

Adelaide International Bird Sanctuary Flyway Partnership Report



Report by The Nature Conservancy

For the:
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Executive summary

This report fulfills the requirement of an Agreement between the South Australian Department of Environment, Water and Natural Resources (DEWNR) and The Nature Conservancy to provide information and advice concerning the status of the Adelaide International Bird Sanctuary as a conservation area for migratory shorebirds and for establishing international partnerships to promote the site and further its conservation mission. The report was written by staff from the Conservancy in extensive consultation with staff from DEWNR and numerous partners and represents the current opinion of the Conservancy based on information available at the time of writing the report.

The Adelaide International Bird Sanctuary (AIBS) is a recognized site of importance for migratory and resident shorebirds, as well as numerous other species of plants and animals and natural habitats. We provide an overview of the shorebird diversity at the site as well as the context of the East Asian-Australasian Flyway (EAAF) of which it is a key component. We also provide examples of similar flyway-based conservation work in other hemispheres to provide more context and areas to look for additional conservation ideas.

The first deliverable was to review the science regarding the value of AIBS as a site on the flyway. In this analysis we focused on seven focal migratory shorebird species, while acknowledging the value of AIBS for the at least 45 other shorebird species known to have occurred in the area. Our review suggests that AIBS is well positioned to provide leadership in shorebird conservation regionally, nationally, and across the flyway. We recommend that AIBS and its collaborators build off the existing strengths of the site to promote itself and ongoing best practices. AIBS should engage other sites in the flyway to provide opportunities for shared learning. Ongoing monitoring should be continued and, ideally, be complemented with additional research on the focal species.

The second deliverable was to identify sites to potentially establish agreements with DEWNR. In this section, we present a list of important issues for AIBS to consider when establishing partnerships. We conducted a thorough analysis of existing data on shorebird counts from across the EAAF to determine sites with potentially important biological links to AIBS, based on high counts of the shared seven focal shorebird species. We also surveyed existing partnership efforts that have identified important bird or wetland conservation areas in the flyway, including the EAAF Partnership, Ramsar Convention, and Important Bird Area (Key Biodiversity Area) program, for other indications of site conservation importance or conservation potential.

We offer our set of recommendations for sites to consider for partnerships in Table 8, along with some of each sites' biological and partnership-related attributes. In our opinion, the establishing of an effective, productive, and long-lasting partner relationship requires more than the known presence of shared shorebird species. We suggest that such a relationship consider other factors such as identification of the site as important by regional or global entities, existence of an established protected area (or conservation zone), presence of a managing entity, and existence of some kind of already functioning partnership support. We believe that these additional factors plus the identification of shared shorebird species should both be used to identify potential partner sites.

In this report, we emphasize the importance of the Yellow Sea region due to its clearly demonstrated priority for shorebird conservation, particularly for the seven focal species at AIBS, and its ongoing threats to shorebird habitat. There are numerous recommended sites in the China portion of the Yellow Sea that are: (1) of high importance for shorebird conservation; (2) have been identified by one or more

of the EAAFP, Ramsar, and IBA programs; and (3) have some sort of existing partnership support from either internal or external partners. The Korea portion of the Yellow Sea also provides several viable partnership opportunities due to their identified importance for shorebirds and the presence of ongoing conservation activities and partnerships. Sites outside of the Yellow Sea region in several other countries also emerged from our analyses as potential areas for partnerships. All these non-Yellow Sea sites are worthy of partnership consideration, though the large distances between them make them more of 'one-off' opportunities, which reduces the economies of scale for visiting and maintaining a relationship.

Of particular interest to DEWNR is the opportunity for exchange of information and experiences based on the presence of indigenous involvement in either shorebird sites or shorebird conservation. Our analyses revealed, however, that this opportunity is limited. We suggest that the best opportunities lie within Australia itself, particularly in the Southeast Queensland part of Gulf of Carpentaria and at the sites of Roebuck Bay and 80 Mile Beach in Western Australia. We believe that there are strong opportunities with indigenous and local conservation groups in both areas to work with AIBS to facilitate this kind of partnership. Outside of Australia, the highest potential for working with indigenous groups is in Alaska, USA, and partners there are interested in engaging with AIBS. However, the logistics and cost of visiting these parts of Alaska are formidable and these factors should be considered.

The third deliverable was to generate an action plan for promoting and establishing the role of the AIBS in the flyway. Our recommendation is that AIBS: (1) continue engaging in the EAAF Partnership, particularly through participation in the biennial Meeting of Parties; (2) actively participate in implementation of the Australia Wildlife Conservation Plan for Migratory Shorebirds; and (3) expand as much as is feasible the research component of shorebird conservation work at AIBS, particularly in the areas of long-distance tracking and in shorebird condition monitoring. To address the specific goal of implementing or establishing a cultural/indigenous component to shorebird conservation, we suggest that AIBS could consider pioneering or establishing this component of shorebird conservation in the EAAF, rather than restricting itself to trying to find a partner site which has this interest. This would be a novel contribution of AIBS to the wider effort to conserve shorebirds across the flyway and, we feel, would be greatly appreciated by partners across the network.

Overview of the Adelaide International Bird Sanctuary

General description: Several overlapping geographic areas can and are referred to by the general description of “Adelaide International Bird Sanctuary.” These are the Adelaide International Bird Sanctuary as a designated site by the East Asian-Australasian Flyway (EAAF), the Adelaide International Bird Sanctuary National Park–Winaityinaityi Pangkara, and the Adelaide International Bird Sanctuary (AIBS) in general. Although these different conceptual areas can be somewhat interchangeable, the primary focus of this report is the area designated as the EAAF site. However, due to varying ownerships and management focus of the varying entities occurring inside the respective boundaries of each of these three areas, much of the management focus for shorebirds will apply to the National Park. Each of these three geographic areas is summarized below.

Adelaide International Bird Sanctuary EAAF Site. The boundaries of the area proposed and designated as EAAF site number 131 are shown in [Figure 1](#). The area of the EAAF designated site is approximately 37,069 ha and it encompasses parts of the east and west sides of the Gulf St Vincent, from just north of Ardrossan on the west, around the north end of the Gulf, to Torrens Island on the east. The designated area of the EAAF site does not include areas such as the Department of Defence’s Port Wakefield Proof and Experimental Range, Dry Creek Saltfields, and Barker Inlet Wetlands, even though these areas are known to provide habitat for shorebirds. The nomination of AIBS for inclusion in the EAAF Site Network was submitted in September 2016 and was declared a globally significant EAAFP site on 16 December 2016 as site #131.

Adelaide International Bird Sanctuary National Park–Winaityinaityi Pangkara. The Park currently consists of 14,633 ha and over 50 km of coastline along the east side of the Gulf St Vincent ([Figure 2](#); DEWNR 2018). The intention to create a sanctuary was declared in March 2014 by the South Australia Government. This was followed later that year by the purchase of 2,300 ha by the SA Government and the first stages of the Park were proclaimed in 2016 and 2017. The Nature Conservancy (TNC) purchased about 86 ha as an addition to the Park in 2016. The Park now includes areas of land to the low water mark, except in front of local townships, and the land that was formerly constituted as the Port Gawler Conservation Park (DEWNR 2018); it is anticipated that additional lands will be added into the park in the future.

Adelaide International Bird Sanctuary. The wider and more conceptual Adelaide International Bird Sanctuary (AIBS) spans over 60 km of coastline from Adelaide’s northern suburbs along Gulf St Vincent in the communities of St Kilda, Port Gawler, Middle Beach, Port Prime, Thompson Beach, and Port Parham (DEWNR 2018). In addition, the following classified conservation areas occur in the region, which either complement the broader AIBS concept or could be incorporated into the national park in future: Clinton Conservation Park, Torrens Island Conservation Park, Barker Inlet Aquatic Reserve, St Kilda–Chapman Creek Aquatic Reserve, Adelaide Dolphin Sanctuary, Upper Gulf St Vincent Marine Park, and Lower Yorke Peninsula Marine Park.

Overview of shorebirds. Shorebirds and shorebird habitat were the main reasons for establishing the AIBS. Shorebirds present in AIBS include both migrant and resident species; a complete list of shorebirds occurring at AIBS and related information about each are shown in [Table 1](#). A total of 52 shorebird species, including 37 migratory species, have been recorded in the AIBS area, including the former Dry Creek Saltfields. These species can be divided into four classes as follows:

Seven focal species. Seven shorebird species are the primary ones occurring at AIBS as designated by the AIBS Collective's Taskforce 1 (Protect Shorebirds); they are also the species of highest conservation priority and deserve to be the centre of attention for conservation and research. These species are: Eastern Curlew, Great Knot, Red Knot (both subspecies *piersmai* and *rogersi* are possibly present), Red-necked Stint, Curlew Sandpiper, Sharp-tailed Sandpiper, and Bar-tailed Godwit (both subspecies *menzbieri* and *baueri* are known to be present). The primary objectives for these species as specified by the AIBS Collective's Taskforce 1 are:

- i. Populations of these species at AIBS are stabilized or improved and achieve their migratory departure weight.
- ii. Shorebird and habitat monitoring programs are designed, implemented, and tested to deepen understanding about site performance.

Other long-distance migratory species: These are other migratory shorebird species that breed primarily at high northern latitudes, occur regularly at AIBS, but are not generally of such high conservation concern as the seven focal species. However, AIBS is an important site for most of these species and their needs and conservation issues need to be factored into AIBS management actions, especially to the extent that these needs differ from those of the seven focal species.

Residents and short distance migrants: These are regularly occurring shorebirds at AIBS which are either found year-round or migrate very short distances. They are: Black-winged Stilt¹, Banded Stilt, Red-capped Plover, Red-necked Avocet, and Double-banded Plover (a short-distance migrant from New Zealand).

Rare or vagrant species: These are species that occur very rarely at AIBS and are therefore generally not considered of conservation concern at the site, but tend to be of great interest to birders. Examples of these include: White-rumped Sandpiper, Hudsonian Godwit, and Lesser Yellowlegs.

Overview of biodiversity values (non-shorebird). As might be expected of such a large conservation area located along this relatively intact section of South Australia's coast, AIBS harbours other significant biodiversity exclusive of shorebirds. Although these biodiversity values are not a focus of this report, we summarize some of these values here with the understanding that they should be considered as part of the wider conservation context at the site.

Birds. Numerous species of birds occur at AIBS, including several of high conservation priority or otherwise of conservation interest. Examples include: Slender-billed (Samphire) Thornbill (Coleman et al. 2017), Little Egret, Fairy Tern, Caspian Tern, *Neophema* parrots (Orange-bellied, Blue-winged, Elegant, Rock), Yellow-tailed Black-Cockatoo, Musk Duck, Chestnut Teal, Blue-billed Duck, Freckled Duck, Australasian Shoveler, Osprey, White-bellied Sea-Eagle, Gilbert's Whistler, Hooded Robin, Brown Quail, and Painted Buttonquail. Birds of concern because of their potential negative effects on other species are Little Raven and Silver Gull, which are known predators of eggs and chicks of resident nesting shorebirds.

Mammals. Some species of mammals known to occur at AIBS are: Common Brushtail Possum, Australian Sea-lion, Bryde's Whale, Long-nosed Fur-Seal, Water-rat, Western Grey Kangaroo, Short-beaked Echidna, and Large Forest Bat.

¹ Called White-headed Stilt by some authorities, e.g., Menkhorst *et al.* (2017).

Reptiles. Thirteen species of reptile recorded at AIBS have regional conservation significance. These include two snakes (Common Death Adder, Yellow-faced Whip-snake), a large varanid (Sand Goanna), three agamids (dragon lizards), a pygopodid (Lined Wormlizard), and six scincid species, including two species of Bluetongue lizard (information obtained from AIBS' EAAFP Site Information Sheet²).

Plants. Two species of high conservation concern occur at AIBS: Bead Samphire (*Tecticornia flabelliformis*) and Osborn's Eyebright (*Euphrasia collina osbornii*). There are likely to be 650 species of native plants and possibly 230 species of exotic plants, for a total within the Bird Sanctuary of approximately 880 flora species (DEWNR 2016).

Ecological communities. Key ecological communities found at AIBS include coastal saltmarsh (including the Subtropical and Temperate Coastal Saltmarsh ecological community listed under *Environment Protection and Biodiversity Conservation Act 1999*, <http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=118>), river systems, tidal wetlands, salinas, artificial lakes, sabkhas, and mangroves.

Introduction to the East Asian-Australasian Flyway (EAAF) and other shorebird flyways

Overview of flyways. The ranges and migration pathways of migratory birds are generally grouped into flyways for management and conservation purposes. As generally defined, a flyway includes the breeding range, non-breeding (sometimes known as wintering) range, and the pathways used to get between these two, including stopover areas, for a suite of species. Although the flyway concept is a model of bird migration that masks a lot of complexity of avian migration ecology and demography, the concept is a very useful way of organizing cooperative conservation action between and within countries for stakeholders that are separated by large distances.

A variety of generally similar classifications of global flyways have been developed, including those by BirdLife International, Wings over Wetlands, the Convention on Migratory Species, and the Agreement on the Conservation of African-Eurasian Migratory Waterbirds³. All these systems agree on the existence of eight global flyways, of which Australia forms part of the East Asian-Australasian Flyway (Bamford et al. 2008, Hansen et al. 2016, Weller and Warren 2017). Perhaps of utmost importance when discussing flyways is the concept of full life-cycle conservation: the success of conservation work at any single site also depends upon the success of work done at additional sites in the network.

² http://www.eaaflyway.net/wordpress/new/theflyway/flywaysitenetwork/EAAF131_SIS_Adelaide-International-Bird-Sanctuary.pdf

³ References for flyway designations:

Wings over Wetlands: <http://www.wetlands.org/ABOUTWOW/tabid/118/language/en-US/Default.aspx>

AEWA: <http://www.unep-aewa.org/en/legalinstrument/aewa>

CMS: <http://www.cms.int/en/legalinstrument/central-asian-flyway>

BirdLife: <http://www.birdlife.org/worldwide/programme-additional-info/migratory-birds-and-flyways>

Introduction to the EAAF and existing threats. Australia is part of the EAAF and, for most shorebird species occurring within it, forms the southern, wintering, or terminal part of the flyway. The EAAF (map at right from Bamford et al. 2008) is arguably one of the most significant global flyways, based on number of species, individual birds, and species of conservation priority using it. As stated by MacKinnon et al. (2012): “A higher number and proportion of waterbirds are globally threatened in the EAAF than in any of the other seven major flyways of the world.” MacKinnon et al. (2012) estimate that 21% of the intertidal species are globally threatened or near threatened in the EAAF, compared with 16% of waterbird species in Europe, central Asia, Africa, and the Middle East and 9% in the Americas (Figure 3).



Much of the concern about the conservation status of birds in the EAAF is attributable to the high dependency of many migratory shorebirds on the Yellow Sea region of East Asia (Studds et al. 2017), which is suffering from very high rates of intertidal habitat loss and degradation. This dependency has been known since the early 2000’s and the importance of the Yellow Sea region has been pointed out in numerous published papers (e.g., Barter 2002, MacKinnon et al. 2012, Murray and Fuller 2015, Melville et al. 2016, Szabo et al. 2016, Studds et al. 2017, Weller and Warner 2017). As stated by Studds et al. (2017): “Seven⁴ of the taxa declined at rates of up to 8% per year. Taxa with the greatest reliance on the Yellow Sea as a stopover site showed the greatest declines, whereas those that stop primarily in other regions had slowly declining or stable populations. Decline rate was unaffected by shared evolutionary history among taxa and was not predicted by migration distance, breeding range size, non-breeding location, generation time or body size. These results suggest that changes in stopover habitat can severely limit migratory populations.” These important results are shown in Figure 4.

The overall vulnerability of the EAAF is further illustrated by the observations of MacKinnon et al. (2012): “Observed rates of declines of waterbird⁵ species of 5–9% per year ... are among the highest of any ecological system on the planet. Breeding success among migrating species in their Arctic breeding grounds and survival on most wintering grounds (for northern breeding species) at the southern end of their migrations appears satisfactory, at least where hunting is sustainable. However, problems clearly are occurring along the EAAF during migration. Unless major steps are taken to reverse current trends, the EAAF is likely to experience extinctions and associated collapses of essential and valuable ecological services in the near future.”

The EAAF Partnership has approved a single species action plan for one of the focal shorebird species at AIBS: Eastern Curlew. This plan⁶, approved in 2017, has the goal of returning the Curlew to a positive population growth rate for at least three generations with the following actions:

1. Identify, protect and manage remaining sites used by the species during its annual cycle.
2. Reduce or eliminate illegal harvesting and incidental bycatch.

⁴ Bar-tailed Godwit (subspecies *menzbieri* and *baueri*), Eastern Curlew, Curlew Sandpiper, Great Knot, Red Knot, and Lesser Sand Plover.

⁵ This appears to mean shorebirds, gulls, and terns, though the emphasis in the report is on shorebirds. Some of the shorebirds in the flyway do not occur in Australia (e.g., Spoon-billed Sandpiper).

⁶ Available at: <http://www.eaaflyway.net/our-activities/task-forces/far-eastern-curlew/>

3. Robustly monitor the species' population trend.
4. Determine key demographic parameters to support population modelling.
5. Constitute a Far Eastern Curlew Task Force and keep it functioning until the goal is achieved.

Summary of other flyways and flyway conservation efforts relevant to AIBS. Conservation efforts in other flyways around the globe can offer some valuable insights and lessons for the conservation of long-distance migratory shorebirds. In this section, some examples of shorebird conservation projects in other geographic areas are highlighted that might have ideas for AIBS to emulate in the future.

Atlantic Flyway Shorebird Initiative.⁷ This Initiative is a major effort to conserve shorebird populations in the Atlantic Americas flyway, covering a large geographic area including eastern North, Central, and South America and the Caribbean. Although largely led by the U.S. Fish and Wildlife Service (the lead federal agency in the USA for migratory bird conservation), the effort has grown to include agencies, NGOs, and universities from throughout the flyway. It began in 2007 as a planning effort focused on a single species (American Oystercatcher) and culminated in 2015 as a full-fledged business plan that includes all conservation strategies and actions needed to conserve a total of 15 shorebird species⁸. Key aspects of this Initiative include the identification of a quantitative goal (increase focal shorebird populations 10% by 2025), development of a ten-year budget with estimated funding needs (US\$90.38 million over ten years), identification of four primary threats and five strategies to address them, specification of seven risks to success (regulatory, financial, environmental, economic, scientific, social, institutional), and the development of a monitoring and evaluation plan. Another important component of this Initiative is the commitment of the National Fish and Wildlife Foundation to providing substantial funding toward implementing strategies identified in the Initiative.

Pacific Americas Shorebird Conservation Strategy. The Strategy focuses primarily on the Pacific coasts of North, Central and South America and spans 120 degrees of latitude from northeastern Russia and northwestern USA to southern Chile (Senner et al. 2016). The project area is subdivided into four focal geographic regions (Arctic/subarctic, North-temperate, Neotropical, South-temperate) that share broad habitat characteristics and similar conservation challenges and opportunities. Together, these regions encompass the suite of habitats used by populations of 21 target shorebird species⁹ during their annual cycles along the Pacific coast of the Western Hemisphere. They were chosen as conservation targets because they are representative of specific habitats in the Flyway, populations of conservation concern or endemic to the Flyway.

The following key strategies were identified as those likely to be most effective based on their ability to restore or reduce stress on targets, change human behavior to reduce threats, or create conditions for conservation actions to succeed and reduce threats: Manage and Conserve Existing Habitats, Cultivate and Empower Conservation Constituencies, Create Conservation Initiatives with Natural Resource Industries, Strengthen Compliance and Enforcement, Develop Environmental and Wildlife Protection

⁷ <http://atlanticflywayshorebirds.org/>

⁸ American Golden-Plover, American Oystercatcher, Greater Yellowlegs, Lesser Yellowlegs, Marbled Godwit, Piping Plover, Purple Sandpiper, Red Knot, Red-necked Phalarope, Ruddy Turnstone, Sanderling, Semipalmated Sandpiper, Snowy Plover, Whimbrel, and Wilson's Plover.

⁹ American Oystercatcher, Black Oystercatcher, Blackish Oystercatcher, Magellanic Oystercatcher, Snowy Plover, Wilson's Plover, Rufous-chested Dotterel, Whimbrel, Long-billed Curlew, Hudsonian Godwit, Marbled Godwit, Black Turnstone, Red Knot, Surfbird, Sanderling, Dunlin, Rock Sandpiper, Semipalmated Sandpiper, Western Sandpiper, Short-billed Dowitcher, and Willet.

Policies, Improve Knowledge of Present and Future Habitats, and Increase Partner and Stakeholder Capacity. Unlike the Atlantic Initiative, this Strategy does not identify a specific goal for either individual species or populations, does not have even an estimated budget for the cost of implementing the strategies, nor is there funding specifically identified to support the effort.

Agreement on the Conservation of African-Eurasian Migratory Waterbirds. “The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago. Developed under the framework of the Convention on Migratory Species (CMS) and administered by the United Nations Environment Programme (UNEP), AEWA brings together countries and the wider international conservation community in an effort to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.”¹⁰ AEWA has developed several species action plans for shorebirds that contain elements of potential value to shorebird conservation at AIBS. We highlight here some of the available action plans that have some lessons for AIBS.

- International Single Species Action Plan for the Conservation of the Eurasian Curlew (*Numenius arquata arquata*, *N. a. orientalis* and *N. a. suschkini*; Brown 2015).
 - a. The long-term goal of this plan is to restore the AEWA populations of the Eurasian Curlew to favourable conservation status, as demonstrated by its assessment as Least Concern against IUCN Red List criteria.
 - b. The purpose (i.e., over the next ten years) of this plan is to conserve important breeding and non-breeding habitats, increase breeding success, maximise juvenile and adult survival, and address key knowledge gaps.
 - c. The plan sets the following four objectives: ensure sufficient and adequate habitats, increase productivity, increase survival rates, and fill key knowledge gaps.
- International Single Species Action Plan for the Conservation of the Sociable Lapwing (*Vanellus gregarious*; Sheldon et al. 2012).
 - a. Goal: To restore the Sociable Lapwing (Plover) to a favourable conservation status and remove it from the threatened categories of the IUCN Red List, CMS Annex I, and Column A of the AEWA Table 1.
 - b. Objective: to reverse the recent negative population trend leading to a population increase in the range of 8,000 - 10,000 breeding pairs by 2022. Strategies:
 - i. Baseline annual survival rate identified and increased by 2022.
 - ii. Reproductive success is maximised through maintained nest survival rates higher than 35% (5-year rolling mean) and overall productivity higher than 0.75 fledged chicks per female (5-year rolling mean).
 - iii. All key sites along the flyways are protected and adequately managed.
 - iv. All identified knowledge gaps are filled by 2022.
 - v. International cooperation is maximised through the full engagement of all principal range states in the framework of the Single Species Action Plan and AEWA.
- International Single Species Action Plan for the Conservation of Black-tailed Godwit (*Limosa l. limosa* & *L. l. islandica*; Jensen et al. 2008).

