Hovland Consulting LLC

Shorebirds

GLOBAL ASSESSMENT & PRIORITIES

August 29, 2024

This report is a global assessment for shorebirds and recommends priority strategies. It was informed by input from over 60 experts, a literature review, research, mapping, a decision tool, and input from the Packard Foundation team.

The report goes through **threats** (such as human disturbance, aquaculture, and climate change), outcomes, and eight **strategies** (emphasizing collaboration, habitat protection, threat reduction, community leadership, scaling work, communications, monitoring, and capacity).

Prepared by:
Hovland Consulting for the Packard Foundation

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Executive Summary

Background: The Packard Foundation, a long-time supporter of fostering marine protection, advancing biodiversity, and supporting marine birds, recently updated its strategy under a new Ocean Initiative, which prioritizes work in the four countries of China, Chile, Indonesia, and the United States and tightly integrates work with Ocean-reliant communities – those whose livelihoods, food security, or culture rely on healthy ocean ecosystems and whose priorities include a healthy ocean. Earlier shorebird conservation work funded by the Packard Foundation focused on the Pacific Americas Flyway in Latin America, including monitoring, capacity building, coastal habitat protection and management, and community coordination in key shorebird breeding, migratory, and wintering grounds. The goal of this work was to create an Assessment of Shorebird Conservation Opportunities in the context of this new Ocean Initiative, considering what strategies for shorebird conservation could align with Packard Foundation goals.

Process: The process to understand the opportunities and strategic direction was to use **research** (reviewing over 100 articles, shorebird conservation plans, strategies, program evaluations, and other materials), **interviews** (11 experts with global and country-specific perspectives), a detailed **survey** (47 respondents from around the world), a **decision-making tool** (assessing 10 categories of important information for nearly 500 geographies of state and countries globally), and ongoing guidance from the **Packard Foundation team**. *Please see the Acknowledgements for more details on the process.*

People and shorebirds are linked

Many shorebird populations are threatened and declining, with 59 species (over one-quarter) under threat levels ranging from vulnerable to critical. There are many different families of shorebirds - Sandpipers, Snipes, Phalaropes, Plovers, Coursers, Oystercatchers, Thick-knees, Jacanas, Avocets, Stilts, and more. They use diverse habitats such as Arctic tundra, intertidal mudflats, freshwater wetlands, inland grasslands, deserts, and coastal beaches. Shorebirds face many challenges including habitat destruction (beachfront real estate, wind turbines, aquaculture farms), insufficient food sources to fuel their long-distance migrations, glacial melting of breeding grounds, and more.

> "Conservation is a social movement. Science and data are important, but…most of all we need the main actors to change their behavior."
>
> – Burung Indonesia

Four core **strategies** to collaborate, protect habitat, reduce key threats, and empower local communities can help reach for global conservation goals. With more funding available, more global collaboration, creative communications, enhanced monitoring, selective research, and building local capacity could be pursued.

- **Collaborate across sectors and disciplines** by involving conservationists, communities, businesses, and the government.

> "We will never save birds based only on conservation at individual sites. You have to preserve a quality environment and sufficient habitat in surrounding landscapes, or we are lost."
>
> – Stan Senner, shorebird expert & retired VP for Bird Conservation, National Audubon Society

- **Protect habitat, nesting, and important bird areas, prioritizing key species**. Roughly half of Important Bird and Biodiversity Areas[1] are unprotected and could be priority locations, also considering improving connections across each flyway.
- **Reduce key threats of habitat destruction and disturbance from people and climate** with novel ways of protection, including government standards for development and energy, working with developers, sustainable aquaculture certification, conservation easements, improving bird-friendly building designs, and finding blue carbon funding to strengthen climate resilience and mangrove protection.
- **Empower local communities** to see enduring conservation, strengthen leadership, increase involvement, and improve livelihoods to create a more sustainable and inclusive conservation approach.

> "Foster environmental and community leadership for self-protection of natural resources and defending against growth that does not produce local benefits."
>
> – CECPAN

- As funding levels increase, aim to **scale work and increase global alliances**. Consider high-impact pilot projects with global implications that could later scale. **Coordinate** work across flyways and bolster existing global people networks.
- As funding levels increase again: **Deploy creative communications**, such as through storytelling, music, and art. Support **monitoring, enforcement,** and select research, considering satellite tracking. Finally, build **local capacity**.

Key geographies are:

- **East Asian Australasian Flyway**: Important countries include China, Indonesia, Australia, South Korea, Japan, Malaysia, and Vietnam to support flyway stopovers.
- **Pacific, Atlantic, and Central America Flyways**: Important countries include the United States, Chile, Mexico, Canada, Argentina, Colombia, and Brazil to form a connected flyway network.

While shorebird species populations are declining, there are very **tangible actions that can be pursued, in collaboration with local communities, governments, and even businesses and private landowners**, to reduce threats and improve their outlook.

[1] From BirdLife International: Global criteria for an IBA include 1) Regularly holds significant numbers of a **globally threatened** species (critical, endangered, or vulnerable), 2) Holds a significant population of at least two **range-restricted species** (range <50,000 km^2), 3) Hold a significant component of the group of species whose distributions are largely or wholly confined to one **biome-realm** (WWF classifications, representing major regional terrestrial and aquatic habitat types distinguished by their climate, flora and fauna), and 4) Holds **congregations** of ≥1% of the global population of one or more species on a regular or predictable basis. IBAs form a subset of Key Biodiversity Areas (KBAs) that have been embedded in various international agreements and safeguard mechanisms and serve as indicators for the biodiversity policy framework of the Convention on Biological Diversity and the Sustainable Development Goals.

WHY NOW

Crucial wetlands and mudflats are being destroyed

Wetland ecosystems, both coastal and inland, and mudflats are crucial habitats for shorebirds. In these areas, shorebirds rest during migration and find their food, such as biofilm, which is rich in healthy fats that can support long migrations of many shorebirds.

Figure 1 shows different types of wetlands around the globe, with the highest areas of wetlands in the United States (Alaska), China (including inland wetlands in Tibet), India, Canada, and Mexico. Destruction of wetland habitat is one of the most important threats, caused by multiple factors (Figure 2).

> "Not all shorebirds are coastal and if you want to conserve shorebirds you need to support inland wetlands too, such as midcontinental wetlands in North and South America."
>
> – Oikonos Ecosystem Knowledge

FIGURE 1: WETLANDS

Source: World Wildlife Fund Global Lakes and Wetlands Database
See Figure B1 for larger map.

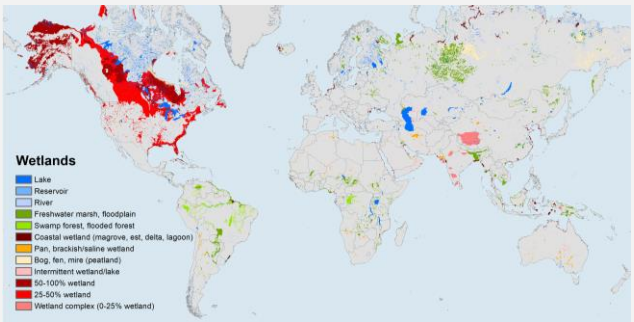
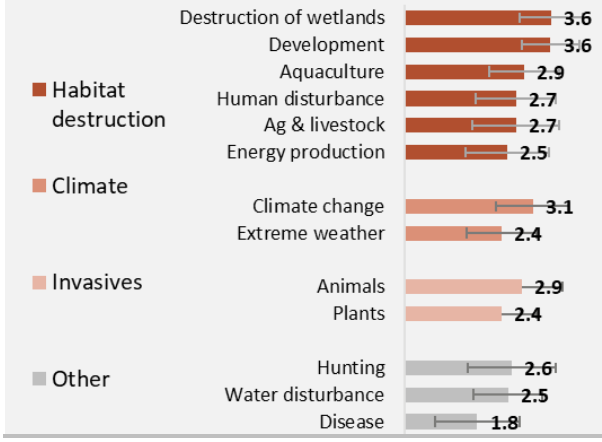


FIGURE 2: THREATS

Source: Expert survey input. 4=extremely important, 3=very important, 2=moderately important, 1=important, 0=not important. Bars for standard deviation.



Key threats include development, human disturbance, aquaculture, and climate change

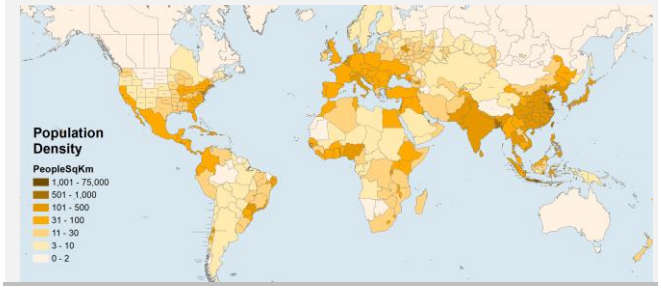
People pose a significant threat to shorebirds. This manifests in many coexistent ways, such as destroying wetlands through residential, commercial, or industrial development that eliminates key habitats. Dense population centers contain high-rise buildings that are less likely to be bird friendly. Human disturbance on beaches from tourism or recreation can destroy nesting sites. Figure 3 depicts overall population density, used as a proxy to represent the various threats people pose, including wetland destruction, development, and human disturbance.

Aquaculture is also a threat to shorebirds, especially in China, Indonesia, India, Vietnam, and Central America. Breeding, rearing, and harvesting of shrimp or fish, while bringing economic benefits to people, can disrupt shorebirds by displacing important ecosystem functions, habitat, and food. Aquaculture farms can also destroy mudflats used to rest, cause waters to be too deep for shorebirds, or be designed in ways that harm birds, such as use of nets.

Climate change poses a significant risk to shorebirds. Forty percent[i] of the world's Ramsar wetlands of

FIGURE 3: HUMAN THREAT

Population density used as a proxy for multiple human threats. Source: ESRI Population at Administration level. See Figure B2 for larger map.

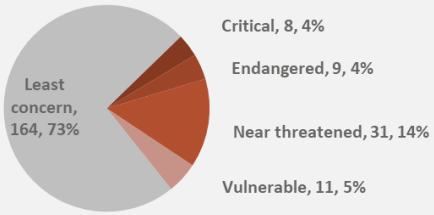


international importance are at risk to 1 meter sea level rise.[2] Rising sea levels can destroy habitat or make it too deep to function as useful habitat for the birds. Rising temperatures melt areas used for breeding. Changing seasons disturb flight timing or nesting.

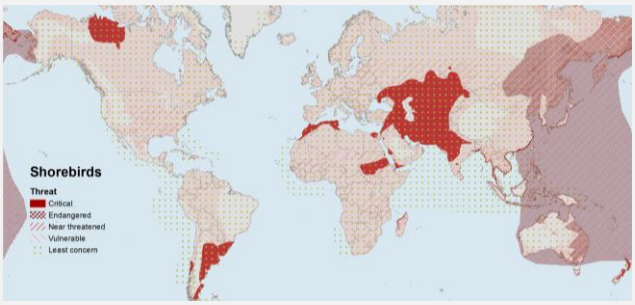
In addition to those described, other moderately important threats include rats, ravens, cats, or dogs disturbing nests; conversion of shorebird habitat into farmland or livestock grazing; sport hunting or poaching of shorebirds; wind power, oil and gas, and more.

FIGURE 4: SHOREBIRD THREAT LEVELS

Source: IUCN. Number of shorebird species by threat level



Global regions where individual shorebird species are threatened (all habitat overlayed). Source Data: BirdLife International, Handbook of the Birds of the World. Version 2022.2. See Figure B3 for a larger map.



As a result of these threats, 59 species of shorebirds (27% of 223 in total) are under significant threat according to the International Union for Conservation of Nature (IUCN).[ii] Figure 4 shows that 17 species are critical or endangered and another 42 are near-threatened or vulnerable. The habitat of the threatened birds spans the globe but is higher in central and eastern Asia. Experts agreed that conserving shorebirds under the greatest threat was important (Figure C7).

> "The threats that shorebirds are facing are interlocking and synergistic. There is no one 'smoking gun' and, thus, there will not be a single 'silver bullet.'"
>
> – University of Massachusetts Amherst

Local communities are often left out of the conversation

Local communities are linked to successful conservation of shorebirds. Threats to shorebirds can occur when people use habitats for other uses – from agriculture and aquaculture to buildings and energy development, and other disturbances, such as recreation affecting nests, introducing predators, or polluting water. On the flip side, there are numerous benefits to communities that can accrue such as sustainable livelihoods, cultural value, and ecosystem services.

However, local communities have often been left out of decisions, their voices have not been heard, or their Indigenous knowledge has not been respected. More could be done to promote community participation, empower local partners, and support sustainable economic development.

> "It is very important that conservation is not seen as something imposed from people outside the community."
>
> – Comité Nacional Pro Defensa de la Flora y Fauna (CODEFF)

[2] A Ramsar site is a wetland site designated to be of international importance under the Ramsar Convention, also known as "The Convention on Wetlands", an international environmental treaty signed on 2 February 1971 in Ramsar, Iran, under the auspices of UNESCO.

OUTCOMES & SCENARIOS

Flyway habitat

To protect shorebirds, establish **globally linked and interconnected networks of protected habitat, especially wetlands, across all flyways globally**.

The habitat should encompass the entire shorebird **life cycle**, including breeding, migration corridors, stopover sites, plus summering and wintering habitats. The sites should be **resilient to threats**, especially human disturbance, with strong enforcement. Other important components of habitat protection are to maintain **flyway continuity**, enhance **ecosystem resilience**, and **restore threatened and priority species**. Rather than a fragile chain of smaller sites that could collapse if one fails, consider a broad suite of protections on surrounding landscapes. *See Appendix C, Figure C1 for more details from the survey input on shorebird outcomes.*

> "The goal [should be] sets of linked sites in all main flyways that are globally identified, monitored, protected and well managed."
>
> – BirdLife International

Local community benefits

Vital community benefits are **improved sustainable livelihoods coupled with increased empowerment**., which can be achieved by working in partnership with local communities, improving engagement, empowerment, and respect (Figure 5).

Livelihoods: With livelihoods, community members could make a living supporting themselves with community conservation management, supportive research, sustainable and eco-friendly tourism, and similar ways.

Community empowerment is a crucial outcome. Community power and decision-making can be increased by encouraging, developing, and supporting community leadership and sharing of Indigenous knowledge.

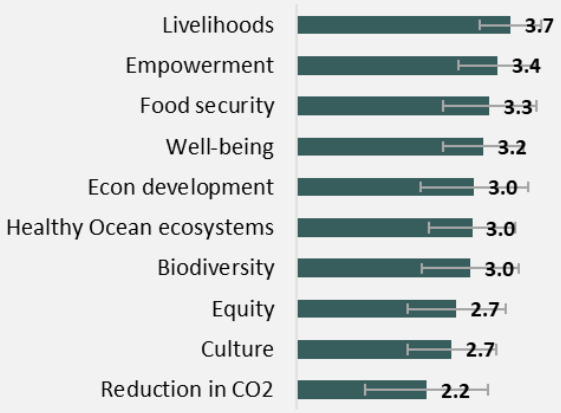
Other benefits: Improved well-being is an important benefit, focusing on enhanced resilience to a changing climate that supports the overall health of the community. Greater food security through sustainable fishing is also important to communities, though less directly relevant to shorebird conservation.

Working directly with communities can often also reduce potential key threats that communities might pose, such as destroying wetlands. Prioritizing benefits for communities contributes to a sustainable approach crucial for effective conservation. By actively involving local communities in shorebird conservation – from identifying potential sites, advocating for protection, and involvement in monitoring and enforcement – the goal is to create a sustainable and inclusive approach to conservation that benefits both the shorebirds and local communities. *See Chapter 3 for more details on community strategies.*

> "Success in shorebird conservation looks like strong local constituency that supports and engages actively in the protection, celebration and promotion of these locations and the species that use them."
>
> – California Natural Resources Agency

FIGURE 5: COMMUMITY BENEFITS

Source: Expert survey input. 4=extremely important, 3=very important, 2=moderately important, 1=important, 0=not important. Bars for standard deviation.



