CONSERVATION PLAN FOR THE WILSON'S PLOVER

(*CHARADRIUS WILSONIA*)

Version 1.0

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WESTERN HEMISPHERE
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Cover Photo: Male Wilson's Plover in breeding plumage, exhibiting territorial alert posture near nest. St. Marks National Wildlife Refuge, eastern Panhandle, northwest Florida, M. Zdravkovic/Conservian

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Fig. 1. Wilson's Plover Nests of the Gulf of Mexico / © M. Zdravkovic, D. LeBlanc, S. Liptay, Conservian

EXECUTIVE SUMMARY

The **Wilson's Plover** (*Charadrius wilsonia*) is a medium-size shorebird found primarily in coastal habitats. It nests on barren to densely vegetated substrates (Zdravkovic 2005) above the high-tide line on barrier islands, coastal lagoon shores, mainland beaches (Corbat and Bergstom 2000), dredge-spoil islands, river-mouth habitat, coastal saline lakeshores, and occasionally on inland saline lakeshores (Zdravkovic 2005). The species' breeding range is contracting at the northern limits; on the Atlantic Coast, it no longer nests north of Virginia (Corbat and Bergstrom 2000). Limited trend data available for this species indicate that Wilson's Plover populations are in decline due to human-caused disturbance and habitat loss. Essential information is lacking regarding Wilson's Plover range-wide population status, distribution, and abundance.

There are generally three recognized Wilson's Plover subspecies (Ridgeway 1919, Hellmayr and Conover 1948, Blake 1977): ***C. w. wilsonia***, ***cinnamonius***, and ***beldingi***. No population data exist for the latter two throughout most of their range. The major migration routes for the Wilson's Plover remain unknown. Very few data exist outside the United States on the major breeding and nonbreeding areas used by all three Wilson's Plover subspecies. Information on resident vs. nonresident Wilson's Plover subspecies distribution is limited. Subspecies designations warrant further study as well.

The *C. w. wilsonia* breeding population is found in saline habitats along the Atlantic Coast from Virginia to Florida; on the U.S. Gulf Coast, and Mexican Coast south to Belize; and throughout the Bahamas and Greater Antilles. This subspecies winters on the southeast Atlantic and U.S. Gulf Coasts to northern and eastern South America. *C. w. cinnamonius* is found from northeast Colombia to northeast Brazil and the southern Caribbean islands. *C. w. beldingi* is found from the Pacific coast of northwest Mexico to central Peru (Ridgeway 1919).

The *C. w. wilsonia* breeding adult population was estimated at 6,000 individuals in the U.S. Shorebird Conservation Plan (Brown *et al.* 2001). Recent comprehensive, standardized, breeding surveys conducted on the U.S. Atlantic and Gulf Coasts indicate that the breeding population estimate for *C. w. wilsonia* for the continental United States is 4,000–4,300 breeding pairs (≤ 8,600 breeding individuals) (Boettcher 2007, Cameron 2008, Georgia DNR 2010, FSA 2011, Sanders *et al*. 2013, and Zdravkovic 2005, 2007a, 2009, 2012, 2013). The U.S. Atlantic

population is estimated at 1,000–1,100 breeding pairs (≤ 2,200 individuals) (Boettcher 2007, Cameron 2008, Georgia DNR 2010, FSA 2011, Sanders *et al.* 2013), and the Gulf Coast population is estimated at 3,000–3,200 breeding pairs (≤ 6,400 individuals) (Zdravkovic 2005, 2009, 2012a, 2012b; Florida Shorebird Alliance Database 2011). No comprehensive surveys have been conducted in Mexico. In 2006, Coastal Bird Conservation (CBC) conducted breeding surveys of the Laguna Madre of Mexico, documenting 619 breeding pairs (Zdravkovic 2007a). These data, combined with estimates for northeast Mexico and Yucatan, total approximately 975–1,025 breeding pairs (≤ 2,050 individuals). No comprehensive surveys have been conducted for *C. w. wilsonia* in the Caribbean. The Puerto Rico breeding population is estimated at 180–200 pairs (A. Morales-Pérez and J. Salguero pers. comm.), and the U.S. Virgin Islands breeding population is estimated at 45–65 pairs (Lombard 2007*).* A population estimate for the Caribbean of 1,800–2,000 breeding pairs (≤ 4,000 individuals) is based on partial survey data, and range and distribution data. This estimate includes the U.S. Caribbean population. Thus, the total population estimate for the *C. w. wilsonia* subspecies is **13,550–14,650** breeding adults.

No population data exist for the other two Wilson's Plover subspecies, *C. w. cinnamonius* and *C. w. beldingi.* Population estimates based on known breeding densities for *C. w. wilsonia* were used to extrapolate estimates for both. The estimated population for *C. w. cinnamonius* is **6,500–8,500** breeding adults. The estimated population for *C. w. beldingi* is **6,500–8,500** breeding adults. The range-wide total population estimate for the combined Wilson's Plover subspecies (all three) is **26,550 –31,650** breeding adults.

Recent surveys have identified Texas as having the largest currently known breeding populations of Wilson's Plover *(C. w. wilsonia)* in North America, supporting approximately 31% of the estimated U.S. population; the Laguna Madre of Texas alone supports 20% of the estimated 8,600 breeding Wilson's Plover adults found in the United States (Liptay and Zdravkovic 2008; Zdravkovic 2005, 2013). Coastal Louisiana ranks second in number of important breeding sites and supports approximately 30% of the total U.S. population (Zdravkovic 2013). The most important breeding macrohabitats used by the Wilson's Plover in the United States are barrier islands/peninsulas and artificially created/restored habitat.

Known important nonbreeding areas in the United States include sites in Texas, Louisiana, Florida, and South Carolina; in Central America, sites in Pacific El Salvador (Jones

and Komar 2008); and in South America, sites in Pacific Colombia (Ruiz *et al.* 2008). However, information is limited from a lack of population data over much of the species' range.

The Wilson's Plover is listed in the U.S. Shorebird Conservation Plan as a Species of High Concern (Category 4) based on abundant threats on its breeding and nonbreeding grounds, a small population, and its limited breeding distribution (Brown *et al.* 2001). The species trend was recently re-evaluated and is categorized as Apparent Decline (Trend 4) in population estimates of American shorebirds (Andres *et al*. 2012). The Audubon WatchList designation for the Wilson's Plover is Moderate High Priority (Yellow Category). The Wilson's Plover has no U.S. federally listed status beyond the nation's Migratory Bird Treaty Act. The current threats and risks to Wilson's Plovers are primarily human-induced and -created. Loss of habitat and human disturbance to nesting areas are the primary threats to this species (Corbat and Bergstrom 2000).

The Wilson's Plover should be considered as a potential "Surrogate Species" by the U.S. Fish and Wildlife Service (USFWS) for beach-nesting bird species within the U.S. Southeast and Southwest Regions. The species is considered an "Indicator Species" for beach-nesting birds for the Landscape Conservation Cooperatives (LLCs) of the Gulf Coastal Plains-Ozarks, and should also be considered as an indicator species for the South Atlantic, Peninsular Florida, Coastal Prairies, and Caribbean LCCs (C. Hunter, USFWS, pers. comm.).

The Wilson's Plover warrants immediate conservation action due to: 1) a low and declining population and a contracting species range; 2) ongoing range-wide loss of breeding and nonbreeding habitat; 3) lack of range-wide monitoring data to determine population status; and 4) high vulnerability to global climate change.

Major factors contributing to the decline of the Wilson's Plover include:

- Loss of habitat caused by unrelenting human development and range-wide alteration of all coastal habitats.
- High levels of disturbance from human recreational activities on breeding, migration, and wintering grounds that render much of the former and/or potential habitat unusable.
- Lack of a specific protected status in the United States or elsewhere throughout its entire range, despite a very low and declining population.
- High species vulnerability to current and future global climate change and sea-level rise.
- Single species of six breeding plovers in the United States or North America with no significant inland breeding population.

Recommended Conservation Actions:

Petition for U.S. federally listed status of the Wilson's Plover subspecies *C. w. wilsonia,* given its low and declining U.S. population (≤8,600 breeding adults), a limited and contracting species range, rapid loss of habitat, and intense, human-created disturbance during all stages of the species' life cycle. Federally listed status for the Wilson's Plover will provide an "umbrella effect" of protection for all other beach-nesting species using the same habitats, particularly on the U.S. Gulf Coast, much like the Piping Plover has for the Atlantic Coast. Implementing this key conservation action will support and enable the following recommended conservation actions:

- Aggressively preserve all remaining coastal habitat within known key sites throughout the species' range through acquisition, conservation easements, and zoning restrictions.
- Restrict rebuilding of non-essential structures within coastal high-hazard zones on barrier beaches, barrier islands, and coastal habitats after storm events.
- Strongly support beach-nesting bird habitat creation, enhancement, and restoration using methods sensitive to the needs of Wilson's Plover and other beach-nesting birds.
- Increase monitoring of Wilson's Plover population status and trends through regular, coordinated, comprehensive, standardized, concurrent, range-wide surveys on breeding and nonbreeding grounds, using a multi-species shorebird survey approach as appropriate.
- Identify key range-wide Wilson's Plover breeding, migratory, and wintering habitat; implement monitoring, protection, stabilization, and/or restoration activities cooperatively with partners using standardized, proven methods sufficient to maintain or increase current population levels of Wilson's Plovers.
- Prioritize research that addresses known gaps in Wilson's Plover ecology and conservation; directly benefits the species and its habitats; and supports protective legislation.
- Research the impacts of disturbance to breeding and nonbreeding Wilson's Plovers (inclusive of all shorebirds using the same habitats), and key aspects of the species' migratory routes, subspecies designations, productivity, lifespan, and survivorship.

RESUMEN EJECUTIVO

El ***Charadrius wilsonia*** **(Chorlito piquigrueso)** es un ave playera de tamaño mediano que se encuentra principalmente en hábitats costeros. Esta ave anida en sustratos con densa vegetación o totalmente desprovistos de cobertura alguna (Zdravkovic 2005); sus nidos son ubicados por encima de la línea de marea alta en islas barreras, orillas de lagunas costeras, playas continentales (Corbat y Bergstom 2000), islas artificiales construidas con material de dragado, desembocadura de ríos, orillas de lagos salinos costeros, y ocasionalmente orillas de lagos salinos de interior (Zdravkovic 2005). El ámbito de reproducción de la especie está disminuyendo en el norte de su distribución; en la costa del Atlántico, ya no anida más al norte de Virginia (Corbat y Bergstrom 2000). La escasa información disponible sobre la tendencia de esta especie indica que las poblaciones del *Charadrius wilsonia* están disminuyendo debido a la perturbación causada por el hombre y a la pérdida de hábitat. Hace falta información clave que incluya el estado de sus poblaciones en todo el ámbito de la especie, su distribución, y su abundancia.

Generalmente son reconocidas tres subespecies del *Charadrius wilsonia* (Ridgeway 1919, Hellmayr y Conover 1948, Blake 1977): ***C. w. wilsonia, cinnamonius*** y ***beldingi***. No hay datos sobre las poblaciones *cinnamonius* y *beldingi* en la mayor parte de su ámbito. Las principales rutas de migración para el *Charadrius wilsonia* son aún desconocidas. Existe poca información en las principales áreas fuera de los Estados Unidos usadas por las tres subespecies durante la época reproductiva y no reproductiva. La información es escasa sobre la distribución de las subespecies del *Charadrius wilsonia* residentes contra migratorias. La determinación de las subespecies requiere también de más estudios.

La población reproductiva de ***C. w. wilsonia*** se encuentra en los hábitats salinos de la Costa Atlántica desde Virginia hasta Florida en los Estados Unidos; en la costa del Golfo de los EE.UU. y de México, hasta Belice; y en las Bahamas y las Antillas Mayores. Esta subespecie pasa el invierno en la costa sureste del Atlántico además la costa del Golfo de los EE.UU., hasta la costa norte y este de Suramérica. La subespecie ***C. w. cinnamonius*** se encuentra desde el noreste de Colombia hasta el noreste de Brasil y las islas del Caribe del sur. La subespecie ***C. w. beldingi*** se encuentra desde la costa del Pacífico del noroeste de México hasta el centro de Perú (Ridgeway 1919).

La población de adultos reproductivos de ***C. w. wilsonia*** se estimó en 6.000 individuos en el Plan de Conservación de Aves Playeras de los Estados Unidos (Brown *et al.* 2001). Censos recientes estandarizados y exhaustivos en la época reproductiva en las costas del Golfo y del Atlántico de los EE.UU. indican que los estimados de la población reproductiva de *C. w. wilsonia* para el área continental de los EE.UU. es de 4.000–4.300 parejas reproductivas (≤ 8.600 individuos reproductivos) (Boettcher 2007, Cameron 2008, Georgia DNR 2010, FSA 2011, Sanders *et al*. 2013, y Zdravkovic 2005, 2007a, 2009, 2012, 2013). La población del Atlántico de los EE.UU. se estima entre 1.000–1.100 parejas reproductivas (≤ 2.200 individuos) (Boettcher 2007, Cameron 2008, Georgia DNR 2010, FSA 2011, Sanders *et al.* 2013) y la población de la costa del Golfo se estiman entre 3.000–3.200 parejas reproductivas (≤ 6.400 individuos) (Zdravkovic 2005, 2009, 2012a, 2012b; base de datos de Florida Shorebird Alliance 2011). Ningún censo exhaustivo ha sido llevado a cabo en México. En el año 2006, la Conservación de Aves Costeras (CBC por sus siglas en inglés) realizó censos durante la época reproductiva en la Laguna Madre de México, en los que se encontraron 619 parejas reproductivas (Zdravkovic 2007a). Estos datos, combinados con los estimados del noreste de México y la Yucatán, dan un total de aproximadamente 975–1.025 parejas reproductivas (≤ 2.050 individuos). No hay censos exhaustivos de *C. w. wilsonia* que hayan sido llevados a cabo en el Caribe. La población reproductiva de Puerto Rico está estimada entre 180–200 parejas (A. Morales-Pérez y J. Salguero comm. pers.) y en las Islas Vírgenes de los EE.UU. la población reproductiva se estima entre 45–65 parejas (Lombard 2007*).* Un estimado de la población para el Caribe es de 1.800–2.000 parejas reproductivas (≤ 4.000 individuos), el cual está basado en datos parciales de censos, y datos de su ámbito y distribución. Este estimado incluye la población del Caribe de los EE.UU. Por lo tanto, el estimado de la población total de la subespecie *C. w. wilsonia* es de **13.550–14.650** adultos reproductivos.

No hay datos existentes para las poblaciones de las otras dos subespecies *C. w. cinnamonius* y *C. w. beldingi.* Los estimados de las poblaciones se basan en densidades conocidas de poblaciones reproductivas de *C. w. wilsonia* que se usaron para extrapolar los estimados para ambas subespecies. La población estimada para ***C. w. cinnamonius*** es de **6.500–8.500** adultos reproductivos. La población estimada para ***beldingi*** es de **6.500–8.500** adultos reproductivos. El estimado de la población en todo el ámbito de distribución para las tres subespecies son de **26.550 –31.650** adultos reproductivos.

Censos recientes han identificado que Texas alberga la mayor población reproductiva conocida actualmente del *Charadrius wilsonia* (*C. w. wilsonia*) en Norte América, que acoge aproximadamente el 31% de la población estimada en los Estados Unidos; solo la Laguna Madre de Texas acoge el 20% de los 8.600 adultos reproductivos estimados del *Charadrius wilsonia* se encuentran en los EE.UU. (Liptay y Zdravkovic 2008; Zdravkovic 2005, 2013). La costa de Louisiana es el segundo sitio de reproducción de importancia y acoge aproximadamente el 30% de la población de los Estados Unidos (Zdravkovic 2013). Los macrohábitats de reproducción más importantes usados por el *Charadrius wilsonia* en los EE.UU. son las islas barreras/penínsulas y los hábitats artificialmente creados o restaurados.

Las áreas de no reproducción conocidas en los Estados Unidos incluyen los sitios en Texas, Louisiana, Florida, y Carolina del Sur; en Centro América, sitios en la costa del Pacífico de El Salvador (Jones y Komar 2008); y en Suramérica, sitios en la costa del Pacífico de Colombia (Ruiz *et al.* 2008). Sin embargo, la información es escasa por falta de datos de las poblaciones en buena parte del ámbito de la especie.

El *Charadrius wilsonia* está incluido en el Plan de Conservación de Aves Playeras de los Estados Unidos como una "especie de alta preocupación" (Categoría 4) debido a la gran cantidad de amenazas en sus áreas de reproducción e invernada, su pequeña población, y su restringida área de reproducción (Brown *et al.* 2001). La tendencia de la población de la especie fue recientemente reevaluada y su categoría es de Aparente Disminución (Tendencia 4) en las estimaciones de las poblaciones de aves playeras de América (Andres *et al*. 2012). La designación de WatchList de Audubon para el *Charadrius wilsonia* es de ave de Prioridad Alta Moderada (Categoría Amarilla). El *Charadrius wilsonia* no tiene ningún estatus federal en el listado de especies amenazadas o en peligro más allá del Acta de Tratado de Aves Migratorias de los Estados Unidos. Las amenazas y los riesgos actuales para el *Charadrius wilsonia* son principalmente inducidos o provocadas por el hombre. La pérdida de hábitat y la perturbación humana en las áreas de anidación son las principales amenazas para la especie (Corbat y Bergstrom 2000).

El *Charadrius wilsonia* debe ser considerado como una "especie sucedánea" potencial por el Servicio de Pesca y Vida Silvestre de los EE.UU. (USFWS por sus siglas en inglés) para las especies de aves que anidan en las playas en las regiones sureste y suroeste de los EE.UU. La especie es considerada como una "especie indicadora" para las aves que anidan en las playas

para los Cooperativos para la Conservación de Paisajes (LLCs por sus siglas en inglés) de la región Planicies Costeras del Golfo-Ozarks, y debe ser también considerada como una especie indicadora para los LLCs del Atlántico Sur, la Península de Florida, las Praderas Costeras, y el Caribe (C. Hunter, USFWS, comm. pers.).

El *Charadrius wilsonia* merece acciones inmediatas de conservación debido a: 1) una población pequeña que está disminuyendo, así como un ámbito que se está reduciendo; 2) pérdida continua de hábitat de reproducción y no reproducción en todo su ámbito; 3) falta de datos de monitoreo en todo su ámbito para establecer el estado de sus poblaciones; y 4) alta vulnerabilidad al cambio climático global. Los principales factores que contribuyen a la disminución de las poblaciones del *Charadrius wilsonia* incluyen:

- Pérdida de hábitat causada por constante desarrollo y la alteración de los hábitats costeros por humanos en todo su ámbito.
- Altos niveles de perturbación por actividades recreativas en áreas de migración, reproducción, e invernada que hacen inservibles muchos de los hábitats potenciales o que fueron alguna vez usados por la especie.
- Falta de estatus específicos de protección en los Estados Unidos y en otros países en todo su ámbito, a pesar de tener una población pequeña y en disminución.
- Alta vulnerabilidad de la especie a cambios climáticos globales futuros y actuales y aumento en el nivel del mar.
- Única especie de los seis Charadridae que se reproducen en los Estados Unidos o Norteamérica sin una población significativa reproductiva en el interior.

Acciones de conservación recomendadas:

Petición para incluir la subespecie *C. w. wilsonia* en el listado federal de los Estados Unidos de especies amenazadas o en peligro, dado que su población es pequeña y se está reduciendo en los EE.UU. (≤8.600 adultos reproductivos), su limitado y cada vez más reducido ámbito, la rápida pérdida de su hábitat, y la intensa perturbación por humanos durante todas las etapas del ciclo de vida de la especie. El estatus federal de especie amenazada o en peligro del *Charadrius wilsonia* proporcionará un "efecto sombrilla" de protección para todas las aves que anidan en las playas y usan los mismos hábitats, particularmente en la costa del Golfo de los

EE.UU., parecido a como ocurre con *Charadrius melodus* en la costa del Atlántico. Implementar esta acción clave de conservación apoyará y brindará la oportunidad para las siguientes acciones de conservación propuestas:

- Preservar agresivamente todos los hábitats costeros que quedan en los sitios claves conocidos en todo el ámbito de la especie a través de la adquisición de tierras, servidumbres para la conservación, la zonificación.
- Restringir la reconstrucción de estructuras no esenciales en las zonas costeras de alto riesgo en las playas barreras, islas barreras, y hábitats costeros después de eventos de tormenta.
- Apoyar fuertemente la creación, aumento, y restauración de hábitats usados por las aves que anidan en las playas, por los métodos sensibles a las necesidades del *Charadrius wilsonia* y otras aves que anidan en las playas.
- Aumentar el monitoreo del estado y la tendencia de las poblaciones del *Charadrius wilsonia* a través de censos a gran escala, simultáneos, estandarizados, exhaustivos, coordinados, y regulares en áreas de reproducción y no reproducción, usando un método de censo de multi-especies de aves playeras donde sea apropiado.
- Identificar hábitats claves de migración, invernada, y reproducción del *Charadrius wilsonia*; implementar las actividades de monitoreo, protección, estabilización, y/o restauración cooperativamente con socios a través de métodos adecuados y estandarizados para mantener o incrementar los niveles actuales de las poblaciones del *Charadrius wilsonia*.
- Priorizar la investigación dirigida a llenar los vacíos de conocimiento en la ecología y conservación del *Charadrius wilsonia*, a mejorar directamente la especie y sus hábitats, y a apoyar la legislación de protección.
- Investigar los impactos de la perturbación que afectan la población reproductiva y no reproductiva del *Charadrius wilsonia* (incluidas todas las especies de aves playeras que usan los mismos hábitats), y aspectos claves de las rutas migratorias de la especie, la determinación de sus subespecies, su productividad, su longevidad, y su supervivencia.

PURPOSE

"We have no right to exterminate the species that evolved without us... we have the responsibility to do everything we can to preserve their continued existence."

– Sir David Attenborough

The purpose of this conservation plan is to provide all organizations and individuals working or living within the coastal zone with the most current information about the populations and habitats of the Wilson's Plover throughout the species' range. The audience for this plan includes federal and state agencies, nongovernmental organizations (NGOs), policy makers, site managers, scientists, academics, funding agencies, private landowners, and the public. This plan addresses conservation issues that are key to achieving the population goals set forth in the U.S. Shorebird Conservation Plan (Brown *et al.* 2001) and contains much new information on Wilson's Plover *(C. w. wilsonia)* population status, distribution, abundance, habitat use, and key breeding sites in the United States.

The Wilson's Plover Conservation Plan presents new range-wide subspecies population estimates and new information on Wilson's Plover breeding biology and behavior that will directly affect the conservation and management of this species.

The plan was written in accordance with the U.S. Shorebird Conservation Plan (Brown *et al.* 2001), the Piping Plover Atlantic Coast Population Revised Recovery Plan (USFWS 1996), and the Recovery Plan for the Pacific Coast Population of the Western Snowy Plover (USFWS 2007); these documents are cited frequently throughout the plan. While this conservation plan focuses on the Wilson's Plover, inclusive references to other beach-nesting bird species are made in support of Wilson's Plover conservation. Due to the similarities in habitat requirements, breeding biology, behavior, and conservation concerns among Piping Plover *(Charadrius melodus)*, Snowy Plover *(Charadrius alexandrinus)*, and Wilson's Plover, successful conservation actions employed for Piping and Snowy Plovers can be expected to yield similar beneficial results for the Wilson's Plover. The Wilson's Plover shares the same or similar breeding and/or nonbreeding habitats with many other shorebird species including American Oystercatcher *(Haematopus palliatus)* and Red Knot *(Calidris canutus)*, and with many colonial

beach-nesting seabirds such as Black Skimmer *(Rynchops niger)* and Least Tern *(Sternula antillarum)*.

Wilson's Plover populations are sustained by the same habitats that support many of the shorebirds listed in the U.S. Shorebird Conservation Plan as well as federally listed non-avian species such as beach mouse (*Peromycus polionotus)* and several species of sea turtles; all currently face the same or very similar conservation threats as the Wilson's Plover. Implementing actions to conserve the Wilson's Plover and its breeding, migratory, and wintering habitats will benefit multiple imperiled wildlife species in the same coastal ecosystem. Partnering efforts that address the large ecological overlap of imperiled coastal wildlife will maximize the overall effectiveness of all conservation actions taken.

STATUS AND NATURAL HISTORY

"Here, if we love to wander in these seaside solitudes, we may see this gentle bird running along the beach ahead of us, his feet twinkling so fast we can hardly see them; he is unafraid, as he stops and turns to watch us; the black bands on his head and chest help to obliterate his form and he might be mistaken for an old seashell or a bit of driftwood; but, as we draw near, he turns and runs on ahead of us, leading us thus on and on up the beach. There is an air of gentleness in his manner and an air of wildness in his note as he flies away".

– Arthur Cleveland Bent,
"The Wilson's Plover, Life Histories of North American Shorebirds," 1929

The Wilson's Plover (*Charadrius wilsonia)* is a medium-size shorebird found primarily in coastal habitats. It nests on barren to densely vegetated substrates (Zdravkovic 2005) above the high-tide line on barrier islands, coastal lagoon shores, mainland beaches (Corbat and Bergstom 2000), dredge spoil islands, rivermouth habitat, coastal saline lakeshores, and occasionally on inland, saline lake shorelines relatively close to the coast (Zdravkovic 2005). The species' breeding range is contracting at the northern limits and it no longer nests north of Virginia on the Atlantic Coast (Corbat and Bergstrom 2000). Historically, this species extended as far north as New Jersey. Limited trend data available for this species indicate that Wilson's Plover populations are in decline due to human-caused disturbance and habitat loss.

Scientific Name: *Charadrius wilsonia* / **English Common Name:** Wilson's Plover / **French Common Name:** Pluvier de Wilson / **Spanish Common Name:** Chorlo Pico Grueso or Chorlito Piquigrueso / **Portuguese Common Name:** Batuíra-Bicuda / **Venezuelan Common Name:** Playero Corredor / **Other Common Name:** Thick-billed Plover

MORPHOLOGY

The Wilson's Plover (*Charadrius wilsonia)*, named for Alexander Wilson by his friend George Ord in 1814, is a medium-size, ringed plover measuring approximately 6.5–7.9 in. (165–200 mm) in length, weighing 1.9– 2.5 oz. (55–70g), with a single breast band. It has flesh-colored to pinkish legs and feet, and a long, heavy bill that is black in all plumages. Its upper parts are generally grayish brown; under parts are white; and back plumage color is separated from the head plumage color by a white collar. In breeding plumage, the Wilson's Plover has a complete breast band that is brownish to black in color and generally wider than the breast band of other North American plovers. Both sexes are similar in appearance, except that the breast band, lores, and fore-crown appear black on the male and more gray-brown with a rufous tinge on the female. Nonbreeding adults of all races resemble breeding females and are not visually distinguishable (ffrench 1973, Ruiz *et al.* 2008) (Fig.2 shows annual plumages)**.**

Fig. 2. Wilson's Plover subspecies (*C. w wilsonia*) in breeding and nonbreeding plumages: 1.) Breeding Female, 2.) Breeding Male, 3.) Male transition to breeding plumage, 4.) Winter adult.
(photos 1-3 ©M. Zdravkovic/Conservian; photo 4, C. Anderson).

Map 1. Wilson's Plover Range-wide Subspecies Map.

TAXONOMY

There are three generally recognized Wilson's Plover subspecies, *C. w. wilsonia*, *C. w. cinnamonius,* and *C. w. beldingi* (Map 1). Geographic differences are noted in the coloration of upper parts, facial and head pattern, and breast band width; no differences are noted in general size, except perhaps in middle toe length (Ridgeway 1919, Hellmayr and Conover 1948, Blake 1977). Plumage varies geographically, with West Indian and South American breeding birds showing more rufous on the head and breast band (Corbat and Bergstrom 2000).West Indian individuals were formerly recognized as a fourth subspecies "*rufinucha*" or "*rufincha*," but no consistent differences exist (Ridgeway 1919, Hellmayer and Conover 1948). Study of subspecies' DNA is needed to determine current or additional Wilson's Plover subspecies.

POPULATION ESTIMATE

C. w. wilsonia

The population estimates presented in this plan use the U.S. Shorebird Conservation Plan confidence level ratings (Brown *et al.* 2001) (*see key to ratings below*). The current Atlantic Coast breeding population estimates by state, based on comprehensive surveys for the southeast coastal United States are: **Virginia** 25–35 pairs; **North Carolina** 245–270 pairs; **South Carolina** 375–400 pairs; and **Georgia** 355–395 pairs (Georgia DNR 2010). The total U.S. Atlantic population is estimated at 1,000–1,100 breeding pairs (≤ 2,200 individuals) (Boettcher 2007, Cameron 2005, 2008; Georgia DNR 2010, FSA 2011, Sanders *et al.* 2013). From 2004 to the present, Coastal Bird Conservation (CBC) conducted the first standardized, comprehensive surveys for breeding, beach-nesting birds including Wilson's Plover (*C. w. wilsonia)* on the U.S. and Mexican Gulf Coasts. Breeding Wilson's Plover pairs located during the most current surveys are shown in Table 1. Estimates were made using survey data for each state: **Texas** 1,225–1,330 pairs; **Louisiana** 1,260–1,290 pairs; **Mississippi** 25–35 pairs; and **Alabama** 15–20 pairs (Liptay and Zdravkovic 2008, Zdravkovic 2005, 2007a, 2009, 2012a, 2012b). In **Florida**, state-wide surveys have not been conducted for Wilson's Plover. A population estimate of 475–525 pairs (1,050 individuals) is based on combined numbers for known surveyed sites/regions in Florida (Zdravkovic 2009, Zdravkovic *in prep*, Florida Shorebird Alliance (FSA) Database 2011). The U.S. Gulf Coast population is estimated at 3,000–3,200 breeding pairs (≤ 6,400 individuals). The Wilson's Plover high-confidence total population for the **continental United States** is estimated at **4,000–4,300 breeding pairs (≤ 8,600 individuals)** (Table 1).

U. S. Shorebird Conservation Plan Confidence Level Ratings

Poor: A population estimate based on an educated guess.

Low: A population estimate based on broad-scale surveys where estimated population size is likely to be in right order of magnitude.

Moderate: A population estimate based on a special survey or on broad-scale surveys of a narrowly distributed species whose populations tend to concentrate to a high degree either a) in a restricted habitat, or b) at a small number of favored sites. Estimate thought to be within 50% of the true number.

Good: A calculated estimate based on broad-scale mark:recapture ratios or other systematic estimating efforts resulting in estimates on which confidence limits can be placed.
High: Number obtained from a dedicated census effort and thought to be accurate and precise.

Table 1. Continental U.S. Wilson's Plover *(C. w. wilsonia)* breeding pair population estimates by state.

STATE	Wilson's Plover Pairs (survey data)	Range Estimate (in pairs)	Data Year & Source
Virginia	30 pairs	25–35 pairs	Boettcher 2007
North Carolina	242 pairs	245–270 pairs	Cameron 2008
South Carolina	371 pairs	375–400 pairs	Sanders *et al.* 2013
Georgia	359 pairs	355–395 pairs	GADNR 2010
SE Atlantic Total	1,004 pairs	1,000– 1,100 pairs	
Florida	466 pairs	475–525 pairs	CBC data (Zdravkovic 2009), FSA database 2011
Alabama	17 pairs	15–20 pairs	Zdravkovic 2013
Mississippi	25 pairs	25–35 pairs	Zdravkovic 2013
Louisiana	1,276 pairs	1,260–1,290 pairs	Zdravkovic 2013
Texas	1,090 pairs	1,225–1,330 pairs	Zdravkovic 2005, 2008, 2013
Gulf Coast Total	2,874 pairs	3,000– 3,200 pairs	
U.S. Total	**3,878 pairs**	**4,000–4,300 pairs**	

No national comprehensive surveys have been conducted in **Mexico**. In 2006, CBC conducted surveys in Laguna Madre of Mexico documenting 619 breeding pairs; based on these surveys, the population is estimated at 650–750 pairs (≤ 1,500 individuals)(Zdravkovic 2007a). These data, combined with estimates for the northeast Mexican coast and Yucatan, total approximately 975–1,025 breeding pairs (≤ 2,050 individuals) (Zdravkovic 2007a).

No comprehensive surveys have been conducted for *C. w. wilsonia* in the **Caribbean**. The Puerto Rico breeding population is estimated at 180–200 pairs (A. L. Morales-Pérez and J. Salguero pers. comm.) and the U.S. Virgin Islands' breeding population is estimated at 45–65 pairs (Lombard 2007). A low- to moderate-confidence population estimate for the Caribbean of 1,800–2,000 breeding pairs (≤ 4,000 individuals) is based on partial survey data and range and

distribution data. This estimate includes the U.S. Caribbean population. Thus, the total moderate-confidence subspecies population estimate for *C. w. wilsonia* is **13,550–14,650 breeding adults.**

C. w. cinnamonius* and *C. w. beldingi

C. w. cinnamonius is found from northeast Colombia to northeast Brazil and the southern Caribbean islands. *C. w. beldingi* is found from the Pacific coast of northwest Mexico to central Peru. No comprehensive population data exist for these two subspecies from the Caribbean or Central and South America, and very little is known about their population status. *C. w. beldingi* was included in a Snowy Plover breeding survey conducted by Pronatura Noroeste on the Pacific coast of Mexico in 2007, which reported 850 individuals (Palacios *et al.* 2009). The survey was not considered comprehensive for Wilson's Plover because efforts focused primarily on Snowy Plover.

During the writing of this plan, an extensive number of colleagues from *C. w. cinnamonius* and *C. w. beldingi* breeding ranges were contacted about breeding population estimates; nearly all replied, however no estimates were offered. Historical shorebird literature was searched for absence/presence data on Wilson's Plover, but little information was gleaned. This lack of data is in itself informative and may indicate the uncommonness of this species. Given the absence of survey data for both of these subspecies in all areas except Pacific coastal Mexico, a formula based on known densities of U.S. and Mexico Gulf Coast breeding populations was applied to range-wide subspecies' coastline measurements for unknown areas, and used to extrapolate a low to moderate confidence estimate. For *C. w. cinnamonius*, this population estimate is **6,500–8,500** breeding adults; for *C. w. beldingi,* **6,500–8,500** breeding adults. Given the comprehensive breeding density data and male/female ratios for the U.S. and northeast Mexico, it is unlikely that true breeding adult numbers will exceed the high end of these ranges.

Low- to moderate-confidence range-wide population estimates for the combined Wilson's Plover subspecies (all three) total **26,550–31,650** breeding adults (13,275–15,825 pairs)(Table 2).

Table 2. Wilson's Plover (*Charadrius wilsonia*) Range-wide Subspecies Population Estimates

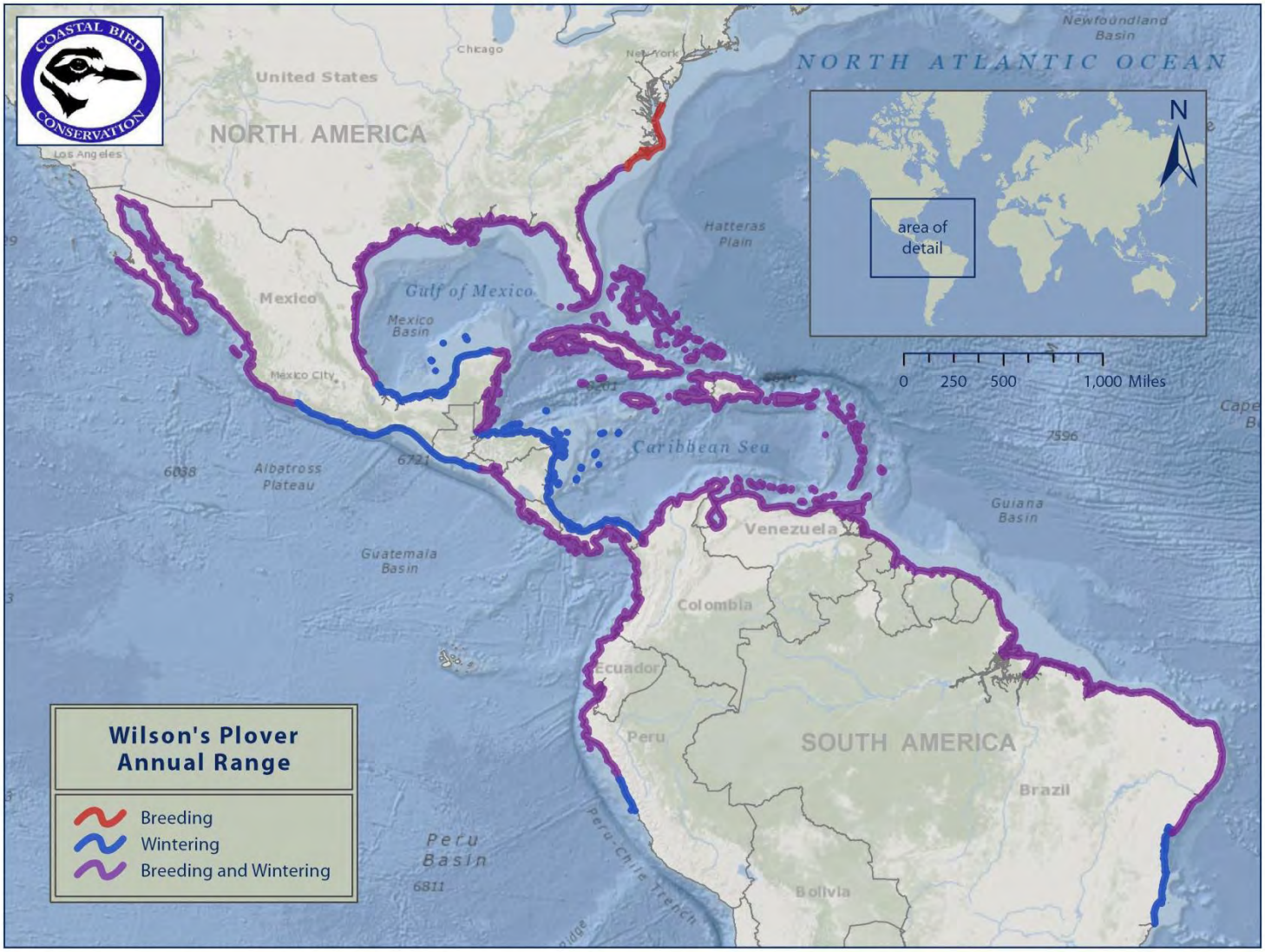
Subspecies	Estimate in Pairs	Breeding Individuals
C. w. wilsonia	6,775–7,325 pairs	13,550–14,650 individuals
C. w cinnamonius	3,250–4,250 pairs	6,500–8,500 individuals
C. w. beldingi	3,250– 4,250 pairs	6,500–8,500 individuals
Total Species Population	**13,275–15,825 pairs**	**26,550–31,650 individuals**

Note: Population estimates in this plan for the U.S. Atlantic and Gulf Coasts and northeast Mexico for *C. w. wilsonia* are based on breeding pair numbers located during comprehensive, standardized, coordinated census efforts. Ranges are given to account for known or potentially unsurveyed habitat and/or potentially missed birds. Due to very low numbers of single birds detected during breeding surveys, by multiple surveyors across multiple regions and years, on the U.S. Atlantic and Gulf Coasts and the Mexico Gulf Coast, no standard formulas were applied to these totals; also, no assumptions were made regarding undetected single birds. ***It is strongly recommended that no single bird formulas be applied to these numbers,*** as there is no evidence (for this species) to warrant this assumption. Current and reliable survey and nest monitoring data in areas of both high and low breeding populations indicate that male/female sex ratios for the Wilson's Plover are approximately 1:1 (Winn and George 2001, Zdravkovic and DeMay 2006, Boettcher *et al.* 2007, Mendez 2007, Lombard 2007, Cameron 2008, Liptay and Zdravkovic 2008, Sanders *et al*. 2013, Zdravkovic 2005, 2007a, 2010).

