

# Assessing hunting policies for migratory shorebirds throughout the Western Hemisphere

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We evaluated policies that pertain to the hunting of migratory shorebirds for jurisdictions ( $n = 57$ ) throughout the Western Hemisphere. We focused on participation in international treaties and the existence and terms of domestic legislation with respect to the subsistence, commercial and sport hunting of shorebirds. Most (96.5%) jurisdictions are party to at least one international treaty designed to protect migratory birds and nearly 90% have established corresponding domestic laws. Of the 27 jurisdictions that authorize some form of shorebird hunting, 22 (81.5%) require a hunting license for one or more forms of hunting, 14 (51.8%) specify a season for hunting and 12 (44.4%) have bag limits for at least a portion of the hunted species. Most (91.2%) jurisdictions fall into two policy categories, including those that protect all or nearly (>90%) all and those that protect very few (<10%) migratory shorebird species. The former includes 39 (68.4%) jurisdictions, 29 of which have complete prohibitions on shorebird hunting. The latter group includes 13 (22.8%) jurisdictions that either have no policy that includes shorebirds or protect only those species formally listed in the Bonn Convention. Remaining jurisdictions include five of the six overseas departments and collectivities of France, all of which have shorebird hunting seasons when from eight to 32 species may be taken. Ten of 11 jurisdictions where sport hunting of shorebirds is legal and practiced are exclusive to the Atlantic Flyway. Priorities for further regulation are those species for which the likelihood that harvest levels may exceed sustainable limits is high. This group includes species that have a low tolerance for mortality and species that may have a high tolerance but evidence suggests that harvest may exceed sustainable levels. More information is needed on collective legal and illegal harvest of all shorebirds in order to establish sustainable flyway-wide hunting policies.

## Keywords

shorebirds  
hunting  
policy  
Western Hemisphere  
treaties  
regulation

## INTRODUCTION

Shorebirds are among the bird groups of highest conservation concern in the world (IWSG 2003, Piersma 2007) with three times as many species declining as increasing (Wetlands International 2006, Nebel *et al.* 2008). Despite significant investments in conservation planning (e.g., Donaldson *et al.* 2000, Brown *et al.* 2001), many populations throughout the Western Hemisphere continue to decline (Morrison *et al.* 2001, Bart *et al.* 2007, Andres *et al.* 2012). Evidence of ongoing declines is geographically widespread, with recent documentation from the breeding grounds (e.g., Pattie 1990, Gratto-Trevor *et al.* 2001, Jehl 2007), winter grounds (e.g., Morrison *et al.* 2004, Ottema

& Ramcharan 2009, Morrison *et al.* 2012), and migratory staging sites (e.g., Butler & Lemon 2001, Watts & Truitt 2011, Ross *et al.* 2012). Many factors have been hypothesized as causes for declines in shorebird populations, including habitat loss and degradation (e.g., Vickery *et al.* 1999, Galbraith *et al.* 2002), human disturbance within staging sites (e.g., Burger 1986, Foster *et al.* 2009), reductions in critical prey populations (e.g., Baker *et al.* 2004, Escudero *et al.* 2012), climate change (Meltofte *et al.* 2007), and recovery of predator populations (e.g., Ydenberg *et al.* 2002, Lank & Ydenberg 2003).

In recent years, hunting has been identified as a potential population-level constraint for some shorebird populations

in the Western Hemisphere (Hutt 1991, Ottema & Spaans 2008, Ottema & Ramcharan 2009, Morrison *et al.* 2012). Shorebird hunting continues to be legal within many jurisdictions (Andres 2011) but for most species, information on collective harvest is grossly inadequate to effectively evaluate whether hunting mortality is a population driver. However, recent estimates of sustainable mortality limits for populations within a portion of the hemisphere suggest that several species exhibit an alarmingly low tolerance for hunting pressure (Watts *et al.* 2015). For example, within the Western Atlantic Flyway six species have sustainable mortality limits estimated at <1,500 individuals per year. These include Whimbrel *Numenius phaeopus* and Red Knot *Calidris canutus*, both of which have experienced dramatic declines in recent decades. Information from only a small fraction of jurisdictions suggests that current harvest levels are likely high enough to be of concern for some populations (Morrison *et al.* 2012, Reed 2012, Baker *et al.* 2013).

One of the greatest challenges in managing migratory shorebirds is that they exist within a legal quandary. As a recognized principle of international law, states have sovereign rights over all wild animals that fall within their jurisdictional boundaries but no jurisdiction over animals outside of these boundaries (Baslar 1998, Matz 2005, Hathaway *et al.* 2012). The practical result of this principle is that animals that migrate from one jurisdiction to another are subject, in succession, to the sovereign rights and policies of all states along their migration route (Osterwoldt 1989). According to conventional international law, there is nothing to prevent a jurisdiction from over-exploiting a migratory species to the point of extinction while other jurisdictions expend considerable resources to protect it. Because a migratory population represents a single biological unit, cooperation among range states is critical to successful management. A continuing challenge preventing a more holistic approach to the management of shorebird harvest is that hunting and the associated regulatory policies exist as a complex mosaic spread over a large geographic area where jurisdictions vary in cultural, political and economic histories. A significant barrier to progress toward holistic management is that we currently have no comprehensive overview of the patchwork of policies that regulate shorebird hunting across the Western Hemisphere.

Effective wildlife management requires clear objectives, unambiguous policies, adequate resources to implement policies, a political will to enforce policies, and the availability of appropriate judicial sanctions when policies are violated. Our objective in this paper is to present a benchmark assessment of shorebird hunting policies for jurisdictions throughout the Western Hemisphere. These include domestic policies as well as international conventions and treaties. We focus on the existence and terms of policies rather than rates of compliance and enforcement.

## METHODS

### Study area

Our study area includes jurisdictions falling within the Western Hemisphere. Because our focus is policy relevant to migratory shorebirds, we chose an alternative definition of the Western Hemisphere more in keeping with the primary shorebird flyways within the region, including the West Atlantic Flyway, the East Pacific Flyway, and the Mississippi Flyway or Interior American Flyway (van de Kam *et al.* 2004). The formal definition of the hemisphere encompasses the area that lies west of the Prime Meridian and east of the Antimeridian and includes western portions of Europe and Africa and eastern portions of Russia that fall within the East Atlantic Flyway and East Pacific Flyways, respectively. We chose to define the region as falling between the 20<sup>th</sup> meridian west and the 160<sup>th</sup> meridian east to exclude these areas. Exceptions to these boundaries include the exclusion of Greenland, which is traditionally associated with the East Atlantic Flyway, the inclusion of all the Aleutian Islands and the exclusion of Russia, which is traditionally associated with the East Pacific Flyway. Because our intent was to assess policy, uninhabited islands (e.g., Navassa Island, Clipperton Island) were disregarded. For many jurisdictions included within the hemisphere, political affiliations have changed dramatically over the centuries and continue to evolve.

### Types of hunting considered

Several types of hunting are practiced throughout the Western Hemisphere. These types vary in terms of motivation and potential impact on shorebird populations. For the purpose of this assessment, we categorized hunting types according to the following definitions (adapted from Ojasti 1996).

*Subsistence hunting* – We define subsistence hunting as the take of wildlife to round out the protein intake of hunters and their families. This type of hunting is typically practiced by indigenous groups and is often considered a component of cultural heritage. The focus of this form of hunting is often large animals that may be taken with relatively little expense. For birds, this typically includes eggs and young that may be collected and large species that may be trapped. Subsistence hunting is widely accepted throughout most cultures. Even within jurisdictions where hunting is illegal, it is often overlooked by enforcement agents. Subsistence hunting may contribute to the formation of local markets when the take of wildlife by subsistence hunters exceeds their food requirements. Surplus meat or products from subsistence or opportunistic take are sold in local markets. It is important to note that local market exchange differs from commercial hunting, where sale is the primary motivation. Like subsistence hunting itself, the local sale or exchange of excess meat is widely accepted.

*Commercial hunting* – We define commercial hunting as the take of wildlife for sale to markets that are typically outside the local community. This type of hunting often

requires some form of capital investment, structured distribution, and often a chain of middlemen. The focus of this form of hunting is species that are valuable in the market for consumption or the pet trade. Unlike subsistence hunting, enforcement of hunting or trade laws that govern commercial hunting is more rigorous, creating a black market that is difficult to quantify.