Priority shorebird species

Experts emphasized the need to consider protecting important species, including threatened and other shorebird species. Expert input and input from nine other shorebird conservation plans[3] identified **33 highest priority shorebirds**, which are detailed in Table 1. There were an additional 51 birds with 1-4 survey mentions.[iii] The seasonal habitats for the top 18 species are depicted in the maps in Figure 6.

> "End the regional focus on the Americas and focus on the top threatened species."
>
> – University of California Santa Cruz

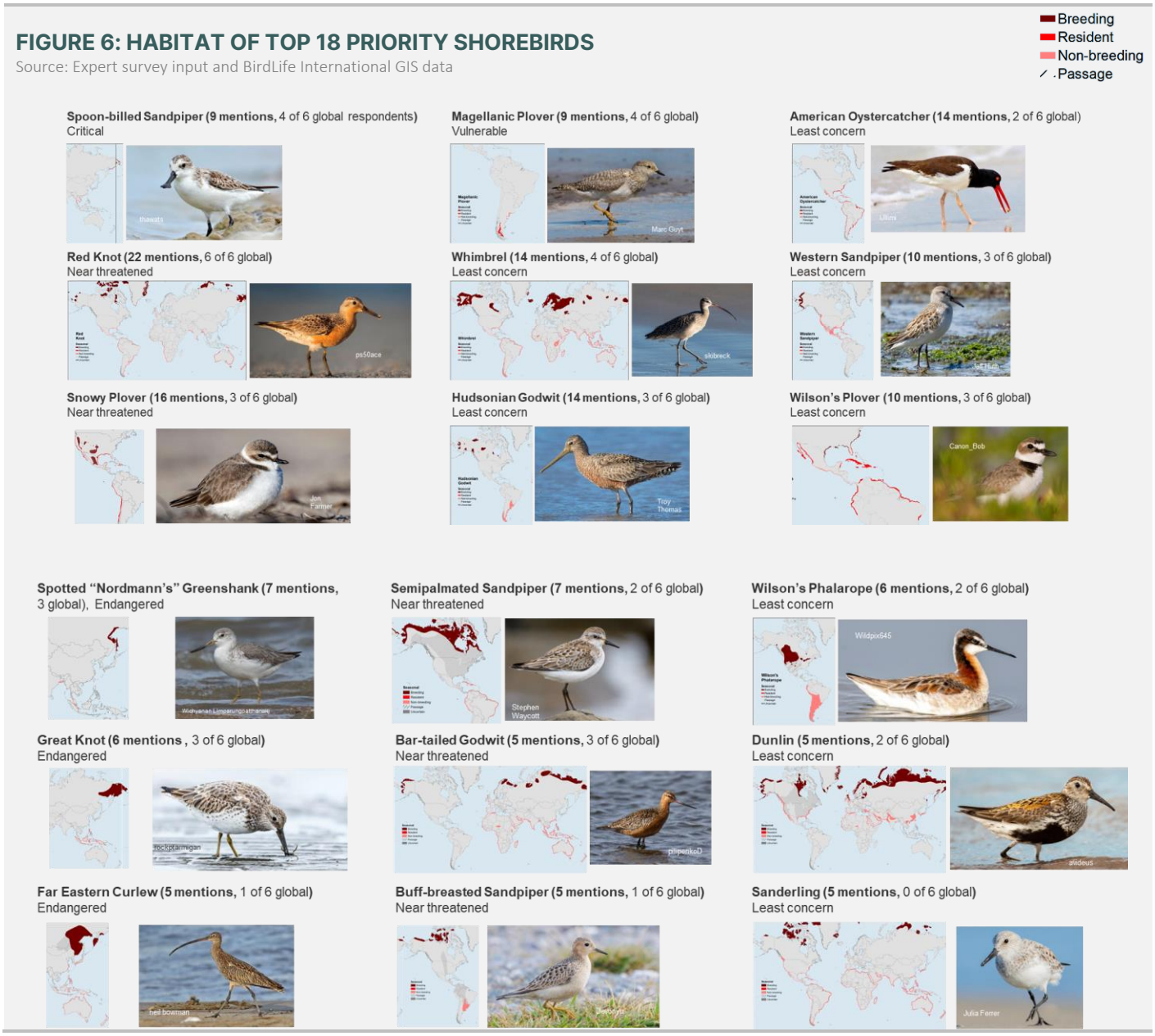
The most common family of priority shorebirds were Sandpipers, Snipes, and Phalaropes, followed by Plovers and Oystercatchers. Five of the species (Red Knot, Whimbrel, Bar-tailed Godwit, Dunlin, and Sanderling) are far-ranging species with global habitat (Figure B14).

IUCN Threat Category	#	Family: Species (# survey mentions in parenthesis). Gold color indicates that the species was identified in at least one shorebird conservation plan, but not in surveys or interviews.
TOTAL	33	
Critical	1	**Sandpiper**: Spoon-billed Sandpiper (9)
Endangered	4	**Sandpipers, Snipes, Phalaropes** • Spotted Greenshank (7) • Great Knot (6) • Far Eastern Curlew (5) **Plovers** • Siberian Sandplover
Near-threatened	5	**Sandpipers, Snipes, Phalaropes** • Red Knot (22) • Semipalmated Sandpiper (7) • Bar-tailed Godwit (5) • Buff-breasted Sandpiper (5) **Plovers** • Snowy Plover (16)
Vulnerable	6	**Sandpipers, Snipes, Phalaropes** • Sharp-tailed Sandpiper • Wood Snipe **Other** • Magellanic Plover (9)
Least Concern	20	**Sandpipers, Snipes, Phalaropes** • Whimbrel (14) • Hudsonian Godwit (14) • Western Sandpiper (10) • Wilson's Phalarope (6) • Dunlin (5) • Sanderling (5) • American Woodcock • Black Turnstone • Greater Yellowlegs • Red Phalarope • Rock Sandpiper **Plovers** • Wilson's Plover (10) • American Golden Plover • Grey Plover • Killdeer **Oystercatchers** • American Oystercatcher (14) • Blackish Oystercatcher • Magellanic Oystercatcher **Other** • Peruvian Thick-knee • South American Painted-snipe

[3] Other plan priority species (gold in Table 1) are from the Pacific Americas Shorebird Conservation Strategy, Southern Pacific Shorebird Conservation Plan, Atlantic Flyway Shorebird Initiative, Chile National Shorebird Conservation Action Plan (endangered, vulnerable), Chiloe Conservation Plan, Canadian Shorebird Conservation Plan (category 5 or 4), key shorebirds in Indonesia (via interview), Key Species of East Asian Australasian Flyway, and Society of Entrepreneurs and Ecology list of key protected birds.

FIGURE 6: HABITAT OF TOP 18 PRIORITY SHOREBIRDS

Source: Expert survey input and BirdLife International GIS data

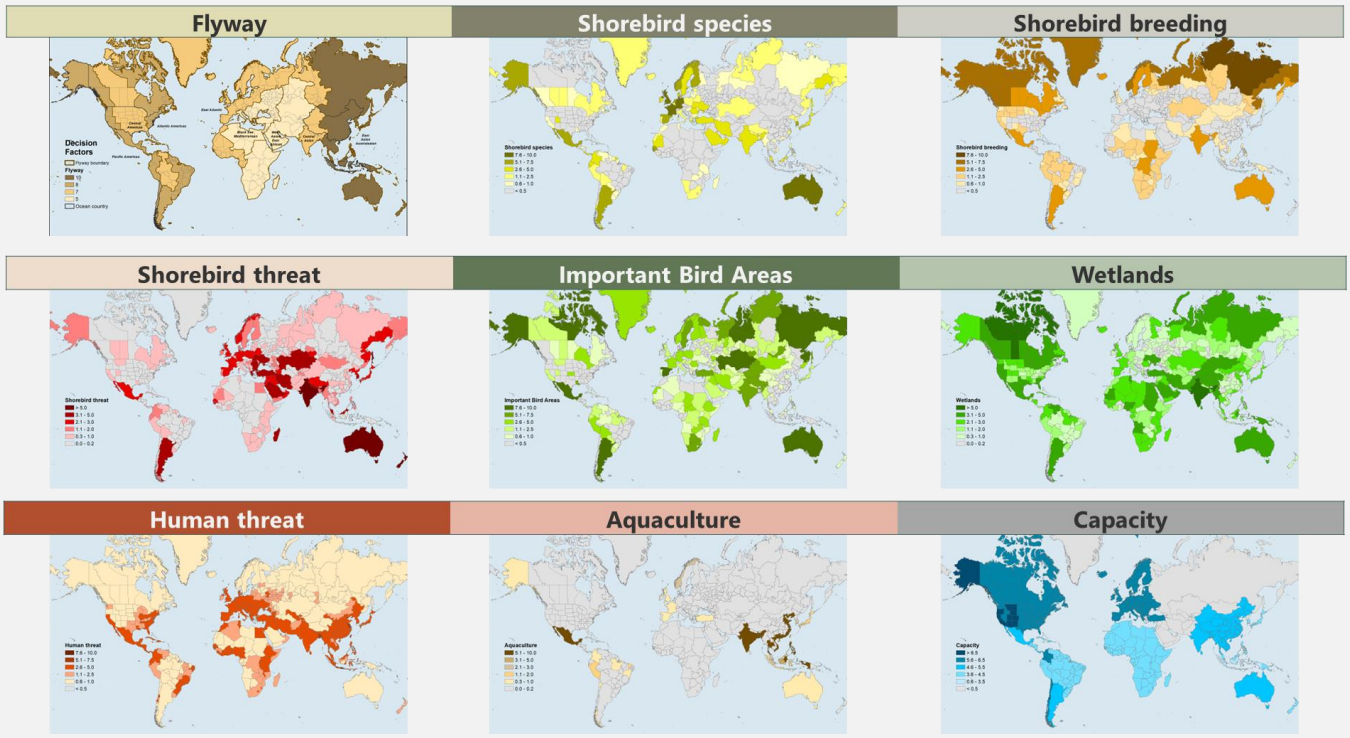


Decision Tool to inform priority geographies

To support greater understanding and selection of priority regions and countries, a Decision Tool was developed to bring together many important aspects of shorebirds and communities. The tool included up to ten important factors related to geographies, shorebirds, habitat, threats, and capacity. The whole of the work covering research, interviews, surveys, and data analysis informed the selection of factors and their importance (Figure 7). Reducing threats for shorebirds throughout their life cycle, with special emphasis on priority shorebirds show up in the Decision Tool factors. Additionally, capacity was included to reflect the potential for implementation. The weights represent the importance of each factor in the combined priority score. Generally, most weights are roughly 10%, with slightly higher values for some reflecting importance. Figure 8 shows the map and scoring factors for the top

FIGURE 7: DECISION TOOL FACTORS

Geographies assessed on a country level except for the US, Chile, China, Indonesia, Canada, Russia, and Brazil, which are divided by state. Sources: Hovland Consulting analysis with underlying input detailed in other Figures, including BirdLife International, World Wildlife Fund, ESRI (population), OECD (Aquaculture), and Expert Survey. See Appendix A for more details, including Figure A1 for larger maps of the underlying factors.

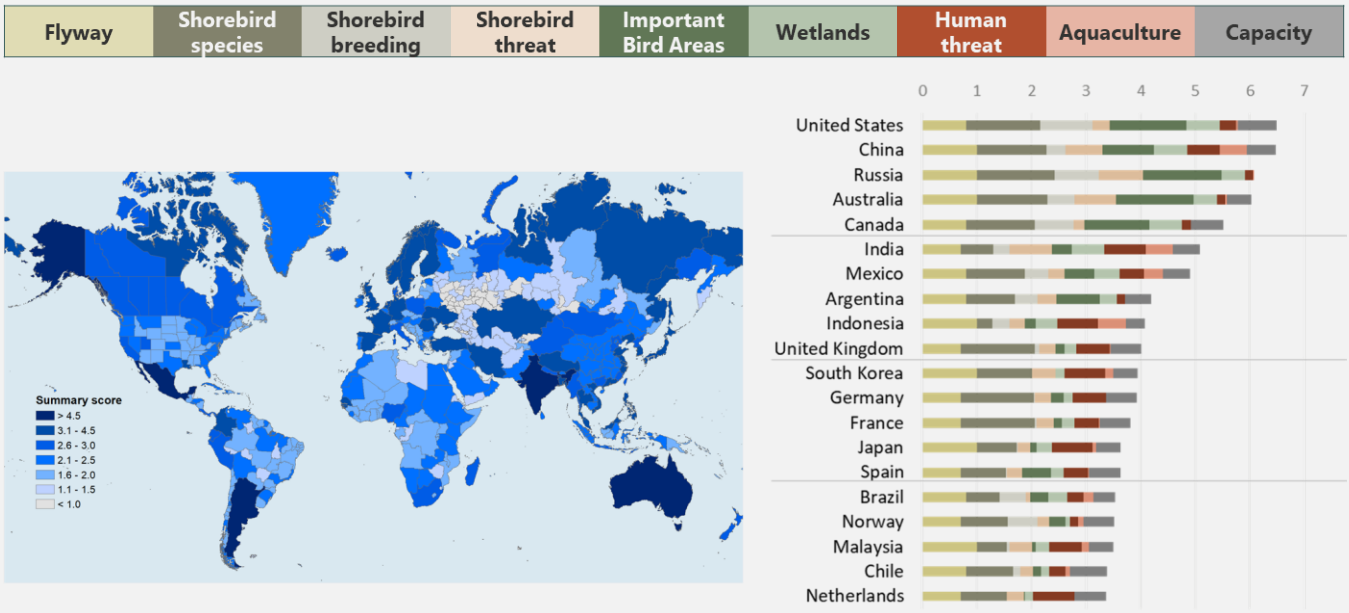


20 countries globally. *See Appendix A for more details on the Decision Tool.*

- Flyway priority (weight 10%): Informed by the expert survey, the more threatened flyways (e.g., East Asian Australasian) have the highest scores.
- Shorebird diversity and priority (weight 35%): Dense and larger areas score higher, reflecting the benefit of protecting many species in a single location or country.
  - Shorebird species (number of species and location overlap), with higher scores for shorebirds that received the most mentions in the survey or were prioritized in other shorebird conservation plans.
  - Shorebird breeding habitat (area basis), extant, probably extant, or possibly extant of shorebird habitat, with higher scores for priority shorebirds
  - Shorebird threat levels as seen in important bird areas, weighing more highly critical, endangered, and vulnerable shorebirds.
- Habitat (weight 25%):
  - Important bird areas (on an area basis), with higher value for priority shorebirds and unprotected areas, but also giving some value to all important bird areas considering broad environmental protection benefits.
  - Wetlands, as a crucially important habitat, weighting more highly coastal and highly dense wetlands but considering all areas with water.
- Key threats (weight 20%):
  - Human threat, represented by population density as a proxy for development, disturbance, energy, wetland destruction, etc.
  - Aquaculture threat (tons of aquaculture), weighing more highly shrimp aquaculture

FIGURE 8: SCORE FOR PRIORITY GEOGRAPHIES BASED ON THE DECISION TOOL

Baseline Scenario. Source: Hovland Consulting analysis with underlying input detailed in other Figures. See Appendix A for more details.