¹⁰ From <http://www.unep-aewa.org/>

- a. The goal of this plan is to restore Least Concern status on the IUCN Red List. The short term objective is to halt the current decline and contraction of distribution while the long-term objective is to restore all Western Palaearctic populations to a favourable conservation status. In addition, the plan aims at maintaining the favourable status of the *islandica* population.
- b. The conservation priorities are:
 - i. The prevention of further breeding habitat loss and degradation, and restoration of breeding habitats.
 - ii. The reduction of chick-mortality and nest destruction where Black-tailed Godwits breed in intensively managed farmland.
 - iii. The provision of adequate support for and the protection and management of important Black-tailed Godwit staging and wintering areas.
 - iv. The guarantee of legal protection of Black-tailed Godwits in all range states.
 - v. The stopping of hunting in spring (high priority) and other hunting and the elimination of illegal hunting.
 - vi. Improvement of the understanding of the distribution and trend of the eastern breeding populations.
 - vii. Improvement of the understanding of the migration and wintering areas of the eastern populations.

Deliverable 1: Review of the science regarding the value of AIBS as a site on the flyway

Contextual assessment of AIBS relative to other important shorebird sites. In this section, we provide some background information to provide a context for AIBS' role (or potential role) in conserving migratory shorebirds. The regional importance of AIBS is confirmed by Purnell et al. (2015) who suggested: "Gulf St Vincent is considered the second-most important [to The Coorong, Lake Alexandrina & Lake Albert, EAAFP #016] shorebird area in South Australia due to its abundance and diversity of species of shorebirds." However, Clemens et al. (2016) found that: "In southern Australia since 1996, populations of 14 of 19 migratory shorebird species¹¹ decreased significantly, whereas in northern Australia only five of 19 migratory shorebird species decreased and three increased significantly" and "The areas that appear to be losing large numbers of multiple shorebird species most rapidly were [in order]: the Mackay area, Queensland; Richmond River Estuary, New South Wales; Gulf of St Vincent, South Australia...". These authors also report that four of seven resident shorebird species are significantly decreasing (Red-kneed Dotterel, Black-fronted Dotterel, Black-winged Stilt, Red-necked Avocet) and only two of seven are significantly increasing (Sooty Oystercatcher, Australian Pied Oystercatcher). Clemens et al. (2016), Table 2 has species-level trend information for both northern (North of 27.8°S latitude) and southern (South of 27.8°S latitude) Australia.

For this report, we conducted an additional analysis to assess the relative status of AIBS among other country-wide shorebird sites. We compiled a list of all sites from Australia and New Zealand in Bamford et al. (2008) which contained greater than or equal to the 1% threshold of the population estimate for the flyway for one or more of the seven focal species (Eastern Curlew, Great Knot, Red Knot, Red-necked Stint, Curlew Sandpiper, Sharp-tailed Sandpiper, Bar-tailed Godwit). For each site, we extracted the site-specific maximum count for each of these species contained in Bamford et al. (2008). Since these data were based on published and unpublished sources from approximately 1986 to the mid-2000s; we updated the counts with more recent count data available in Conklin et al. (2014) and Sagar et al. (1999) for the same site. For each site in the resulting site database, we calculated a normalized abundance for each of the seven focal species at each site by dividing the count at a site by the largest count for a given species across all sites. The normalized abundances were then added across species to compute a site 'importance' score, ranging from zero (if a site had none of the species) to a theoretical maximum of seven (if a site had the highest count for all seven species). In this methodology, a higher score can be considered as a more "important" site for hosting several of the focal species. The results are shown in [Table 2](#).

Although most available data for the AIBS region is available at the sub-site scale (i.e., from specific sub-areas such as Thompson Beach or Port Prime), some aggregated data for the larger Gulf St Vincent region is available in Purnell et al. (2017). Using the above methodology, Gulf St Vincent, of which AIBS comprises a significant part, ranks highly among the Australia/New Zealand sites ([Table 2](#); it would rank between 20 and 21 out of 100 sites analyzed). This analysis verifies the relative importance of AIBS as a shorebird site itself and its comparative status to other shorebird sites in Australia/New Zealand.

Overview and assessment of key aspects of management and conservation at AIBS. The AIBS has a large geographic extent comprised of a variety of land uses, land owners, political subdivisions, and existing and planned conservation tenures ([Figure 2](#)).

¹¹ Black-tailed Godwit, Lesser Sand Plover, Terek Sandpiper, Red-necked Stint, Eastern Curlew, Ruddy Turnstone, Curlew Sandpiper, Marsh Sandpiper, Great Knot, Grey Plover, Greater Sand Plover, Common Greenshank, Red Knot, Sanderling

Land protection (includes acquisition, covenants, restoration). The area formally designated as National Park encompasses 14,633 ha with the potential for the incorporation of additional lands (DEWNR 2018). Additional protection efforts have occurred, such as the recent assisted acquisition of 86 ha by The Nature Conservancy. The area is a formally designated protected area by the South Australian Government. Of particular importance is the future of the Dry Creek Saltfields, which have consistently supported the largest numbers of many AIBS shorebird species in the past. The Saltfields were considered an important part of the early planning for the AIBS, however their exact future status is still under evaluation (DEWNR 2013). Purnell et al. (2015) consider the “artificial wetlands of the Dry Creek Saltfields support the greatest abundance of shorebirds in the region (15,000 on average) and add resilience to the regional population that is irreplaceable. Informed adaptive management of these habitats will be required to maintain shorebird populations now that salt production has ceased.” Purnell et al. (2015) also have a good discussion of the Saltfields and the possibilities for what should be done there. For the purpose of the assessment in this report, the Saltfields are a critical part of the assessment of the significance of the AIBS.

Management/Stewardship. The overall goals for management at the Adelaide International Bird Sanctuary National Park–Winaityinaityi Pangkara (DEWNR 2018) are “to minimise disturbance to the natural ecological processes that support life in the park, to protect natural and cultural values, to improve the integrity of important ecological communities and to enable people to enjoy the park and share in its Kaurna culture.” Management at the Park will incorporate the best available and up-to-date science and management practices, complemented with Kaurna traditional knowledge. More detailed management specifications will be provided by operational plans in the areas of visitor facility development, fire management, pest plant and animal control, interpretation, and other activities.

The primary management issues to be addressed at the Park are as follows (DEWNR 2018):

1. Conserve shorebirds and their habitat to stabilize and possibly increase numbers of shorebirds (migratory and resident) using the Park.
2. Advance Kaurna spiritual, cultural, and economic relationships with Country and community by maintaining, promoting, and sustaining traditional cultural sites and practices within the Park and supporting the development of economic opportunities.
3. Create a unique coastal nature-based visitor experience by establishing the park as a nature-based tourism and wellbeing destination and enabling and developing economic and tourism opportunities that protect the environment and social and cultural values of the site in collaboration with local councils, tourism organisations, Kaurna people, and other local stakeholders.
4. Maintain managed coastal access for visitors and local people in a way that is compatible with shorebird protection, particularly in Shorebird Conservation Zones.

Education/Outreach. The AIBS has started with a very strong engagement program to involve a wide variety of stakeholders in the management of the protected area under the umbrella of the Bird Sanctuary Collective (DEWNR 2017). The Collective are the leadership roundtable for AIBS and include members from local councils and businesses, state government, social innovation enterprises, environmental and social NGOs, regional development bodies, Kaurna and Vietnamese Elders, universities, local Vietnamese farmers, and others. The Collective are supported by four focus area taskforce groups that work to protect shorebirds, build and protect the local economy, enhance wellbeing, and strengthen the global flyway, respectively.

Purnell et al. (2015) mention a variety of workshops, training sessions, and field trips, for a variety of audiences in the AIBS area and several brochures are now available. The Friends of AIBS group¹² exists to support on-ground action and promote the site. Several informational videos are now available:

- a. "The Adelaide International Bird Sanctuary", BirdLife Australia (<https://www.youtube.com/watch?v=1WokMcl2ylw>).
- b. "An introduction to the shorebirds of the Samphire Coast", AMLRNRM Board (<https://www.youtube.com/watch?v=eaqXT0svhVg>).

Monitoring. An excellent monitoring program started in 2009 through BirdLife Australia (e.g., Purnell et al. 2015, 2017) that should be continued. The integration with BirdLife Australia's Shorebirds 2020 program¹³ is also a very important step to help put the results from AIBS in the more general context of shorebird conservation, abundance, and distribution in Australia. We recommend that efforts be taken to standardize the AIBS monitoring sufficiently to be able to calculate temporal trends with a reasonable degree of precision, though per Purnell et al. (2015), efforts are underway to do this ("...increase the sensitivity of our trend analysis to a level where declines of 47–64 percent would be detected within a 20-year period"). Trend analyses were conducted by Purnell et al. (2012), including specific analyses with Dry Creek Saltfields data only. Note that the use of volunteer-based counts contributes greatly to the cost-efficiency of the monitoring as well as helping engage citizens in the conservation project.

Research. There are at least two research projects that have attempted to track migrating shorebirds using some kind of marking technology on birds in the AIBS area. Although we do not recommend basing partnership decisions solely on the basis of where specific individual birds traveled, this type of research is helpful in pointing to general geographic areas and is very compelling to the public.

Bar-tailed Godwit. Capture and marking of this species was conducted at Thompson Beach in 2012 and 2013 (Purnell et al. 2015). "The bar-tailed godwit, known as AKK, has returned to Thompson Beach, near Dublin, after a 10,000km trip from its northern Arctic breeding grounds, and a quick stopover in China. The migratory shorebird was banded at Thompson Beach in November 2012 by the Victorian Wader Studies Group, as part of a monitoring program set up by the Natural Resources Adelaide and Mount Lofty Ranges and BirdLife Australia. In April 2013, AKK was snapped by South Australian bird researcher and photographer Adrian Boyle at Nanpu, near Beijing. Then late [November 2014], Adelaide birdwatcher Peter Corcoran captured the bird's return to Thompson Beach."¹⁴

Grey Plover. Several Grey Plovers were satellite-tagged in 2014-2015 season at Thompson Beach (Purnell et al. 2015), with two more in 2015-2016, and one more in 2017. Results from this project, supported by the Adelaide and Mount Lofty Ranges Natural Resources Management Board, are reported on the "Grey Plover in South Australia" web site¹⁵ and on the Grey Plover Facebook page¹⁶. [Figure 5](#) shows a map of the tracks of some of these birds, which clearly show the migration pathways of Grey Plover from AIBS north through various countries of the EAAF to their breeding grounds on Wrangel Island, Russia.

¹² <https://www.facebook.com/adelaideinternationalbirdsantuary/>

¹³ <http://www.birdlife.org.au/projects/shorebirds-2020>

¹⁴ <http://www.adelaidenow.com.au/news/south-australia/bartailed-godwit-makes-a-10000km-trip-from-its-northern-arctic-breeding-grounds-back-to-adelaide/news-story/1b1826112c6ed999f982bd5950faf063>

¹⁵ <http://www.vwsg.org.au/Grey-Plover-tracking.html>

¹⁶ <https://www.facebook.com/people/Grey-Plover/100009541537136>

Deliverable 1: Summary and Recommendations. Given the above contextual assessment, AIBS is well positioned to provide leadership and examples for shorebird conservation regionally, in Australia, and across the EAAF. Site managers are already engaged in strong activities to incorporate land into the protected area estate; stimulate partnerships among the public and cooperating organizations; develop tourism infrastructure, signage, and visitor materials; and manage and monitor shorebirds. Given the clear importance of AIBS as a shorebird conservation site, we recommend that AIBS, the Collective, and DEWNR focus on building off the existing strengths of the site (proximity to a major urban center, relatively easy access to various parts of the site, existing partners, existing research interests) to promote itself and the best practices of AIBS nationally. AIBS should also continue efforts to engage other sites in the flyway (based on the analyses below) to provide opportunities for shared learning (e.g., staff interchanges, visits) with sites in other countries. It is critical that ongoing monitoring conducted by BirdLife Australia be continued and that this be complemented, to the extent possible, with additional research on the focal species of shorebirds. AIBS should be actively promoting itself as a center of shorebird conservation learning and actively seek to engage other shorebird sites, particularly in Australia, to promote the exchange of best practices for education, conservation, management, monitoring and research. Internationally, AIBS should seek to partner with one or more international sites based on the analyses below, with the intention of seeking engagements that will bring learning, visitor interchanges, and technical (and maybe financial) resources to both parties.

Deliverable 2: Identify sister sites to potentially establish agreements with DEWNR

DEWNR has a strong interest, as a component of its conservation actions at AIBS, in establishing partnerships with shorebird sites in other countries in the EAAF. Whether formal or informal, these relationships have to be based on a combination of the actual connection provided by the birds themselves (either shared species or shared individual birds), the capacity of partners and administrators at the other site to engage in a relationship, and the likelihood of achieving a shared conservation goal. Some specific considerations for site partnering or establishing a “sister site” relationship that we feel are important¹⁷ include:

- Established biological connection through shared species and, maybe, shared individual birds;
- Active, involved, engaged site management agency which could be a government agency or an NGO, with a chief or director involved who has some kind of tenure;
- Helpful, especially in China, to have a formal declaration as Nature Reserve;
- Available assistance from local NGO (or international NGO) who can provide contacts, facilitate introductions, handle logistics, set up meetings, etc. to help the partnership develop and move forward;
- Consider multi-party partnership, e.g., between AIBS, the site managing agency/organization, a local partner organization, and a national/international NGO; note that one of these could serve dual roles in some cases;
- Helpful to have connection to local or nearby schools; and
- Consider language, communication, and travel as barriers and opportunities, though they all have to be dealt with and budgeted for.

Therefore, for this analysis, we present a series of potential sites based on shared species derived from literature analysis and potential for conservation success to inform the identification of sister sites.

Analysis of EAAF sites. To provide an overview of the potential “universe” of sister sites based on shared shorebird species, we compiled a list of all sites in Bamford et al. (2008) outside of Australia and New Zealand which contained greater than or equal to the 1% threshold of the population estimate for the flyway for one or more of the seven focal species (Eastern Curlew, Great Knot, Red Knot, Red-necked Stint, Curlew Sandpiper, Sharp-tailed Sandpiper, Bar-tailed Godwit). For each site, we extracted the site-specific maximum count for each of these species contained in Bamford et al. (2008). Since these data were based on published and unpublished sources from approximately 1986 to the mid-2000’s; we updated the counts with more recent count data available in Conklin et al. (2014) and Bai et al. (2015) for any site for which there was a more recent, higher count. To this list, we also added sites listed in Xia et al. (2016) to obtain a complete list of additional potentially important sites in coastal China. These additional sites were then cross-checked against Bamford et al. (2008), Conklin et al. (2014), and Bai et al. (2015) to extract any count information for the seven focal species contained in these latter references.

For each site in the resulting site database, we then calculated a normalized abundance for each of the seven focal species at each site by dividing the count at a site by the largest count for a given species across all sites. The normalized abundances were then added across species to compute a site ‘importance’ score, ranging from zero (if a site had none of the species) to a theoretical maximum of seven (if a site had the highest count for all seven species). In this methodology, a higher score indicates more of the focal species occurring at higher abundances than a lower score; hence, a higher score could be considered as a more “important” site for hosting several of the focal species. As a result of

¹⁷ we thank Doug Watkins for some of these ideas

this analysis, we obtained a list of 97 sites in China and South Korea that were in one or more of the above references, but did not appear to have any of the seven focal shorebird species; these sites are listed in [Appendix I](#) and are not considered further in this report.

This produced a list of 81 potentially important shorebird sites ([Table 3](#)) from 14 countries¹⁸ with an average “importance” score of 0.37 and a range of 2.89 (Yalu Jiang National Nature Reserve, China) to 0.00 (Sungei Buloh Wetland Reserve and Qupaluk). An analysis of Gulf St Vincent, based on data from Purnell et al. (2017) using maximum simultaneous counts for the eight-year period 2008/2009 to 2015/2016, has an “importance” score of 0.53. Some issues to consider in this analysis are that the Bamford et al. (2008) compilation is not completely current, with many of the individual site counts being three or more decades old. Also, many important sites were not included in Bamford et al. (2008) and the sites selected may or may not be currently viable due to development occurring after they were surveyed. Similarly, these sites may or may not correspond to existing or potential conservation areas. Due to the skewed nature of the importance scores (few high values and many low values) and coarseness of the data, we also assigned an importance rank of high, medium, or low to each site based on an approximate histogram of score values; these ranks are also shown in [Table 3](#). The number of sites by importance rank was High, 7; Medium, 22; and Low, 52.

The importance analysis was complemented with an extensive review of a variety of regional, national, or flyway-wide assessments of existing or potential shorebird or waterbird conservation sites conducted by several scientific teams from various organizations. Our goal was to obtain other information on as many sites as possible to document their importance for a variety of conservation criteria, including importance for the EAAF, importance for other conservation values (e.g., Ramsar designation, Important Bird Area), and overall regional-wide comparative status. These larger-scale analyses included:

- Conservation of migratory shorebirds in the Yellow Sea region, Hua et al. (2015);
- Priority sites and gaps for migratory waterbirds in China's coastal wetlands, Xia et al. (2016);
- Coastal wetlands of international importance for waterbirds in China, Bai et al. (2015);
- China coastal wetland conservation and management blueprint, Paulson Institute (2016);
- Situation analysis of East and Southeast Asian intertidal habitats, MacKinnon et al. (2012);
- Shorebird conservation priorities in the EAAF, Conklin et al. (2014);
- Designation as sites under Ramsar Convention (<http://www.ramsar.org/>) or EAAF Partnership Flyway Site Network (<http://www.eaaflyway.net/>); and
- Designation as an Important Bird Area (<http://datazone.birdlife.org/site/search>).

Combining the shorebird importance of sites with the results of the regional, national, or flyway-wide assessments yields preliminary lists of sites for AIBS to consider for exploring potential partnerships. The first set consists of sites that have high or medium importance for the seven focal shorebird species and have been designated as important by one or more of either EAAF, Ramsar, or the Important Bird Area (IBA) program. These sites are listed in [Table 4](#) and can be regarded as the highest priority or of highest interest for exploring partnerships. A second set of sites are those of high or medium importance for the seven focal shorebird species but that have no other designation as being important. These sites are listed in [Table 5](#) and also deserve merit for additional research for partnerships, particularly as to whether they are in the process or could be designated by either EAAF, Ramsar, or the IBA program. A third set of sites are those of low shorebird importance but that have designation by

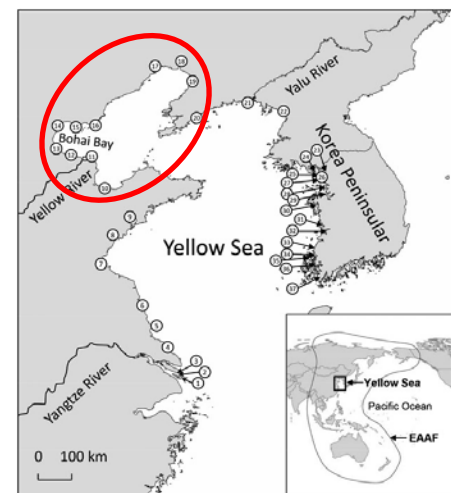
¹⁸ Number of sites in each country: China 30, South Korea 14, Russia 10, Japan 6, USA 6, Malaysia 4, Indonesia 3, Papua New Guinea 2, Bangladesh 1, Myanmar 1, North Korea 1, Philippines 1, Singapore 1, Thailand 1.

one or more of either EAAF, Ramsar, or the IBA program. These are listed in [Table 6](#) and are also of secondary importance for partnership consideration since the designation indicates their overall importance for conservation, even though the abundance of specific shorebird species may be relatively low. A fourth set of sites, included for completeness in [Table 7](#), are those of low shorebird importance with no designation. We do not recommend these sites be considered further for partnerships with AIBS.

We begin our discussion of potential partnership sites for AIBS by highlighting specific geographic areas containing high concentrations of the focal shorebird species for AIBS by extracting and merging the data from Tables 2, 4, 5, and 6 with the regional, national, or flyway-wide assessments listed above. Given the overall importance of China that emerges from these data, [Figure 6](#) provides an overview map of sites in coastal China, outlined in more detail in the discussion below.

Yellow Sea. This geographic area has the highest known density of important sites and individual shorebirds, a fact known since at least the publication of Barter (2002). As discussed above, the threats to shorebirds and shorebird habitat in the Yellow Sea are very well documented by many sources. Yang et al. (2011), Murray et al. (2014), and Murray and Fuller (2015) discuss recent severe wetland losses in the Yellow Sea and elsewhere in Asia. Lists of migratory shorebirds that use this geographic area in spring and fall migrations are given in Barter (2002) and Hua et al. (2015), Table 1 (note that the Yellow Sea region also harbors many shorebird species that do not occur in Australia, including very high conservation priority species such as Spoon-billed Sandpiper and Nordmann's [Spotted] Greenshank). There is also fairly accurate data on shorebird counts from many of these areas (e.g., Barter 2002, Barter et al. 2003, Barter and Xu 2004, Barter et al. 2005), although the rapid rate of habitat conversion leads to these data becoming quickly out of date. The general shorebird use of the region is described in Ma et al. (2013). Piersma et al. (2016) and Studds et al. (2017) demonstrate clearly that shorebird species which use the Yellow Sea for stopover are severely declining and that the rate of decline is correlated with the degree of reliance on the Yellow Sea as a stopover site ([Figure 4](#)). Of the 84 sites listed in [Table 3](#) with some importance for the seven focal species of shorebirds from AIBS, 41 (or 50%) are in the Yellow Sea region in the coastal provinces of China¹⁹, North Korea, or South Korea. Without a doubt, the Yellow Sea is a priority for shorebird conservation in the entire EAAF and deserves attention as an area to look for partner sites for AIBS.

