human development, increasing recreational use of coastal areas, and beach stabilization projects all threaten the limited amount of suitable habitat remaining (Clark *et al.* 2000, Hunter *et al.* 2002, K. Forgues, pers. comm.). In the Great Lakes region of the United States and Canada, loss of coastal wetland habitat to development, shoreline hardening, and invasive species threatens important migratory stopover sites (de Szalay *et al.* 2000, State of the Great Lakes 2007)

On a broad scale, the conversion or loss of agricultural fields that essentially serve as surrogate wetlands for many species dependent on these habitats will result in the loss of important shorebird foraging and roosting habitat. Extensive rice fields along the Texas and Louisiana coastlines of the Gulf of Mexico are used by a variety of migratory shorebirds during northbound migration (Norling *et al.* unpubl. data). The conversion of these fields to housing,

Chinese tallow production, and “improved pasture” will result in the loss of important foraging habitat for Whimbrels passing through the region, particularly during spring migration (M. Whitbeck, pers. comm.).

The loss of mangrove forests to extraction for boat and house construction, shrimp farming, salt production, and urbanization is likely a significant threat to Whimbrel nonbreeding habitat, not only because of the loss of habitat but also of ecosystem function (FAO 2007, Serrano 2008). The extensive mangrove forests along the coasts of Colombia and Brazil, which overlap with several important Whimbrel conservation sites, have experienced the highest losses relative to other South American countries since the 1980s (FAO 2007). Panama is also noted as one of six countries having reported the largest losses of mangrove forests since the 1980s, mainly due to conversion to shrimp farms and to salt production (FAO 2007).

In the Chiloé Island region of Chile, aquaculture activities in the form of manual algae collection and shrimp farming threaten mudflat habitat used by foraging Whimbrels throughout the year (Andres *et al.* 2009). Other threats to the region include shoreline housing development and disturbance in the form of increasing aquaculture activities and free-roaming dogs (Espinoza *et al.* 2006).

CONTAMINANTS

The threat to Whimbrels of chronic exposure to environmental contaminants is more difficult to assess than the more tangible and measurable threat of habitat loss or degradation. Exposure to contaminants can weaken the viability of the population by affecting factors such as the quality and quantity of prey availability, lifetime reproductive success, overall fitness of individual birds, and even adult mortality. In some cases just one factor could be having the greatest impact on the population; in others, it could be the cumulative effect of several factors. The threat of environmental contaminants due to specific events, such as oil spills, is also important and is easier to identify and quantify with regards to the level of threat and appropriate conservation measures. For example, the threat of oil spills to important wintering areas in Central and South America has been highlighted in the WHSRN conservation plans for several shorebird species (e.g. Red Knot, Hudsonian Godwit, Western Sandpiper). Several important wintering areas for the Whimbrel are threatened by increased shipping traffic and increased risk of oil spills, as is the case in the two ports in the São Luís area along the northeastern coast of

Brazil. Pollutants from major cities upstream, particularly from the São Luís area, are also of concern (Serrano 2008). Less is known about how contaminant levels may be affecting the overall quality of important wintering and migratory sites that host large numbers of Whimbrels.

HUMAN DISTURBANCE

Relative to other threats faced by the Whimbrel throughout its lifecycle, disturbance by humans is most likely a minor factor but one that still deserves management and conservation attention. On the remote and dispersed breeding grounds, human disturbance is probably not an important factor except in association with resource extraction activities as described above. During shorebird migration and on the wintering grounds, however, excessive disturbance can reduce foraging and resting time, increase energy expenditure, decrease the level of use of available habitat, and perhaps indirectly increase mortality (Harrington 2003). Expanding development and increasing demand for access to coastal areas for recreation means higher levels of human disturbance within most coastal areas along the Atlantic and Pacific coasts of the United States (Clark *et al.* 2000, Hunter *et al.* 2002, Hickey *et al.* 2003). On the wintering grounds, free-roaming dogs and other domestic animals in coastal habitats of Chile (Espinosa 2006) and Colombia (Ruis *et al.* 2007) have been cited as sources of disturbance. Non-specified sources of human disturbance have also been cited in Brazil (Araujo *et al.* 2006) and Chile (Cornelius *et al.* 2001). Disturbance associated with activities such as aquaculture may also be significant factors in the wintering range as well as on migration. On Chiloé Island, Chile, disturbance from the practice of aquaculture involving algae harvesting within the intertidal zone may be of concern, although Whimbrels appear to be able to acclimate somewhat to certain levels of disturbance (Andres *et al.* 2009). For example, Whimbrels on Chiloé Island have been observed using aquaculture floats as high-tide roost sites; perhaps a benefit to the species from such practices is that alternative roosting sites are provided close to coastal foraging areas (Andres *et al.* 2009, J. Johnson, pers. comm.).