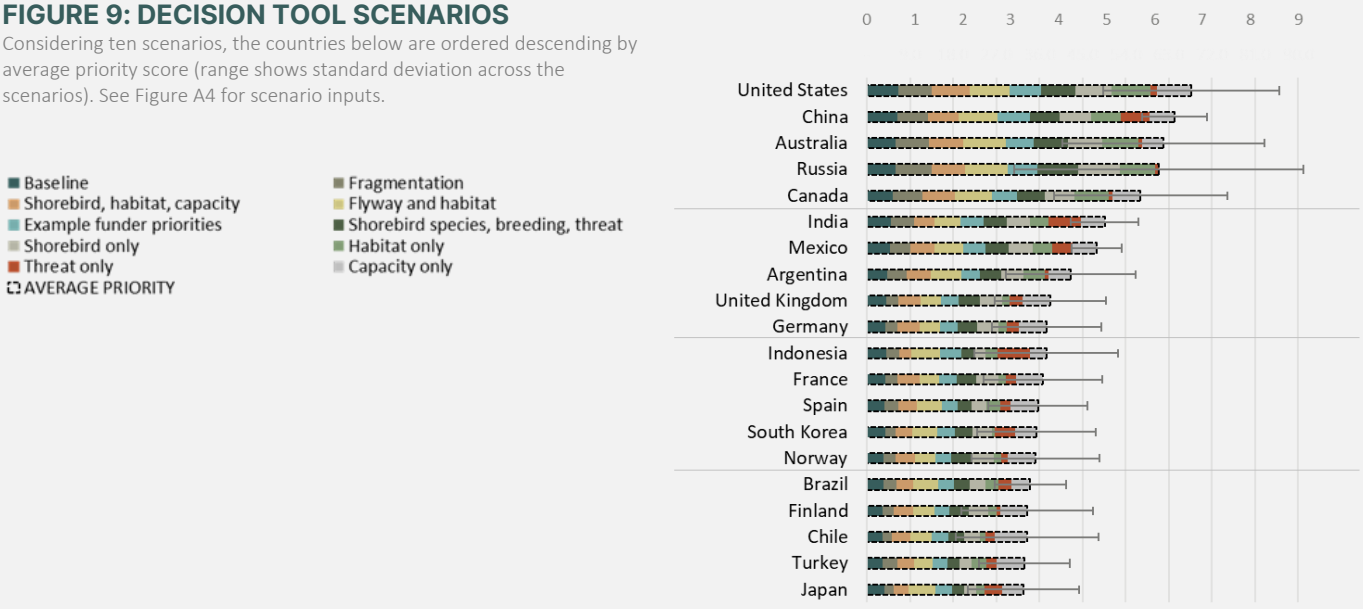


- **Capacity** to implement (weight 10%): Capacity of existing groups, or the potential to grow with investment, that are involved in shorebird conservation, especially civil society and communities (Figures C9 and C10).

The Decision Tool's Baseline scenario results show the geographic scores and top 20 countries and the reasons they rose to the top (Figure 8). The Decision Tool also looks at multiple scenarios of factors and offers similar priority countries (Figure 9) as the Baseline scenario.

FIGURE 9: DECISION TOOL SCENARIOS

Considering ten scenarios, the countries below are ordered descending by average priority score (range shows standard deviation across the scenarios). See Figure A4 for scenario inputs.



STRATEGIES

High priority strategies were informed by the myriads of input throughout the project – expert input through interviews and a survey, a literature review, reviewing other shorebird plans, and more.

Strategies that rose to the top were centered on habitat protection and community engagement and benefits. Four essential strategies are to 1) Collaborate across sectors and disciplines (including conservationists, scientists, communities, governments, and businesses), 2) Protect habitat and nesting areas for key species, 3) Reduce key threats and consider novel partnerships (such as with developers or private and owners), and 4) Improve community leadership, involvement in solutions, and sustainable livelihoods. *See Appendix C, Figure C5 for details on the survey input on shorebird conservation strategies.*

As more funding allows, the next key strategies are 5) Scale work globally and increase global alliances, 6) Deploy strategic communications, 7) Improve monitoring, enforcement, and select research; and finally, 8) Build capacity.

1) Collaborate across sectors and disciplines

To achieve positive outcomes for shorebirds and communities, environmental groups, communities, businesses, government, academia, and youth all need to come together.

Create collaboration agreements among parties to identify the 'who' and the 'what' of conservation plans with local communities and other interested parties. This can ensure that place-based interventions are tailored to the unique needs of diverse communities and address the varied social components of conservation, considering communities, economics, business needs, and policymaker goals. *See Appendix C, Figure C6 for survey results related to coalition building and collaboration.*

> "What we often label as 'conservation' is generating information that nobody uses…There's no accountability if there's no 'who' or 'what.' When you have worked across sectors, you can't go back to being siloed."
>
> –Cornell University Coastal Solutions Fellows

2) Protect habitat, nesting, and important bird areas, prioritizing key species

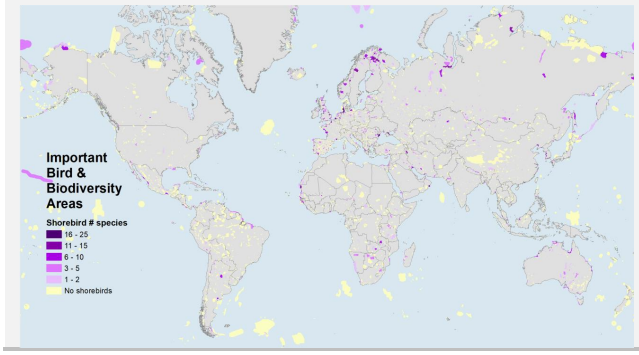
The protection of enough habitat for shorebirds to nest, feed, migrate, and live is a cornerstone of the strategy.

Increase official protections on Important Bird and Biodiversity Areas (IBAs) with shorebirds. IBAs are defined to consider globally threatened species, restricted-range species, biome-restricted species, and congregations (more than 1% of one or more species on a regular basis). Roughly half (55%) of IBAs and KBAs are currently covered by protected areas. For the strategy, prioritize areas that are unprotected, have wetlands, mudflats, or other important ecosystems, and have a diversity of shorebirds. Protected areas that are large in size are valuable, but connectivity is also important. Figure 10 represents the map of IBAs globally, highlighting where shorebird species are present as well as other birds. *See Appendix C, Figure C2 for other important aspects of protected areas, such as the shorebird population sizes and enforcement.*

> "Even for long distance flights, the flight is not the constraint. Everything is conditional on what happens at the sites before and after the flight."
>
> – University of Groningen

FIGURE 10: IMPORTANT BIRD AND BIODIVERSITY AREAS

Source: BirdLife International. See Figure B9 for a larger map.



However, conservation is needed in areas beyond just the high congregation spots. Habitat should be connected throughout each flyway considering the entire life cycle, migration corridors, and opportunities outside of IBAs. One very important part of this is to ensure nesting areas are protected. Figure 11 visualizes the nesting habitat when looking collectively at all shorebirds is generally in the northern hemisphere. The second map in Figure 11 shows how the nesting habitat narrows slightly when looking at the highest priority shorebirds. *See Appendix B, Figure B4 for the habitat of the most threatened of these priority shorebirds.*

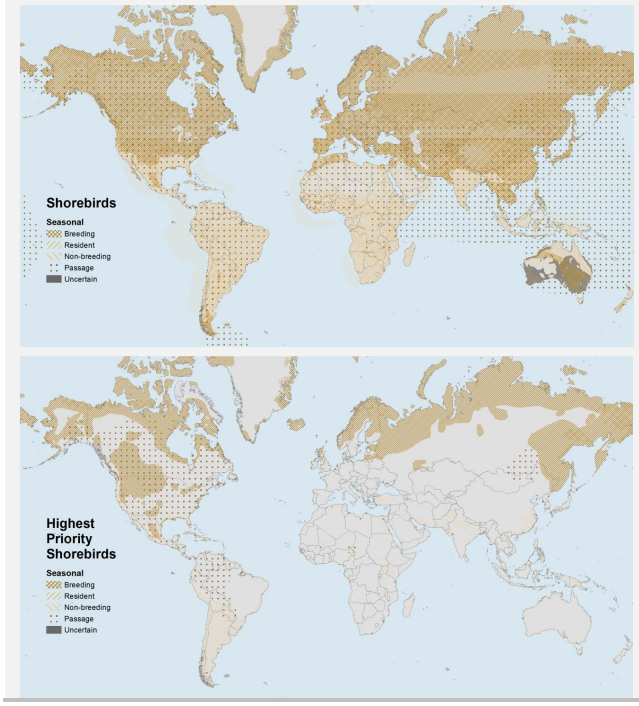
> "Ensure the preservation of critical habitats and minimize human threats to their survival, ensuring the continuity of ecosystem services."
>
> – Wildlife Conservation Society Colombia

3) Reduce key threats and pursue novel partnerships

Because development, habitat destruction, human disturbance, and other threats from people are so important, it behooves conservationists to think through new ways to partner with people – from developers to private landowners – to find place for common ground and improved outcomes for shorebirds and people.

FIGURE 11: NESTING HABITAT – ALL AND HIGHEST PRIORITY SHOREBIRDS

Data: BirdLife International, Handbook of the Birds of the World (2022) Bird species distribution maps of the world. Version 2022.2
See Figures B5-B6 for larger maps.



Such novel partnerships could mean working with developers to protect viewscapes, creating better government standards for development and energy projects, creating a sustainable aquaculture certification, creating land or water easements on private land, working with cities on bird-friendly development, or strengthening climate resilience and partnering with blue carbon funding sources. These new approaches can reduce the threats that shorebirds face and protect a wider range of habitats, in service of protecting the habitat surrounding official protected areas and linking migration corridors. *See Appendix C, Figure C5 for details in the survey results for the most important threat reduction strategies.*

CASE STUDY 1: PARTNERING WITH DEVELOPERS IN CHILE

Coquimbo Bay in Chile serves as a flagship example of a creative success story involving a partnership with businesses. Red de Observadores de Aves y Vida Silvestre de Chile (ROC) partnered with a real-estate developer to conserve and co-manage the sand dunes & maintain views.

In Coquimbo Bay, a large beach area in central North Chile, situated in the southern half of the bay, the shorebird habitat faces significant challenges due to high population density, recreational activities, and poor environmental conditions. Three wetlands, located in the north, center, and south of the bay, are particularly degraded.

ROC identified an area with relatively better environmental conditions, characterized by intact dunes, and conducted bird surveys there. This area, which includes a real estate development with buildings and a golf course, garnered interest from two members of the neighborhood association keen on conserving the dunes. After months of negotiation, an agreement was reached with the real estate company to co-manage the beach area in front of their property for the protection of the American Oystercatcher and other shorebirds. They secured a conservation easement that made it illegal to build on the dunes.

> "We like to think of creative solutions to conservation. Sometimes it's not what we expected but we do what we can, and we will take all the opportunities we can get."
>
> – Red de Observadores de Aves y Vida Silvestre de Chile (ROC)

CASE STUDY 2: PRIVATE EASEMENT IN ALASKA

After the 1989 Exxon Valdez oil spill off the coast of Alaska, Stan Senner coordinated the billion-dollar restoration program and Alaska used some of those funds to purchase open space on the Alaskan coast at Kachemak Bay. The city of Homer supported purchasing those lands that were important shorebird habitats and putting a conservation easement on them so they could not be developed. Fast forward 35 years. Stan visited Homer in 2023 and saw that the area was very developed except for the land protected by conservation easements. As a result, Kachemak Bay still holds important habitat for shorebirds.

> "Stop destruction of habitat by purchasing land and establishing easements. For example, purchase water rights to maintain functional habitat at saline lakes such as Great Salt Lake and Lake Abert in North America."
>
> – Oikonos Ecosystem Knowledge

Partner with developers to protect shorebirds, exploring ways to co-manage habitat and provide value to the developer, such as maintaining a viewscape or providing open space for visitors. *See Case Study 1 for an example in Chile.*

Advocate for changes to the standards of environmental evaluations to improve shorebird outcomes. This can apply to development/building projects (e.g., environmental impact policies); oil spill clean-up capacity, funding, and policies; and the like.

Improve aquaculture: Establish "green or sustainable" shrimp and aquaculture farming certifications that guarantee bird-friendly practices. These could be national or international in scope.

Explore conservation easement possibilities: Secure land or water conservation easements, with potential to work with private landowners such as farmers, local businesses, or real estate companies. *See Case Study 2 for an example in Alaska.*

Bird-friendly city design: Similar to the idea that aquaculture can be done in a bird-friendly way, cities can also be designed with birds in mind. Advocates are exploring what this looks like, from how far apart to construct buildings to levels of light pollution to areas of respite in a city. While this strategi is most applicable to newer cities, aspects also apply to existing cities. *See Case Study 3 for examples in China.*

Strengthen climate resilience: Strengthen coastal resilience, mitigate threats associated with sea level rise and habitat degradation, integrate climate change considerations into conservation planning, and consider partnerships with blue carbon for conservation funding.

Finally, consider other ways to address important threats, such as reducing predators directly or their impact on habitat

CASE STUDY 3: BIRD-FRIENDLY CITIES IN CHINA

Mangrove Conservation Foundation is collaborating with universities to develop a new initiative aimed at understanding land-use planning and enhancing areas crucial for migratory birds. In cities like Shenzhen and Shanghai, which have internationally protected wetlands, they are working to ensure there are ample spaces for birds to rest and thrive. Their goal is to support the natural functions of the birds and their habitat and minimize human disturbances. This involves educating the public, using methods to deter birds without harming them, and incorporating bird-friendly design elements into urban planning, such as leaving corridors between high-rise buildings for flight, limiting light pollution at night, and using bird-safe building materials.

> "In city planning, consider the ways that birds fly and leave space between the high-rise buildings. Or consider creating buildings that are not all made of windows or have stickers on the windows to let the birds know that it is a window."
>
> – Mangrove Conservation Foundation

> "Understand the responses of shorebirds and their habitat to the effects of climate change to design nature-based solutions that can strengthen coastal resiliency for shorebirds and people."
>
> – Pronatura Noroeste A.C.

4) Improve community leadership, involvement in solutions, and sustainable livelihoods

Engaging communities should be done in a thoughtful way, and often it may take time to understand the community's needs, priorities, and find common ground. Three essential strategies are to strengthen leadership and knowledge sharing, increase involvement in solutions and build capacity, and improve sustainable livelihoods (Figure 12).

> "Observe, learn and listen to local communities, rather than educating with foreign ideas."
>
> – University of Groningen

Strengthen leadership & knowledge sharing

Empower and build leadership capacity within ocean-reliant communities to effectively engage in conservation efforts & sustainable resource management. Find consensus and synergize with local needs through a bottom-up approach.

Share local knowledge: Revitalize local knowledge on resource management to enhance the local care and management of natural resources. Facilitate knowledge sharing among community members.

Expand community engagement, education and awareness: Use storytelling to raise awareness about the value of shorebirds and their habitats.

FIGURE 12: COMMUNITY STRATEGIES

Source: Expert survey input. 4=extremely important, 3=very important, 2=moderately important, 1=important, 0=not important. Bars for standard deviation.

Provide policy support: Support community involvement in policy advocacy and prioritize legislation that includes community benefits.

Increase involvement in solutions & capacity

Establish community resource planning and develop resource plans aligning conservation efforts with local economic needs. Sign collaboration agreements with the community that clearly identify the 'who' and the 'what' of conservation plans within local communities.

Create nature-based solutions and advocate for locally integrated strategies and approaches that deliver multiple benefits at multiple levels.

Emphasize **place-based solutions** tailored to the unique contextual needs of diverse communities.

Collaborate with local scientists and stablish networks of local leaders and partners for effective conservation.

Obtain funding: Raise funds to sustain operations in the community.

Improve livelihoods

Actively involve communities in assessment and management with long-term commitments to economic development and sustainable livelihoods.

Engage local communities in paid management activities through direct co-management and monitoring of protected and important areas.

Promote ecotourism and other sustainable businesses.

Consider revenue streams from blue carbon.

> "Community co-production is fundamental to being effective, but it takes time and it takes understanding, which requires the insights of social scientists to build the dialogue and liaise with the community. A smart approach leverages traditional knowledge and integrates it into a strategy and whatever is trying to be achieved."
>
> – National Fish and Wildlife Foundation

5) Scale work and increase global alliances

Coordinate conservation initiatives on a global scale, complemented by flyway-level networks that coordinate actions and share best practices. *Note that national environmental standards for development and aquaculture certification, already covered in Strategy 3, are also important ways to scale work at a national level.*

Expand international agreements and policy, such as the Convention on Wetlands (Ramsar) and the Convention on Migratory Species, play an important role, facilitate cross-regional cooperation, and can lay the groundwork for protection globally. Advocates could elevate shorebird conservation priorities on the international stage through engagement with global policy frameworks and initiatives such as COP16 on Biodiversity and the UN Declaration on Ecosystem Restoration.

> "Inter-governmental collaboration with agreement on importance of wetlands [would lead to global scaling of the work]."
>
> – Mangrove Conservation Foundation

Build pilot projects to scale: Conduct high-impact pilot projects on a small-scale that have likelihood of incorporation into national policies with potential global implications.