TREND INFORMATION

Little historical data exist to document trends in *C. w. wilsonia* range-wide population, and no trend data are available for *C. w. cinnamonius* or *C. w. beldingi*. The known historical breeding range of the Wilson's Plover has contracted at the northern limits and this species no longer breeds in New Jersey or Maryland (Corbat and Bergstom 2000). The last documentation of nesting in New Jersey occurred in 1955 (Sibley 1997); the last known nest in Maryland was on Assateague Island in 1985. The Wilson's Plover was last observed in Maryland in 1989 (Hoffman 1996). The current northernmost limit of its breeding range is Virginia (Corbat and

Bergstrom 2000). Analyses of Audubon Christmas Bird Count data indicate both short- and long- term declines (Butcher and Niven 2007) and a 78% decline in Wilson's Plovers wintering in the continental United States over the past 40 years (NABCI, State of the Birds 2009). The species is categorized as Trend 4 (Apparent Decline) in recent population estimates of American shorebirds (Andres *et al.* 2012). In **North Carolina**, the species was once considered common, as described by Pratt (1919): "In North Carolina it is one of the most common and widely distributed beach-nesting birds." However, fewer than 250 pairs now breed in the State (Cameron 2005). Nesting pair numbers on Ocracoke Island and Hatteras Spit on Hatteras Island have declined, and nesting no longer occurs at Oregon Inlet (Fussell 1994). In **Florida**, Audubon Christmas Bird Count data from 1967 to 2007 show a decline of 90.5% in wintering Wilson's Plover populations (Niven 2007). Cruickshank (1980) reported a sharp decrease from 1960 to 1980, which he attributed to human encroachment in plover habitat in Brevard County. Weston (1965) reported a decline in northwestern Florida from 1916 to 1964, describing the species as "formerly common, but now decidedly uncommon" in the Pensacola area. Howell (1932) considered the Wilson's Plover as "common" statewide and noted that John James Audubon mentioned this wintering shorebird species as "more abundant than any other" near St. Augustine in 1885. Scott (1881) also noted that Audubon called the bird abundant in Clearwater (*in* Howell 1932). On Mustang Island in **south Texas**, both Wilson's and Snowy Plover staging populations are declining (Amos 2005). No trend data are available for subspecies *C. w. beldingi* or *C. w. cinnamonius.*



Map 2. Wilson's Plover Annual Range Map

DISTRIBUTION

Breeding Range

C. w. wilsonia

C. w. wilsonia currently breeds from Virginia to Florida on the U.S. Atlantic coast; on the U.S. and Mexican Gulf Coast to northern Veracruz; from Yucatán, Mexico, to mainland Belize and Belize Cays; and throughout the Bahamas, Greater Antilles, Virgin Islands on St. Martin, St. Barthélemy, St. Kitts (St. Christopher), Antigua, and Barbuda in the northern Lesser Antilles (Stevenson and Anderson 1994, Howell and Webb 1995, Turcotte and Watts 1999, Texas Breeding Bird Atlas 1987–1992 unpubl. data, Raffaele *et al.* 1998). Breeding is unconfirmed farther south along the Caribbean coast of Central America. No breeding records have been

recorded south of Belize (Am. Ornithol. Union 1998), including the Caribbean coasts of Costa Rica (Stiles and Skutch 1989) and Panama (Ridgely and Gwynne 1989).

C. w. cinnamonius

C.w cinnamonius breeds in the southern Caribbean from northeast Colombia to northeast Brazil, Baia de Todos os Santos (Lunardi and Macedo 2010) and islands of Trinidad, Aruba, Bonaire, Margarita, and Curaçao off the coast of Venezuela (Meyer de Schauensee and Phelps 1978, Voous 1983, Hayman *et al.* 1986, Hilty and Brown 1986, Tostain *et al.* 1992, Sick 1993, Am. Ornithol. Union 1998). In Brazil, the subspecies has been recorded nesting along the Maranhão coast in May (Rodrigues *et al.* 1996); Rio Grande do Norte in March, April, and June (Sick 1997, Azevedo *et al.* 2004); and in Bahia from April to October. Bahian birds are considered to be resident in Mangue Seco, on the northern coast (Grantsau *et al.* 2002).

C. w. beldingi

C. w. beldingi breeds on the Pacific coast of Northwest Mexico, including central Baja California, south to Panama, and from the Pacific coast of Colombia to northwest Peru (Ridgeway 1919). More specifically, in **Mexico** *C. w. beldingi* breeds on the west coast of Baja California Sur and from throughout the Gulf of California south to Nayarit (Howell and Webb 1995, Russell and Monson 1998). In Central America, *C. w. beldingi* breeds in **El Salvador** at Bahía de Jiquílisco (Thurber *et al.* 1987); along the Pacific coast of **Costa Rica** at Golfo de Nicoya (Stiles and Skutch 1989); and in **Panama** at Playa Coronado (western Panama Province), Aguadulce (Coclé Province), and the Pearl Islands (Ridgely and Gwynne 1989, Am. Ornithol. Union 1998). In South America *C. w. beldingi* breeds in **Colombia**'s Sanquianga National Park (Ruiz *et al.* 2008) (Map 2 shows species annual range).

All Subspecies

The Wilson's Plover has no known significant inland breeding populations. The inland-most breeding record for *C. w. wilsonia* is from La Sal Vieja, a salt lake in southeast Texas located approximately 64 km (40 miles) inland from the Gulf of Mexico. A small group of two to four nesting pairs were found at this site during three consecutive breeding season surveys

(Zdravkovic 2005). On the U.S. Pacific coast, a single inland breeding record exists from 1948 for *C. w. beldingi* from the Salton Sea in southeast California (Am. Ornithol. Union 1983).

Nonbreeding Range

C. w. wilsonia

Wilson's Plovers winter in very low numbers on the Atlantic Coast from North Carolina to northern Florida, and on the Gulf Coast in Texas, Louisiana, Alabama, Mississippi and northern Florida. Wintering populations greater than 200 individuals have not been located in the United States, as most birds leave the Atlantic and upper Gulf Coast states by late fall; however, the greatest Wilson's Plover U.S. winter populations are found in south Florida (Root 1988, Christmas Bird Count data, Sprandel *et al.* 2000, Smith 2007, Elliott-Smith *et al.* 2009, Zdravkovic and Durkin 2011). International Winter Piping Plover Census data show that only 844 individuals were detected across the entire U.S. and Caribbean range, with 48% of the birds located in Florida and 38% in the eastern Caribbean (Elliot-Smith *et al.* 2009). Coastal Bird Conservation (CBC) nonbreeding surveys of the lower Laguna Madre show that most Wilson's Plovers have left the south Texas region by November (Zdravkovic and Durkin 2011).

Birds winter from Florida south throughout the breeding range in the Caribbean, to coastal Mexico and Central America, to northern South America (Corbat and Bergstrom 2000). In the United States, nonbreeding Wilson's Plovers congregate in loose groups, mixed with other shorebirds, most often Semipalmated Plover *(Charadrius semipalmatius).* Most groups range from fewer than 10 birds up to 100 individuals (Zdravkovic 2009).

The highest nonbreeding (staging/migratory) numbers for *C. w. wilsonia* in the United States have been recorded on San Jose Island on the south Texas coast, with 1,000–1,200 individuals in mid-July (Amos 2005). Other high counts (individuals) include: in the lower Laguna Madre, Texas, 175 in July (Liptay and Zdravkovic 2008); in South Carolina, 93 in August (S. Maddock unpubl. data); in northeast Florida , 126 in July (P. and D. Leary unpubl. data) and 138 in September (Huguenot Memorial Park Management Plan 2008); in southwest Florida, 194 in February (L. Kenney unpubl. data); and in the Lower Florida Keys, 96 in October and 72 in December (Zdravkovic 2009).

In El Salvador, several hundred migratory/wintering birds have been documented on the estuaries of Bahía de Jiquilisco and Jaltepeque and Río Lempa (Jones and Komar 2008).

Migratory *C. w. wilsonia* from the north also have been observed wintering as far south as the Atlantic coast of South America (including offshore islands) south to Bahia, Brazil (Sick 1993), and to coastal São Paulo, Brazil (R. Ridgely and L. Bevier pers.comm.*in* Corbat and Bergstrom 2000).

All Subspecies

Much information is lacking on Wilson's Plover wintering habitat locations outside its U.S. range. Subspecies-specific population numbers of wintering Wilson's Plover are currently unknown, as winter plumages of all subspecies are too similar to be distinguished visually (ffrench 1973, C. Ruiz unpubl. data). The highest global concentrations of wintering Wilson's Plovers, as much as 10% of the species' population, have been recorded in mangroves and mudflats on the south Pacific coast of Colombia (Ruiz *et al.* 2008). All three Wilson's Plover subspecies have been recorded in Colombia (Naranjo *et al.* 1987, Ruiz *et al.* 2008). On the Pacific coast, *C. w. wilsonia* and *C. w. beldingi* were first reported during a shorebird distribution and habitat selection study at Buenaventura Bay (Naranjo *et al.* 1987). *C. w. beldingi* has been recorded wintering along the Pacific coast south to Peru (Hayman *et al.* 1986). It is likely that high numbers of Wilson's Plovers may be wintering in yet unsurveyed areas of the Caribbean and Central and South America.

MIGRATION

Northbound

Northbound (spring) migration to breeding grounds begins as early as January in south Florida and February in south Texas, and continues through the end of March on the Gulf Coast (Zdravkovic 2005, Zdravkovic 2009, Zdravkovic 2010, M. Zdravkovic unpubl. data). On the Atlantic Coast, pairs form by mid-March (Tomkins 1944). In Panama, most individuals leave the west coast during the last half of March and return in late September (Strauch and Abele 1979). In a resident population in Venezuela, pair formation and breeding activities begin in March (Morrier and McNeil 1991).

Southbound

Timing of staging and southbound (fall) migration to wintering grounds fluctuate yearly, but most breeding Wilson's Plovers and their fledged young move out of nesting territories in south coastal Texas by the first week of July; in Louisiana, Mississippi, Alabama, and Florida, it's by mid to late July. They begin congregating in small mixed flocks, ranging from 10 to 40 adults and juveniles, at nearby coastal areas where there is good foraging habitat. Late-nesting birds may tend broods until mid- August on the U.S. Gulf Coast (Zdravkovic 2005, 2007b, 2009, 2010). Large staging groups have been documented in July in coastal south Texas. Staging groups ranging from 200 to 400 individuals have been recorded on the front beaches of San Jose Island in south Texas in early to mid- July (Amos 2005). Coastal Bird Conservation (CBC) has documented staging groups of up to 170 individuals in late July on Boca Chica Flats at the mouth of the Rio Grande, Texas (Liptay and Zdravkovic 2008). Most of the fall migration along the Gulf Coast occurs August through October (Howell and Webb 1995). On the Atlantic Coast, Wilson's Plovers leave some barrier beaches by July, but congregate in flocks on other beaches (Corbat 1990); most of the fall migration occurs in August and September, "although occasionally some birds may linger at northern limits of range until November" (Palmer 1967).

Residential Range

Populations are considered "residential" when a species can be found year round, however, numbers may fluctuate seasonally with migration through an area. In the Caribbean, some resident populations in the Greater Antilles decline during the nonbreeding season (Raffaelle *et al.* 1998), indicating that some breeders there may be migratory. In Panama, Ridgely *et al.* (1998) recorded that resident Wilson's Plover numbers were greatly augmented by northern migrants with "flocks of well over 100" in the Canal Zone at Farfan Beach and Fort Amador. In Colombia, populations of resident Wilson's Plovers along the Pacific coast have been estimated in the hundreds (Franke 1986, Naranjo *et al.* 1987, Aparicio *et al.* 1996, Naranjo and Mauna 1996). Sanquianga National Park has been identified as an important site for Wilson's Plovers on the southern Pacific coast. Both *C. w. wilsonia* and *C. w. beldingi* occur in the park's Delta del Río Iscuandé throughout the year, with a peak abundance of 1,500 individuals recorded in January (Ruiz *et al.* 2008). Currently, there are no data available on the major migration routes of Wilson's Plover.

DIET AND FORAGING HABITAT

Fiddler crab *(Uca spp.)* is the main food source for the Wilson's Plover (Fig.4), however they will also consume a variety of insects and small crustaceans (Strauch and Abele1979, Morrier and McNeil 1991, Thibault and McNeil 1994, 1995). Studies within the coastal lagoons of northeastern Venezuela found 98% of the diet of *C. w. cinnamonius* to be comprised of *Uca cumulanta* (Morrier and McNeil 1991). Wilson's Plovers are visual feeders, capturing fiddler crabs by pursuing them (Thibault and McNeil 1995), shaking the carapace free of the legs, then swallowing it whole (Bergstrom 1982) (Fig.3).

Fig. 3. Wilson's Plover with fiddler crab / ©C. Anderson

Fig. 4. Fiddler Crab colony / ©M.Zdravkovic/Conservian

In Georgia, the birds forage on intertidal mudflats (Strauch and Abele 1979, Thibault and McNeil 1994, 1995) and on areas above the high-tide line on sandy beaches (Corbat 1990); in Texas, it is on sparsely vegetated salt flats (Bergstrom 1982). Because the Gulf of Mexico tidal range is very low, Wilson's Plovers are not dependent on low tides for feeding and will forage throughout the day and night. In south Texas and northeast Mexico, they feed on fiddler crabs usually found above the low-tide line, behind the primary dune line, and on the damp wind-driven tidal flats of the Laguna Madre that are often associated with low-lying, vegetated areas, washover salt ponds, and lagoon edges and inlets. In Louisiana, Mississippi, Alabama, and Florida, Wilson's Plovers forage for fiddler crabs on sparsely to densely vegetated flats on the bayou side (back side) of barrier beaches, inlet and washover salt ponds, saltmarsh edges, and

Gulf inlets associated with mainland beach habitat, mangrove wetlands, and lagoons (Zdravkovic 2005, Zdravkovic 2010). The birds also feed on aquatic invertebrates found on front beach shorelines throughout the Gulf Coast (Liptay and Zdravkovic 2008.)

BREEDING BIOLOGY AND BEHAVIOR

Fig. 5. Female Wilson's Plover on nest, LA / © M.Zdravkovic/Conservian

Breeding and Nesting Chronology

The Wilson's Plover breeding season starts when birds choose mates and begin to defend breeding territories. In the United States, pairs are present on breeding grounds in the southernmost latitudes of **Florida** by mid to late January (Zdravkovic 2009). Wilson's Plovers form seasonally monogamous pair bonds. There has been no documentation of marked birds exhibiting courtship behavior with more than one bird during the same breeding season (Bergstrom and Corbat 2000). Wilson's Plover nesting chronology is fairly consistent throughout the Gulf Coast. CBC data indicate that Wilson's Plovers in **coastal Florida, Alabama,**

Mississippi, Louisiana, Texas, and northeast Mexico begin nesting during the same time period during the third week of March; however, early nests and peak nesting and peak hatching periods may fluctuate by a week or more from year to year (Zdravkovic 2005, Zdravkovic and DeMay 2006, Zdravkovic 2009, Zdravkovic 2010). Accurate knowledge of local Wilson's Plover nesting chronology is very important for site managers to ensure proper timing of protective measures.

Preliminary data from a pattern recognition study using digital images of Wilson's Plovers have documented the same pair returning to the same nesting area for two consecutive breeding seasons (Zdravkovic 2009). Observations suggest that Wilson's Plovers may form pair bonds before arrival on breeding grounds. In the lower **Florida Keys**, a group of 72 individuals were documented at Boca Chica Beach Naval Air Base property on nonbreeding habitat on 27 December 2008. Most of the birds were still in winter plumage with the exception of two males possessing nearly full breeding plumage. Both of these males were observed giving territorial calls and exhibiting aggressive territorial behavior towards other plovers in the group. Since the group was not occupying breeding habitat, the aggressive males may have been exhibiting territorial behavior over females (Zdravkovic 2009).

Wilson's Plovers in **south Florida** and the **Florida Keys** have been documented in pairs on breeding territory by mid to late January (Zdravkovic 2009, J. Duquesnel pers. comm.). In southwest Florida, a migratory group of 14 apparently paired Wilson's Plovers (seven pairs) in breeding plumage were observed on 26 January 2006 at Cape Romano. These birds were not observed to exhibit territorial behavior (Zdravkovic 2009) and were apparently migratory, since breeding Wilson's Plovers were not located at subsequent visits to this site during the 2006 nesting season (S. Hood, pers. comm. 2006). Nest scrapes (a nest cup before eggs are laid) were found as early as 26 January at Cape Romano, in **southwest Florida**; however, no breeding birds were located on subsequent visits to this site (M. Zdravkovic unpubl. data). In the **Florida Keys**, many birds arriving on breeding grounds through February and March have not yet acquired full breeding plumage, but have been observed paired (Zdravkovic 2009). Early breeding pairs, often with very vocal males in full breeding plumage, may defend territories and make nest scrapes for one month or more before eggs are laid (Zdravkovic 2009). Early nests documented on the **Florida Gulf coast** in 2006, 2007, and 2008 occurred in the last week of March. Currently, the earliest documented nest initiation is 18 March and the earliest documented hatching is 16 April

in the lower Florida Keys (Zdravkovic 2009). The earliest historically documented Wilson's Plover nest for Florida is 14 March (Cruikshank 1928 *in* Stevenson and Anderson 1994).

In the Laguna Madre region of **south Texas**, Wilson's Plovers are paired and defending breeding territories by late February (M. Zdravkovic unpubl. data). Based on CBC data, the earliest nest in that region was initiated by 27 March, with the first full clutch by 31 March (Zdravkovic 2005). This is the earliest documented nesting information recorded for Wilson's Plovers in Texas. During three consecutive breeding seasons of monitoring in south Texas (2003–2005), the earliest hatches occurred by 24 April and the latest on 16 July; the latest clutches were completed by 22 June (Zdravkovic 2005, 2006). The earliest confirmed Wilson's Plover nest initiation dates for **Louisiana** are 26 March and the earliest hatch recorded occurred 26 April. The latest clutches at two CBC study sites in Louisiana were completed by 18 June and the latest hatches occurred by 12 July (Zdravkovic 2007b, 2010). Nest dates on the Atlantic Coast are similar to the Gulf Coast. In **South Carolina,** breeding pairs defend territory and make scrapes by the last week of March (S. Maddock unpubl. data). In **Georgia**, early nests occurred during the last week of March (Georgia Shorebird Alliance 2013 unpubl. data) with nests still active in the third week of July (Corbat and Bergstrom 2000).

In **Mexico**, Wilson's Plover nesting chronology in the Laguna Madre region was comparable to Texas and other Gulf Coast states (Zdravkovic 2005, 2006, 2009, 2010). In **Costa Rica,** nesting occurs from February to June (Stiles and Skutch 1989). In **Suriname**, nesting begins by mid-April (Renssen 1974). On the Pacific coast of **Colombia,** nests are established by early March (Ruiz *et al.* 2008).

Site Fidelity

Wilson's Plovers have high site fidelity. Corbat (1990) color-banded 35 Wilson's Plovers on Georgia's barrier islands, and of these, 17 (48.6%) were resighted in ≥1 subsequent years. Of these, 15 (88.2%) were found on the same island and nine (52.9%) were found on the same beach where they had been banded. In Texas, two pairs banded in 1980 were subsequently found nesting in 1981 at 45yards (41m) and 331ft (303m), respectively, from their previous year's nest sites (Berstrom 1988a). Preliminary data from a CBC pattern recognition study in the Florida Keys, using digital images of Wilson's Plovers, have documented the same pair returning to the same 55-ft (50-m) area nesting site for two consecutive breeding seasons. This occurrence

illustrates both site fidelity and pair bonds for more than one breeding season (Zdravkovic 2009). In a study in North Carolina, adult Wilson's Plovers banded in 2008 had a 90% second-year return rate to breeding sites at Onslow Beach in 2009 (Ray *et al.* 2011). Wilson's Plovers banded in 2010 had an 82% return rate in 2011at this same site (Derose 2012).

Breeding Densities

Wilson's Plover breeding densities are highly variable and differ depending on habitat type, quality, and quantity. The closest, simultaneously active nests were found 18yds (16.5m) apart in Louisiana (Zdravkovic 2010); 29.5yds (27m) apart in the panhandle of Florida (M. Zdravkovic unpubl. data); and, 39yds (35.5m) apart in Texas (Bergstrom 1988a). The majority of nests on the Gulf Coast are spaced from 110–1,010yds (100–1,000m) apart or more (Zdravkovic 2005, Zdravkovic 2007b, Zdravkovic 2010), and are usually out of sight of each other (Bergstrom 1988a). The highest densities occur in **non-linear habitats** with low human-caused disturbance and low fragmentation (Fig.6). High-quality, non-linear habitat can support many pairs in a small area because of topographic features (*e.g.* dunes) or vegetation (*e.g.* mangrove wetlands, saltmarsh) that obstruct on-the-ground visual range, thus allowing pairs to nest in close proximity. These habitats may also afford better protection from predation since the nesting areas they support tend to be maze-like or serpentine by nature. Higher concentrations of breeding pairs also engage in larger group defensive behavior affording more effective defense against predators. Non-linear type habitats include washover passes, salt pannes, mangrove lagoon shorelines, interdune and back-dune flats, dredge spoil islands, and restoration sites.

Areas of highest breeding density in non-linear habitats on the Gulf Coast were recorded at important sites (*i.e.,* supporting 1% or more of the subspecies population) in the Laguna Madre of Texas (Brazos Island/South Bay and flats associated with the mouth of the Rio Grande) (Fig 6); in the Laguna Madre of Mexico (Playa Bagdad); and Louisiana's Johnson's Bayou (rivermouth habitat and associated salt panes) and the Chandeleur and East Timbalier Islands (Zdravkovic 2005, 2006, 2007a, 2013). Highest densities ranged from 17-23 breeding pairs per square kilometer in specific areas, however, these densities were not consistent throughout entire sites and some areas supported no breeding pairs. Breeding pair densities in non-linear habitat at other important sites in the Laguna Madre of Texas and Mexico ranged from approximately 1.8–4.0 pairs per square kilometer. Again, these densities were not consistent throughout all areas of habitat and some areas supported no breeding pairs (Zdravkovic 2005, 2006, 2007a, 2010, 2013).

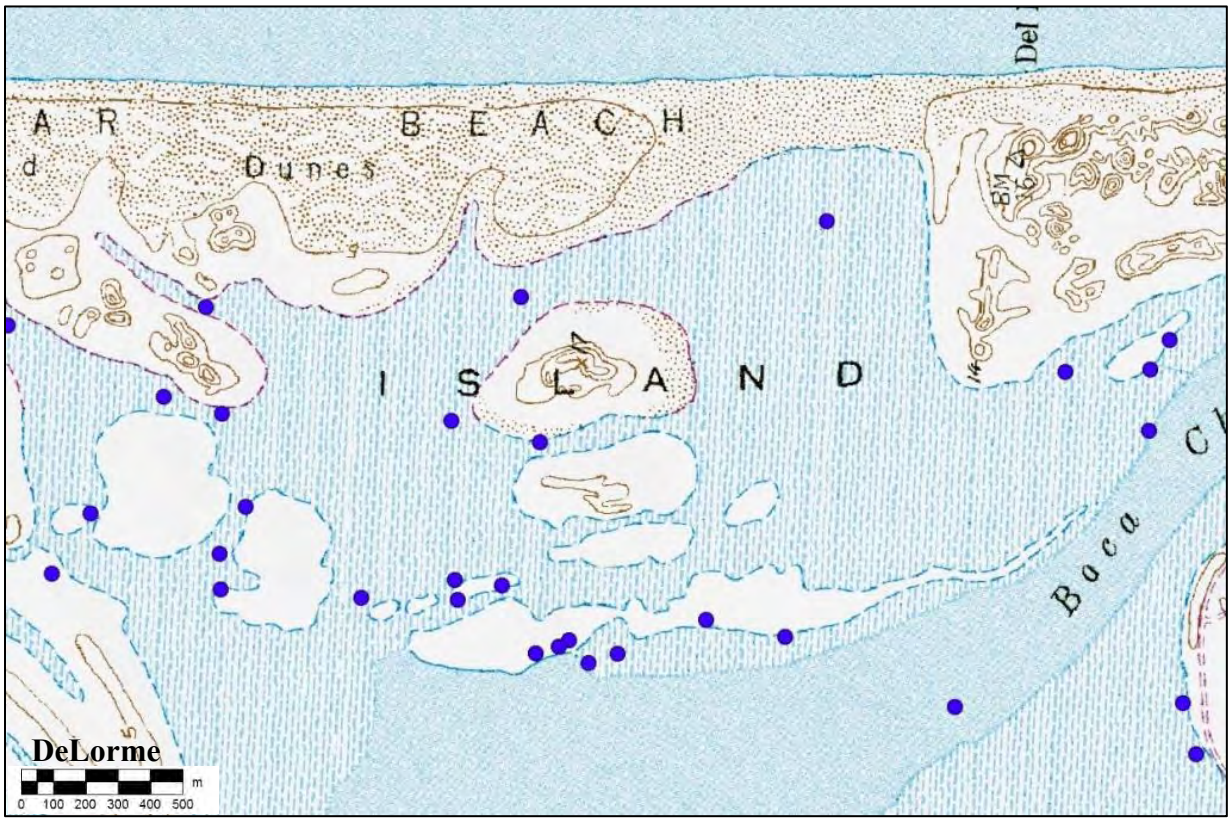
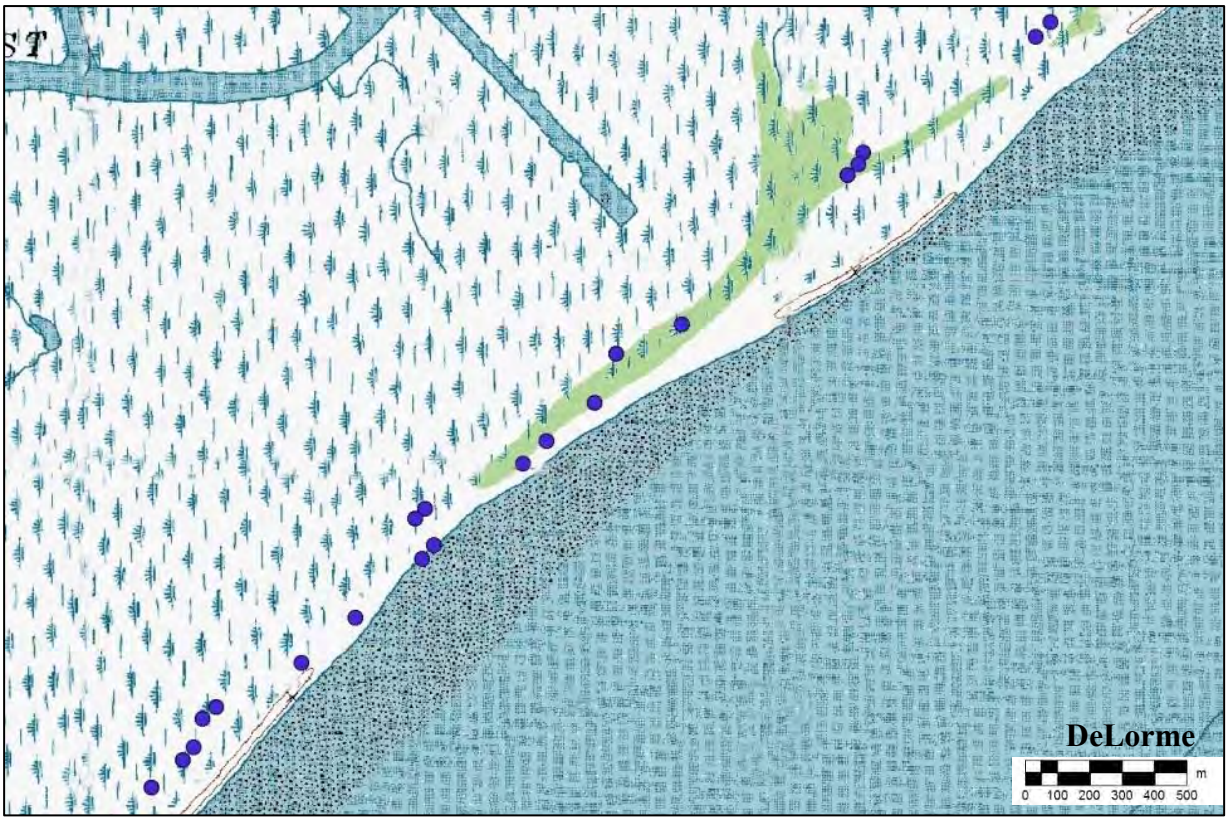


Fig. 6. Wilson's Plover high breeding densities in non-linear habitat on Brazos Island/South Bay, TX, 2005. Blue dot = one Wilson's Plover pair. / Conservian/CBC.

Fig. 7. Wilson's Plover high breeding densities in linear habitat at Point Au Fer, Louisiana, 2005. Blue dot = one Wilson's Plover pair. / Conservian/CBC**.**



High-quality **linear** habitats (*i.e.,* habitats with low human-caused disturbance and low fragmentation) can also support high densities of Wilson's Plovers. Linear habitats are usually associated with narrow mainland beaches like those found in Louisiana and the upper Texas coast. These narrow beaches (some only 33yds/30m wide) are usually backed by vegetation, saltmarsh, and/or bayou, and are devoid of dune formations. They are created by wave action that pushes course shells into the saltmarsh from the Gulf. The highest Wilson's Plover breeding pair densities located in linear habitat in Louisiana were recorded at the mainland beach and barrier island sites of Point Au Fer (Fig.7) and the Grand Terre Islands. High densities ranged from 10 to15 breeding pairs per linear kilometer in specific areas; however, densities varied throughout entire sites. Breeding pair densities at other important linear sites on the Louisiana coast ranged from 1.8–3.2 pairs per linear kilometer in 2005 (Zdravkovic and DeMay 2006).

High-quality linear habitat can also be found on Atlantic Coast beaches. Coast-wide breeding pair densities recorded in Georgia in 2000 ranged from 0–7.5 pairs per linear kilometer (Winn and George 2001); in South Carolina , densities averaged 2.8 pairs per linear km. Wilson's Plover breeding pair densities at high-quality sites are highly variable, unpredictable, and can fluctuate greatly from year to year at specific sites or across regions, depending on weather, rainfall amounts, vegetation amounts, and food availability. Much of the variability is likely due to the dynamic nature of the habitats which support this species. (Fig. 8) shows changes in breeding plover habitat during wet and dry breeding seasons (2004-2005) in south Texas.

Wilson's Plover breeding pair densities at low-quality sites (*i.e.,* sites with high human-caused disturbance and habitat loss through development) support lower numbers of breeding pairs, depending on the degree of habitat loss and fragmentation. In South Carolina, breeding pair density was higher at undeveloped sites, with 7 pairs of plovers per linear km compared to developed sites with 2 pairs of plovers per linear km (Dikun 2008). In Louisiana, at adjacent sites, Elmer's Island (undeveloped) supported 5 breeding pairs per linear km compared to Grande Isle (developed) which supported no breeding pairs (Zdravkovic 2013).

Breeding Wilson's Plover populations can vary regionally with changes in annual rainfall. Table 3 shows data for five comprehensive breeding surveys for Wilson's Plovers conducted at the same sites over a 10-year period in the lower Laguna Madre region in south Texas. The regional survey coverage area spans 45 linear miles (70 km) from Mansfield Channel

south to the mouth of the Rio Grande, including barrier islands, dredge spoil islands, and mainland areas supporting beach-nesting bird habitat. The survey data demonstrates how breeding pair totals can fluctuate annually and illustrates the importance of regular, regional, and statewide surveys to detect trends. During the first year of CBC surveys in 2003, the lower Laguna Madre region was in drought conditions. Rainfall was low in 2000–2001(Table 4), and many breeding sites in 2003 were dry and affected by windblown sand (M. Zdravkovic unpubl. data). Rainfall amounts increased from 2002-2004. By the 2004 breeding survey period, areas that had been dry the previous breeding season now supported vegetation and fiddler crabs, and Wilson's Plover breeding pair numbers responded positively (Table 3). Breeding surveys continued to show an increase in breeding pairs in 2005 and 2008, even though 2005 was a drier year (Fig. 8). Breeding numbers peaked in 2008 with 356 pairs located regionally and by 2013 had dropped to less than half that number with 162 pairs—very similar to 2003 numbers of 128 pairs (Zdravkovic 2005, Liptay and Zdravkovic 2008, M. Zdravkovic unpubl data).

Correlation between CBC data and regional rainfall amounts indicate that when annual rainfall drops below 17 inches (43cm) for two consecutive years, Wilson's Plover breeding pairs decrease regionally (Table 3). From 2009 to 2012, CBC did not conduct breeding surveys in the region, thus no data exists for these years. The regional monitoring data collected by CBC on human-caused disturbance indicate that it is unlikely that known human-caused impacts negatively affected breeding plover numbers in the lower Laguna Madre. CBC data show that human-caused disturbance has been reduced at breeding sites through the implementation of protective measures (Liptay and Zdravkovic 2008, Zdravkovic and Durkin 2011). Consecutive years of drought very likely affected shorebird food sources, such as the fiddler crab. General observations made in 2013 noted diminished numbers of fiddler crab colonies associated with breeding sites (M. Zdravkovic unpubl. data). Areas that had formerly shown the familiar crab holes and "asterisk" patterns of crab colonies (Fig.4.) were not present at former crab colony sites. CBC data for Snowy Plovers in the lower Laguna Madre region over the same time period shows a similar pattern as the breeding Wilson's Plover data.

Table 3. Breeding Wilson's Plover surveys over a 10 year period in the lower Laguna Madre region of Texas (U.S. I. = U.S. Species Important Area for Wilson's Plovers). / Conservian/CBC

Texas Lower Laguna Madre	Breeding Pairs Detected*				
Site Names	**2003**	**2004**	**2005**	**2008**	**2013**
Mouth of Rio Grande (U.S.I.)	10	37	19	14	14
Boca Chica Flats (U.S.I.)	0	17	23	31	12
Brazos Island/South Bay (U.S.I.)	33	43	53	55	18
Brownsville Ship Channel	N/D	27	29	14	11
Port Isabel/Long Island	N/D	26	28	20	9
Bahia Grande Lakes Complex (U.S.I.)	6	12	15	59	33
Sea Ranch/Isla Blanca	N/D	6	6	1	2
Laguna Atascosa NWR (U.S.I.)	12	17	17	53	32
Buena Vista Ranch	0	0	0	2	0
East Lake	0	0	0	0	0
La Sal Vieja	4	4	2	0	0
La Sal Del Rey	0	0	0	0	0
South Padre Island	63	92	92	107	49
Site Totals	**128**	**281**	**284**	**356**	**162**

***** Pair totals include specific sites in the lower Laguna Madre region that were consistently surveyed after 2003.

Table 4. Yearly rainfall totals for the Texas Lower Laguna Madre Region in inches (NOAA). Green = two consecutive years of average rainfall below 17 in (43 cm).

Location	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Brownsville S.P.I. Int'l Airport, TX	16.49	16.73	28.29	33.74	29.71	14.41	21.67	31.05	38.37	26.19	36.56	17.93	21.07
Harlingen, TX	20.10	21.94	30.96	32.78	33.15	17.62	23.95	35.15	40.13	21.77	33.68	14.53	12.37
Port Mansfield, TX	14.64	14.22	28.15	23.35	24.04	21.49	23.35	45.00	25.52	17.36	32.52	10.89	12.86
Average Annual Rainfall	17.08	17.63	29.13	29.96	28.97	17.84	22.99	37.07	34.67	21.77	34.25	14.45	15.43

Fig. 8. Photos of Wilson's Plover breeding habitat during dry and wet years in the lower Laguna Madre region, TX. Left side shows 2004 nest within area-meter hoop. Right side shows 2005, drier conditions, no nest present. / © M. Zdravkovic/Conservian

Breeding Territoriality and Group Attraction/Defensive Behavior

This section on Wilson's Plover breeding behavior is presented to provide essential information necessary to conduct successful breeding surveys and monitoring of this species. Wilson's Plovers are territorial, solitary nesters that engage in a complicated, cooperative, group behavior in defense of a wider breeding territory against a perceived threat (Zdravkovic 2010, M. Zdravkovic unpubl. data). CBC has extensively documented Wilson's Plover cooperative group defensive behavior throughout the Gulf Coast. **It is very important to understand this behavior when conducting breeding surveys for this species to avoid over-estimating breeding pair numbers, especially in non-linear breeding habitat**. Both male and female Wilson's Plovers defend individual pair nesting territory against *intra*specifics and *inter*specifics, but will engage cooperatively in a group defense of the overall breeding territory against a perceived intruder with other nearby breeding Wilson's Plovers (Zdravkovic 2007b, 2010). As Tomkins (1944) eloquently described, "where there are a number of plover nests in the vicinity, concern about an intruder tends to hold in abeyance the territorial jealousy of the birds." Males are often more aggressive, yet females on the Gulf Coast have been observed to chase other birds (intraspecifics and interspecifics) from the nesting territory in cooperation with the male and independently (Zdravkovic 2010, M. Zdravkovic unpubl. data).