*Sport or recreational hunting* – We define sport/recreational hunting as the take of wildlife for recreation or sport by local residents, which is the primary focus of most hunting policy and regulation. Although the take is consumed, protein intake is not the primary motivation. This type of hunting is typically practiced by upper- and middle-class people. The focus of this hunting often includes larger animals that may be killed with firearms or other weapons. Sport hunting may also be practiced by nonresidents as part of a tour or destination hunting trip. This is significant because nonresident hunters are often the basis for the development of a tourism industry that may have implications for population management of game species.

*Nuisance/control hunting* – We define nuisance/control hunting as the take of wildlife to protect property or agricultural crops. This type of hunting is typically practiced by government agencies or landowners. The focus of this hunting is the control of nuisance species, including mammals such as *Rattus spp.*, *Mus musculus*, and *Herpestes javanicus*, as well as birds such as *Cathartes aura*, *Myiopsitta monachus*, *Passer domesticus*, and *Columba livia*.

*Scientific collecting* – We define scientific collecting as the take of wildlife for scientific research. This type of hunting is conducted by domestic or international scientists. In addition to the take for museum collections, this category also includes the capture of live animals for zoos. The focus of collection activities extends beyond those species that are considered to be game animals.

For the purpose of this project, nuisance/control and scientific collecting were set aside to focus on policies relating to subsistence, commercial, and sport/recreational hunting. These types were considered separately to provide additional insight into both policy and management challenges.

### **Policy details**

We evaluated hunting policies with respect to 45 migratory shorebird species (Table S1). We excluded sedentary species, short-distance migrants (species that exhibit only local movements), and vagrants that do not migrate through the hemisphere in numbers on an annual basis. Our treatment has a clear northern focus and does not include migratory species restricted to the Patagonian Flyway (e.g., Magellanic Plover *Pluvianellus socialis*, Rufous-chested Dotterel *Charadrius modestus*) due to the lack of information available to the authors. We examined the extent to which policy within a jurisdiction explicitly protects each species. We consider three levels of protection including (1) not protected, (2) seasonally protected, and (3) fully protected. We define ‘not protected’ as the lack of policy prohibition on hunting a species. We define

‘seasonally protected’ as policy that defines a season during which a species may be lawfully hunted. We define ‘fully protected’ as the existence of policy that prohibits hunting of a species throughout the year. We evaluated seasonality in hunting policy by examining the characteristics of open seasons. We define an ‘open season’ as the dates and times during which hunting may be lawfully conducted. We describe bag limits when specified. We define ‘bag limits’ as provisions under the law that control how many birds of a given species or group may be killed within a given time period or geographic area.

### **International treaties**

Several international treaties are pertinent to hunting policy in the Western Hemisphere. Though there are a number of international conventions that promote conservation of wildlife and habitat, we considered treaties only when species to be protected under the terms of the agreement were explicitly defined and when these species included one or more migratory shorebirds listed in Table S1. These include the Convention on the Conservation of Migratory Species of Wild Animals, the Specially Protected Areas and Wildlife Protocol, the Convention for the Protection of Migratory Birds (commonly called the Migratory Bird Treaty or Convention), and the Convention for the Protection of Flora, Fauna and Natural Scenic Beauty of the Countries of America. We determined which shorebird species are listed for protection under each treaty (Table S1) and which jurisdictions were party to these agreements (Table S2).

*The Convention on the Conservation of Migratory Species of Wild Animals (CMS)* – The intent of CMS, also known as the Bonn Convention (adopted 1979, in force 1983), is to conserve migratory species throughout their ranges. The success of this goal relies upon international cooperation among range states (i.e., jurisdictions included in the annual movements of a species) in enforcing policies that protect migratory species within their respective jurisdictions. The Convention also encourages support and cooperation among parties in promoting research focused on migratory species, which is critical to establishing and monitoring the conservation status of migrants. To support these goals, the appendices of the convention list endangered migratory species (CMS App. I), which are to be given full protected status by range states, and species with unfavorable conservation status (CMS App. II), which are to be the focus of international agreements among range states for the purposes of conservation.

*The Specially Protected Areas and Wildlife Protocol (SPAW)* – SPAW (adopted 1990, in force 2000) is a technical agreement that is part of the Cartagena Convention (adopted 1983, in force 1986), also known as the Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region. The aim of the Convention is for jurisdictions of the wider Caribbean to protect and sustainably manage their common coastal and marine resources. The intent of the SPAW Protocol in particular is to assist jurisdictions within the wider

Caribbean region in implementing the Convention on Biological Diversity (adopted 1992, in force 1993) through protection, preservation, and management of areas of special value and threatened and endangered species. The Protocol includes Annexes I and II, which list flora and fauna, respectively, that are to be fully protected through prohibition of all take, possession, killing, or commercial trade of the species listed therein. Annex III of the Protocol lists flora and fauna that are to be managed by jurisdictions through prohibition of all non-selective methods of take, establishment of a closed season for hunting, and regulation of the take, possession, and transport of species listed therein.

*The Migratory Bird Treaty (MBT)* – The MBT aims to protect migratory birds by prohibiting the take, capture, kill, possession, barter, sale, purchase, transport, import, or export of any nongame migratory bird included in the terms of the convention, except when such activities are performed by indigenous or aboriginal people. There are several bilateral migratory bird agreements encompassed by the MBT that are relevant to this study, including those between the U.S. and Canada (adopted 1916, in force 1916) and between the U.S. and Mexico (adopted 1936, in force 1937). These treaties were amended in 1997 to allow for a spring subsistence harvest that includes egg gathering and harvest of 18 shorebird species. The subsistence hunting season is generally open between 1 Apr and 31 Aug with a 30-day closure during the height of the nesting season.

*The Convention for the Protection of Flora, Fauna and Natural Scenic Beauty of the Countries of America*, also known as the Western Hemisphere Convention and the Washington Convention (WC) – WC is an agreement between North, Central, and South American nations (adopted 1940, in force 1942). The governments of party nations are committed to protecting and conserving the natural environment, indigenous flora and fauna, and migratory birds in sufficient numbers and in ranges extensive enough to avoid potential species extinctions. The Convention also aims to protect and conserve natural landscapes, geological formations, and regions of aesthetic, historic, or scientific value. The Convention calls for the rational, sustainable use of all migratory birds and for special protection for those species listed in the Annex to the Convention. The Annex is composed of a list of protected species proposed by each member nation. Hunting, killing, capture, or collection of these species is to be prohibited except when authorized for scientific purposes or when necessary in the administration of the region where the species is located. It should be noted that this convention currently has no standing secretariat and is not active.

In addition to the aforementioned conventions, the appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES; adopted 1973, in force 1975) are used by some Caribbean jurisdictions to define protected species for which hunting is prohibited. CITES focuses on regulating trade of threatened and endangered species that are subjected to commercial

exploitation. Shorebird species relevant to this study that are listed in the appendices of the Convention include only Eskimo Curlew *Numenius borealis* (CITES App. I). Since the Convention specifies regulations for trade of the species listed in the appendices and does not require prohibitions or regulations related to hunting of the species listed therein, we have not included CITES in Table S2.

### **Data collection**

We assessed legislation related to wildlife on the highest administrative level for each jurisdiction, and if necessary, at the next highest level. For instance, laws of independent countries were first assessed at the national level. For some countries, second-level administration has greater influence on hunting policy, particularly on game species, seasons, and/or bag limits. In these cases, provincial or state laws were examined to fill the gaps in national policy. Administrative status and degree of autonomy varied considerably among dependent territories and other entities. Thus, policy was assessed at the level of the sovereign state (only when this policy was applicable to dependencies) as well as at the level of the dependent jurisdiction's government.

We attempted to identify all laws and regulations regarding hunting with a particular focus on policies relevant to shorebirds. We systematically searched for legislation from each jurisdiction, utilizing government databases, national official gazettes, national hunting calendars, peer-reviewed journal articles, government agency reports, websites of international conventions and treaties (CITES, CMS, SPAW), and reports by independent scientific or conservation organizations such as BirdLife International and the Caribbean Environment Programme. Where specific details such as bag limits and seasons could not be found in the legislation, we consulted local contacts, provincial or state hunting calendars, and local online news sources. Because some jurisdictions issue annual hunting calendars that often enact adjustments such as changes in the dates of the open season, bag limits, or authorized game species, we attempted to find the most recent information through the 2013–2014 hunting season. An exception was made for French Guiana, as legislation enacting a major change in hunting regulations relevant to shorebirds was passed in Mar 2015. We have included information from this recent decree in our policy assessment.