Enhance flyway collaborations and flyway-specific strategic planning: There is a need for more global and flyway cooperation, as flyway conservation can be fragmented by national and local funding, interests, and needs. Two notable initiatives are the Asian Waterbird Conservation Fund and the East Asian - Australasian Flyway Partnership (EAAFP), which focuses on EAAF as one of the most threatened flyways, encompassing many developing countries. The Asian Water Bird Census monitors the status of waterbirds by involving the public to help observe the waterbirds in the areas and they report through each organization. Other flyway partnerships such as the Americas Flyways Initiative, joint ventures, and inter-regional frameworks are important existing cross-regional efforts. Existing

conservation plans to implement include the Midcontinent, Pacific, and Atlantic Americas Shorebird Conservation Plans, as well as the Chile National Shorebird Conservation Plan. The need for strategic planning in Asia, Africa, and Europe is critical for effective global conservation actions and strategies.

Support global people networks (e.g., BirdLife International, Avian Knowledge Network, BirdEyes), share data and best practices by bringing together key individuals working on shorebird conservation worldwide to create a platform for exchanging experiences, lessons learned, and best practices, fostering collaboration on a global scale.

> "Having the essential networks of people and governance in place and funded is critical to do flyway and certainly global level research and conservation for wide-ranging species like shorebirds. Implement multi-national research, monitoring and conservation networks made up of representatives from local communities, the government, academia, and NGOs in each major flyway to serve as the foundation for all conservation efforts."
>
> – Point Blue

6) Deploy strategic communications

As funding levels increase, more attention can be directed to enhance public awareness and education to support shorebird conservation and community engagement (Figure 13).

Be creative with communication strategies to reach the public and larger audiences. Communicate through local storytelling while engaging and empowering communities. Theunis Piersma from University of Groningen emphasized the importance of storytelling to convey scientific findings to a broader audience, as exemplified by collaborations with skilled storytellers, partnerships with writers and filmmakers, and the establishment of initiatives like BirdEyes. The example of numerous books chronicling the journey of E7, a bird tracked with satellite transmitters from New Zealand to Alaska, flying over the Pacific underscores the potential to captivate imaginations and inspire collective action through compelling narratives. Awareness building might take the form of shorebird festivals, such as Cordova or Kachemak Bay in Alaska.

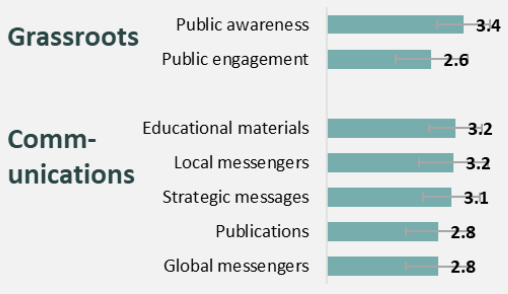
> "Personally, I find resonance in performances with a musician friend who, though not a scientist, adds a visceral element to the facts- the stories hit you in the belly. Combining facts with emotive storytelling through music creates a powerful impact, exemplified by a performance in China with piano and drums symbolizing extinction in 2011 that continues to resonate."
>
> – University of Groningen, founder of BirdEyes

Expand outreach and education to mobilize support for shorebird conservation at local, national, and global levels. This includes educating interested parties about the value of shorebirds and their habitats, as well as the threats they face.

> "Outreach and education on shorebirds and their threats that link to local communities and their economies and wellbeing [could lead to broader global conservation]. Outreach needs to happen at a global scale…so that more funding is available and funding entities are better informed about the perils that shorebirds face and how fixing those issues also helps communities be more resilient."
>
> – Audubon California

FIGURE 13: AWARENESS & COMMUNICATIONS

Expert survey input. 4=extremely important, 3=very important, 2=moderately important, 1=important, 0=not important. Bars for standard deviation.



> "Create effective larger scale education and intervention initiatives…to reduce the diverse activities (i.e., dogs, tourists…) that recreational disturbance poses to stopover and wintering sites."
>
> – National Audubon Society

7) Support tracking, enforcement, and select research

As funding levels increase, enhance the ability of governments and communities to track progress and enforce protections, complemented by select research.

Use satellite tracking technology to improve in-depth knowledge of the movement and presence of shorebirds (population counts alone provide limited information). Leverage shorebirds' migratory patterns to address global threats and improve ecosystem preservation.

Enhance governance and enforcement, including more global funding. Improve compliance with existing laws and regulations, especially in relation to human disturbance threat reduction.

> "There are many laws that are wonderful on paper but are not complied with due to lack of oversight and ignorance; simply by complying with what already exists, the change in favor would be spectacular."
>
> – Comité Nacional Pro Defensa de la Flora y Fauna (CODEFF)

Selectively pursue supportive research on threats, such as threats to biofilm as a key food source for shorebirds, sustainable economic uses of shorebird habitat, strategies, and outcomes. Bring research results to the global collaboratives and apply them to see changes in shorebird outcomes. *See Appendix C, Figure C8 for details on types of monitoring and research strategies.*

> "Shorebird research will provide scientific facts to adopt a better strategy and management."
>
> – University of Groningen

8) Build local capacity

Capacity to implement this work is important at every scale: Local, national, continental, hemispheric, and global.

Build capacity through programs like the Coastal Solutions Fellows Program and citizen science initiatives to create future conservation leaders. Cultivate fellow capacity by fostering a sense of belonging and purpose and develop a community of practice. *See Appendix C, Figures C9 and C10 for existing capacity of civil society and communities and the potential to increase the capacity with investment.*

PRIORITY GEOGRAPHIES

All flyways of the world host important shorebirds.

Based on expert input and complemented by the Decision Tool that looked at ten key aspects in every country in the world, a few specific flyways rose to the top as places to focus – especially the **East Asian/Australasian and America flyways** (Pacific, Atlantic, and Central). *See Appendix C, Figures C3 and C4 for survey input on flyways and regional importance.*

As a measure of flyway fragmentation, Figure 15 depicts the protection level of Important Bird Areas. Flyways are on average only 55% protected; the highest protections are in the East Atlantic flyway with nearly 90% protected. The East Asian Australasian and the Pacific and Atlantic Americas have the highest unprotected shorebirds IBAs.

Below is a summary of the eight flyways across the globe.

- **East Asian Australasian**: High biodiversity of shorebirds and numerous declining species. Urgent need for conservation efforts due to ongoing habitat loss, especially in the Yellow Sea.
- **Pacific Americas**: Significant opportunities for conservation outcomes, especially in Latin America. Existing capacity building efforts in applied science, leadership, and community engagement. Strong need for funding to implement conservation projects.
- **Atlantic Americas**. Increasing changes in shorebird habitats due to developing coastal communities. Emerging flyway-scale strategies and collaborations. Opportunities for cooperation with international lenders like the Latin American Development Bank.
- **Central Asian Flyway:** This flyway offers opportunities in shorebird research, monitoring and determining threats in the largest delta of the world, Ganges-Brahmaputra-Meghna Delta, which remains a black box from the shorebird perspective.
- **East Atlantic/West African**: The northern sections of this flyway in Europe, especially in Scandinavia, are the most protected and least fragmented. However, the lower West Africa region within the East Atlantic Flyway is less protected and there is a compelling need for investment in conservation efforts. The region faces challenges due to international market forces leading to overfishing, particularly of sharks for the Chinese market. West-Africa is home to two special shorebird areas which have no comparison in the world, the Banc d'Arguin in Mauritania and the Bijagós Archipelago in Guinea-Bissau.
- **Central Americas**: Important for migratory birds, including those breeding in Alaska and the Arctic, as

FIGURE 14: FLYWAYS OF THE WORLD

Source: Flyway relative importance (based on survey results) and Wader Flyways of the World for flyways (assigned to single flyways)

FIGURE 15: FLYWAY FRAGMENTATION

Total area (thousand square kilometers) of Important Bird and Biodiversity Areas by flyway of unprotected and protected areas (absolute and relative). Source: Hovland Consulting analysis using input from BirdLife International. See Figure B11 for country fragmentation by flyway.

well as utilizing stopover locations. Important to recognize grassland significance for a diverse range of shorebirds in this region.

- West Asian/East African: Some of the most critically-threatened shorebirds are in this flyway, especially threatened by human development. There are many important bird areas and wetlands.
- Black Sea Mediterranean: The Mediterranean coast in Spain, such as Doñana National Park, has coastal habitat that is very important for shorebirds.

CONCLUSION

This assessment presents a way to approach shorebird conservation in a new light, to establish protected habitat across flyway networks and create local community benefits. It builds on the strong environmental and conservation expertise to empower and work in partnership with communities, integrate their knowledge and leadership into conservation efforts, consider economic development, engage collaboratively with diverse partners such as developers, aquaculture business, government, and policymakers.

These strategies and approaches can protect critical habitat, significantly reduce key threats, and lead to empowered communities with sustainable livelihoods.

> "Shorebird conservation should be approached as an integrated problem that touches on local issues related to human and ocean wellbeing differently in many separate regions."
>
> – University of Massachusetts Amherst

APPENDIX A: DECISION TOOL DETAILS

The Decision Tool normalizes each factor on a scale of 0-10 and combines them with weights. Table A1 shows the Decision Tool's factors, weights, and sub-factors.

Table A1: Decision Tool Factors, weights, and sub-factors

	Factor	Weight	Overview	Unit/ calc	**Sub-factor details** (weight)
Geography	Flyway priority	10%	Flyway priority from survey scores	- (relative)	Scores based on survey input: • 10= East Asian Australasian (maximum) • 5=Black Sea Med (minimum)
Shorebirds	Shorebird species	15%	# of shorebird species known in IBAs by survey priority level in locations within unit	# species * location (IBAs)	Reflects survey & plans: • 50% Highest priority (5+ survey mentions) • 20% 1-4 survey mentions • 20% other plan priorities • 10% other shorebirds
Shorebirds	Shorebird breeding	10%	Breeding sites of shorebirds by priority level (extant, probably extant, or possibly extant)	Sq km area of potential breeding habitat * species using for nesting	Reflects survey & plans: • 50% Highest priority (5+ survey mentions) • 20% 1-4 survey mentions • 20% other plan priorities • 10% other shorebirds
Shorebirds	Shorebird threat	10%	Threat level of shorebirds known in IBAs	# species * location (IBAs) by threat level	Scores based on survey/ interview input: • 25% Critical • 25% Endangered • 20% Vulnerable • 20% Near threatened • 10% Least concern
Habitat	Important Bird Areas	15%	Important bird areas, prioritizing shorebirds and unprotected areas	Square kilometers	• 65% Shorebird IBAs unprotected • 20% Shorebird IBAs protected • 10% IBAs unprotected • 5% IBAs protected
Habitat	Wetlands	10%	Wetlands are priority ecosystems for shorebirds, other water important	Square kilometers	• 20% each coastal wetland or 50-100 wetland • 15% 25-50% wetland • 10% each 0-25% wetland, saline wetland, or intermittent wetland • 5% floodplain • 2% each for lake, reservoir, river, swamp, or bog
Threats	Human	15%	Human population density as representative of potential threat for development, disturbance, energy, wetland destruction, etc.	People per square km	• 10 if >10,000 people per square km • 9 if 5-10,000 • 8 if 1-5,000 • 7 for 500-1,000 • 5 for 100-500, and similar
Threats	Aquaculture threat	5%	Aquaculture threat to habitat, especially shrimp aquaculture	Tons of aquaculture	• 75% shrimp aquaculture • 25% other aquaculture
Capacity	Capacity	10%	Groups involved or interested in shorebird conservation, especially civil society and communities, plus regional capacity scores	Existing and potential capacity (with investment) by country/region # of groups	Groups from survey input. • 45% CSOs (20% existing, 15% potential, 10% known partners) • 45% communities (20%, 15%, 10%) • 10% government (5%, 3%, 2%)
Funder	Example funder priorities	0% (not including in Baseline Scenario)	Example funder priority countries (Chile, China, Indonesia, and the US), used in the Scenario "Example Funder Priorities"	- (relative)	

Figure A1 shows maps of the underlying factors. Figure A2 shows top countries by flyway. Table A2 shows scenario weightings.

FIGURE A1: DECISION TOOL FACTORS MAPPED (LARGE)

Each factor's underlying data was normalized to have a score from 0-10.