Wilson's Plover group defense can be illustrated by the use of loosely circular, adjacent areas of individual pair territories within a wider group territory. The innermost circle includes the immediate area that a pair will defend around its own territory, nest, or young. The size of this area of defense will vary by pair, habitat type, and chronology within the breeding cycle, and can range from 110–1,300 yds (100 to1,200 m) in diameter. The defending pair, for example "pair A", will alert all nearby pairs in the vicinity of an intruder with loud, sharp, emphatic "*wheep*" and shorter "*whip*" alarm calls (Zdravkovic 2007b, 2010). Howell (1932) described the call as "a surprisingly human-whistled *whip.*" Bergstrom (1988b) described this call as "*tweet*". These alarm calls, intermittently repeated between pauses, attract neighboring breeding Wilson's Plover pairs into pair A's circle of defense. The wider outer circle of group defense will include all neighboring pairs B, C, D, *etc.* The size of the defending group of Wilson's Plovers will depend upon the number of breeding pairs in the immediate vicinity. Group defense of territory can vary from two to ten or more pairs (M. Zdravkovic unpubl. data). Breeding plovers can be attracted by alarm calls from pair A from up to a 1,300-yd (1,200-m) radius or more, depending

on habitat topography (Zdravkovic 2010). Open habitats tend to have wider areas of group defense. Non-linear habitats with topography that conceals plovers from each other's view (*e.g.,* dunes or vegetation) will tend to have smaller overall group territories of defense. Each breeding pair will have its own smaller area of territory within the overall group territory that generally does not overlap into neighboring territories. Individual Wilson's Plover pair territories will remain fixed until chicks hatch or a nest fails. Alerted Wilson's Plovers will fly in and run into the area of defense (Zdravkovic 2010); these will be a mix of males and females, the majority often being males (Tompkins 1944, Zdravkovic 2010), likely due to Wilson's Plover incubation roles. Females tend to incubate more of the daylight hours while males incubate at night (Bergstrom 1986); also, females with young often remain concealed in vegetated areas during a period of perceived threat (Zdravkovic 2010).

The defending pair with a nest in closest proximity to the intruder will usually perform the most vigorous defense in the form of varied distraction displays (Zdravkovic 2010): approaching the intruder, leading away from the nest, crouching low, crouch-and-run display, dragging-wing display, and giving loud alarm calls and exhibiting alert posture (see cover photo) as described by Bergstrom (1988b). Broken-wing display is exhibited by dramatic slapping of wings against the ground and dragging of tail feathers, accompanied by a highly agitated, almost guttural, grunting call audible only at close proximity. Bergstrom (1988b) described this as the "distraction call." Alarm calls become more frequent and emphatic in defense of the nest area as the hatch date approaches, during hatching, and when very young chicks are present.

After hatching occurs, an individual pair territory area can change or increase due to chick mobility. Chicks usually hide in low, often dense, wet vegetation (Bergstrom 1988a). When chicks are present, one or both parents will also exhibit specific defensive behavior of young. One parent will face into vegetation where young are concealed while giving a short repeated "*whip*" alarm call, and often move into vegetation (Zdravkovic 2010). The other parent will often continue with distraction displays, if young are nearby. One or both parents will alternate between calling to young and conducting low, circular flyovers of the immediate habitat (Zdravkovic 2010), often giving the territorial "song rattle" call as described by Bergstrom (1988b). The young will answer it with a soft chirp audible only at close proximity (M. Zdravkovic unpubl. data). One of the parents will usually lead the young to protective cover. Other defending adults may join in the low flyovers (Zdravkovic 2010). As observed by

Bergstrom (1988a), parents defended an area around the chicks if other Wilson's Plovers were nearby. Pair A (with nest or young closest to the intruder) will chase off any defending plovers from Pair B, C, D, *etc.*, that venture too close to their immediate area of defense, especially when the threat of danger lessens. Concurrently, the other defending plovers will exhibit alert posture, run-and-stop behavior, charging runs (hunched low and fast towards intruder), and give alarm calls (Zdravkovic 2010). During this display, plovers within the group will often behave territorially towards each other also, exhibiting running and chasing behavior, doing parallel runs as described by Bergstom (1988a) and charging runs, especially when the threat of danger decreases (Zdravkovic 2010). Group defense of territory will continue until the intruder leaves the area. Then, depending on proximity the defending plovers will walk, run, or fly back to their own nesting territories (Zdravkovic 2010, M. Zdravkovic unpubl. data).

Breeding Territoriality and Interspecific Group Attraction/Defensive Behavior

Wilson's Plovers and Snowy Plovers use similar nesting habitats and often nest in close proximity to one another. Both species exhibit very similar interspecific and intraspecific cooperative group attraction behavior and defense of territory against a perceived threat. Nearby nesting Snowy Plovers may also be attracted to a Wilson's Plover alarm call, move into the immediate area, and engage in defensive behavior of the larger territory. The reverse may also occur with Wilson's Plovers being attracted by Snowy Plover alarm calls. Compared to Wilson's Plover group defensive behavior, Snowy Plovers tend to be less vocal, though no less aggressive.

Both plover species normally tend to become aggressive towards each other (intraspecifically and interspecifically) when one pair moves into the inner circle of the other pair's territory during defense against a perceived threat. Both species often pursue and fly at each other when territories are crossed. Although uncommon, both species have been observed to strike at chicks and juveniles (intraspecific and interspecific) that cross into their territories (Zdravkovic 2010). During a decade of breeding surveys from 2003 to 2013 throughout the Gulf Coast, CBC observed hundreds of territorial and group attraction/defensive behavior interactions between Wilson's and Snowy Plovers; only one observation was recorded of a Snowy Plover adult striking a Wilson's Plover chick (M. Zdravkovic unpubl. data). Unusually aggressive plover behavior is likely caused by the presence of the human observer. Bergstrom and Terwilliger (1987) observed that human presence near nests often started aggressive behavior

between Piping Plovers and Wilson's Plovers nesting in close proximity on Metompkin Island, Virginia. The human is perceived as an intruder and often causes movement of one plover family group into the territory of another (Zdravkovic 2010). Wilson's Plover group defensive behavior has also been observed when the perceived threat comes from coyotes *(Canis latrans)*, domestic dogs *(Canis lupus familiaris),* and avian predators (Zdravkovic 2010).

For the most part, Wilson's and Snowy Plovers have evolved to coexist and may benefit from interspecific group defense of nesting territories. This behavior has been most frequently observed in the Laguna Madre of south Texas and Tamaulipas, Mexico, where concentrations of breeding pairs are the highest found on the Gulf Coast and comparable numbers of both species often nest in close proximity to one another (Fig.9) (Zdravkovic 2005, 2010). Aggressive territorial behavior between plover species is less likely to occur when breeding pair densities are low.

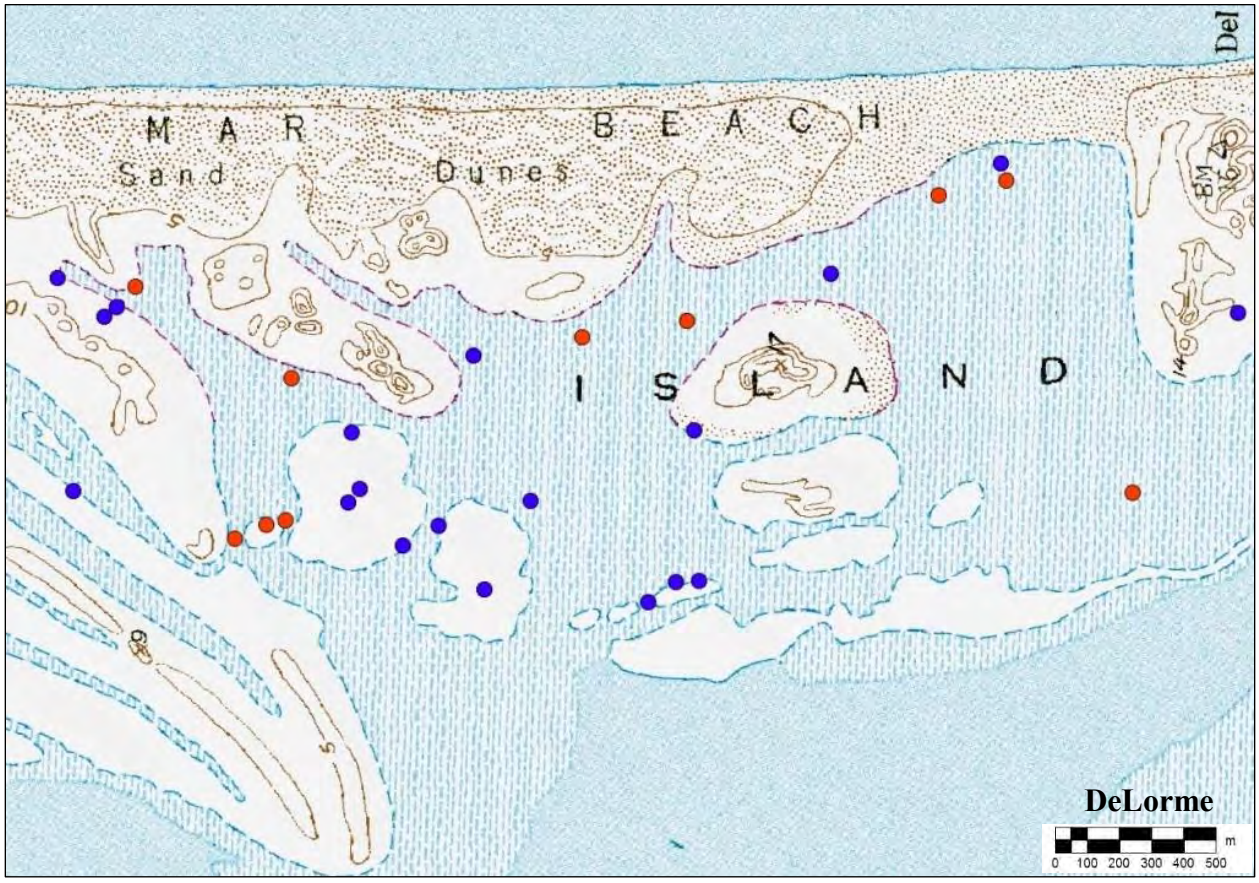


Fig. 9. Wilson's Plover and Snowy Plover pair high breeding densities in non-linear habitat on South Padre Island, Texas, 2004. Blue dot = one Wilson's Plover pair, Red dot = one Snowy Plover pair / Conservian/CBC.

Inter- and intraspecific defensive behavior is far less common on the rest of the Gulf Coast (Zdravkovic 2010, M. Zdravkovic unpubl. data); thus, low densities of nesting plovers do not have the same defense against predators. Group defensive behavior decreases later in the breeding season once most pairs have fledged their young and moved to congregate in nearby feeding areas (see Fledging section). Late nesting birds may be at a disadvantage as few, if any, plovers are present to respond to their alarm calls (Zdravkovic 2010, M. Zdravkovic unpubl. data).

The intensity of all cooperative group attraction/defensive behavior described in this section varies between breeding plover pairs and individuals within a breeding pair (Zdravkovic 2010, M. Zdravkovic unpubl. data). Territorial response can also vary depending on the reproductive stage of the breeding pair (Winn and George 2001, Zdravkovic 2011) and not all breeding pairs with a nest nearing its hatch date, or with young chicks, exhibit vigorous defensive behavior (Zdravkovic and Hecker 2011).

Nests and Young

Wilson's Plovers are capable of breeding during the first spring following hatch year (A. Derose-Wilson unpubl. data, M. Zdravkovic unpubl. data). Wilson's Plover nests are shallow depressions in the sand, called scrapes. During courtship, males excavate several scrapes and the female selects one in which to lay her eggs. Copulation occurs between egg-laying (M. Zdravkovic unpubl.data) (Fig. 10). The female will lay one egg approximately every other day, taking generally five to six days to lay a complete clutch (Bergstrom 1988a). The typical clutch size is three eggs, but occasionally a nest will have only two (Bent 1929, Bergstrom 1988a), particularly later in the breeding season (M. Zdravkovic unpubl. data). Rarely, a nest may contain four eggs (Bent 1929, Bergstrom 1988a). Wilson's Plover eggs are oval to short-oval in shape, cream to buff-colored, smooth and non-glossy. They are heavily spotted and speckled, and blotched and scrawled with dark brown and gray (Fig.1.). Mean size of 78 eggs laid by 20 different females in south Texas was 35.23mm x 25.85mm (Bergstrom 1988a). Regular incubation begins with the laying of the last egg (Figs.5&11). Males and females share in incubation, switching off periodically to forage for food (Corbat and Bergstom 2000).

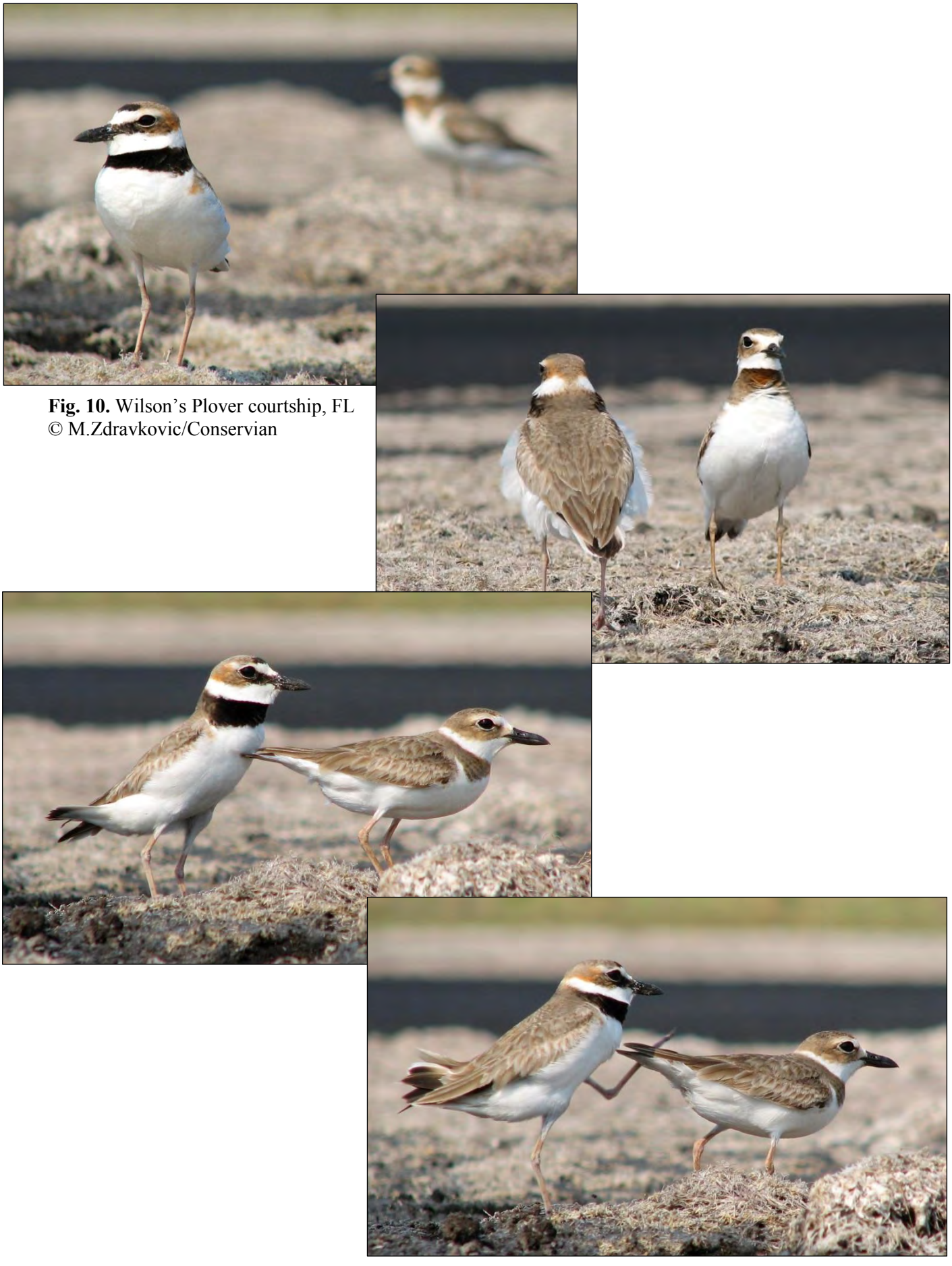


Fig. 10. Wilson's Plover courtship, FL
© M.Zdravkovic/Conservian

Wilson's Plovers on the Gulf Coast do not incubate nests continuously. Nests are commonly left un-incubated for 30 minutes or more depending on the time of day and weather conditions (Zdravkovic 2010). The mean percent of daylight hours that 14 pairs in south Texas incubated was 77% (Bergstrom 1986). Percent of time the nest was incubated during daylight hours varied strongly with air temperature: more time was spent on the nest at the lowest and highest temperatures, and much less at moderate air temperatures near 86–88° F (30–31° C) (Bergstrom 1982). Occasionally, pairs in south Texas, Louisiana, and the Florida Keys have been observed to leave full-clutch nests unattended for up to one hour regardless of air temperature, with no apparent detriment to the eggs; these clutches hatched successfully (Zdravkovic 2005, 2010). In Texas, the longest absences (90 min) occurred at moderate air temperatures, 84–95° F (29–35° C) (Bergstrom 1982).

Females conduct more daylight incubation, while males appear to incubate most of the night (Bergstrom1986). The average incubation period for Wilson's Plover nests is 25 to 27 days (Corbat and Bergstrom 2000) but can range from 23 to 32 days (Corbat and Bergstrom 2000). Wilson's Plovers generally fledge only one brood per season (Corbat and Bergstrom 2000), but pairs that repeatedly lose clutches will re-nest three or more times depending on the length of time remaining in the breeding season (Zdravkovic 2010, M. Zdravkovic unpubl. data). Re-nests may be initiated as early as five days after nest loss (Bergstrom1988a).

Wilson's Plovers nest near other beach-nesting bird species including Snowy Plovers, Piping Plovers, Least Terns, Common Nighthawks *(Chordeiles minor),* American Avocets *(Recurvirostra americana),* and Black-necked Stilts *(Himantopus mexicanus)* (Bergstrom 1988a); Antillean Nighthawks *(Chordeiles gundlachii)* (J. Duquesnel unpubl. data); Horned Lark *(Eremophila alpestris)*(S. Liptay unpubl. data); Black Skimmer, American Oystercatcher, Willet *(Tringa semipalmata)* and Killdeer *(Charadrius vociferous)* (M. Zdravkovic unpubl. data); and Collared Plovers *(Charadrius collaris)* (Ruiz *et al.* 2008)

Nest Success

Wilson's Plover nest hatching success varies by site. Bergstrom (1988a) documented a range of 25–54% hatching success in south Texas in 1979–1980; Corbat (1990) documented 11–55% in Georgia from 1986–1987.

Fig.11a. Wilson's Plover male shading nest, FL Keys./© M.Zdravkovic/Conservian
Fig.11b. Wilson's Plover male brooding young, S.W. FL./© R.J. Wiley

In south Texas, Hood and Dinsmore (2006) monitored a total of 94 nests during two breeding seasons in 2003–2004 and documented an average nest success of 58% using statistical program MARK. Additionally, in CBC studies of Wilson's Plover nests monitored in south Texas in 2003 and 2004, actual observed hatching success ranged 55–79%; and in 2007 in Louisiana, 50–76% . When averaged annually across sites, nest success rates were similar. In south Texas, of 47 nests monitored with known outcomes at three sites in 2003, 66% hatched successfully; of 82 nests monitored with known outcomes at three sites in 2004, 63% hatched successfully (Zdravkovic 2005). In Louisiana, of 38 nests monitored with known outcome at three sites, 66% hatched successfully (Zdravkovic 2010). These CBC study sites in Texas and Louisiana have high-quality habitat that support high densities of Wilson's Plovers. Many of these sites currently endure much lower impacts from human disturbance compared to other nesting areas on the Gulf Coast, therefore data from these sites likely represent the higher range of nest success for Wilson's Plovers on the U.S. Gulf Coast. In North Carolina, using Mayfield analysis, a nest success rate of 46% was found for 20 nests monitored in 2008, and 44% for 26 nests monitored in 2009. The actual observed survival rate of hatched nests was 45% in 2008 and 50% in 2009 (Ray *et al.* 2011). A CBC study in Louisiana found that vegetation density had no correlation to hatching success. Although 83% of Wilson's Plovers chose sparse to moderately vegetated habitats over dense to barren habitats for nesting, no significant differences were recorded in nest success rates. A nest located in a barren microhabitat had the same chance of hatching (66%) as a nest located in a densely vegetated microhabitat (Zdravkovic 2010). These findings differ from those by Corbat (1990), who found that, in comparing microhabitat variables between successful and unsuccessful nests in Georgia, the percentage of vegetation cover was higher at successful nests than at unsuccessful nests.

Hatching

Chicks are precocial and can walk within hours of hatching. The parents remove the empty eggshells from the scrape after each chick hatches. Hatching time for a full clutch can range from 8–36 hours, during which time the hatched chicks will usually remain in or near the scrape unless disturbed. Occasionally, one egg will take longer to hatch and adults will continue to tend it for a day or more before abandoning it. Chicks are downy and well camouflaged to blend with their surrounding habitats (Bergstrom 1988a) (Fig.12&25).

Fig. 12. Wilson's Plover chicks:
1. Hatching day
2. One week old
3. Two weeks old
© M. Zdravkovic/Conservian

Behavior of Young

Usually within the first day of hatching, chicks are led by parents to the closest low, wet, vegetated areas to forage on their own (Bergstrom 1988a), feeding on small insects and aquatic invertebrates (M. Zdravkovic, unpubl. data). Chicks will remain in or near areas of moderate or dense vegetation for foraging and protective cover until fledging (Zdravkovic 2005, 2010) (Fig.13). If a brood is subjected to high disturbance or if the foraging habitat is inadequate, the chicks can move 1 mile (1.6 km) or more in any direction soon after hatching (M. Zdravkovic unpubl. data). The parents will continue to brood the chicks during the first week after hatching and also act as sentinels by giving alarm calls to warn chicks of approaching danger.

By 10 days of age, the young will follow one adult, often the female, into areas of moderately to densely vegetated cover, if available, and not emerge until 40 or more days of age. This behavior is usually associated with mangrove wetland and saltmarsh areas that provide both cover and foraging habitat. By 10 days of age, the young are presumably strong enough to easily navigate that habitat (Zdravkovic 2010). Often one adult, usually the female, will remain concealed in close proximity to the young, while the other adult defends the territory (Zdravkovic 2010). Adult Wilson's Plovers will use distraction displays to confront predators near their broods and attempt to lead predators away from the area. Chicks up to four weeks of age (pre-fledging) will lie flat and motionless when a perceived threat is near, relying on their camouflaged plumage for protection (Zdravkovic 2010). One or both adults will continue to aggressively defend the area until the young are capable of fully sustained flight. Parents will often defend an area even after present young have fledged (Zdravkovic 2010).

Wilson's Plover young feed primarily using their own ability; however, a CBC study in the Florida Keys has documented, for the first time, Wilson's Plover adults assisting their young in feeding. An adult male Wilson's Plover was observed capturing a fiddler crab, shaking it hard several times, and placing it on the ground approximately 2.2 yds (2m) away from its three-week-old chick. The chick ran to the fiddler crab, picked it up, and swallowed it whole (Zdravkovic 2009). The size of the crab was smaller than that usually taken by an adult, which typically takes crabs ranging from one-quarter to one-half the length of its bill (Morrier and McNeil 1991). The smaller crab was presumably for the chick, whose bill was approximately

three-fourths the adult size. This same chick was observed on the following day hunting and taking small fiddler crabs independently with the defending adult male guarding a few meters away (Zdravkovic 2009).

Fledging

A Wilson's Plover breeding biology study in Louisiana conducted by CBC and Barataria-Terrebonne National Estuary Program (BTNEP) has yielded new data on the number of days required for young to fledge. Previous fledge information came from Tomkins (1944) who observed that young birds up to 21 days of age had not fledged. The data was incorrectly used as the minimum number of days required for fledging. This single account has persistently been cited in many current publications as the actual time required for fledging, though it was corrected by Bergstrom (1988b) and in the Birds of North America (Corbat and Bergstrom 2000). An apparently little known record by Sprunt and Chamberlain (1949) provides solid information that predates Tomkins (1944): "A very young bird was banded on July 6,1931, at Bird Bank, Stono River, South Carolina, by E. Milby Burton. Twenty-eight days later it was captured after much effort. Although it was well feathered, it could not actually fly." A CBC study monitoring banded birds in Louisiana supports these data and found that the number of days required for fledging (sustained flight) vary by brood and habitat type. Wilson's Plover fledging occurs between 31 and 35 days of age (Zdravkovic 2010). Some young may be capable of short flights ≤ 16.4 yds (≤ 15m) at 30 days old (Zdravkovic 2010). Newly fledged young appear to have shorter tail and wing feathers and thus also appear slightly smaller than adults. Fledging may often be prolonged beyond 35 days if a brood is residing in an area of abundant food supply and dense, vegetated cover such as saltmarsh or mangrove wetland habitat. If disturbance in a brood-rearing area is low, young may often have no urgent need to attempt flight (Zdravkovic 2010). A CBC study of Wilson's Plovers in the Florida Keys also produced fledging chronology data in 2010 that concur with these findings (M. Zdravkovic unpubl. data). **For management purposes** at Wilson's Plover breeding sites, young should not be considered fledged until **40 days of age.** This is especially important at sites where **off-road vehicles (ORVs)** may run over young or impact breeding habitats.

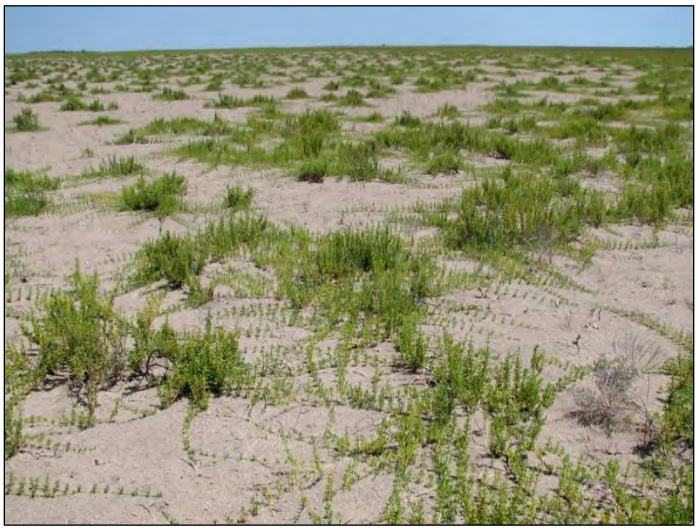


Fig. 13. Wilson's Plover cover and foraging habitat for young, Gulf Coast. /© M.Zdravkovic/Conservian
Fig. 14. Wilson's Plover recently fledged young/ © J. Kennedy

Post-fledging Group Defensive Behavior

After Wilson's Plover young fledge, one or both adults will usually remain with post-fledged juveniles and join other pairs of its species that also have newly fledged young. These small, loose flocks of 20 or more birds (depending on the number of breeding pairs that have nested in the immediate area) will gather in areas of good foraging habitat within the larger breeding area, usually during the first and second week of July on the Gulf Coast. By this time in

the breeding season, adult plumages have become very faded and worn, and the adult females become difficult to visually distinguish from juveniles over 50 days of age. Juvenile plumage appears "fresher" than late breeding season females (Fig.14.). Another cue for distinguishing juveniles from adult females is a lack of territorial behavior, apparent in breeding adults.

Mixed flocks of adults and fledged young will exhibit a variation of cooperative group defensive behavior. The group will stand together as a widely spaced flock, with all adults in alert posture, facing the perceived threat; some adults give *"wheep"* and *"whip*" alarm calls. Juveniles will stay with the group and move within it, generally remaining submissive to adult territorial advances. Adults within the group will exhibit run-and-stop behavior, often exchanging places with each other and occasionally behaving territorially towards each other, and especially towards the juveniles. This territorial behavior within the group is much less aggressive than during the nesting season; the primary difference is that the mixed group of adults and fledged young will usually remain together as one group (Zdravkovic 2010). If an intruder approaches too closely, the entire group will take flight in unison and fly in a low, wide, loosely grouped circle around the area, calling, then landing in the same spot or very nearby (Zdravkovic 2010). In July and August as the breeding season moves into migration, Wilson's Plover flocks can increase in size to up to 200 or more birds (Amos 2005, Liptay and Zdravkovic 2008, Zdravkovic 2010), and will often mix with Semipalmated Plovers and other small shorebirds (Corbat and Bergstrom 2000).

Fledging Success

Fledging productivity data for Wilson's Plovers are limited. Fledging success varies by breeding site. At three CBC study sites in Louisiana, 35 monitored breeding pairs fledged an estimated minimum of 1.0 young per pair in 2006 and 2007 (Zdravkovic 2007b). In Virginia in 2006, 16 monitored pairs fledged an estimated 26 young, or 1.63 chicks per pair; in 2007, 22 pairs fledged an estimated 40 young, or 1.82 chicks per pair (Boettcher *et al.* 2007). A study at Onslow Beach, North Carolina, estimated productivity at 0.88 ± 0.26 chicks fledged per pair (20 pairs) in 2008, and 1.00 ± 0.25 chicks fledged per pair (26 pairs) in 2009; and also found that chick survival was higher for those nests hatching earlier in the breeding season (Ray *et al.* 2011). At Jiquilisco Bay, El Salvador, an estimated 60 pairs fledged an estimated 41 young, or 0.68 chicks per pair (Martinez 2008 *in* Jones and Komar 2008).

Survival Rates

Few data exist on post-fledging chick survival rates. In a CBC study in Louisiana, only three of 19 chicks banded in 2009 (16%) were resighted in 2010 (Zdravkovic 2010). In a study in North Carolina, only 9.5% of chicks banded in 2008 returned in 2009 (Ray 2011).

SPECIAL HANDLING: BANDING AND TRACKING DEVICES

Data from past and recent studies involving banding of Wilson's Plovers demonstrate that great care should be exercised when considering banding this species. In the past, banding of Piping Plovers on the Atlantic Coast resulted in high numbers of leg injuries and mortalities (Amirault *et al.* 2006). During a Wilson's Plover study in North Carolina using colored darvic bands and metal USFWS bands, only half of the birds were resighted one year later on the breeding grounds (Corbat 1990). During a CBC study in Louisiana using sealed darvic color bands and USFWS metal service bands placed on the bird's lower leg, only 20% of banded adults were resighted (10 out of 49). Low band-resighting return rates on the breeding grounds may be an indicator of overall annual adult survivorship, or may indicate the likelihood that bands affected the birds' survival rates (Zdravkovic 2010).

Data from two breeding Wilson's Plover studies in North Carolina, in which only unsealed plastic darvic bands were used, indicate that plastic bands appear to have very low negative impacts to this species. Adult Wilson's Plovers banded in 2008 had a return rate of 90% to breeding sites in 2009 (Ray *et al*. 2011). At this same site, birds banded in 2010 had an 82% return rate in 2011 (Derose-Wilson 2012). One of the studies also tested plastic flags on Wilson's Plovers, but removed them after they were found to cause injury to the birds' legs (Derose-Wilson 2012).

This plan does not recommend large-scale banding of Wilson's Plovers, given the inherently higher risks known to be associated with banding beach-nesting plovers. If banding is necessary, it is **recommended that only unsealed plastic bands be used** and that the number of bands placed on each bird be **kept at a minimum**. This plan also recommends that all banding projects be initiated and conducted by programs or groups that plan to carry out long-term monitoring studies on this species and have the funding in place to do so. Banding of Wilson's Plovers is a very labor-intensive process, as it must usually be done by capturing the bird on the

nest. When captured, Wilson's Plovers are alert, fairly calm, and tolerant, though not docile. They are a high-spirited, clever, and tenacious species that shows very little tolerance to endure tracking devices, and they have shown to be consistently adept at removing radio transmitters (Zdravkovic 2010). This species is not a good candidate for harness attachment; attempts at such would likely lead to mortality of the bird. Trial attachment of **geolocators** on Wilson's Plover legs demonstrated that **the smallest currently available devices were too large** (Zdravkovic 2010). In the near future, geolocators for use on smaller birds will become available, making the need for banding large numbers of a species obsolete.

MAJOR HABITATS

Breeding Habitat

The Wilson's Plover is primarily a shorebird of coastal, saline habitats. It uses a wide diversity of habitats for nesting, compared to other beach-nesting bird species. Wilson's Plovers nest above the high waterline on the varied habitats of barrier islands/peninsulas, coastal lagoons, coastal lagoon shores, mainland beaches (Corbat and Bergstrom 2000), rivermouth shorelines, and coastal lakeshores. They also readily use artificially created habitats including dredge spoil islands, impoundments, salt evaporation ponds, limestone fill (Zdravkovic and DeMay 2006, Zdravkovic 2005, 2009) pavement and roadsides (Bergstrom 1988a), and occasionally will nest on inland saline lake shorelines (Zdravkovic 2005).

Habitat Descriptions

Below is a classification of U.S. Atlantic and Gulf Coast Wilson's Plover breeding *macro*habitats and descriptions of associated nesting *micro*habitats (Zdravkovic and Hecker 2011, Zdravkovic 2005, 2006, 2007a, 2009, 2010) (Fig 15).

Barrier Island/Barrier Peninsula: Barren to moderately vegetated beach habitats occurring in front of the primary dune line, salt marsh or uplands; these include barren to moderately vegetated beaches, inlets and salt ponds, and habitat behind the primary or secondary dunes and along the bayside shoreline. Additional barren to densely vegetated microhabitats include

interdune blowouts; low, back dune edges; and washover fans, washover passes, and associated salt pond and inlet shorelines, sand/shell/algal/mud flats, and mangrove-lined lagoon edges.

Barrier Island Restoration: Naturally or historically existing habitats that have been degraded or lost through erosion, where a sincere attempt has been made to mimic or replace the previously existing natural habitat. Successful barrier island restorations generally have the same microhabitat ranges as natural barrier islands/barrier peninsulas.

Delta Islands, Bay Islands, and Shell Mound Bars: Barren to moderately vegetated islands associated with a delta or estuary. Breeding microhabitats include shell/sand/mud beach in front of the primary dune or salt marsh; bayside habitats located behind the primary dune; saltmarsh with vegetated, low, back dune edges; and barren to moderately vegetated shell/sand/mud/algal flats.

Mangrove Islands: Densely vegetated, subtropical/tropical islands composed primarily of transitional mangrove wetlands. Breeding microhabitats include open areas of salt panne, algal mat, and poritic limestone, rock barren habitat.

Mainland Coastal Bay/Lagoon: Mainland bays, subtropical and tropical hypersaline lagoons, and estuaries. Breeding microhabitats include mangrove-edged shorelines and barren to densely vegetated algal/mud/sand flats.

Rivermouth Shores: Sparse to moderately vegetated rivermouth shorelines open to the sea or Gulf. Breeding microhabitats include mangrove-edged shorelines and barren to densely vegetated algal/mud/sand flats, and salt pannes.

Mainland Beach: Barren to moderately vegetated microhabitats occurring in front of the primary dune line, saltmarsh, and uplands. Microhabitats also include barren to densely vegetated interdune blowouts, washover fans and associated salt ponds, and open sand/shell/algal/mud flats located behind primary and/or secondary dune lines

Saline Lake Shorelines: Coastal and inland hypersaline lakes with breeding microhabitats that include barren to densely vegetated algal/mud/sand/salt flat shorelines, low dunes, and interconnected salt ponds, often bordered by dense mainland scrub/uplands.

Artificially Created Sites: Dredge spoil islands, artificial lakes and channels, impoundments, salt evaporation ponds, levees, and wetland fill areas. Breeding microhabitat includes barren to densely vegetated sand/gravel/limestone substrates, and algal/sand/mud flats; nesting substrate that has been human-altered; marsh- and beach-restoration sites; mitigation ridge; and dredge spoil and/or beach planting sites with sand and shell substrates and vegetation ranging from none to moderate. *This classification refers to created habitats that did not historically exist naturally*.

Fig. 15. Major Breeding Habitats of the Wilson's Plover. 1.) Barrier Island; 2.) Barrier Island Restoration; 3.) Shell Mound; 4.)Mangrove Island/salt panne; 5.) Mainland Coastal Bay; 6.) Rivermouth; 7.) Mainland Beach; 8.) Inland Saline Lake; 9.) Artificially Created/impoundment; 10.) Artificially Created/dredge spoil. / © M. Zdravkovic/Conservian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The most common types of vegetation associated with Wilson's Plover nests are: glasswort (*Salicornia spp*.) and saltwort (*Batis maritima*) (Bergstrom 1988a); sea oats *(Uniola paniculata),* beach elder *(Iva imbricata),* salt meadow cordgrass *(Spartina patens),* and Russian thistle *(Salsola kali)* (Corbat 1990); shoregrass (*Monanthochloe littoralis)*, cenicilla or sea purslane *(Sesuvium portulacastrum),* sea blight (*Sueda linearis)*, black mangrove (*Avicennia germinans),* sea oxeye daisy *(Borrichia frutescens),* saltgrass (*Distichlis spicata*), and coastal sea rocket (*Cakile lanceolata)* (Zdravkovic 2005).

Habitat Use

Although Wilson's Plovers are found nesting in a wide variety of coastal habitats, studies have shown that they largely prefer barrier islands/barrier peninsulas and artificially created/restored habitats. On the U.S. Atlantic Coast, nearly all breeding Wilson's Plovers in Virginia (Boettcher *et al.* 2007) and in Georgia (Winn and George 2001) were located on barrier island habitats. In North Carolina, 83% of breeding Wilson's Plovers were found on barrier islands (Cameron 2008); in South Carolina, 79% (Sanders *et al.* 2013). In the Gulf Coast states, barrier island habitat supported 32% of breeding Wilson's Plovers, and artificially created/restored habitat supported 27% (Zdravkovic *in prep*) (Fig.16) and (Appendix 3). Wilson's Plovers will nest on habitats with vegetation ranging from barren to dense, however they prefer areas of sparse to moderate vegetation (Zdravkovic 2005, Zdravkovic 2010).