HARVEST

Hunting in North America was a significant cause of Whimbrel population decline during the 19th century (Bent 1929, Birdlife International 2006). Most hunting pressure in North America is now alleviated through legal protection in the United States and Canada. However, subsistence harvesting may still pose some level of threat to the population. Although the Whimbrel is not open to subsistence harvesting in Alaska (USFWS 2008), some birds are taken nonetheless. Specific data on current levels of harvest are lacking, but large-bodied shorebirds are known targets of these activities (Alaska Shorebird Group 2008).

Presently, hunting in South America may be significant threat to the Whimbrel. In Brazil, migratory shorebirds are prized for their subcutaneous fat (Serrano 2008). Hunting is a traditional practice for communities of fishermen in Colombia (Johnston *et al.* 2006), although not to the extent as in recent decades. In the Guyanas (Suriname, French Guyana, and Guyana), hunting pressure on shorebirds is notable, although no good estimates are available for the number of Whimbrels taken per year (Ottema and Spaans 2008).

CLIMATE CHANGE

Although the exact impacts of climate change on the Whimbrel in the Western Hemisphere are unknown, biologists have emphasized several issues of concern that span the entire lifecycle of the species. On the breeding grounds near Churchill, Manitoba, biologists have documented a change in breeding distribution with the abandonment of historically important breeding habitat correlated with shrub encroachment, increased tree cover, and wetland drying (Ballantyne 2009). Lescop-Sinclair and Payette (1995) suggested that the black spruce treeline along the eastern coast of Hudson Bay has advanced by about 12 kilometers since the late 1800s. Continued advance of the treeline towards the Hudson Bay coastline due to warming temperatures could eventually eliminate or substantially reduce suitable Whimbrel breeding habitat. Similar patterns may be affecting the Whimbrel's breeding habitat range-wide along the border of the treeline and sub-arctic tundra. Given the range of habitats used by breeding Whimbrel however, including dwarf-shrub habitats, these patterns may not necessarily result in habitat reductions in all areas.

The decoupling of the synchronicity between the timing of avian breeding and the abundance of critical food resources is another potential effect of climate change (Visser *et al.*

2004). The result for long-distance migratory shorebirds could be higher rates of adult mortality or reproductive failure, if birds arriving on sub-arctic and arctic breeding grounds do not have access to the abundance of food resources needed to replace energy used during migration or to successfully produce young (Tulp and Schekkerman 2007). The same decoupling phenomenon could also impact Whimbrels during their migration if the timing of the availability of critical food resources at important stopover and staging sites does not match up with the arrival of migrating birds.

Warming temperatures in the tundra ecosystems where Whimbrels breed may also have dramatic impacts on all levels of trophic interaction, which may affect shorebird breeding success in unpredictable ways. For example, shorebird reproductive success may decline because of reduced lemming abundance due to warmer temperatures during the winter, leading to lower prey abundance for predators like the arctic fox, which would in turn focus on other prey including ground-nesting birds like geese and shorebirds (Ims and Fuglei 2005, Cadieux *et al.* 2008).

Perhaps one of the most complex potential impacts of climate change on Whimbrel conservation is the predicted change in weather and wind patterns and how those changes could lead to disruptions in their migration strategy (Gill *et al.* 2005). If Whimbrels have a wind-sensitive migration strategy, then they will likely be affected by potential changes in major weather systems in both the Pacific and Atlantic Oceans. It is unclear how long-distance migrants may adapt to such changes, particularly if they are at their maximum migration threshold (Gill *et al.* 2005).

The most recent projection of sea-level rise due to global climate change is 0.18–0.59 meters by the year 2100 (IPCC 2007). Rising water levels may significantly decrease the amount of intertidal habitat available for use by shorebirds, particularly in areas where shoreline development, coastal protection barriers, or natural topographic features prevent the landward migration of habitat (Galbraith *et al.* 2002). A reduction in intertidal habitat would affect shorebirds both along their coastal migration routes and throughout their wintering range. In some areas, sea-level rise may increase the amount of intertidal habitat in the near term as the coastline shifts landward and existing saltmarsh or other low-lying habitats are inundated and converted to intertidal flats (Galbraith *et al.* 2002).