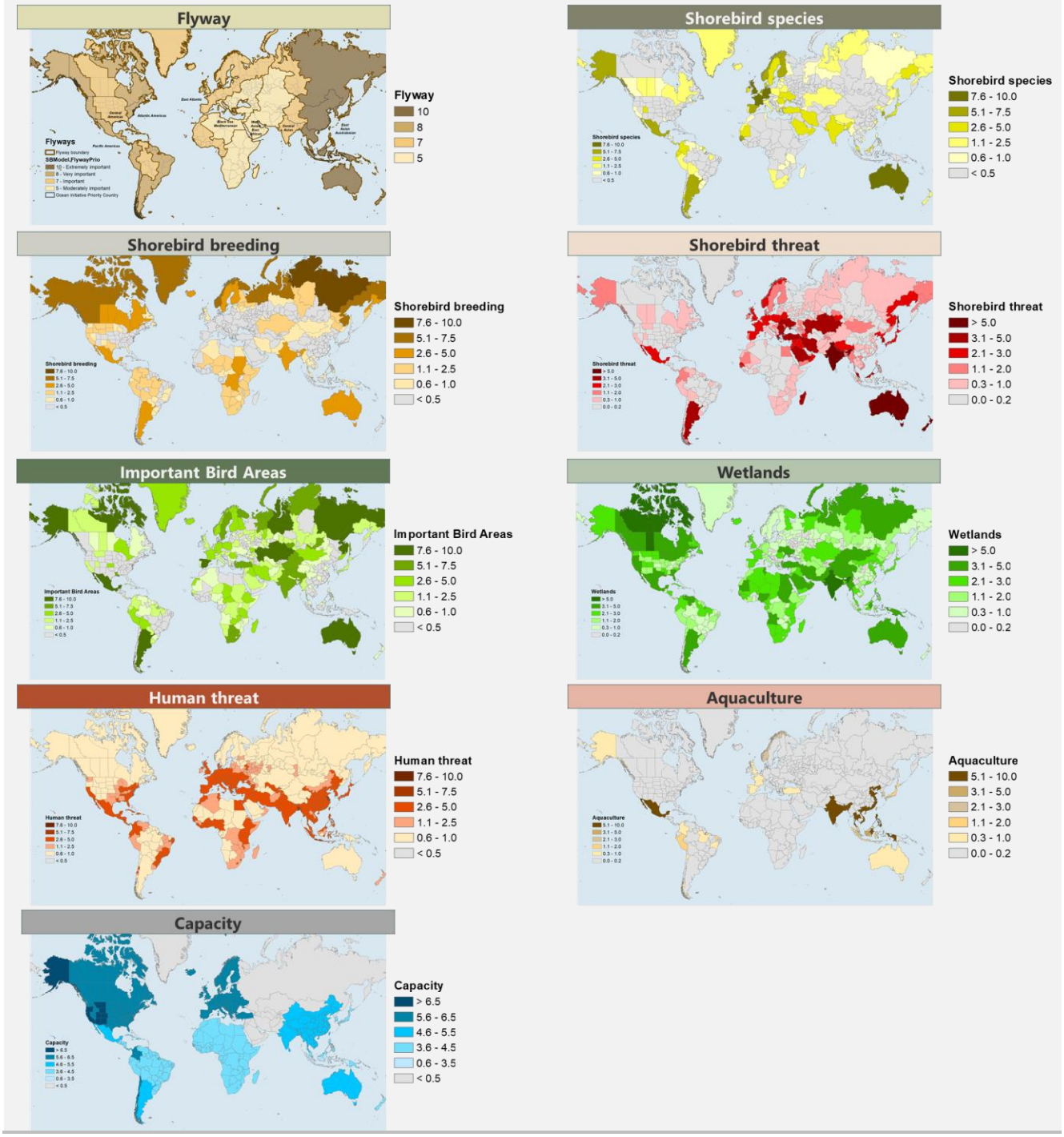


FIGURE A2: TOP COUNTRIES BY FLYWAY

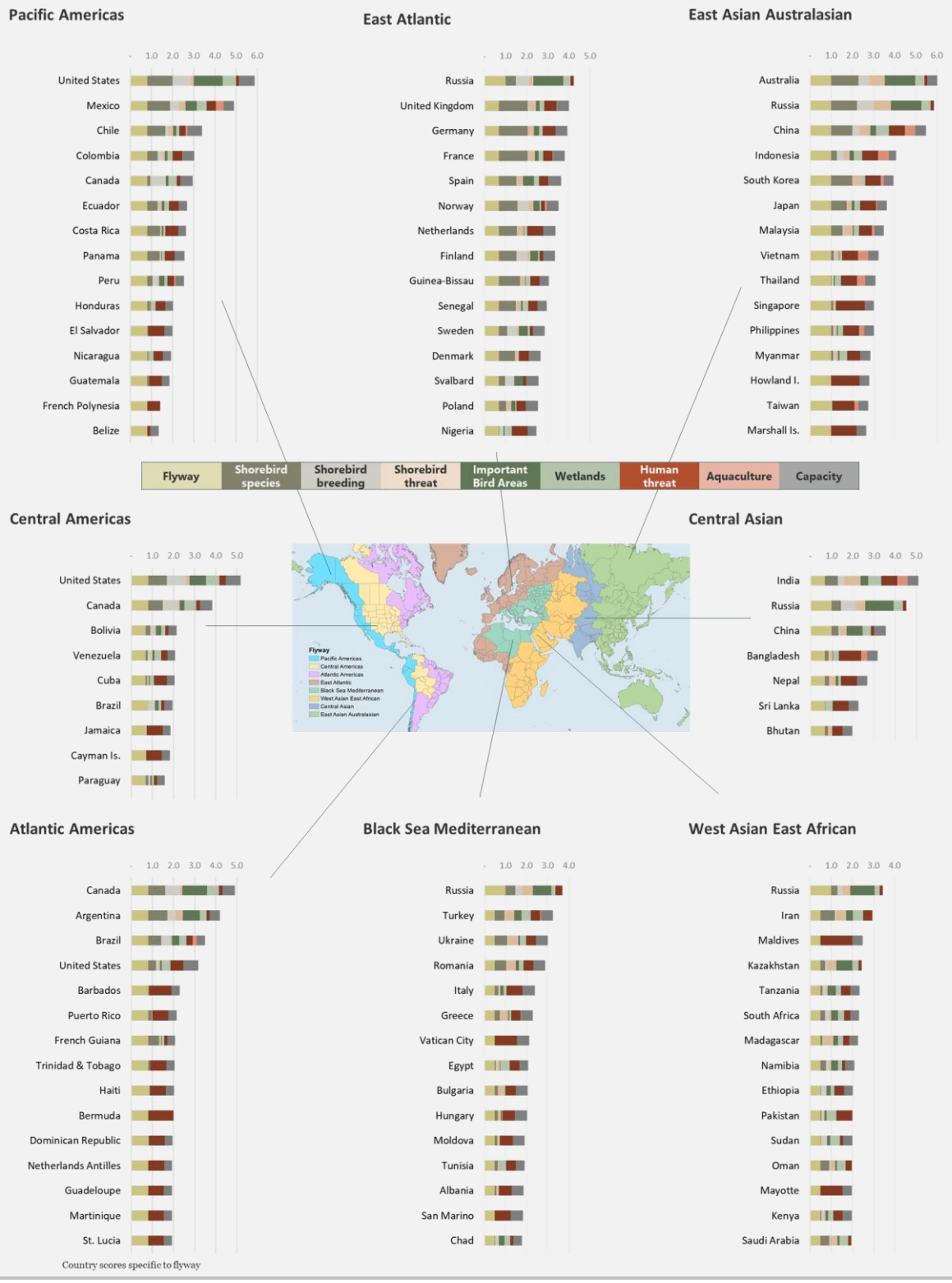


FIGURE A3: SCENARIO INPUTS

See Figure 18 for priorities by scenario.

	Geography		Shorebirds			Habitat		Threat		Capacity
Scenario name	Example Funder	Flyway	Shorebird species	Shorebird breeding	Shorebird threat	IBAs	Wetlands	Human threat	Aquaculture	Capacity
Baseline		**10%**	**15%**	**10%**	**10%**	**15%**	**10%**	**15%**	**5%**	**10%**
Fragmentation			10%	10%	20%	30%	30%			
Shorebird, habitat, capacity			30%	10%	10%	20%	10%			20%
Flyway and habitat		50%				35%	15%			
Example funder priorities	5%	10%	15%	10%	10%	15%	10%	15%	5%	5%
Shorebird species, breeding, threat			33%	33%	33%					
Shorebird only			40%	30%	30%					
Habitat only						60%	40%			
Threat only								65%	35%	
Capacity only										100%

APPENDIX B: SHOREBIRD DATA AND MAPS

Figure B1 shows Wetlands. Figure B2 shows population density. Figures B3-4 show shorebird habitat by bird threat level for all shorebirds and priority shorebirds. Figures B5-6 show nesting habitat for all shorebirds and priority shorebirds. Figures B7-8 show shorebird habitat by family for all shorebirds and priority shorebirds. Figures B9-10 show Important Bird and Biodiversity Areas for all shorebirds and priority shorebirds. Figure B11 shows flyway fragmentation by country. Figure B12 shows the number of shorebird species by threat level and bird family. Figure B13 shows the shorebird habitat for priority shorebirds by number of survey mentions. Figure B14 shows priority shorebird species with global habitat – the Red Knot, Whimbrel, Bar-tailed Gotwit, Dunlin, and Sanderling. Finally, Figure B15 shows the number of Important Bird Areas where shorebird species are found.

FIGURE B1: WETLANDS (LARGE)

Source: World Wildlife Fund Global Lakes and Wetlands Database

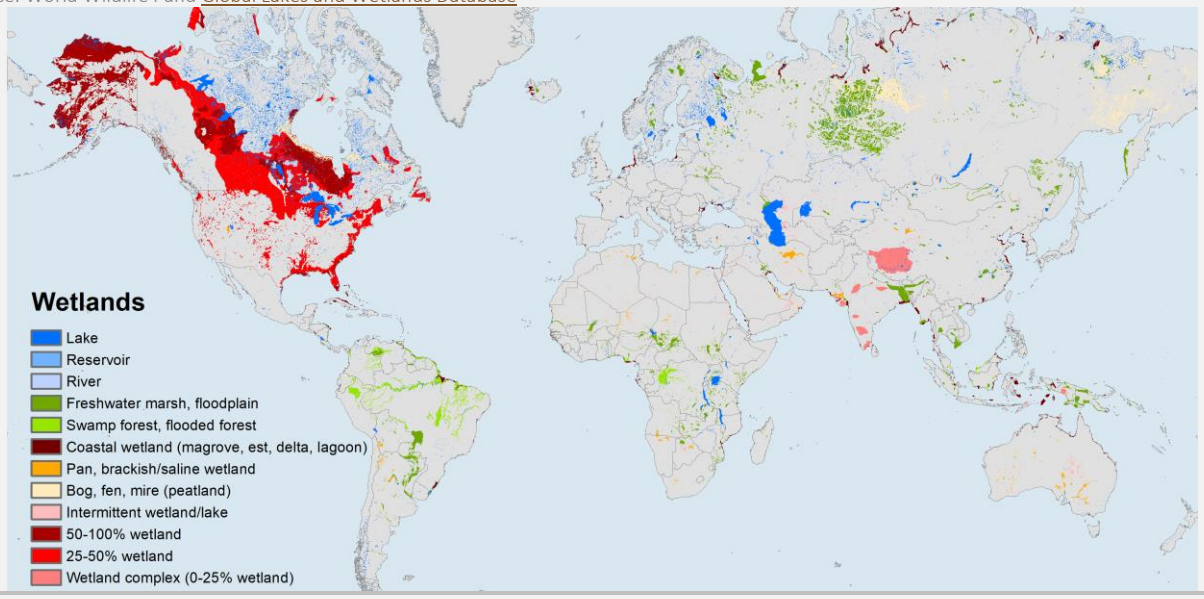


FIGURE B2: HUMAN THREAT (LARGE)

Population density used as a proxy for multiple human threats

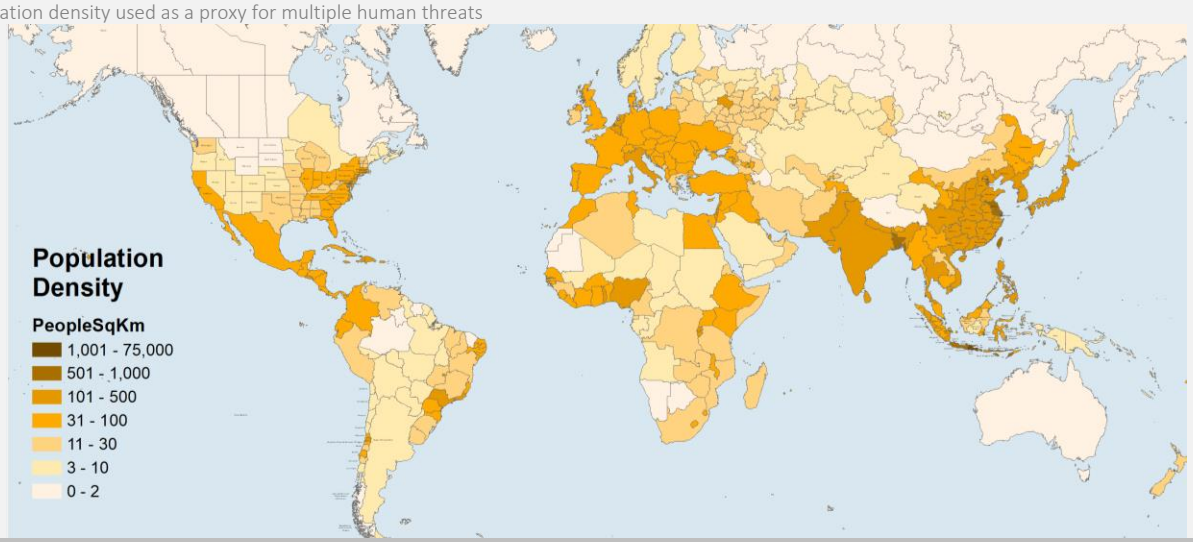


FIGURE B3: SHOREBIRD HABITAT AND THREAT LEVELS - ALL SHOREBIRDS (LARGE)

Global regions where individual shorebird species are threatened
(all habitat overlayed). Data: BirdLife International, Handbook of the Birds of the World. Version 2022.2

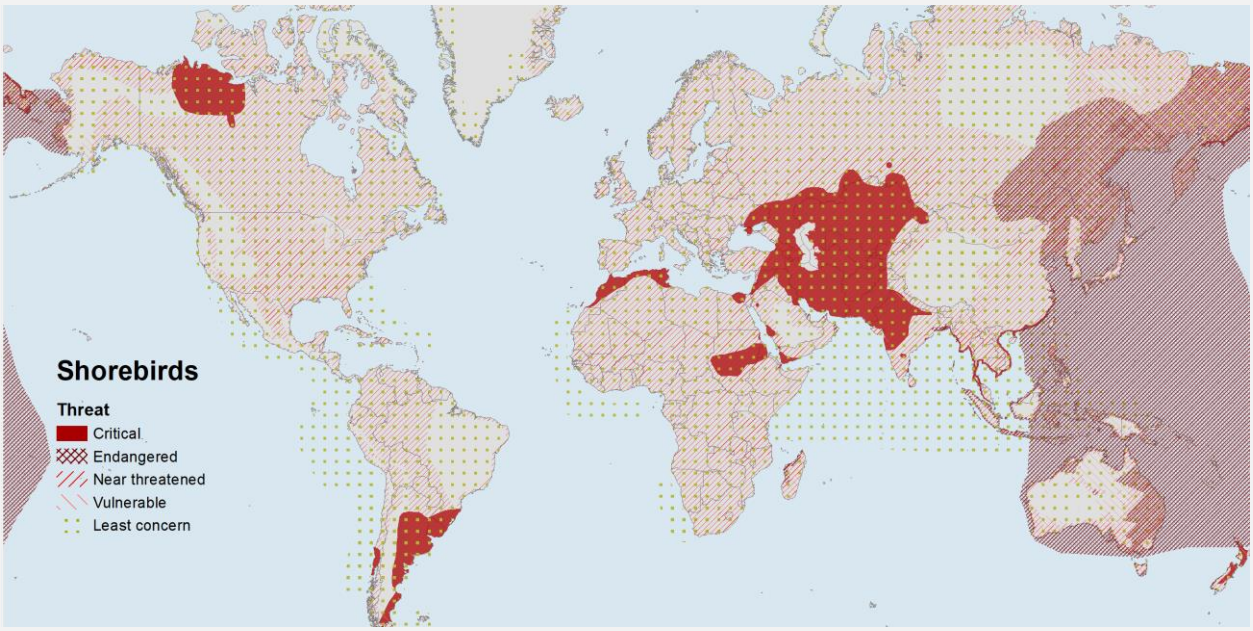


FIGURE B4: SHOREBIRD HABITAT AND THREAT LEVELS - HIGHEST PRIORITY SHOREBIRDS

Source: BirdLife International

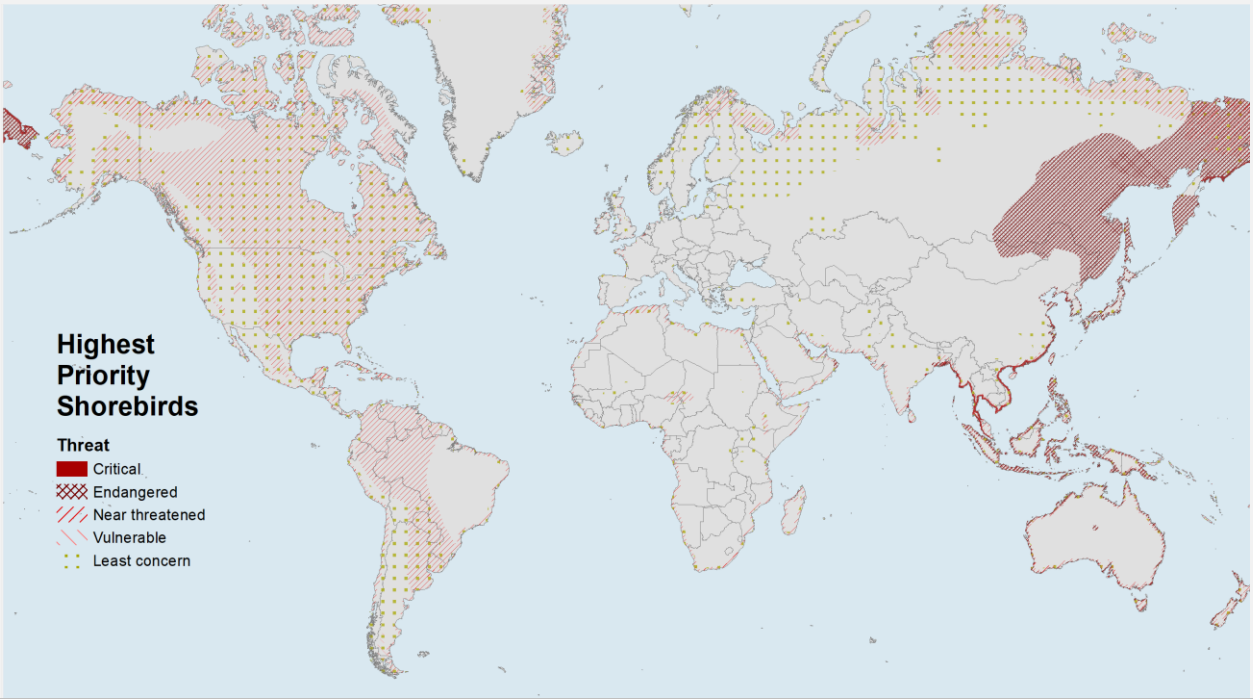


FIGURE B5: NESTING HABITAT – ALL SHOREBIRDS (LARGE)

Source: BirdLife International, Handbook of the Birds of the World (2022) Bird species distribution maps of the world. Version 2022.2

