ORNITOLOGIA NEOTROPICAL 19 (Suppl.): 623–631, 2008

THE STATUS AND CONSERVATION OF HUDSONIAN GODWITS (*LIMOSA HAEMASTICA*) DURING THE NON-BREEDING SEASON

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Resumen. – El estado y conservación de la Becasina de Mar (*Limosa haemastica*) durante la época no-reproductiva. – La Becasina de Mar (*Limosa haemastica*) es un ave limícola Neártica que reproduce a lo largo del ártico y sub-ártico Canadiense y de Alaska y pasa la estación no-reproductiva en el sur de Sudamérica. Se conoce poco sobre su historia natural y rutas de migración. Combinada con su pequeño tamaño poblacional y el uso de un número de hábitats en peligro, esta falta de conocimiento ha convertido a la Becasina de Mar en una especie de alta preocupación para la conservación. En un esfuerzo para resolver estas cuestiones, la Red Hemisférica de Reservas para Aves Playeras apoyó la elaboración del Plan de Conservación de la Becasina de Mar. Este trabajo presenta las conclusiones del plan relacionadas con el estado y la conservación de la Becasina de Mar durante la temporada no-reproductiva. Estas conclusiones incluyen la identificación de sitios que son considerados sitios importantes para la conservación. El plan también propone preguntas guía para los esfuerzos de investigación en los próximos años. El plan también identifica los riegos de mayor importancia que enfrenta la especie en Sudamérica. Finalmente, el plan presenta un cronograma para completar los proyectos de investigación y conservación que deberían guiar las actividades de los científicos y conservacionistas interesados en Becasina de Mar hasta el año 2015.

Abstract. – The Hudsonian Godwit (*Limosa haemastica*) is a Nearctic shorebird that breeds across the Canadian and Alaskan arctic and sub-arctic and spends the non-breeding season in southern South America. Little is known about the godwits' natural history or migration routes. Combined with its small population and use of imperiled habitats, this lack of knowledge has caused Hudsonian Godwits to be labeled a species of high conservation concern, and the Western Hemisphere Shorebird Reserve Network to support the preparation of a Hudsonian Godwit Conservation Plan. This paper presents the findings of the plan relating to the status and conservation of godwits during the non-breeding season, including the identification of important sites for conservation, questions to guide research efforts in the coming years, and the major conservation threats facing godwits in South America. Finally, the plan presents a timeline for the completion of research and conservation projects that should guide the activities of scientists and conservationists interested in Hudsonian Godwits through the year 2015. *Accepted 14 December 2007.*

Key words: Hudsonian Godwit, *Limosa haemastica*, migration, Nearctic shorebirds, non-breeding season, South America, wetland conservation.

INTRODUCTION

The Hudsonian Godwit (*Limosa haemastica*) is one of the most poorly studied of all waders breeding in North America. For instance, although it has been known since the early 20th century that godwits spent the boreal winter in the Southern Cone of South America (Wetmore 1927), it was not known until the mid 1980s that a large proportion of the

TABLE 1. List of the sites of conservation importance for Hudsonian Godwits in South America. Data from Senner (2007).

Site name	Country	High count
Bahía San Sebastián, Tierra del Fuego	Argentina	19,340
Bahía Bustamante, Chubut	Argentina	6,900
Bahía Samborombón, Buenos Aires	Argentina	5,330
Río Gallegos, Santa Cruz	Argentina	1,000
San Antonio Oeste, Río Negro	Argentina	800
Albufera Mar Chiquita, Buenos Aires	Argentina	600
Golfo San Jorge, Santa Cruz	Argentina	550
Estuario Río Deseado, Santa Cruz	Argentina	520
Bahía Blanca, Buenos Aires	Argentina	400
Río Grande, Tierra del Fuego	Argentina	287
Lagoa de Peixe, Rio Grande do Sul	Brazil	800
Marchantaria Island, Amazonas	Brazil	83
Bahía Lomas, Región XII	Chile	11,660
Putemun, Región X	Chile	7,000
Seno de Relóncavi, Región X	Chile	4,940
Curaco de Vélez, Región X	Chile	4,500
Quetalmahue, Región X	Chile	1,950
Huildad, Región X	Chile	1,800
Caulín, Región X	Chile	1,700
Yaldad, Región X	Chile	1,650
Castro, Región X	Chile	1,382
Estuario de Maulin, Región X	Chile	572
Isla Lemuy, Región X	Chile	465