We translated all legislation into English where necessary and information relevant to hunting policy was extracted. In particular, we identified regulations pertaining to subsistence, commercial, and sport hunting, as well as the administration of hunting programs and the enforcement of hunting policy. For each type of hunting, we were interested in determining whether there were restrictions regarding groups authorized to perform hunting (e.g., resident vs. nonresident, indigenous peoples, etc.), open seasons, general and species-specific bag limits, game species, and species partially and fully protected. We identified the government agencies or officials responsible

for administering and enforcing hunting policy, and we determined whether there were requirements for hunters to obtain hunting permits or licenses and for hunters to report their take to game wardens or other agency representatives.

## RESULTS

A total of 57 jurisdictions were identified in the Western Hemisphere, including 35 independent nations and 22 dependent territories or other entities (Table S2). The dependencies included three overseas departments of France, three overseas collectivities of France, three constituent countries of the Kingdom of the Netherlands, three special municipalities of the country of the Netherlands, eight overseas territories of the United Kingdom, and two unincorporated organized territories of the United States.

### *International treaties*

The majority (96.5%) of jurisdictions within the Western Hemisphere are party to at least one international treaty designed to protect migratory birds (Table S2). Exceptions include Dominica and Saint Kitts and Nevis. Due to the large number of dependencies, many jurisdictions are party to treaties via their sovereign states. In terms of the level of participation, SPAW involves the largest number (40) of participating jurisdictions, followed by CMS (29), WC (24) and MBT (5). MBT has fewer parties because compared with the other treaties that have global or regional reach, MBT has a different history as a series of bilateral agreements. The rate of jurisdictional ratification varies among treaties, with CMS and MBT reaching 100% and WC and SPAW reaching only 87% and 70%, respectively. The low ratification rate for SPAW reflects the lack of action on the part of the United Kingdom. With regard to shorebird hunting, international treaties have been effective in precipitating domestic policy throughout the Western Hemisphere that is consistent with the original intent. Nearly 90% of the jurisdictions that are party to

one or more of the international treaties have adopted domestic law that is consistent with the specific treaty.

All migratory shorebirds considered in this study have listings on multiple international treaties (Table S1). However, the treaties differ in terms of both the extent of protection they afford to species and their geographic coverage (via jurisdictional inclusion). CMS lists all migratory species in either Appendix I (species listed as endangered: Piping Plover *Charadrius melodus* and Eskimo Curlew) or Appendix II (species listed as having unfavorable conservation status) and includes more than 50% of all jurisdictions in the hemisphere. As indicated above, only Appendix I species have mandatory protection from hunting and only four species appear on this list. MBT provides mandatory protection for all migratory shorebirds except for game species, including Wilson's Snipe *Gallinago delicata*, American Woodcock *Scolopax minor* (hunted in Canada and United States), and Upland Sandpiper *Bartramia longicauda* (hunted in Mexico), but includes only five jurisdictions. SPAW has the greatest geographic reach but the lowest species coverage, protecting only two endangered species, one of which has likely been extinct for decades. WC is one of the more interesting treaties, having broad geographic coverage (42% of jurisdictions) but offering only spotty protection of species. Through this treaty, Brazil commits to full protection of 10 species and seasonal protection of the remaining 36 species, Cuba commits to protection of 22 species, the United States commits to protection of two species, and Bolivia and the Dominican Republic commit to the protection of one species.

### *Domestic hunting policy*

Jurisdictions vary dramatically in the extent to which domestic policy addresses shorebird hunting (Table S3). All jurisdictions identify government ministries responsible for administering hunting policy and the majority (93%) identify an agency responsible for enforcing policy. Sixteen percent of jurisdictions have no domestic policy governing shorebird hunting. Even more significant is that 57.9%,

**Table 1.** Summary of hunting policies across Western Hemisphere jurisdictions by hunting type. Parenthetic values indicate percentages of total jurisdictions ( $n = 57$ ). 'Not treated' means this type of hunting is not treated in the law. 'Not specified' means the laws treat the topic of hunting, but there is no clear indication regarding the legality of hunting of shorebird species. An exception to this rule was made for subsistence hunting; where no authorized species were listed (which was the case for the majority of jurisdictions), we assumed all species were open to subsistence hunting. We define shorebird hunting as 'Authorized' where the laws permit hunting of one or more migratory shorebird species with or without defined open and closed seasons and 'Prohibited' where no migratory shorebird species have open seasons for hunting.

Hunting policy	Subsistence	Commercial	Sport
Not treated	33 (57.9%)	30 (52.6%)	9 (15.8%)
Not specified	0 (0%)	3 (5.3%)	3 (5.3%)
Authorized	16 (28.1%)	1 (1.8%)	16 (28.1%)
Prohibited	8 (14.0%)	23 (40.4%)	29 (50.8%)

57.9% and 21.1% of jurisdictions have no policy that speaks to subsistence, commercial, and sport hunting, respectively (Table 1). By comparison, 14.0%, 40.4% and 50.8% of jurisdictions have prohibitions on these forms of shorebird hunting. Of the 27 jurisdictions that authorize some form of shorebird hunting, 22 (81.5%) require a hunting license and 13 (48.1%) require a report of take. Nine (33.3%) of these jurisdictions allow nonresident hunting.

Of the jurisdictions that authorize shorebird hunting, 14 (53.8%) specify a season for hunting and 12 (46.2%) have bag limits for at least a portion of the hunted species. Established shorebird hunting seasons are focused on fall migration rather than spring migration, with some jurisdictions including the winter period. In general jurisdictions located within winter ranges tend to have seasons that run from late fall through winter, and seasons for more northerly jurisdictions run through the primary passage periods. Seasons for Canada, Cuba, Mexico, and the United States vary by state or province. For jurisdictions that specify bags, daily limits range from three to 50 and, as with seasons, are set on the state or provincial level for Canada, Cuba, Mexico, and the United States. Hunters in Barbados are unusual in being self-regulated. Aside from government-mandated full protection of Upland Sandpiper, Buff-breasted Sandpiper *Calidris subruficollis*, and Hudsonian Godwit *Limosa haemastica*, hunting policies including hunted species, seasons, and bag limits in Barbados are set by voluntary agreement within the Barbados Wild-Fowlers Association rather than by the government.

### Gaps in species and geographic protections

With respect to domestic shorebird hunting policy, most jurisdictions fall into one of two categories, including those that fully protect more than 90% of species and those that protect fewer than 10% of species (Fig. 1). The former includes 39 (68.4%) jurisdictions, 29 of which have complete prohibitions on shorebird hunting. The remaining 10 jurisdictions allow for the hunting of 1–4 shorebird species that are considered ‘game’ species. The latter group includes 13 (22.8%) jurisdictions that either have no policy that includes shorebirds or protect only those species listed in Appendix I of the Bonn Convention. The remaining jurisdictions include five of the six overseas departments of France, all of which have shorebird hunting seasons during which 8–32 species may be taken.

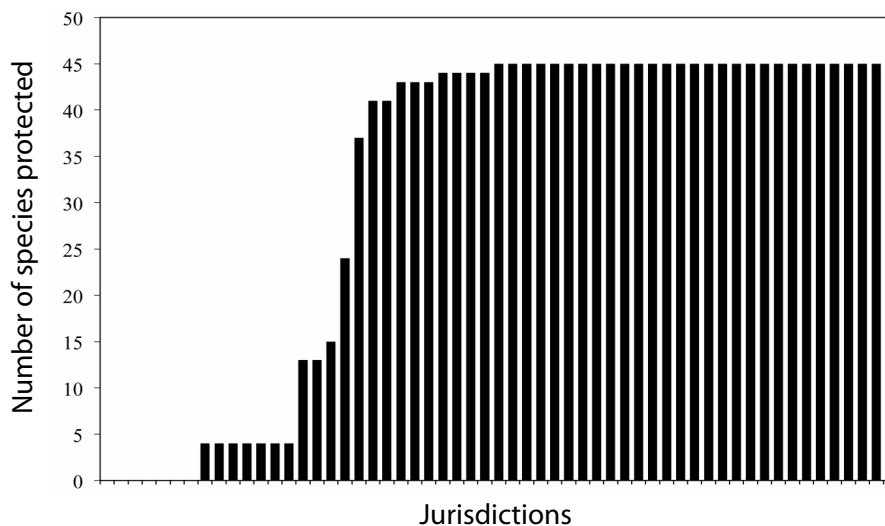
## DISCUSSION

International conventions and treaties are intended to engender the cooperation needed to protect shared resources such as migratory birds over the large geographic areas that they require. Treaties that are relevant to shorebird hunting have received broad participation by jurisdictions throughout the Western Hemisphere. However, international treaties represent poor legal instruments because of the separation between the parties bound by the legal obligation (governments that are voluntary signatories to the convention) and the actors in the field. Conservation conventions bind governments but not

hunters, farmers or developers. What is critical to the effectiveness of a convention is the commitment on the part of governments to follow through with the intent of a treaty to establish domestic laws. From a purely practical perspective, domestic laws provide more tangible deterrents to hunting. With respect to shorebird hunting, treaties have been effective throughout the Western Hemisphere, with nearly 90% of participating jurisdictions establishing domestic hunting laws.