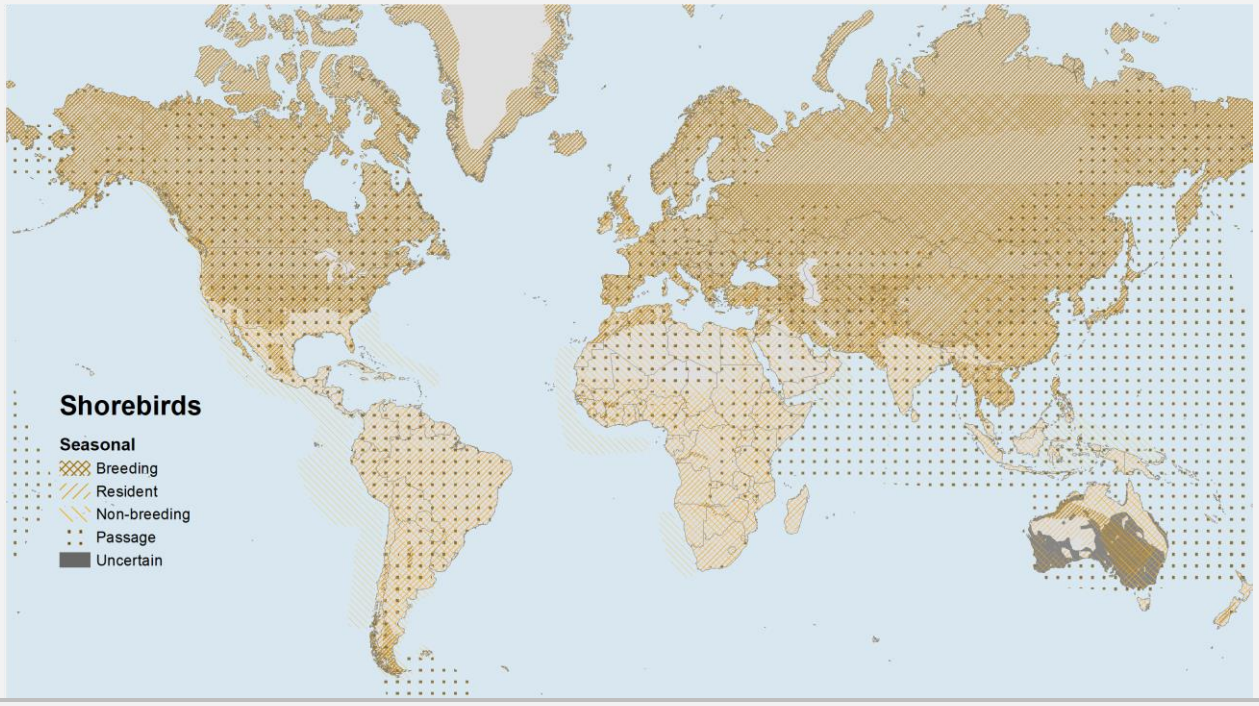


FIGURE B6: NESTING HABITAT – HIGHEST PRIORITY SHOREBIRDS (LARGE)

Highest Priority indicates 5 or more mentions from experts (see Table 1). Habitat source: BirdLife International

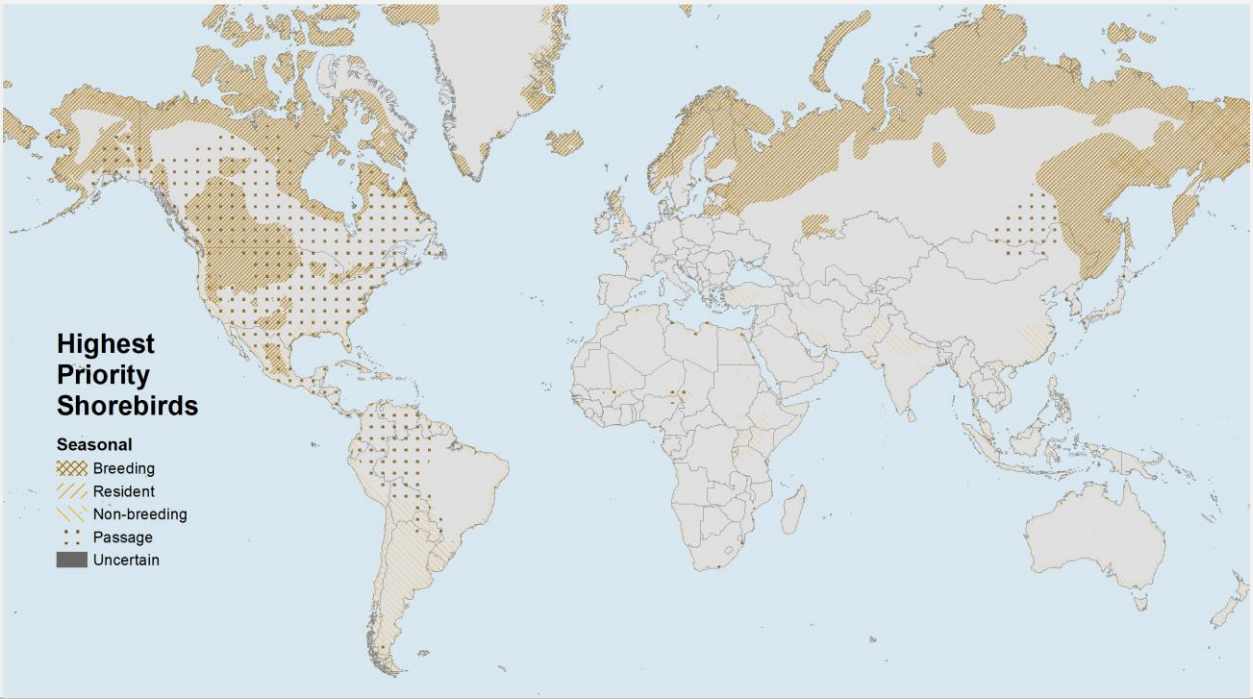


FIGURE B7: FAMILY – ALL SHOREBIRDS (LARGE)

Source: BirdLife International, Handbook of the Birds of the World (2022) Bird species distribution maps of the world. Version 2022.2

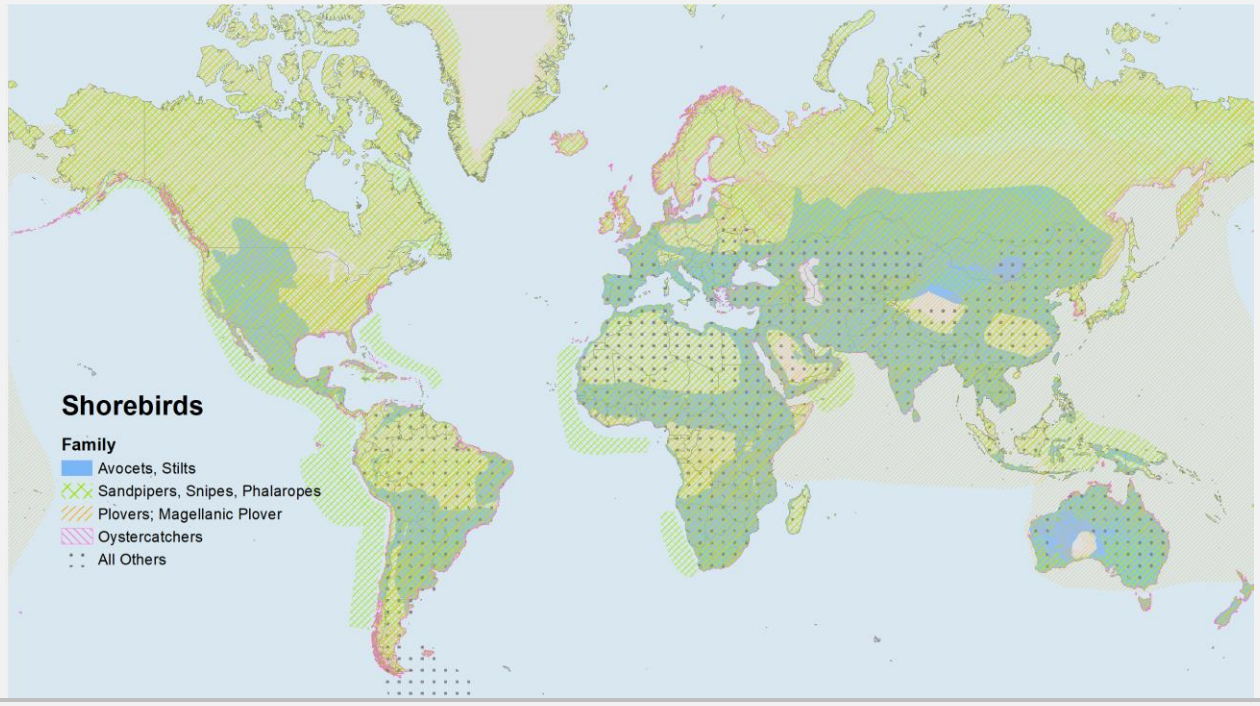


FIGURE B8: FAMILY – HIGHEST PRIORITY SHOREBIRDS (LARGE)

Highest Priority indicates 5 or more mentions from experts (see Table 1). Habitat source: BirdLife International

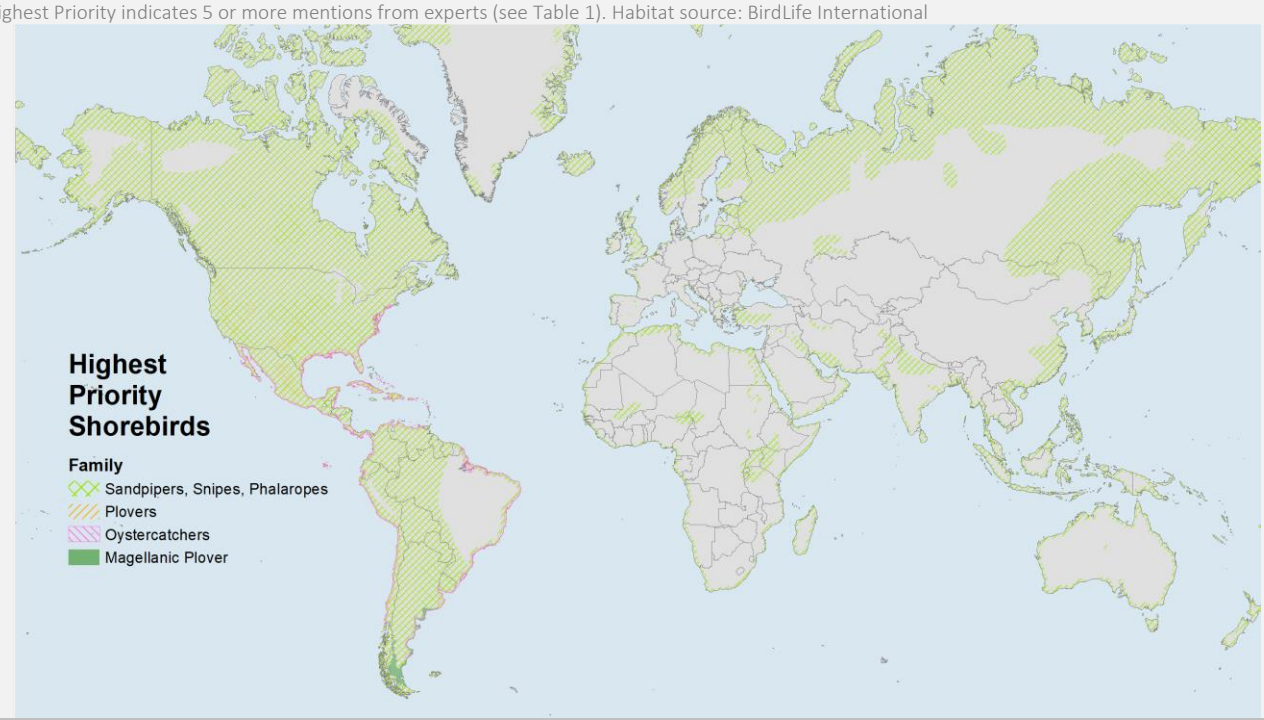


FIGURE B9: IMPORTANT BIRD AND BIODIVERSITY AREAS – ALL SHOREBIRDS (LARGE)

Source: BirdLife International, Handbook of the Birds of the World (2022) Bird species distribution maps of the world. Version 2022.2

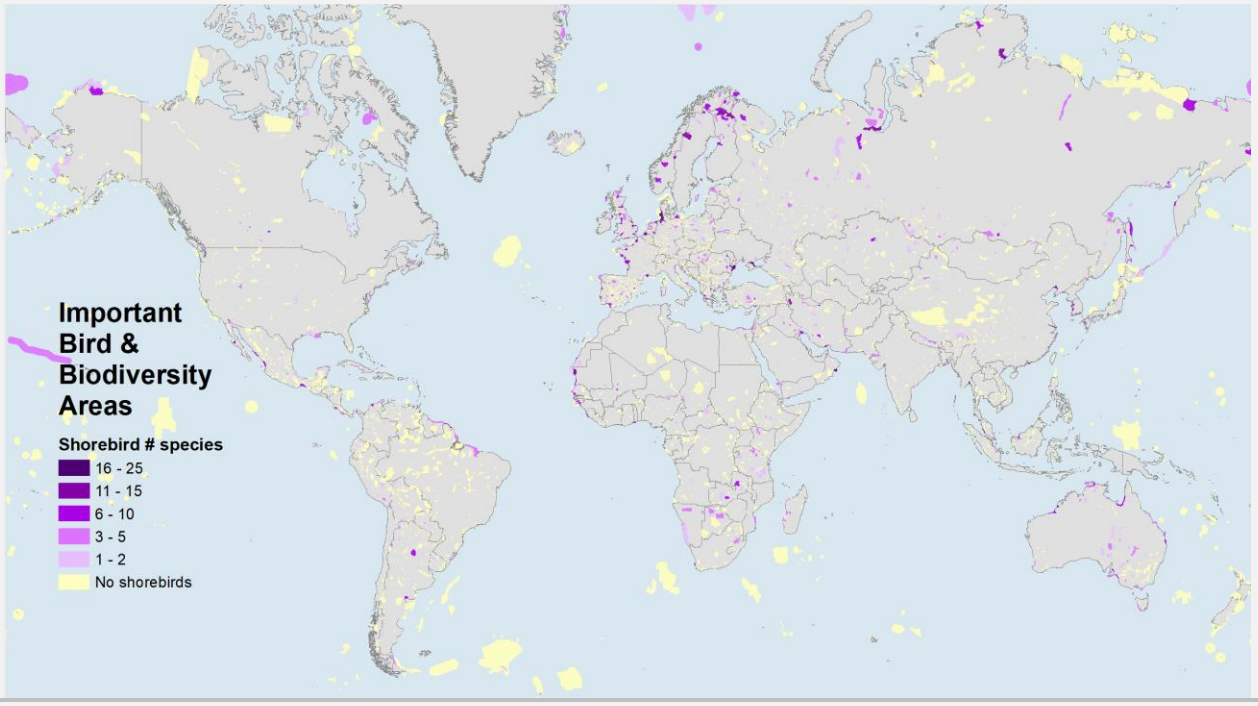


FIGURE B10: IMPORTANT BIRD AND BIODIVERSITY AREAS – HIGHEST PRIORITY SHOREBIRDS

Highest Priority indicates 5 or more mentions from experts (see Table 1). Habitat source: BirdLife International