At right is a map (Hua et al. 2015, Figure 1) to illustrate this large area, which includes the highly important subareas of the Bohai Sea (circled in red) and its several bays, including the critically important Bohai Bay. Additional maps of the geography of the Yellow Sea area are shown in Figure 8. The important areas



¹⁹ Liaoning, Hebei, Tianjin, Shandong, Jiangsu, and Shanghai.

highlighted by MacKinnon et al. (2012) for intertidal waterbird²⁰ diversity in the EAAF, including the Yellow Sea region, are shown in Figure 7. This comprehensive assessment of the EAAF also emphasizes the importance of the Yellow Sea, with six of 16 sites (37.5%) across the flyway being in this geography. The analysis of Conklin et al. (2014) also emphasizes the flyway-wide importance of the broader Yellow Sea area for the conservation of EAAF shorebirds and those occurring at AIBS (Figure 9). They found only seven areas that supported 15 or more priority shorebird populations across the EAAF, all of which were in the Yellow Sea region, plus an additional three sites supporting 11-14 populations in the Yellow Sea. The importance of the Yellow Sea is also specifically highlighted in the EAAFP single species action plan for the Eastern Curlew (Appendix II).

Some of the specific sites that emerged from this analysis as deserving consideration for AIBS partnerships in the Yellow Sea region are discussed here. These are sites for which some information about the site is readily available through the internet.

Chongming Dongtan National Nature Reserve, Shanghai, China (EAAFP #002, Ramsar #1144). This is a national nature reserve for the protection of migratory birds and their habitat. It is located in the estuary of the Yangtze River, at the eastern end of Chongming Island, the third largest Island in China.²¹ The site has long been known as an important stopover site for shorebirds and is heavily used by waterfowl and other wetland birds (Ma et al. 2009). Although hunting has been largely controlled as a threat at this site since the reserve was established in 2005, numerous other extractive activities (e.g., fishing, grazing) continue to occur in the reserve. The reserve has demonstrated migratory stopover importance for AIBS species such as Great Knot, Red Knot, and Red-necked Stint (Choi et al. 2009).

- Key shorebird species: Dunlin, Eastern Curlew, Great Knot, Kentish Plover, Spotted Redshank, Grey Plover, Common Greenshank, Little Ringed Plover, Marsh Sandpiper, Sharp-tailed Sandpiper.
- The 32,600 ha site holds the biggest and the only remaining natural mudflat on the Yangtze River estuary.
- Other important bird species: Spoon-billed Sandpiper, Black-faced Spoonbill, Hooded Crane.
- The Nature Conservancy in China has been engaged in conservation work at this site in the recent past, but is not currently active there.

Yalu Jiang National Nature Reserve, Liaoning, China (EAAFP #043). “The Yalu River estuary, located at the east of Liaoning Province near the border of China and Democratic People's Republic of Korea, is China’s northernmost coastal stopover site for water birds, including thousands of Great Knots and Bar-tailed Godwits. It is also identified by BirdLife as an IBA.”²² The Reserve extends for about 70 km along the coast and has intertidal mudflats and saltmarsh outside the seawall, complemented with ponds and paddies inside the seawall (Choi et al. 2015). Data from Choi et al. (2015), based on surveys conducted from 2010-2012, confirm this site’s importance for staging Bar-tailed Godwits (a minimum of 42% of northward-migrating *baueri* and 19% of *menzbieri*) and Great Knot (22% of northward-migrating individuals).

- Key shorebird species: Bar-tailed Godwit, Broad-billed Sandpiper, Dunlin, Eastern Curlew, Great Knot, Grey Plover, Spotted Redshank, Common Greenshank, Eurasian Curlew, Eurasian Oystercatcher, Red Knot, Ruddy Turnstone, Terek Sandpiper, Whimbrel, Wood Sandpiper.

²⁰ Includes shorebirds, terns, cranes, storks, herons, etc.

²¹ http://english.forestry.gov.cn/index.php?option=com_content&view=article&id=388:chongming-dongtan-national-birds-nature-reserve&catid=18&Itemid=114

²² <http://whc.unesco.org/en/tentativelists/6189/>

- Area 108,057 ha.
- The New Zealand based Pukorokoro Miranda Naturalists Trust established a sister site relationship with Yalu Jiang NNR and signed an MOU with the reserve in 2004 (Doug Watkins, pers. comm.).²³

Yancheng National Nature Reserve, Jiangsu, China (EAAFP #005, Ramsar #1156). “In 1983, Yancheng was established by the Central Government for conserving rare birds and their habitats. It was designated as a UNESCO Man and Biosphere Reserve in 1992 and was admitted as Northeast Asian Crane Reserve Network site in 1997 and as an East Asian-Australian Migratory Shorebirds Network Site in 1999. The reserve was designated as a Ramsar site in 2001. Yancheng Nature Reserve stretches along the shoreline of the Yellow Sea for 582 km from north to south. The total area is 453,000ha, composed of 17,400 of core area, 46,700 of buffer zone, and 388,900 ha of experimental zone. Yancheng includes a crane farm and crane exhibition centre, two museums with collections of marine shells and fossils, an educational museum, bird and butterfly specimens, parking space, conference room, offices a waterfowl lake and fish ponds. Key species are Red-crowned Cranes and waterbirds.”²⁴

Shuangtai Hekou National Nature Reserve, Liaoning, China (EAAF #004, Ramsar #1441). “The estuary of the Liao River at Liaodong Bay in northeastern China, the site includes part of the world's largest reed marsh, a large area of Suaeda community, and shallow sea. It provides important habitat for resting and breeding of over 100,000 waterbirds from 106 species, including the critically endangered Siberian Crane and the endangered Oriental Stork and Red-crowned Crane, and is the largest breeding site in the world for the vulnerable Saunder’s Gull. The site provides seasonal occupation for 20,000 people for reed irrigation and harvest, oil exploration facility checking, agriculture and aquaculture. Conservation measures include environmental awareness and education for the protection of birds. A Wetland Ecosystem Monitoring Station has been established to observe and study waterbirds and monitor the status of the wetland.”²⁵

Huang He Delta National Nature Reserve, Shandong, China (EAAF #006, Ramsar #2187). “The wetland is composed of two units, with the northern part located at Diaokou River, while the southern part is located along the course of the Yellow River and extends out to the Bohai Sea. The site is an almost naturally intact estuary wetland composed of shallow estuarine waters, tidal flats, marshes, reed swamps, canals and drainage channels, and aquaculture ponds. It has an annual accretion rate of 32.4 km² which is one of the fastest rates in the world and is due to the large amount of sediment brought down by the Yellow River. The wetland is an important migratory waterbird staging and wintering area and supports 38 species in internationally important numbers, with a total waterbird count of between 80,500 and 248,600 in recent years. The large amount of reeds found in the wetland form the basis of the weaving and paper production industries in the area. In recent years, flow from the Yellow River has decreased, resulting in wetland degradation.”²⁶

Luannan Coast, Tangshan, Hebei, China. This site has emerged in recent years as a critically important area for shorebirds in the EAAF, particularly Red Knot, Great Knot, Bar-tailed Godwit, and Curlew

²³ <http://www.miranda-shorebird.org.nz/about-us/pukorokoro-miranda-news-articles/the-trusts-engagement-with-china-korea-and-the-east-asian-australasian-flyway>

²⁴ <https://wli.wwt.org.uk/2012/05/members/asia/asia-members/yancheng-dafeng-national-nature-reserves/>, http://www.yancheng.gov.cn/EnglishWebsite/Tourism/Scenic_Spots/201603/t20160330_535134.html

²⁵ <https://rsis Ramsar.org/ris/1441>

²⁶ <https://rsis Ramsar.org/ris/2187>

Sandpiper (Rogers et al. 2010, Yang et al. 2011, Hassell et al. 2017). For the purposes of this report, we define the Luannan Coast as including the subsites of Nanpu, Beipu, Hangu, and Zuidong (Rogers et al. 2010, Hassell et al. 2017). Per Hassell et al. (2017), the site is situated on the edge of Bohai Bay, 190 km southeast of Beijing. The mudflats in the area previously had an extent 25 km long and 1-3 km wide, but some of the mudflats have already been lost to reclamation. The mudflats are separated by a seawall from the Nanpu Salt Ponds complex, possibly the largest in Asia. The salt ponds are critical habitat for birds to forage, roost and, for some species, to nest but some of these are also being lost to industrial development. The area of ponds adjacent to the coast is vast, stretching 10 km inland and across the entire 20 km, from southeast to northwest and therefore roosting opportunities are many and varied for migratory shorebirds and terns. The entire site is currently not under any form of official protection, though it is receiving some very recent attention via a partnership between World Wildlife Fund (WWF), the Paulson Institute, and local government. “Located in the central part of EAAF, it is an important staging site for some migratory water birds such as Red Knot, Curlew Sandpiper, Black-tailed Godwit and Spotted [Nordmann’s] Greenshank. Three threatened species of water birds were recorded here, together with other 22 species of water birds whose population has reached 1% of global population” (Paulson Institute 2016). Extensive shorebird surveys were carried out in the area in 2003 and 2004 by Yang and Zhang (2006), who found a total of 36 shorebird species, primarily in migration. “Nanpu wetland consists of natural intertidal mudflats, aquaculture ponds, and salt pans. Its unique geographic location and wetland resources make Nanpu Wetland one of the most important stopover sites for migratory water birds along the EAAF, including rare and endangered species such as Red Knot, Great Knot, Curlew Sandpiper, Black-tailed Godwit, and Nordmann’s Greenshank. Each year, as many as 350,000 water birds stage and refuel here. Among the water birds at the Nanpu wetland, the population of 22 species exceeds one percent of their global population sizes or their population sizes along the EAAF.”²⁷

- “The Paulson Institute, WWF, Hebei Provincial Forestry Department and Hebei Luannan County Government signed a five-year MoU for cooperation among the four parties, aiming to protect Nanpu coastal wetland, one of the most important habitats for migratory waterbirds along Bohai Bay in China. The four parties will work closely to conserve and manage the site and establish a provincial nature reserve at Nanpu wetland [in 2018]. According to the MoU, the Paulson Institute and WWF will support the planning and application of the proposed provincial nature reserve; and continue to work with other partners to support follow-up conservation and management, development, and environmental education efforts. The objective is to enhance biodiversity conservation at Nanpu wetland and promote a harmonious relationship between local people and nature. Located in Luannan County of Hebei Province and north of Bohai Bay, Nanpu wetland consists of natural intertidal mudflats, aquaculture ponds, and salt pans. Its unique geographic location and wetland resources make Nanpu Wetland one of the most important stopover sites for migratory water birds along the EAAF, serving as a key stopover site for rare and endangered species such as Red Knot, Curlew Sandpiper, Black-tailed Godwit, and Spotted [Nordmann’s] Greenshank. Each year, as many as 350,000 water birds stage and refuel here. Among the water birds at the Nanpu wetland, the population of 22 species exceeds 1 percent of their global population sizes or their population sizes along the EAAF, making it a wetland of international importance according to criteria determined by the Ramsar Convention, an intergovernmental treaty that provides the framework for the conservation of wetlands and their resources.”²⁸

²⁷ <https://birdingbeijing.com/2017/07/06/more-good-news-for-yellow-sea-conservation-and-how-you-can-help/>

²⁸ <http://www.paulsoninstitute.org/news/2017/06/15/building-nanpu-wetland-nature-reserve-for-a-healthier-ecosystem/>

- “Located at the northern part of Bohai Bay, Nanpu Wetland consists of natural intertidal mudflats, aquaculture and salt ponds. Many researchers confirm it is one of the most important stop-over sites for 350,000 migratory waterbirds to rest and fuel up along the EAAF. Among the 40 shorebird species passing through the Wetland, 22 have their numbers exceeding 1% of their populations in the EAAF, such as Red Knot and Curlew Sandpiper. Therefore, Nanpu Wetland is listed as a “Wetland of Provincial Importance” by The People’s Government of Hebei Province. On 15 June 2017, Forestry Department of Hebei Province, The People’s Government of Luannan County, WWF and The Paulson Institute signed a 4-party MoU in Luannan to work together in the establishment of the [Nature] Reserve and its future management.”²⁹
- “In addition, WWF-China with the support of WWF-Hong Kong has signed a new memorandum of understanding with the Forestry Department of Hebei Province, The People’s Government of Luannan County and the Paulson Institute for Hebei Luannan Nanpu wetland conservation to protect this important stopover site for 350,000 migratory birds along the EAAF. WWF-Hong Kong will share its valuable experience managing Mai Po Reserve with the management team for the successful establishment of the Nanpu Wetland Nature Reserve.”³⁰

Geum Estuary, Chollabuk, South Korea (EAAF #100 & #101, Ramsar #1925, IBA KR019). This is one of the most significant sites around the Yellow Sea for shorebirds and is perhaps the best remaining site in South Korea after the Saemangeum seawall was constructed (Weller and Warren 2017). This site includes the Seocheon Tidal Flat Ramsar site and Yubudo Island. There is a collaborative project with BirdLife International and BirdLife Australia at this site (<http://geum.birdlife.org.au/>). “This multi-faceted project aspires to demonstrate alternative and sustainable paths for developing coastal wetlands in the Republic of Korea. The project aims to support conservation initiatives within the Estuary for the protection of migratory shorebirds and their habitat, including habitat restoration, systematic monitoring and the possibility of the Estuary being listed as a World Heritage Site. The project also aims to explore and implement opportunities for the Estuary to become a world-class eco-tourism attraction.”

- Area about 2,185 ha; estuary is about 400 km long from Jangsu County to Gunsan-Seocheon Bay, where it flows into the Yellow Sea.
- Key shorebird species: Spoon-billed Sandpiper, Eastern Curlew.
- Other important bird species: Baikal Teal, Swan Goose, Black-faced Spoonbill, Whooper Swan.

Cheonsu Bay, Chungcheongnam, South Korea (EAAF #046). “Cheonsu Bay has two lakes and rice paddies so the site provides food and habitat to 320 species. Important species: Bar-tailed Godwit, Black-tailed Godwit, Common Greenshank, Kentish Plover, Whimbrel, Baikal Teal, Mallard, Bean Goose.”³¹ Infrastructure includes the Seosan Birdland visitor center (<http://www.seosanbirdland.kr/>); there is a birding festival there.

Songdo Tidal Flat, Incheon, Kyonggi, South Korea (Ramsar #2209). From Ramsar: “The Site includes two sections of a larger area of tidal mud flat along the coast of Incheon Metropolitan City, which has a complicated coastline with about 170 large and small islands. It is an important feeding and roosting ground for threatened waterbirds such as endangered black-face spoonbill as well as the vulnerable far

²⁹ <http://www.eaaflyway.net/a-4-party-collaboration-in-the-protection-of-nanpu-wetland-luannan-county-hebei-province/>, <http://www.globaltimes.cn/content/1052249.shtml>

³⁰ https://www.wwf.org.hk/en/news/press_release/?uNewsID=18900

³¹ <http://www.eaaflyway.net/wordpress/new/theflyway/flywaysitenetwork/Cheonsu%20Bay%20SIS%20final.pdf>

eastern curlew, great knot and Saunders's gull. It also regularly supports 1% of the population of the Eurasian curlew as well as of the far eastern curlew."

Zhuanghe Wan, Liaoning, China (IBA CN059). From BirdLife: "Located on the east coast of the Liaodong Peninsula between the Biliu He and Dayang He estuaries, with a few smaller river estuaries and salt water lakes or lagoons. The IBA has a complex coastline with wide tidal flats, many bays, reedbeds and salt marshes. It is an important stop-over for migratory waterbirds, but there is high pressure to convert the wetlands for aquaculture." This site is based on shorebird counts from 2005, published in Barter et al. (2005), and highlighted in Conklin et al. (2014). Other than being identified as an IBA, it appears to have no protected status of any kind.

Laizhou Wan, Shandong, China (IBA CN328). From BirdLife: "On the northern Shandong peninsula and is one of the three large bays in the Gulf of Bohai. The bay is rather shallow with most of the area not exceeding 10 m in depth, and it is becoming shallower as sediments are deposited by the local rivers." This site appears to be based on unpublished shorebird counts by Mike Barter from 2004 that were highlighted in Conklin et al. (2014). Other than being identified as an IBA, it appears to have no protected status of any kind.

Mundok Migratory Bird Wetland Reserve, South Pyongan, North Korea (EAAF #046, IBA KP019). Called the Chongchon River estuary by BirdLife's IBA program. Pukorokoro Miranda Naturalists' Trust has surveyed shorebirds at this site in at least 2009 and signed an agreement to work on shorebird conservation with the Nature Conservation Union of Korea in 2014. This agreement included a plan to survey shorebirds in North Korea, which was carried out in 2015 and 2016. [Note: the web site describing this, <http://www.miranda-shorebird.org.nz/about-us/pukorokoro-miranda-news-articles/the-trusts-engagement-with-china-korea-and-the-east-asian-australasian-flyway>, is only up to date as of July 2016.]

Other geographic regions. The analyses performed to construct Tables 3, 4, 5, and 6 and the regional and flyway-wide assessment review shows additional regions of importance across the broad expanse of the EAAF, along with more isolated scattered sites in a variety of countries. These regions include coastal Guangdong Province, China (MacKinnon et al. 2002, Xia et al. 2016); North Bay of Bengal Coast, India & Bangladesh (MacKinnon et al. 2002); Sumatra Coast, Indonesia; Western Sarawak Coast and North-Central Selangor Coast, Malaysia; Gulf of Martaban, Myanmar; Inner Gulf of Thailand; and Alaska, USA. There are also scattered important sites in various other countries, including Russia, Philippines, Papua New Guinea, and Japan. Some of the specific sites that emerged in this analysis as deserving consideration for AIBS partnerships in other geographic regions are discussed here.

Mai Po Nature Reserve, Hong Kong/Guandong, China (EAAF #003, Ramsar #750). "Located on the northwestern corner of Hong Kong, the Mai Po and Inner Deep Bay wetlands is recognized as 'Wetland of International Importance' under the Ramsar Convention in 1995. The 1,500-hectare area acts as a key way station and wintering site along the East Asian-Australasian Flyway where 50 million migratory waterbirds travel through each year. Since 1983, WWF has been managing the 380-hectare Mai Po Nature Reserve within the Inner Deep Bay. Classified as a Biodiversity Management Zone under the Mai Po and Inner Deep Bay Ramsar Site Management Plan, the Mai Po Nature Reserve offers benefits to wildlife and the local community through education, recreation and conservation."³²

³² http://www.wwf.org.hk/en/whatwedo/water_wetlands/mai_po_nature_reserve/

- “Mai Po Nature Reserve is situated in Shenzhen River estuary to the northwest of Hong Kong, serving as a key staging site or over-wintering site for a large number of water birds. However, it is still under the threats from increased sedimentation, ongoing expansion of terrestrial trees and shrubs, alien invasive species, and urban development. According to the ecological behaviors of black-faced spoonbill and other migratory water birds and the different threats they face, the nature reserve has implemented a management model according to different management zones and habitat types. The Ramsar site in Mai Po comprises four management zones, namely: Core Zone (CZ), Biodiversity Management Zone (BMZ), Wise Use Zone (WUZ) and Private Land Zone (PLZ), with each management zone having its own specific management goal. Twenty-one *gei wai* (intertidal shrimp ponds) within the nature reserve are divided into brackish *gei wai*, brackish habitats for waterbirds, and rainwater-based habitats. As for vegetation management, the weeds and saplings on the embankment are removed to provide better habitats for migratory waterbirds including black-faced spoonbill. Thanks to these efforts, Mai Po and Deep Bay have become the world’s second largest wintering site for black-faced spoonbill. Each year, more than 400 black-faced spoonbills spend their winter here, accounting for about 20 percent of its global population.” (Paulson Institute report).
- The area of the site is 1,500 ha and it is managed by WWF-Hong Kong.
- Species meeting EAAF site criteria: Asian Dowitcher, Common Greenshank, Common Redshank, Dunlin, Eurasian Curlew, Grey Plover, Kentish Plover, Little Ringed Plover, Pied Avocet, Spoon-billed Sandpiper, Nordmann’s (Spotted) Greenshank, Spotted Redshank.
- Other important species: waterfowl, Black-faced Spoonbill.
- The site has a center for training in nature reserve management and environmental education and offers guided public awareness programmes and school activities.

Nakdong Estuary, Busan, South Korea (EAAFP #097). “The Nakdong estuary creates a unique landscape of the tideland at ebb tide and the estuary at high tide with various sand islands and marshy grounds with the broad range for the ebb and flow of the tide. In addition, it plays a role as an important gate and destination for migratory birds since it is located at the southern part of the Korean peninsula. It is suitable as a winterization place for winter visitors and a breeding place for summer visitors since it is warm in winter and cool in summer. The total area is 8,849 ha.”³³ The Nakdong Estuary Eco Center (<http://www.busan.go.kr/wetland/index>) is located at the site.

Suncheon Bay, Chollanam, South Korea (EAAFP #079, Ramsar #1594). “Suncheon bay is an inner bay surrounded by the Goheung and the Yeosu peninsula and three streams Dong-cheon, Yisa-cheon and Beolgyo-cheon running through it, which created an extensive brackish water zone. A large number of different organisms live in Suncheon Bay including various species of legally protected birds and wild animals. Different types of habitats in Suncheon Bay, such as salt marsh, tidal flat, rice paddy, salt pan and estuary, provide sufficient food resources and spacious resting area for migratory waterbirds. There are 239 bird species belonging to 17 orders and 54 families in Suncheon Bay. The highest number of individuals observed by species was over 20,000. The most dominant species is Kentish Plover, followed by Dunlin, Common Shelduck and Black-headed Gull.”³⁴ “A wide estuarine tidal flat and intertidal marshes, creating one of the most diverse and beautiful coastal ecosystems in the country. Two rivers flow through the city and surrounding rice fields at the northern part of the bay, and numerous streams flow through the site, sustaining clean water quality and influx quantity. The tidal flats are largely muddy with shallow salt marshes supporting a wide-range of species, including at least 25 threatened birds, e.g.

³³ <http://www.eaaflyway.net/documents/network/sis/sis-rok-eaaf097.pdf>

³⁴ <http://www.eaaflyway.net/wordpress/documents/network/sis/sis-rok-eaaf079.pdf>

Black-faced Spoonbill, Nordmann's Greenshank, Spoonbill Sandpiper, and Relict Gull. It is the only wintering site for Hooded Crane and supports over 1% of the population of Common Shelduck, Hooded Crane, Eurasian Curlew, Saunder's Gull and Kentish Plover."³⁵ Recreation/visitation infrastructure includes the Suncheon Bay Nature Eco-park³⁶, a Boardwalk, and the Yongsan Observatory. It is also the site of Ramsar's Regional Center for East Asia.