CONSERVATION STRATEGIES AND ACTIONS

To better coordinate the following conservation strategies and actions overall, we recommend that a communication network soon be established between individuals, organizations, and agencies currently involved in the study and conservation of the Whimbrel. The network would serve to share information, ideas, and project updates in a timely fashion, facilitate collaboration on projects throughout the Western Hemisphere, and generate better-coordinated monitoring and survey protocols. This network may take shape simply as a dynamic, easily accessible database of current and potential project partners (as is presented in this plan), as a more involved email list-serve or Web page, or as an informal working group that convenes during Western Hemisphere Shorebird Group meetings or other appropriate gatherings.

HABITAT PROTECTION AND PREVENTION OF LOSS

Habitat protection and the prevention of habitat loss may be the most important conservation actions needed for the Whimbrel within the Western Hemisphere. The continued loss or degradation of habitats that support significant numbers of breeding, migrating, or wintering Whimbrels will result in irreversible ‘weak links’ throughout the species’s lifecycle, impeding and potentially negating all other conservation strategies and actions. Acquisition and protection efforts should be directed by the best information available on Whimbrel distribution throughout the annual cycle and be focused on habitats that support significant numbers of the Western Hemisphere population. Logically, acquisition and protection goals also need to take into account the relative importance of sites to all shorebird species within the Western Hemisphere in order to maximize the impact of funds available for acquisition and conservation.

Continued efforts to recognize and designate important sites for Whimbrels within the Western Hemisphere Shorebird Reserve Network (WHSRN) will be essential for directing, supporting, and facilitating habitat protection and acquisition efforts. Such designations can also be instrumental in raising awareness about the sites and regions that support significant numbers of the species throughout its lifecycle. Sites that support at least 1% of the biogeographic population of the Whimbrel should be nominated for inclusion within WHSRN, with a comprehensive overview of the overall importance of the sites to other shorebird species as well.

Eighteen such migratory stopover/staging sites have been recognized in this plan, as well as 16 wintering sites in six countries (Tables 2 and 3).

Examples of several areas of importance to the Whimbrel that currently warrant considerable attention with regards to habitat protection and prevention of habitat loss include: breeding grounds within the Mackenzie River Delta in Northwest Territories, Canada, that are threatened by a proposed gas pipeline project (Pirie 2008); wintering areas on Chiloé Island and adjacent mainland areas in Chile (Andres *et al.* 2009); and migratory stopover sites in coastal Georgia (Winn *et al.* unpubl. data).

DISTURBANCE MANAGEMENT AT STAGING/STOPOVER AND WINTERING SITES

The impact that disturbance to migrating and/or wintering Whimbrels may have on the overall fitness or survival of individual birds is unknown. Even so, efforts at the local scale need to identify areas where disturbance from recreational, commercial, industrial, or other uses may be negatively impacting important roosting and/or foraging sites so that efforts to mitigate those impacts may be developed and initiated. The information provided in this plan regarding important migration and wintering sites used by Whimbrels should provide local biologists and land managers with a starting point for identifying these areas and prioritizing the level of disturbance threat to each site. The details of how and if any mitigation efforts may be implemented, however, will vary widely throughout the migration and wintering range of the species and are beyond the scope of this plan. Undoubtedly though, these efforts will likely need to include creative ideas and techniques that will protect Whimbrels while accommodating a wide variety of individuals, groups, industries, recreational users, aquaculture businesses, ecotourism companies, and others.

REDUCE HARVEST PRESSURE

The overall impact of hunting on Whimbrel populations throughout the Western Hemisphere is unknown. However, because hunting of large-bodied shorebirds is a known threat, particularly in some regions of Central and South America, action should be taken to alleviate this pressure to the greatest extent possible. Solutions that include a combination of legal action/enforcement (where feasible), education, and alternatives (where needed) may hold the greatest potential for reducing pressure and minimizing the take of all large-bodied shorebird

species. In local communities where large-bodied shorebirds provide an important food source, ecologically sustainable alternative food resources will need to be developed to maintain the communities' well-being and their adherence to hunting restrictions. In general, biologists and managers at the local level should identify communities that hunt shorebirds and engage them in finding solutions that reduce hunting pressure and maintain their wellbeing.