Domestic wildlife policies are heterogeneous across the Western Hemisphere. In many ways, diversity reflects the political histories of the jurisdictions. A large portion of current jurisdictions exist as political units of European countries and wildlife policies reflect the cultural histories of respective ‘motherlands’. For example, the majority of jurisdictions that are overseas territories of the United Kingdom (e.g., Bermuda, British Virgin Islands, Cayman Islands) have complete prohibitions on shorebird hunting, while the majority of overseas departments and collectivities of France (e.g., French Guiana, Guadeloupe, Martinique) have relatively liberal hunting policies, reflecting the respective policy stances of the two countries. Cultural history has undoubtedly played a similar role in the evolution of hunting policies within jurisdictions that have recently become independent.

The regularly changing statuses of jurisdictions affiliated with European ‘mother countries’ augments the complexity of hunting policy interpretation throughout much of the Caribbean. Prior to 2007, Saint-Martin and Saint-Barthélemy were island communes under Guadeloupe’s administrative rule. Still today, the hunting laws of Saint-Martin are very similar to those of Guadeloupe, whereas hunting is prohibited in Saint-Barthélemy (A. Levesque, pers. comm.). The dissolution of the Netherlands Antilles in 2010 resulted in changes in the administrative statuses and laws of Curacao, Sint Maarten, Saba, Sint Eustatius, and Bonaire. All of the old Netherlands Antilles laws have ceased to be in force, and jurisdictions are now in an interim phase where some of the old laws have been newly adopted and some have not (K. DeMeyer, pers. comm.). Saba, Sint Eustatius, and Bonaire became special municipalities of the Netherlands, and Dutch law is now being introduced by the island governments in stages. Ten other Caribbean jurisdictions (32.3%) have gained independence only within the past 55 years and have been faced with developing comprehensive policy concerning all aspects of administration since that time. Another difficulty in interpreting hunting policy in the Caribbean arises from the ambiguity of the language of the legislation. Laws often use local common names rather than species names when listing protected species. Some of these common names may refer to a particular species in some usages whereas in other contexts, the same name may be used to refer to a group of species (e.g., ‘gaulding’ or ‘gaulin’ as a name for Yellow-crowned Night Heron *Nyctanassa violacea* and as a catch-all name for egrets and herons). Even among local contacts within the respective jurisdictions, it is not always known to which species common names used in the hunting legislation are intended to refer (L. Sorenson, pers. comm.).



**Fig. 1.** The number of migratory shorebird species fully (during all seasons) protected by domestic policy within all ( $n = 57$ ) jurisdictions in the Western Hemisphere. The total number of shorebird species considered is 45. Jurisdictions were ordered from low to high according to the number of shorebird species protected.

Of the three forms of hunting examined here, sport hunting is the focus of most domestic policy throughout the Western Hemisphere. The commercial hunting of shorebirds is authorized in Venezuela and prohibited in 23 jurisdictions. These primarily include jurisdictions with general hunting prohibitions. Commercial hunting is not acknowledged in policy for most jurisdictions, including Guadeloupe, Martinique, and Saint Martin, where other forms of hunting are authorized. Subsistence hunting has legal status in 16 jurisdictions, including 10 where all other forms of shorebird hunting are prohibited. Although difficult to quantify, this form of hunting is widespread throughout rural communities, is accepted in many cultures regardless of national policy and may have the largest collective impact on shorebird populations. The total number of subsistence hunters is unknown but believed to be very large. Gondelles *et al.* (1981) estimated that there were one million subsistence hunters in Venezuela alone, suggesting that tens of millions may practice some form of subsistence hunting throughout the hemisphere. Information on the magnitude of take for all taxonomic groups is lacking and represents an urgent research priority. While this form of hunting has high social acceptance as an activity contributing to the diet of chronically underfed people, its relentless practice over vast geographic areas likely poses a threat to wildlife populations. Due to the focus of formal policy on sport hunting, the remainder of this discussion is devoted to this form of hunting.

One finding of this assessment is that most (91.2%) jurisdictions fall into two policy categories, including those that protect all or nearly all (>90%) and those that protect very few (<10%) migratory shorebird species. For jurisdictions that protect nearly all species, Wilson's Snipe is the focus of most hunting activity, with open seasons in the Bahamas, Cuba, Venezuela, Mexico, Grenada, Canada, and the United States. Tolerance for hunting in Wilson's

Snipe is high, with an estimate of sustainable mortality of nearly 400,000 individuals/yr within the Western Atlantic Flyway (Watts *et al.* 2015). Canada and the United States also allow hunting of American Woodcock, which has an estimated mortality limit of 315,000/yr. Mexico supports a hunting season of Upland Sandpiper with an estimated mortality limit of 71,000/yr. Beyond these three species, Grenada allows hunting of Greater Yellowlegs *Tringa melanoleuca*, Eastern Willet *Tringa semipalmata semipalmata*, and Whimbrel with estimated mortality limits of 10,200/yr, 5,300/yr and 1,200/yr, respectively.

Jurisdictions with policies that currently protect fewer than 10% of shorebird species are a mixed group. Half of these jurisdictions (Aruba, Saba, Bonaire, St. Eustatius, Curacao, Sint Maarten) are affiliated with the Netherlands and shorebird hunting is not treated in policy except for prohibitions related to Appendix I of the Bonn Convention. However, despite this policy gap, shorebird hunting is not practiced within these jurisdictions (P. Hoetjes, pers. comm.). Similarly, Anguilla is an overseas territory of the United Kingdom and hunting does not appear to occur in practice. Saint Kitts and Nevis is the newest independent jurisdiction within the Western Hemisphere and does not have policy relating to shorebird hunting. However, there is no hunting on Nevis (Collier & Brown 2008) and most wetlands on Saint Kitts are protected with no hunting (M. Ryan, pers. comm.). Remaining jurisdictions (Antigua and Barbuda, Barbados, Guyana, Saint Lucia, Saint Vincent and the Grenadines, Nicaragua) are independent, may or may not have policy addressing shorebird hunting, and hunting occurs in practice. Antigua and Barbuda does not treat shorebird hunting in policy but permits general sport hunting. Barbados is unusual in having a well-organized hunter community that maintains harvest records and is self-regulating. In recent years, the Wild-Fowlers Association on Barbados has voluntarily removed

several shorebird species from the hunt list and adaptive management of harvest is continuing (Reed 2012). Guyana does not specify shorebirds in regulation but authorizes subsistence hunting and does permit both commercial and sport hunting in general. Saint Lucia authorizes both subsistence and sport hunting and provides a list of shorebird species in regulation. However, hunting seasons have not been established. Saint Vincent and the Grenadines list all shorebirds as open to hunting during a season that runs from 1 Oct to 28 Feb. Nicaragua prohibits commercial hunting and authorizes subsistence and sport hunting but does not specify shorebirds within regulations. Though shorebirds in Trinidad and Tobago are currently protected by a moratorium on hunting, the ban is temporary, covering only the 2013–2014 and 2014–2015 seasons. Furthermore, the moratorium has been the subject of controversy and dissent among local hunters; the Confederation of Hunters Associations for Conservation of Trinidad and Tobago filed a judicial review in 2013 that is still active in the courts system. When the moratorium on hunting is lifted (set to occur in Oct 2015), Charadriidae and Scolopacidae species (93.3% of shorebird species) will be subject to hunt, with an open season from 1 Nov to 28 Feb and no bag limits.