Sonadia & Moheshkhali Island, Chittagong, Bangladesh (EAAF #103). "Sonadia island supports the last remaining remnant of mangrove forest in south east Bangladesh. In addition to this important mangrove area, the island supports large numbers of sand dune vegetation, waterbirds, rich communities of mollusks and echinoderms and marine turtles. Located in the far south-eastern corner of Bangladesh, the site lies a few km north of Teknaf Peninsula, north-west of Cox's Bazar town. The site includes Sonadia Island (in its entirety) and part of the adjacent Moheshkhali Island (the majority of Ghotivanga Mouza), both of which fall under the Kutubjum Union, Moheshkhali Upazilla. Sonadia Island is of great significance for migratory shorebirds, waterfowl, gulls and terns. It also provides refuge for many resident species such as Small Pratincoles, terns, egrets and herons. Sonadia Island clearly meets two criteria based on threatened species [Spoon-billed Sandpiper, Nordmann's Greenshank]."³⁷

Bako-Buntal Bay, Kuching, Sarawak, Malaysia (EAAF #112). "Bako Buntal Bay is an important non-breeding site for migratory waterbirds. Thirty-two species of shorebirds comprising an estimated 20,000-25,000 individuals winter in the bay and its immediate environs. Several globally threatened and near threatened species such as the Nordmann's Greenshank, Asian Dowitcher and Far Eastern Curlew make their stops here. The area supports more than 10 % of the global population of Chinese Egret while the numbers of Red Knot and Great Knot are among the highest for any site in Malaysia. Thirty-two shorebird species have been recorded in the bay to date, the most common being Mongolian Plover, Greater Sand-Plover, Great Knot, Grey Plover and Red Knot. Numbers of Red Knot and Great Knot are among the highest for any site in Malaysia. Near-threatened shorebirds identified are the Malaysian Plover and Asian Dowitcher."³⁸ Parts of the site are in Santubong National Park³⁹ and Bako National Park.⁴⁰

Inner Gulf of Thailand, Samut Songkhram, Thailand (Ramsar #1099, IBA TH032). "Comprises a 195 km-long section of the coastal zone of the Inner Gulf of Thailand, from Laem Phak Bia in the west to Chonburi in the east. Four major rivers discharge into the Gulf of Thailand along this stretch of coastline, creating extensive areas of intertidal habitats. The site includes an estimated 23,500 ha of intertidal mudflats, extending over 2 km from the shoreline at low tide in places. Previously, the Inner Gulf of Thailand supported a large area of mangroves. However, this habitat has now been extensively converted to other land uses, and, currently, less than 1,600 ha of mangroves remain, much of which consists of regenerating *Avicennia*-dominated scrub. Areas that previously supported mangroves now support anthropogenic habitats, including at least 10,600 ha of saltpans and from 40,000 to 80,000 ha of shrimp ponds, many of which are abandoned. Inland of the intertidal zone, the site supports large areas of *Suaeda*-dominated coastal flats, fish-ponds and rice paddies. Due to high levels of human use and

³⁵ <https://rsis Ramsar.org/ris/1594>

³⁶ http://english.visitkorea.or.kr/enu/ATR/SI_EN_3_1_1_1.jsp?cid=681459,
<http://www.suncheonbay.go.kr/intro/2/index.php>

³⁷ <http://www.eaaflyway.net/documents/network/sis/sis-bang-eaaf103.pdf>

³⁸ <http://www.eaaflyway.net/documents/network/sis/sis-malay-eaaf112.pdf>

³⁹ <https://www.sarawakforestry.com/parks-and-reserves/santubong-national-park/>

⁴⁰ <https://www.sarawakforestry.com/parks-and-reserves/bako-national-park/>

high human population densities, it is unrealistic for more than a small part of the site to be placed under strict conservation management. However, the whole site was defined as a single IBA, because conservation actions aimed at controlling over-exploitation of natural resources and promoting compatible forms of land use are required across the whole site. In 2001, an 87,500 ha section of the IBA around Don Hoi Lot in Samut Songkhram province was designated as a Ramsar Site.”⁴¹

Sungei Buloh Wetland Reserve, Singapore (EAAF #073, IBA SG001). “First opened as a Nature Park in 1993. In 2002, 130 hectares were officially gazetted as a Nature Reserve and renamed Sungei Buloh Wetland Reserve to better reflect its status. In [2002], it was recognised as a site of international importance for migratory birds and awarded a certificate by Wetlands International. In 2003, Sungei Buloh Wetland Reserve became Singapore's first ASEAN Heritage Park. Since then Sungei Buloh has expanded to include 202ha of mangroves, mudflats, ponds and forests, providing an even larger sanctuary for the flora and fauna that call it home.”⁴² The site has a visitor center, trails, and guided walks.

Moroshechnaya River Estuary, Kamchatka, Russia (EAAF #001, Ramsar #695). “The Moroshechnaya Estuary is located on the west side of the Kamchatka Peninsula in the Russian Far East. The Moroshechnaya River, one of the largest rivers in the region, flows westward across the Kamchatka plain from the Sredinny Mountain Range to the Sea of Okhotsk. The river is 270 km long and its watershed covers 5,450 km². Tidal flows at the river mouth created a 20 km long by 2 km wide estuary. The estuary is separated from the Sea of Okhotsk by a 1.5 to 2 km wide shingle spit with an area of 30 km². Tides range up to 5.7 m and influence the estuary for tens of kilometers inland. At low tide, large sandy beaches and mudflats are exposed, creating important feeding areas for substantial numbers of the shorebirds during migration. The biggest tidal flat area is situated to northeast of this spit.”⁴³ “A steppe-like valley of the Moroshechnaya River, with numerous oxbow lakes and a saline lagoon. Principal habitats are non-forested raised bogs with pools and ridges, supporting *Sphagnum*, *Empetrum nigrum*, and *Salix middendorfi*. Vegetation is dominated by floodplain tundra, mire and meadow communities, with patches of mixed *Betula ermanii*, *Pinus pumila*, and *Salix* sp. forests. The area provides important habitat for migrating, feeding, breeding and molting populations of waterbirds. Breeding species include various geese, ducks and colonial sea birds. The wetland supports the largest population of [Bean Goose] in the region, large numbers of which molt and stage at the site. Migrating waterbirds include up to 500,000 ducks and several thousand waders. Human activities include traditional reindeer grazing, fishing, hunting, and foraging.”⁴⁴

- Key shorebird species: Dunlin, Red-necked Stint, Whimbrel, Great Knot, Bar-tailed Godwit, Black-tailed Godwit, Red Knot, Lesser Sandplover, Eastern Curlew, Eurasian Oystercatcher, Spoon-billed Sandpiper, Grey Plover, Ruddy Turnstone, Terek Sandpiper, Common Greenshank.
- Area 219,000 ha.

Yukon Delta National Wildlife Refuge (Yukon-Kuskokwim Delta), State of Alaska, USA (EAAF #109). This area is also designated as a Western Hemisphere Shorebird Reserve Network Hemispheric site (Yukon

⁴¹ <http://datazone.birdlife.org/site/factsheet/inner-gulf-of-thailand-iba-thailand>

⁴² <https://www.nparks.gov.sg/gardens-parks-and-nature/parks-and-nature-reserves/sungei-buloh-wetland-reserve>

⁴³

[http://www.eaaflyway.net/wordpress/new/theflyway/flywaysitenetwork/SIS%20EAAF001%20\(Moroshechnaya\)_v2017.pdf](http://www.eaaflyway.net/wordpress/new/theflyway/flywaysitenetwork/SIS%20EAAF001%20(Moroshechnaya)_v2017.pdf)

⁴⁴ <https://rsis Ramsar.org/ris/695>

Delta National Wildlife Refuge⁴⁵) and an Audubon Important Bird Area⁴⁶. “The site comprises extensive grass-sedge meadows in the contiguous deltas of the Yukon and Kuskokwin Rivers as well as estuaries, sea coast and an offshore island. The mostly tree-less landscape is dominated by small wetlands that, when thawed in summer-autumn, provide breeding and post-breeding habitat for several million waterbirds of several families. The waterbirds disperse into the East Asian – Australasian and/or American flyways. The proposed site, including Nunivak Island, encompasses about 4,824,000 ha. Approximately 20% percent of these lands are Native selected and conveyed lands, and currently do not fall under consideration of this nomination. The delta has approximately 25,000 residents. 85% of these are Alaska Natives, both Yupik Eskimos and Athabaskan Indians. The main population center and service hub is the city of Bethel, with a population of around 6,000. Bethel is surrounded by 49 smaller villages, with the largest villages consisting of over 1,000 people. Most residents live a traditional subsistence lifestyle of hunting, fishing, and gathering.”⁴⁷ “Yukon Delta National Wildlife Refuge was established to conserve fish and wildlife populations and habitats in their natural diversity, including, but not limited to shorebirds, seabirds, tundra swans, emperor, white-fronted and Cackling Geese, black brant and other migratory birds, salmon, muskox, and marine mammals; to fulfill treaty obligations; to provide the opportunity for continued subsistence uses; and to ensure water quality and necessary water quantity.”⁴⁸

- Key shorebird species: Bar-tailed Godwit, Western Sandpiper, Dunlin, Ruddy Turnstone, Sharp-tailed Sandpiper, Rock Sandpiper, Pacific Golden Plover, Bristle-thighed Curlew.
- Other important bird species: Long-tailed Duck, Emperor Goose, Spectacled Eider, Steller’s Eider, Arctic Tern, Aleutian Tern.
- > 500,000 shorebirds annually, > 30% of the global population of Bar-tailed Godwit and Bristle-thighed Curlew.

Qupaluk, State of Alaska, USA (EAAF #133). “The site is located northeast of Teshekpuk Lake within the National Petroleum Reserve in Alaska (NPR-A) on the Arctic Coastal Plain of Alaska. The habitat is a matrix of low elevation tundra wetlands and thaw lakes interspersed with slightly higher and drier areas of tundra. The site is undisturbed and high quality breeding habitat for dozens of migratory birds, many of whom migrate along the East Asian-Australasian, the Central Pacific, various American (e.g., Pacific, Mississippi, Central, Atlantic), and the East Atlantic flyways. This site also provides essential post-breeding habitat for waterfowl that undergo a flightless molt and is important habitat for other non-avian wildlife species.”⁴⁹ A larger area including Teshekpuk Lake has also been designated as an Important Bird Area.⁵⁰ Although the designated flyway site does not have documented counts for any of the seven focal AIBS shorebird species, several of them do occur in the broader Arctic Coastal Plain of Alaska, in which this site is embedded (Johnson et al. 2007). The entire region is also vitally important as hunting and fishing grounds for native Iñupiat from the towns of Barrow and Nuiqsut. However, the site and surrounding areas are extremely remote and hard to visit.

Australia and New Zealand sites. Our analyses revealed several sites in Australia and New Zealand that share some of the same species as AIBS and offer high potential for partnering based on similarities in

⁴⁵ <http://www.whsrn.org/site-profile/yukon-delta-nwr>

⁴⁶ <http://www.audubon.org/important-bird-areas/central-yukon-kuskokwim>

⁴⁷ [http://www.eaaflyway.net/wordpress/new/theflyway/flywaysitenetwork/SIS%20EAAF109%20\(Yukon%20Delta%20National%20Wildlife%20Refuge\)_v2017.pdf](http://www.eaaflyway.net/wordpress/new/theflyway/flywaysitenetwork/SIS%20EAAF109%20(Yukon%20Delta%20National%20Wildlife%20Refuge)_v2017.pdf)

⁴⁸ https://www.fws.gov/refuge/Yukon_Delta/

⁴⁹ http://www.eaaflyway.net/wordpress/wp-content/uploads/2017/05/SIS-EAAF133-Qupaluk_v2017.pdf

⁵⁰ <http://www.audubon.org/important-bird-areas/teshekpuk-lake-e-dease-inlet>

management issues, language, governmental structure, and indigenous and other partner engagement. These sites are discussed below.

Roebuck Bay, WA, Australia (EAAFP #111, Ramsar #479). “The site is one of the most important migration stopover and non-breeding areas for shorebirds in Australia and globally. Roebuck Bay is the arrival and departure point for large proportions of the Australian populations of several shorebird species (notably Bar-tailed Godwit). Roebuck Bay is a rich shorebird feeding ground, supporting an exceptionally high (globally) macro-invertebrate biomass, including many species believed new to science. Roebuck Bay is a tropical marine embayment with extensive, highly biologically diverse, intertidal mudflats. The site is internationally important for at least 20 species of migratory shorebirds with total numbers of shorebirds using the site each year in many years estimated at over 100,000. Roebuck Bay remains one of the most important sites for shorebird conservation in the East Asian-Australasian Flyway.”⁵¹ Important shorebird species occurring at Roebuck Bay include: Bar-tailed Godwit, Black-tailed Godwit, Red Knot, Great Knot, Red-necked Stint, Curlew Sandpiper, Sanderling, Eastern Curlew, Little Curlew, Whimbrel, Common Greenshank, Grey-tailed Tattler, Terek Sandpiper, Ruddy Turnstone, Asian Dowitcher, Greater Sand Plover, Oriental Plover, Lesser Sand Plover, Grey Plover, Red-capped Plover, and Pied Oystercatcher.

Roebuck Bay is a major site in Australia for shorebird research and is located close to the Broome Bird Observatory⁵², a full-time research, education, and recreation facility. “The [Observatory] seeks to engage birdwatchers and the wider community in learning more about migratory shorebirds and their conservation, offering accommodation, camping, tours and training courses. The Observatory also partners with many academic institutions, community groups and government agencies to facilitate research projects, including a regular cannon-netting program for tagging, monitoring and tracking shorebirds with the Global Flyway Network” (Weller and Warren 2017). Another group facilitating conservation work at the site is the Roebuck Bay Working Group⁵³.

“Roebuck Bay lies in the traditional estate of Aboriginal people belonging to both Jukun and Yawuru groups. The northern shore from Burrugun (Dampier Creek), past the law grounds at Ganin (Fishermans Bend), to Mangkalagun (Crab Creek) was an important area for seasonal meetings, exchanging gifts, arranging marriages and settling disputes. In addition, many localities have Dreamtime stories associated with them. Numerous shellfish middens, marking former camping places, can still be seen along coastal cliffs and dunes. Aboriginal people continue to make extensive use of the Bay's natural resources e.g., gathering shellfish, fishing and hunting Dugong.”⁵⁴ The Yawuru people have increased access to land in the Roebuck Bay region, including the Yawuru Conservation Reserve and the new Yawuru Indigenous Protected Area (IPA). The “Yawuru Ranger Program has been established in partnership with the WA Department of Parks and Wildlife [DPAW] to ensure that Yawuru people are trained and employed to look after country into the future. These land and sea Rangers work for DPAW and perform land and sea management services for the Park Council partners.”⁵⁵ For locations of Indigenous ranger groups and IPAs see

https://www.pmc.gov.au/sites/default/files/files/ia/IEB/IPA_WOC_national_map.pdf

⁵¹[http://www.eaaflyway.net/wordpress/new/theflyway/flywaysitenetwork/SIS%20EAAF111%20\(Roebuck%20Bay\)_v2017.pdf](http://www.eaaflyway.net/wordpress/new/theflyway/flywaysitenetwork/SIS%20EAAF111%20(Roebuck%20Bay)_v2017.pdf)

⁵² <http://www.broomebirdobservatory.com/>

⁵³ <http://www.roebuckbay.org.au/>, <https://www.facebook.com/roebuckbay/>

⁵⁴ <http://www.environment.gov.au/water/topics/wetlands/database/pubs/33-ris.rtf>

⁵⁵ <http://www.yawuru.com/our-organisation/land-sea/>

80 Mile Beach, WA, Australia (EAAFP #110, Ramsar #480). “Eighty-mile Beach is the most important in Australia for use by migrant shorebirds, particularly on southward migration (August-November). The site consists of a 220km section of coastline and adjacent mudflats, together with two large ephemeral lakes and a series of springs occurring in marshland to the east. More than 472,000 migratory shorebirds have been counted on the mudflats during the September to November period. The site is one of the three most important for migratory shorebirds in Australia. It is considered to be one of the major stopover and non-breeding areas for migratory shorebirds visiting Australia.”⁵⁶ The 12 migratory shorebird species at 80 Mile Beach that meet the EAAF 1% criterion are: Bar-tailed Godwit, Common Greenshank, Terek Sandpiper, Grey-tailed Tattler, Ruddy Turnstone, Great Knot, Red Knot, Sanderling, Red-necked Stint, Curlew Sandpiper, Greater Sand Plover, and Oriental Plover. The southern sector of 80 Mile Beach is regarded by Aboriginal people as being part of Nyangumarta country, while the northern area (Anna Plains Station) is regarded as Karajarri country. In the southern section, the Yamatji Marlpa Aboriginal Corporation and Nyangumarta Rangers⁵⁷ manage the Nyangumarta Warrarn IPA. The Karajarri have a ranger group⁵⁸ and a declared IPA for part of 80 Mile Beach (and an IPA consultation for other parts of the site) and have completed a Healthy Country Plan.⁵⁹

Southeastern Gulf of Carpentaria, Qld (EAAFP #120 [Karuma Smithburne/Delta Downs] and #125 [Nijinda Durlga/Tarrant]). The shorebird area is a near-continuous area of waterbird habitat extending for about 350 km along the Gulf coast. The Karumba-Smithburne (Delta Downs) section is near the centre and the Nijinda Durlga (Tarrant) section is near the western end of this larger area. The two designated sites comprise the most important sections of the larger area, with highest densities of migratory shorebirds, and include extensive intertidal mud and sand flats backed by mangroves, bare salt flats and some shelly beaches. Over 26,000 migratory shorebirds of at least 20 species feed and roost in the site. Specific species occurring at one or both sites in internationally important numbers include: Great Knot, Red Knot, Black-tailed Godwit, Bar-tailed Godwit, Greater Sand Plover, Lesser Sand Plover, and Eastern Curlew. Additionally, the site supports many other waterbirds such as terns and herons, some known or suspected to be migratory. The region is also known to be an important southbound migratory staging site (Weller and Warren 2017). Much of the terrestrial habitat is owned and/or managed by traditional owners through the Carpentaria Land Council Aboriginal Corporation (<http://www.clcac.com.au/home>). This includes the Land and Sea Rangers program, established in 2007, which carries out a variety of activities such as fire management, weed control, feral animal control, beach surveys and marine debris patrols, biodiversity and native vegetation monitoring, and engaging with local schools through a Junior Ranger Program. The Gangalidda and Garawa Rangers⁶⁰ have received specific training in shorebird identification and monitoring and the Normanton Rangers⁶¹ have conducted colonial waterbird surveys. For locations of indigenous ranger groups and IPAs see https://www.pmc.gov.au/sites/default/files/files/ia/IEB/IPA_WOC_national_map.pdf

Moreton Bay, Qld (EAAFP #013, Ramsar #631). “Moreton Bay is a semi-enclosed basin bounded on its eastern side by two of the largest sand islands in the world. It is one of only three extensive intertidal

⁵⁶ [http://www.eaaflyway.net/wordpress/new/theflyway/flywaysitenetwork/SIS%20EAAF110%20\(Eighty-Mile%20Beach\)_v2017.pdf](http://www.eaaflyway.net/wordpress/new/theflyway/flywaysitenetwork/SIS%20EAAF110%20(Eighty-Mile%20Beach)_v2017.pdf)

⁵⁷ <http://ymac.org.au/tag/nyangumarta-rangers/>

⁵⁸ <https://www.karajarri.org/>

⁵⁹ <http://www.klc.org.au/docs/default-source/Ranger-Fact-Sheets/karajarri-healthy-country-plan?sfvrsn=6>

⁶⁰ <http://www.clcac.com.au/land-sea/rangers/gangalidda-garawa>

⁶¹ <http://www.clcac.com.au/land-sea/rangers/normanton>

areas of seagrass, mangroves and saltmarsh on the eastern coast of Australia that provide habitat for water birds. At least 43 species of shorebirds use intertidal habitats in the Bay [which] is particularly significant for the population of wintering Eastern curlews (3,000 to 5,000) and the Grey-tailed tattler (more than 10,000), both substantially more than 1% of the known Flyway population. Moreton Bay lies within Queensland waters. Most of the land fronting the bay consists of land under the control of the Government of the State of Queensland, but there are substantial areas of privately owned land along the western shore. A number of canal estates have access to the bay and some of the privately held land is also proposed for canal estates.”⁶² Important shorebird species include: Pacific Golden Plover, Grey-tailed Tattler, Lesser Sand Plover, Eastern Curlew, Bar-tailed Godwit, and Curlew Sandpiper.

Great Sandy Strait, Qld (EAAFP #092, Ramsar #992). “The Strait is a double-ended sand passage, 70 km long north to south and 5 to 15 km wide east to west. The area includes permanent shallow marine water, wide channels, open water, extensive seagrass beds, mangrove forests, intertidal sand and mud flats, tidal rocky areas, island and mainland shorelines, salt flats and salt marshes together with freshwater lagoons, marshes, forested wetlands and patterned fens. Management issues include numerous recreational activities, commercial fishing and tourism, and increasing threats associated with urban and agricultural development. The eastern shore is the Great Sandy National Park, including Fraser Island and the Inskip Point Recreation Area and also a few small freehold and leasehold. National Park and Conservation status is confirmed on several of the Great Sandy Strait islands. The eastern (mainland) side is mainly freehold and leasehold in the north, national park and state forest in the central area and forest and the Wide Bay Military Training Area in the south. Queensland Department of Primary Industry Fish Habitat Areas cover significant areas in the central and far southern portions.”⁶³ Important shorebird species include: Eastern Curlew, Grey-tailed Tattler, Lesser Sand Plover, Whimbrel, Bar-tailed Godwit, and Common Greenshank.