RESEARCH AND MONITORING NEEDS

Despite significant advances in our understanding of shorebird biology and conservation throughout the Western Hemisphere in the past decade, our understanding of the basic ecology and conservation needs of the Whimbrel remains limited. We are faced with important gaps in information that is critical for developing and implementing effective conservation strategies for the species. In this section of the plan, we present priority research and monitoring needs for the Whimbrel.

MIGRATION AND CONNECTIVITY

There is wide recognition among shorebird researchers and biologists that there is a great need for a better understanding of the migratory pathways and connectivity between breeding and nonbreeding sites of all Nearctic shorebird species. The long-term conservation of highly migratory species that depend on resources distributed on a hemispheric scale will require efforts that integrate all stages of their lifecycle regardless of where those stages occur. We need to understand status, risks, and resource requirements on the breeding grounds, wintering grounds, and within significant staging areas along their migration pathway. Virtually none of these linkages between critical areas have been made for the Whimbrel, and it is only with this information that researchers and managers will be able to approach the conservation of this species on an appropriate scale. Although the recent use of molecular biology, satellite-tracking technology, and conventional banding and re-sighting efforts is beginning to reveal the migratory routes and migration strategies of the Whimbrel, our current understanding of these topics remains limited.

Regional survey efforts along the Pacific and Atlantic coasts of the United States, Mexico, and Central America, along the Great Lakes, and along the Hudson and James Bay

coastlines in Canada offer insight into important staging and stopover sites that Whimbrels use during spring and fall migration (see ‘Migration’ and ‘Conservation Sites’ sections). However, how these sites fit into the overall migration strategy of the western and eastern breeding populations of the Whimbrel and their relative importance to the overall population in the Western Hemisphere is not well understood. Emphasis should be placed on coordinated efforts to identify all critical staging and stopover sites for the Whimbrel along the Pacific, Atlantic, and Gulf Coasts, and to determine the relative importance of these sites within the Western Hemisphere. Examples of such efforts are underway in various regions including spring and fall surveys in coastal Virginia (B. Watts and B. Truitt, pers. comm.), post-breeding surveys of staging areas in the Bristol Bay region of coastal Alaska (J. Johnson, pers. comm.), and all-shorebird migration surveys at Akimiski Island in James Bay, Canada (E. Nol, pers. comm.). Very little information is available for important migration sites that Whimbrels may use in Central and South America prior to reaching the coastlines of the United States.

It has been suspected that the western and eastern breeding populations of the Whimbrel in North America remain segregated to the Pacific and Atlantic Coasts, respectively, during the boreal winter (Skeel and Mallory 1996). However, more research is needed on the exact migration routes used by Whimbrels and to what extent and where these two populations may mix throughout the annual cycle. For example, in 2008 the northbound migratory pathway of a female Whimbrel was tracked via satellite from coastal Virginia to suspected breeding grounds in northern Alaska; her southbound route was also tracked, which went along the Pacific Coast to Washington and then cross-country to the Great Lakes (Watts *et al.* 2008) (Figure 2). This unexpected pathway exemplifies what we may not know about overall Whimbrel migration strategy in the Western Hemisphere. Furthermore, the suggestion that potentially large numbers of northbound Whimbrels use extensive areas of rice fields along the Texas and Louisiana coastlines (Norling *et al.* unpubl. data) begs the question of how important the Mississippi and/or Central Flyways may be for this species. This type of information is fundamental for quantifying to what extent population estimates obtained at stopover sites during migration can be used to estimate population size (Watts *et al.* 2008).



Figure 2. Map showing the migration route of a Whimbrel fitted with a satellite tag on the Eastern Shore of Virginia on 20 May 2008 (updated tracking map, Watts *et al.* 2008) (Courtesy of the Center for Conservation Biology at the College of William and Mary and Virginia Commonwealth University).

The use of satellite-tracking technology is proving to be an extremely powerful tool for investigating these questions in large-bodied shorebirds and should continue to be a research priority for the Whimbrel (e.g., Johnson *et al.* 2007a, Watts *et al.* 2008). Efforts are already underway to deploy satellite tags on Whimbrels on their wintering grounds on Chiloé Island, Chile (Johnson *et al.* 2007); on breeding grounds in Alaska (L. Tibbitts, pers. comm.); and at staging sites in Virginia (Watts *et al.* 2008).

Banded individuals have also been useful for beginning to understand connections along the flyways (Johnson *et al.* 2007, Watts *et al.* unpubl. data). However, the low availability of observers in most parts of the species's range and low re-sighting probability for the Whimbrel limit the effectiveness of this technique. Despite these limitations, banding should still be considered a complementary tool for investigating migration and connectivity questions. It is also an important tool for investigating a variety of questions at the local scale and for describing populations and sexes based on biometrics, as well as important demographic parameters such as adult survival (Johnson *et al.* 2007a).