Remaining jurisdictions (Guadeloupe, Saint-Martin, Martinique, French Guiana, Saint Pierre and Miquelon) are all overseas departments or overseas collectivities of France where hunting is a constitutional right. These jurisdictions support hunting of a variable (30–80%) number of shorebird species. Shorebird conservation efforts including policy work have been ongoing within these jurisdictions in recent years. In 2014 French Guiana added Red Knot to the list of protected species and agreed to protect a portion of the Mana Rice Fields. In 2015, new legislation was passed that extended protected status to an additional 23 migratory shorebird species. Additionally, Regional Guidelines for Management of Wildlife and Habitat (Orientations Régionales de Gestion de la Faune sauvage et de ses Habitats, ORGFH) were validated by French Guiana in 2004. Efforts are underway to establish a locally relevant collection card (similar to a hunting license) and species-specific hunting quotas and seasons, among other initiatives (ONCFS 2010). In 2013 the Red Knot was legally protected in Guadeloupe and Martinique, a bag limit of 20 birds per day per hunter was instituted in Guadeloupe, and a three-year moratorium on the shooting of Hudsonian Godwits and Whimbrel was established in Martinique. However, the ban on hunting Whimbrel was lifted early; Whimbrel were open for hunt in Martinique during the 2014–2015 hunting season with a bag limit of five birds per season per hunter. The Conservatoire du littoral is working with stakeholders on Saint Pierre and Miquelon to produce a management plan for the Miquelon-Langlade Isthmus, the primary shorebird hunting area (J. Paquet, pers. comm.). Saint-Martin now has a bag limit of 20 birds per day per hunter and along with Guadeloupe has established a moratorium on hunting Solitary Sandpiper *Tringa solitaria* for the 2014–2016 hunting seasons.

The role of hunting in recent shorebird declines remains unclear due to the nearly complete lack of harvest data and the difficulty of separating source populations during the non-breeding season for some species. However, it is worth noting that legal (sport) shorebird hunting is concentrated within the Western Atlantic Flyway. Of the 11 jurisdictions where shorebird hunting is legal and occurs in practice, all but Nicaragua are restricted to this flyway. It is also worth noting that many of the recent population declines in the Western Hemisphere appear to be focused on this flyway. Morrison *et al.* (2012) compared surveys (1982/1986–2008/2011) covering the most significant shorebird winter areas in northern South America and documented declines in Semipalmated Sandpipers *Calidris pusilla*, Black-bellied Plovers *Pluvialis squatarola*, Ruddy Turnstones *Arenaria interpres*, dowitchers (*Limnodromus scolopaceus* and *L. griseus*), Whimbrel, Willet, Lesser Yellowlegs *Tringa flavipes* and Greater Yellowlegs. A similar comparison of surveys (1982/1986–2003/2004) in southern South America documented a significant decline in Red Knots (Morrison *et al.* 2004). Declines on the winter grounds for many of these species are supported by surveys within migratory staging areas along the Atlantic Flyway (e.g., Howe *et al.* 1989, Clark *et al.* 1993, Morrison *et al.* 1994, Ross *et al.* 2001, Baker *et al.* 2004, Watts & Truitt 2011). However, for most species for which comparative information exists, corresponding trends for the Pacific Flyway (where only Nicaragua supports legal sport hunting) are either equivocal or stable (e.g., Paulson 1993, Morrison *et al.* 2006, Andres *et al.* 2009, Andres *et al.* 2012).

The presumptive objective of hunting policy is to ensure the future health of hunted populations by limiting take to or below the limits of what populations are capable of withstanding. Priorities for further regulation include those species for which the likelihood that harvest levels may exceed sustainable limits is high. This group includes species that have a low tolerance for mortality (sustainable mortality limit <10,000/yr) but are hunted widely and species that may have a high tolerance but evidence suggests that harvest may exceed sustainable levels. Species with low tolerances for mortality include Whimbrel, Eastern Willet, Ruddy Turnstone, Black-bellied Plover and Short-billed Dowitcher *Limnodromus griseus* (Watts *et al.* 2015). All of these species continue to be hunted legally in seven jurisdictions. Hudsonian Godwit, Black-necked Stilt *Himantopus mexicanus*, Sanderling *Calidris alba*, Buff-breasted Sandpiper, and the *rufa* population of Red Knot continue to be legally hunted in fewer than four jurisdictions. For example, due to their large size, Whimbrels are preferred by hunters within all hunting areas. The annual harvest of Whimbrel on Barbados alone ranges from 100 to 160 individuals (Reed 2012). Whimbrel harvest within the French West Indies is unknown, but the take of more than 100 individuals from a single swamp was documented in 2013 (Anonymous source). Annual harvest of Whimbrel within Saint Pierre and Miquelon is estimated to be in the range of 80 individuals (J. Paquet, pers. comm.). Given the estimated take for such a small portion of the areas where they may be legally taken, it



seems possible that the legal harvest may exceed the estimated limit of 1,200 birds per year. Aside from Wilson's Snipe and American Woodcock, the Lesser Yellowlegs is likely the most widely hunted species throughout the Western Atlantic Flyway. Even though estimates of sustainable mortality are high (79,000 individuals/yr; Watts *et al.* 2015), known harvest suggests that this limit may be exceeded. The annual harvest on Barbados alone ranges from 5,700 to 19,900 (Reed 2012), harvest on Guadeloupe likely exceeds 8,000 birds annually (B. Andres, pers. comm.) and harvest in northern South America (much of which represents illegal take) is believed to be significant (Ottema & Spaans 2008). More information is needed on collective, legal harvest of all shorebirds in order to establish sustainable flyway-wide hunting policy.

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## ONLINE SUPPLEMENTARY MATERIAL

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**Table S1.** Migratory shorebird species in the Western Hemisphere and protection status extended under international treaties and conventions.

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**Table S3.** Hunting policy for Western Hemisphere jurisdictions.

**Table S4.** Exposure of migratory shorebird species to sport/recreational hunting within Western Hemisphere jurisdictions.

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*Supplementary material for*

## **Assessing hunting policies for migratory shorebirds throughout the Western Hemisphere**

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This PDF contains:

**Table S1.** Migratory shorebird species in the Western Hemisphere and protection status extended under international treaties and conventions.

**Table S2.** Status of international treaties and agreements relevant to shorebird protections within Western Hemisphere jurisdictions.

**Table S3.** Hunting policy for Western Hemisphere jurisdictions.

**Table S4.** Exposure of migratory shorebird species to sport/recreational hunting within Western Hemisphere jurisdictions.

**Table S1.** Migratory shorebird species in the Western Hemisphere and protection status extended under international treaties and conventions. We excluded all sedentary species, short-distance migrants (i.e., species performing local movements), and rare vagrants. The four-letter alpha code presented here is used to refer to species in Table S4. We present species protections under four international agreements, including the Convention on the Conservation of Migratory Species of Wild Animals (CMS), the Specially Protected Areas and Wildlife (SPA) Protocol of the Cartagena Convention, the Convention for the Protection of Migratory Birds (MBT), and the Washington Convention (WC). Three-letter abbreviations are provided in parentheses where species protections do not apply to all signatories and refer to the jurisdictions where protections apply. Included are Bolivia (BOL), Brazil (BRA), Canada (CAN), Cuba (CUB), Dominican Republic (DOR), United States (USA), and Mexico (MEX).