Firth of Thames, New Zealand (EAAFP #019, Ramsar #459, IBA NZ020). “8500 ha of intertidal flats provide foraging for internationally important numbers of migratory shorebirds, with major high tide roost sites occurring on adjacent shell ridges (cheniers) and shallow pools. The extremely high use of the littoral zone of the Firth of Thames by wildlife of immense conservation value indicates a need for more specific national protection mechanisms. Currently, minimal protection is afforded under the Ramsar designation together with the guiding principles behind the Hauraki Gulf Marine Park, of which it is a part. The Firth of Thames hosts approximately 35 000 shorebirds each year. Of these, about 11 000 are Arctic breeders from Siberia and Alaska. It was a traditional food gathering region for Maori, and the Hauraki Collective, a grouping of 11 iwi from around the region of the site have reached a settlement with the Crown under the Treaty of Waitangi Settlement Act.”⁶⁴ The two species which qualify Firth of Thames as an EAAF site are Bar-tailed Godwit and Red Knot. The Pukorokoro Miranda Shorebird Centre⁶⁵, operated by the Pukorokoro Miranda Naturalists’ Trust and located about an hour outside of Auckland, assists field researchers with accommodation and other support and is used as a base for bird banding and wader counts of the Firth of Thames. The Centre’s goals are to promote awareness of coastal ecology, the flora and fauna of the Pukorokoro Miranda coast, shorebirds and their ecology, and facilitate research and education.

⁶² <https://rsis.ramsar.org/ris/631>

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[http://www.eaaflyway.net/wordpress/new/theflyway/flywaysitenetwork/SIS%20EAAF092%20\(Great%20Sandy%20Strait\)_v2017.pdf](http://www.eaaflyway.net/wordpress/new/theflyway/flywaysitenetwork/SIS%20EAAF092%20(Great%20Sandy%20Strait)_v2017.pdf)

⁶⁴ http://www.eaaflyway.net/wordpress/new/theflyway/flywaysitenetwork/EAAF019_SIS_Firth_of_Thames.pdf

⁶⁵ <http://www.miranda-shorebird.org.nz/>

Deliverable 2: Summary and Recommendations. The universe of potential partner sites is quite large, as illustrated by the many entries in Tables 2, 3, 4, 5, and 6. However, the establishing of an effective, productive, and long-lasting partner relationship requires more than the known presence of certain shorebird species. We suggest that such a relationship consider other factors such as identification of the site as important by regional or global entities, existence of an established protected area, presence of a managing entity, and existence of some kind of already functioning partnership support (perhaps from a local, national, or international NGO). We believe that these additional factors plus the identification of shared shorebird species should both be used to identify potential partner sites. Unfortunately, due to the large number of potential sites and multiple criteria, it is not possible to recommend a single “best” site; instead, we offer a set of recommendations based on the variety of factors DEWNR has indicated as being important for establishing a partnership with AIBS and different priority geographic regions. As a guide to our discussion and recommendations, we summarize the “top” sites and some of their attributes in [Table 8](#). We also include a list of existing “official” EAAFP site partnerships in [Appendix III](#), though there is not necessarily any formal method for establishing or recognizing these linkages (Mark Carey, pers. comm.) and there does not immediately appear to be any formal pattern or logic as to why these linkages were created.

For partnerships based on biological connectivity or shared shorebird species, the Yellow Sea region deserves consideration due to its clearly demonstrated priority for shorebird conservation, particularly the seven focal species at AIBS, as summarized earlier in this report. The primary sites to explore for partnerships in the China portion of the Yellow Sea (primarily the western and northern coasts) are those that are existing protected areas, specifically one or more of Chongming Dongtan, Huang He, Shuangtai Hekou, Yalu Jiang, and/or Yancheng National Nature Reserve. All these are of high importance for shorebird conservation; have been identified by one or more of the EAAFP, Ramsar, and IBA programs; and generally have some sort of existing partnership support from either internal or external partners. A secondary set of sites, which we would recommend being assessed in conjunction with the primary sites, are the other sites mentioned above, including Luannan Coast, Zhuanghe Wan, and Laizhou Wan. These sites have high shorebird abundance, but are not currently protected. Efforts underway at Luannan Coast (as discussed above) suggest that at some point in the near future (< five years), they may be at a point where a viable partnership could be established. Continual monitoring of the Luannan Coast effort and at other sites will be required to stay abreast of this evolving situation. We strongly recommend that, if AIBS investigates partnerships with sites in China, that an experienced consultant with extensive contacts in the region be engaged.

The Korea portion of the Yellow Sea (primarily the eastern and northeastern coasts) also provides several viable partnership opportunities. We highlight the Geum Estuary of South Korea due to its identified importance for shorebirds and the presence of ongoing conservation activities, including a partnership with BirdLife Australia. Other sites in the Korean portion of the Yellow Sea that emerge as priorities for partnerships include Cheonsu Bay and Songdo Tidal Flat in South Korea and the Mundok Migratory Bird Wetland Reserve in North Korea. Although technically not in the Yellow Sea region since they are on the south and southeast coasts of South Korea, we also highlight the Nakdong Estuary and Suncheon Bay sites as worthy of consideration. Note that the Saemangeum Area, though listed in [Table 4](#), is not highlighted here since most of its shorebird value has been lost from a massive land reclamation project at the site (Moores et al. 2008, Moores et al. 2016).

Several sites outside of the Yellow Sea region in several countries emerge from this analysis as potential areas for partnerships. Of these, only two emerged as having documented high to medium use by the

seven focal shorebird species: Moroshechnaya River Estuary, Russia, and Yukon-Kuskowim Delta, USA. Several other sites seem worth of exploration of partnerships in various countries, but had low use by the seven focal shorebird species, possibly because of limited or incomplete data. Note that many of these sites **are** important for shorebirds, just not the seven focal species. However, all sites are of documented importance as wetlands by one or more of the regional designation schemes and seem to have some form of current protected status and a viable management entity. These include the Mai Po Nature Reserve, Hong Kong; Bako-Buntal Bay, Malaysia; Inner Gulf of Thailand; and Sungei Buloh Wetland Reserve, Singapore. All these sites are worthy of partnership consideration, though the large distances between them make them more of one-off opportunities, which reduces the economies of scale for visiting and maintaining a relationship.

The opportunity for exchange of information and experiences based on the presence of indigenous involvement in shorebird sites seems limited to a very few sites based on our analysis. Probably the best opportunities for this lie within Australia itself, particularly in the Southeast Queensland part of Gulf of Carpentaria (holding two different EAAF sites) and at the sites of Roebuck Bay and 80 Mile Beach in Western Australia. More specifics on indigenous involvement, including ranger groups, are referenced in the site descriptions above. We believe that there are strong opportunities with Indigenous groups and local conservation groups in both areas work with AIBS to facilitate this kind of partnership. Outside of Australia, the highest potential for working with other indigenous groups is in Alaska, USA. Both of the two EAAF sites in Alaska have high levels of indigenous engagement at the sites, particularly in their use of the sites for traditional purposes and subsistence hunting. Staff with two U.S. federal agencies, the Bureau of Land Management and Fish and Wildlife Service, expressed to us their interest on working on partnering with AIBS and their respective local communities. However, the logistics and cost of visiting these parts of Alaska are formidable and these factors should be considered before attempting to make connections.

We also highlight two sites that have relatively low value for shared shorebird species with AIBS, but are very high on the list for their existing ecotourism facilities and opportunities and for their wetlands and shorebird habitat management capabilities: Mai Po Nature Reserve, Hong Kong, and Sungei Buloh Wetland Reserve, Singapore. Both sites have outstanding reputations in the EAAF region for the ease with which visitors can see the sites; for being centers for nature-based tourism for local, regional, and international wildlife watchers; and for being models for wetland management and training. Despite their relatively low value specifically for the seven AIBS focal species of shorebirds, both sites harbor a large diversity of wetland birds and would make for strong partnership opportunities.

Deliverable 3: Action plan for promoting and establishing the role of the AIBS in the flyway.

AIBS is very well positioned to lead shorebird conservation efforts nationally and across the EAAF and it has many strengths to offer this effort. We suggest that AIBS concentrate on establishing itself as a leader by engaging in the following shorebird conservation and outreach efforts: (1) helping implement Australia's migratory shorebird conservation plans; (2) maintaining and increasing current efforts at research, education, and outreach for shorebird conservation; (3) active participation in international events to highlight the importance of the shorebird conservation work ongoing at AIBS; and (4) using the existing involvement with the Kurna people at AIBS to establish a broader cultural/indigenous component to shorebird conservation work in the EAAF. We also include in Appendix IV information on important shorebird conservation sites outside of Australia and the EAAF that have successfully promoted and established themselves and recommend that AIBS research these sites for ideas and best practices to further its role in the flyway.

Migratory Shorebird Conservation Plans

Two related national shorebird conservation plans exist that AIBS can and should contribute to: the Wildlife Conservation Plan for Migratory Shorebirds (WCP; Commonwealth of Australia 2015) and the Migratory Shorebird Conservation Action Plan (CAP; Weller and Warren 2017). Both are closely connected and we therefore treat them as one single conservation plan for discussion purposes. The following are the high priority objectives and conservation strategies identified for initial stages of work by both the WCP and the CAP, presented as listed in the plan, along with ideas on how the strategies can link directly to AIBS.

Objective 1: *Protection of important habitats for migratory shorebirds has occurred throughout the EAAF.*

Strategy i: Seek the support of the Chinese and Republic of Korean governments to protect remaining tidal flats in the Yellow Sea. In collaboration with key partners such as the Department of the Environment and Energy, BirdLife Australia, and others, AIBS can help several of the key actions identified in the plan, particularly by partnering at one or more of the sites mentioned in China or South Korea in the discussion above for Deliverable 2.

Strategy ii: Support the EAAFP Implementation Strategy. This document (EAAFP 2012) consists of general guidance for partners on waterbird and habitat conservation throughout the flyway. All activities undertaken by AIBS, either at the site, nationally, or internationally should be consistent with this document since AIBS is an official EAAFP partner site. Since the current Strategy covers the period 2012 – 2016, AIBS should also consider assisting EAAFP in developing its next Implementation update when it is developed.

Objective 2: *Wetland habitats in Australia, on which migratory shorebirds depend, are protected and conserved.*

Strategy: Identify key areas for shorebird species and improve legal site protection and management using international, national and state mechanisms, including an update of the directory of important habitat for migratory shorebirds. There are a number of important sites in the broader region of the AIBS that are not yet protected or under conservation management. For example, the former saltfields to the south of the sanctuary are significant for shorebirds in the region. Complementary management of these unprotected sites as well as considering the use of zoning within the AIBS to reduce disturbance to feeding shorebirds could be considered.

Objective 3: *Anthropogenic threats to migratory shorebirds in Australia are minimised or, where possible, eliminated.*

Strategy i: *Develop and implement a community education and awareness program to reduce the effects of recreational disturbance on migratory shorebirds.* Recreational disturbance is a known threat at AIBS and one that is identified in the draft management plan as both a challenge and an opportunity. AIBS should continue its work in addressing this threat, develop techniques to monitor the success or failure of threat reduction efforts, and adaptively work to reduce the threat while allowing appropriate visitor access and use. The work of AIBS in this particular field is something that should be highlighted and communicated to partners elsewhere in Australia and throughout the EAAFP.

Strategy ii: *Investigate the impacts of climate change on migratory shorebird habitat and populations in Australia.* Although climate change is a critical threat nationally, regionally, and globally that must be addressed collectively, AIBS should do what it can to assess ongoing impacts of climate change (e.g., sea-level rise) at the site and can provide leadership in implementing shorebird-focused climate change adaptation activities.

Strategy iii: *Investigate the significance of cumulative impacts on migratory shorebird habitat and populations in Australia.* Although a priority nationally, this particular strategy is something that AIBS would contribute to by demonstrating success in addressing and abating threats to shorebird populations.

Strategy iv: *Develop and implement guidelines for wetland rehabilitation and the creation of artificial wetlands to support populations of migratory shorebirds.* The themes of wetland creation and restoration are not currently major priorities for AIBS. However, this might be an area for future work, given the loss of wetland habitats generally and the excellent visitor opportunities that some constructed wetlands can provide for wildlife and bird watching. For example, the saltfields to the south have a direct ecological connectivity to the AIBS and the shorebirds that occur there and their management as viable shorebird habitat would be an important demonstration of management of a retired saltfield for conservation outcomes.

Strategy v: *Ensure all areas important to migratory shorebirds in Australia continue to be considered in development assessment processes.* AIBS and its local partners should remain vigilant about development-related threats to the area as much as is practical and possible.

Objective 4: Knowledge gaps in migratory shorebird ecology in Australia are identified and addressed to inform decision makers, land managers and the public. The strategies identified for this objective are important for AIBS to participate in as an important Australian shorebird site, particularly the maintenance of ongoing monitoring programs. However, they are not something that AIBS by itself is uniquely in a position to strengthen or enhance.

Research, Education, and Outreach.

These are all critical components of almost any conservation program and are an identified priority at AIBS—they are mentioned specifically as a strategy under the draft management plan's Theme 1: "Conserving Shorebirds and their Habitat." The success of implementing dynamic and long-term education, outreach and research will directly reflect on the conservation success of AIBS and in its ability to meet the goals and objectives specified in the draft management plan as well as the national shorebird conservation plan mentioned above. Education, outreach and research are also common components of most, if not all, of the successful shorebird conservation project sites mentioned in Appendix IV and for some of the more established sites mentioned above that have shared species connections with AIBS.

As outlined in the text under Deliverable 1, AIBS has numerous outreach and education efforts underway conducted by various partners. These efforts, complemented by activities outlined in the draft management plan, must be continued to build support in the various local communities for AIBS and its conservation activities.

We do wish to highlight the importance of continued research activities, separately from ongoing monitoring, for AIBS to be a true leader in shorebird conservation. Research into the long-distance movements of shorebirds at AIBS is essential to both determining the specific connectivity of AIBS to other sites throughout the EAAF and in generating public interest in this amazing migration spectacle. Since the total numbers of shorebirds at AIBS are not at large as at other sites and the return on catch effort tends to be lower, the capturing and tagging of shorebirds must be continued over time in order to obtain sufficient data for rigorous analysis. Also of value will be continued investigation into techniques to measure body condition and season-long survival, the key metrics for migratory shorebirds that AIBS is ostensibly responsible for at this site. Finally, continued research on resident and short-distance migratory shorebirds, which depend on AIBS for reproduction and other activities, is also a key recommendation we make.

International Participation.

We recommend that, as part of AIBS' overall efforts at conservation and promotion, partners consider conducting outreach by attending meetings, conferences, birding festivals, and similar events outside Australia. Some specific suggestions of these events that have come to our attention include:

- a. 2018 International Ornithological Congress (<http://www.iocongress2018.com/>), Vancouver, Canada, 19-26 August 2018. Although the IOC has traditionally been an academic meeting, the Canadian hosts want to really expand the meeting into a more generalized meeting that supports conservation, tourism, public interest, etc. This might be a great setting for AIBS to promote itself and its shorebird conservation efforts to participants from all over the world, including the Pacific. There is a specific symposium planned on "Migratory Waterbirds in the East Asian-Australasian Flyway: Ecology and Conservation", organized by Zhijun Ma (Fudan University, China) and Theunis Piersma (University of Groningen, Netherlands). Also of interest is the specific integration of the IOC with the Vancouver International Bird Festival (with potentially as many as 30,000 public visitors) and the Aboriginal Tourism BC association (<https://www.aboriginalbc.com/>); the latter aspect could be of great interest to AIBS. The meeting itself could also possibly be a springboard for additional trips and/or visits or meetings with partners, either in Canada or Alaska.
- b. Copper River Delta Shorebird Festival (<http://www.copperriverdeltashorebirdfestival.com/>), Cordova, Alaska, USA, 3-6 May 2018. This and the next festival are annual events held each year in Alaska that would offer the opportunity for AIBS to pitch itself to interested conservationists and tourists. They also might provide an opportunity for visits or meetings with partners in Alaska or Canada.
- c. Kachemak Bay Shorebird Festival (<http://kachemakshorebird.org/>), Homer, Alaska, USA, 10-13 May 2018.
- d. EAAF Meeting of Parties (MOP), estimated to occur in January or March 2019 and biennially after that. The 8th MOP was 16-21 January 2015 and the 9th MOP was 11-15 January 2017. This is probably the most essential international meeting for AIBS to continue to attend. It offers the most direct opportunity to showcase AIBS' successes to committed partners, learn from what others are doing, and establish cross-boundary partnerships.

Establishing a cultural/indigenous component to shorebird conservation work.

This is perhaps the most innovative, yet challenging, component of the shorebird conservation work to be done at AIBS. As discussed in the Summary for Deliverable 2 above, very few sites were uncovered in this analysis with an active component of indigenous involvement or management in shorebird conservation. The best opportunities for AIBS are likely to occur with other shorebird sites in Australia itself, particularly to learn from and emulate the successful existing ranger programs in northern Australia (Queensland and Western Australia). Outside of Australia, the sites with the most extensive indigenous involvement are those in Alaska, USA. However, these areas are expensive and difficult to get to (although Anchorage itself is an option to get close) and the indigenous involvement is focused more on subsistence use of the natural resources (including birds) rather than directly with habitat management for shorebirds. But, Alaska offers the advantages of a shared language and partners from the U.S. federal agencies who are involved with site management being very interested in working on partnerships.

Thinking more broadly about the theme of an indigenous component to shorebird conservation, it may be necessary to implement this on a separate or parallel track to a partnership specifically directed at shared shorebird species. For example, Andrew Coulson (formerly with DEWNR) initiated conversations with the organization Canada World Youth⁶⁶ and Conservation of Arctic Flora and Fauna (CAFF)⁶⁷ to explore possible indigenous youth exchanges between South Australia and Canada. CAFF has an Arctic Migratory Birds Initiative which is “designed to improve the status and secure the long-term sustainability of declining Arctic breeding migratory bird populations” and works in both the EAAF and the Americas Flyway. Although most of the focal shorebird species and/or populations occurring at AIBS do not occur (or range just barely) into Canada, the Canadian Arctic is nevertheless vitally important breeding habitat for shorebirds and the conservation issues are qualitatively similar to those of the Russian Arctic. Therefore, the general theme of both indigenous engagement and shorebird conservation could be met by such an exchange (and there are no language barriers). The primary obstacle to this type of arrangement is financial: the costs of travel and support to implement such an exchange, particularly in the Canadian Arctic, are formidable (though not insurmountable).

⁶⁶ <http://canadaworldyouth.org/>

⁶⁷ <https://www.caff.is/>

Deliverable 3: Summary and Recommendations.

Our generalized recommendation for an action plan for AIBS is to implement as many of the above directions and strategies as is possible, given funding, human resources, and the interest of all partners involved. However, many of the ongoing efforts that AIBS is participating in are clearly on the right track and need to be continued. To the extent that there are priorities for action, we recommend that AIBS: (1) continue engaging the EAAFP, particularly through participation in the biennial MOPs; (2) actively participate in implementation of the national migratory shorebird conservation plans; and (3) expand as much as is feasible the research component of shorebird conservation work at AIBS, particularly in the areas of long-distance tracking and in shorebird condition monitoring.

Implementing or establishing a cultural/indigenous component to shorebird conservation is a primary interest of AIBS and deserves special attention. As discussed under Deliverable 2, there appear to be few significant sites for the conservation of shared shorebird species elsewhere in the EAAF with a degree of cultural/indigenous engagement. Therefore, we suggest that AIBS could consider pioneering or establishing this component of shorebird conservation in the EAAF, rather than restricting itself to trying to find a partner site which has this interest, in addition to the other factors discussed earlier in this report. This would be a novel contribution of AIBS to the wider effort to conserve shorebirds across the flyway and, we feel, would be greatly appreciated by partners across the network.

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Figure 1. Map of the Adelaide International Bird Sanctuary site nominated for inclusion in the East Asian-Australasian Flyway Site Network, as contained in the site nomination form submitted in September 2016.



Figure 2. Aerial extent of the Adelaide International Bird Sanctuary National Park – Winaityinaityi Pangkara, as of November 2017. Map courtesy of Protected Areas Unit, Department of Environment, Water and Natural Resources.

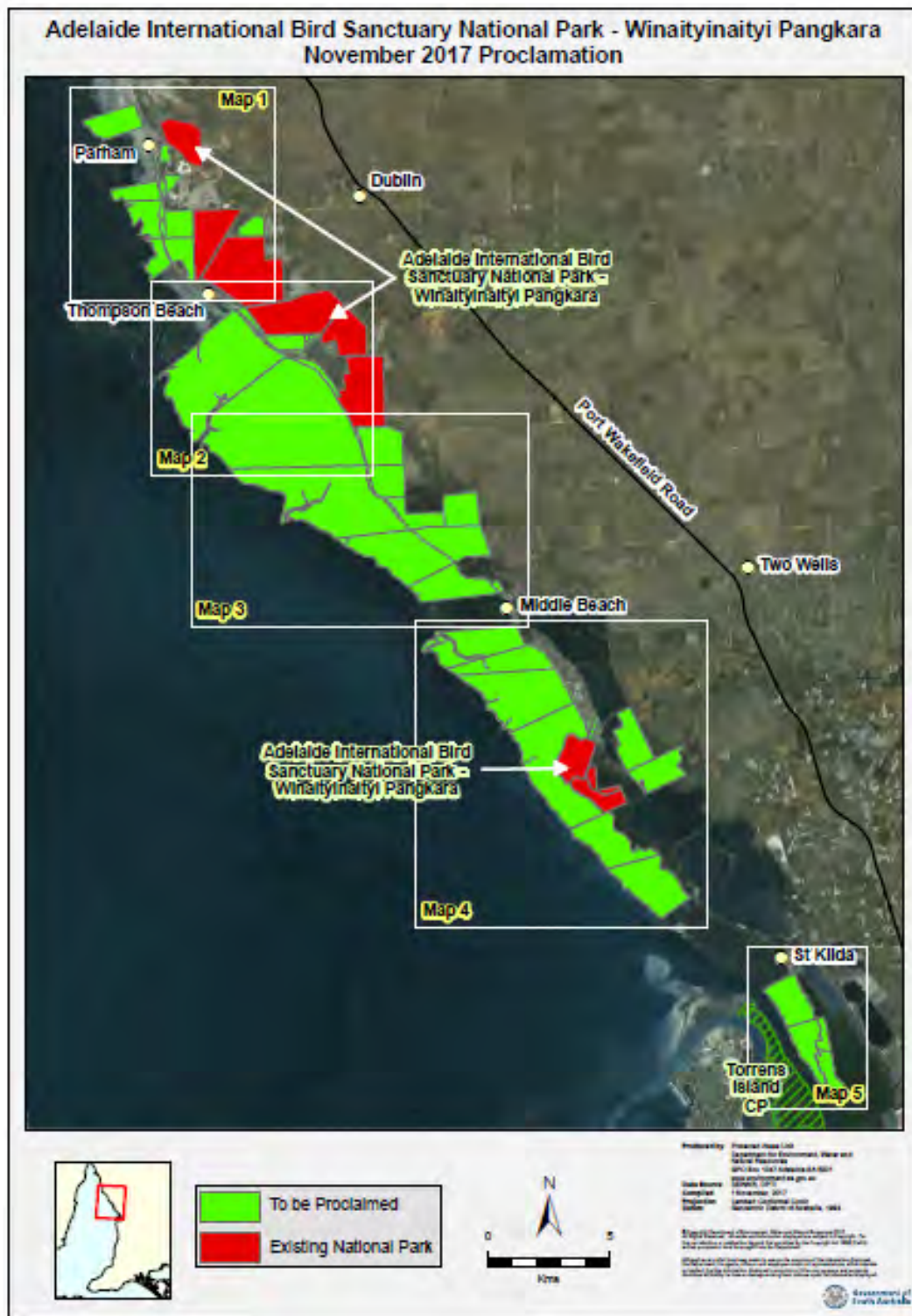


Figure 3. Total number and proportion of globally threatened and near threatened waterbirds in flyways of the world. Original is Figure 2 from MacKinnon et al. (2012) using data from Kirby (2010).