population spent this time on Tierra del Fuego (Morrison & Ross 1989). Furthermore, it is presumed that a number of important breeding areas and stopover sites have yet to be discovered (Elphick & Klima 2002).

This paucity of information combined with the species' small population size (estimated at 50,000–70,000 individuals, Morrison *et al.* 2006), its reliance on a few very important sites, and the existence of imminent threats to important habitats throughout its range, caused the U.S. (Brown *et al.* 2001) and Canadian (Donaldson *et al.* 2000) Shorebird Conservation plans to list the Hudsonian Godwit as a species of high conservation concern. To better coordinate related conservation efforts and generate broad interest in the study of the species, a conservation plan was developed with support from the Manomet Center for Conservation Sciences and the Western Hemisphere Shorebird Reserve Network (WHSRN).

In this paper, I present the findings of the Hudsonian Godwit Conservation Plan (Senner 2007) relating to this species' status and conservation during the non-breeding season. These findings are organized into four sections: Important sites, research questions, conservation threats, and future actions.

IMPORTANT SITES

One of the goals of the conservation plan was to identify the important sites used by Hudsonian Godwits throughout their annual cycle. Following the protocol designed by WHSRN

(Fernández *et al.* 2006), an important site was defined as an area that supports ≥ 1% of the population of Hudsonian Godwits (≥ 500 individuals) during the non-breeding season. Because little is known about turnover rates at migration sites, the plan also included those sites that have registered single day high-counts representing ≥ 0.5% of the population during migration (≥ 250 individuals). Using these criteria, the plan identified 56 sites as important, 23 of which are in three South American countries (Table 1).

Those 23 sites include 10 that are important during migration. Four of those sites are only important during southward migration (Manaus, Bahía Bustamante, Golfo San Jorge, and Estuario de Río Deseado); three are only of importance during northward migration (Río Gallegos, San Antonio Oeste, and Albufera Mar Chiquita); and three are of importance during both migrations (Lagoa de Peixe, Bahía Samborombón, and Bahía Blanca). The remaining 13 sites, eight of which are on Isla Chiloé, are most important to godwits during the boreal winter.

Of the 23 sites identified in South America, three are of primary importance: Isla Chiloé, Bahía San Sebastián, and Bahía Lomas. During the boreal winter, counts at these three sites have recorded over half of the estimated total population (Morrison & Ross 1989). Five other sites (Lagoa de Peixe, Bahía Samborombon, Río Gallegos, Seno de Relóncavi, and the Estuario de Maulin) also host important numbers of godwits between December–February, but not at the same levels as Isla Chiloé and the two bays on Tierra del Fuego. These five other sites possibly support as many as 12,000 godwits during the boreal winter (Morrison & Ross 1989, Senner unpubl.). The rest of the godwit population is spread thinly along the Argentine coast, at a number of widely scattered sites inland in Argentina, and at a very few sites on the Chilean coast north of Puerto Montt and occasionally as far north as Piura, Peru (Morrsion & Ross 1989, Senner 2006a, 2006b).

One other site is worth mentioning specifically, Marchantaria Island near Manaus, Brazil. While this site is not known to support ≥ 1% of the population, sporadic coverage of the island during the 1990s found concentrations of close to 100 godwits on a number of occasions (Elphick & Klima 2002, B. H. Harrington pers. com.). These observations provide the largest counts of godwits between their North American staging areas and major stopover sites in southern Brazil and Argentina, and also provide some of the only observations that hint at the exact migratory route of godwits during their southward migration. Because coverage of the site has been limited (B. H. Harrington pers. com.), it is likely that larger numbers of godwits have used the site.