Common name	Species name	Alpha code	CMS	SPA	MBT	WC
Black-necked Stilt	<i>Himantopus mexicanus</i>	BNST	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> , CUB)
American Avocet	<i>Recurvirostra americana</i>	AMAV	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> )
American Oystercatcher	<i>Haematopus palliatus</i>	AMOY			Yes	Yes (BRA)
Black-bellied Plover	<i>Pluvialis squatarola</i>	BBPL	Yes <sup>1</sup>		Yes	Yes (BRA)
American Golden-Plover	<i>Pluvialis dominica</i>	AMGP	Yes <sup>1</sup>		Yes	Yes (BRA)
Pacific Golden-Plover	<i>Pluvialis fulva</i>	PAGP	Yes <sup>1</sup>		Yes	Yes (BRA)
Snowy Plover	<i>Charadrius nivosus</i>	SNPL	Yes <sup>1</sup>		Yes	Yes (BRA, CUB)
Wilson's Plover	<i>Charadrius wilsonia</i>	WIPL	Yes <sup>1</sup>		Yes	Yes (BRA)
Semipalmated Plover	<i>Charadrius semipalmatus</i>	SEPL	Yes <sup>1</sup>		Yes	Yes (BRA, CUB)
Piping Plover	<i>Charadrius melodus</i>	PIPL	Yes <sup>1</sup>	Yes	Yes	Yes (BRA)
Killdeer	<i>Charadrius vociferous</i>	KILL	Yes <sup>1</sup>		Yes	Yes (BRA, CUB, DOR)
Spotted Sandpiper	<i>Actitis macularius</i>	SPSA	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> , CUB)
Solitary Sandpiper	<i>Tringa solitaria</i>	SOSA	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> , CUB)
Wandering Tattler	<i>Tringa incana</i>	WATA	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> )
Greater Yellowlegs	<i>Tringa melanoleuca</i>	GRYE	Yes <sup>1</sup>		Yes	Yes (BOL, BRA <sup>2</sup> , CUB)
Willet	<i>Tringa semipalmata</i>	WILL	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> , CUB)
Lesser Yellowlegs	<i>Tringa flavipes</i>	LEYE	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> , CUB)
Upland Sandpiper	<i>Bartramia longicauda</i>	UPSA	Yes <sup>1</sup>		Yes (CAN, USA)	Yes (BRA <sup>2</sup> )
Eskimo Curlew	<i>Numenius borealis</i>	ESCU	Yes	Yes	Yes	Yes (BRA <sup>2</sup> , USA)
Whimbrel	<i>Numenius phaeopus</i>	WHIM	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> , CUB)
Long-billed Curlew	<i>Numenius americanus</i>	LBCU	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> , CUB)
Hudsonian Godwit	<i>Limosa haemastica</i>	HUGO	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> , CUB, USA)
Bar-tailed Godwit	<i>Limosa lapponica</i>	BTGO	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> )
Marbled Godwit	<i>Limosa fedoa</i>	MAGO	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> , CUB)
Ruddy Turnstone	<i>Arenaria interpres</i>	RUTU	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> )
Red Knot	<i>Calidris canutus</i>	REKN	Yes		Yes	Yes (BRA <sup>2</sup> )
Surfbird	<i>Calidris virgata</i>	SURF	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> )
Stilt Sandpiper	<i>Calidris himantopus</i>	STSA	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> , CUB)
Sanderling	<i>Calidris alba</i>	SAND	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> , CUB)
Dunlin	<i>Calidris alpina</i>	DUNL	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> )
Purple Sandpiper	<i>Calidris maritima</i>	PUSA	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> )
Baird's Sandpiper	<i>Calidris bairdii</i>	BASA	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> )
Least Sandpiper	<i>Calidris minutilla</i>	LESA	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> )
White-rumped Sandpiper	<i>Calidris fuscicollis</i>	WRSA	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> , CUB)
Buff-breasted Sandpiper	<i>Calidris subruficollis</i>	BBSA	Yes		Yes	Yes (BRA <sup>2</sup> , CUB)
Pectoral Sandpiper	<i>Calidris melanotos</i>	PESA	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> , CUB)
Semipalmated Sandpiper	<i>Calidris pusilla</i>	SESA	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> , CUB)
Western Sandpiper	<i>Calidris mauri</i>	WESA	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> , CUB)
Short-billed Dowitcher	<i>Limnodromus griseus</i>	SBDO	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> , CUB)
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>	LBDO	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> )
Wilson's Snipe	<i>Gallinago delicata</i>	WISN	Yes <sup>1</sup>			Yes (BRA <sup>2</sup> , CUB)
American Woodcock	<i>Scolopax minor</i>	AMWO	Yes <sup>1</sup>		Yes (MEX)	Yes (BRA <sup>2</sup> )
Wilson's Phalarope	<i>Phalaropus tricolor</i>	WIPL	Yes <sup>1</sup>		Yes	Yes (BRA)
Red-necked Phalarope	<i>Phalaropus lobatus</i>	RNPH	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> )
Red Phalarope	<i>Phalaropus fulicarius</i>	REPH	Yes <sup>1</sup>		Yes	Yes (BRA <sup>2</sup> )

<sup>1</sup> CMS Appendix II species are not afforded specific protection under the Convention but are to be the focus of international agreements among range states for the purposes of conservation. <sup>2</sup> Afforded partial protection under WC through an annual closed season.

**Table S2.** Status of international treaties and agreements relevant to shorebird protections within Western Hemisphere jurisdictions. These include the Bonn Convention or the Convention on the Conservation of Migratory Species of Wild Animals (CMS); the Specially Protected Areas and Wildlife (SPA) Protocol of the Cartagena Convention, also known as the Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region; the Migratory Bird Treaty (MBT) or the Migratory Birds Convention; and the Convention for the Protection of Flora, Fauna and Natural Scenic Beauty of the Countries of America, also known as the Washington Convention (WC). We have indicated the jurisdictions in which each treaty has been signed and/or entered into force.

Jurisdiction	CMS	SPA	MBT	WC
Anguilla		Yes <sup>1,2</sup>		
Antigua & Barbuda	Yes	Yes <sup>1</sup>		
Argentina	Yes			Yes
Aruba	Yes <sup>2</sup>	Yes <sup>2</sup>		
Bahamas		Yes		
Barbados		Yes		
Belize		Yes		
Bermuda	Yes <sup>2</sup>	Yes <sup>1,2</sup>		
Bolivia	Yes			Yes <sup>1</sup>
Bonaire	Yes <sup>2</sup>	Yes <sup>2</sup>		
Brazil				Yes
British Virgin Islands	Yes <sup>2</sup>	Yes <sup>1,2</sup>		
Canada			Yes	
Cayman Islands	Yes <sup>2</sup>	Yes <sup>1,2</sup>		
Chile	Yes			Yes
Colombia		Yes		Yes <sup>1</sup>
Costa Rica	Yes			Yes
Cuba	Yes	Yes		Yes <sup>1</sup>
Curacao	Yes <sup>2</sup>	Yes <sup>2</sup>		
Dominica				
Dominican Republic		Yes		Yes
Ecuador	Yes			Yes
El Salvador				Yes
Falkland Islands	Yes <sup>2</sup>	Yes <sup>1,2</sup>		
French Guiana	Yes <sup>2</sup>	Yes <sup>2</sup>		
Grenada		Yes		
Guadeloupe	Yes <sup>2</sup>	Yes <sup>2</sup>		
Guatemala		Yes <sup>1</sup>		Yes

Table S2 continued.

Jurisdiction	CMS	SPAW	MBT	WC
Guyana		Yes		
Haiti				Yes
Honduras	Yes			
Jamaica		Yes <sup>1</sup>		
Martinique	Yes <sup>2</sup>	Yes <sup>2</sup>		
Mexico		Yes <sup>1</sup>	Yes	Yes
Montserrat	Yes <sup>2</sup>	Yes <sup>1,2</sup>		
Nicaragua				Yes
Panama	Yes	Yes		Yes
Paraguay	Yes			Yes
Peru	Yes			Yes
Puerto Rico		Yes <sup>2</sup>	Yes <sup>2</sup>	Yes <sup>2</sup>
Saba	Yes <sup>2</sup>	Yes <sup>2</sup>		
Saint Kitts & Nevis				
Saint Lucia		Yes		
Saint Pierre & Miquelon	Yes <sup>2</sup>	Yes <sup>2</sup>		
Saint Vincent & Grenadines		Yes		
Saint-Barthelemy		Yes <sup>2</sup>		
Saint-Martin	Yes <sup>2</sup>	Yes <sup>2</sup>		
Sint Eustatius	Yes <sup>2</sup>	Yes <sup>2</sup>		
Sint Maarten	Yes <sup>2</sup>	Yes <sup>2</sup>		
South Georgia & South Sandwich Islands		Yes <sup>1,2</sup>		
Suriname				Yes
Trinidad & Tobago		Yes		Yes
Turks & Caicos Islands	Yes <sup>2</sup>	Yes <sup>1,2</sup>		
U.S. Virgin Islands		Yes <sup>2</sup>	Yes <sup>2</sup>	Yes <sup>2</sup>
United States		Yes	Yes	Yes
Uruguay	Yes			Yes
Venezuela		Yes		Yes

<sup>1</sup> Have signed but have not yet ratified.<sup>2</sup> Included under sovereign state authority.

**Table S3.** Hunting policy for Western Hemisphere jurisdictions. Administration and Enforcement columns indicate whether the law designates an agency or person responsible for administering and enforcing hunting policy, respectively. Subsistence, Commercial, and Sport columns refer to the three types of hunting as defined in the methods section. We present whether shorebirds are authorized for take under each type. 'Not treated' means this type of hunting is not treated in the law. 'Not specified' means the laws treat the topic of hunting, but there is no clear indication regarding the legality of hunting of shorebird species. An exception to this rule was made for subsistence hunting, where no authorized species were listed (which was the case for the majority of jurisdictions), we assumed all species were open to subsistence hunting. We define shorebird hunting as 'Authorized' where the laws permit hunting of one or more migratory shorebird species and 'Prohibited' where no migratory shorebird species have open seasons for hunting. Where sport hunting of shorebirds is authorized, the legality of sport hunting by nonresidents is presented in the Nonresident column. Where subsistence, commercial, and/or sport hunting of shorebirds are authorized or not specified, the Permit and Report columns indicate which types of hunting require licensing and reporting, respectively. The '(record)' designation in the Report column indicates jurisdictions that require that records be kept for future inspection rather than that reports be sent to government agencies at a specified time.