Population genetics analyses may also be a valuable technique for determining linkages between breeding, staging, and nonbreeding populations of the Whimbrel, and have been initiated on wintering grounds on Chiloé Island, Chile (Johnson *et al.* 2007a). With these linkages completed, one could theoretically determine the proportion of a breeding population that uses a particular nonbreeding area; this would result in a more accurate estimate of the breeding population size, given that surveying birds during the nonbreeding season is more efficient than on the breeding grounds.

Finally, coordination and partnerships between agencies and organizations undertaking such projects throughout the Western Hemisphere is fundamental to the success of these efforts. Multi-partnership projects that encompass multiple sites within the Western Hemisphere will be more effective for determining these migratory connections and will also potentially be more attractive to funding agencies that strive to address research and monitoring priorities on a biologically meaningful scale for these highly migratory species.

STOPOVER ECOLOGY

We know very little about Whimbrel stopover ecology throughout the species's migratory range. For example, our ability to estimate the total number of birds that use key staging and stopover sites relies on accurate information about turnover or daily site-fidelity rates, yet there are no reliable published estimates for this species at any sites. Without this information, biologists are limited to using peak counts during migration for estimating overall population size and the relative importance of sites to the entire Western Hemisphere population. Researchers should prioritize studies investigating turnover rates using individually color-marked birds and/or radio telemetry at known key staging or stopover sites. Efforts to

individually color-mark birds (as well as satellite-tag birds) will also contribute information on inter-annual site fidelity to migratory staging and stopover sites. For example, two band returns of birds flagged in coastal Virginia and re-sighted in subsequent migration periods suggest high migratory site fidelity for at least a portion of the migrants (CCB and TNC, unpubl. data). More information on site fidelity patterns can guide effective conservation and management efforts on both a local and regional scale.

The significance of key staging areas for refueling by many long-distance migratory shorebirds is well understood (Myers 1983, Myers *et al.* 1987). However, we still lack much of the fundamental information on the foraging and refueling requirements for many species at these sites. Foraging and habitat requirements of the Whimbrel at known key staging and stopover sites should be investigated to identify potential limiting factors in these areas and to guide site management and conservation efforts. For example, along the mid-Atlantic and southeast coasts of the United States, Whimbrels are known to feed extensively on fiddler crabs (*Uca* sp.), but very little is known about the relationship between fiddler crab populations and Whimbrel foraging requirements and foraging efficiency. In western Washington, USA, Whimbrels are known to use agricultural fields slightly inland from the coast, particularly during spring migration, but little information is available on habitat and foraging requirements during this period. This type of information could offer better insight into the shifting spatial use of fields by Whimbrels during spring migration and guide more effective survey efforts, as well as management and conservation efforts of those habitats (J. Buchanan, pers. comm.).

WINTERING ECOLOGY – ADULTS AND JUVENILES

Despite the fact that mortality on the nonbreeding grounds is thought to be an important limiting factor for shorebird populations, information on all aspects of Whimbrel ecology on the nonbreeding grounds is lacking. We need basic information that will offer insight into what factors might be affecting the Whimbrel in these areas, particularly factors affecting adult and juvenile mortality. Researchers should prioritize studies investigating all aspects of the ecology of birds on the nonbreeding grounds including habitat use and requirements, foraging requirements, linkages between roost concentrations and foraging areas, conservation threats, and sources of mortality.

Additionally, very little is known about the distribution and status of nonbreeding Whimbrels that remain at wintering sites during the boreal summer. Both yearling and 2-year-old birds may remain on the wintering grounds during their first and second summers, respectively (Skeel and Mallory 1996). Surveys of Chiloé Island, Chile, during the boreal summers of 2000–2004 documented a high count of 900 Whimbrels (L. Espinoza, pers. comm.), suggesting that this area is important to the survival of over 1% of the biogeographic population. Initial surveys during the boreal summer should be targeted at other important wintering sites identified in this plan in order to identify other potential areas of concentration for over-summering nonbreeders.