RESEARCH QUESTIONS

The next important function of the conservation plan was to identify research questions that need to be addressed for scientific and conservation purposes:

What migration route do godwits use? Three separate breeding populations of Hudsonian Godwits exist: one in southcentral and western Alaska; one in the Mackenzie and Anderson River deltas of the Northwest Territories, Canada; and one along the western coast of the James and Hudson bays (Elphick & Klima 2002). These populations roughly correspond to what may be three separate non-breeding populations (Bahía Samborombón, Isla Chiloé, and Tierra del Fuego). There are few observations, aside from those on Marchantaria Island, linking godwits with stopover sites and non-breeding areas further to the south in South America during their southward migration (Elphick & Klima 2002). Similarly, between the southernmost state of Brazil and the Texas coast, there are few sight-

ings of northbound godwits (Coffey 1960, Howell & Webb 1995). Given the godwits' small population and the reliance of most shorebirds on stopover sites for a successful migration and breeding season (Baker *et al.* 2004), it is pivotal that we define the migration routes of each population and identify the important stopover sites along those routes.

Are there separate populations and do they mix during the boreal winter and migration? As noted above, there appear to be three breeding populations and these three populations may correspond to three separate non-breeding populations. From a conservation standpoint, it is important to understand the dynamics linking these breeding populations and to understand how factors such as climate change (Gill *et al.* 2005, Piersma & Lindström 2004) and coastal development may affect each population differently.

What types of local movements occur during the non-breeding season? Espinosa *et al.* (2006) report wide fluctuations in the number of godwits on Isla Chiloé from month to month each year. This is possibly indicative of movements between widely scattered sites or, at the very least, between sites on the nearby Chilean mainland and Isla Chiloé. Observations from Tierra del Fuego confirm that godwits move between Bahía Lomas and roosting sites on the adjacent mainland, and suggest that movements may also occur between Bahía Lomas, Bahía San Sebasitián, and Río Grande (Senner pers. observ.). Understanding these movements will improve population estimates and clarify how factors such as human disturbance effect godwits' movements.

What are the most important habitat characteristics for non-breeding areas and stopover sites? In South America, the presence of soft sediments (i.e., mud) appears to be the common factor amongst all of the sites used by Hudsonian Godwits (Senner 2006a). The majority of these sites are large bays with extensive intertidal mudflats, although a variety of other habitats are also used. More detailed habitat and diet studies are needed, however, to help delineate which factors are most important for godwits. Understanding these characteristics may help identify previously unidentified stopover sites in rarely visited areas.

What is the status of the birds that spend the austral winter in South America? Surveys of South American coastal sites regularly encounter Hudsonian Godwits during the austral winter months of June, July, and August. Along the coast of northern Argentina, numbers can approach 200 individuals (Blanco *et al.* 1995), while at Lagoa de Peixe, as many as 100 have been reported during these months (Harrington *et al.* 1993). On Isla Chiloé, counts over the past 20 years have varied greatly, but have averaged 389 ± 428 individuals, with a peak of 1492 birds in 1999 (Espinosa *et al.* 2006). There are also a growing number of records of birds in Peru during these months (Senner 2006b, Schulenberg pers. com.). Information documenting this phenomenon is needed, especially addressing which age-class and sex these individuals represent, what percentage of these birds are first-year birds, and which South American sites are most important. Such information may prove important for conservation efforts, since a single catastrophic event at a site supporting large numbers of young, non-breeding godwits would reduce future godwit breeding stock.

CONSERVATION THREATS

Few, if any, of the sites most important to Hudsonian Godwits in South America are without significant conservation concerns.

The threats facing godwits fall into five broad categories: habitat loss and degradation, environmental contamination, human disturbance, climate change, and disease.