Jurisdiction	Administration	Enforcement	Subsistence	Commercial	Sport	Nonresident	Permit	Report
Anguilla <sup>1</sup>	Yes	Yes	Not treated	Not treated	Not treated			
Antigua & Barbuda	Yes	No	Not treated	Not treated	Not specified		Sport	
Argentina	Yes	Yes	Not treated	Prohibited	Prohibited <sup>2</sup>			
Aruba <sup>3</sup>	Yes	Yes	Not treated	Not treated	Not treated			
Bahamas	Yes	Yes	Not treated	Not treated	Authorized	Prohibited	Sport	
Barbados	Yes	No	Not treated	Not treated	Not treated			
Belize	Yes	Yes	Not treated	Prohibited	Prohibited			
Bermuda <sup>1</sup>	Yes	Yes	Not treated	Not treated	Prohibited			
Bolivia	Yes	Yes	Prohibited	Prohibited	Prohibited			
Bonaire <sup>3</sup>	Yes	Yes	Not treated	Not treated	Not treated			
Brazil	Yes	Yes	Authorized	Prohibited	Prohibited			
British Virgin Islands <sup>1</sup>	Yes	Yes	Prohibited	Prohibited	Prohibited			
Canada	Yes	Yes	Authorized	Prohibited	Authorized	Authorized	Subsistence, sport	Subsistence, sport
Cayman Islands <sup>1</sup>	Yes	Yes	Authorized <sup>4</sup>	Not treated	Prohibited		Subsistence	Subsistence
Chile	Yes	Yes	Not treated	Not treated	Prohibited			
Colombia	Yes	Yes	Authorized	Prohibited	Prohibited			
Costa Rica	Yes	Yes	Authorized	Prohibited	Prohibited		Subsistence	Subsistence
Cuba	Yes	Yes	Not treated	Not treated	Authorized	Authorized	Sport	Sport
Curacao <sup>3</sup>	Yes	Yes	Not treated	Not treated	Not treated			
Dominica	Yes	Yes	Not treated	Not treated	Prohibited			
Dominican Republic	Yes	Yes	Prohibited	Prohibited	Prohibited			
Ecuador	Yes	Yes	Authorized	Prohibited	Prohibited		Subsistence	
El Salvador	Yes	Yes	Authorized	Not specified	Prohibited		Subsistence, commercial	
Falkland Islands <sup>1</sup>	Yes	No	Not treated	Not treated	Prohibited			
French Guiana <sup>3</sup>	Yes	Yes	Authorized	Prohibited	Authorized	Not treated		
Grenada	Yes	No	Not treated	Not treated	Authorized	Not treated		
Guadeloupe <sup>5</sup>	Yes	Yes	Not treated	Not treated	Authorized	Authorized	Sport	Sport (record)

Table S3 continued.

Jurisdiction	Administration	Enforcement	Subsistence	Commercial	Sport	Nonresident	Permit	Report
Guatemala	Yes	Yes	Prohibited	Prohibited	Prohibited			
Guyana	Yes	Yes	Authorized	Not specified	Not specified		Commercial, sport	Commercial (record), sport
Haiti	Yes	Yes	Not treated	Not treated	Prohibited			
Honduras	Yes	Yes	Authorized	Not specified <sup>6</sup>	Prohibited		Subsistence, commercial	Subsistence
Jamaica	Yes	Yes	Not treated	Not treated	Prohibited			
Martinique <sup>5</sup>	Yes	Yes	Not treated	Not treated	Authorized	Authorized	Sport	Sport
Mexico	Yes	Yes	Authorized	Prohibited	Authorized	Authorized	Sport	Subsistence, sport
Montserrat <sup>1</sup>	Yes	Yes	Not treated	Not treated	Authorized	Not treated		
Nicaragua	Yes	Yes	Authorized	Prohibited	Not specified		Subsistence, sport	
Panama	Yes	Yes	Authorized	Prohibited	Prohibited		Subsistence	
Paraguay	Yes	Yes	Prohibited	Prohibited	Prohibited			
Peru	Yes	Yes	Authorized	Prohibited	Prohibited		Subsistence	
Puerto Rico <sup>7</sup>	Yes	Yes	Not treated	Prohibited	Authorized	Authorized	Sport	Sport
Saba <sup>3</sup>	Yes	Yes	Not treated	Not treated	Not treated			
Saint Kitts & Nevis	Yes	Yes	Not treated	Not treated	Not treated			
Saint Lucia	Yes	Yes	Authorized <sup>4</sup>	Not treated	Authorized	Not treated	Subsistence, sport	
Saint Pierre & Miquelon <sup>5</sup>	Yes	Yes	Not treated	Not treated	Authorized	Not treated		
Saint Vincent & Grenadines	Yes	Yes	Not treated	Not treated	Authorized	Not treated	Sport	
Saint-Barthelemy <sup>6</sup>	Yes	Yes	Prohibited	Prohibited	Prohibited			
Saint-Martin <sup>5</sup>	Yes	Yes	Not treated	Not treated	Authorized	Authorized	Sport	Sport (record)
Sint Eustatius <sup>3</sup>	Yes	Yes	Not treated	Not treated	Not treated			
Sint Maarten <sup>3</sup>	Yes	Yes	Not treated	Not treated	Not treated			
South Georgia & South Sandwich Islands <sup>1</sup>	Yes	Yes	Prohibited	Prohibited	Prohibited			
Suriname	Yes	Yes	Prohibited	Not treated	Prohibited			
Trinidad & Tobago	Yes	Yes	Not treated	Not treated	Prohibited <sup>8</sup>			
Turks & Caicos Islands <sup>1</sup>	Yes	Yes	Not treated	Not treated	Prohibited			
U.S. Virgin Islands <sup>7</sup>	Yes	Yes	Not treated	Prohibited	Prohibited			
United States	Yes	Yes	Authorized	Prohibited	Authorized	Authorized	Subsistence <sup>9</sup> , sport	Subsistence <sup>9</sup> , sport
Uruguay	Yes	Yes	Not treated	Prohibited	Prohibited			
Venezuela	Yes	Yes	Not treated	Authorized	Authorized	Authorized	Commercial, sport	Commercial, sport

<sup>1</sup> Sovereign state is the United Kingdom. <sup>2</sup> Based on provincial hunting calendars, not specified at the federal level. <sup>3</sup> Sovereign state is the Kingdom of the Netherlands. <sup>4</sup> Authorized species are specified in individual permits.

<sup>5</sup> Sovereign state is France. <sup>6</sup> Defined as an exercise performed by individuals living in rural communities for the purpose of commercializing the products. <sup>7</sup> Sovereign state is the United States.

<sup>8</sup> Sport hunting in Trinidad and Tobago is currently prohibited under a two-year moratorium that is up for renewal in Oct 2015. The ban is the subject of current legal battles between hunters and the administrators responsible for the ban, and it is under judicial review as of Mar 2014. If the ban is lifted, Charadriidae and Scolopacidae species will be subject to hunt, with open season from 1 Nov–28 Feb and no bag limits. <sup>9</sup> Required by many or most tribes.



**Table S4.** Exposure of migratory shorebird species to sport/recreational hunting within Western Hemisphere jurisdictions. We list shorebird species according to their levels of protection under the law within each jurisdiction. ‘Not Protected’ means species are authorized for hunt throughout the year, ‘Seasonally Protected’ species are subject to open and closed seasons (provided in the table), and ‘Fully Protected’ species are not authorized for hunt. Where we note that open season dates vary by state, territory, or province, we provide the range of dates that seasons fall between. Bag limits are the number of birds that may be taken per hunter per day, unless otherwise noted.