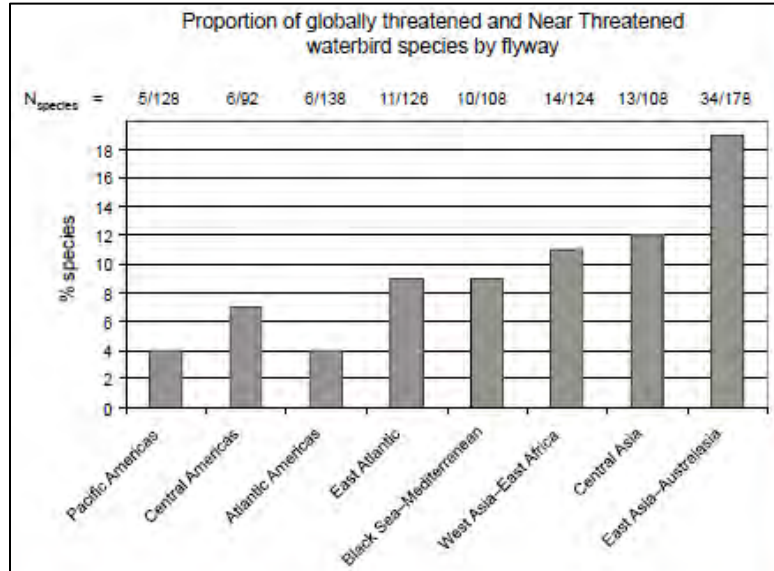


Figure 4. Predictors of flyway-level population trend estimates between 1993–2012 for ten EAAF migratory shorebirds. (a) Bayesian variable selection identifying predictors that are important (indicator value ≥ 0.75 ; green shading), inconclusive (indicator value between 0.25 and 0.75; yellow shading) and unimportant (indicator value ≤ 0.25 ; red shading). (b) Bayesian linear regression of Yellow Sea reliance as a predictor of flyway-level population trend estimates. Grey shading shows the 95% CRI around the regression line. Points show flyway-level population trend estimates, the mean annual rate of change in total abundance estimates. Error bars represent the 95% CRI around population trends. These analyses included the *menzbieri* subspecies of bar-tailed godwit and excluded the *baueri* subspecies (see Methods). Original is Figure 1 from Studds et al. (2017).

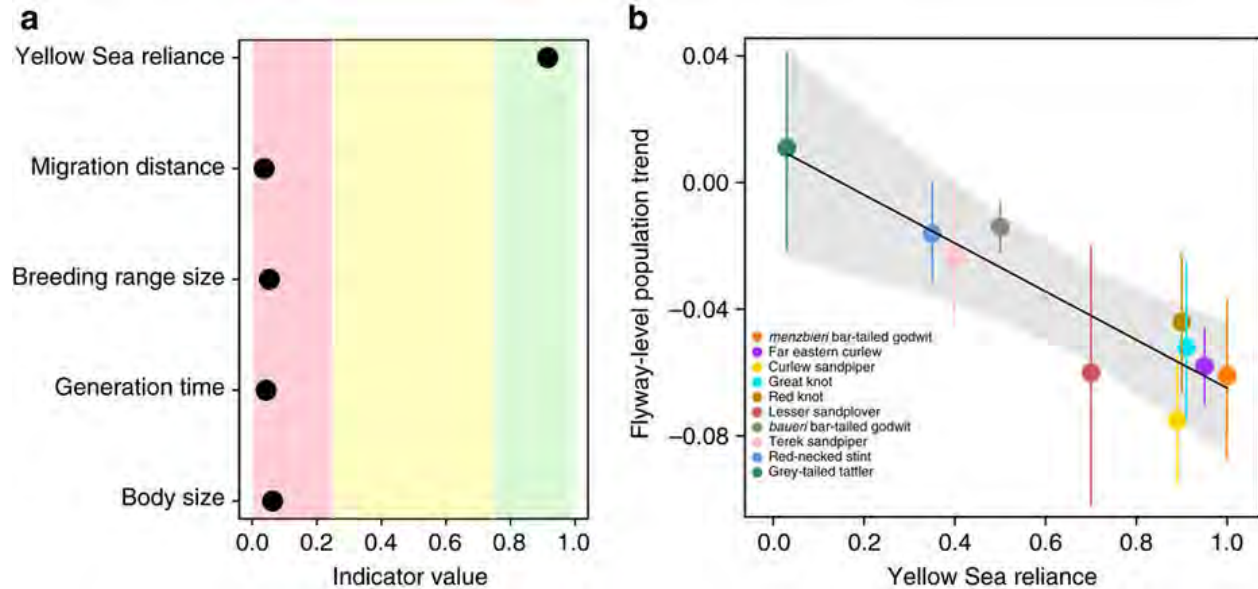


Figure 5. Grey Plover satellite tracks from plovers banded in March 2016 at Thompson Beach, South Australia. See <http://www.vwsg.org.au/Grey-Plover-tracking.html> for more detailed methodology and information on project. Image from <https://www.facebook.com/photo.php?fbid=1644747939186575&set=a.1567406083587428.1073741828.100009541537136&type=3&theater>

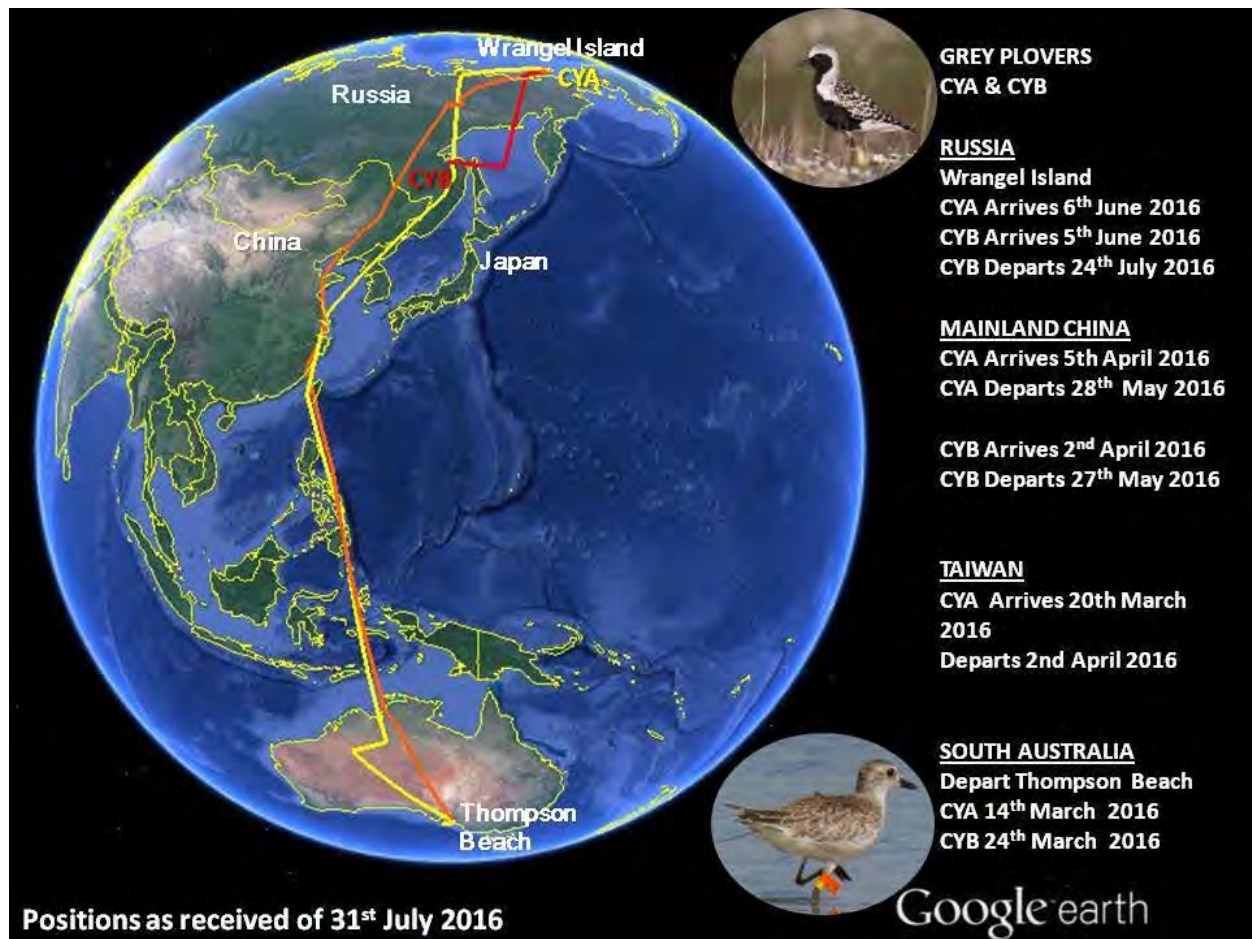


Figure 6. Maps of EAAF and important shorebird sites in coastal China. The left-hand map shows the location map of the study area in the entire flyway. The right-hand map shows the 11 coastal provinces in China in light blue with identified sites in grey (survey sites) or red (current EAAF designated sites in China). Original is Figure 1 from Xia et al. (2016).

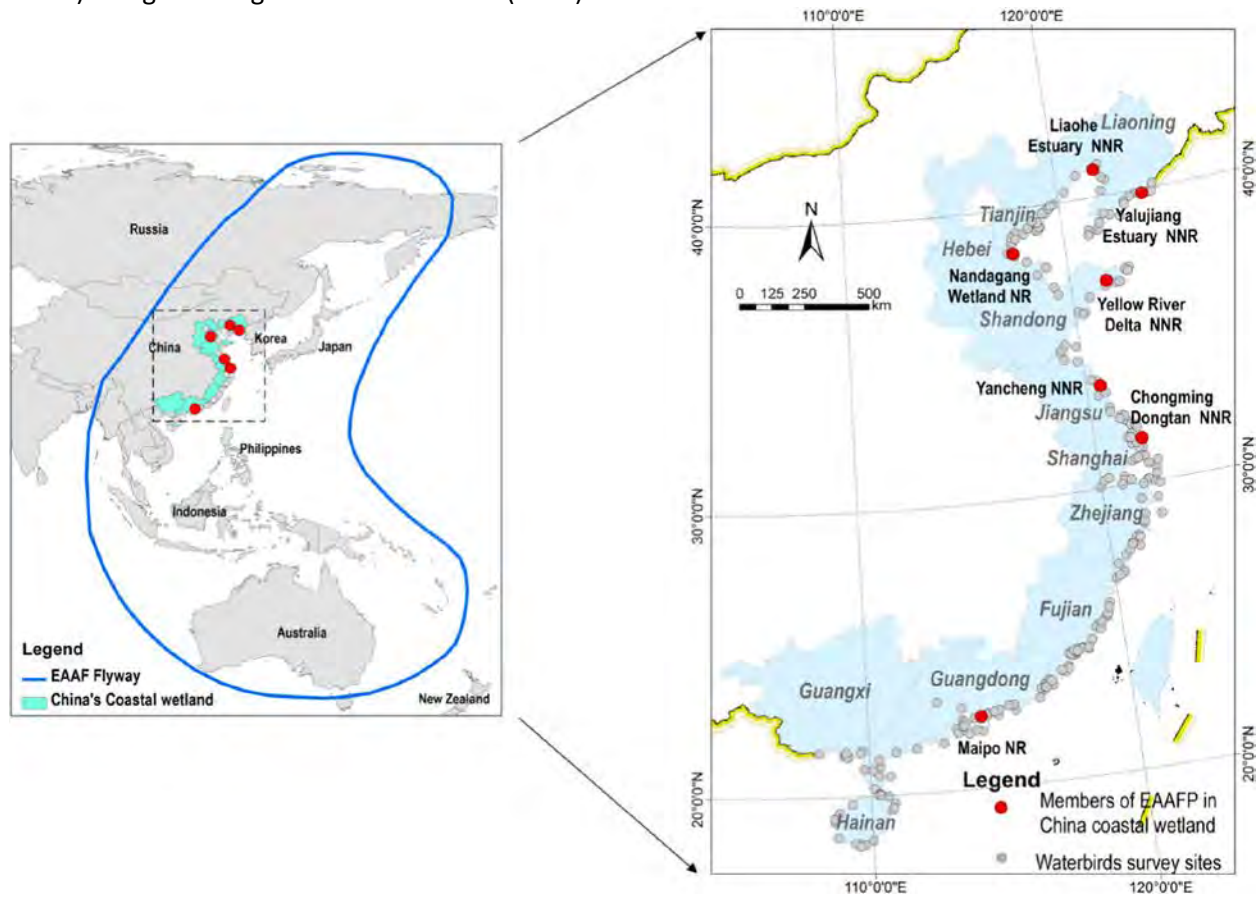


Figure 7. Sixteen key areas for intertidal waterbird biodiversity in the East Asian-Australian Flyway. Key intertidal areas as identified by biodiversity of waterbirds depending on tidal flats. Birds, top trophic predators, were used as a convenient indicator of tidal flat biodiversity given the relative availability of data on bird numbers. To select key areas the ornithological importance of 395 sites with significant tidal flats for all coastal East and Southeast Asian countries was assessed using three parameters: (a) globally threatened and Near Threatened wader species and other waterbirds using tidal flats at the site; (b) overall wader abundance; (c) wader populations of international importance (1% of their biogeographical population). Original is Figure 5 from MacKinnon et al. (2012).



Figure 8. Bohai Sea and Bohai Bay maps from Wikipedia (https://en.wikipedia.org/wiki/Bohai_Sea).



Figure 9. Critical areas of the East Asian-Australasian Flyway, based on the number of priority shorebird populations supported in internationally important numbers. The cluster of red squares illustrates the regional importance of the Yellow Sea region for shorebird conservation. Original is page 24 from Conklin et al. (2014).

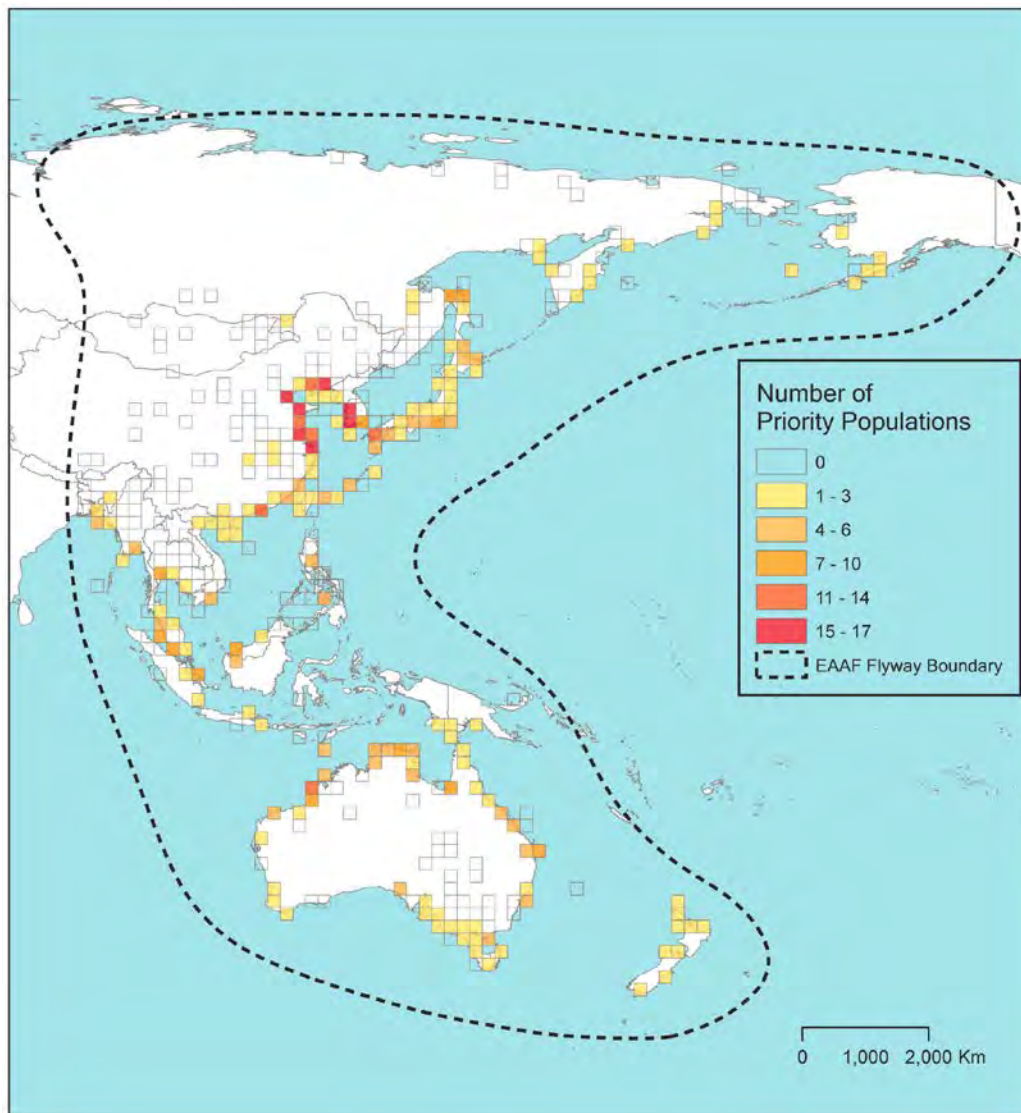


Table 1. List of shorebird species occurring at the AIBS. Derived from Purnell et al. (2015), Table 5; Purnell et al. (2017), Table 9; and Coleman and Cook (2009), Tables 2 and 3. *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) status from EPBC Act List of Threatened Fauna, <http://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl?wanted=fauna>. Notes on vagrants determined from Blaylock et al. (2017) and Menkhorst et al. (2017).

Common Name	Scientific Name	Notes
Latham's Snipe	<i>Gallinago hardwickii</i>	Not an aggregatory species
Black-tailed Godwit	<i>Limosa limosa</i>	
Bar-tailed Godwit	<i>Limosa lapponica</i>	Critically Endangered, EPBC (subspecies <i>menzbieri</i>); Vulnerable, EPBC (subspecies <i>baueri</i>)
Hudsonian Godwit	<i>Limosa haemastica</i>	Rare vagrant
Little Curlew	<i>Numenius minutus</i>	
Whimbrel	<i>Numenius phaeopus</i>	
Eastern Curlew	<i>Numenius madagascariensis</i>	Critically Endangered, EPBC
Common Redshank	<i>Tringa totanus</i>	Rare vagrant
Marsh Sandpiper	<i>Tringa stagnatilis</i>	
Lesser Yellowlegs	<i>Tringa flavipes</i>	Rare vagrant
Common Greenshank	<i>Tringa nebularia</i>	
Wood Sandpiper	<i>Tringa glareola</i>	
Terek Sandpiper	<i>Xenus cinereus</i>	
Common Sandpiper	<i>Actitis hypoleucos</i>	
Grey-tailed Tattler	<i>Tringa brevipes</i>	
Ruddy Turnstone	<i>Arenaria interpres</i>	
Great Knot	<i>Calidris tenuirostris</i>	Critically Endangered, EPBC
Red Knot	<i>Calidris canutus</i>	Endangered, EPBC
Sanderling	<i>Calidris alba</i>	
Little Stint	<i>Calidris minuta</i>	
Red-necked Stint	<i>Calidris ruficollis</i>	
Long-toed Stint	<i>Calidris subminuta</i>	
Pectoral Sandpiper	<i>Calidris melanotos</i>	
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	
Cox's Sandpiper	<i>Calidris x paramelanotos</i>	Curlew-Pectoral Sandpiper hybrid (Christidis et al. 1996, Menkhorst et al. 2017)
Curlew Sandpiper	<i>Calidris ferruginea</i>	Critically Endangered, EPBC
White-rumped Sandpiper	<i>Calidris fuscicollis</i>	Rare vagrant
Baird's Sandpiper	<i>Calidris bairdii</i>	Rare vagrant
Broad-billed Sandpiper	<i>Limicola falcinellus</i>	
Ruff	<i>Philomachus pugnax</i>	
Buff-breasted Sandpiper	<i>Tryngites subruficollis</i>	Rare vagrant
Red-necked Phalarope	<i>Phalaropus lobatus</i>	

Common Name	Scientific Name	Notes
Australian Painted Snipe	<i>Rostratula australis</i>	Resident; Endangered, EPBC
Pied Oystercatcher	<i>Haematopus longirostris</i>	Resident
Sooty Oystercatcher	<i>Haematopus fuliginosus</i>	Resident
Black-winged (White-headed) Stilt	<i>Himantopus (himantopus) leucocephalus</i>	Resident
Red-necked Avocet	<i>Recurvirostra novaehollandiae</i>	Resident
Banded Stilt	<i>Cladorhynchus leucocephalus</i>	Resident
American Golden Plover	<i>Pluvialis dominica</i>	Rare vagrant
Pacific Golden Plover	<i>Pluvialis fulva</i>	
Grey Plover	<i>Pluvialis squatarola</i>	
Ringed Plover	<i>Charadrius hiaticula</i>	Rare vagrant
Little Ringed Plover	<i>Charadrius dubius</i>	Rare vagrant
Red-capped Plover	<i>Charadrius ruficapillus</i>	Resident
Double-banded Plover	<i>Charadrius bicinctus</i>	Short-distance migrant from New Zealand
Lesser Sand Plover	<i>Charadrius mongolus</i>	Endangered, EPBC
Greater Sand Plover	<i>Charadrius leschenaultii</i>	Vulnerable, EPBC
Oriental Plover	<i>Charadrius veredus</i>	
Inland Dotterel	<i>Charadrius australis</i>	
Black-fronted Dotterel	<i>Elseyaornis melanops</i>	Resident
Red-kneed Dotterel	<i>Erythrogonys cinctus</i>	Resident
Banded Lapwing	<i>Vanellus tricolor</i>	Resident
Masked Lapwing	<i>Vanellus miles</i>	Resident
Oriental Pratincole	<i>Glareola maldivarum</i>	Rare vagrant
Australian Pratincole	<i>Stiltia isabella</i>	

Table 2. List of shorebird sites in Australia and New Zealand with counts greater than or equal to the 1% threshold of the population estimate for the EAAF of one or more of the seven focal shorebird species (Eastern Curlew, Great Knot, Red Knot, Red-necked Stint, Curlew Sandpiper, Sharp-tailed Sandpiper, Bar-tailed Godwit), ranked in descending order of 'importance' score based on data from Bamford et al. (2008), updated with data in Conklin et al. (2014) and Sagar et al. (1999) for the same site. Methodology as described in text. Gulf St Vincent site added for comparison.