Bildstein *et al.* (1991) labeled habitat loss and degradation as the most widespread cause of concern for shorebirds globally, and South America is no exception. Habitat loss and degradation is a factor affecting over half of the sites important to godwits in South America. Foremost among those areas are Isla Chiloé and Seno de Relóncavi in southern Chile, where burgeoning aquaculture practices are severely threatening intertidal habitats in the region (Espinosa *et al.* 2006). These aquaculture practices include salmon, shrimp and oyster farming, and seaweed collecting. The combination of these practices has brought increased traffic into what were formerly infrequently visited areas, caused the development of the shoreline surrounding these bays, and possibly damaged intertidal invertebrate life by removing large quantities of seaweed and algae whose nutrients would normally cycle through the ecosystem. The effects of these practices are already being seen on godwit numbers in some of the bays most heavily used by the seaweed collectors, with godwits regularly displaced during the falling tide or, in some cases, forced to largely abandon some sites (B. Andres pers. com., Senner pers. observ.).

At Bahía San Sebastián, the northern portion of the bay, which is the most heavily used by godwits, is the proposed site of a new ferry terminal that would supplant and enlarge the current small dock located in the same area. The proposed terminal would likely involve the dredging of a portion of the northern bay and would probably change the flow and retention of sediments in the intertidal zone. Shipping traffic would also likely increase in the bay.

Other areas endangered by habitat degradation and loss include Río Grande, Argentina, where a new harbor has been proposed adjacent to one of the main roosting areas used by godwits and Red Knots (*Calidris canutus*), and Bahía Blanca and Bahía Samborombón, Argentina, where sprawl from urban areas may disturb important intertidal mudflats (Senner pers. observ.).

Environmental contamination is nearly as pervasive a threat to godwits as is habitat degradation. Many of the most important sites for godwits lie along major shipping routes, especially those in Argentine Patagonia and on Tierra del Fuego, and some of those sites are also near petroleum extraction activities. Those sites found along the coast of the Buenos Aires province of Argentina are also repositories for the agrochemicals used on the Pampas grasslands found inland in the province (D. Blanco pers. com.). Bahía Blanca, in particular, has high levels of many agro- and petrochemicals that come from agricultural areas upriver and the industrial operations ringing the bay (Paoloni *et al.* 2005).

The effect of disturbance on birds is often hard to quantify, but the pervasive disruption of birds' daily activities can lead to significant energetic costs (Gill *et al.* 1996). Throughout South America, disturbance is a growing problem for many shorebirds. Stray dogs are seemingly ever-present and frequently disrupt foraging and roosting flocks (Senner pers. observ.). Tourism is also becoming an issue. In San Antonio Oeste, for instance, the number of tourists visiting the area's beaches has increased by 257% over the past eight years (Sawicki & Sawicki 2006) and may encroach on habitats used by godwits in the bay. More pressing are the seaweed gatherers on Isla Chiloé, where their increased presence may soon alter which sites godwits are able to use.

The current and future effects of climate change on godwits are not well understood. Climate change could have unpredictable consequences for godwits throughout their

annual cycle. For instance, godwits are presumably reliant on favorable winds and weather patterns to accomplish their long oceanic flights. Warming ocean temperatures could change historic patterns and disrupt those flights (Gill *et al.* 2005). An increase in the number and severity of storms also could have negative consequences for godwits (Piersma & Lindstöm 2004). Slight disruptions in migration timing and difficulty caused by unfavorable conditions may influence the health of godwits reaching their breeding grounds and impair their ability to successfully breed (Gunnarsson *et al.* 2006). Finally, the amount of coastal habitat available to godwits may shrink as ocean levels rise, affecting the distribution of godwits during much of the year (Austin & Rehfisch 2003, Galbraith *et al.* 2002).

Diseases pose a constant but often low-level threat to bird populations. Little is known about population-level impacts of diseases to shorebirds, including godwits. Avian botulism has periodic outbreaks across the Western Hemisphere (USGS National Wildlife Health Center 2005) and is known to cause death in some shorebirds (Adams *et al.* 2003). The West Nile Virus also may be a threat, as it has now spread throughout much of North America. Possibly an even greater threat is the spread of the H5N1 strain of Avian Influenza. It has yet to affect any Nearctic or Neotropical species, but it presents a large health concern for wild and domestic birds.