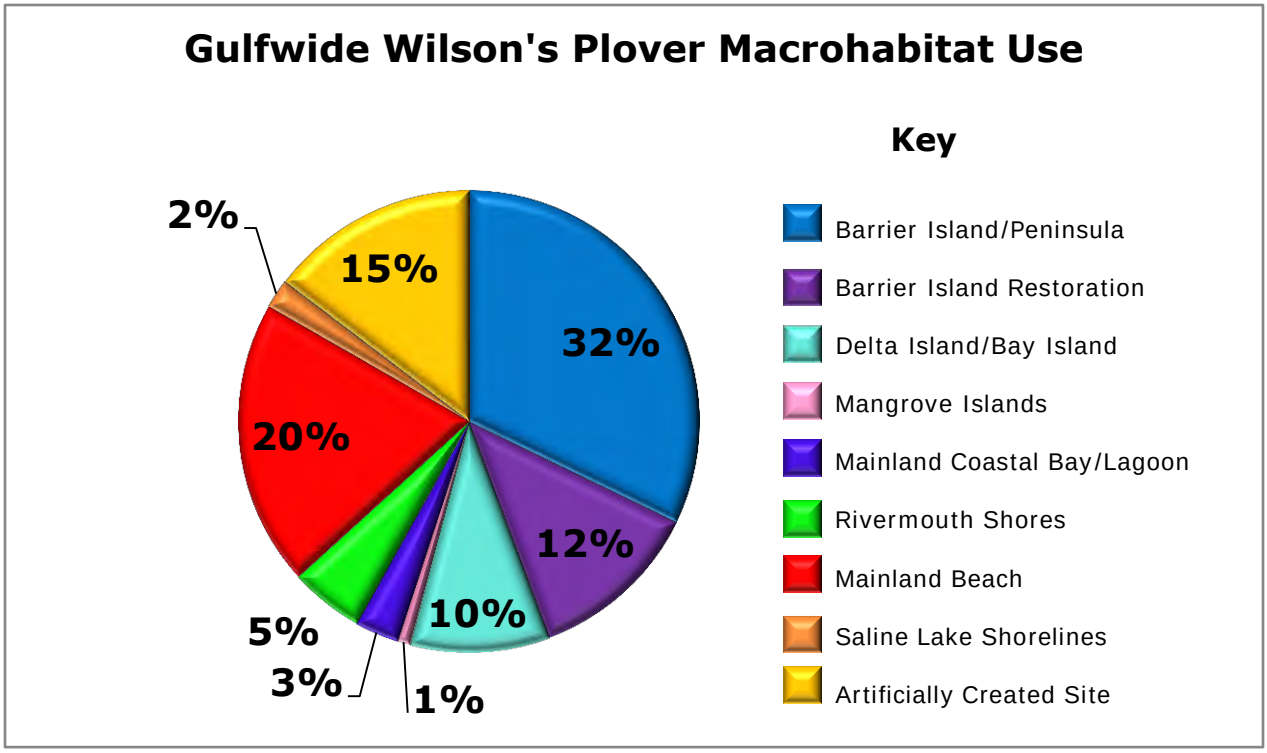


Fig. 16. Wilson's Plover Gulf Coast Macrohabitat Use./ Conservian/CBC

Nonbreeding Habitat

Nonbreeding Wilson's Plovers are found in many of the same macrohabitats used during breeding. They seek out areas of good foraging habitat on beaches, barrier islands, coastal bays, and river mouths where the fiddler crab, its primary food, is found. They are particularly attracted to areas with intertidal pools, extensive intertidal mudflats (Strauch and Abele 1979), salt pond inlets, mangrove island salt pannes, and artificial limestone fill areas associated with wetlands (Zdravkovic 2009).

Nonbreeding Wilson's Plovers typically roost in small groups on dry substrates above the high-tide line; on barrier islands and mainland beaches throughout south Florida (M. Zdravkovic unpubl. data); near mangroves, mudflats, and on rock jetties and shell heaps in Venezuela (Thibault and McNeil 1994); and on rock jetties on Grand Bahama Island (M. Zdravkovic unpubl. data). In the Florida Keys, they can be found on man-made limestone fill substrates associated with mangrove wetlands (Zdravkovic 2009).

CONSERVATION STATUS

The Wilson's Plover has no federal protection in the United States beyond the Migratory Bird Treaty Act of 1918 (18 U.S. Code 703-712). The nests and eggs of Wilson's Plover are protected under this federal law, as are the eggs of most other migratory birds. Prohibited activities include pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting such conduct toward migratory birds. However, this law affords the Wilson's Plover no protection from human disturbance or the loss of nests or young through unintentional take, nor does it provide any protection for breeding or nonbreeding habitats. The Wilson's Plover is listed nationally by the U.S. Shorebird Conservation Plan (Brown *et al*. 2000) and regionally by Southeastern Coastal Plains-Caribbean Region Plan (Hunter 2002) as a Species of High Concern (Prioritization Category 4). Rankings for Wilson's Plover in the U.S. Shorebird Conservation Plan have recently been re-evaluated due to new population data acquired over the past decade. The species is now categorized as Apparent Decline (Trend 4) (Andres *et al.* 2012) with significant threats on breeding and nonbreeding grounds. The Wilson's Plover is also classified as a Bird of Conservation Concern by the U.S. Fish and Wildlife Service (2008) and is included as a breeding and wintering priority species by the North American Wetlands Conservation Council (1999). The Wilson's Plover is state-listed as Endangered in Virginia and Maryland; Threatened in South Carolina; Rare in Georgia; and State-Protected in Alabama. These listings in actuality, however, provide little or no on-the-ground protection in the absence of a federally listed status. The 2012 IUCN Red List Category designation for the Wilson's Plover is Least Concern with a decreasing population trend. The global population estimates put forth in this plan of **26,550 –31,650** breeding adults are low to moderate confidence estimates. Population estimates based on comprehensive, standardized survey data for two of the three subspecies, *C. w. cinnamonius* and *C. w. beldingi*, are greatly needed. The U.S. population of the nominate race *C. w. wilsonia* is under 10,000 breeding adults at **≤ 8,600** individuals.

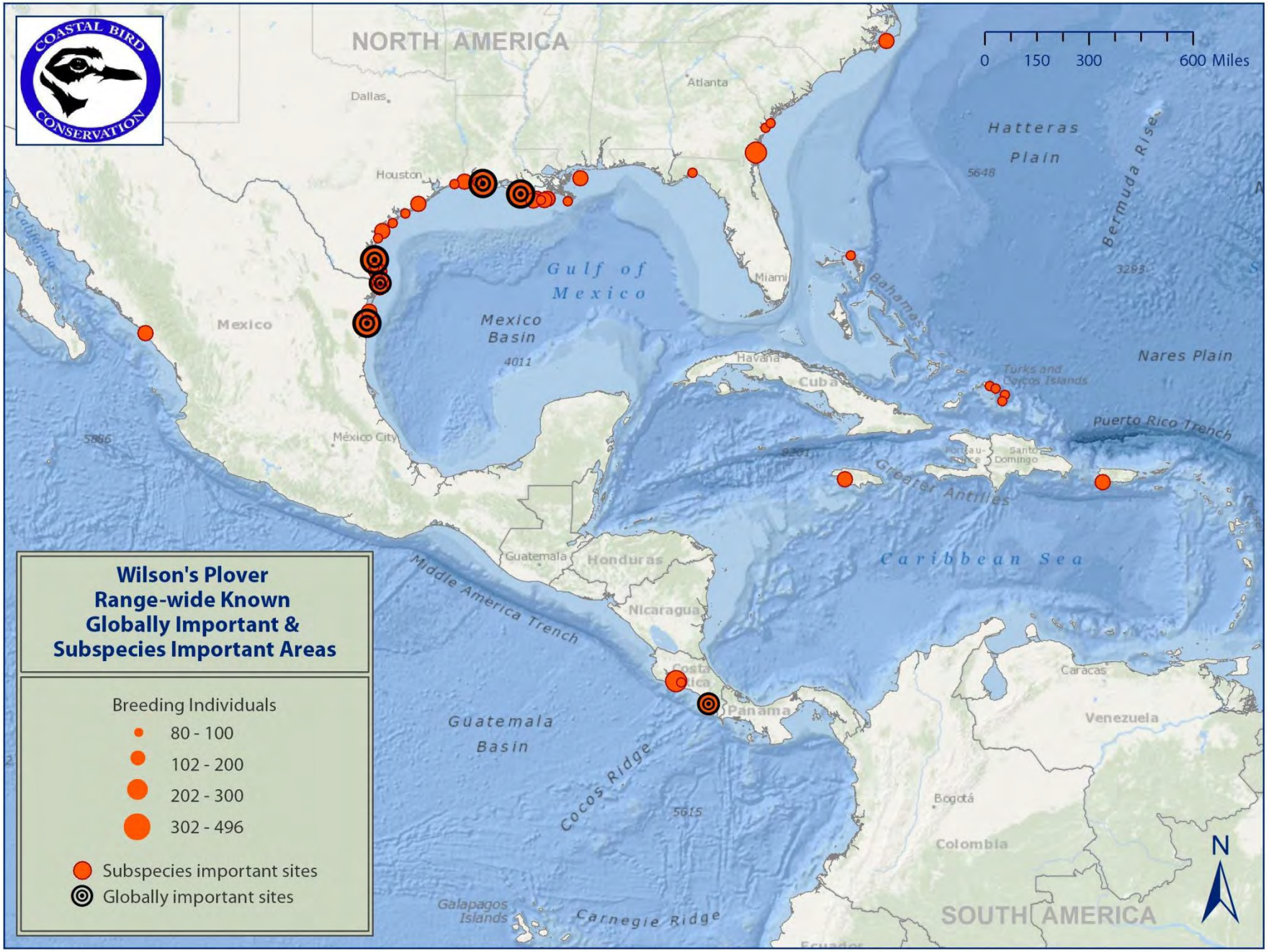
POPULATION GOALS

Limited trend data indicate a decline in Wilson's Plover numbers, however there are insufficient historical data available on the species' former population status on which to base rigorous population goals. Wilson's Plovers exist in a limited, vulnerable, and quickly

diminishing coastal environment. It is recommended that the U.S. population be stabilized and then gradually increased from its current level to at least 10,000 individuals (Brown *et al.* 2001). Range-wide populations must still be assessed before goals can be proposed for subspecies populations outside of the United States. All protective actions proposed for *C. w. wilsonia* can and should be applied to *C. w. cinnamonius* and *C. w. beldingi*.

CONSERVATION SITES

Following the criteria established by the Western Hemisphere Shorebird Reserve Network (WHSRN) and by the Important Bird Areas (IBAs) program, all Wilson's Plover breeding and nonbreeding sites that support 1% or more of the total species population (**at least 265 individuals)** are listed as "Important Sites" for Wilson's Plovers in this plan (Table 5) and (Maps 3 & 4). The list also includes sites that support 1% or more of one of the three *subspecies* populations. Due to a lack of population data available for two of the three subspecies, the U.S. subspecies *C. w. wilsonia* population range estimate of 8,000–8,600 breeding adults was used as a baseline and applied to all three subspecies. Range-wide sites supporting **at least 80 individuals** of a subspecies qualified as important Wilson's Plover subspecies sites. A few sites that were slightly below the 1% threshold were also included, given the potential for numbers to vary annually or a lack of solid survey data. For the majority of sites, Wilson's Plover population data were collected within the last five years. Site descriptions, including information on ownership, management, and conservation status, were included if known (Appendix 4). Vast areas of habitat across this species' range in the Caribbean and Central and South America remain currently unsurveyed and unassessed. The highest concentrations of breeding *C. w. wilsonia* have been located in Texas, supporting approximately 31% of the estimated U.S. population (Zdravkovic 2005), throughout **coastal Louisiana** (Zdravkovic and DeMay 2006, Zdravkovic 2013) (Maps 5,6&7), and in Mexico in the Laguna Madre region of **north Tamaulipas** (Zdravkovic 2007a). The Laguna Madre region supports the highest currently known breeding populations of *C. w. wilsonia* in North America, or approximately 37% of the combined U.S. and Mexico populations (Zdravkovic 2007a). Coastal Louisiana ranks second in number of important breeding sites, supporting approximately 30% of the U.S. breeding population of Wilson's Plovers (Zdravkovic 2013).



Map 3. Wilson's Plover *(Charadrius wilsonia)* Range-wide Known Important Breeding Areas. Global IBA = 265+ individuals, Subspecies IBA = 80+ individuals.

Map 4. Wilson's Plover *(Charadrius wilsonia)* Range-wide Known Important Nonbreeding Areas. Global IBA = 265+ individuals, Subspecies IBA = 80+ individuals.

Wilson's Plover Range-wide Sites of Global and Subspecies Importance

NOTE: Abbreviations used in Table 5: **IBA** – Important Bird Area; **WHSRN** – Western Hemisphere Shorebird Reserve Network site; **RAMSAR** – Ramsar Wetland of International Importance; **NWR** – National Wildlife Refuge (U.S. Fish and Wildlife Service); **NAS** – National Audubon Society; **U.S.I.** –U. S. Species Important Site ; **N/D** – no data. **G.I. – Globally Important Site.** ***Globally Important sites are bold with asterisk and gray highlights. All other sites are subspecies important.***

Table 5. Sites of importance for > 1% of Wilson's Plover (*Charadrius wilsonia*) species' and subspecies' populations.

Site Name	State / Province	Country	Region	Latitude	Longitude	Designations	Habitat Type	Sub-species	Non-breeding Indiv.	Breeding Pairs	Source
Cape Lookout National Seashore	North Carolina	USA	Eastern	35°02'16"N	76°04'37"W	U.S.I.	Barrier Island	*wilsonia*	≥ 10	76	Cameron 2008, Elliot-Smith *et al.* 2009, J. Altman, pers. comm.
Deveaux Bank	South Carolina	USA	Eastern	32°32'13"N	80°11'07"W	Piping Plover Critical Habitat U.S.I.	Barrier Island	*wilsonia*	93	2	Sanders *et al*. 2013, Maddock unpubl. data
Little Tybee Natural Area	Georgia	USA	Eastern	31°58'31"N	80°53'29"W	U.S.I.	Barrier Island	*wilsonia*	≥ 10	40+	GA DNR, Timothy Keyes pers. comm.
Ossabaw Island Heritage Preserve	Georgia	USA	Eastern	31°48'11"N	81°06'22"W	U.S.I.	Barrier Island	*wilsonia*	≥ 10	44+	GA DNR, Timothy Keyes pers. comm.
Cumberland Island National Seashore	Georgia	USA	Eastern	30°52'11"N	81°30'34"W	U.S.I.	Barrier Island	*wilsonia*	≥ 10	106	GA DNR, B. Winn pers. comm.
Big Bird Island	Florida	USA	North-eastern	30°29'15"N	81°25'14"W	IBA U.S.I.	Barrier Island	*wilsonia*	126	2	P. and D. Leary unpubl. data, FSA/FFWC database
Little Bird Island	Florida	USA	North-eastern	30°27'36"N	81°25'06"W	IBA U.S.I.	Barrier Island	*wilsonia*	93	2	P. and D. Leary unpubl. data, FSA/FFWC database

Site Name	State / Province	Country	Region	Latitude	Longitude	Designations	Habitat Type	Sub-species	Non-breeding Indiv.	Breeding Pairs	Source
Huguenot Memorial Park	Florida	USA	North-eastern	30°25'04"N	81°24'28"W	IBA U.S.I.	Barrier Island	*wilsonia*	138	2	Huguenot Memorial Park Mgt. Plan 2007, FL Shorebird Alliance database
Saddle Bunch Keys NAS Antenna Facility	Florida	USA	Florida Keys	24°38'13"N	81°35'37"W	U.S.I	Artificially Created Site	*wilsonia*	96	20	Zdravkovic 2009
Boca Chica Beach NAS	Florida	USA	Florida Keys	24°33'33"N	81°41'58"W	U.S.I.	Mangrove Island	*wilsonia*	72	2	Zdravkovic 2009
Honeymoon Island State Park	Florida	USA	South-western	28°05'29"N	82°50'01"W	IBA U.S.I.	Barrier Island	*wilsonia*	194	18	L. Kenney unpubl. data, B. Forys pers. comm.
St. Marks NWR	Florida	USA	North-western	30°05'59"N	84°09'02"W	IBA U.S.I.	Artificially Created Site	*wilsonia*	≥ 10	36	Zdravkovic *in prep*
Chandeleur Islands, Breton Island NWR	Louisiana	USA	South-eastern	29°53'29"N	88°49'29"W	IBA U.S.I.	Barrier Island	*wilsonia*	N/D	54	Zdravkovic 2013
Southwest Pass	Louisiana	USA	South-eastern	29°00'51"N	89°20'39"W	U.S.I.	Delta Island	*wilsonia*	N/D	44	Zdravkovic 2013
Port Fourchon Mitigation Ridge	Louisiana	USA	South-eastern	29°06'56"N	90°12'24"W	U.S.I.	Artificially Created Site	*wilsonia*	N/D	64	Zdravkovic 2013
Caminada Headland / Wisner Property (Fourchon East and West, Bayou Moreau, Bayou Von Thunder)	Louisiana	USA	South-eastern	29°6'28"N	90°10'55"W	U.S.I.	Mainland Gulf Beach	*wilsonia*	64	68	Zdravkovic and DeMay 2006, S. Maddock unpubl. data

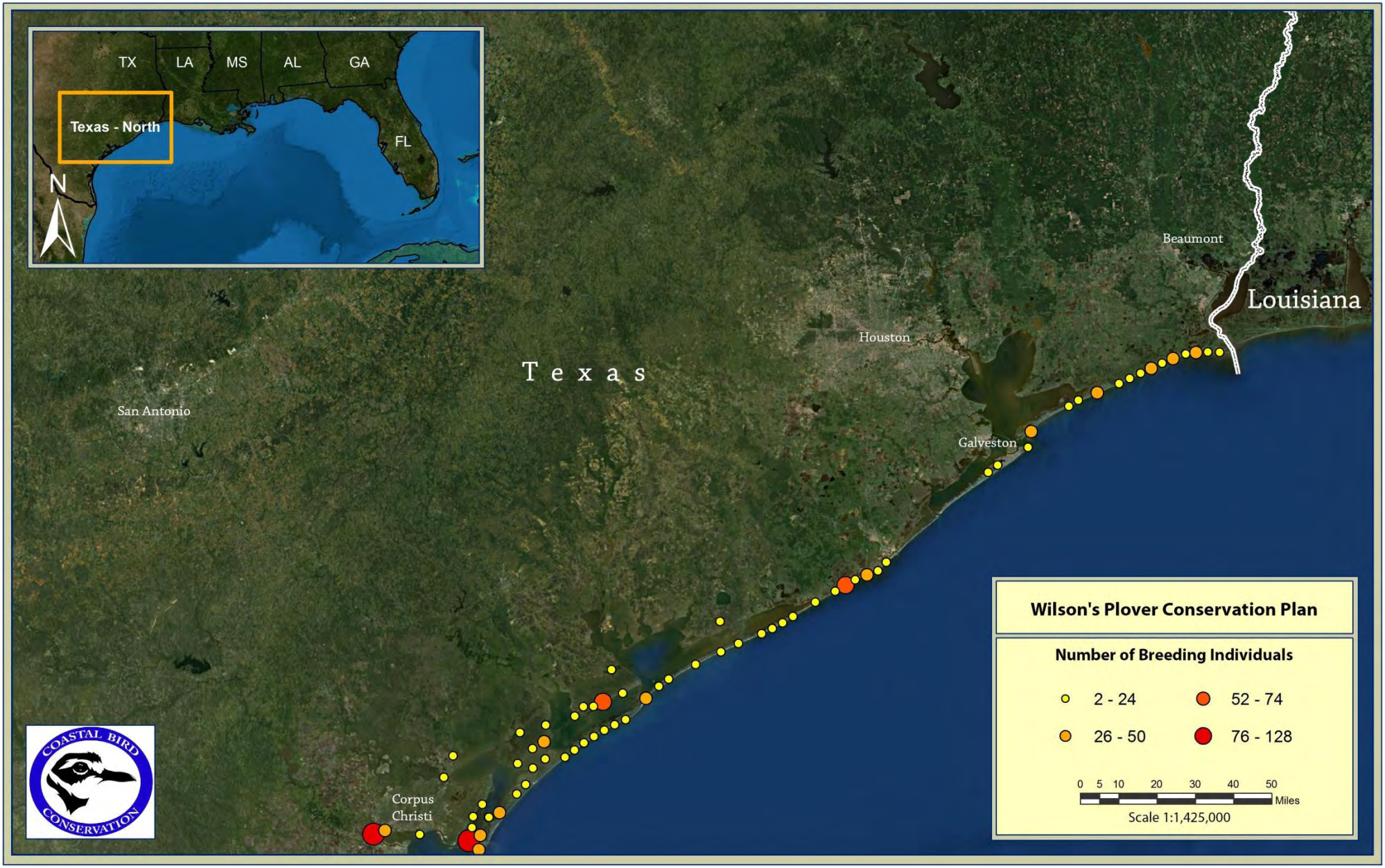
Site Name	State / Province	Country	Region	Latitude	Longitude	Designations	Habitat Type	Sub-species	Non-breeding Indiv.	Breeding Pairs	Source
East Timbalier Island NWR	Louisiana	USA	South-eastern	29°03'57"N	90°19'16"W	IBA U.S.I.	Barrier Island, Restor-ation	*wilsonia*	≥ 10	54	Zdravkovic and DeMay 2006
Timbalier Island	Louisiana	USA	South-eastern	29°03'38"N	90°28'23"W	IBA U.S.I.	Barrier Island, Restor-ation	*wilsonia*	≥ 10	47	Zdravkovic 2013
Whiskey Island	Louisiana	USA	South-eastern	29°02' 53"N	90°47'21"W	U.S.I.	Barrier Island, Restora-tion	*wilsonia*	N/D	70	Zdravkovic 2013
Trinity Island	Louisiana	USA	South-eastern	29°6'28"N	90°40'6"W	U.S.I.	Barrier Island, Restora-tion	*wilsonia*	N/D	72	Zdravkovic 2013
Point Au Fer*	**Louisiana**	**USA**	**South-western**	**29°16'53"N**	**91°18'57"W**	**G.I. U.S.I.**	**Mainland Gulf Beach**	***wilsonia***	N/D	**168**	**Zdravkovic 2013**
Rockefeller State Wildlife Refuge*	**Louisiana**	**USA**	**South-western**	**29°40'55"N**	**92°53'04"W**	**G.I. U.S.I.**	**Mainland Gulf Beach**	***wilsonia***	N/D	**188**	**Zdravkovic 2013**
Mermentau River East	Louisiana	USA	South-western	29°45'21"N	93°06'51"W	U.S.I.	Mainland Gulf Beach	*wilsonia*	N/D	50	Zdravkovic 2013
Johnson's Bayou	Louisiana	USA	South-western	29°45'41"N	93°39'31"W	U.S.I.	Mainland Gulf Beach, River-mouth	*wilsonia*	N/D	64	Zdravkovic 2013
McFadden NWR	Texas	USA	South-eastern	29°39'59"N	94°4'30"W	U.S.I.	Mainland Gulf Beach	*wilsonia*	N/D	50	M. Zdravkovic unpubl. data
Bolivar Flats	Texas	USA	South-eastern	29°22'14"N	94°43'52"W	WHSRN, IBA U.S.I.	Barrier Peninsula	*wilsonia*	169	25	W. Burkett Houston Audubon Society, M. Zdravkovic unpubl data

Site Name	State / Province	Country	Region	Latitude	Longitude	Designations	Habitat Type	Sub-species	Non-breeding Indiv.	Breeding Pairs	Source
San Bernard NWR	Texas	USA	South-eastern	28°54'48"N	95°34'42"W	WHSRN, IBA U.S.I.	Mainland Gulf Beach / River-mouth	*wilsonia*	Present during staging	60	Eubanks *et al*.,2006, M. Zdravkovic unpubl. data
East Matagorda Peninsula	Texas	USA	South-eastern	28°32'42"N	96°07'15" W	U.S.I.	Barrier Peninsula	*Wilsonia*	N/D	40	M. Zdravkovic unpubl. data
Matagorda Island NWR	Texas	USA	South-eastern	28°10'43"N	96°38'25"W	U.S.I.	Barrier Island	*wilsonia*	N/D	43	Zdravkovic 2005
San Jose Island*	**Texas**	**USA**	**South-eastern**	**28°00'01"N**	**96°56'01"W**	**G.I. U.S.I.**	**Barrier Island**	***wilsonia***	**1,000–1,200**	**~40**	**M. Zdravkovic unpubl. data, Amos 2005**
East Shore Spoil Islands –includes Harbor Island	Texas	USA	South-eastern	27°52'02"N	97°4'45"W	U.S.I.	Artificially Created Site	*wilsonia*	N/D	55	Zdravkovic unpubl. data
Upper Laguna Madre dredge spoil Islands	Texas	USA	South-eastern	27°35'47"N	97°15'24"W	U.S.I.	Artificially Created Site, Dredge Spoil	*wilsonia*	N/D	71	Zdravkovic 2005, M. Zdravkovic unpubl. data
Lower Laguna Madre dredge spoil Islands	Texas	USA	South-eastern	26°29'39"N	97°23'19"W	U.S.I.	Artificially Created Site, Dredge Spoil	*wilsonia*	> 10	50	Zdravkovic 2005, Zdravkovic and Durkin 2011
Padre Island National Seashore*	**Texas**	**USA**	**South-eastern**	**26°45'13"N**	**97°23'21"W**	**G.I. WHSRN**	**Barrier Island**	***wilsonia***	**≥ 10**	**248**	**Zdravkovic 2005, M. Zdravkovic unpubl .data**

Site Name	State / Province	Country	Region	Latitude	Longitude	Designations	Habitat Type	Sub-species	Non-breeding Indiv.	Breeding Pairs	Source
Laguna Atascosa NWR	Texas	USA	South-eastern	26°20'57"N	97°21'06"W	WHSRN, U.S.I.	Mainland Coastal Bay	*wilsonia*	96	53	Liptay and Zdravkovic 2008, Zdravkovic and Durkin 2011
Bahia Grande Lakes Complex	Texas	USA	South-eastern	26°02'20"N	97°15'10"W	U.S.I.	Coastal Saline Lake	*wilsonia*	52	59	Liptay and Zdravkovic 2008, Zdravkovic and Durkin 2011
South Padre Island	Texas	USA	South-eastern	26°18'27"N	97°12'20"W	WHSRN, Critical Piping Plover winter habitat, U.S.I.	Barrier Island	*wilsonia*	80	95	Liptay and Zdravkovic 2008, Zdravkovic and Durkin 2011
Brazos Island/ South Bay	Texas	USA	South-eastern	26°01'39"N	97°09'20"W	Critical Piping Plover winter habitat, U.S.I.	Barrier Peninsula	*wilsonia*	150+	55	Liptay and Zdravkovic 2008, S. Colley pers. comm.
Boca Chica Flats/ Mouth of the Rio Grande	Texas	USA	South-eastern	25°57'16"N	97°09'16"W	Critical Piping Plover winter habitat, U.S.I.	Mainland Gulf Beach, River-mouth	*wilsonia*	170	54	Zdravkovic 2005, Liptay and Zdravkovic 2008
Playa Bagdad*	**Tamaulipas**	**Mexico**	**Eastern**	**25°49'53"N**	**97°09'33"W**	**G.I. WHSRN, RAMSAR**	**Mainland Gulf Beach**	***wilsonia***	**N/D**	**150**	**Zdravkovic 2007a**
Bara El Conchillal	Tamaulipas	Mexico	Eastern	25°41'24"N	97°11'25"W	WHSRN, RAMSAR	Mainland Gulf Beach	*wilsonia*	N/D	87	Zdravkovic 2007a
Bara Los Americanos	Tamaulipas	Mexico	Eastern	24°43'59"N	97°37'07"W	WHSRN, RAMSAR	Barrier Island	*wilsonia*	N/D	59	Zdravkovic 2007a

Site Name	State / Province	Country	Region	Latitude	Longitude	Designations	Habitat Type	Sub-species	Non-breeding Indiv.	Breeding Pairs	Source
Bara Soto La Marina*	**Tamaulipas**	**Mexico**	**Eastern**	**24°16'21"N**	**97°42'50"W**	**G.I. WHSRN, RAMSAR**	**Barrier Island**	***wilsonia***	**N/D**	**155**	**Zdravkovic 2007a**
Ceuta	Sinaloa	Mexico	Western	23°54'00"N	106°57'00"W	WHSRN, RAMSAR	Barrier Island	*beldingi*	N/D	50–100	C. Küpper unpubl. data
Barra de Santiago Estuary	Ahuachapan	El Salvador	Western	13°43'00"N	90°01'00"W	IBA	River-mouth/ Mangrove Wetland	*beldingi*	105	N/D	O. Komar, unpubl. data
Estero de Jaltepeque and Río Lempa Estuaries	La Paz	El Salvador	Western	13°18'07"N	88°52'23"W	IBA	Mangrove Estuary/ River-mouth	*beldingi*	200	15	Rodríguez and Komar 1997, Ibarra Portillo et al. 2005 *in* Herrera and Komar 2007, O. Komar 2008 unpubl. data
Bahía de Jiquilisco *	**Usulutan**	**El Salvador**	**Western**	**13°12'44"N**	**88°28'00"W**	**G.I. IBA**	**Mainland Beach/ Mangrove Wetland**	***beldingi***	**500+**	**60+**	**Jones and Komar 2008, Martínez 2008**
Nicoya Gulf mangroves and Coastal areas*	**Puntarenas**	**Costa Rica**	**North-eastern**	**09°49'04"N**	**84°50'30"W**	**G.I. IBA**	**Barrier Peninsula, Mangrove Wetland**	***beldingi***	**N/D**	**~ 125**	**Sandoval and Sanchéz *in prep.***
Tárcoles, Carara, and La Cangreja	Puntarenas	Costa Rica	North-eastern	09°46'22"N	84°37'46"W	IBA	Barrier Peninsula, Mangrove Wetland/ Lagoon	*beldingi*	N/D	~ 50+	Sandoval and Sanchéz *in prep.*
Sierpe Wetlands and Osa Peninsula*	**Puntarenas**	**Costa Rica**	**South-western**	**08°52'00"N**	**83°28'00"W**	**G.I. IBA**	**Mangrove Wetland**	***beldingi***	**N/D**	**~ 150**	**Sandoval and Sanchéz *in prep.***

Site Name	State / Province	Country	Region	Latitude	Longitude	Designations	Habitat Type	Sub-species	Non-breeding Indiv.	Breeding Pairs	Source
Sanquianga National Park*	**Nariño**	**Colombia**	**Western**	**02°14'45"N**	**78°40'43"W**	**G.I. IBA**	**River-mouth, Bay Islands**	***beldingi/ wilsonia***	**500**	**50+**	**Ruiz *et al.* 2008**
Delta del Río Iscuandé (Bajos de La Cunita y Quiñónez)*	**Nariño**	**Colombia**	**Western**	**02°39'53"N**	**78°03'16"W**	**G.I. WHSRN, IBA**	**River-mouth, Bay Islands**	***beldingi/ wilsonia***	**1,500**	**~ 100+**	**Ruiz 2009**
Black River Great Morass	St. Elizabeth	Jamaica	Western	18°04'0"N	77°47'59"W	IBA	Mangrove Wetland	*wilsonia*	N/D	100	BirdLife International (2013) IBA Factsheet
Suroeste IBA / Cabo Rojo Salt Flats	Puerto Rico	USA	South-western	17°57'23"N	67°03'50"W	IBA/ WHSRN	Mangrove Wetland, Coastal Bay / Lagoon	*wilsonia*	93	76	Soc. Ornitol. Puertoriq. Inc 2005, Wege and Anadon-Irizarry 2008
North, Middle, and East Caicos Ramsar Site	Turks & Caicos Isl.	UK	Northern	21°47'56"N	71°46'31"W	IBA/ RAMSAR	Mangrove Wetland	*wilsonia*	N/D	50	Wege and Anadon-Irizarry 2008
East Caicos and adjacent areas	Turks & Caicos Isl.	UK	North-eastern	21°41'49"N	71°31'10"W	IBA	Mangrove Wetland	*wilsonia*	N/D	~ 30+	Wege and Anadon-Irizarry 2008
Grand Turk Salinas and Shores	Turks & Caicos Isl.	UK	Eastern	21°27'00"N	71°08'00"W	IBA	Mangrove Wetland	*wilsonia*	N/D	~ 30+	Wege and Anadon-Irizarry 2008
Salt Cay Creek, Salinas	Turks & Caicos Isl.	UK	South-west	21°12'00"N	71°15'00"W	IBA	Mangrove Wetland, Salt Pannes	*wilsonia*	N/D	~ 30+	Wege and Anadon-Irizarry 2008
North Atlantic Abaco Cays	Abaco	Bahamas	Northern	26°55'26" N	77°33'47"W	IBA	Mangrove Wetland, Barrier Island	*wilsonia*	N/D	50+	BirdLife International (2013) IBA Factsheet



Map 5. Wilson's Plover breeding distribution on Texas mid and upper coast (the state supporting highest populations of breeding Wilson's Plovers in U.S.). / Conservian/CBC.

Map 6. Wilson's Plover breeding distribution in the lower Laguna Madre of Texas (area of highest populations of breeding Wilson's Plovers in U.S.). / Conservian/CBC.

Map 7. Wilson's Plover breeding distribution in Louisiana (state supporting second highest population of breeding Wilson's Plovers in U.S.) / Conservian/CBC.

CONSERVATION THREATS

"For if one link in nature's chain might be lost, another might be lost, until the whole of things will vanish by piecemeal."

– Thomas Jefferson, 3rd U.S. President

The Wilson's Plover inhabits a coastal ecosystem that is increasingly subjected to the pressures of human-created habitat loss and disturbance. Prior to World War II, more than 90% of the U.S. coastal barrier lands and wetlands existed as undeveloped natural areas, largely inaccessible to the public (Coastal Barrier Task Force 1983). Population growth is widespread along the U.S. Atlantic seaboard and is expected to continue increasing significantly, particularly in the southeastern states (Crossett *et al.* 2004). The human coastal population of the five U.S. Gulf Coast states has doubled since 1960. "Although coastal ecosystems comprise less than 10% of the Nation, they host over one-third of its human population, nearly two-thirds of its fisheries, half of the migratory songbirds in the Nation, and one-third of its wetlands and wintering waterfowl. The Nation's coasts also provide habitat for 45% of all Threatened and Endangered species, including three-fourths of the federally listed birds and mammals" (U.S. Fish and Wildlife Service 1995*a*).

Ever-increasing development and recreational use of coastal areas continues to destroy and fragment existing coastal habitats, bringing with it the associated displacement of shorebirds through disturbance, increased attraction of mammalian predators , and contamination to shorebird food resources. "These anthropogenic changes are currently exerting pressures on the natural coastal ecosystems so severe as to imminently cause collapse of these systems" (Sale *et al.* 2008). In 2008, the United Nations (UN) updated its list of goals to include "Ensure environmental sustainability." The UN is calling for integration of the principles of sustainable development into country policies and programs in order to help reverse the loss of environmental resources by 2015. Given that 50% of the world's wetlands have been lost since 1900, environmentally sound policies are needed to ensure the sustainability of our ecosystems (Millennium Development Goals 2008).

LOSS, DEGRADATION, AND ALTERATION OF HABITAT

Coastal habitats, perhaps more than any other natural areas on earth, have been subjected to a continuing barrage of human manipulation, often culminating in environments devoid of any former natural biodiversity. Dynamic coastal environments lack the physical stability to support residential and commercial structures, resorts, vacation homes, roads, and parking lots. Loss of beach-nesting bird habitat through rampant development of these unstable areas has been exacerbated through continual attempts to armor the shifting sands and shorelines to protect coastal development and real estate. Seawalls, shoreline stabilization through artificial dune building and beach planting, and the dredging and creation of permanent breach-ways all serve to diminish available shorebird breeding and wintering habitat (Fig.17).

"Beach stabilization efforts interfere with coastal dune formation, causing beach erosion and loss of plover nesting and wintering habitat. Shoreline stabilization features such as jetties and groins may cause significant habitat degradation by robbing sand from the down-drift shoreline" (U.S. Fish and Wildlife Service 1996*a in* Recovery Plan for the Pacific Coast Population of the Western Snowy Plover, USFWS 2007). Building or nourishing beaches with sand can be beneficial for Wilson's Plovers and other beach-nesting birds ***if such projects are properly designed and promote an increase in appropriate habitat***; otherwise, it can be quite detrimental. "For example, if an inappropriate size class of sand (*e.g.*, coarser-grained sand) and range of minerals are introduced that are different from the current composition of native sand on a beach, it can alter dune slope (making it steeper or narrower), affect mobility and color of sand, decrease the abundance of beach invertebrates, and facilitate establishment of invasive exotic plants that may have a competitive advantage over native plants" (Feeney and Maffei 1991).

Fig. 17. (left) Habitat degradation through alteration and stabilization, Florida panhandle./ © M.Zdravkovic/Conservian

Fig.18. (right) Habitat obliteration through severe human disturbance and development, Florida Panhandle. / © K. Castleman/Conservian

Human alterations to the coastline in reaction to storm events continue to degrade existing beach-nesting and other shorebird habitats. Alterations include traditional jetties, groins, seawalls, and breakwaters as well as "beach stabilization" efforts such as sacrificial dunes and the plantings of beach, saltmarsh, and mangrove areas under the auspices of restoration. Beach plantings of native American beach grass *(Ammophila breviligulata)* and sea oats to "stabilize dunes" usurp preferred, natural, existing, open beach-nesting bird habitat. Tidal marsh restoration and planting of *Spartina spp*. to "restore" tidal marsh habitat in response to storm events also eliminates foraging habitat for Wilson's Plovers and many other shorebird species. In the Florida Keys, for example, mangrove restoration projects that remove artificial limestone fill areas are depleting the last remaining nesting habitat of the Wilson's Plover and other beach-nesting birds' breeding areas. Most of the natural beach-nesting bird habitat of the Florida Keys has long been built over with roads and structures. Remnants of the remaining natural habitat are at high risk from current and future rising sea levels. Wilson's Plovers have adapted in a few areas by nesting on artificial limestone fill substrates. However, the current trend is to restore even these remaining scarified areas to mangrove wetlands (Zdravkovic 2009).

HUMAN-CREATED DISTURBANCE – WITHIN THE CONTINENTAL UNITED STATES

While human alterations of the coastline continue to further reduce the amount of Wilson's Plover breeding and nonbreeding habitat, the added associated human disturbance likewise reduces the viability of the remaining habitat (Fig.18). Human recreation wherever the land meets the sea is constantly increasing. A suite of beach-use and maintenance activities further degrade beach habitats or make them unusable for beach-nesting and migratory birds. Use of off-road and all-terrain vehicles (ORVs, ATVs), beach camping, mechanical beach raking, semi-permanent beach furniture, and dogs and cats *(Felis catus)* (outdoor and feral), have rendered large expanses of otherwise intact beach habitat unusable to most wildlife.