Jurisdiction	Not protected	Seasonally protected	Fully protected	Open season	Bag limits
Anguilla					
Antigua & Barbuda					
Argentina <sup>1</sup>			All shorebirds		
Aruba <sup>2</sup>			ESCU, PIPL		
Bahamas		WISN	All other shorebirds	29 Sep–28 Feb	50 game birds (aggregate)
Barbados <sup>3</sup>		All other shorebirds	UPSA, BBSA, HUGO, WHIM	15 Jul–15 Oct	LEYE: 1,250/swamp/y, AMGP: 100/swamp/d, All species: 300/swamp/d (aggregate)
Belize			All shorebirds		
Bermuda			All shorebirds		
Bolivia			All shorebirds		
Bonaire <sup>2</sup>			REKN ( <i>rufa</i> ), ESCU, BBSA, PIPL		
Brazil			All shorebirds		
British Virgin Islands <sup>4</sup>			All shorebirds		
Canada		WISN, AMWO <sup>5</sup>	All other shorebirds	Varies by province/territory. WISN: 15 Aug–23 Jan, AMWO: 1 Sep–3 Jan	Varies by province/territory. WISN: 8–10, AMWO <sup>6</sup> : 8
Cayman Islands			All shorebirds		
Chile			All shorebirds		
Colombia			All shorebirds		
Costa Rica			All shorebirds		
Cuba		WISN <sup>5</sup>	All other shorebirds	Varies by province. 3 Oct–28 Mar, only on Sat., Sun. & public holidays.	Varies by province. WISN: 3–10
Curacao <sup>2</sup>			REKN ( <i>rufa</i> ), ESCU, BBSA, PIPL		
Dominica			All shorebirds		
Dominican Republic			All shorebirds		
Ecuador			All shorebirds		
El Salvador			All shorebirds		
Falkland Islands			All shorebirds		

Table S4 continued.

Jurisdiction	Not protected	Seasonally protected	Fully protected	Open season	Bag limits
French Guiana	UPSA, RUTU, SPSA, WILL, GRYE		WIPL, WHIM, HUGO, REKN, AMOY, BNST, BBPL, AMGP, SEPL, KILL, BTGO, STSA, SAND, DUNL, LESA, WRSA, BBSA, PESA, SESA, WESA, SBDO, LBDO, SOSA, LEYE	None	20 small game birds (aggregate)
Grenada		WHIM ( <i>hudsonicus</i> ), GRYE, WILL ( <i>semipalmata</i> ), WISN	All other shorebirds	1 Sep–28 Feb	None
Guadeloupe		AMGP, BBPL, RUTU, LEYE, SOSA <sup>7</sup> , GRYE, SBDO, WHIM, WISN, HUGO, UPSA, WILL, STSA, PESA	BNST, SEPL, WIPL, KILL, SPSA, REKN, SAND, LESA, SESA, WESA, WRSA, BBSA, WIPH	14 Jul–first Sun. of Jan <sup>8</sup>	20 shorebirds (aggregate)
Guatemala			All shorebirds		
Guyana	All shorebirds			None	Y – determined during permitting
Haiti			All shorebirds		
Honduras			All shorebirds		
Jamaica			All shorebirds		
Martinique		AMGP, BBPL, RUTU, LEYE, GRYE, SBDO, WISN, UPSA, WILL, STSA, PESA	REKN, BNST, SEPL, WIPL, KILL, SPSA, SAND, LESA, SESA, WESA, WRSA, BBSA, SOSA, WHIM <sup>9</sup> , HUGO <sup>9</sup>	Last Sun. in Jul–15 Feb	None
Mexico <sup>1</sup>		WISN <sup>5</sup> , UPSA <sup>5</sup>	All other shorebirds	Varies by state. WISN: 11 Oct–2 Mar, UPSA: 2 Aug–23 Feb	Y – determined during permitting
Montserrat	All other shorebirds		Charadriidae & Scolopacidae families	None	None
Nicaragua	All shorebirds			None	None
Panama			All shorebirds		
Paraguay			All shorebirds		
Peru			All shorebirds		
Puerto Rico		WISN	All other shorebirds	2 open seasons: 10 Nov–17 Dec & 12 Jan–28 Jan	WISN: 8
Saba <sup>2</sup>			REKN ( <i>rufa</i> ), ESCU, BBSA, PIPL		
Saint Kitts & Nevis <sup>10</sup>					
Saint Lucia <sup>11</sup>	WHIM, SPSA, SOSA, LEYE, GRYE, WILL, WRSA, LESA, SESA, PESA, STSA, UPSA, SAND, SBDO, BBSA, BNST, SEPL, WIPL, KILL, RUTU, AMGP, BBPL			None	None

Table S4 continued.

Jurisdiction	Not protected	Seasonally protected	Fully protected	Open season	Bag limits
Saint Pierre & Miquelon		AMGP, BBPL, AMWO, WISN, WHIM, GRYE, LEYE, SBDO	All other shorebirds	31 Aug–31 Dec, or until fresh water & the Grand Barachois are iced over	None
Saint Vincent & Grenadines		All shorebirds		1 Oct–28 Feb	Y - determined during permitting
Saint-Barthelemy <sup>12</sup>			All shorebirds		
Saint-Martin		AMGP, BBPL, RUTU, LEYE, SOSA <sup>7</sup> , GRYE, SBDO, WHIM, WISN, HUGO, UPSA, WILL, STSA, PESA	BNST, SEPL, WIPL, KILL, SPSA, REKN, SAND, LESA, SESA, WESA, WRSA, BBSA, WIPH	14 Jul–first Sun. of Jan <sup>8</sup>	20 shorebirds (aggregate)
Sint Eustatius <sup>2</sup>			All shorebirds		
Sint Maarten <sup>2</sup>			REKN ( <i>rufa</i> ), ESCU, BBSA, PIPL		
South Georgia & South Sandwich Islands			All shorebirds		
Suriname			All shorebirds		
Trinidad & Tobago <sup>13</sup>			All shorebirds		
Turks & Caicos Islands			All shorebirds		
U.S. Virgin Islands <sup>14</sup>			All shorebirds		
United States		WISN, AMWO <sup>5</sup>	All other shorebirds	Varies by state, some with 2 open seasons. WISN: 1 Sep–28 Feb (max. of 107 d), AMWO: 22 Sep–31 Jan (max. of 45 d)	AMWO: 3, WISN: 8
Uruguay			All shorebirds		
Venezuela		WISN	All other shorebirds	1 Nov–30 Jun	None

<sup>1</sup>Based on provincial or state hunting calendars.

<sup>2</sup>Jurisdictions of the Kingdom of the Netherlands have recently undergone administrative status changes and laws are in an interim phase of change and development. The current legal status of hunting within each jurisdiction is presented; however, bird hunting is not known to have been practiced for over 40 years in any jurisdictions of the Kingdom of the Netherlands (P. Hoetjes, pers. comm.).

<sup>3</sup>Aside from protection of UPSA, BBSA, and HUGO, shorebird hunting regulations are self-imposed by The Barbados Wild-Fowlers Association.

<sup>4</sup>Information is from C. Petrovich, pers. comm.

<sup>5</sup>Closed in some states, territories, or provinces.

<sup>6</sup>In Manitoba and Quebec, bag limit of four AMWO applies for nonresidents of Canada.

<sup>7</sup>Hunting of SOSA is prohibited in Guadeloupe and Saint-Martin for 2014–2015 season.

<sup>8</sup>May only hunt on the following days: 14 Jul–15 Aug: Tue., Sat., Sun. and holidays (21 Jul); 16 Aug–30 Sep: Tue., Thu., Sat., Sun.; 1 Oct–end of season: every day except Wed. and holidays (1 Nov, 11 Nov, 25 Dec, 1 Jan).

<sup>9</sup>Martinique's 2013–2014 calendar placed these species under temporary ban until 15 Feb 2016; however, WHIM was opened for hunt during the 2014–2015 season with a bag limit of five birds/season/hunter.

<sup>10</sup>Many coastal areas and wetlands are protected and hunting is prohibited at these sites. There is very little bird hunting practiced on St. Kitts (M. Ryan, pers. comm.) and no hunting on the island of Nevis (Collier and Brown 2008).

<sup>11</sup>Saint Lucia law lists all of these shorebird species as partially protected, but the open/closed seasons have never been established. No other shorebird species protections are specified in the legislation.

<sup>12</sup>Information is from A. Levesque, pers. comm.

<sup>13</sup>There is currently a controversial 2-year moratorium on hunting that is up for renewal in Oct 2015. The ban is under judicial review as of Mar 2014. If the ban is lifted, Charadriidae and Scolopacidae species will be subject to hunt, with an open season from 1 Nov–28 Feb and no bag limits.

<sup>14</sup>According to U.S. federal regulation.