FUTURE ACTIONS

The first step toward the long-term protection and conservation of Hudsonian Godwits is to organize a working group of scientists and conservationists whose goal is researching, monitoring, and conserving Hudsonian Godwits. Beyond creating a group that can begin to implement some of the plan's suggested actions, the most important step is to learn more about all facets of the godwits' life and annual cycle. Without more information about godwits' movements and habitat requirements, it is difficult to begin to develop a comprehensive conservation strategy. Even without better information, however, it is important to start by identifying actions that can be initiated in the immediate future.

To help guide future conservation actions, the plan sets forth a timeline of conservation and research actions that need to be undertaken beginning in 2007 and ending in 2015. While the dates listed in this timeline only represent goals, they reflect the relative priority in which threats and research questions should be addressed.

2007. The first action to undertake in 2007 is the creation of a Hudsonian Godwit working group. The creation of this working group will aid in the completion of other needed actions, particularly at a regional and local level. Additionally, it is important to begin efforts to recognize Isla Chiloé as a WHSRN site and to identify important breeding areas within the upper Cook Inlet, Alaska and Mackenzie River Delta, Canada; these areas are facing immediate pressure from development and human disturbance. Finally, a cohort of color-banded godwits, from both the Atlantic and Pacific non-breeding populations, should be created to aid efforts to better understand godwits' migration routes.

2008. The most important actions for 2008 are the establishment of a cohort of godwits with satellite trackers or data loggers and the analysis of genetic differences between the separate populations. Both endeavors will help identify the migration routes of the three populations and elucidate the relationship between those

populations. Understanding these better will also enable us to identify important stopover sites and habitats and to initiate conservation efforts in those areas, particularly in the central part of North America. Also of importance is initiating studies of godwit breeding and non-breeding habits, which are poorly understood. These studies will further help us to understand which habitats are most important to godwits and what factors are limiting their population. Finally, efforts should be begun to recognize more South American sites by WHSRN and Ramsar, especially Bahía Lomas, Bahía Blanca, and Bahía Samborombón.

2009. The focus of 2009 should be on monitoring. Most important is the expansion of the shorebird/waterbird monitoring program in the Southern Hemisphere and surveys of North American fall staging areas. Also necessary are the resumption of aerial surveys of Tierra del Fuego and Isla Chiloé during the austral summer and censuses of South American sites during the boreal summer for non-migratory godwits. Additionally, building on efforts to recognize more South American sites by WHSRN or Ramsar, more intensive conservation activities should begin at focal sites in South America.

2010–2015. This period should focus on a reevaluation, and revision, of the goals and priorities set during the writing of the conservation plan. The period should also see the completion of the projects begun in the early stages of this process, particularly the satellite telemetry and godwit breeding and non-breeding habits studies; the completion of these efforts should aid significantly in the reevaluation process. Finally, efforts should be begun to extend citizen science monitoring programs and Migratory Bird Days and birding festivals to South America. The creation of these types of programs will hopefully help to grow grassroots conservation efforts in rural areas.

CONCLUSION

The Hudsonian Godwit Conservation Plan is a starting point for efforts to conserve and study Hudsonian Gowits. Hopefully, more focused conservation and research efforts will begin soon, because godwits face a host of threats throughout their annual cycle, particularly at their two most important non-breeding areas. Knowledge of the life-history and conservation of Hudsonian Godwits can only increase; as we learn more, we will be able to implement better management practices and provide better protection for godwits in the areas where they are most vulnerable.

ACKNOWLEDGMENTS

Thanks to the Manomet Center for Conservation Science and the Western Hemisphere Shorebird Reserve Network for providing the funding to complete the conservation plan. Thanks to the Commonweal Institute for making my attendance at the conference possible. Thanks also to Guillermo Fernández and Stephen Brown for convening this symposium. And thanks to Adrian Farmer, Meredith Gutowski, Kate Coddington Senner, Graciela Escudero, and Stanley Senner for reviewing early versions of this manuscript.

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