Off-Road Vehicle (ORV) Use

Unrestricted use of ORVs in plover habitat is highly destructive to nests, chicks, food supply, and habitat. In coastal south Texas, CBC documented Wilson's Plover, Snowy Plover, and Least Tern nests destroyed and the young crushed by ORVs driving in nesting habitat (Zdravkovic 2005) (Fig.19). While ORV impact studies in relation to Wilson's Plovers are few, impacts to Piping Plover and Snowy Plover nesting habitat and disruption of normal behavior patterns are well documented. Vehicle use in breeding habitat can crush nests, young, and adults; separate chicks from parents; and damage wrack by pressing it into the sand, making it unavailable as cover or foraging substrate (Recovery Plan for the Pacific Coast Population of the Western Snowy Plover, USFWS 2007). Vehicles create ruts that can trap or impede chick movements and prevent plovers from using habitat that is otherwise suitable. Plover chicks also tend to crouch in tire depressions, making them vulnerable to vehicles (Piping Plover Atlantic Coast Population Revised Recovery Plan, USFWS 1996). In Massachusetts, between 1989 and 1997, a total of 25 Piping Plover chicks and two adults were found dead in off-road vehicle tire ruts on the upper beach between the mean high-tide line and the fore-dune (U.S. District Court of Massachusetts 1998 *in* Piping Plover Atlantic Coast Population Revised Recovery Plan, USFWS 1996). McGowan (2008) documented American Oystercatchers in North Carolina leaving their nests in response to ATV traffic, and found that ATV traffic was negatively correlated with the amount of time oystercatchers spent incubating.


Fig. 19. Impacts of ORV use in Wilson's Plover habitat in Texas. 1.) Crushed Wilson's Plover chick, two weeks old; 2.) Scarred algal flats with nest in area-meter hoop. / © M.Zdravkovic/Conservian

Non-recreational use of ORVs for monitoring and research purposes, including natural resource management, in plover breeding habitat can also be a source of disturbance, adult and chick mortality, and habitat damage—as can service vehicles. In southwest Florida, direct mortality of eggs and chicks from ORV and foot traffic has been documented on beaches. While some ORV use on Florida beaches is recreational, the heaviest use is administrative—by law enforcement personnel, park rangers, beach managers, and sea-turtle survey crews (Lott and Fischer 2010). Many beaches that do not allow public ORV use are still being heavily impacted by constant daily use of nonessential service vehicles that drive unrestricted through beach-nesting bird and shorebird habitat as part of "site management" activities. These nonessential vehicles include police and security patrols, site management staff, municipal staff, lifeguards, vendors, *etc.*, and many drive through shorebird habitat multiple times a day, every day of the year (Zdravkovic *in prep*).

Driving ORVs at night in beach-nesting bird habitat can be especially hazardous to adult and fledgling Wilson's Plovers, Snowy Plovers, and Least Terns, which tend to "freeze up" in the oncoming headlights and can be subsequently run over (M. Zdravkovic unpubl. data). In California at Vandenberg Air Force Base, 66 Western Snowy Plover adults were run over and killed by nighttime ATV use (Recovery Plan for the Pacific Coast Population of the Western Snowy Plover, USFWS 2007). Throughout North America, seasonal (May–October) daily sea-turtle monitoring via ATVs and ORVs is disruptive to nesting plovers and young; it damages front-beach nesting and foraging habitat by creating ruts, destroying vegetation, and crushing

wrack (Zdravkovic *in prep*). Epstein (1999) documented Wilson's Plover disturbance and chick mortality due to daily sea-turtle patrolling on Merritt Island, Florida.

Pedestrian disturbance

Pedestrians, particularly large concentrations, can deter beach-nesting birds and other shorebirds from using otherwise suitable habitats. Anthony (1985) found that intensive human activity at Damon Point, California, had a "bracketing effect" on the distribution of nesting Western Snowy Plovers by confining their breeding activity to a smaller section of the available habitat and precluding their regular use of otherwise suitable habitat. Fox (1990) also found that Western Snowy Plovers "avoided humans at Damon Point, and the presence of fishermen and beachcombers kept them hundreds of yards away from potential habitat." Studies of the Atlantic Coast population of the Piping Plover, which has habitat requirements very similar to the Snowy Plover, indicate that "some Piping Plovers that nest early in the season are forced to move elsewhere when human use becomes too intense" (Cairns and McLaren 1980). Novick (1996) and Davis (1999) documented lower nesting success for American Oystercatchers in North Carolina in areas where human disturbance was higher. McGowan (2006) found pedestrian traffic caused American Oystercatchers to leave their nests. Davis also noted in the American Oystercatcher Conservation Plan that oystercatchers avoid nesting in areas with high levels of human activity (Schulte and Brown 2007).

Beach Raking

"Although removal of human-created refuse on the beach is desirable to reduce the threat of predation, the indiscriminate nature of mechanized beach cleaning or beach raking adversely affects plovers" (Piping Plover Atlantic Coast Population Revised Recovery Plan, USFWS 1996). Mechanized beach cleaning crushes nests and removes and destroys the wrack line, which provides important natural habitat for foraging and protective cover (Piping Plover Atlantic Coast Population Revised Recovery Plan, USFWS 1996). Beach raking also alters the topography, removes objects associated with Western Snowy Plover nesting, and prevents the establishment of native beach vegetation (J. Watkins 1999 *in* Recovery Plan for the Pacific Coast Population of the Western Snowy Plover, USFWS 2007). "Even if human activity was low on

these beaches, raking activities completely preclude the possibility of successful Western Snowy Plover nesting" (Powell 1996 *in* Recovery Plan for the Pacific Coast Population of the Western Snowy Plover , USFWS 2007). On the Gulf Coast, Wilson's Plovers and other beach-nesting bird species are similarly impacted by beach raking on highly used public beaches and on privately owned hotel, condominium, and residential beaches, making suitable habitat unusable (Zdravkovic *in prep*).

Predators

"Predation, once a predominantly natural phenomenon, is now further exacerbated through the introduction of non-native predators and the unintentional human-related support of both native and non-native predators. Elevated predation impacts result from landscape-level alterations in coastal dune habitats which, in turn, now support increased predator populations within the immediate vicinity of nesting habitat for plovers. When exotic predators are introduced into the ecosystem and thrive there, they frequently occur in much higher densities and possess more effective strategies than native predators and, hence, usually have a more severe effect" (Western Snowy Plover Recovery Plan, USFWS 2007). Known mammalian and avian predators of Wilson's Plover eggs, chicks, and adults include Raccoon (*Procyon lotor*), Coyote (*Canis latrans*), Bobcat (*Lynx rufus*), Ghost Crab (*Ocypode quadrata*), various rodent species (Corbat and Bergstrom 2000), Gull-billed Tern (*Gelochelidon nilotica*), Chihuahuan Raven *(Corvus cryptoleucus)* (Zdravkovic 2005, M. Zdravkovic unpubl. data), Boat-tailed Grackle *(Quiscalus major)* (B. Winn pers. comm.) and introduced West Indian mongoose (*Herpestus javanicus*) (Lombard 2007). Loss or abandonment of eggs due to predation by fire ants (*Solenopsis invicta*) has also been observed in both the Western Snowy Plover (Fancher *et al.* 2002, Powell *et al.* 2002) and the Wilson's Plover (J. Duquesnel unpubl. data). Coyotes were the primary Wilson's Plover nest predator documented by CBC in Louisiana 2006–2008, and in the lower Laguna Madre region and Padre Island National Seashore in Texas in 2003–2004 for both Wilson's and Snowy Plovers (Zdravkovic 2005, 2010).

Dogs and Cats

Dogs on beaches pose a serious threat to all plovers during both the breeding and nonbreeding seasons. Unleashed pets, primarily dogs, may chase plovers, destroy nests, and kill young. Repeated disturbances by dogs, leashed and unleashed, can interrupt brooding, incubating, and foraging behavior of adult plovers and cause chicks to become separated from their parents (The Recovery Plan for the Pacific Coast Population of the Western Snowy Plover, USFWS 2007). "Even when not deliberately chasing birds, dogs on a beach may disturb Snowy Plovers and other shorebirds that are roosting or feeding." Page *et al.* (1977) found that Snowy Plovers flushed more frequently and remained off their nests longer when a person was accompanied by a dog than when alone.

Domestic and feral (stray) cats are also widespread predators. Predation of Snowy Plovers by cats increases when housing is constructed near plover breeding habitat. As natural beaches continue to be surrounded by urban areas, plovers will increasingly be subjected to predation by cats in the future (The Recovery Plan for the Pacific Coast Population of the Western Snowy Plover, USFWS 2007). Feral and house cats are known to take Snowy Plover adults and eggs (B. Farner, pers. comm. *in* Powell and Collier 1994) and Piping Plover adults and eggs (Piping Plover Atlantic Coast Population Revised Recovery Plan, USFWS 1996), plus cause significant abandonment of nests (The Recovery Plan for the Pacific Coast Population of the Western Snowy Plover, USFWS 2007).

HUMAN-CREATED DISTURBANCE – OUTSIDE THE CONTINENTAL UNITED STATES

During breeding Snowy and Wilson's Plover surveys in 2006, CBC encountered human disturbance of beach-nesting bird habitats throughout **Mexico**'s Laguna Madre region. Fragmented or disturbed habitat was primarily associated with areas that were accessible by vehicle. Front beaches and washover passes endured higher levels of disturbance because they serve as primary access roads to and from dwellings, boats, and other roads. Habitat in close proximity to small towns and fishing villages were the most highly impacted. These areas showed damage from daily vehicle use, fishing operations, the 'beaching' of fishing boats above the high-tide line, and rubbish disposal. Free-ranging cattle (*Bos taurus*), horses, *(Equus caballus),* and burros (*Equus asinus*) also contributed to habitat degradation (Zdravkovic 2007a).

In **Colombia**, ongoing human-caused habitat loss is the single greatest threat to shorebirds, including all three subspecies of Wilson's Plover. Loss of breeding and wintering habitat is caused or exacerbated by: expanded farming and cattle raising; timber harvesting near wetland areas; illicit cultivation of drug-related plants (and the resulting impacts of deforestation and chemical contamination in wetlands, rivers, and oceans on both the Pacific and Caribbean coasts); contamination from coal and petroleum extraction activities; changes in hydrology and water contamination associated with megaprojects (highways, ports); and development of coastal areas for increasing tourism (Ruiz *et al.*2008). In **Venezuela**, human encroachment into natural areas continues to be the most pervasive threat to most of the waterbirds and wetlands. The primary threats are habitat destruction, human recreational uses, pollution from industrial mining (including mercury contamination from gold-mining operations mainly in Bolivar and Amazonas), pollution from agricultural runoff (fertilizers and pesticides), and pollution from untreated sewage, sedimentation, and drainage. Mangroves in several areas, most notably in the Delta, are threatened by deforestation and timber extraction per the Waterbirds Report for Venezuela (Rodner 2006). In **Suriname** the primary threats to waterbirds are poaching and over-hunting, per the Waterbirds Report for Suriname (Ottema 2006). In **Brazil**, human disturbance to the Wilson's Plover and other beach-nesting birds is increasing from the expanding real estate and tourist enterprises along the coast (Deluca *et al.* 2006). In the **U.S. Virgin Islands**, development, human disturbance, and predation are the primary threats to Wilson's Plovers and other shorebirds. Unmonitored recreational pedestrian and ORV use of beaches and salt ponds creates significant disturbance that causes nest destruction and abandonment. Wilson's Plovers and all other ground-nesting birds also are exceedingly vulnerable to predation by the introduced West Indian mongoose, dogs, and cats (Lombard 2007). In **Peru**, increasing and unregulated ORV use on beaches damages shorebird feeding habitat and disturbs foraging and resting flocks (G. Engblom 2008, pers. comm.).

WIND FARMS

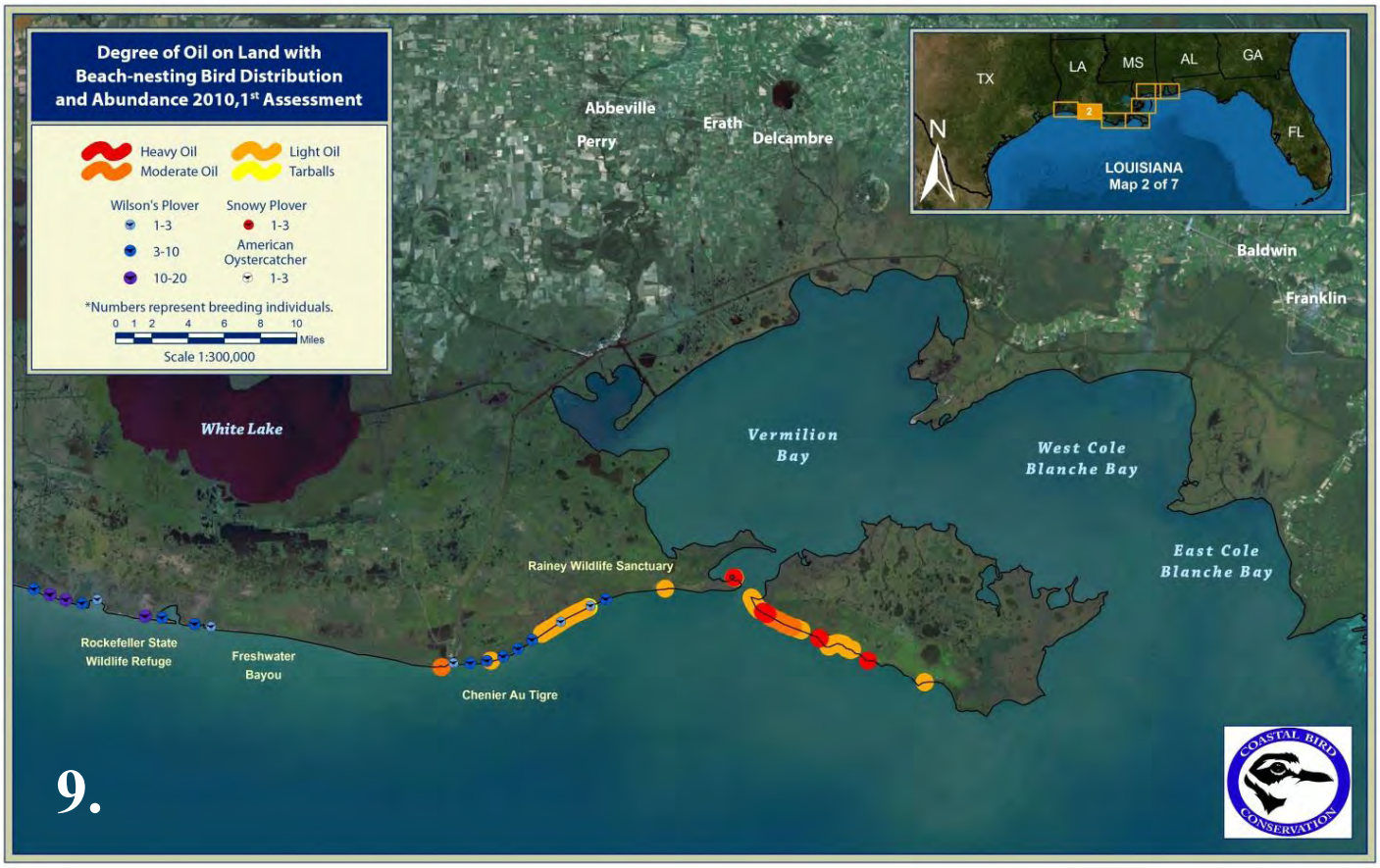
Wind turbines present an increasing threat to all bird species. It is estimated that approximately 573,000 birds died in 2012 in the United States as a result of collisions with wind turbines (Smallwood 2013). Since 2008, wind farm projects in the lower Laguna Madre region of Texas have erected over 560 wind turbines in coastal Kenedy, Willacy, and Cameron Counties,

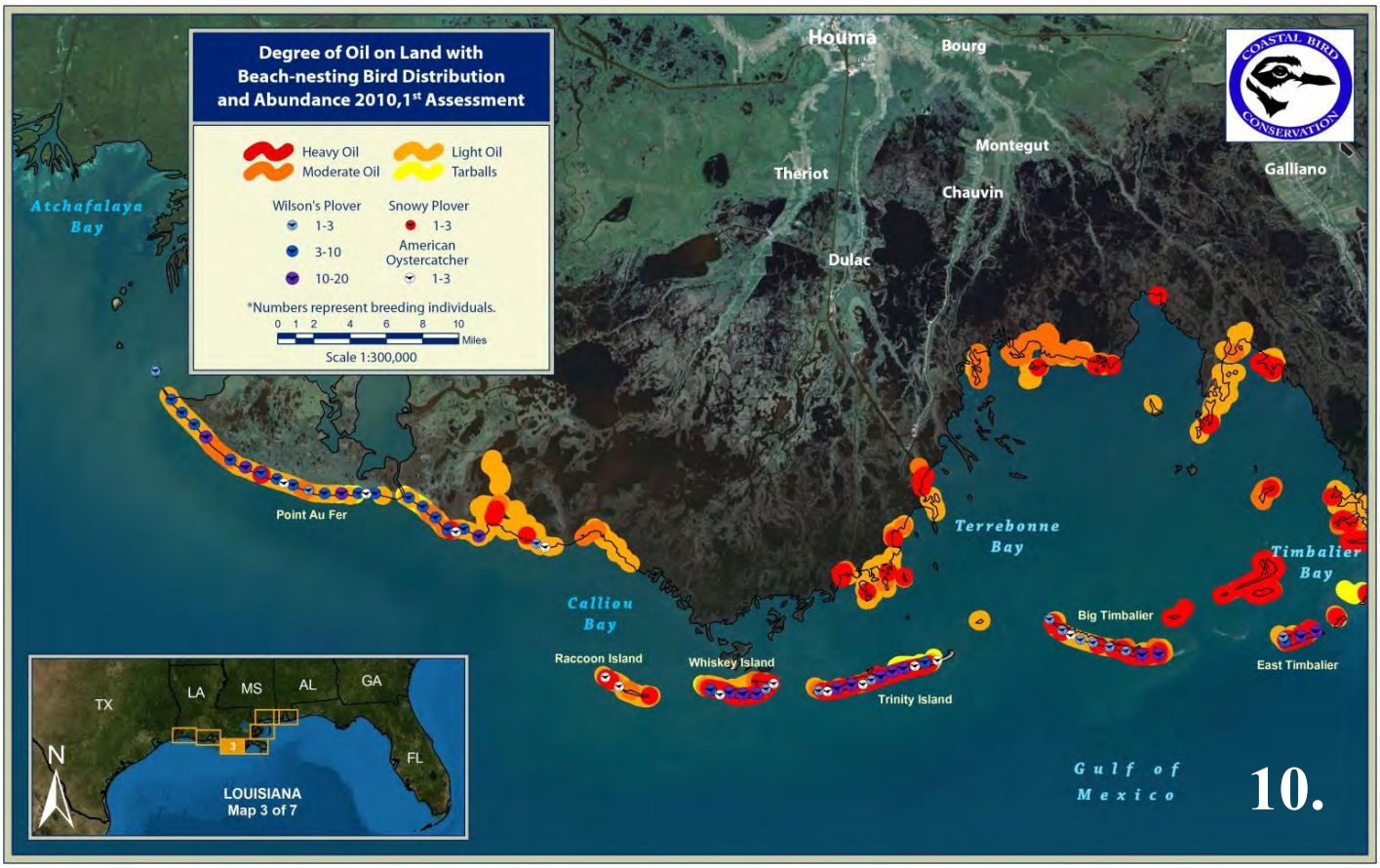
with more projects planned in the future. The wind turbines are approximately 400 feet tall with 100-foot long blades that move at a speed of 200mph. Wind farms in the Laguna Madre region have been installed on large stretches of private land, however they have the potential to impact vast areas of protected public lands adjacent to them. The entire Laguna Madre is a designated binational Western Hemisphere Shorebird Reserve Network (WHSRN) site and part of the world's largest hypersaline lagoon system (Tunnel and Judd 2002).Wind turbines in the Laguna Madre region are positioned within the Central Flyway—globally important for over 350 migratory, wintering, and resident bird species. The lower Laguna Madre Region also supports 20% of the estimated 8,600 breeding Wilson's Plover adults in the United States. Padre Island National Seashore, within the Laguna Madre, is a globally important site for breeding Wilson's Plover's, supporting more than 1% of the total species population (Liptay and Zdravkovic 2008, Zdravkovic 2005, 2013). Because wind farms in the Laguna Madre are located on private lands there are no studies available to provide data on impacts to regional shorebird populations.

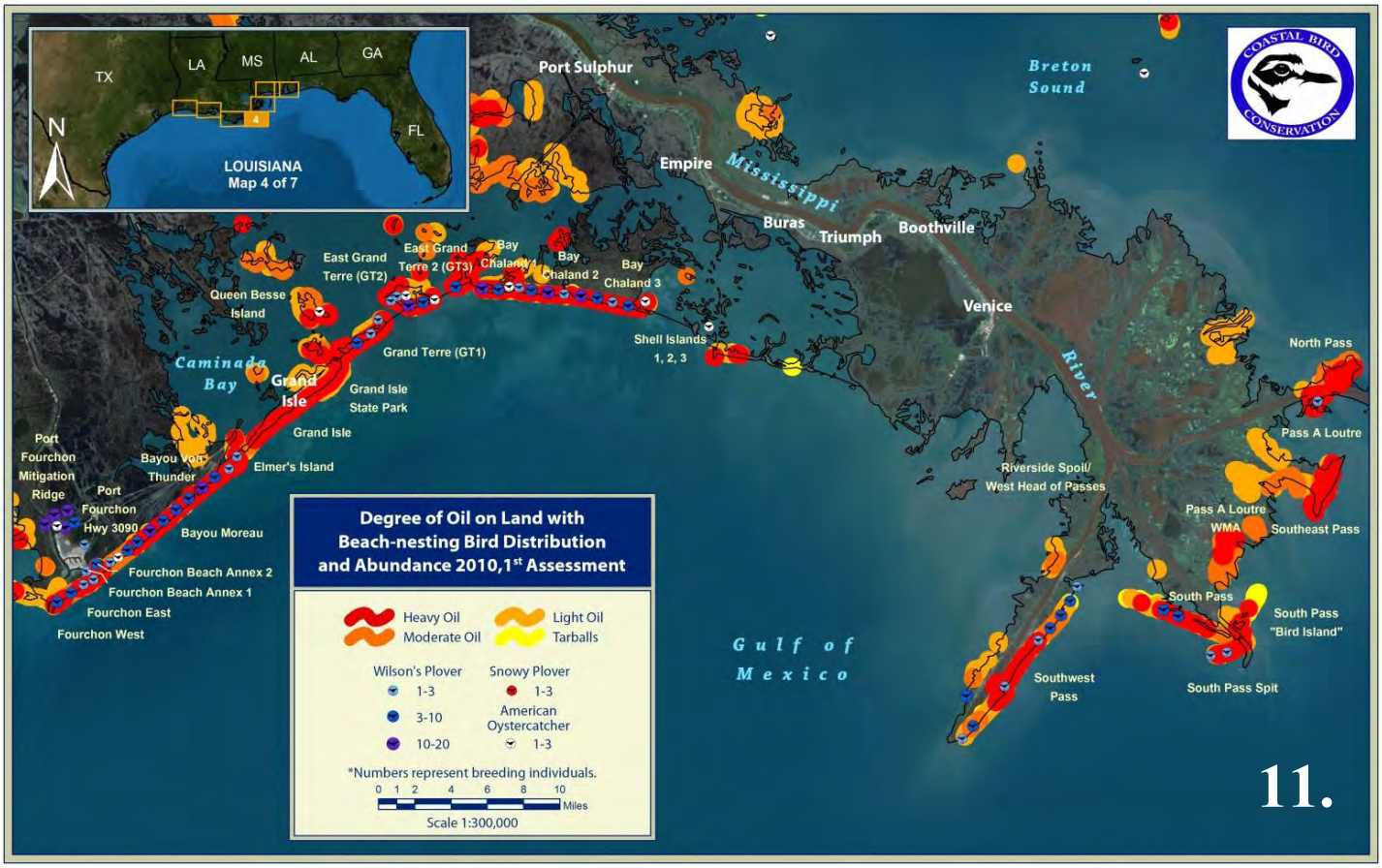
ENVIRONMENTAL CONTAMINATION

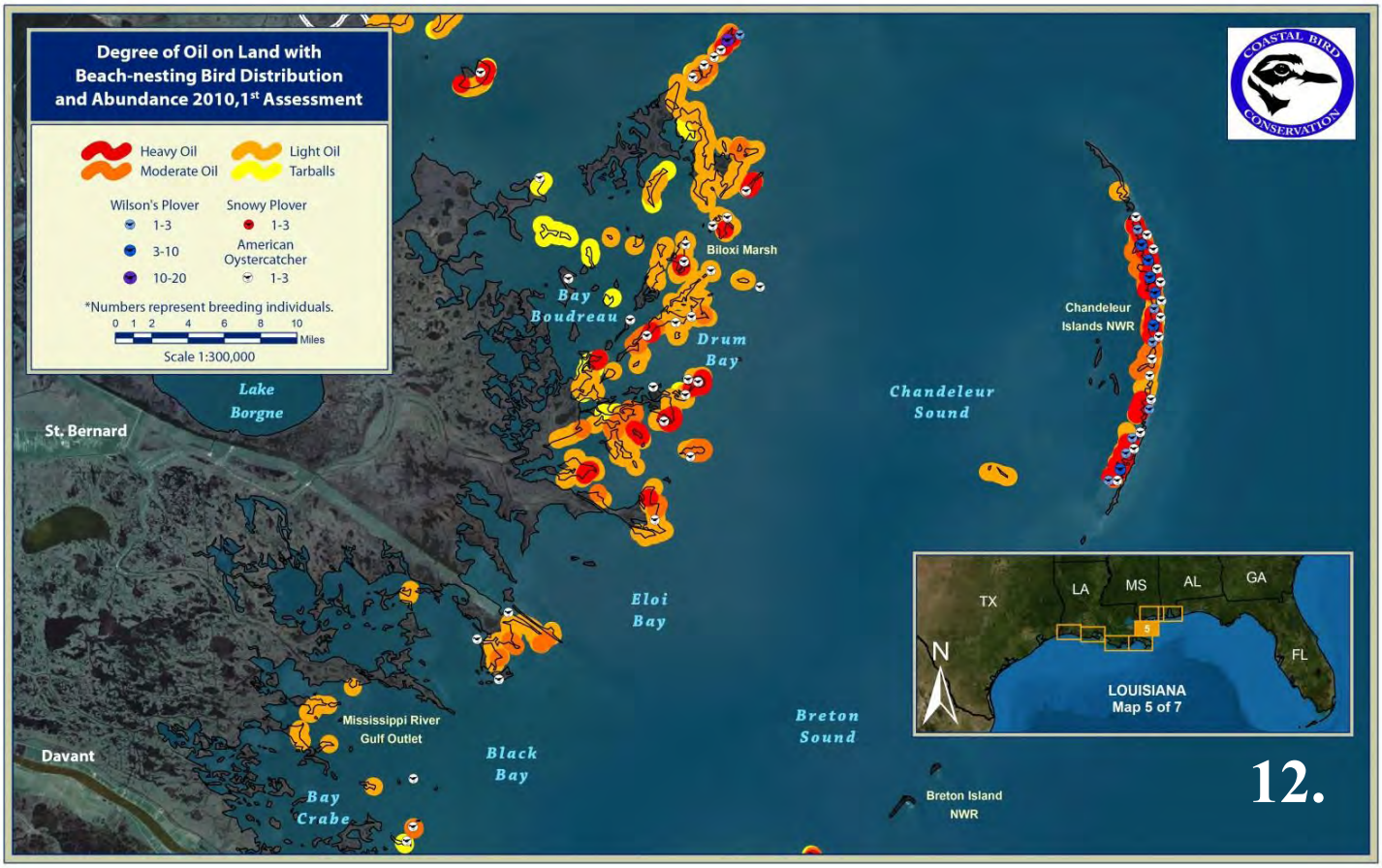
In addition to human disturbance and habitat loss or degradation, environmental contaminants pose a threat to shorebirds (Senner and Howe 1984). In 2010, CBC beach-nesting bird surveys documented over 40% of the estimated Gulf Coast Wilson's Plover population breeding within the BP (British Petroleum) Deepwater Horizon oil-impacted zone, potentially becoming directly exposed to oil, dispersant chemicals, contaminated habitat and food sources, and spill-response related disturbance. The majority of these birds bred in coastal Louisiana, the most severely oil-impacted state (Maps 8-12) (Zdravkovic 2013). Beyond direct oiling, of greatest concern for shorebirds is immediate and long-term damage to the food resources and habitat, and the potential for an increase in "dead zones" on the Gulf Coast. "Shorebirds ingest oil directly by preening or through eating contaminated prey. Oil spills also may affect shorebirds by killing the crustaceans on which they feed. Biological effects of spills are usually greater in low energy environments where oil accumulates" (Jackson *et al.* 1989); therefore spills may have a greater impact on the lower energy Gulf Coast (Rodgers *et al.* 1997). Two to four years after the Exxon Valdez oil spill in Alaska, hydrocarbon analysis of fecal samples demonstrated that Black Oystercatcher chicks were fed contaminated prey, which depressed their growth rates relative to chicks in un-oiled areas (Andres 1999).

Maps 8-12. Louisiana 2010 solitary beach-nesting bird distribution and BP Deepwater Horizon Gulf oil spill data / Conservian/CBC




Degree of Oil on Land with Beach-nesting Bird Distribution and Abundance 2010, 1st Assessment
Heavy Oil
Moderate Oil
Light Oil
Tarballs
Wilson's Plover
1-3
3-10
10-20
Snowy Plover
1-3
American Oystercatcher
1-3
*Numbers represent breeding individuals.
0 1 2 4 6 8 10
Miles
Scale 1:300,000
Houma
Bourg
Montegut
Theriot
Chauvin
Galliano
Dulac
Atchafalaya Bay
Point Au Fer
Terrebonne Bay
Timbalier Bay
Calliou Bay
Raccoon Island
Whiskey Island
Trinity Island
Big Timbalier
East Timbalier
TX
LA
MS
AL
GA
FL
N
LOUISIANA
Map 3 of 7
Gulf of Mexico
10.


TX
LA
MS
AL
GA
FL
N
LOUISIANA
Map 4 of 7
Port Sulphur
Breton Sound
Empire
Mississippi River
Buras
Triumph
Boothville
Venice
East Grand Terre (GT2)
East Grand Terre 2 (GT3)
Bay Chalard
Bay Chaland 2
Bay Chaland 3
Queen Besse Island
Grand Terre (GT1)
Shell Islands 1, 2, 3
Caminada Bay
Grand Isle
Grand Isle State Park
Grand Isle
Port Fourchon Mitigation Ridge
Port Fourchon
Hwy 3090
Bayou Yon Thunder
Elmer's Island
Bayou Moreau
Fourchon Beach Annex 2
Fourchon Beach Annex 1
Fourchon East
Fourchon West
Riverside Spoil/ West Head of Passes
North Pass
Pass A Loutre
Pass A Loutre WMA
Southeast Pass
South Pass
South Pass "Bird Island"
South Pass Spit
Southwest Pass
Degree of Oil on Land with Beach-nesting Bird Distribution and Abundance 2010, 1st Assessment
Heavy Oil
Moderate Oil
Light Oil
Tarballs
Wilson's Plover
1-3
3-10
10-20
Snowy Plover
1-3
American Oystercatcher
1-3
*Numbers represent breeding individuals.
0 1 2 4 6 8 10
Miles
Scale 1:300,000
Gulf of Mexico
11.



Oil and chemicals still present on the Gulf Coast from BP Deepwater Horizon disaster response will very likely continue to affect its coastal ecosystems. In September 2010, five months after the disaster, a team of researchers from University of Georgia led by Samantha Joye confirmed oil on the Gulf floor stretching 70 miles (113km) from the BP Macondo well source. Large areas of the sea floor remain covered by patches of oil several inches thick, chemically identified as originating from the BP Macondo well. No living sea life was found within the oiled areas, which researchers have described as an invertebrate graveyard. In January 2011, the Natural Resources Damage Assessment (NRDA) office estimated that 83 linear miles (133km) of shoreline were still heavily or moderately oiled. As of February 2011, subsequent research shows that the crude oil on the bottom is not degrading and that layers of soot from burned surface oil still contain petroleum. Researchers also estimate that the equivalent of between 1.5 and 3 billion barrels of methane were discharged into the Gulf during the BP oil disaster. "Microbial consumption of these gases could lead to the extensive and persistent depletion of oxygen in hydrocarbon-enriched waters" (Joye *et al.* 2011).

Petroleum compounds from the 2010 BP oil disaster on the Gulf of Mexico have been found in the eggs of White Pelicans that winter on the Gulf Coast. The Minnesota Department of Natural Resources found that petroleum compounds were present in 90 percent of the eggs tested on Marsh Lake in western Minnesota. Nearly 80 percent of the eggs also contained the chemical dispersant Corexit used in the Gulf to break up surface oil on the water. According to the U.S. Environmental Protection Agency, Corexit contains cancer-causing chemicals and endocrine-disrupting compounds which can disrupt hormone balance and affect embryo development (Minnesota DNR 2012). Wilson's Plovers and other breeding and beach-nesting birds on the Gulf Coast very likely have these same contaminants within their systems, but no research is currently being conducted to evaluate this. Long-term, oil-related impacts to beach-nesting birds from the BP Deepwater Horizon oil disaster will only be known through continued and consistent monitoring of shorebird populations on the Gulf Coast.

Reactions to Environmental Incidents: Aftermath of the BP Deepwater Horizon Oil Spill

On April 21, 2010, CBC began beach-nesting bird surveys in Alabama, one day after the BP Deepwater Horizon explosion. During the first week of May, the Chandeleur Islands and the Mississippi Delta became the first areas where oil made landfall. During the first week of June, the Caminada Headland in Louisiana from Grand Isle to Port Fourchon became oiled. In July, Hurricane Alex moved through the Gulf, pushing more oil ashore and re-oiling the Caminada Headland, Barataria, Timbalier and Terrebonne Bays. By late July, oil was found ashore from the Florida panhandle to Galveston Island, Texas. The BP Deepwater Horizon oil spill impacted approximately 1,054 linear miles (1,697 km) of Gulf coastline (NRDA 2011) not only by oil, but also by pre-oil landfall preparations and post-landfall cleanup activities. Detrimental activities within beach-nesting bird habitat included beach raking, boom placement, sand-berm construction, inlet and bayou closings, crew transport, and erection of major staging areas and operations. Damage and disturbance to shorebird nesting sites, along with severe degradation of large areas of coastal habitat, occurred throughout the Florida panhandle, Alabama, Mississippi, Louisiana, and Texas (Fig.20). Throughout the 2010 breeding season, CBC documented severe habitat damage within active breeding habit, as these areas became "highways" for all types of 4x4 vehicles (ORVs) and heavy equipment. Nearly all of the sites surveyed by CBC in 2010 were impacted directly from oiling and/or part of the collateral damage associated with oil

response. Due to remoteness many breeding areas did not have the benefit of protective signage as a regular part of management, however at protected sites, CBC documented areas that had been driven through with signage downed by oil-response activities.

Oil spill response brought excessive human-caused disturbance to many remote nesting areas that saw little disturbance prior to the BP oil spill. For beach-nesting birds and chicks, accessing foraging habitat became an impossible gauntlet of speeding vehicles and deep ruts. During 2010 surveys, CBC encountered staff from multiple agencies, BP oil spill response crew leaders and crew, federal and state agencies, local law enforcement, and county and city agencies driving vehicles within breeding habitat or performing oil-response activities, unaware of the impacts of their actions or the presence of beach-nesting birds. Much of the secondary or collateral damage to beach-nesting birds and habitat could have been avoided or reduced with proper communication, preparation, and implementation of basic, protective measures and management practices (Zdravkovic 2013).

Fig. 20. BP Deepwater Horizon oil spill impacts to Wilson's Plovers 2010. /
© M.Zdravkovic/Conservian
1.) Oiled male
2.) Oiled female at nest with boom.
3.) Chick separated from adults by boom.


2.


3.

Fig. 21. Oil buried by Hurricane Alex in 2010, Louisiana. / © S.Liptay/Conservian

As of 2012, beach-nesting birds on the Gulf Coast have endured three breeding seasons of increased human-caused disturbance due to ongoing oil-related cleanup activities from the BP oil spill. Every major storm event passing through the Gulf has exposed buried oil and deposited new tar mats and tarballs on shorebird habitat throughout the oil-impacted zone; each event brings a new chain reaction of oil cleanup activities and the associated disturbance and destruction to shorebird habitat. (Fig. 21). Cleanup methods in many areas of the Gulf also include techniques like "deep cleaning" that destroy small organisms living within the sand and intertidal zone—an important shorebird food resource. This chain of events will likely continue for many years to come, and has thus far been very poorly regulated to limit further damage and disturbance to breeding, beach-nesting birds on the Gulf Coast (M. Zdravkovic *in prep*).

Ecoestrogens (a broad class of chemicals that mimic estrogen and disrupt normal functioning of the endocrine system) are common by-products of the industrial world and exist in a myriad of everyday products. Ecoestrogens readily find their way into waterways and can alter the reproductive systems of organisms exposed to high doses, particularly fish and other marine

animals. In the wild, ecoestrogens cause feminization of males and tend to become concentrated in large predators such as sharks. Studies on humans have linked ecoestrogen to decreased sperm counts in men, breast cancer in women, and early puberty in girls. The current influx of ecoestrogens into the coastal environment may have profound chain-reaction effects on all wildlife within the coastal zone, with the potential to alter and disrupt all shorebird food resources (Voiland 2005).

GLOBAL CLIMATE CHANGE AND SEA-LEVEL RISE

The Wilson's Plover is an obligate coastal species that inherently uses low-lying coastal habitats for feeding, nesting, migrating, and wintering. Wilson's Plovers and their habitats are therefore particularly vulnerable to any effects of sea-level rise. The Intergovernmental Panel on Climate Change (IPCC) predicts that global temperature will rise between 2.5–10.4°F (1.4–5.8°C) by 2100, an increase likely without precedent in the last 10,000 years (IPCC 2001). As a result of thermal expansion of ocean water and increased melting of land-fast ice, sea level is expected to rise between 0.3–2.9ft (0.09–0.88m) by 2100. In addition, global climate change is expected to include increased severity of coastal storms (IPCC 2001).