MONITORING NEEDS

Population Estimates and Trends

Existing population estimates for the Whimbrel in the Western Hemisphere have been derived from a variety of survey efforts conducted over at least a 30-year period with varying methodologies and at different stages of the lifecycle (e.g. Morrison *et al.* 2006, Andres *et al.* 2009). Despite these considerable efforts, we still lack a reliable population estimate for this species. Due to the remote location of breeding sites and their dispersed distribution, surveys on the wintering grounds and within significant migratory staging areas may provide the best information on status and trends. Whimbrels are widely distributed along the entire Pacific and Atlantic coasts of Mexico, Central America, and South America during the boreal winter; a comprehensive survey during the nonbreeding season would require years of effort and significant funding sources. A survey of this magnitude has not been attempted since the efforts of the Canadian Wildlife Service in the mid-1980s (Morrison and Ross 1989). While emphasis should be placed on considering an update to this monumental survey effort, current priority should be placed on obtaining recent and more accurate estimates from areas of known concentration for this species during the boreal winter, such as the conservation sites identified in this plan. For example, recent intensive surveys on Chiloé Island and the nearby mainland more than tripled the estimate for the same region from the mid-1980s (Andres *et al.* 2009, Morrison *et al.* 1989, Morrison *et al.* unpubl. data). Updated surveys in known concentration regions such as the north-central coast of Brazil, the coast of Suriname, and the Bay of Panama may again significantly alter our current understanding of Whimbrel distribution and abundance during the boreal winter.

Detection issues that have been highlighted during previous survey efforts for the Whimbrel should be taken into consideration for all current or planned projects. The species's varied habitat use and distinct behavioral characteristics during the wintering and migration stages result in several detection issues with wide-ranging survey efforts. Whimbrels surveyed by air along the Chiloé Island coastline in 2006 were noted to be less likely to flush compared to other species and more sparsely distributed along the coastline and, consequently, more difficult to detect (Johnson *et al.* 2007a, Andres *et al.* 2009). On a broader scale, more sparsely distributed birds are more likely to be missed by aerial surveys compared to large groups and could collectively result in notable numbers of birds being missed. Additionally, Whimbrels exploit a wide range of habitats, including terrestrial ones such as fields, grasslands, and meadows (Skeel and Mallory 1996), which creates the potential to be under-represented during aerial surveys that focus solely on coastal habitats (Watts 1998, B. Watts, pers. comm.). Even ground surveys or boat-based surveys have the potential to under-represent the number of birds present, since many coastal areas are difficult to survey and/or access on the ground (F. Sanders, pers. comm.). For example, estimates of Whimbrel density on feeding areas provided overall counts that were >50% higher than those obtained by direct counts of roosting sites in Sanquianga National Park, Colombia (Johnston-Gonzalez, unpubl. data).

As part of the effort to promote current and more accurate site estimates, emphasis should also be placed on supporting the efforts of the Neotropical Waterbird Census. In particular, the periodicity and geographic scope should be expanded to strategically encompass key sites year-round that are important for Whimbrels as well as other high-priority shorebird species, maximizing the information obtained through these annual survey efforts. For example, data from these censuses have provided valuable information for describing the status of the Hudsonian Godwit (Espinosa *et al.* 2005) and have been slated as a way to continue Whimbrel census efforts in the Chiloé Island region (Johnson *et al.* 2007a).

Current priority should also focus on coordinated efforts to survey the numbers of Whimbrels using key staging areas along the Pacific, Atlantic, and Gulf Coasts and Great Lakes shorelines throughout the more contracted spring migration period. Combined with efforts to estimate site-specific residency time and/or daily fidelity, these data can be used to estimate the total number of Whimbrels using key staging areas. This information can further be integrated with advances in our understanding of the linkages between migratory staging/stopover sites and

breeding/wintering areas to estimate overall population size. Coordination is a key factor in implementing these surveys. For example, along the Atlantic coast of the United States, experts believe that northbound Whimbrels may depart for breeding grounds from multiple, geographically distinct areas, such as Georgia (B. Winn pers. comm.) and Virginia (Watts *et al.* 2008). Therefore, only coordinated surveys throughout the spring migration period will accurately describe the total number of Whimbrels traveling north via the Atlantic Coast. Surveys such as these at key sites over time will not only allow us to better estimate overall population size but also provide information on population trends for the species.