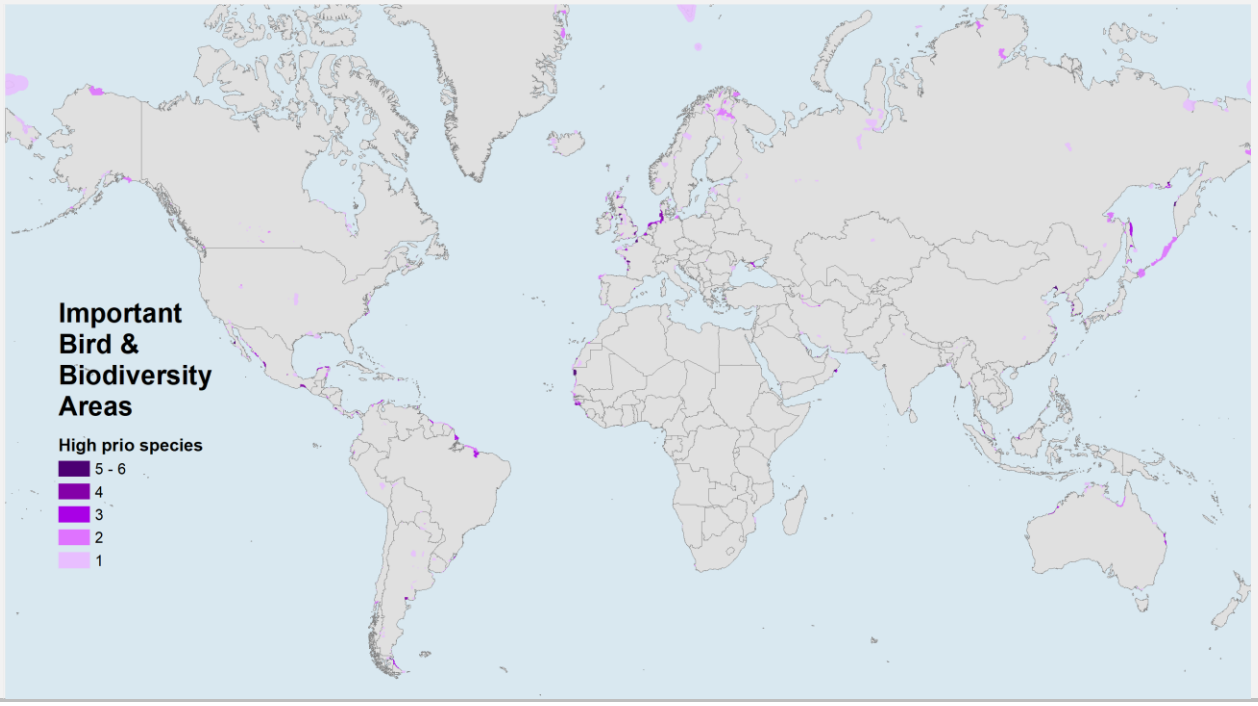


FIGURE B11: FLYWAY FRAGMENTATION BY COUNTRY

Total area (thousand square kilometers) of Important Bird and Biodiversity Areas by flyway of unprotected and protected areas (absolute and relative).
Source: Hovland Consulting analysis using input from BirdLife International

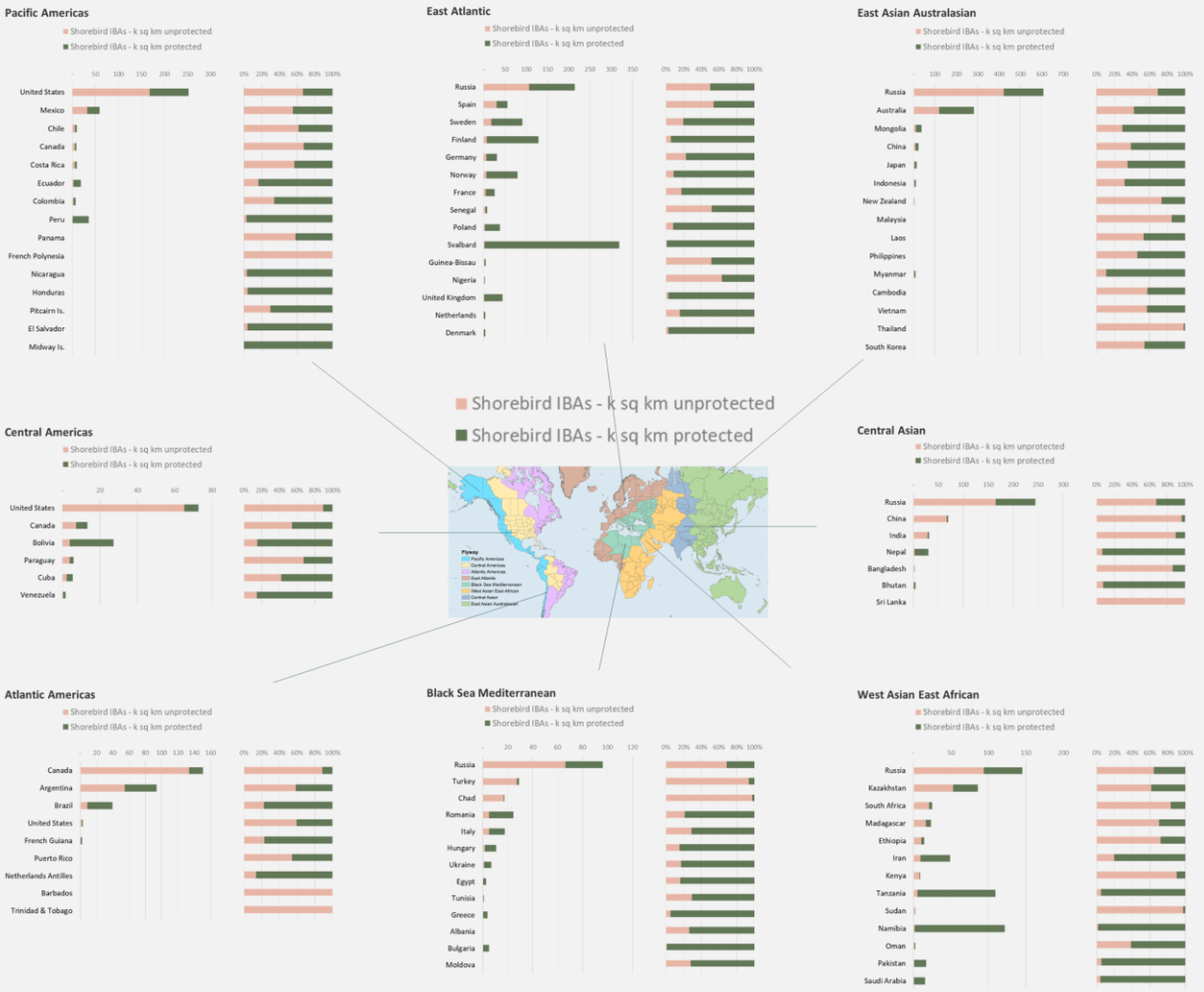


FIGURE B12: ALL SHOREBIRD SPECIES BY THREAT

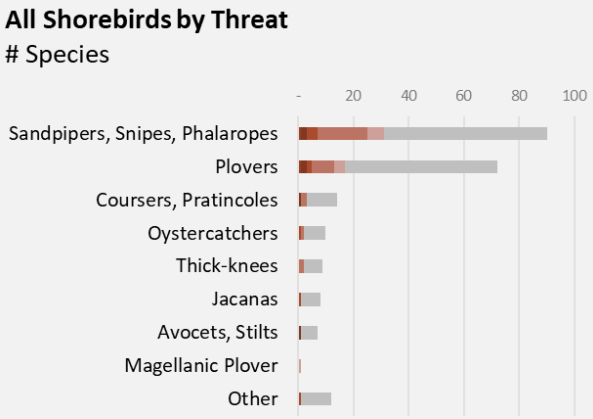


FIGURE B13: PRIORITY SHOREBIRDS HABITAT

Highest Priority indicates 5 or more mentions from experts (see Table 1). Habitat source: BirdLife International

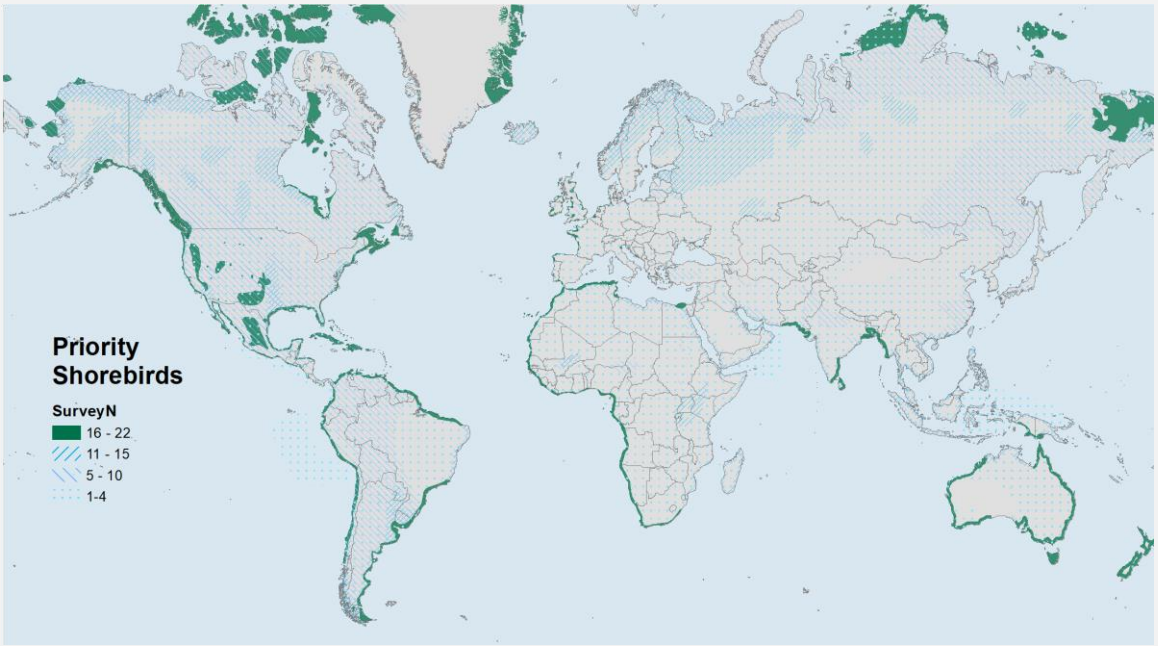
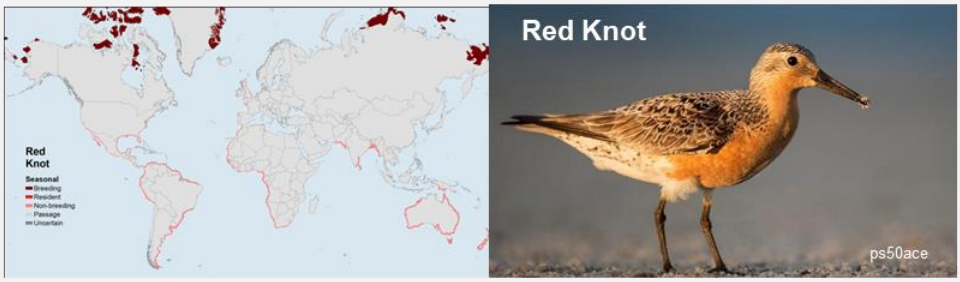
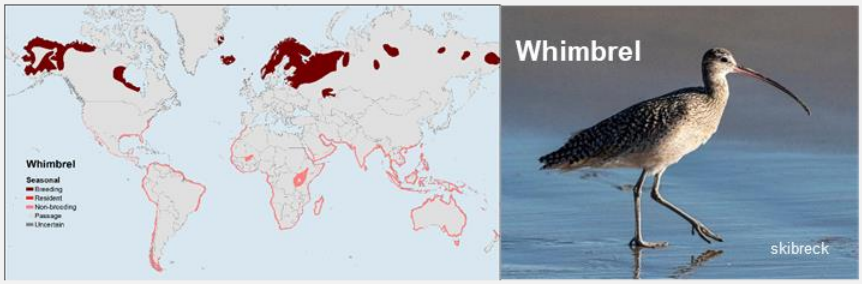
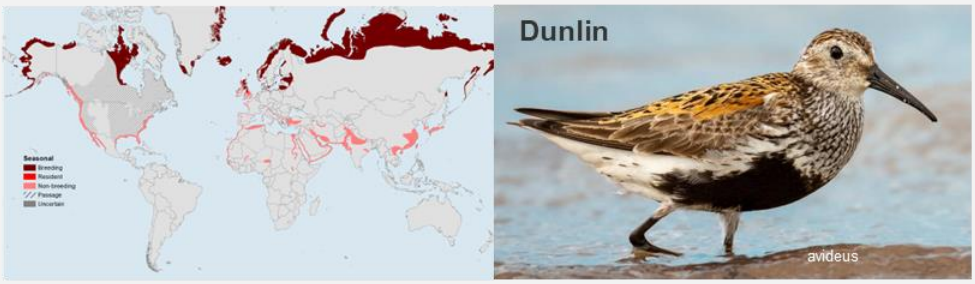


FIGURE B14: PRIORITY SHOREBIRDS WITH GLOBAL HABITAT



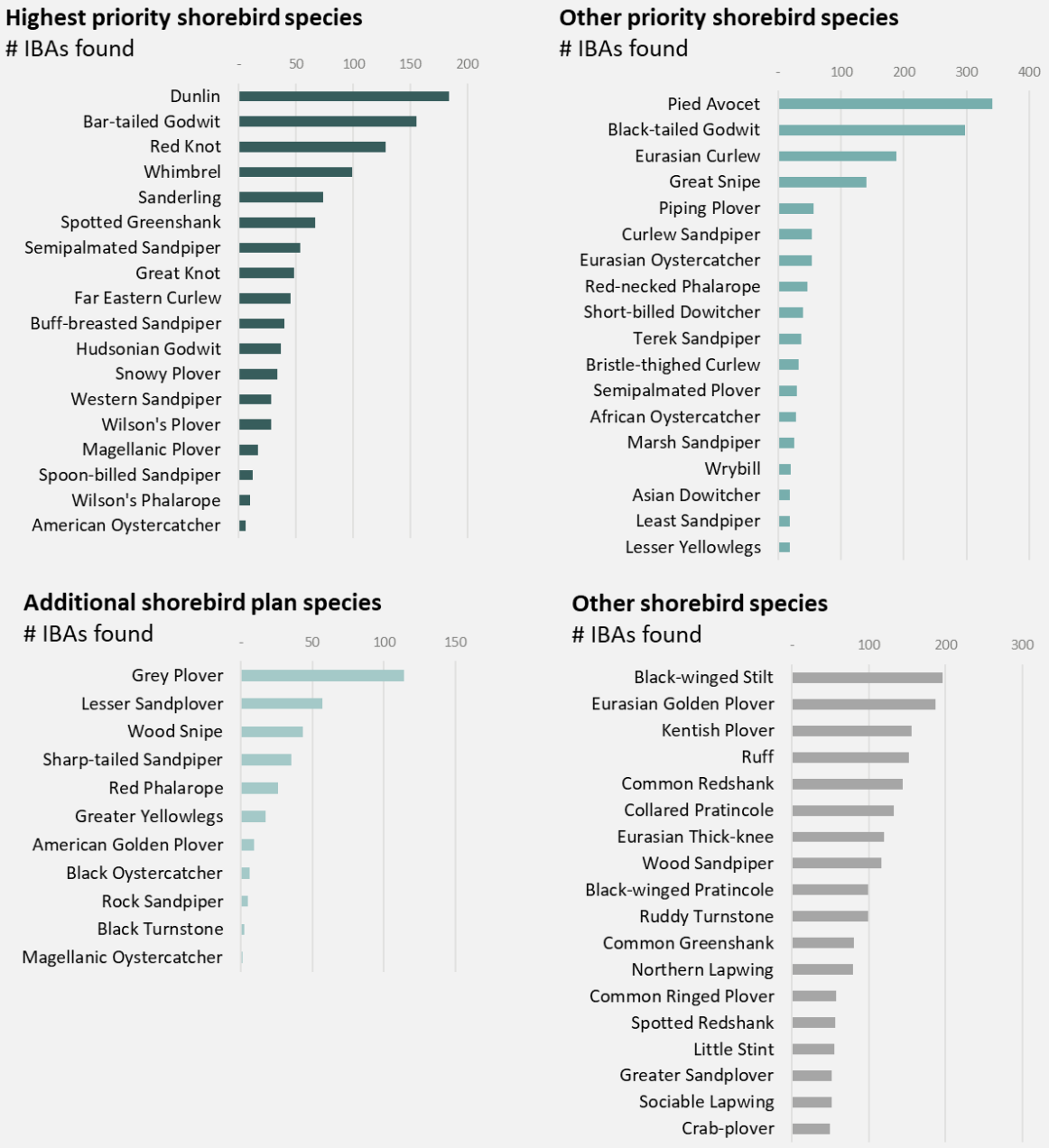




Breeding
Resident
Non-breeding
Passage
Uncertain

FIGURE B15: SHOREBIRD SPECIES FOUND IN IMPORTANT BIRD AREAS

Source: BirdLife International



APPENDIX C: SURVEY RESULTS

The survey explored outcomes, strategies, capacity, and more. The charts below show the results from 47 survey respondents (please see the Process & Acknowledgements for the full list). Respondents' underlying regions included global, Pacific Flyway (such as Argentina, Chile, Colombia, Ecuador, Mexico, Panama, United States), and Asia (such as Bangladesh, China, and Indonesia). Survey scores were weighted to represent an overall or global view and reduce regional bias. Survey respondents were 60% NGOs, 33% academic/experts, and 7% government representatives and also came from a mix of grantees (current and former Packard Foundation grantees) and others.