A study on the effects of sea-level rise on Snowy Plovers in Florida concluded that "sea-level rise will cause a decline in suitable habitat and carrying capacity for this species, and an increase in the risk of its extinction and decline" (Aiello-Lammens *et al.* 2011). Coastal Louisiana presents a different situation: a human-caused breakdown of the natural coastal and delta ecosystems (Penland *et al.* 2005) combined with sea-level rise. Because of centuries of human alterations, the Mississippi River Delta is no longer replenishing lost land. With the occurrences of Hurricane Katrina and Rita in particular, the Louisiana coast has undergone major changes. *Before* Hurricane Katrina, an average of 15,000 acres (6,070 ha) of land were being lost Statewide to open water each year—a rate that would have meant 60 square miles (155 sq. km) lost over 50 years. Due to Hurricanes Katrina and Rita, 73 square miles (189 sq. km) were lost in a single year (2005) (Sheikh 2006). Region-wide, the U.S. Geological Survey reports that within the 742 square miles (1,922 sq. km) of affected coastline, more than 118 square miles (306 sq. km) of land were transformed into new water areas (Sheikh 2006). Permanent habitat loss on the Chandeleur Islands may have occurred where 86% of surface land area was lost during Katrina (Sallenger *et al.* 2009).

These changes can be expected to affect Wilson's Plovers and all beach-nesting birds and their habitats, although the impacts are difficult to predict. Stochastic events such as storms, hurricanes, and tropical cyclones are part of the natural cycle and are generally beneficial and necessary to build and maintain barrier islands and beach-nesting bird habitat. How the coastal environment and its obligate species will react or adapt to stronger and more frequent storms and rising sea levels over a short time span is unknown. The effects of sea-level rise on availability of shorebird food sources are unknown but potentially serious. Wilson's Plovers depend primarily on fiddler crabs and other tidal zone marine organisms for food, and the ability of these organisms to adjust rapidly to unnaturally high sea levels is unknown.

CONSERVATION STRATEGIES AND ACTIONS

"Combining management needs for species that use the same types of habitat in the landscape increases the efficiency of management, reduces costs, and increases the effectiveness of specific projects by addressing the needs of a variety of birds simultaneously. Detailed plans are required for each group of species. Therefore, it is important that each initiative, based on a specific group of birds, continues to provide the best information possible about what is needed for those species. In addition, integration requires a focused effort to look for overlapping opportunities for habitat conservation. Overall, the challenge of integrating bird conservation for multiple species groups will yield significant benefits in terms of the efficiency of the conservation achieved on the ground, and the broad base of support that can be generated for bird conservation by working together"

– U.S. Shorebird Conservation Plan (Brown *et al*. 2001)

FEDERAL PROTECTION

Petition for the federal protection of Wilson's Plover subspecies *C. w. wilsonia,* given its low and declining population in the U.S. (<8,600 breeding adults), limited and contracting geographic range, rapid loss of habitat, and intense, human-created disturbance throughout all areas of the species' annual life cycle.

Under the Wilson's Plover's current status, protection attempts have been very limited. The minimal protection it has is from efforts carried out for other federally listed beach-nesting

species. Listed status will strengthen the ability of all concerned organizations and agencies to effectively protect this species and its habitats. Immediate results of the listing designation generally include mandates that governmental agency staff dedicate more time and resources towards the species and develop U.S. recovery and conservation plans with quantitative recovery goals and critical habitat designations. Section 6 of the U.S. Endangered Species Act (ESA) specifically coordinates the activities of federal and state agencies toward the protection of listed species; further, it allows the U.S. Fish and Wildlife Service (USFWS) to grant funds to affected states for management actions that help to protect and recover the species. For many listed species, once increased government funding is allocated, these resources are often complemented by funds from private sources (Hecker 2008). Federally listed status for the Wilson's Plover will provide an "umbrella effect" of protection for all other beach-nesting species using the same habitats. This measure is particularly important on the U.S. Gulf Coast which supports approximately 75% of the U.S. Wilson's Plover breeding population. The Wilson's Plover nests in all five Gulf Coast states and uses the widest variety of habitats compared to other beach-nesting birds. This species has been recorded in all nine macrohabitat types classified in this plan, thus affording the largest expanses of habitat protection for all species involved (Zdravkovic 2005, 2009, 2012). The Wilson's Plover should be considered as a potential "Surrogate Species" by the U.S. Fish and Wildlife Service (USFWS) for beach-nesting bird species within the U.S. Southeast and Southwest Regions. The species is considered an "Indicator Species" for beach-nesting birds for the Landscape Conservation Cooperatives (LLCs) of the Gulf Coastal Plains-Ozarks, and should also be considered as an indicator species for the South Atlantic, Peninsular Florida, Coastal Prairies, and Caribbean LCCs (C. Hunter, USFWS, pers. comm.).

The Wilson's Plover could become the "Piping Plover of the Gulf," to drive and expedite recovery of all beach-nesting bird populations and habitats on the Gulf Coast. U.S. Federal listing of the Wilson's Plover would set a positive precedent for the range-wide conservation of the species and its habitat, perhaps leading to protected status in other countries. This plan recommends that, until Federal listing for the Wilson's Plover is achieved, existing species laws such as ESA protections for the Piping Plover should be used to help protect the Wilson's Plover and its habitats.

HABITAT PROTECTION

Support aggressive action to preserve newly formed, reclaimed, and existing coastal habitat important to the Wilson's Plover through acquisition, conservation easements, and zoning restrictions. To preserve coastal species diversity and habitats, we must shift our current beliefs about development of these fragile ecosystems. Responsible and realistic coastal zone planning and management must be adopted that protects human life and interests, as well as ensures biodiversity and sustainability of the natural habitats of the coastal ecosystem. True habitat protection begins with a cessation of coastal development.

Prohibit all stabilization and alteration of coastal shorebird habitat, particularly on key coastal barrier habitat. Coastal habitats, especially mainland and barrier beaches and barrier islands, used by the Wilson's Plover and many other beach-nesting species are in a state of constant change. These habitats are ephemeral and change seasonally and annually with storms and other hydrology-altering events. These natural coastal formation processes are necessary to create and maintain the highest-quality habitats for plovers and other beach-nesting birds. "All efforts of habitat protection must recognize and allow for these natural dynamic processes to occur unimpeded if healthy habitat levels are to be perpetuated. Barrier beaches absorb wind and wave forces of coastal storms, thereby providing storm protection to property and other resources on nearby mainland areas" (Coastal Barriers Task Force 1983, Massachusetts Barrier Beach Task Force 1994). Barrier islands and beaches and their associated ecosystems have the ability to naturally regenerate themselves when left unaltered. All beach stabilization, sand fencing, planting of vegetation, and building of sacrificial dunes in current or potential plover breeding and nonbreeding habitat must be prohibited. These actions are destructive to shorebird habitat and typically are ineffective at preserving human coastal interests, possibly even exacerbating existing erosion problems. Development, alteration, and stabilization of the coastal environment may eventually become prohibitively costly to continue and maintain if the currently predicted trend of strengthening hurricanes and rising sea levels continues (IPCC 2001).

Prohibit rebuilding of nonessential structures within flood zones. In addition to allowing all remaining habitat to persist naturally, measures should be taken to compensate for currently compromised habitat. Socially and environmentally responsible planning and management dictates that all nonessential commercial and residential structures within the flood

zone that are lost to storm events and erosion should not be re-established there. Federal funding of real estate losses within coastal flood-zone areas should be directed towards relocating necessary structures further inland beyond coastal flood zones. Coastal high-hazard zones can then be designated as protected under the Coastal Barrier Resources Act (CBRA), ensuring two benefits: a gradual increase of natural, coastal habitat for human enjoyment and wildlife, and some defense against future catastrophic structural losses caused by the predicted effects of global climate change.

The 1959 Texas Open Beaches Act is an example of restrictions on rebuilding on public beaches after storm loss. Under this act, the strip of beach between the average high-tide line and the average low-tide line is considered public property. Although this law is often invoked to keep public beaches open to ORV use, over the years the State has also used the law to seize houses where storm erosion was so severe they were obstructing use of public property. In 1993 the State invoked this act following Hurricane Alicia. Due to extensive overbuilding on barrier beaches, the aftermath of Hurricane Ike in 2008 may lead to the most extensive use of this law in Texas history. Similar laws exist in California and Oregon.

Maintain natural breeding habitat after storm events. A dramatic example of the positive effects of storm events on beach-nesting bird habitat is illustrated in two Louisiana state-wide shorebird censuses. In 2005, CBC partnered with BTNEP to conduct the first ever, comprehensive, state-wide census for breeding beach-nesting birds in Louisiana. In preparation for ground surveys, the entire Louisiana coastline was aerially surveyed to identify all potential breeding habitat to ensure no areas were missed. The Wilson's Plover was the primary plover species surveyed. The census, conducted a few months before Hurricanes Katrina and Rita, recorded under 800 pairs in total (Zdravkovic and DeMay 2006). In 2010, CBC and BTNEP conducted a second state-wide, beach-nesting bird census using the same methodology. The 2010 census documented over 1,200 breeding pairs of Wilson's Plovers over the same survey area (Zdravkovic 2013). The increase in breeding pairs was due in part to the effects of Hurricanes Katrina and Rita, which created new, open nesting habitat. During the period between censuses, breeding Wilson's Plover expanded to fill the new habitat areas, producing a state-wide increase of 33% over five years and an increase in breeding pairs by as much as 58% at specific sites. Breeding sites such as Rockefeller State Wildlife Refuge supported 79 total pairs over 26 miles (49km) of narrow, 33ft (10m) wide, linear, mainland Gulf beach in 2005

(Zdravkovic and DeMay 2006). Five years after Katrina and Rita, this same site supported 188 pairs of breeding Wilson's Plovers (Zdravkovic 2013). Though Louisiana lost much coastal acreage during Katrina and Rita, beach-nesting bird habitat increased with the hurricane's scouring removal of vegetation. As beach-nesting bird habitat is both lost and created by hurricanes and other storm events, abundance and distribution of beach-nesting birds may shift from region to region (Zdravkovic 2013). Much of the nesting habitat formed during the hurricanes in 2005 had become naturally well vegetated by 2010. By 2012, vegetation within some sites had grown in too densely to support nesting Wilson's Plovers (M. Zdravkovic unpubl. data). Another factor that contributed to Louisiana's state-wide increase in breeding Wilson's Plovers in 2010 were large-scale barrier island restoration projects conducted in the aftermath of Hurricane Katrina and Rita (Zdravkovic 2013).

Support beach-nesting bird habitat creation, enhancement, and restoration. While preventing development of all beach-nesting bird habitat should be the first line of defense against habitat loss, creation of new habitat or enhancement of existing habitat (through properly designed use of deposited or dredged material) can also be a very effective method of increasing available shorebird habitat. Wilson's Plovers readily use dredge spoil islands for nesting. Spoil islands constructed of suitable material can be used to offset loss of breeding habitat (Sprunt and Chamberlain 1970). In many areas, the U.S. Army Corp. of Engineers are working with state agencies and private organizations to build and maintain dredge spoil islands that will support colonial nesting birds (McGowan *et al.* 2005, S. Cameron pers. comm.). In Texas, artificially created sites, such as dredge spoil sites, artificial lakes, channels, and levees, supported 30% of the breeding Wilson's Plovers recorded statewide in 2004 (Zdravkovic 2005). In Louisiana in 2005, barrier island restoration and artificially created sites supported only 3% of the statewide Wilson's Plover breeding population (Zdravkovic and DeMay 2006). In 2010, post Katrina, over 30% of the state's breeding population of Wilson's Plovers was documented nesting on artificially created or restored sites after implementation of multiple barrier-island restoration projects (Appendix 3) (Zdravkovic *in prep*). Gulf-wide, these manmade or enhanced habitats supported 27% of the Wilson's Plovers found breeding on the Gulf Coast (Fig.17) (Zdravkovic *in prep*). Opportunities to use dredge spoil for Wilson's Plovers and other beach-nesting bird habitat creation should be pursued by state and federal agencies. Proper timing and placement of dredged materials in beach-nesting bird habitat is important and should be conducted outside the

breeding season. Dredge material should be taken from areas that do not impact existing breeding or migratory shorebird habitats.

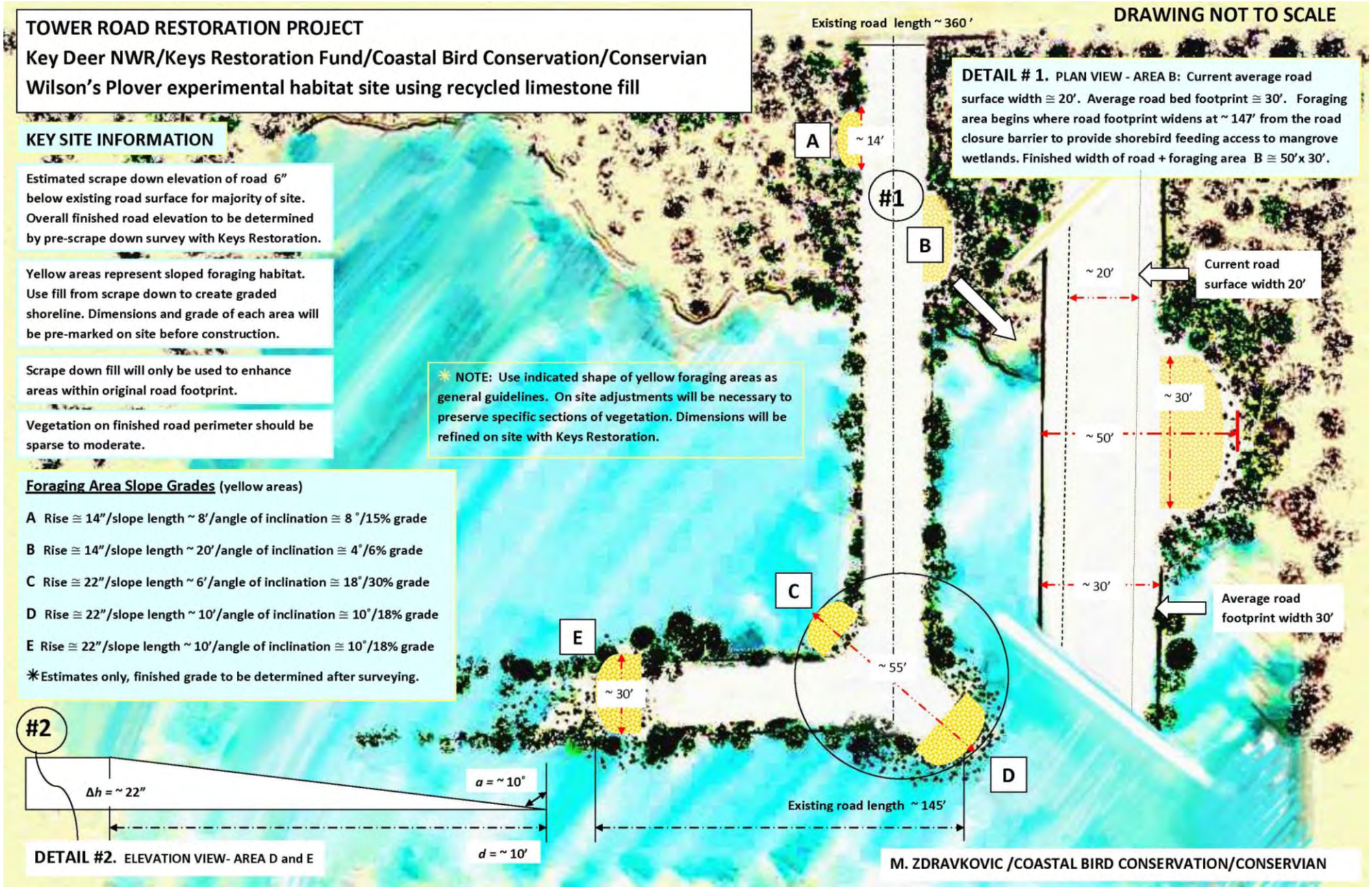
Limestone Fill Scrapedown vs. Habitat Creation

In 2009, CBC began cooperative habitat restoration/creation for shorebirds with the Key Deer National Wildlife Refuge and The Keys Restoration Fund. The Tower Road Restoration Project represents the first known limestone fill habitat to be "upcycled" for breeding Wilson's Plovers. Upcycling is the process of converting waste materials into new materials or products with better quality or higher environmental value. Newly created habitat successfully attracted nesting Wilson's Plovers to the site during the first breeding season after project implementation. (Fig.22).

Before extensive development of the Florida Keys and the accompanying human disturbances, Wilson's Plovers and colonial tern species nested on natural substrates such as beaches, dry salt pannes, exposed limestone, sand, and algal mat that remained above high tide during the breeding season. As development has eliminated most of these natural areas, the Wilson's Plover has found replacement nesting habitat on limestone fill areas associated with mangrove wetlands. These areas provide the necessary dry nesting substrate, abundant fiddler crabs (food source), and quality foraging and cover habitat for chicks at the mangrove edges. These artificial fill areas associated with mangrove wetlands are often less disturbed than the high human-use beaches of the Keys and also provide much needed foraging and roosting habitat for migratory and wintering shorebirds.

A major goal of CBC work in the Florida Keys is to preserve and enhance all existing limestone fill habitat currently used for nesting by the Wilson's Plover. Preserving limestone fill areas rather than restoring them to mangrove wetlands will also be far less costly. Under current management practices, most limestone fill areas in the Florida Keys under state and federal ownership are being "restored" to mangrove wetlands. This process is progressively eliminating the last few remaining Wilson's Plover/beach-nesting bird sites in the Florida Keys.

Fig. 22. Upcycled Wilson's Plover Breeding Habitat in the Florida Keys. / © M. Zdravkovic/Conservian



COMPREHENSIVE MANAGEMENT AND DISTURBANCE CONTROL

Prohibit all use of recreational vehicles on coastal habitat. Off-road vehicle (ORV) prohibitions should apply to all recreational use of vehicles, ATVs, and dirt bikes, and would also include nonessential use of service vehicles, with the exception of emergencies. Alternative ways of beach access should be provided for beach goers in the form of ferries, shuttles, and pedestrian walkways. When necessary, only unpaved access roads with unpaved parking areas should be maintained. If access roads must be restored after storm damage, only unpaved roads should be constructed using gravel or shell substrates. When paved beach access roads are destroyed by storms, large amounts of broken asphalt contaminants and debris are left in the natural habitat. In some areas of the Florida Panhandle, asphalt barrier-beach access roads have been washed out so often that black asphalt gravel and debris has mixed with the white sand to become part of the beach substrate (Zdravkovic *in prep*.).

Enforce strict regulations on non-recreational vehicle use. All-terrain vehicles (ATVs) are a valuable tool for conducting research, monitoring, and surveying in many areas of vast habitat; however, they should be used only when necessary by highly trained individuals (Zdravkovic *in prep*.). "Daily use of ATVs or ORVs for sea-turtle monitoring should be restricted to the intertidal zone, below the wrackline, to minimize risks of impact to foraging plover young and to limit daily damage (tire ruts and crushed wrack) to front beach plover-nesting habitat" (Epstein 1999). To avoid incidental impacts to plover nests and young, Epstein (1999) suggests "marking nests and working closely with sea-turtle monitoring crews to inform them of the presence of plover nests on the upper beach and chicks feeding in the intertidal areas." It would be misguided to assume that two decades of sea-turtle monitoring using ORVs/ATVs in plover nesting and chick foraging habitat on the U.S. Gulf and Atlantic Coast have not negatively impacted the Wilson's Plover and other beach-nesting bird species, including the Snowy Plover, American Oystercatcher, and Least Tern.

All research and monitoring of imperiled, beach-nesting species demands responsible, coordinated, and compatible methods that do not increase risk to any other imperiled species. Daily sea-turtle monitoring using ORVs at beach-nesting bird sites should be re-examined and conducted only if justified. Sea-turtle beaches should be monitored on foot whenever possible. If ORVs are absolutely necessary for monitoring, speeds should be kept below 10 mph (16 km/h); 5 mph (8km/h) is recommended in the recovery plan for areas occupied by nesting Atlantic

Coast Piping Plovers (U.S. Fish and Wildlife Service 1996) and in the Southeastern Coastal Plains-Caribbean Region Report (Hunter 2000). At greater speeds, detection of plover chicks is not possible. Night use of ORVs and ATVs is extremely hazardous to all shorebirds, both wintering and breeding, and should not be permitted beyond emergency situations.

Use standardized, proven management and protection practices to limit human disturbance in beach-nesting birds' breeding and nonbreeding habitat. Habitat loss due to high human disturbance can be reclaimed by effective beach management practices. More than a decade of intensive management and protection techniques employed to restrict human disturbance has been shown to increase plover populations (Piping Plover Atlantic Coast Population Revised Recovery Plan, USFWS 1996). Long-term agreements to reduce human disturbance should be initiated at all important breeding and nonbreeding sites with site managers, to assure protection and management of habitat sufficient to maintain current populations of Wilson's Plovers.

Immediate protection of all coastal habitats is necessary for Wilson's Plover as well as for the preservation of many imperiled coastal species dependent on the same habitats, including Snowy Plover, Piping Plover, Collared Plover, American Oystercatcher, Common Tern, Black Skimmer, Gull-billed Tern, Least Tern, many species of sea turtles: Kemps Ridley (*Lepidochelyskempii)*, Loggerhead *(Caretta caretta)*, Green *(Chelonia mydas),* Leatherback *(Dermochelys coriacea),* and Hawksbill (*Eretmochelys imbricata*); and, several beach mouse subspecies.

Standardized methods of management and protection in high human-use areas have proven to be very successful for increasing both Snowy Plovers and Piping Plover populations. These methods include use of symbolic fencing (posting and roping), pet restrictions, vehicle restrictions, limiting beach access points and boat landing areas, prohibiting all beach raking/cleaning practices, limiting use of beach furniture, and maintaining a visible law enforcement presence. On National Wildlife Refuges where protection and management of wildlife is the paramount purpose and goal of federal ownership, complete closures of plover habitat during the breeding season should be employed or continued (Piping Plover Atlantic Coast Population Revised Recovery Plan, USFWS 1996; The Recovery Plan for the Pacific Coast Population of the Western Snowy Plover, USFWS 2007). Snowy Plover nesting areas within some refuges are closed to the public use during the breeding season. Military

installations often limit or redirect training activities that are near Snowy Plover nesting areas, and some state parks and recreation areas restrict public access in certain areas during the breeding season (The Recovery Plan for the Pacific Coast Population of the Western Snowy Plover USFWS, 2007). Nesting and foraging Wilson's Plovers showed increased use of areas of Onslow Beach at the Camp Lejeune Marine Corps Base in North Carolina after they were closed to recreational vehicles and, therefore, had lower levels of human disturbance (Ray *et al.* 2011).

Symbolic fencing has been used successfully for over a decade to protect Piping Plover and Snowy Plover nests, nesting areas, and often chicks. Symbolic fencing consists of one or two lengths of cord or rope strung between posted signs to delineate areas where human entry (*e.g.*, pedestrians and vehicles) is prohibited (Fig.23). Installation of symbolic fencing at a public beach in Santa Barbara, California (Sands Beach, Coal Oil Point Reserve), reduced disturbance rates by more than half and resulted in successful re-establishment of a breeding population of Snowy Plovers at the site. Snowy Plovers numbers increased throughout the season with distribution limited to within the protected area. Snowy Plovers that were outside the protected area moved inside as people began using the beach. "Before protection, plovers did not breed at Coal Oil Point. During protection, Snowy Plovers bred in increasing numbers each year and had high success at fledging young" (Lafferty *et al.* 2006).

Fig. 23. Examples of protective signage for shorebirds. / © M. Zdravkovic/Conservian

In New England, Piping Plover numbers doubled between 1988 and 1993 while maintaining high levels of productivity, demonstrating that populations can increase very rapidly in places intensely managed to reduce impacts of human-induced mortality, human disturbance, and predation (Piping Plover Atlantic Coast Population Revised Recovery Plan, USFWS 1996). In Massachusetts, in the late 1980s, approximately 60 beaches were monitored and benefited from increased protection activities where breeding Piping Plovers occurred. These increased protection activities included: 1) research, monitoring, and wardening (guarding) by a network of staff and volunteers from early April to early August; 2) use of symbolic fencing at nesting sites; 3) new levels of scrutiny of the management of sites with respect to human disturbance and beach management; 4) advocacy for the protection of these birds and sites with property owners and managers; and 5) increased media interest and attention on the conservation of these birds and habitats. Public interest in Piping Plovers increased and the conservation of beach-nesting birds in Massachusetts was launched into the mainstream media under the banner of protecting Federally Endangered species (Hecker 2008).

As Piping Plover populations in Massachusetts increased throughout the1990s, breeding pairs expanded into all existing and available plover habitat within the state. Symbolic fencing erected prior to the breeding season helped facilitate use of "new" sites by providing undisturbed nesting habitat in areas that would otherwise have been rendered unavailable due to human disturbance (M. Zdravkovic unpubl. data). As a result of intensive management and abundant, high-quality habitat, the Massachusetts Piping Plover population increased from 126 pairs in 1987 to approximately 500 pairs in 2000. Massachusetts supports 80% of the approximately 625 pairs breeding in New England (Mostello and Melvin 2000).

Due to the similarities in breeding habitat requirements between Snowy, Piping, and Wilson's Plovers, the successful management methods employed for Snowy and Piping Plovers can be expected to yield similar beneficial results if used to protect Wilson's Plover breeding areas. Such protective measures are in use at many Piping and Snowy Plover breeding sites that are also used by Wilson's Plovers on the U.S. Atlantic and Gulf Coasts. On the Gulf Coast in Florida, CBC conducted a study (2008–2011) to demonstrate the effectiveness of protective measures to increase beach-nesting bird populations. The two tables below (Fig.24a, Fig.24b) show the results of four years (2008–2011) of CBC-recommended protective measures being cooperatively implemented at seven selected study sites across the region with partners Florida

State Parks DEP, The Nature Conservancy, The St. Joe Company, and St. Vincent National Wildlife Refuge. In the first table (Fig.24a), historical data for the combined sites show 28 breeding pairs of Snowy Plovers. In 2007, CBC surveys documented only 10 breeding pairs remaining. In 2008, CBC and partners erected symbolic fencing and implemented other protective measures as described in this text at the study sites. Breeding pair numbers of American Oystercatchers and Wilson's Plovers stabilized then responded with steady increase. Although no historical data exist for Wilson's Plovers at these sites, breeding pairs increased by 45% during the four-year study period (Fig.24b). CBC results from 2011show breeding Snowy Plover pairs were nearly restored to historical 1989 numbers, with 27 total pairs across the seven study sites.

Breeding Site	Snowy Plover Breeding Pairs*				Protective Measures Implemented			
	1989	2002	2006	2007	2008	2009	2010	2011
Topsail Hill Preserve State Park	8	3	0	0	0	0	1	0
Grayton Beach State Park	*combined w/ Deer Lake SP	0	0	0	0	1	1	1
Deer Lake State Park	8*	2	2	1	2	3	3	4
Watersound Conservation Area	*combined w/ Deer Lake SP	0	0	0	2	3	3	3
Camp Helen State Park	4	3	2	2	3	4	4	4
TNC John S. Phipps Preserve	3	0	1	1	1	1	2	4
St. Vincent National Wildlife Refuge	5	3	11	6	12	11	12	11
PAIR TOTALS	**28**	**11**	**16**	**10**	**20**	**23**	**26**	**27[a]**

Fig 24a. Conservian/Coastal Bird Conservation Beach-nesting Bird Disturbance Study Sites in the Florida Panhandle. Results of Protective Measures Implemented for Beach-nesting Birds.

Fig 24b. Conservian/Coastal Bird Conservation Beach-nesting Bird Disturbance Study Sites in the Florida Panhandle. Results of Protective Measures Implemented for Beach-nesting Birds.

Breeding Site [b]	**American Oystercatcher Pairs**					**Wilson's Plover Pairs**				
	2007	2008	2009	**2010**	**2011**	2007	2008	2009	2010	**2011**
St. Vincent National Wildlife Refuge	2	2	2	**5**	**0** [c]	0	0	0	0	**1**
TNC John S. Phipps Preserve	2	3	2	3	**3**	5	4	7	8	**9**

1. References for Snowy Plover pair data: **1989 =** Chase and Gore 1989**, 2002 =** Lamonte *et al.*. 2006**, 2006 =** Himes *et al.*. 2007**, 2010-2011**= Zdravkovic 2010b and Zdravkovic *in prep*)
*Chase and Gore described area (1989) as "Highway 30A Lakes", a larger study area encompassing what would become Deer Lake and Grayton Beach State Parks along with adjacent private lands; Camp Helen SP was described as Philips Inlet and Topsail Hill Preserve SP as Topsail Hill.
[a] Breeding Snowy Plover pairs numbers nearly restored to 1989 historical pair totals.
[b] No historical data exists for these species at these sites.
[c] Breeding American Oystercatchers on St Vincent NWR moved to Flagg Island in 2011 (a newly accreted sandbar/island off of St Vincent NWR.

Symbolic fencing is one of the most commonly used tools for restricting human disturbance to plover breeding areas. Posting of nesting areas is recommended to prevent: disturbance to courting and territorial plovers, obliteration of nest scrapes, crushing of eggs, and repeated flushing of incubating adults (Piping Plover Recovery Plan, USFWS 1996). Signs and posts should be designed and constructed using current methods, which include techniques to deter perching avian predators. The timing of symbolic fencing placement for Wilson's Plovers will vary by location, since the start of the breeding season varies regionally. Symbolic fencing should be erected several weeks before the first plover nests are on the ground and ideally be in place when breeding birds arrive on territory. For Wilson's Plovers breeding in the United States, initial posting of habitat should be completed by 1 March; however, at sites where Snowy Plovers also nest, by 1 February, to accommodate both species (Zdravkovic *in prep*). On heavily to moderately used beaches, large expanses of habitat should be fenced prior to nesting, so that birds will have enough space to establish individual territories without the threat of human disturbance. Fencing can later be reduced to accommodate the actual size of established nesting areas and associated foraging habitats. Both the Atlantic Coast Piping Plover recovery plan and the Western Snowy Plover recovery plan recommend a minimum 55-yard (50-m) radius buffer around individual plover nests to ensure adequate protection from disturbance and limit flushing of incubation adults. Larger buffers of 1,100-1,300ft (335–396m) are beneficial for plover chicks/broods however, to provide increased amounts of resting and foraging habitat. Symbolic fencing is also very effective for protecting foraging and resting areas for migrating and wintering shorebirds (Lafferty *et al.* 2006), and provides the secondary benefit of allowing wrack to accumulate and beach vegetation to increase naturally.

Predator exclosures, constructed of galvanized or coated steel welded-wire fence, can be a very effective predator management tool and has been used with much success to increase hatching success of Piping Plover and Snowy Plover nests (Atlantic Coast Piping Plover Recovery Plan, USFWS 1996; Western Snowy Plover Recovery Plan, USFWS 2007). They are however very labor intensive, costly, and require regular monitoring. Predator exclosures were used successfully by CBC to protect Wilson's Plover nests from heavy predation by coyotes at two study sites in Louisiana (Zdravkovic 2010).

Support management and protection measures with a law enforcement presence. For protection and management measures to be effective, a visible law enforcement presence is necessary to ensure that the public complies with all protection efforts. Regular patrolling and enforcement of beach-nesting bird area closures and vehicle/pet/other restrictions also demonstrates that land managers are serious about compliance. Effective management and protection requires close cooperation between land managers, biologists, and the varied law enforcement agencies that may have jurisdiction in beach-nesting bird habitats (The Recovery Plan for the Pacific Coast Population of the Western Snowy Plover, USFWS 2007). In Oregon (Western Snowy Plover) and Massachusetts (Piping Plover), such cooperation has been established with the shared goal of increasing awareness, communication, and coordination to alleviate jurisdictional conflicts, and train officers on how to minimize disturbance while patrolling federally endangered plover habitat. Conflicting priorities and personnel turnover require perseverance to maintain these effective working relationships. The Federally protected status of both the Western Snowy Plover and Piping Plover mandates that these species will receive protection under the law, thus clarifying the role of law enforcement (The Recovery Plan for the Pacific Coast Population of the Western Snowy Plover, USFWS 2007).The Wilson's Plover would benefit greatly from federal listing, which would provide the needed impetus to require U.S. law enforcement involvement in protecting this species and its habitat.

Establish an international Wilson's Plover Conservation Action Group, with connections to other shorebird conservation and research groups working within the species' range. This group and network of partners will work to monitor and assess species progress; initiate and implement Conservation Plan actions; supervise and advise ongoing and future research projects; assess and monitor plan effectiveness; and initiate the process to petition for U.S. Federal listing for the Wilson's Plover *C. w. wilsonia* subspecies. The Conservation Action Group will also work to gain protected status across the species range.

WILSON'S PLOVER ACTION PLAN GROUP: PROPOSED GOALS

- With other partners, propose the subspecies *C. w. wilsonia* for U.S. Federal Endangered/Threatened species status. During interim, Action Group works with USFWS to designate the Wilson's Plover as a "Surrogate Species".

- Initiate and implement range-wide research, monitoring, and protection for Wilson's Plovers with applications to other beach-nesting bird species that use the same and/or similar habitats (*i.e.*, an "umbrella species" approach).
- Monitor all environmental policies and legislation that affect Wilson's Plovers and their habitats across the species range with the goal of influencing all such legislation to the benefit of the species.
- Actively seek out and work with all research and conservation partners to establish a network of cooperators with the primary aim of addressing mutual conservation needs of the Wilson's Plover and other shorebirds.
- Initiate cooperation and coordination between all applicable agencies and organizations working within the coastal zone regionally, nationally and internationally to foster a mutually beneficial, multi-species approach to disseminate existing conservation and recovery plans, (*e.g.,* Atlantic Coast Piping Plover Recovery Plan, Western Snowy Plover Recovery Plan, Marine Turtle Plans, Beach Mouse Plans, Plant and Lichen Recovery Plans). Coordination between such groups will ensure the best use of existing information and resources to promote multi-species awareness and ensure that all groups work together to efficiently manage coastal habitats.
- Support funding of research as identified by the plan, which addresses gaps in Wilson's Plover ecology directly related to the preservation and increase of the species population and its habitat. Prioritize research necessary to support protective legislation, inclusive of other shorebirds using the same habitats.
- Offer peer review, guidance, and endorsement of publicly funded surveys, monitoring, and research (including government-funded academic research) to ensure necessity of research, validity of methods, and benefits to the Wilson's Plover.

Policy and Legislation

Monitor, initiate, support ,and implement government policies/legislation at the local, state, national, and international level to preserve coastal habitat for the Wilson's Plover and other beach-dependent species. Environmental policy and legislation must be conducive to preserving biodiversity within the coastal zone if this list of conservation actions and strategies is to be implemented. All agencies and organizations with coastal conservation interests must cooperatively monitor policies and legislation which affect habitats and species within the coastal zone, with the goal of influencing all such legislation to the benefit of these species and their habitats.

Public Outreach

Initiate, support, and implement large- and small-scale public information and education on the condition of all coastal habitat and beach-dependent species. The importance of public places in the coastal zone as a national resource cannot be overemphasized. The U.S. Fish and Wildlife Service recently released a new addendum report entitled "Wildlife Watching in the U.S.: The Economic Impacts on National and State Economies in 2006," using data from the 2006 National Survey of Fishing, Hunting, and Wildlife Associated Recreation. The new report shows that national expenditures for wildlife watching are equivalent to the revenues generated from all spectator sports, amusement parks and arcades, non-hotel casinos, bowling centers, and skiing facilities *combined*. The report details the economic impacts of wildlife-watching expenditures by state; the top five states ranked by economic output include California, Florida, Texas, Georgia, and New York—all coastal states. The report further shows that wildlife watching not only contributes significantly to people's enjoyment of the outdoors but is a major factor in the state and national economies (Wildlife Watching in the U.S.: The Economic Impacts on National and State Economies in 2006, USFWS).

Public appreciation and enjoyment of the coastal zone is a human birthright; however, it is essential that all such activity is environmentally responsible and sustainable to ensure the continued biodiversity and integrity of the coastal ecosystem. Public imagination must be inspired to create a paradigm shift in the public psyche on the symbiotic relationship between humanity and the Earth which sustains it. In recent years many environmental issues and individual species in peril have been brought to the public's attention through large-scale education efforts, television series, feature films, news media, internet, and endorsement supported by corporations and public figures. These avenues have the potential to reach a large segment of the general public and become a catalyst for positive change in environmental policy and legislation. The lost human-Earth connection must be re-established to the degree that it becomes second nature again, if we are to take the necessary actions to ensure the preservation of that which sustains us.

RESEARCH AND MONITORING NEEDS

Adequate monitoring and research programs are among the highest priorities for the U.S. Shorebird Conservation Plan, so that the status and trends of each species can be properly addressed (Brown *et al.* 2001).

Many significant elements fundamental to our understanding of Wilson's Plover range-wide population status, distribution, and abundance, are lacking, but necessary for the conservation of this species. No population or trend data exist for two of the three subspecies (*C. w. cinnamonius* and *C. w. beldingi*) throughout most of their ranges. The Wilson's Plover primary migration routes remain unknown. Very few data exist outside of the United States on the major breeding and nonbreeding areas used by all three Wilson's Plover subspecies. Information on resident vs. nonresident populations of Wilson's Plover subspecies, and accurate distribution data on these populations, are limited. Accuracy and overlap of subspecies designations warrant further study as well. Because the Wilson's Plover shares the same or similar breeding and/or nonbreeding habitats, conservation threats, and conservation needs with many other beach-nesting, migratory and wintering shorebirds, this plan strongly advocates for cooperation among all concerned groups, organizations, and agencies working to conserve beach-dependent shorebirds; limited resources necessitate it.