Breeding Ecology

The continuation and expansion of existing efforts to estimate shorebird breeding numbers, distribution, trends, and habitat associations across arctic and sub-arctic regions (e.g. Program for Regional and International Shorebird Monitoring [PRISM], National Park Service Inventory and Monitoring Program) are critical to understanding the conservation status of migratory shorebirds. Although the remote, dispersed breeding grounds for the Whimbrel and other shorebirds make comprehensive and regular survey efforts difficult or impractical, priority should continue to be placed on identifying sites of importance for breeding birds. This is particularly important considering the large discrepancy between the population estimates for Whimbrels on their wintering grounds versus the combined estimates for Whimbrels on their breeding grounds. In addition to these efforts, biologists should prioritize initiating or maintaining existing long-term monitoring programs for discrete breeding populations in order to document factors affecting reproductive success, breeding habitat requirements, and adult mortality on the breeding grounds. This information is critical for a better understanding of limiting factors for the species that may be occurring on the breeding grounds (Jehl and Linn 2001). Several such areas for monitoring discrete breeding populations of the Whimbrel have already been identified (e.g. Churchill, Manitoba; Mackenzie River Delta, Northwest Territories). Detailed information on factors affecting reproductive success can also help guide potential management efforts where feasible. In the Churchill region, for example, the Common Raven has been identified as a threat to nesting Whimbrel; consequently, managing raven numbers becomes a potential management consideration or action (E. Nol, pers. comm.).

Identifying specific habitat requirements for the Whimbrel throughout its breeding range is fundamental to predicting where breeding populations may be found, what potential threats exist that may impact particular habitats, and how to best focus conservation and management efforts. For example, a recent study in the Mackenzie River Delta focused on creating a predictive habitat model to anticipate and guide mitigation for the potential effects of habitat alteration/degradation on breeding Whimbrels from a large gas pipeline project, if approved (Mackenzie Gas Pipeline Project) (Pirie 2008). Additionally, information on variations in reproductive success and limiting factors between different habitat types can guide conservation and management efforts or help to predict the impacts of alterations to breeding sites (e.g., upland versus lowland habitats and the Mackenzie Gas Pipeline Project) (Pirie 2008).

Population Demographics

We know virtually nothing about Whimbrel population demography rates that would help us to better understand and evaluate the conservation status of the species throughout the Western Hemisphere. By establishing individually marked birds in the population and implementing many of the recommended research and monitoring activities described in this plan, biologists can begin to address unknown parameters like juvenile and adult survival, seasonal survival estimates, age at first breeding, and site fidelity during all life stages. Further analysis of this type of information can highlight important thresholds that can help focus conservation efforts to the most sensitive life stages of the species and establish conservation thresholds to guide management and conservation activities (e.g. reproductive thresholds needed to maintain a stable population).

CONSERVATION TIMELINE

By 2010

- Complete a 2–4 page detailed summary of the plan in English and Spanish.
- Translate the Whimbrel Conservation Plan to Spanish and Portuguese.
- Establish a communications network between individuals, organizations, and agencies currently involved in the study and conservation of the Whimbrel.
- Nominate sites important for the Whimbrel on Chiloé Island and the surrounding mainland of Chile that meet the criteria for designation by WHSRN.
- Nominate Parque Nacional Natural Sanquianga, Colombia, as a WHSRN Site of Regional Importance.
- Identify additional nonbreeding and migratory stopover/staging sites important to Whimbrel throughout the Western Hemisphere.
- Nominate additional sites important for the Whimbrel that meet the criteria for designation by WHSRN.
- Continue to establish a cohort of individually color-banded Whimbrels from both the Pacific and Atlantic coasts of the Americas, and maintain marking efforts until research goals are met or further needs are identified.
- Continue deployment of satellite tags on Whimbrels from both the Pacific and Atlantic coasts of the Americas.
- Continue and expand genetic studies to investigate the relationship between western and eastern breeding populations.

By 2011

- At newly identified important stopover/staging sites for the Whimbrel, conduct an assessment of threats to the species and potential limiting factors (at a local scale).
- Identify partners and funding to initiate coordinated Whimbrel surveys during northbound migration along the Pacific and Atlantic flyways. Where applicable, collaborate with other species' working groups to run a multi-species census.
- Initiate further studies designed to determine the importance of the Central and/or Mississippi flyways to Whimbrel migration.
- Initiate studies of turnover rates at sites known or thought to be terminal stopover/staging areas during northbound migration.
- Secure funds to continue long-term monitoring of the reproductive biology of the Whimbrel in the Churchill region of Manitoba, Canada.
- Secure funds to continue studies of the reproductive biology of the Whimbrel, and factors affecting breeding success, in the Mackenzie River Delta.