FIGURE C1: SHOREBIRD OUTCOMES

Survey input: 4=extremely important, 3=very important, 2=moderately important, 1=important, 0=not important. Bars standard deviation.

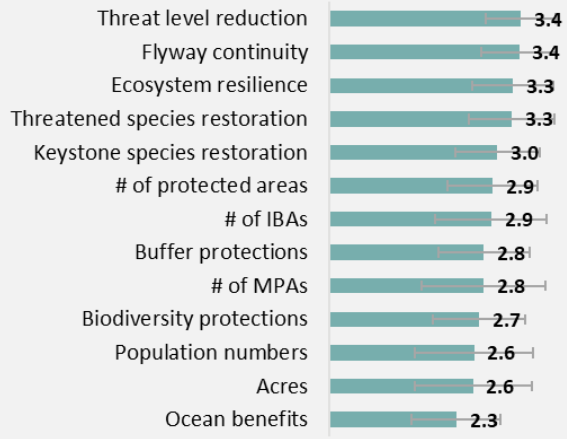


FIGURE C2: PROTECTED AREA ASPECTS

Important aspects of protected areas for shorebirds

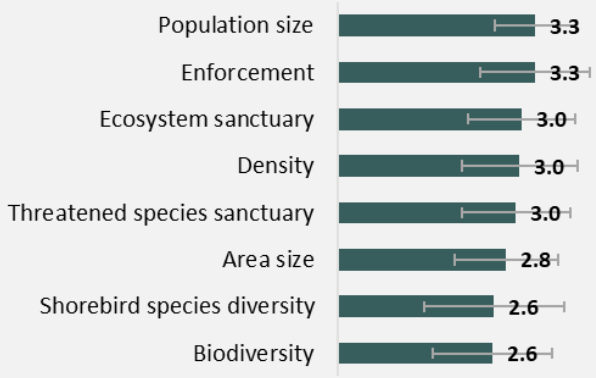


FIGURE C3: FLYWAY IMPORTANCE

Survey input: 4=extremely important, 3=very important, 2=moderately important, 1=important, 0=not important. Bars standard deviation.

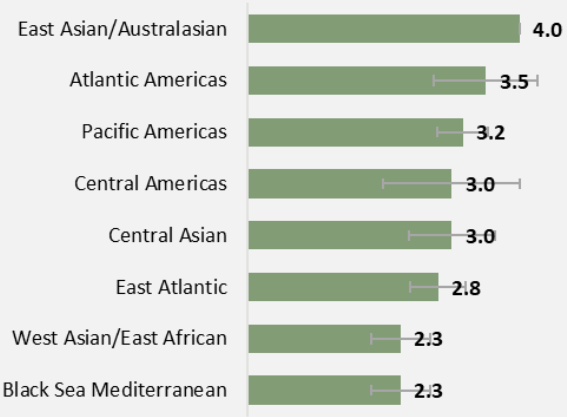


FIGURE C4: REGION IMPORTANCE

For conservation and communities

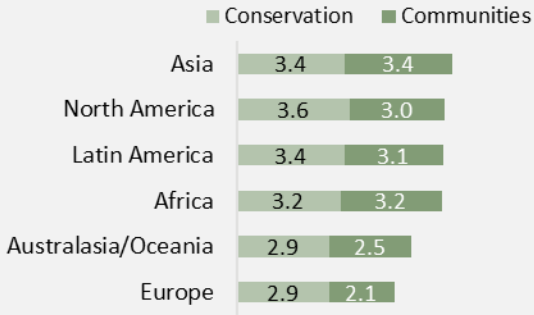


FIGURE C5: SHOREBIRD CONSERVATION STRATEGIES

Survey input: 4=extremely important, 3=very important, 2=moderately important, 1=important, 0=not important. Bars standard deviation.

FIGURE C6: COALITION BUILDING

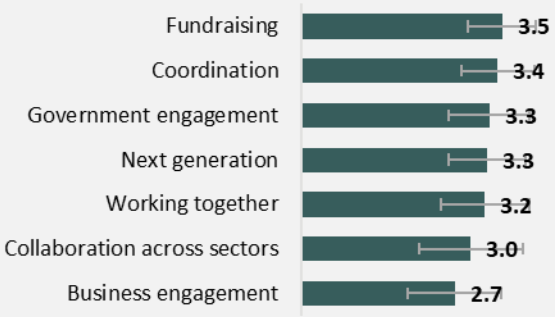


FIGURE C7: SHOREBIRD SPECIES – THREAT LEVEL

Survey input: 4=extremely important, 3=very important, 2=moderately important, 1=important, 0=not important. Bars standard deviation.

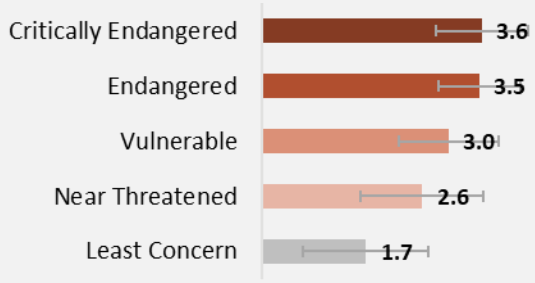


FIGURE C8: MONITORING & RESEARCH STRATEGIES

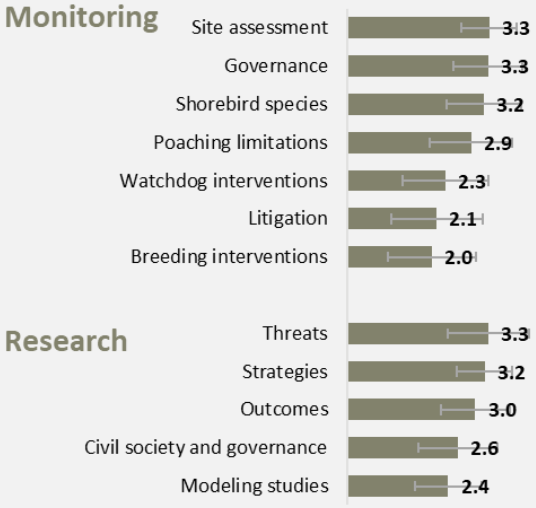
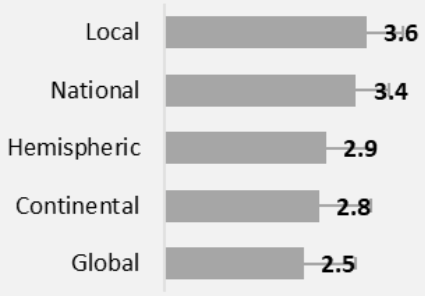


FIGURE C9: CAPACITY BY SCALE

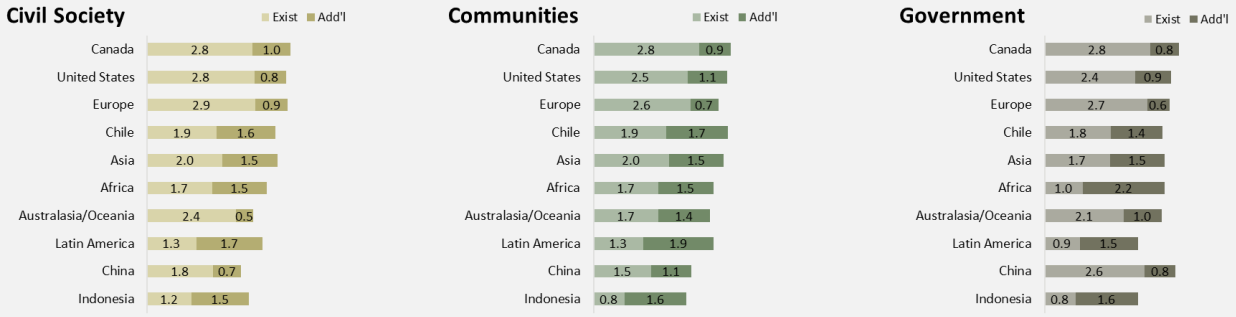
Survey input: 4=extremely strong, 3=very strong, 2=moderately strong, 1= strong, 0=not strong. Bars standard deviation.
Survey question: How important are the following levels of capacity for effective stakeholder engagement in shorebird conservation efforts, broadly reflecting civil society, community, and government capacity?



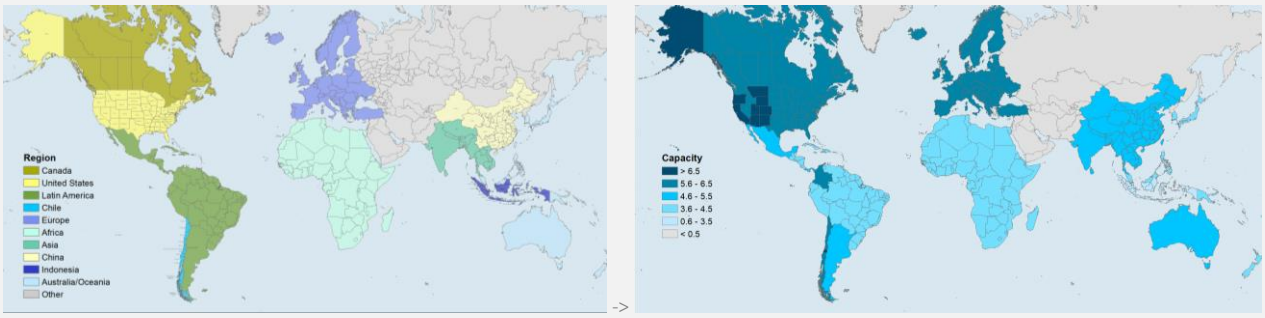
Local	Strong local leadership, legal capacity, and documenting of Indigenous knowledge. NGOs that know the local landscape and politics and can increase awareness and actions
National	Hosting trainings and workshops at conferences; Supporting Indigenous land rights, independence, and preservation at national levels; Developing national protection policies and strengthening compliance of domestic laws, such as mining operations to protect watersheds and wetlands
Hemispheric (Flyways)	Sponsoring coordinated efforts across flyways
Continental	Coordination within one continent, such as Latin America, Asia, Africa, etc.
Global	Conducting global assessments and collaborating on global advocacy action in support of communities and Indigenous rights

FIGURE C10: CAPACITY STRENGTH – EXISTING AND POTENTIAL WITH INVESTMENT

Survey input: 4=extremely strong, 3=very strong, 2=moderately strong, 1= strong, 0=not strong.
Survey question was: How strong is the capacity of Civil Society, Communities, and Governments in the specified regions for increasing shorebird conservation and related community co-benefits? Existing refers to existing capacity; Potential indicates the potential for growth given philanthropic or other investment in capacity.



Note the map is the representation of the geographies asked about in the capacity question (e.g., the survey did not ask about the Middle East, Russa, or East Asia). Additional write-in details on capacity (communities, NGOs, and governments detailed in Appendix C informed the capacity score in the right map.



ENDNOTES

[i] Columbia University and NASA Socioeconomic Data and Applications Center (SEDAC). "Sea Level Rise Impacts on Ramsar Wetlands of International Importance, v1 (2000–2010)." https://sedac.ciesin.columbia.edu/data/set/lecz-slr-impacts-ramsar-wetlands/data-download. Accessed June 2024.

[ii] International Union for Conservation of Nature. "IUCN Red List of Threatened Species." https://www.iucn.org/resources/conservation-tool/iucn-red-list-threatened-species. Accessed June 2024.

[iii] African Oystercatcher, American Avocet, Andean Avocet, Asian Dowitcher, Australian Pratincole, Baird's Sandpiper, Black Stilt, Black-banded Plover, Black-tailed Godwit, Bristle-thighed Curlew, Collared Plover, Curlew Sandpiper, Diademed Plover, Eskimo Curlew, Eurasian Curlew, Eurasian Oystercatcher, Fuegian Snipe, Great Snipe, Ibisbill, Imperial Snipe, Javan Plover, Least Sandpiper, Least Seedsnipe, Lesser Yellowlegs, Little Curlew, Long-billed Curlew, Long-billed Dowitcher, Marbled Godwit, Marsh Sandpiper, Masked Lapwing, Mountain Plover, New Guinea Woodcock, Noble Snipe, Pacific Golden Plover, Pied Avocet, Pied Lapwing, Piping Plover, Puna Plover, Red-necked Phalarope, River Lapwing, Rufous-chested Plover, Semipalmated Plover, Short-billed Dowitcher, Spotted Sandpiper, Stilt Sandpiper, Surfbird, Terek Sandpiper, Tuamotu Sandpiper, Upland Sandpiper, Willet, and Wrybill

PROCESS & ACKNOWLEDGEMENTS

This assessment was performed by Hovland Consulting for the Packard Foundation in the first half of 2024. Thanks to the following organizations for providing input:

- 11 interviewees from around the world:
  - Global: Theunis Piersma at the University of Groningen
  - US: Stan Senner – shorebird expert and retired VP for Bird Conservation, National Audubon Society – and Scott Hall at the National Fish and Wildlife Foundation
  - Pacific: Osvel Hinojosa-Huerta and Viviana Ruiz Gutierrez at Cornell University
  - Chile: Sharon Montecino and Ivo Tejeda at Red de Observadores de Aves y Vida Silvestre de Chile (ROC)
  - Indonesia: Adi Widyanto and Jihad Udin at Burung Indonesia
  - China: Lei Guan at the Society of Entrepreneurs & Ecology (SEE) and Patrick Yeung at the Mangrove Conservation Foundation

- 47 survey respondents: Audubon California, BirdEyes and the Royal Netherlands Institute for Sea Research, BirdLife International, BirdLife International y Soluciones Costeras, Burung Indonesia, California Natural Resources Agency, Centro de Estudio y Conservación del Patrimonio Natural – Cecpan, Centro de Incidencia Ambiental, Coastal Solutions Fellows Program, Cornell Lab of Ornithology, Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET-Argentina), EcoNusa Foundation, Indonesia, former US Fish and Wildlife Service - Migratory Bird Program, Fundación Inalafquen, Fundacion Refugia, Fundación TrekkingChile, H. T. Harvey & Associates, Instituto de Ciencias del Mar y Limnologia, UNAM, Mangrove Conservation Foundation, Manomet, National Audubon Society, Oikonos Ecosystem Knowledge, Pacific Birds Habitat Joint Venture, Point Blue Conservation Science, Pronatura Noroeste AC, Red de Observadores de Aves y Vida Silvestre de Chile (ROC), SEE Foundation, Sociedad Audubon de Panamá, The Nature Conservancy of California, UCSC, Conservation Action Lab, Universidad Javeriana Cali, University of Groningen, University of Massachusetts Amherst, WHSRN / Manomet, Wildlife Conservation Society Colombia, Xiamen University, plus independent researchers and retired experts
- Packard Foundation Shorebird and Ocean teams

Underlying research reviewed also including the following:

- Nine Shorebird Conservation Plans: Canada, Pacific Flyway, US, California, Atlantic Flyway, Indonesia, Chiloe Island, Chile, East Asian Australasian Flyway
- 65 research articles, topics including: Shorebirds in China, Indonesia, US, and Chile; Other regional shorebird studies (e.g., Brazil); Alternative and novel strategies; Effects of human activity, pollution, and climate change; Wetland management policies and practices; Shorebird behavior and migration patterns; Conservation strategies; Biofilm; Community engagement; Global North versus Global South inequality

Hovland Consulting LLC
www.hovlandconsulting.com
val@hovlandconsulting.com