In order to adequately assess the current range-wide status of the Wilson's Plover, the following monitoring and research actions are recommended: **a) Monitor Wilson's Plover population status and trends** through regular, coordinated, comprehensive, standardized, range-wide surveys, and **identify key breeding and nonbreeding sites**. All partners across this species' range agree that obtaining high confidence global population estimates and identifying all important habitat areas in the Caribbean, Mexico, and Central and South America are the top priorities for assessing the status of this species. Current and high confidence breeding population estimates exist for breeding *C. w. wilsonia* in the United States and on the barrier islands of the Laguna Madre of Mexico only. No comprehensive surveys have been conducted throughout vast areas of this species' range in the Caribbean or Central and South America. Currently there are no comprehensive population data for two of the three subspecies of Wilson's Plover *C. w. beldingi or C. w. cinnamonius*. Surveys should include detailed descriptions and locations of all existing Wilson's Plover habitat. Once initial range-wide populations and habitats

have been assessed, range-wide surveys should be conducted every 3 to 5 years to monitor populations and provide trend data. *Combine with:* **b) Conduct multi-species surveys**. All Wilson's Plover surveys can and should be combined when appropriate with surveys for other imperiled beach-nesting birds, such as Piping and Snowy Plovers, American Oystercatchers, Red Knots, and others. A multiple-species survey approach conducted and supervised by skilled surveyors is a much more efficient use of all funds and resources. CBC has successfully employed a multi-species approach to statewide beach-nesting bird surveys on the U.S. and Mexican Gulf Coast since 2003. *Combine with:* **c) Assess all potential habitat through aerial surveys of coastal habitat.** Whenever possible, prior to conducting labor-intensive ground surveys, aerial surveys should be conducted for the Caribbean and Central and South America. Due to the ephemeral nature of beach-nesting bird habitats and the lack of basic data on locations of Wilson's Plover habitat, it is strongly recommended that aerial photographs be captured using unmanned aerial aircraft systems (UAS) or conventional aircraft to identify all potential Wilson's Plover habitat. Current satellite images are also very valuable tools when available; however, they do not provide the level of detail necessary to accurately plan ground surveys.

Determine and designate range-wide important Wilson's Plover breeding and nonbreeding sites. Propose monitoring/protection/ stabilization/restoration of these sites with partners through the use of standardized, proven methods of management. Most key Wilson's Plover breeding and nonbreeding locations known thus far lack protection and many more important sites have yet to be located or designated.

Determine major Wilson's Plover migratory flyway routes and sites through research. Very few data exist on Wilson's Plover staging, migration, timing, and flyway routes, or major migratory and wintering locations. Tracking technology using geo-locator devices and satellites are not yet available for use on birds as small as the Wilson's Plover, but may be in the near future. When such devices become available, tracking sample sizes of strategically chosen Wilson's Plovers over the species' range should produce new data on Wilson's Plover migration routes. *Combine with:*

Determine subspecies differences, distribution, and populations through DNA/genetic and stable isotope research across the species' range outside of the United States. Collect sample sizes of DNA (blood and/or feathers) to create an isotopic signature for each major breeding and nonbreeding site where more than one subspecies of Wilson's Plover occurs

to determine subspecies distribution and designation for all three subspecies.

Implement beneficial management guidelines for Wilson's Plovers where this species shares habitat with other beach-nesting birds. A practical manual of management guidelines is greatly needed to promote and standardize protection efforts for Wilson's Plovers and other shorebirds by land managers on U.S. and Mexican Gulf, southeastern Atlantic Coast, and the Caribbean. Conservian/Coastal Bird Conservation is currently drafting the Gulf Coast Beach-nesting Bird Assessment and Management Guidelines for the National Fish and Wildlife Foundation for five species of beach-nesting birds. The two-part document is a new tool to assist land managers to stabilize and increase beach-nesting bird populations, and includes summaries of current beach-nesting bird status, identification of principal threats, and recommendations for threat-reduction actions. The goal of these guidelines is to provide the most current information available for restoring, protecting, and increasing beach-nesting bird populations and their habitats throughout the U.S. Gulf Coast. The document could also be adapted for use in the Caribbean and Central and South America as more information on Wilson's Plovers and other beach-nesting birds in these areas becomes available.

Develop and implement regional Wilson's Plover and multi-species shorebird management plans in the Caribbean, Mexico, and Central and South America; also, identify and develop methods for establishing and integrating such plans with local and national governments.

Research and test all feasible population sampling methods for practical use in monitoring breeding Wilson's Plover and Snowy Plover populations in high-density areas. Wilson's and Snowy Plover breeding pair densities are highly variable, unpredictable, and can fluctuate greatly from year to year at specific sites or across regions, depending on inter-related habitat changes, weather, food availability, disturbance, and other factors. Breeding densities in many areas are also too low for sampling to be successful. These factors combine to make current population sampling methods unfeasible for breeding plovers. However, if a viable method which saves time and resources could be devised and proven, it might be successfully employed at high-density plover breeding sites during years between full surveys, to contribute to basic trend data. Sampling methods cannot, however, supply site-specific population estimates necessary for site managers to base management decisions. Thus far, no viable methods had been designed to efficiently sample breeding plover populations.

CBC has conducted research into the use of distance sampling as a method of estimating plover populations in the Laguna Madre of Texas and found this method unsuccessful, given the highly variable and unpredictable nature of plover breeding densities. Recent Snowy Plover population data for the Gulf Coast from the U.S. Geological Survey's 2007–2008 range-wide assessment (Thomas *et al.* 2012) presents population estimates for breeding Snowy Plovers that were extrapolated from sample surveys conducted for the species' breeding range, including Florida and Texas. Estimates for Snowy Plovers proposed by Thomas *et al.*(2012) for both of these states are high when compared to years of statewide plover breeding survey data collected by CBC and partners, which do not support these new population estimates (Himes *et al.* 2007, Lamonte *et al.* 2006, Liptay and Zdravkovic 2008). Any initial testing of population sampling methods should also be combined with separate, concurrent, comprehensive surveys of each site sampled, to insure viability of the sampling method.

Prioritize research that addresses known gaps in Wilson's Plover conservation and ecology that are directly related to the preservation and increase of the species and its habitat, especially research that is necessary to support protective legislation. This research includes Wilson's Plover productivity, lifespan, and survivorship—for which little to no information exists. This plan strongly endorses research on the impacts of disturbance to breeding and nonbreeding Wilson's Plovers inclusive of other shorebirds using the same habitats. While much information exists on the effects of disturbance to Piping and Snowy Plovers, very little research has been conducted specifically regarding disturbance to Wilson's Plovers.

CONSERVATION ACTION TIMELINE

By 2014: Establish an international Wilson's Plover Conservation Action Group, with membership throughout the species' range to implement the Wilson's Plover Conservation Plan. The Action Group then:

- Works with the Landscape Conservation Cooperatives (LCCs) of the South Atlantic, Peninsular Florida, Gulf Coastal Plains-Ozarks, Coastal Prairies, and Caribbean to designate the Wilson's Plover as an "Indicator Species".
- Works with USFWS to designate the Wilson's Plover as a "Surrogate Species".
- Creates a website to act as a point of contact and resource for knowledge and information on the species, provide information on current projects, and address the needs and

progress of the Plan. Website will be linked to other conservation group websites and listserves.

- Maintains an evolving GoogleEarth placemark file of range-wide important Wilson's Plover breeding and nonbreeding sites and adds important sites to file as designated.

By 2015: Wilson's Plover Conservation Action Group and other partners **propose the subspecies *C. w. wilsonia* for federal endangered/threatened species status**.

- The Action Group initiates and follows through with the process to achieve U.S. Federally listed status.

By 2016: Implement a manual of beneficial management practices for the Wilson's Plover and other beach-nesting birds for the U.S. and Mexican Gulf and S.E. Atlantic Coasts and the Caribbean

- Adapt management guidelines as needed for the Americas

By 2017: Survey and monitor range-wide Wilson's Plover population **status and trends** and identify **key important areas** through coordinated, comprehensive, standardized surveys.

- Conduct coordinated range-wide nonbreeding surveys for Wilson's Plovers by combining efforts (wherever possible) with all other planned surveys in appropriate habitat across the species' range.
- Identify all major important Wilson's Plover breeding and nonbreeding areas in the Caribbean, Mexico, and Central and South America.

By 2018: Determine and designate range-wide important breeding and nonbreeding **sites** and propose **efficient actions** for the monitoring/protection/stabilization/restoration of Wilson's Plover populations and habitat at these sites.

- Nominate all currently known important Wilson's Plover sites that meet criteria for designation as a WHSRN site. Continue to nominate new important sites as identified.

Determine major migratory flyway routes and staging sites, using tracking/geo-locating technology.

Determine subspecies differences and distribution through DNA and stable isotope research on breeding and nonbreeding grounds.

By 2020: Develop Wilson's Plover shorebird management plans in cooperation with partners in the Caribbean, Mexico, and Central and South America.
Revise/update this Wilson's Plover Species Conservation Plan.
Begin planning with partners for range-wide Wilson's Plover **breeding and nonbreeding surveys** to be conducted every five years.

The USGS International Piping Plover Censuses (both breeding and wintering) initiated in 1991 and held every 5 years are excellent examples of regular, coordinated, concurrent, standardized, range-wide surveys that use a combination of experienced field staff and trained volunteers. These regular range-wide surveys are a very large undertaking requiring the cooperation and coordination of many federal, state, and nongovernmental organizations, and more than 1,000 volunteers. These surveys provide invaluable population and trend data for the Federally listed Piping Plover. Recently the Snowy Plover was added to the USGS range-wide surveys. The Wilson's Plover was included in winter surveys for part of the species' range. These types of well-supervised, volunteer-based surveys can be a reality for many areas that have experienced site managers, a strong, well-established volunteer network, and habitats that can be accessed and surveyed within a reasonable timeframe. This type of coordinated survey for Wilson's Plovers and other beach-nesting birds and nonbreeding shorebirds, supervised by experienced field staff, should be an attainable goal for some U.S. states.

Much plover breeding habitat in Louisiana, Texas, the Caribbean, Mexico, and Central and South America is too vast, remote, and difficult to survey to expect comprehensive coverage by volunteers. These quickly diminishing, natural coastal areas provide high-quality, unfragmented, low-disturbance plover breeding and nonbreeding habitat. Accurate surveying of plover populations in remote and vast areas requires specific knowledge and understanding of the species' behavior and habitat requirements, a major time commitment in the field, and adequate funding. Identification of range-wide important Wilson's Plover areas will likely only be an attainable goal through coordinated, multi-species shorebird conservation efforts. This will be an ambitious undertaking that will require range-wide interest and cooperation. Once initial assessment of Wilson's Plover range-wide populations and habitats has been completed, full breeding and nonbreeding surveys should be conducted every 3 to 5 years to monitor population and provide trend data.

EVALUATION

The Wilson's Plover Conservation Action Group will be instrumental in implementing and coordinating research, monitoring, and conservation for the Wilson's Plover. The greatest current need is to identify and preserve all key, high-quality, breeding and nonbreeding habitat throughout the species' range. First, surveys are required in order to identify habitat and assess populations over vast areas of the species' range; thus far, only the United States has been fully assessed.

To assist in accomplishing the goals of the Wilson's Plover Conservation Plan, Conservian/CBC will continue working with all concerned partners across the Wilson's Plover range to assess conservation needs specific to each area, establish or strengthen shorebird conservation efforts, and improve protection and management of these species. Achieving the goals will involve: 1) leading or assisting in the assessment of shorebird populations and sites of critical importance; 2) conducting multi-species field surveys and mapping populations of priority shorebirds; 3) conducting shorebird research directly related to the preservation and increase of priority species and habitats; 4) monitoring and protecting important nesting and foraging sites; and, 5) establishing long-term protection programs for shorebirds and important sites with the express purpose of maintaining or increasing shorebird populations.

Species Conservation Assessment

This plan is the beginning of range-wide conservation efforts specifically focused on the Wilson's Plover. Progress on Wilson's Plover conservation and by the Action Group will be measured by:

- Success of acquiring U.S. Federally listed status for the Wilson's Plover *C. w. wilsonia* subspecies.
- Increased regular, cooperative, coordinated population surveys and monitoring of the Wilson's Plover across the species' range.
- Increased number of Wilson's Plover range-wide sites identified and permanently protected through local, national, and international legislation or designations.
- Increased amount of created, enhanced, or restored habitat maintained specifically for Wilson's Plovers and other beach-nesting birds.

- Increased number of conservation groups, organizations, and agencies that cooperate/coordinate with the Action Group and agree to prioritize this species within the scope of their own conservation efforts.
- Stabilized or increased range-wide Wilson's Plover population and trend.

On the broad scale, the survival of Wilson's Plover, and that of the Earth's coastal ecosystems, is wholly dependent upon human desire and ability to ensure environmental sustainability. We are currently in the process of globally altering the Earth's ecosystems at a higher rate and level than any in human history. We must be cognizant of the shortcomings of our human generational memory. The environments that our grandparents knew are fast becoming past memories and much of humanity is unaware of their catastrophic loss. The conservation goals of this plan can be accomplished through vigilant cooperation and coordination by all conservation groups and individuals interested in the coastal zone. Some of the conservation actions proposed in this plan may be considered ambitious; however, they are not without precedent, as similar efforts have been successfully accomplished or are ongoing for the Piping Plover and Snowy Plover.

Fig. 25. Wilson's Plover chick, hatching day, S. Texas. / © M. Zdravkovic/Conservian

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APPENDICES

APPENDIX 1: CONSERVATION RANKINGS AND STATUS OF THE WILSON'S PLOVER

U.S. Shorebird Conservation Plan Status and Scores:

Population size estimate: 8,000–8,600 breeding individuals
Priority Score: 4 = High Priority
Population Trend: 4 = Apparent Decline
Threats Breeding: 4 = Significant potential threats exist
Threats Nonbreeding: 4 = Significant potential threats exist

States with officially designated status for Wilson's Plovers:

Maryland – Endangered, species of greatest conservation need
Virginia – Endangered
North Carolina – Species of greatest conservation need
South Carolina – Threatened
Georgia – Rare
Alabama–State Protected

Countries:

El Salvador – Endangered

NatureServe Status

Global Status: G5 Globally Secure
Global Status Last Reviewed: 25Nov,1996
Global Status Last Changed: 25Nov,1996
Rounded Global Status: G5 - Secure
National: U.S.
New Jersey (SNA) =A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities.[2]
Maryland (S1B) = Breeding population is critically imperiled at subnational level
Virginia (S1B) = Critically imperiled breeding population at subnational level
North Carolina (S3B)= Breeding population is vulnerable at subnational level
South Carolina (S3?)= Inexact numeric rank at subnational level
Georgia (S2) = Imperiled at subnational level
Florida (S2) = Imperiled at subnational level
Alabama (S1) = Subnational Critically imperiled
Mississippi (S3?B)= Inexact numeric rank of breeding population at subnational level

Louisiana (S1S3B, S3N) = Imperiled: Breeding Population Vulnerable, S3N=Nonbreeding population is vulnerable
Texas (S4B)= Apparently secure breeding population at subnational level
National Status: N4B= Apparently secure at National level
NNRN= national conservation status not yet assessed

Global Conservation Status

2012 IUCN Red List Category: LC - Least concern with a decreasing population

CITES Status: None

Global Range: Estimated global Extent of Occurrence of 850,000 km², > 328,187 square miles)

APPENDIX 2: LIST OF CURRENT OR POTENTIAL COLLABORATORS

Below is a list of organizations and agencies that have been involved in surveys, monitoring, and/or research on beach-nesting birds/shorebirds. They may represent potential collaborators and/or project funders and/or sources of support on combined efforts for range-wide Wilson's Plover monitoring and research needs.

United States: U.S. Fish and Wildlife Service / U.S. Geological Survey / U.S. Shorebird Council Plan /National Audubon Society / Manomet Center for Conservation Sciences / Western Hemisphere Shorebird Reserve Network / Gulf Coast Joint Venture /Barataria-Terrebonne National Estuary Program (BTNEP) / Mobile Bay National Estuary Program (MBNEP)

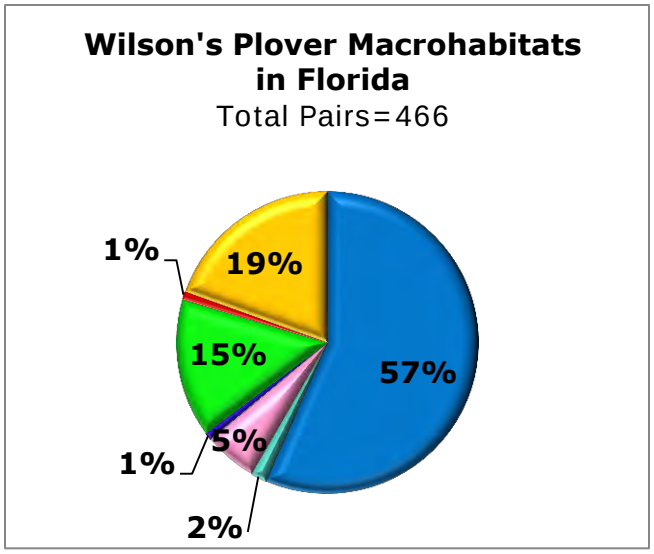
The Caribbean: BirdLife International / Sociedad Ornitologica Puertorriquena, Inc. (SOPI) / Bahamas National Trust / Turks and Caicos National Trust

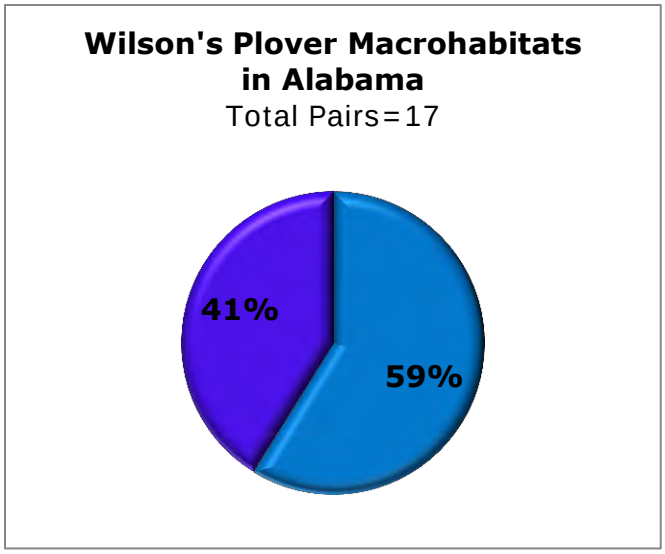
Mexico: Pronatura Noroeste / Ducks Unlimited of Mexico (DUMAC)

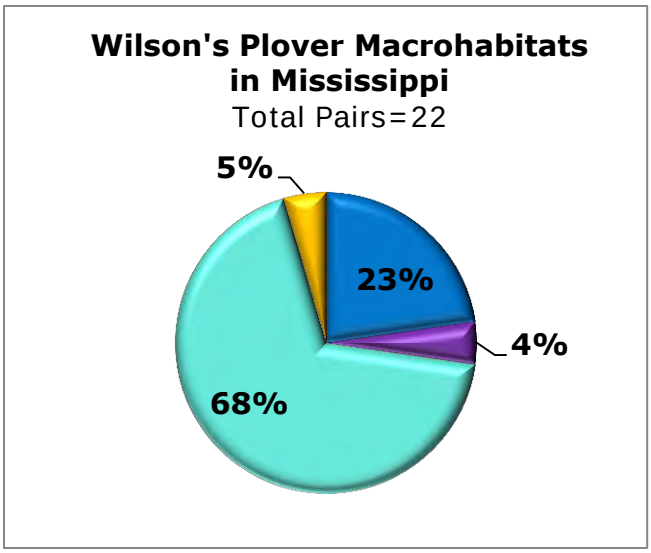
Central America: *Salva*NATURA

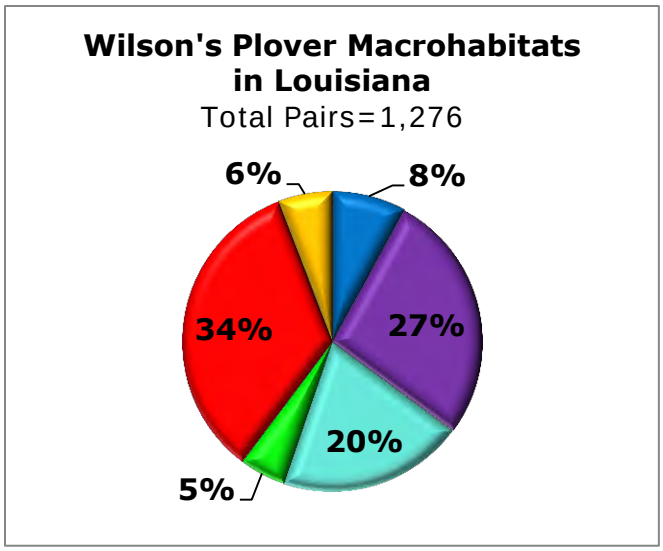
South America: Asociación CALIDRIS

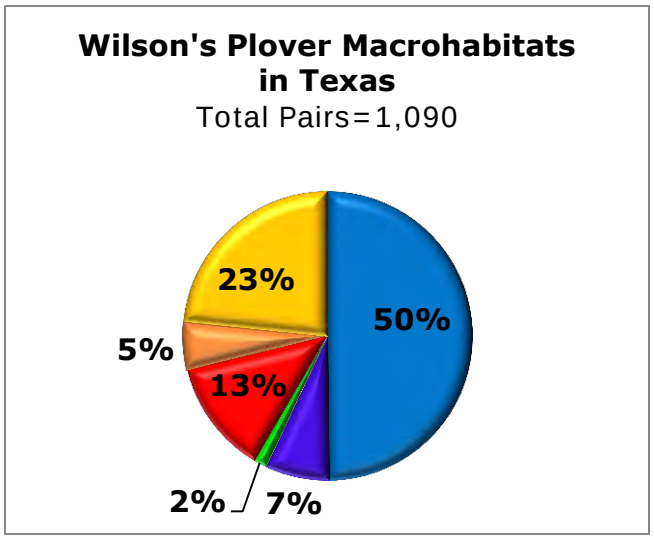
APPENDIX 3: Fig. 26. Breeding Wilson's Plover U.S. Gulfwide Macrohabitat Use by State











APPENDIX 4: WILSON'S PLOVER RANGE-WIDE IMPORTANT SITES AND DESCRIPTIONS

Following the criteria established by the Western Hemisphere Shorebird Reserve Network (WHSRN) and by the Important Bird Areas (IBAs) program, all Wilson's Plover breeding and nonbreeding sites that support 1% or more of the total species population (**at least 265 individuals)** are listed as "important sites" in this plan (Table 5)(Maps 3&4). The list also includes sites that support 1% or more of one of the three *subspecies* populations. Due to a lack of population data available for two of the three subspecies, the U.S. subspecies *C. w. wilsonia* population range estimate of 8,000–8,600 breeding adults was used as a baseline and applied to all three subspecies. Range-wide sites supporting **at least 80 individuals** of a subspecies qualified as important Wilson's Plover subspecies sites. A few sites that were slightly below the 1% threshold were also included, given the potential for numbers to vary annually or a lack of solid survey data. All U.S. sites in this list are sites of Wilsons Plover subspecies importance.

UNITED STATES

South Atlantic Coast (*C. w. wilsonia)*

Although much Wilson's Plover habitat throughout the southeast Atlantic Coast has been lost through development, coastal alteration, and disturbance by humans, the region still supports over 25% of the U.S. breeding population of Wilson's Plovers.

North Carolina / Cape Lookout National Seashore

Population data: Breeding: 76 pairs (Cameron 2008); Nonbreeding: present during migration, uncommon in winter (Elliot-Smith *et al.* 2009).

Description: Natural barrier island chain of the Outer Banks that includes the North Shore Core Banks, South Shore Core Banks, and Shackleford Banks, composed of five islands spanning 56 miles (90 kilometers) and 28,243acres (11,430 hectares), bordered by Ocracoke Inlet to the north and Beaufort Inlet.

Ownership, Management, and Conservation Status: Federally owned, protected, and managed by the National Park Service, Department of the Interior, which manages for Wilson's Plovers, Piping Plovers, and other beach-nesting birds under their Interim Protected Species Management Plan (IPSMP). Under the IPSMP, the Park Service conducts annual beach-nesting bird breeding

surveys and posts protective signage in nesting and chick foraging habitat. The seashore is also developing an ORV management plan to protect species and to manage ORV use. Conservation threats at the National Seashore include ORV use, boat landings, pedestrian traffic, and mammalian predators in beach-nesting bird habitat. The Shackleford banks area is 9 miles (14.4km) long and managed as a Wilderness Area with no ORV use permitted. A 4-mile (6.4-km) stretch of the Core Banks is closed annually to ORV traffic from 1 April to 31 August per the IPSMP, during which time the area is only accessible by boat. Sections open to ORVs on the Core Banks are undeveloped and generally receive low to moderate recreational use during the spring and summer. Two vehicle ferries also provide access to the banks (J. Altman, pers. comm.).

South Carolina / Deveaux Bank

Population data: Breeding: approximately 2 pairs (Sanders *et al.* 2013); Nonbreeding: staging, 93 individuals present in low numbers in winter (Maddock unpubl. data).
Description: Barrier island habitat spanning approximately 2.20 miles (3.6 km).
Ownership, Management, Conservation Status: State-owned under the Department of Natural Resources with federally designated Piping Plover wintering Critical Habitat only accessible by boat. No humans, ORVs, or pets are permitted above the high-tide line. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds.

Georgia / Little Tybee Natural Area

Population data: Breeding: 40+ pairs; Nonbreeding: present in low numbers in winter (under 10 birds) (Georgia Department of Natural Resources [GADNR]).
Description: A series of barrier islands with extensive dune habitat and roughly 3.5 miles (5.6 km) of suitable beach habitat in a constant state of change, with frequent over-wash, deposition, and erosion events. The island, including marsh, is 6,506 acres (2,632 ha).
Ownership, Management, and Conservation Status: State-owned Natural Area only accessible by boat, but can be heavily visited during summer weekends given its proximity to Savannah and Tybee Island. The state posts and signs key nesting habitat for the American Oystercatcher, Wilson's Plover, and Least Tern, and monitors the site every two weeks throughout nesting

season. Conservation concerns include boat landings and general human disturbance, unleashed dogs, raccoon depredation, storm surge, and over-wash events (T. Keyes pers. comm.).

Georgia / Ossabaw Island Heritage Preserve

Population data: Breeding: 44+ pairs; Nonbreeding: present in very low numbers in winter (GA DNR)

Description: Large barrier island with extensive dune systems; 9,000 acres (3,642 ha) with 10 miles (16 km) of Atlantic beachfront.

Ownership, Management, and Conservation Status: State-owned and closed to the public with the exception of organized trips and boater visits below mean high tide. Conservation concerns for shorebirds include raccoon and hog depredation, sea-turtle patrols using ORVs, and recreational boaters (T. Keyes pers. comm.).

Georgia / Cumberland Island National Seashore

Population data: Breeding: 106 pairs; Nonbreeding: present in low numbers during winter (GADNR).

Description: Barrier island with an extensive dune system; approximately 19,565 acres (7,918 ha) and 17.5 miles (28km) of beach.

Ownership, Management, and Conservation Status : Mix of federally owned (under the National Park Service [NPS]) and privately owned. Cumberland Island National Seashore is managed by NPS, which posts areas of nesting activity for American Oystercatchers, Wilson's Plovers, and Least Terns. Nearly 2,000 acres (809 ha) of Cumberland Island are privately owned and unprotected from development. Debates continue about allowing the construction of a causeway to increase park visitation, since the Dept. of the Interior has been under pressure to allow easier access to the park. Conservation concerns for shorebirds include ORV use, daily sea-turtle patrols using ATVs, daily NPS law enforcement patrols, resident drivers, damage/disturbance caused by feral pigs *(Sus scrofa)* and horses *(Equus caballus),* introduced bobcats, and recreational boaters (B. Winn, pers. comm.).

Florida: Atlantic and Gulf coasts

The state of Florida supports the highest numbers of wintering Wilson's Plovers in the United States, however much of Florida's extensive coastline has been heavily impacted by development and human disturbance. Currently only one site in Florida (St. Marks NWR) is known to support nearly 1% of the U.S. Wilson's Plovers breeding population. Florida state-wide Wilson's Plover breeding distribution (Maps 13-15).

Florida: Northeast Atlantic Coast / Big Bird and Little Bird Island IBAs

Population data: Breeding: present in low numbers on Big Bird Island (Florida Fish and Wildlife Conservation Commission database); Nonbreeding: staging, 126 individuals on Big Bird Island and 93 individuals Little Bird Island (D. and P. Leary unpubl. data).

Description: Big Bird Island and adjoining roost site, Little Bird Island, are in Duval County. Approximately 5 acres (2 ha) of tidal wash flats are on the lee side of a large sand spit running east to west from the north tip of Little Talbot Island in Nassau Sound; the east portion provides Wilson's Plover and other shorebird foraging habitat.

Ownership, Management, and Conservation Status: Big Bird Island is jointly owned and managed by Florida Department of the Environment (DEP), Parks and Recreation (Talbot Island State Park), and the City of Jacksonville. The site is a high-disturbance/high human-use area. (D. and P. Leary unpubl. data). Current management efforts are insufficient to prevent disturbance to breeding and migratory shorebirds.

Florida Northeast Atlantic Coast / Huguenot Memorial Park IBA

Population data: Breeding: present in low numbers (Florida Shorebird Alliance database); Nonbreeding: staging, 138 individuals (Huguenot Memorial Park Management Plan 2008).

Description: Barrier island associated with broad, tidal wash flats; in Duval County. Approximately 2-miles (3.2-km) long. Provides habitat for Federally listed wintering Piping Plovers, sea turtles, the imperiled Red Knot, and other breeding and migratory shorebirds.

Ownership, Management, Conservation Status: State- and federally owned but leased to and managed by the City of Jacksonville. The park is heavily impacted by public ORV use and human disturbance. Current management efforts are insufficient to protect the park's wildlife and habitats. The City is revising its management plan to increase resource protection and compatible

public use; however, there is strong pressure from ORV supporters to continue the current levels of intense recreational use.

The Florida Keys / Saddle Bunch Naval Air Station Antenna Facility

Population data: Breeding: 20 pairs; Nonbreeding: staging/migratory, 96 individuals (Zdravkovic 2009).

Description: Artificially created limestone fill habitat within mangrove wetlands; Saddle Bunch Key, Monroe County. Approximately 94 acres (38 ha).

Ownership, Management, and Conservation Status: Owned and managed by the U.S. Navy and not open to the public. Navy management limits all nonessential entry into nesting areas during the Wilson's Plover breeding season. Disturbance is low due to lack of accessibility.

The Florida Keys / Boca Chica Beach Naval Air Station

Population data: Breeding: 2 pairs; Nonbreeding: migratory/wintering, 72 individuals (Zdravkovic 2009).

Description: Mangrove island wetlands with associated lagoon. Approximately 110 acres (44.5 ha)

Ownership, Management, and Conservation Status: Naval Air Station property, Florida Keys, Monroe County. Open to the public , a high human-use/high-disturbance site. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds. CBC plans to discuss with Navy Natural Resources Department the potential for protective signage.

U.S. Gulf Coast (*C. w. wilsonia)* / Honeymoon Island State Park IBA

Population data: Breeding: 18 pairs; Nonbreeding: staging, 125; migratory/wintering, 194 (L. Kenney unpubl. data).

Description: Barrier island, largely undeveloped, in Pinellas County; connected to the mainland by a causeway. Major habitats include approximately 3 miles (5km) of linear beaches, well-established dunes, and a maritime forest with both deciduous and pine overstory. The back (eastern) portion is lined with a dense forest of mangroves. Approximately 667 acres (270 ha) (B. Forys, pers. comm.).

Ownership, Management, and Conservation Status: State-owned and managed by the Florida Parks Department. This high-disturbance/high human-use area is partially posted seasonally for beach-nesting birds.

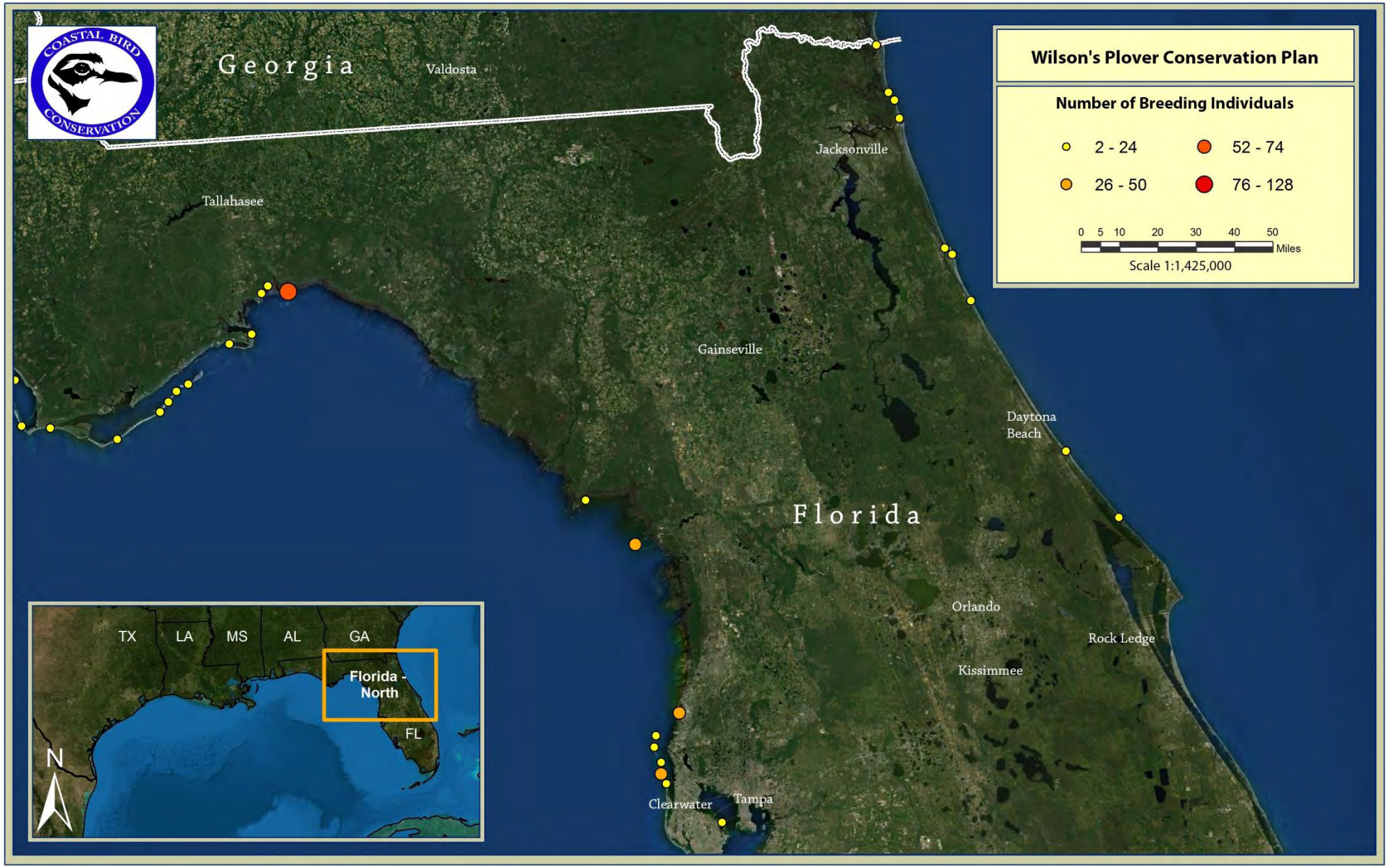
Florida Northwest Coast (Panhandle area) / St. Marks National Wildlife Refuge IBA

Population data: Breeding: 36 pairs (Zdravkovic *in prep*.); Nonbreeding: present in low numbers.

Description: Panhandle area (northwest Gulf Coast); coastal marshes, islands, tidal creeks, and estuaries from seven rivers in north Florida. Refuge established in 1931 to provide wintering habitat for waterfowl and other migratory birds; supports over 250 species of birds. Wilson's Plover breeding habitat within the refuge is approximately 2 sq. miles (5 sq. km). During dry seasons, Wilson's Plovers nest on impoundments, exposed dried mud, dried aquatic vegetation (formerly submerged), and surrounding salt panne habitat (Zdravkovic 2013).

Ownership, Management, and Conservation Status: Federally owned and managed by the U.S. Fish and Wildlife Service. Most beach-nesting bird areas are closed to the public during the breeding season.

Map 13. Wilson's Plover breeding distribution in N.E. Florida (includes Alabama and Mississippi). / Conservian/CBC.



Map 14. Wilson's Plover breeding distribution in Florida (mid and upper coasts) / Conservian/CBC.

Map 15. Wilson's Plover breeding distribution in south Florida. / Conservian/CBC

Louisiana

In 2005, CBC and partners conducted the first comprehensive breeding surveys for beach-nesting birds on the Louisiana coast, with a second comprehensive survey conducted in 2010 before and during the BP Deepwater Horizon oil disaster. The results of these surveys indicate that Louisiana supports significant numbers of Wilson's Plover breeding pairs relative to other Gulf Coast states, second only to Texas. Breeding Wilson's Plovers occurred on nearly all of Louisiana's Gulf beach and barrier island habitat in 2005 and 2010. Much of Louisiana's Wilson's Plover habitat still remains intact, relatively undisturbed, and inaccessible due to the natural protection of the saltmarsh and bayou which surrounds it; however, many important sites received moderate to heavy oiling during the BP oil spill in 2010. These areas continue to endure disturbance from on-going oil cleanup-related activities 3 years after the spill (Zdravkovic unpubl. data).

Louisiana / Chandeleur Islands–Breton National Wildlife Refuge IBA

Population data: Breeding: 54 pairs (Zdravkovic 2013); Nonbreeding: no data

Description: A chain of uninhabited saltmarsh/barrier islands in the Gulf of Mexico that are approximately 40 miles (66km) long and form the easternmost point of Louisiana; also, part of the Breton National Wildlife Refuge in St. Bernard Parish. They are an important stopover site for many birds on southward migration.

Ownership, Management, and Conservation Status: Federally owned and managed. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds, however, large areas of the island chain were restored in 2010 following Hurricane Katrina. The islands received heavy oiling during the BP Deepwater Horizon oil spill. Much oil continues to become exposed on beach shorelines by Gulf storm events. The Chandeleur Islands can only be accessed by boat and has low disturbance due to Refuge restrictions and inaccessibility.

Louisiana / Southwest Pass

Population data: Breeding: 44 pairs (Zdravkovic 2013); Nonbreeding: no data

Description: Delta island approximately 16 miles (26 km) long; in Plaquemines Parish.

Ownership, Management, and Conservation Status: A mix of State- and privately owned land.

Potential to restore with dredge placement in the near future to benefit beach-nesting bird habitat. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds. Received heavy oiling during the BP Deepwater Horizon oil spill and much oil continues to become exposed on beach shorelines by Gulf storm events. A low-disturbance site accessible only by boat or airboat.