- Identify sites of importance for nonbreeding Whimbrels during the austral winter.
- Identify and obtain commitment from the agency or organization to be responsible for maintaining a dynamic database of important Whimbrel conservation sites as described in this plan.
- Develop a strategy and protocol among researchers for maintaining a coordinated database of Whimbrel color-band re-sightings (i.e. data use and ownership guidelines, reporting, archiving, and accessing information). Explore potential to integrate this with the www.bandedbirds.org effort.

By 2012

- Identify partners, funding, and laboratory facilities to support a coordinated study of contaminants at important Whimbrel nonbreeding and stopover/staging sites.
- Initiate additional studies examining potential factors associated with Whimbrel mortality at key nonbreeding sites.

By 2013–2014

- Evaluate achievements to date outlined by the Whimbrel Conservation Plan (Appendix 1).
- Reassess the population estimate of the Whimbrel in the Western Hemisphere.
- Complete satellite telemetry studies.
- Complete genetic studies.
- At the 5-year mark (2014), provide an annotated version of the plan that contains progress notes for all action items to date.

By 2015–2019

- Complete contamination studies.
- Complete a full review and update of the plan after 10 years (2019)

EVALUATION

Perhaps one of the most striking conclusions that this conservation plan highlights is the extent of what we do not know about the Whimbrel in the Western Hemisphere. Although shorebird biologists along both the Pacific and Atlantic coasts are making much needed advances in our understanding of the basic biology of the species, we are still faced with important information gaps that must be filled in order to develop and implement effective and timely

conservation actions and strategies. Hopefully, this plan has successfully summarized what shorebird biologists and managers throughout the Western Hemisphere have categorized as the most important research and monitoring needs for the Whimbrel over the next decade, and will serve as a guiding document to prioritize and focus limited conservation dollars. Furthermore, we encourage shorebird biologists and managers who are involved or interested in Whimbrel research and conservation to provide feedback, updates, and corrections that can be incorporated into future versions of this living document. We recognize that dedicating the time and effort to reviewing and providing feedback for planning exercises such as this can be difficult to prioritize. However, the utility of this conservation plan will be greatly improved if the most up-to-date information and feedback from experts in the field are incorporated. The result is a conservation plan that can effectively and powerfully support and promote funding proposals, help to initiate and prioritize local research, management, and education efforts, support and promote local and regional decision making for shorebird conservation, promote student projects, facilitate collaboration across the range of the species, and ultimately greatly enhance our ability to conserve the Whimbrel throughout the Western Hemisphere.

Finally, we have provided a list of metrics to be used to evaluate the success of Whimbrel conservation efforts over the next decade (Appendix 1). These metrics are based on the recommendations provided in the conservation plan, which was developed based on input from over 60 shorebird biologists throughout the Western Hemisphere. They provide well-defined, measurable benchmarks that will allow the shorebird community to track its collective progress with Whimbrel conservation over time. These benchmarks can, in turn, be reviewed and modified based on the measured progress to ensure that conservation efforts are continually advancing and being directed by priority research and conservation needs for the species.

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APPENDIX I

Metrics to be used in the evaluation of the success of the Whimbrel Conservation Plan.

- Number of members participating and number of countries involved in a communications network devoted to Whimbrel conservation (e.g. an active list-serve or Working Group).
- Number of important conservation sites for the Whimbrel identified and nominated as WHSRN sites.
- Number of important conservation sites for the Whimbrel protected under national or international legislations.
- Number of Whimbrel satellite-tagged and color-banded, banding localities, banding projects, and re-sightings throughout the Western Hemisphere.
- Number of hectares of Whimbrel habitat being incorporated within private/public protected areas systems.
- Number of WHSRN sites important to the Whimbrel that hold other international designations (Ramsar site, World Heritage site).
- Number of countries developing national Whimbrel conservation plans or incorporating Whimbrel needs into national bird/habitat conservation plans.
- Number of regional or national surveys completed for estimation of Whimbrel populations.
- Number of studies/reports/papers contributing information on turnover rates, population size, and trends of the Whimbrel.
- Number of studies contributing information on movements and relationships between breeding grounds and wintering range.
- Number of studies contributing information on effect of climate change, habitat loss, hunting, and disturbance on habitat and populations of the Whimbrel.

APPENDIX II

List of contributors to the development of the Whimbrel Conservation Plan.

NOTE: Names in **bold** indicate contacts involved with current or planned research projects or conservation actions, and are sources of potential collaboration throughout the Western Hemisphere.

Last Name	First Name	Agency/Organization	Location	Email
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