Site	Country	Importance Score
Eighty Mile Beach	Australia	5.78
Roebuck Bay	Australia	1.70
SE Gulf of Carpentaria	Australia	1.63
The Coorong and Coorong NP	Australia	1.45
Port Hedland Saltworks	Australia	1.33
Great Sandy Strait	Australia	1.12
Lake MacLeod	Australia	1.09
Corner Inlet	Australia	1.02
Lake Cawndilla	Australia	1.00
Eastern Port Phillip Bay	Australia	0.92
Moreton Bay	Australia	0.78
Shoalwater Bay and Broad Sound	Australia	0.57
Manukau Harbour	New Zealand	0.49
Shallow Inlet/Sandy Point	Australia	0.47
Western Port Bay	Australia	0.47
Farewell Spit	New Zealand	0.46
Penrice	Australia	0.39
Peel-Harvey system	Australia	0.36
Western Port Phillip Bay	Australia	0.36
Kaipara Harbour	New Zealand	0.35
Gulf St Vincent	Australia	0.34
Lake George	Australia	0.33
Lake Buloke	Australia	0.32
Notch Point	Australia	0.31
Boullanger Bay/Robbins Passage	Australia	0.27
Lake Gregory	Australia	0.27
Tullakool Evaporation Ponds	Australia	0.27
Wilson Inlet	Australia	0.25
Chambers Bay	Australia	0.24
Gippsland Lakes	Australia	0.22
Parengarenga Harbour	New Zealand	0.22
Hunter Estuary	Australia	0.21
Firth of Thames	New Zealand	0.21
Milingimbi coast	Australia	0.21

Site	Country	Importance Score
Lake Preston	Australia	0.20
Yantabulla Swamp	Australia	0.19
Kangaroo Island, South Australia	Australia	0.18
Yantara Lake	Australia	0.17
Swan River Estuary, Perth	Australia	0.17
Roper River area	Australia	0.17
Lake Gol Gol	Australia	0.16
Port Stephens	Australia	0.16
Ocean Grove to Barwon Heads	Australia	0.16
Lake Murdeduke	Australia	0.15
Anderson Inlet	Australia	0.15
Port Wakefield - Webb Beach	Australia	0.14
Castlereagh Bay	Australia	0.14
Orielton Lagoon	Australia	0.14
Mackay Town Beach	Australia	0.14
Pioneer River – McEwan’s Beach	Australia	0.14
Ceduna Bays	Australia	0.14
Port Pirie coast	Australia	0.14
Lake Hawdon south	Australia	0.14
Kakadu National Park	Australia	0.13
Barrow Island	Australia	0.13
Rangaunu Harbour	New Zealand	0.12
Lake Tutchewop, Kerang	Australia	0.12
Whangarei Harbour	New Zealand	0.12
Port McArthur	Australia	0.12
Buckingham Bay	Australia	0.12
Albany Harbours	Australia	0.11
Logan Lagoon, Flinders Island	Australia	0.11
Lake Eyre	Australia	0.11
Lake Cooloongup	Australia	0.11
Vasse Wonnerup Estuary	Australia	0.10
Nericon Swamp	Australia	0.09
Torry Plains Station	Australia	0.09
Tauranga Harbour	New Zealand	0.09
Edithvale-Seaford	Australia	0.08
Waitemata Harbour	New Zealand	0.08
Cape Bowling Green	Australia	0.08
Lake Machattie	Australia	0.07
Lake Hindmarsh	Australia	0.07
Derwent Estuary - Pittwater	Australia	0.07

Site	Country	Importance Score
Lake Yamma Yamma	Australia	0.06
Adele Island	Australia	0.06
Tuckerbil Swamp	Australia	0.06
Fog Bay and adjacent islands	Australia	0.06
Houhora Harbour	New Zealand	0.06
Lake Numalla	Australia	0.05
Lake Connewarre Area	Australia	0.05
Dampier Saltworks	Australia	0.05
Lake Martin	Australia	0.05
Fivebough Swamp	Australia	0.05
Kawhia Harbour	New Zealand	0.05
Price Saltfields-Clinton Cons.Park	Australia	0.05
Elcho Island	Australia	0.05
Ohope/Ohiwa Harbour	New Zealand	0.05
Tuggerah lakes	Australia	0.05
Thomsons Lake Nature Reserve	Australia	0.04
Ashmore Reef	Australia	0.04
Motueka Estuary	New Zealand	0.04
Forrestdale Lake Nature Reserve	Australia	0.03
Boucat Bay	Australia	0.03
Shoal Bay: Tree Pt to Lee Pt	Australia	0.03
East Waimea Inlet	New Zealand	0.03
Matarangi Spit – Whangapoa	New Zealand	0.03
Aotea Harbour	New Zealand	0.03
Westhaven (Whanganui) Inlet	New Zealand	0.02
Invercargill – Awarua Bay	New Zealand	0.02
Avon-Heathcote Estuary	New Zealand	0.02

Table 3. List of shorebird sites outside of Australia and New Zealand with counts greater than or equal to the 1% threshold of the population estimate for the EAAF of one or more of the seven focal shorebird species (Eastern Curlew, Great Knot, Red Knot, Red-necked Stint, Curlew Sandpiper, Sharp-tailed Sandpiper, Bar-tailed Godwit), ranked in descending order of 'importance' score, based on data in Bamford et al. (2008), updated with data in Conklin et al. (2014), Bai et al. (2015), and Hassell et al. (2017) for the same site. Where multiple counts were available for a species the same site, the highest available count was used to calculate the importance score. Methodology as described in text. Gulf St Vincent site added for comparison.

Site	Country	Importance Score	Importance Rank
Yalu Jiang National Nature Reserve	China	2.89	High
Moroshechnaya River Estuary	Russia	2.85	High
Luannan Coast & Saltworks	China	2.64	High
Saemangeum (Dongjin and Mangyeong Estuaries)	South Korea	1.73	High
Shuangtaizihou National Nature Reserve	China	1.44	High
Yukon-Kuskokwim Delta	USA	1.27	High
Lianyungang Coast	China	1.22	High
Dandong Port East	China	0.98	Medium
North-west Bo Hai Wan	China	0.98	Medium
Tianjin Coast	China	0.92	Medium
Geum River Estuary (incl. Yubu Island)	South Korea	0.92	Medium
Yancheng National Nature Reserve	China	0.91	Medium
Banyuasin Delta	Indonesia	0.60	Medium
Asan Bay	South Korea	0.59	Medium
Zhuanghe Wan	China	0.57	Medium
Dongsha Islands	China	0.56	Medium
Nakdong Estuary	South Korea	0.55	Medium
Gulf St Vincent	Australia	0.53	
Huang He (Yellow River) Delta National Nature Reserve	China	0.52	Medium
Huanghua Coast (Cangzhou)	China	0.52	Medium
Namyang Bay	South Korea	0.47	Medium
Ganghwa Island/Tidal Flat	South Korea	0.47	Medium
Egegik Bay	USA	0.44	Medium
Yeongjong Island	South Korea	0.41	Medium
Mundok Migratory Bird Wetland Reserve	North Korea	0.39	Medium
Laizhou Wan	China	0.38	Medium
Chongming Dongtan National Nature Reserve	China	0.34	Medium
Daqing He & Shi Jiu Tuo	China	0.33	Medium
Daursky Nature Reserve	Russia	0.33	Medium
North Bo Hai Wan	China	0.30	Medium

Site	Country	Importance Score	Importance Rank
Pesisir Timur Pantai Sumatera Utara	Indonesia	0.24	Low
Rudong Coast	China	0.23	Low
Song Do Tidal Flat	South Korea	0.23	Low
Linghekou	China	0.23	Low
Inner Deep Bay (Mai Po & Futian)	China	0.23	Low
South Bo Hai Wan	China	0.21	Low
Han River Estuary	South Korea	0.19	Low
Odoptu Gulf	Russia	0.15	Low
Cinder Lagoon	USA	0.15	Low
Port Heiden	USA	0.15	Low
Port Moller/Nelson Lagoon/Mud Bay	USA	0.15	Low
North-central Selangor Coast	Malaysia	0.13	Low
Inner Gulf of Thailand	Thailand	0.10	Low
Inner Gulf of Martaban	Myanmar	0.08	Low
Tugurskiy Bay	Russia	0.08	Low
Pulau Bruit	Malaysia	0.08	Low
Bensbach-Bula Coast	Papua New Guinea	0.07	Low
Kikori Delta	Papua New Guinea	0.06	Low
Laobian – Yingkou Coast	China	0.06	Low
Ganyu Coast	China	0.06	Low
Northern Jiangsu Coastline	China	0.06	Low
Wudi-Zhanhua-Hekou Coast	China	0.05	Low
Kuala Samarahan – Kuala Sadong	Malaysia	0.05	Low
Fukiagehama Kaigan	Japan	0.05	Low
Dongling Coast	China	0.04	Low
Schastiya Bay	Russia	0.04	Low
Khairyuzova Bay	Russia	0.04	Low
Aphae Island	South Korea	0.03	Low
Penzhina River mouth	Russia	0.03	Low
Dongtai (Zhou Gang – Qiang Gang Coast)	China	0.03	Low
Seosan	South Korea	0.03	Low
Sone Higata	Japan	0.03	Low
Benoa Bay	Indonesia	0.03	Low
Lososei Bay	Russia	0.03	Low
Suncheon Bay	South Korea	0.03	Low
Baikal Bay	Russia	0.03	Low
Cheonsu Bay	South Korea	0.03	Low
Jiazhou Wan	China	0.03	Low

Site	Country	Importance Score	Importance Rank
Nanhuidongtan	China	0.03	Low
Daijugarami	Japan	0.03	Low
Manila Bay	Philippines	0.02	Low
Isahaya Higata	Japan	0.02	Low
Haenam Hwangsang	South Korea	0.02	Low
Mukawa Kako	Japan	0.02	Low
Bako-Buntal Bay	Malaysia	0.02	Low
Terpeniya Bay	Russia	0.01	Low
Arao Kaigan	Japan	0.01	Low
Xuwei Saltworks	China	0.01	Low
Ta-Tu-Hsi, Changhua	China	0.01	Low
Sonadia & Mohekhali Island	Bangladesh	0.01	Low
Sungei Buloh Wetland Reserve	Singapore	0.00	Low
Qupaluk	USA	0.00	Low

Table 4. List of potential AIBS partner sites that have high or medium importance for the seven focal shorebird species and that have been designated by one or more of the EAAFP, Ramsar Convention, or Important Bird Area program. Sites are listed by Province within Country and then alphabetically by site name. Imp is Shorebird Importance (H = high, M = medium). EAAFP indicates if the site is a Flyway Site Network site and, if so, its identifying number. Ramsar indicates if the site is a recognized Ramsar site and, if so, its identifying number. IBA indicates if the site is a recognized Important Bird Area by BirdLife International. Bai et al. indicates if the site is identified by Bai et al. (2015) as an important wetland in China. WWF gives the site number as referenced by Conklin et al. (2014). IUCN Key Area gives the name of the key area for waterbird biodiversity from MacKinnon et al. (2012) that the site is part of, if any. Xia et al. indicates whether the site is listed as one of the top 21 priority wetlands in China by Xia et al. (2016). Hua et al. indicates whether the sites is listed in Hua et al. (2016) as an important shorebird site in the Yellow Sea region.

Site Name	Country	Province	Imp	EAAFP	Ramsar	IBA	Bai et al.	WWF	IUCN Key Area	Xia et al.	Hua et al.
Lianyungang Coast (Linhongkou & Liezikou)	China	Jiangsu	H			Yes	Yes	#109		Yes	
Yancheng National Nature Reserve	China	Jiangsu	M	#005	#1156	CN367		#147	Jiangsu and Shanghai Coast	Yes	Yes
Shuangtaizihekou National Nature Reserve	China	Liaoning	H	#004	#1441	CN052	Yes	#130	Liaodong Bay	Yes	Yes
Yalujiang Estuary National Nature Reserve	China	Liaoning	H	#043		CN062	Yes	#85	Yalu Jiang Estuary	Yes	Yes
Zhuanghe Wan	China	Liaoning	M			CN059	Yes	#151			
Huang He [Yellow River] Delta National Nature Reserve	China	Shandong	M	#006	#2187	CN327	Yes	#99	Laizhou Bay	Yes	Yes
Laizhou Wan	China	Shandong	M			CN328		#105	Laizhou Bay		Yes
Chongming Dongtan National Nature Reserve	China	Shanghai	M	#002	#1144	CN375	Yes	#81	Jiangsu and Shanghai Coast		Yes
Mundok Migratory Bird Wetland Reserve	North Korea	South Pyongan	M	#045		KP019	N/A	#279	Yalu Jiang Estuary		Yes

Site Name	Country	Province	Imp	EAAFP	Ramsar	IBA	Bai et al.	WWF	IUCN Key Area	Xia et al.	Hua et al.
Daursky Nature Reserve	Russia	Chita	M	#020			N/A				
Moroshechnaya River Estuary	Russia	Kamchatka Krai	H	#001	Yes	RU3114	N/A	#299			
Nakdong Estuary	South Korea	Busan	M	#097		KR037	N/A		Nakdong-gang Estuary		
Geum Estuary	South Korea	Chollabuk	M	#100	#1925 (part)	KR019	N/A	#318	Yellow Sea Coast of South Korea		Yes
Saemangeum Area	South Korea	Chollabuk	H			KR021 & KR022	N/A		Yellow Sea Coast of South Korea		Yes
Asan Bay	South Korea	Chunchongnam	M			KR017	N/A	#311	Yellow Sea Coast of South Korea		Yes
Ganghwa Island	South Korea	Inchon	M			KR005	N/A	#317	Yellow Sea Coast of South Korea		Yes
Yeongjong Island (south)	South Korea	Inchon	M			KR006	N/A	#337	Yellow Sea Coast of South Korea		Yes
Namyang Bay	South Korea	Kyonggi	M			KR010	N/A	#332	Yellow Sea Coast of South Korea		Yes
Egegik Bay	USA	Alaska	M			Yes	N/A				
Yukon-Kuskokwim Delta	USA	Alaska	H	#109		Yes	N/A				

Table 5. List of potential AIBS partner sites that have high or medium importance for the seven focal shorebird species but are not designated by either EAAFP, Ramsar Convention, or Important Bird Area program. Sites are listed by Province within Country and then alphabetically by site name. Imp is Shorebird Importance (H = high, M = medium). Bai et al. indicates if the site is identified by Bai et al. (2015) as an important wetland in China. WWF gives the site number as referenced by Conklin et al. (2014). IUCN Key Area gives the name of the key area for waterbird biodiversity from MacKinnon et al. (2012) that the site is part of, if any. Xia et al. indicates whether the site is listed as one of the top 21 priority wetlands in China by Xia et al. (2016). Hua et al. indicates whether the sites is listed in Hua et al. (2016) as an important shorebird site in the Yellow Sea region.

Site Name	Country	Province	Imp	Bai et al.	WWF	IUCN Key Area	Xia et al.	Hua et al.
Daqing He & Shi Jiu Tuo	China	Hebei	M		#108	Bohai Bay		Yes
Huanghua Coast	China	Hebei	M	Yes	#100		Yes	
Luannan Coast & Saltworks	China	Hebei	H		#91		Yes	Yes
North Bo Hai Wan	China	Hebei	M					
Dongsha Islands	China	Jiangsu	M			Jiangsu and Shanghai Coast		Yes
Dandong Port East	China	Liaoning	M		#83		Yes	
Northwest Bohai Bay	China	Tianjin	M			Bohai Bay		Yes
Tianjin Coast	China	Tianjin	M	Yes	#136			
Banyuasin Delta	Indonesia	South Sumatra	M			Sumatra Coast		

Table 6. List of potential AIBS partner sites that have low importance for the seven focal shorebird species and that have been designated by one or more of the EAAFP, Ramsar Convention, or Important Bird Area program. Sites are listed by Province within Country and then alphabetically by site name. Imp is Shorebird Importance. EAAFP indicates if the site is a Flyway Site Network site and, if so, its identifying number. Ramsar indicates if the site is a recognized Ramsar site and, if so, its identifying number. IBA indicates if the site is a recognized Important Bird Area by BirdLife International. Bai et al. indicates if the site is identified by Bai et al. (2015) as an important wetland in China. WWF gives the site number as referenced by Conklin et al. (2014). IUCN Key Area gives the name of the key area for waterbird biodiversity from MacKinnon et al. (2012) that the site is part of, if any. Xia et al. indicates whether the site is listed as one of the top 21 priority wetlands in China by Xia et al. (2016). Hua et al. indicates whether the sites is listed in Hua et al. (2016) as an important shorebird site in the Yellow Sea region.

Site Name	Province	Country	Imp	EAAFP	Ramsar	IBA	Bai et al.	WWF	IUCN Key Area	Xia et al.	Hua et al.
Sonadia & Moheshkhali Island	Chittagong	Bangladesh	Low	#103			N/A		North Bay of Bengal Coast		
Inner Deep Bay (Mai Po & Futian NR)	Hong Kong	China	Low	#003	#750	CN001, CN496	Yes	#84	Mai Po and Inner Deep Bay	Yes	
Ganyu Coast	Jiangsu	China	Low			Yes		#93		Yes	
Jiaozhou Wan	Shandong	China	Low			Yes		#101			Yes
Wudi Zhanhua Coast	Shandong	China	Low			Yes		#133			
Nanhuidongtan	Shanghai	China	Low			CN377	Yes	#116			
Pesisir Timur Pantai Sumatera Utara	North Sumatra	Indonesia	Low			ID007	N/A		Sumatra Coast		
Sone Higata	Fukuoka	Japan	Low			JP135	N/A	#227			
Mukawa Kako	Hokkaido	Japan	Low			JP027	N/A	#209			
Fukiagehama Kaigan	Kagoshima	Japan	Low			JP153 (part)	N/A	#173			
Arao Kaigan	Kumamoto	Japan	Low			JP140 (part)	N/A	#166			
Isahaya Higata	Nagasaki	Japan	Low			JP141	N/A	#188			
Daijugarami	Saga	Japan	Low			JP140 (part)	N/A	#170			
Bako-Buntal Bay	Kuching, Sarawak	Malaysia	Low	#112		MY037	N/A		Western Sarawak Coast		
Pulau Bruit	Mukah, Sarawak	Malaysia	Low			MY042	N/A		Western Sarawak Coast		
North-central Selangor Coast	Selangor, Peninsula Malaysia	Malaysia	Low			MY011	N/A		North-central Selangor Coast		
Inner Gulf of Martaban	Yangon, Bago	Myanmar	Low			MM056	N/A		Gulf of Martaban		
Manila Bay	Luzon	Phillipines	Low			PH010	N/A	#283			
Khairuzova Bay	Kamchatka Krai	Russia	Low			RU3113	N/A	#291			
Schastiya Bay	Khabarovsk Krai	Russia	Low			RU3146	N/A	#305			
Lososei Bay	Sakhalinskaya	Russia	Low			RU3167	N/A	#296			
Terpeniya Bay	Sakhalinskaya	Russia	Low			RU3165	N/A				
Sungei Buloh Wetland Reserve		Singapore	Low	#073		SG001	N/A				

Site Name	Province	Country	Imp	EAAFP	Ramsar	IBA	Bai et al.	WWF	IUCN Key Area	Xia et al.	Hua et al.
Suncheon Bay	Chollanam	South Korea	Low	#079	#1594	KR031	N/A	#335			
Cheonsu Bay	Chungcheongnam	South Korea	Low	#046		KR018	N/A	#313	Yellow Sea Coast of South Korea		Yes
Han-Imjin Estuary	Kyonggi	South Korea	Low			KR004	N/A	#324	Yellow Sea Coast of South Korea		Yes
Song Do tidal flat	Kyonggi	South Korea	Low		#2209		N/A	#334	Yellow Sea Coast of South Korea		Yes
Inner Gulf of Thailand	Samut Songkhram	Thailand	Low		#1099 (part)	TH032	N/A		Inner Gulf of Thailand		
Cinder Lagoon	Alaska	USA	Low			Yes	N/A				
Port Heiden	Alaska	USA	Low			Yes	N/A				
Port Moller/Nelson Lagoon/Mud Bay	Alaska	USA	Low			Yes	N/A				
Qupaluk	Alaska	USA	Low	#133							

Table 7. List of sites that have low importance for the seven focal shorebird species and that have not been designated by one or more of the EAAFP, Ramsar Convention, or Important Bird Area program. Sites are listed by Province within Country and then alphabetically by site name. Imp is Shorebird Importance. Bai et al. indicates if the site is identified by Bai et al. (2015) as an important wetland in China. WWF gives the site number as referenced by Conklin et al. (2014). IUCN Key Area gives the name of the key area for waterbird biodiversity from MacKinnon et al. (2012) that the site is part of, if any. Xia et al. indicates whether the site is listed as one of the top 21 priority wetlands in China by Xia et al. (2016). Hua et al. indicates whether the sites is listed in Hua et al. (2016) as an important shorebird site in the Yellow Sea region.