Louisiana / Port Fourchon Mitigation Ridge

Population data: Breeding: 64 pairs (Zdravkovic 2013); Nonbreeding: no data

Description: Artificially created maritime ridge with temporary salt panne areas; approximately 8 miles (13 km) long, in Port Fourchon, Lafourche Parish. Supports beach-nesting birds during growth of saltmarsh and upland vegetation.

Ownership, and Management, Conservation Status: Owned and managed by Lafourche Port Commission. Created by dredge placement, which also created temporary habitat that supports multiple species of beach-nesting birds. A low-disturbance site accessible only by boat or airboat. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds.

Louisiana / East and West Fourchon Beaches, and Bayou Moreau and Bayou Von Thunder Beaches (Hwy 3090 east to Bayou von Thunder)

Population data: Breeding: 68 pairs (Zdravkovic and DeMay 2006); Nonbreeding: wintering, 64 individuals (S. Maddock unpubl. data).

Description: Mainland gulf beach backed by saltmarsh and bayou, approximately 7.2 miles (11.7km) long, in Port Fourchon, Lafourche Parish.

Ownership, Management, and Conservation Status: Multiple private owners. The front beach, closed for bridge repair in 2005 after Hurricane Katrina, was partially reopened in the summer of 2007 and 2008; signage and law enforcement restricted ORV access in dunes and beach-nesting bird breeding areas. CBC staff and private landowners worked closely with Port Fourchon Harbor Police and Port Commission staff to restrict beach driving on the east front of Fourchon Beach. Restrictive signage was erected on dunes and in front of washovers; harbor police patrolled regularly on ATVs. The area is now closed to ORV traffic due to erosion from past hurricanes and ongoing cleanup from the BP Deepwater Horizon Oil spill. All of the Caminada

Headland received heavy oiling during the oil spill; much remains and continues to become exposed on beach shorelines during Gulf storm events. The U.S. Army Corp. of Engineers is planning coastal restoration of the Caminada Headland which includes this site.

Louisiana / Terrebonne Bay Islands

All of the Terrebonne Bay Islands received moderate to heavy oiling during the BP Deepwater Horizon oil spill. Much oil still remains on these islands and continues to become exposed on beach shorelines with the passage of Gulf storm events.

Louisiana / East Timbalier Island National Wildlife Refuge IBA

Population data: Breeding: 54 pairs (Zdravkovic and DeMay 2006); Nonbreeding: present in low numbers.

Description: Barrier island recently enhanced by beach restoration; approximately 2 miles (3.3 km) long, in Lafourche Parish.

Ownership, Management, and Conservation Status: Federally owned and protected by U.S. Fish and Wildlife Service. Dredge placement has increased the beach-nesting bird habitat and supports multiple species of colonial beach-nesting birds. Low-disturbance site, accessible only by boat. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds.

Louisiana / Timbalier Island IBA

Population data: Breeding: 47 pairs (Zdravkovic 2013); Nonbreeding: present in low numbers.

Description: Barrier island recently enhanced by beach restoration; approximately 7 miles (11.5 km) long, in Terrebonne Parish.

Ownership, Management, and Conservation Status: State-owned. Restoration with dredge placement increased the beach-nesting bird habitat and supports multiple species of colonial beach-nesting birds as well as American Oystercatchers. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds. Low-disturbance site accessible only by boat.

Louisiana / Whiskey Island

Population data: Breeding: 70 pairs (Zdravkovic 2013); Nonbreeding: no data.

Description: Barrier island habitat, recently restored; approximately 5.2 miles (8.4 km) long, in Terrebonne Parish.

Ownership, Management, and Conservation Status: State-owned. Restoration with dredge placement has increased the beach-nesting bird habitat and supports multiple species of colonial beach-nesting birds as well as American Oystercatchers. Low-disturbance area only accessible by boat. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds.

Louisiana / Trinity Island

Population data: Breeding: 72 pairs (Zdravkovic 2013); Nonbreeding: no data.

Description: Barrier island habitat, recently restored; approximately 7.2 miles (11.6 km) long, in Terrebonne Parish.

Ownership, Management, and Conservation Status: State-owned. Restoration with dredge placement has increased the beach-nesting bird habitat and supports multiple species of colonial beach-nesting birds as well as American Oystercatchers. Low-disturbance area only accessible by boat. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds.

Louisiana / Point Au Fer – *Globally Important*

Population data: Breeding: 168 pairs (Zdravkovic 2013); Nonbreeding: no data.

Description: Mainland gulf beach backed by salt pannes, saltmarsh, and bayou; approximately 22 miles (34km) long, in Terrebonne Parish.

Ownership, Management, and Conservation Status: Owned by the Catholic Church and unlikely to be developed due to inaccessibility. Low-disturbance area only accessible by boat. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds.

Louisiana / Rockefeller State Wildlife Refuge – *Globally Important*

Population data: Breeding: 188 pairs (Zdravkovic 2013); Nonbreeding: no data.

Description: Mainland gulf beach backed by salt pannes, saltmarsh, and bayou; approximately 27.6 miles (43.5 km) long, in Cameron Parish.

Ownership, Management, and Conservation Status: State-owned and protected by U.S. Fish and Wildlife Service. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds. Low-disturbance area accessible only by boat and airboat. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds.

Louisiana / Mermentau River East

Population data: Breeding: 50 pairs (Zdravkovic 2013); Nonbreeding: no data.

Description: Mainland gulf beach habitat backed by saltmarsh and bayou; approximately 6.4 miles (10.2 km) long, in Cameron Parish.

Ownership, Management, and Conservation Status: Privately owned with minimal commercial use. Low-disturbance area accessible only by boat and airboat. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds.

Louisiana / Johnson's Bayou

Population data: Breeding: 64 pairs (Zdravkovic 2013); Nonbreeding: no data.

Description: Rivermouth and mainland gulf beach habitat with salt pannes backed by saltmarsh and bayou; approximately 6 miles (9.7 km) long, in Cameron Parish.

Ownership, Management, and Conservation Status: Mix of private and public ownership. Moderate disturbance on the gulf beachfront from nearby residents' use of recreational ORVs. Primary breeding habitat (salt panne) behind the beach receives minimal human disturbance. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds.

Texas

Nearly the entire coast of Texas, especially the Laguna Madre region, supports breeding and staging Wilson's Plovers. The Laguna Madre of Texas and of Tamaulipas, Mexico, together form the largest hypersaline lagoon system in the world (Tunnell and Judd 2002), spanning approximately 227 miles (446 km) of coastline from Corpus Christi Bay, Texas, to La Pesca, Mexico. Its complex chain of barrier islands, barrier peninsulas, mainland gulf beaches, and lagoons provides the most important breeding habitat for Wilson's Plovers in North America, supporting 20% of the U.S. population (Zdravkovic 2005, 2007a, 2012a). The Laguna Madre of Texas is also very important for nonbreeding shorebirds including the Piping Plover (Mabee *et al.* 2001) and Snowy Plover (Zdravkovic and Durkin 2011). Sites within the Laguna Madre of Texas are owned and managed by many different private, state, and federal entities, and much is preserved from development through federal ownership; however, it is unprotected from corporate projects on adjacent private lands. Projects currently threatening the landscape on a large scale include wind turbine projects and planned rocket-launch facilities. The Laguna Madre is a binational Western Hemisphere Shorebird Reserve Network (WHSRN) Site of International Importance.

Texas North Coast / McFaddin National Wildlife Refuge

Population data: Breeding: 50 pairs (M. Zdravkovic unpubl. data); Nonbreeding: no data.
Description: Mainland beach habitat backed by saltmarsh and bayou; approximately 21 miles (33km) long, in Jefferson County near the Louisiana border.
Ownership, Management, and Conservation Status: Federally owned and receives moderate to high disturbance on the gulf beachfront from pets, free-ranging cattle, and recreational ORV use by nearby residents. The Gulf beach is eroding, further diminishing beach-nesting bird habitat. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds.

Texas North Coast / Bolivar Flats IBA

Population data: Breeding: 25 pairs (M. Zdravkovic unpubl. data); Nonbreeding: 169 individuals (W. Burkett, Houston Audubon Society, 2008 unpubl. data).

Description: Tidal mudflats, saltmarsh, brackish marsh, and upland roosting sites; 555 acres (224 ha). Southern end of a barrier peninsula, just north of Galveston Island in Galveston County.

Ownership, Management, and Conservation Status: Owned by the Houston Audubon Society for protection as a shorebird sanctuary. Designated a WHSRN Site of International Importance in 2007; supports approximately 140,000 shorebirds representing 37 species, including wintering Piping Plover (Threatened). Black Skimmers and Least Terns have low nest success rates on the flats every year due to high disturbance from vehicular traffic and unleashed dogs. Threats to the site include oil spills, given its proximity to Houston Ship Channel; requests by local fishermen to dredge the slough next to the marsh; the U.S. Army Corps of Engineers' past and potential use of the site as a source for sand; and its proximity to a highly urbanized area and potential for development.

Texas Middle Coast / San Bernard National Wildlife Refuge IBA

Population data: Breeding: 60 pairs (M. Zdravkovic unpubl. data); Nonbreeding: present during staging (Eubanks *et al*. 2006).

Description: Mainland Gulf beach, rivermouth habitats, tidal saltmarshes, mudflats, and managed impounds; 45,730 acres (18,506 ha), in southern Brazoria and eastern Matagorda Counties.

Ownership, Management, and Conservation Status: Federally protected refuge, owned and managed by U.S. Fish and Wildlife Service since1968 to conserve wintering waterfowl and estuarine systems; part of the southernmost range of the San Bernard Watershed. Receives millions of migrating birds annually. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds.

Texas Middle Coast / East Matagorda Peninsula

Population data: Breeding: 40 pairs (M. Zdravkovic unpubl. data); Nonbreeding: no data.

Description: Barrier peninsula, 22.3 miles (35.9 km) long, south of Bay City; runs in front of Matagorda and East Matagorda Bays. Far western end of the peninsula has a manmade ship channel.

Ownership, Management, and Conservation Status: Both State and private ownership. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds.

Texas Middle Coast / Matagorda Island National Wildlife Refuge

Population data: Breeding: 43 pairs (Zdravkovic 2005); Nonbreeding: no data.

Description: Barrier island stretching 38 miles (61km) long and varying in width from 0.75–4.5 miles (1.2km–7.2km); runs along the Coastal bend area in Calhoun County, north of Corpus Christi Bay.

Ownership, Management, and Conservation Status: Established as a National Wildlife Refuge with State Natural Area overlay (north end) in 1994 by a revised Memorandum of Agreement with the State. Texas Parks and Wildlife Department manages the public's recreational uses on the island; the USFWS manages wildlife and habitats. Low-disturbance area is protected from development and accessible only by boat. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds.

Texas Middle Coast / San Jose Island – *Globally Important*

Population data: Breeding: estimated 30–50 pairs (M. Zdravkovic unpubl. data). Actual numbers unknown due to lack of access to private property; Nonbreeding: staging in early July, 1,000–1,200 individuals (Amos 2005).

Description: Barrier island, approximately 21 miles (34km) long and 5miles (8km) wide, in Nueces County.

Ownership, Management, and Conservation Status: Privately owned and accessible only by boat. Property owners do not allow access. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds.

Texas Laguna Madre region / East Shore Spoil Islands (includes Harbor Island)

Population data: Breeding: 55 pairs (M. Zdravkovic unpubl. data); Nonbreeding: no data.

Description: Artificially created spoil islands; 2.82 miles (4.54 km) long. Harbor Island is on northeastern edge of Corpus Christi Bay, eastern Nueces County, with 1.5 miles (2.4 km) of frontage on State Highway 361.

Ownership, Management, and Conservation Status: State-owned. Harbor Island is zoned for industry. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds.

Texas Laguna Madre region / Upper Laguna Madre Spoil Islands

Population data: Breeding: 71 pairs (Zdravkovic 2005, M. Zdravkovic unpubl data); Nonbreeding: not present in winter.

Texas Laguna Madre region / Lower Laguna Madre Spoil Islands

Population data: Breeding: 50 pairs; Nonbreeding: present in low numbers (Zdravkovic and Durkin 2011).

Description: Artificially created dredge spoil islands built and maintained by U.S. Army Corps of Engineers to keep the Intercoastal Waterway (ICW) shipping channels open; a chain of many, small, moderately to densely vegetated islands from Corpus Christi Bay south, intermittently spanning nearly 30 miles (48 km) to Laguna Atascosa NWR in Kleburg, Kenedy, and Willacy Counties.

Ownership, Management, and Conservation Status: Owned by Texas General Land Office (TGLO), except the northernmost islands owned by National Park Service (Padre Island National Seashore). Audubon Texas, in cooperation with Coastal Bend Bays and Estuaries Program (CBBEP), manages several islands for colonial waterbirds; signage restricts the public from bird nesting areas. The CBBEP conducts predator control and invasive-species plant management. Most islands are created and maintained as dredged material placement areas, subject to further dredge disposal as the U.S. Army Corps of Engineers deems necessary (R. Cobb, pers. comm.).

Texas Laguna Madre region / Padre Island National Seashore - *Globally Important*

Population data: Breeding: 248 pairs (Zdravkovic 2005); Nonbreeding: present during staging and migration, very low numbers in winter (M. Zdravkovic unpubl. data).

Description: One of the longest undeveloped stretches of barrier island in the world; 70 miles (113km) long and up to 4 miles (6.4km) wide, encompassing 130,434 acres (52,785 ha) in Kleburg and Kenedy Counties. Contains rare, coastal prairie habitat; a complex, dynamic dune system; and the Laguna Madre, one of the world's few remaining hypersaline lagoons. Supports

over 350 migratory, wintering, and resident bird species in the Central Flyway; fully accessible from the mainland by a major causeway.

Ownership, Management, and Conservation Status: Owned and managed by the National Park Service (NPS); several private in-holdings include mineral and gas access and extraction rights. Coastal Texas beaches are part of the state highway system under the Texas Open Beach Act, so ORV use is permitted on the island's front beach, except on 4.5 mile (7.2km) Malaquite Beach. ORVs are prohibited on the island's dunes, behind the primary dune line, and all bayside habitats; activity is well monitored, to protect breeding and nonbreeding shorebird areas. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds. The island is part of the binational Laguna Madre WHSRN Site of International Importance.

Texas: Lower Laguna Madre Region

The USFWS' South Texas National Wildlife Refuge Complex (STRC) manages five of the twelve sites in Texas supporting 1% or more of the U.S. population of breeding Wilson's Plovers. The STRC has current and ongoing plans to protect all Refuge-owned tracts that support breeding and nonbreeding shorebirds within the lower Laguna Madre region. CBC is working with the STRC to implement restrictions to limit vehicle access to beach-nesting bird breeding and migratory habitat behind the primary dune line, interdune washover passes, and on all algal flats and mangrove wetland areas. However, ORV use remains unrestricted seaward of the primary dune line on the Gulf front shorelines, as front beach is considered part of the Texas state highway system under the Texas Open Beaches Act.

CBC mapping of high numbers of breeding plovers from 2003-2013 on USFWS property in the lower Laguna Madre region has also led to the development of plans for protective fencing at critical nesting sites and migratory/wintering sites. CBC and STRC have begun implementation of protective fencing to restrict the use of ORVs on federally owned tracts of land on the bay (laguna) side of South Padre Island, Brazos Island/South Bay, Boca Chica Flats, and the flats associated with the mouth of the Rio Grande. These sites support the highest concentrations of breeding Wilson's Plovers and Snowy Plovers in the region.

Texas Lower Laguna Madre Region / Laguna Atascosa National Wildlife Refuge

Population data: Breeding: 53 pairs (Liptay and Zdravkovic 2008); Nonbreeding: fall migration, 96 individuals (Zdravkovic and Durkin 2011).

Description: Mainland coastal bay habitat; 98,000 acres (400 sq. km), the largest protected area of natural habitat in the Lower Rio Grande Valley. Located in Cameron County with northernmost point in southern Willacy County.

Ownership, Management, and Conservation Status: Federally owned, managed, and protected since 1946; supports more documented species of birds than any other U.S. refuge. Access to beach-nesting bird habitat is restricted and receives minimal to no human disturbance.

Texas Lower Laguna Madre Region / Bahia Grande Lakes Complex

Population data: Breeding: 59 pairs (Liptay and Zdravkovic 2008); Nonbreeding: fall migration, 96 individuals (Zdravkovic and Durkin 2011).

Description: Coastal saline lake habitat; part of Laguna Atascosa NWR and the STRC, in Cameron County west of Port Isabel, and part of the Texas Tamaulipan Biotic Province, covering 21,762 acres (8,807ha). Matrix of wind tidal flats, brush-covered clay dunes (lomas), stabilized clay dunes interspersed with grass and brush-covered uplands, saline flats, marshes and shallow bays.

Ownership, Management, and Conservation Status: Federally owned, managed, and protected. Access to beach-nesting bird habitat is restricted and receives minimal to no human disturbance.

Texas Lower Laguna Madre Region / South Padre Island

Population data: Breeding: 107 pairs (Liptay and Zdravkovic 2008); Nonbreeding: fall migration, 80 individuals (Zdravkovic and Durkin 2011).

Description: 35-mile (56-km) long barrier island with a complex, dynamic dune system; in Willacy and Cameron Counties. One-fifth (6.5 miles /10.5 km) of island's southernmost end is developed and a highway extends 12.6 miles (14 km) southward. Island s. Separated from Padre Island National Seashore by the Mansfield Channel. Accessible from the mainland via a major causeway from Port Isabel.

Ownership, Management, and Conservation Status: Owned and managed by public and private interests: Cameron County Parks, Texas Parks and Wildlife Department, Texas General Land

Office, USFWS (Laguna Atascosa NWR), and private landowners. Entire island is USFWS critical Piping Plover winter habitat. Some 24,747 acres (10,015 ha) between the north end of Park Road 100 and the Mansfield Channel are within the South Padre Island Unit of Laguna Atascosa NWR. Texas General Land Office owns 2,138 acres (865 ha) on the island's north end and all submerged lands surrounding the island, including spoil island sites along the Mansfield Cut, south side. Island's north end and adjacent Laguna Madre are within a Coastal Barrier Resources Act (CBRA) unit, where expenditure of federal funds for projects (*e.g.*, highways, federal flood insurance, *etc.*) are prohibited (excluding funds for NPS and Refuge lands), limiting development. CBC, with cooperation from STRC, has restricted ORV use in breeding and nonbreeding shorebird habitat on Refuge-owned tracts (J. Wallace pers. comm.).

Texas Lower Laguna Madre Region / Brazos Island/South Bay

Population Data: Breeding: 54 pairs (Liptay and Zdravkovic 2008);Nonbreeding: fall migration, 150+ (S. Colley pers. comm.)

Description: Barrier peninsula with complex dune system, 7.75 miles (12.5 km) long, in Cameron County. Separated from South Padre Island to the north by Brazos Santiago Pass and Brownsville Ship Channel.

Ownership, Management, and Conservation Status: Federally and state-owned (refuge and state park lands managed by USFWS), with small privately owned tracts of land. Entire area is USFWS critical Piping Plover winter habitat. Front beach is open to public ORV use, but CBC in cooperation with STRC has restricted ORV use in breeding and nonbreeding shorebird habitat on Refuge-owned tracts. Currently, SpaceX Corporation is awaiting approval to build a rocket-launch facility on private land within this site. If built, this and adjacent important sites of Boca Chica Flats/Mouth of the Rio Grande will be in jeopardy due to major disturbance from facility operations, increased development, and human-caused disturbance.

Texas Lower Laguna Madre Region / Boca Chica Flats/Mouth of the Rio Grande

Population Data**:** Breeding: 54 pairs (Zdravkovic 2005); Nonbreeding: 170 individuals (adults and juveniles) (Liptay and Zdravkovic 2008).

Description: Mainland gulf beach and rivermouth habitat, includes back beach flats; 6.25 sq. miles (16.20 sq. km) on the U.S./ Mexico border of the Rio Grande River, Cameron County.

Ownership, Management, and Conservation Status: Federally and state-owned (refuge and state park lands managed by USFWS), with small privately owned tracts of land. Entire site is USFWS critical Piping Plover winter habitat. CBC in cooperation with STRC has restricted ORV use in breeding and nonbreeding shorebird habitat on Refuge-owned tracts. Currently, SpaceX Corporation is awaiting approval to build a rocket-launch facility on private land within this site. If built, this and adjacent important sites of Brazos Island/South Bay will be in jeopardy due to major disturbance from facility operations, increased development, and human-caused disturbance.

MEXICO

Gulf of Mexico (subspecies *C. w. wilsonia*)

Laguna Madre of Mexico; northeast Tamaulipas

The Laguna Madre of Mexico is a designated binational WHSRN Site of International Importance. In 2005, the area was declared a protected area by the Mexican government in cooperation with local towns and fisherman. Much of the vast 1.4 million acres (566,562 ha) is still wild and sparsely populated by humans; however, the area has been extensively over-fished during the past 30 years by local fishermen and only recently have fishing limits and area closures been implemented. CBC surveys in 2006 showed that the region supported approximately 19% of the total estimated Gulf Coast Wilson's Plover breeding population (Zdravkovic 2007a), the majority located at the important sites listed below. Few data are available for migratory/wintering Wilson's Plovers. A partial survey in winter of the barrier islands located only 11 individual Wilson's Plovers; however, the area was shown to support significant winter populations of Piping Plovers and Snowy Plovers (Mabee *et al.* 2001). Given the importance of the entire Laguna Madre region to breeding plovers, an international conservation program with the Mexican government should be strengthened to protect Wilson's, Snowy, and Piping Plovers and other beach-nesting birds and their breeding and migratory/wintering locations in northeast Mexico.

Laguna Madre of Mexico; northeast Tamaulipas / Playa Bagdad

Population data: Breeding: 150 pairs (Zdravkovic 2007a); Nonbreeding: no data.

Description: Mainland gulf beach that includes a complex, dynamic dune system with flats and

washover fans, intermittent salt ponds, and river channels associated with a dry lagoon bed, bordered by dense mainland scrub; spans 25 sq. miles (65 sq. km).
Ownership, Management, and Conservation Status: Federally owned. A high human-use/human-disturbance area impacted by vehicles, fishing boats, fishing shanties, and rubbish disposal. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds at this site.

Laguna Madre of Mexico; northeast Tamaulipas / Bara El Conchillal
Population data: Breeding: 87 pairs (Zdravkovic 2007a); Nonbreeding: no data.
Description: Mainland Gulf beach that includes a complex, dynamic dune system with flats and washover fans, extensive barren to densely vegetated dry sand/shell/mud/algal flats interspersed with densely vegetated lomas, bordered by dry lagoon bed, salt lakes, and dense mainland scrub; spans 73 sq. miles (190 sq. km).
Ownership, Management, and Conservation Status: Federally owned. Impacted by free-ranging cattle. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds at this site.

Laguna Madre of Mexico; northeast Tamaulipas / Bara Los Americanos
Population data: Breeding: 59 pairs (Zdravkovic 2007a); Nonbreeding: no data.
Description: Barrier island spanning 50 sq. miles (130 sq. km) with complex, multi-dune ridge system and associated vegetated sand/shell/mud/algal flats, washovers, salt ponds, lagoons, and lagoon inlets.
Ownership, Management, and Conservation Status: Federally owned. Impacted by free-ranging cattle and horses. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds at this site.

Laguna Madre of Mexico; northeast Tamaulipas / Bara Soto La Marina – *Globally Important*

Population data: Breeding: 155 pairs (Zdravkovic 2007a); Nonbreeding: no data.

Description: Barrier island spanning 19 sq. miles (50 sq. km) with a complex, multi-dune ridge system and associated vegetated sand/shell/mud/algal flats, washovers, salt ponds, lagoons, and lagoon inlets.

Ownership, Management, and Conservation Status: Federally owned. Currently a low-disturbance, sparsely populated, natural area. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds at this site.

Pacific Northwest (subspecies *C. w. beldingi*)

Ceuta

Population data: subspecies (*C. w. beldingi*) Breeding: estimated 50–100 pairs; Nonbreeding: present year round, no abundance data available (C Küpper unpubl. data).

Description: Part of a barrier island lagoon system on Gulf of California, in the State of Sinaloa, on Pacific coast of Mexico; 24miles (40 km) long, including beach and adjacent wetlands.

Ownership, Management, and Conservation Status: Mixed ownership: Federal (National Commission on Natural Protected Areas), State of Sinaloa, City of Elota, and some private lands. Designated as a Ramsar site in February 2008 and a WHSRN Site of Regional Importance in 2002. Conservation concerns include disturbance from tourists and recreational activity, nearby hotel developments, and free-ranging cattle. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds at this site (C. Küpper, pers. comm.).

CENTRAL AMERICA (*C. w. beldingi*)

EL SALVADOR

Barra de Santiago Estuary IBA

Population data: Breeding: no data; Nonbreeding: 105 individuals (O. Komar unpubl. data).

Description: Mangrove estuary/rivermouth, mangrove forests; near the Guatemalan border in southwest El Salvador; 4,942 acres (2,000 ha).

Ownership, Management, and Conservation Status: Federally owned, protected, managed by the Ministry of Environment and Natural Resources and by the Barra de Santiago Women's Association (AMBAS, in Spanish). A designated Important Bird Area (IBA).

Estero de Jaltepeque and Río Lempa Estuaries IBA

Population data: Breeding: 15 pairs (Rodríguez and Komar 1997, Ibarra Portillo *et al.* 2005 *in* Herrera and Komar 2007); Nonbreeding: approx. 200 individuals (O. Komar unpubl. data).

Description: Estero de Jaltepeque covers 37,065 acres (15,000 ha) of mangrove estuary/ rivermouth habitat and mangrove forests, connected by tidal creeks to the Lempa River mouth and includes extensive tidal mudflat habitat. Lempa River is the country's largest and runs through parts of Guatemala and Honduras. This site forms a single Important Bird Area with Bahía de Jiquilisco to its east.

Ownership, Management, and Conservation Status: Federally owned, Supports waterbird colonies and foraging shorebirds; no protected status and no specific management activities are currently conducted for shorebird conservation. "Costa del Sol," a sandbar bordering the western half of the site, is a popular tourist area and is heavily developed.

Bahía de Jiquilisco IBA– *Globally Important*

Population data: Breeding: 60+ pairs; Nonbreeding: 500+ (Jones and Komar 2008, Martínez 2008).

Description: Mainland, coastal, mangrove lagoon habitat covering 79,073 acres (32,000 ha) on southern coast.

Ownership, Management, and Conservation Status: Federally owned. A designated Important Bird Area through BirdLife International, a proposed Ramsar site, and the Xirihualtique - Jiquilisco Biosphere Reserve. The Ministry of Environment and Natural Resources actively works with local conservation groups to increase habitat protection.

COSTA RICA

Pacific Coast (*C. w. beldingi*)

Nicoya Gulf Mangroves and Coastal Areas IBA – *Globally Important*

Population data: Breeding: 125 pairs (estimate not based on surveys) (Sandoval and Sanchéz *in prep*.); Nonbreeding: no data.

Description: Along the northeast coast, covers 96,062 acres (38,875 ha), and separates the Nicoya Peninsula from the mainland. Along western shores: mangrove wetlands, from the mouth of the Rio Jesus Maria to the mouth of the gulf. Along eastern shores: large expanses of mudflats during low tides provide important feeding areas for migratory and resident shorebirds (Pereira and Barrantes 1996 *in* Sandoval and Sanchéz *in prep*.).
Ownership, Management, and Conservation Status: Federally owned. Proposed and accepted as an IBA by BirdLife International. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds at this site.

Tárcoles, Carara and La Cangreja IBA
Population data: Breeding 50+ pairs (estimate not based on surveys) (Sandoval and Sanchéz *in prep*.); Nonbreeding: no data.
Description: No data
Ownership, Management, and Conservation Status: Federally owned. Proposed and accepted as an IBA by BirdLife International. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds.

Sierpe Wetlands and Osa Peninsula IBA – *Globally Important*
Population data: Breeding 150 pairs (estimate not based on surveys) (Sandoval and Sanchéz *in prep*.); Nonbreeding: no data.
Description: Along the southern Pacific coast, covers 557,956 acres (225,797 ha) and includes several lagoons and mangrove wetland areas within the Golfo Dulce, created by the Osa Peninsula. Site includes several small rocky islands along the peninsula's Pacific coast and the Isla del Cano biological reserve. Dry season: December to March; wet season: March to November. Periodic flooding creates seasonal ponds and lagoons in the lowland areas (Sandoval and Sanchéz *in prep*.).
Ownership, Management and Conservation Status: Federally owned. Proposed and accepted as an IBA by BirdLife International. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds at this site.

SOUTH AMERICA

COLOMBIA

Pacific Coast (*C. w. wilsonia* and *C. w. beldingi*)

Sanquianga National Park IBA – *Globally Important*

Population data: Breeding 50+pairs (*C. w. beldingi*); Nonbreeding: wintering, 500 individuals (*C. w. wilsonia and C. w. beldingi*)(Ruiz *et al.* 2008).

Description: On the southern Pacific coast of Colombia and northern coast of Nariño (Franco-Maya and Bravo 2005);197,684 acres (80,000-ha). Estuaries of the Sanquianga Delta support the largest and best-preserved mangrove forests in Colombia (Garcés and Zerda 1994). Within the park's buffer zone are several sandbars, islets, and mudflats with sparse vegetation and a few trees (*e.g. Hibiscus tiliaceus*). La Cunita, one of the larger islets on the mouth of the Iscuandé River, is one of the most important shorebird roosting and feeding areas in Colombia (Departamento de Nariño, Pacific Coast).

Ownership, Management, and Conservation Status: Federally owned and protected as a national park since 1975, and a designated IBA for Neotropical migratory shorebirds and Neotropical Cormorants (*Phalacrocorax brasilianus*). Asociación Calidris is working to designate Sanquianga National Park as a WHSRN site. The park and Iscuandé River Delta (already a WHSRN site) support the largest concentrations of shorebirds in Colombia.

Delta del Río Iscuandé IBA (Bajos de La Cunita y Quiñónez) – *Globally Important*

Population data: Breeding 100+ pairs (estimate based on partial surveys); Nonbreeding: (*C. w. wilsonia* and *C. w. beldingi*): 1,500 individuals (Ruiz 2009).

Description: The two uninhabited islets (*bajos*) have extensive intertidal mudflats, sandy beaches, and mangroves; 9,884 acres (4,000 ha) located 4.3 miles (7km) outside Sanquianga National Park limits. La Cunita, the largest, connects with the mainland coast near Juanchillo village during extremely low tides.

Ownership, Management, and Conservation Status: Owned by the Municipality of Iscuandé, Departament of Nariño; part of the Sanquianga National Park and IBA, and designated a WHSRN site based on numbers of nonbreeding Wilson's Plovers (documented by Asociación Calidris)—a first for this species. No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds at this site.

THE CARIBBEAN (subspecies *C. w. wilsonia*)

JAMAICA

Black River Great Morass IBA

Population data: Breeding: 100 pairs (BirdLife International, 2013 IBA Factsheet); Nonbreeding: no data.

Description: Large wetland on the Black River coastal floodplain, St. Elizabeth Parish, southwestern region of Jamaica; 43,908 acres (17,769 ha) includes mangrove wetlands, lagoons, saltmarshes, and mud flats. Encompasses the Lower Morass.

Ownership, Management, and Conservation Status: Owned by Government of Jamaica and the Petroleum Corporation of Jamaica, with some areas on the outer edges owned by farmers and homeowners. It is an Important Bird Area (IBA) and Lower Morass is a Ramsar site.

PUERTO RICO – United States.

Suroeste IBA - Cabo Rojo Salt Flats

Population data: Breeding: 76 pairs; Nonbreeding: 93 individuals (Sociedad Ornitologica Puertorriquena, Inc. [SOPI] 2005).

Description: Suroeste IBA - along the coast of southwestern Puerto Rico, from Cabo Rojo east through La Parguera to Guánica; 33,606 acres (13,600 ha). Includes dry coastal forest, saltflats, saline lagoons, and mangrove swamps.Wilson's Plovers are on the Cabo Rojo Salt Flats and Papayo Salt Flats portion of the IBA. Most of the Cabo Rojo Salt Flats is undeveloped and an important stopover / wintering area for over 20,000 shorebirds (including Neotropical migratory species and Federally listed Piping Plover) in the Atlantic Flyway, and a vital nesting ground for Snowy Plover, Least Tern, Wilson's Plover, Black-necked Stilt, and Killdeer.

Ownership, Management, and Conservation Status: Owned and protected by state and federal entities and nongovernmental organizations (NGO); parts of the IBA are privately owned and unprotected. Cabo Rojo Salt Flats NWR is a WHSRN Site. Land is used for agriculture, fisheries, conservation, research, tourism, recreation, and pasture. SOPI's Shorebird Monitoring Network operates at a number of wetlands within the IBA. The local NGO, *Comité Caborrojeños Pro Salud y Ambiente,* promotes conservation and education projects. Threats include habitat loss and degradation through industrial and housing infrastructure development,

invasive species such as Patas Monkey (*Erythrocebus patas*) and Rhesus Macaque (*Macaca mulatta)*, water pollution and human disturbance (Wege and Anadon-Irizarry 2008).

TURKS AND CAICOS

North, Middle, and East Caicos - Ramsar site and IBA

Population data: Breeding: 50 pairs (Wege and Anadon-Irizarry 2008); Nonbreeding: no data.
Description: 1,448,456 acres (58,617 ha) of wetlands along mainly the southwest sides of North Caicos, Middle Caicos, and part of East Caicos. Over 20,000 waterbirds documented, with globally significant numbers of Caribbean Flamingo (*Phoenicopterus ruber)* and Reddish Egret (*Egretta rufescens)*. Small numbers of migrant Sandhill Cranes (*Grus canadensis)* and wintering Kirtland's Warbler (*Dendroica kirtlandii*) [Threatened] have been recorded.
Ownership, Management, and Conservation Status: Statutory nature reserve mainly on Crown lands and includes the overlapping Vine Point (Man O' War Bush and Ocean Hole) Nature Reserve. Designated an IBA and Ramsar site (share boundaries); included in the Turks and Caicos National Trust (TCNT) Biodiversity Management Plan being implemented by the Trust, its partners, and the local community around the Turks and Caicos Ramsar site. Strict protection afforded by the statutory nature reserve should be implemented fully and extended to the ecologically linked dry land and ponds in Middle Caicos, to East Caicos more fully, and to reef areas on North and East Caicos (Wege and Anadon-Irizarry 2008).

East Caicos and adjacent areas IBA

Population data: Breeding: 30+ pairs, estimate not based on surveys (Wege and Anadon-Irizarry 2008); Nonbreeding: no data.
Description: Uninhabited island of East Caicos and adjacent areas of eastern and northeastern Middle Caicos; 55,598 acres (22,500 ha). East Caicos has scrub, woodland, ponds, caves, marshes, flats, and other wetlands. Middle Caicos has Long Bay (on the northeast shore) and creeks and flats at Lorimers and Increase. Coral reef off Middle and East Caicos. Eastern end of Middle Caicos and around Joe Grant Cay includes cays, creeks, and marshes extending to Windward Going Through, adjoining the Ramsar site. Area supports important populations of waterbirds including globally significant numbers of Reddish Egrets and Common Terns.
Ownership, Management, and Conservation Status: Unprotected IBA in urgent need of statutory

nature reserve status as recommended in TCNT Biodiversity Management Plan. Quantitative information birds and other biodiversity is limited; additional survey information is needed. The currently uninhabited area on East Caicos has been previously threatened by major resort development, and some threats remain(Wege and Anadon-Irizarry2008). No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds.

Grand Turk Salinas and Shores IBA

Population data: Breeding 30+ pairs, estimate not based on surveys (Wege and Anadon-Irizarry 2008); Nonbreeding: no data.

Description: Major wetland areas on Grand Turk Island; 494 acres (200 ha). About 40% of island is wetland – abandoned salinas (or saltpannes) from the salt production industry, saltwater inlets (or creeks), and nearby shores and tidal mud flats. The salinas and wetlands include Town Salina, North Wells, South Wells, North Creek, South Creek, Great Salina, Hawkes Pond, Salina and Hawkes Nest Salina. Significant for breeding and wintering populations of waterbirds; globally important for breeding Least Terns and wintering Short-billed Dowitchers (*Limnodromus griseus)*, Greater Yellowlegs (*Tringa melanoleuca),* Lesser Yellowlegs (*T. flavipes),*and Laughing Gulls (*Larus atricilla)*. Piping Plover (*Charadrius melodus)* [Threatened] has been recorded here.

Ownership, Management, and Conservation Status: Mix of Crown and private ownership; a designated IBA. Saltpanne areas considered locally as wastelands are being filled. The TCI Government Development Manual requires an environmental impact assessment for any development in a salina wetland, but Department of Planning does not enforce it (Wege and Anadon-Irizarry 2008). Currently no specific management activities are conducted for the benefit of breeding or migratory shorebirds at this site.

Salt Cay Creek, Salinas IBA

Population data: Breeding: 30+ pairs, estimate not based on breeding surveys (Wege and Anadon-Irizarry 2008); Nonbreeding: no data.

Description: Southernmost inhabited island, 10 km southwest of Grand Turk; 370 acres (150 ha). Includes natural creek area on southeast Salt Cay and abandoned salinas (salt pannes) throughout

the island. Supports a globally significant breeding population of Least Tern and regionally important numbers of Brown Pelican, Wilson's Plover, Laughing Gull, and Sandwich Tern (*Sterna sandvicensis)*. Large numbers of wintering and migratory shorebirds occur, with up to 2,500 wintering Stilt Sandpiper (*Calidris himantopus)* recorded.

Ownership, Management, and Conservation Status: Mix of Crown and private land ownership; a designated IBA. Parts of the salt pannes are a statutory area of historic interest; Salt Cay Creek is recognised locally as an informal sanctuary. The IBA needs nature reserve status (protected) that includes both Salt Cay Creek and the salinas in the boundary (Wege and Anadon-Irizarry 2008). No specific management activities are currently conducted for the benefit of breeding or migratory shorebirds.

BAHAMAS

North Atlantic Abaco Cays IBA

Population data: Breeding: 50+ pairs (BirdLife International, 2013 IBA Factsheet); Nonbreeding: no data.

Description: Barrier islands and mangrove wetlands to the east and southeast of Grand Bahama island; 101,721 acres (41,165 ha).

Ownership, Management, and Conservation Status: The Bahamas became independent of Great Britain on July 10, 1973. The Abaco Cays encompass several national parks and other natural areas, including coral reefs and old growth forests.

APPENDIX 5: LIST OF FIGURES, TABLES AND MAPS

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