Site Name	Province	Country	Imp	Bai et al.	WWF	IUCN Key Area	Xia et al.	Hua et al.
Dongling Coast	Jiangsu	China	Low	Yes			Yes	
Dongtai Coast	Jiangsu	China	Low	Yes	#88		Yes	
Northern Jiangsu Coastline	Jiangsu	China	Low					
Rudong Coast	Jiangsu	China	Low	Yes		Jiangsu and Shanghai Coast		Yes
Xuwei Saltworks	Jiangsu	China	Low					
Laobian-Yingkou coast	Liaoning	China	Low		#110			
South Bohai Bay	Shandong	China	Low					Yes
Linghekou	Liaoning	China	Low			Liaodong Bay		Yes
Ta-Tu-Hsi, Changhua	Taiwan	China	Low					
Benoa Bay	Bali	Indonesia	Low					
Kuala Samarahan – Kuala Sadong	Samarahan, Sarawak	Malaysia	Low			Western Sarawak Coast		
Kikori Delta	Gulf	Papua New Guinea	Low					
Bensbach-Bula Coast	Western	Papua New Guinea	Low		#280			
Penzhina River mouth	Kamchatka Krai	Russia	Low		#303			
Tugurskiy Bay	Khabarovsk Krai	Russia	Low		#307			
Baikal Bay	Sakhalinskaya	Russia	Low		#287			
Odoptu Gulf	Sakhalinskaya	Russia	Low		#301			
Aphae Island	Chollanam	South Korea	Low		#310			Yes
Haenam Tidal flats	Chollanam	South Korea	Low		#322			Yes
Seosan	Chungcheongnam	South Korea	Low					

Table 8. Summary of sites recommended for partnership consideration with some selection criteria. Shorebird importance index is given in three levels (high, medium, low) based on the abundance of the seven focal species as discussed in the text. Site Recognition indicates if the site is designated by either the EAAFP, Ramsar, or IBA program. Closest population center gives the distance to a nearby city or town. Indigenous/local community engagement gives our qualitative assessment of how engaged indigenous or local communities are in managing the site. Ecotourism gives our assessment of the scale of the ecotourism industry at the site (high, medium, low). Management capability gives our assessment of the capacity for shorebird and/or shorebird habitat management at the site (high, medium, low). Partnerships gives our assessment of the current or existing potential to establish a partnership.

Site Name	Country	Shorebird Importance Index	Site Recognition	Closest population center	Indigenous/local community engagement	Ecotourism (current or potential)	Management capability	Partnerships, existing or potential
Luannan Coast	China	High	None	Tianjin (87km)	None	Low	Low	High
Yancheng National Nature Reserve	China	Medium	EAAFP, Ramsar, IBA	Nanjing (237km)	None	Medium	Low	Medium
Shuangtaizihekou National Nature Reserve	China	High	EAAFP, Ramsar, IBA	Panjin (33km)	None	Low	Low	Low
Yalu Jiang National Nature Reserve	China	High	EAAFP, IBA	Dandong (30km)	None	Medium	Low	High
Huang He (Yellow River) Delta National Nature Reserve	China	Medium	EAAFP, Ramsar, IBA	Dongying (46km)	None	Medium	Low	Low
Chongming Dongtan National Nature Reserve	China	Medium	EAAFP, Ramsar, IBA	Shanghai (56km)	None	Good	Medium	Medium
Mai Po Nature Reserve	Hong Kong	Low	EAAFP, Ramsar, IBA	Hong Kong (14km)	None	High	High	High
Geum Estuary	South Korea	Medium	EAAFP, IBA	Gunsan (8km)	None	Medium	Medium	Medium
Cheonsu Bay	South Korea	Low	EAAFP, IBA	Hongseong (20km)	None	Medium	Medium	Low
Song Do Tidal Flat	South Korea	Low	Ramsar	Incheon (12km)	None	Low	Low	Low
Mundok Migratory Bird Wetland Reserve	North Korea	Medium	EAAFP, IBA	Pyongyang (64km)	None	Low	Low	Low
Nakdong Estuary	South Korea	Medium	EAAFP, IBA	Busan (15km)	None	Medium	Low	Low
Suncheon Bay	South Korea	Low	EAAFP, Ramsar, IBA	Suncheon (13km)	None	Medium	Low	Low
Sonadia & Moheshkhali Island	Bangladesh	Low	EAAFP	Cox's Bazar (15km)	None	Low	Low	Low

Site Name	Country	Shorebird Importance Index	Site Recognition	Closest population center	Indigenous/ local community engagement	Ecotourism (current or potential)	Management capability	Partnerships, existing or potential
Bako-Buntal Bay	Malaysia	Low	EAAFP, IBA	Kuching (19km)	None	Medium	Medium	Low
Inner Gulf of Thailand	Thailand	Low	Ramsar, IBA	Bangkok (120km)	None	Low	Low	Low
Sungei Buloh Wetland Reserve	Singapore	Low	EAAFP, IBA	Singapore (24km)	None	High	High	High
Moroshechnaya River Estuary	Russia	High	EAAFP, Ramsar, IBA	None	None	Low	Low	Low
Yukon Delta National Wildlife Refuge	USA	High	EAAFP, IBA	Bethel (<10km)	High	Medium	High; protected area	High
Qupaluk	USA	Low	EAAFP	None	High	Low	High	Medium
Roebuck Bay	Australia	N/A	EAAFP, Ramsar, IBA	Broome (27km)	Medium	High	Medium	High
80 Mile Beach	Australia	N/A	EAAFP, Ramsar, IBA	Broome (217km)	Medium	High	Medium	High
SE Gulf of Carpentaria	Australia	N/A	EAAFP	Karumba (31km), Burketown (34km)	High	Low	Low	Low
Moreton Bay	Australia	N/A	EAAFP, Ramsar, IBA	Brisbane (40km)	None	High	Medium; part in protected area	Medium
Great Sandy Strait	Australia	N/A	EAAFP, Ramsar, IBA	Maryborough (21km)	None	Medium	Medium	Medium
Firth of Thames	New Zealand	N/A	EAAFP, Ramsar, IBA	Auckland (71km)	Low	High	Medium	High

Appendix I. List of potential wetland conservation sites in China and South Korea that either had no data for the occurrence of any of the seven focal shorebird species (although they may be important for other shorebird species). Sites based on data in Bamford et al. (2008), Conklin et al. (2012), Bai et al. (2015), and Xia et al. (2016) using methodology as explained in the text.

Site name	Province	Country
Dadeng Island & Weitou Bay	Fujian	China
Funing Wan	Fujian	China
Fuqing Wan	Fujian	China
Futou Wan	Fujian	China
Haicang Coast	Fujian	China
Jiulongjiang Estuary Mangrove NR	Fujian	China
Jujiang Saltpan	Fujian	China
Meizhou Wan	Fujian	China
Minjiang Estuary NNR	Fujian	China
Qianbancun	Fujian	China
Quanzhou Wan	Fujian	China
Wenwusha	Fujian	China
Xinghua Wan	Fujian	China
Baguang Yaozao Village	Guangdong	China
Dongguayu	Guangdong	China
Haifeng Wetland PNR	Guangdong	China
Jijia Town	Guangdong	China
Lian'anwei	Guangdong	China
Lihewei	Guangdong	China
Mangrove in Leizhou	Guangdong	China
Mangrove in Xunwe	Guangdong	China
Nan'ao Island	Guangdong	China
Nansha Wetland Park	Guangdong	China
Niutianyang	Guangdong	China
Sanzao	Guangdong	China
Shantou (Nangankou)	Guangdong	China
Xitou Coast	Guangdong	China
Beilun Estuary NNR	Guangxi	China
Daguansha	Guangxi	China
Jinwan Mangrove Beihai	Guangxi	China
Shankou Mangrove NNR	Guangxi	China
Yintan	Guangxi	China
Yujiang Village, Xiangli Town	Guangxi	China
Basuozhen	Hainan	China
Huiwenbianhai	Hainan	China
Mangrove in Yulingang	Hainan	China
Meilisha	Hainan	China

Site name	Province	Country
Qinglangang NR	Hainan	China
Sigeng NR	Hainan	China
Xinyingzhen	Hainan	China
Yinggehai Saltpan	Hainan	China
Beidaihe	Hebei	China
Laoting Coast Jingtanggang	Hebei	China
Luanhekou	Hebei	China
Southwest Bohai Bay	Hebei	China
Tanghai Wetland	Hebei	China
Xinkaihegeziwo Coast	Hebei	China
Jianzuibi	Hong Kong	China
Long Valley	Hong Kong	China
Tai Po Kau	Hong Kong	China
Xianggang Wetland Park	Hong Kong	China
Dafeng NNR	Jiangsu	China
Haizhou Wan	Jiangsu	China
Laobagang	Jiangsu	China
Lusi Fishery	Jiangsu	China
Nantong Coast (Dayangkou)	Jiangsu	China
Qidong South Coast	Jiangsu	China
Sheyang Saltworks	Jiangsu	China
Sizhibeilei Aquafarm	Jiangsu	China
Xiaoyangkou	Jiangsu	China
Yanweigang	Jiangsu	China
Giazhou	Liaoning	China
Haimao Island	Liaoning	China
Jinzhou East Coast	Liaoning	China
Lushun Laotieshan	Liaoning	China
Panjin Nanxiaohe	Liaoning	China
Ridao Saltworks Yinghekou	Liaoning	China
Shicheng Island	Liaoning	China
South Dalian Peninsula	Liaoning	China
Lidao Island	Macau	China
Wuleidao Wan	Shandong	China
Changxing Island	Shanghai	China
Haiwan Town Coast	Shanghai	China
Hengshadongtan	Shanghai	China
Jiuduansha NNR	Shanghai	China
North of Chongming Tidal flats	Shanghai	China
SanJia Port	Shanghai	China

Site name	Province	Country
Beidagang	Tianjin	China
Haibinyuchang	Tianjin	China
Hangu Coast	Tianjin	China
Tanggu Coast	Tianjin	China
Hangzhou Wan Wetland	Zhejiang	China
Jiushan Island	Zhejiang	China
Lingkundao	Zhejiang	China
Linshanhaitu Reservoir	Zhejiang	China
Shangyu Zhongsha Island	Zhejiang	China
Taizhou Wan	Zhejiang	China
Wenzhou Wan	Zhejiang	China
Yongqiang Coast	Zhejiang	China
Yueqing Wan & Xuanmen Wan	Zhejiang	China
Zhenbeitu	Zhejiang	China
Zhoushan Island	Zhejiang	China
Qizi Bay		China
Daebu Island (Do)	Kyonggi	South Korea
Hampyeong Bay (Man)	Chollanam	South Korea
Muan-Gun Tidal flats	Chollanam	South Korea
Paeksu Tidal flat	Chollabuk	South Korea

Appendix II. Discussion of important sites for Eastern Curlew, extracted from the EAAFP single species action plan (available at <http://www.eaaflyway.net/our-activities/task-forces/far-eastern-curlew/>), pages 13-14.

“Internationally, the Yellow Sea region is extremely important as stopover habitat for Far Eastern Curlews. It supports about 80% of the estimated flyway population on the northward migration (most of the remaining population apparently staying on the non-breeding grounds). Fewer are counted in the region during the southward migration, but this may be an artefact of their staggered migration.

Relatively few Far Eastern Curlews pass through **Japan** (Brazil 1991). Thirteen sites of international importance were identified in the Yellow Sea (six in **China**, six in **Republic of Korea** and one in **Democratic People’s Republic of Korea**) (Barter 2002; Bamford et al. 2008). Twelve sites were considered important during the northward migration and seven during the southward migration, with six sites (Dong Sha, Shuangtaizihekou National Nature Reserve, Ganghwa Do, Yeong Jong Do, Mangyeung Gang Hagu and Dongjin Gang Hagu) important during both (Barter 2002; Bamford et al. 2008). It is important to note that despite being recognised as internationally important, habitat in some of these sites has been destroyed since the Barter (2002) surveys. For example, Mangyeung Gang Hagu and Dongjin Gang Hagu in the **Republic of Korea** (both part of Saemangeum impounded since 2006) are no longer considered important sites for Far Eastern Curlew (Moore et al. 2016). Ganghwa Do (Island), Yeongjong Do (Island), Janghang Coast and Yubu Do (Island) in the Geum Estuary and Namyang Bay now account for nearly 90% of population in the **Republic of Korea**. In **China**, Bai et al. (2015) identified seven internationally important sites for Far Eastern Curlew in the Yellow Sea region. During northward migration, Yalu Jiang estuarine wetland, Yellow River Delta and Shuangtaizihekou National Nature Reserve are utilised by large numbers of Far Eastern Curlew, particularly Yalu Jiang with 4,840 individuals recorded in April 2011. During southward migration, Yalu Jiang estuarine wetland, Tianjin coast, Zhuanghe Bay, Shuangtaizihekou National Nature Reserve, Cangzhou coast, Rudong coast, and the Yellow River Delta are considered internationally important. Again, Yalu Jiang is the most important site with 5,289 individuals recorded in July 2011 (Bai et al. 2015).

Recent surveys in the **Democratic People’s Republic of Korea** (Riegen et al. 2016) found internationally important numbers of Far Eastern Curlews at three sites: Ilhae-ri/Sema-ri, Mundok and Undok-ri.

Outside the Yellow Sea, the Moroshechnaya River Estuary in Far East **Russia** is an internationally important site for Far Eastern Curlews during the southward migration. In **Indonesia**, the Banyuasin Delta in Sumatra is important during southward migration (Bamford et al. 2008) and in January (Li et al. 2009), while Pesisir Timur Pantai Sumatera Utara is internationally important in January (Conklin et al. 2014). In Sarawak, **Malaysia**, Pulau Bruit is internationally important for Far Eastern Curlews during northward migration (Mann 2008), and Sejinkat Ashponds is an internationally important non-breeding site (Conklin et al. 2014). There are few records from **Brunei Darussalam** (Moore undated). Bamford et al. (2008) identified the Kikori Delta as an important site in **Papua New Guinea** and Conklin et al. (2014) added the Bensbach-Bula coast.”

Appendix III. List of existing sister site relationships between EAAFP sites. Obtained from <http://www.eaaflyway.net/about/the-flyway/flyway-site-network/sister-sites/>.

Site Name	Country	Management Authority	Site Name	Country	Management Authority
Yalujiang National Nature Reserve	China	Dandong City	Firth of Thames	New Zealand	Pukorokoro Miranda Naturalist Trust
Junam Reservoir	South Korea	Changwon City	Kejo-numa	Japan	Osaki City, Miyagi Prefecture
Zhalong National Nature Reserve	China	Qiqihar City	Janghang Wetland Protected area	South Korea	Goyang City
Moreton Bay, Boondall wetlands	Australia	Brisbane City	Yatsu-higata	Japan	Narashino City, Chiba Prefecture
Hunter River Estuary Wetlands	Australia	Newcastle City	Kushiro Wetland	Japan	Kushiro City
Suncheon Bay	South Korea	Suncheon City	Arasaki	Japan	Izumi City
Fujimae Tidal Flat	Japan	Nagoya City	Swan Bay Tidal Flats	Australia	Greater Geelong City
Yubudo Tidal Flat	South Korea	Seocheon County	Sungei Buloh Wetland Reserve	Singapore	National Parks Board of Singapore

“The EAAFP Sister Site Program brings together Flyway Network sites in different countries that share species to encourage increased awareness of their shared migratory waterbirds and link sites through collaborative activities to promote the conservation of these birds. It is designed to offer a better chance to be engaged with other sites in the Flyway Site Network to conduct collaborative research and monitoring on shared species and exchange information and experience, which is critical for site managers and decision makers to reinforce conservation action. Capacity building is an important element of sister site relationships and exchange visits can help site managers learn new and innovative approaches to different aspects of site management, from visitor centre development to participatory wetland management techniques.”

Appendix IV. Successful examples of shorebird conservation promotion/establishment at sites outside of Australia and the EAAF. These are examples of important conservation sites for shorebirds across the Americas where ongoing efforts at shorebird conservation, education, research, and/or tourism are well-established. We recommend that AIBS examine these sites to obtain examples of best practices in shorebird conservation management due to the existing infrastructure, engaged partners, and data. This discussion includes many of these sites, broken out by geography.

The functional equivalent of the EAAFP in the Americas is the Western Hemisphere Shorebird Reserve Network (WHSRN)⁶⁸. “WHSRN is a conservation strategy launched in 1986 to protect key habitats throughout the Americas in order to sustain healthy populations of shorebirds. To date, WHSRN site partners are conserving more than 14.9 million ha of shorebird habitat in 15 countries.” For examples of active shorebird sites in the Americas/Western Hemisphere, WHSRN designation provides a primary source of both conservation priority and site information. Some important sites with a shorebird conservation focus located in the Atlantic Americas Flyway include:

Delaware Bay, States of Delaware & New Jersey, USA. WHSRN Hemispheric site (<http://www.whsrn.org/site-profile/delaware-bay>). Important web references include: Delaware Shorebird Project (<http://www.dnrec.delaware.gov/fw/shorebirds/Pages/default.aspx>), Delaware Bay Shorebird Project (<http://www.conservewildlifenj.org/protecting/projects/shorebird/>), Delaware Bay Shorebirds (http://www.state.nj.us/dep/fgw/ensp/shorebird_info.htm).

- 21,208 ha site, >500,000 individual shorebirds, designated of hemispheric importance by Western Hemisphere Shorebird Reserve Network in 1986.
- Most abundant migratory species: Semipalmated Sandpiper, Ruddy Turnstone, Red Knot (*ssp rufa*), Sanderling, Dunlin, Short-billed Dowitcher; breeding habitat for Piping Plover (federally threatened).
- Much of the important habitat is protected by federal National Wildlife Refuges, state Wildlife Management Areas, Cape May County Park Commission, and private conservation groups such as The Nature Conservancy, The Natural Lands Trust, and New Jersey Natural Lands Trust.
- Current conservation efforts focus on managing the horseshoe crab (arthropods in the family Limulidae) harvest, whose eggs are the primary food for migrating shorebirds.
- Both states implement seasonal beach closures to protect shorebirds.
- Well-known birding area with an extensive network of “birding trails” and access points.

Bahía de San Antonio, Rio Negro Province, Argentina. WHSRN International site (<http://www.whsrn.org/site-profile/san-antonio-bay>). Engaged partners include the International Conservation Fund of Canada (http://icfcanada.org/our-projects/projects/san_antonio) and Fundación Inalafquen (<https://www.facebook.com/FundacionInalafquen/>).

- Key shorebird species: Red Knot (about 25-50% of population of subspecies *rufa*)
- > 100,000 shorebirds annually
- Area 65,500 ha, a protected provincial natural area
- Conservation officers (rangers) were trained, equipped, and managed to enforce regulations aimed at reducing disturbance and promote awareness of shorebird conservation among tourists, local visitors, school children, and high school and university students.
- Rangers were able to halt by 96% incidences of disturbance caused by people, dogs, and vehicles.

⁶⁸ <http://www.whsrn.org/western-hemisphere-shorebird-reserve-network>

- Rangers gave talks to visitors and at schools reaching more than 400 students and over 4,500 other people.

Bay of Fundy, Provinces of New Brunswick & Nova Scotia, Canada. WHSRN Hemispheric site (<http://www.whsrn.org/site-profile/bay-fundy>). Nature Conservancy of Canada, Johnson's Mills Interpretive Centre (http://www.natureconservancy.ca/en/where-we-work/new-brunswick/featured-projects/johnsons_mills.html), Fundy Shorebirds <http://www.speciesatrisk.ca/fundyshorebirds/>, Mary's Point Shorebird Interpretation Center (<http://www.manszav.com/maryspoint.aspx?lang=en-CA>).

- Key shorebird species: Semipalmated Sandpiper (between 1.1 and 2.2 million annually, about 70% of global population), Least Sandpiper, Sanderling, Black-bellied Plover, White-rumped Sandpiper, Ruddy Turnstone
- Area 62,000 ha; the upper beaches, which extend to the high tide mark of the bay, are privately owned; The intertidal portions of the Bay of Fundy, up to the high tide mark, are managed by the provinces of Nova Scotia and New Brunswick, while subtidal regions are managed by the federal government.
- Acquisition of roosting beaches and marsh uplands by the Nature Conservancy of Canada has proven to be concrete conservation measure which will benefit migrant shorebirds.
- A major management priority is to minimize disturbance on critical beaches and also educate the public about the value of conservation.

Copper River Delta, State of Alaska, USA. WHSRN Hemispheric site (<http://www.whsrn.org/site-profile/copper-river-delta>). Copper River Delta Shorebird Festival (<http://www.copperriverdeltashorebirdfestival.com/>), Copper River International Migratory Bird Initiative (<https://www.fs.fed.us/global/wings/birds/crimbi/crimbi.htm>, <https://www.facebook.com/CopperRiverInternationalMigratoryBirdInitiative/>), Copper River Delta Critical Habitat Area (<http://www.adfg.alaska.gov/index.cfm?adfg=copperriverdelta.main>).

- 151,256 ha site, up to 1.1 million individual shorebirds at a time, designated of hemispheric importance by Western Hemisphere Shorebird Reserve Network in 1990.
- Most abundant migratory species: Western Sandpiper, Dunlin; also provides breeding habitat for Short-billed Dowitcher, Least Sandpiper, Greater Yellowlegs, Wilson's Snipe, Red-necked Phalarope, Spotted Sandpiper, Semipalmated Plover, Dunlin, and Lesser Yellowlegs.
- Much of the area is protected by the State of Alaska and managed by the U.S. Forest Service; remaining lands are managed by the City of Cordova and two Native American regional corporations (Eyak Corporation, Chugach Alaska Corporation).
- Location of the Copper River Delta Shorebird Festival in May (North American spring) every year, including field trips, classes, handicrafts, art shows, and the "tour de peep".
- Home of the Copper River International Migratory Bird Initiative, which seeks to strengthen the conservation of migratory birds along the entire flyway.

Lagunas de ECUASAL, Salinas, Province of Santa Elena, Ecuador. WHSRN Regional site (<http://www.whsrn.org/site-profile/lagunas-de-ecuasal>). Aves y Conservación (<http://avesconservacion.org/web/>).

- Area is about 1,500 ha in two sub-sites; the source of about 70% of the salt used in Ecuador.
- Key shorebird species: Wilson's Phalarope (around 5% of the global population) Semipalmated Sandpiper, Least Sandpiper, Sanderling, Western Sandpiper.
- Other important bird species: Chilean Flamingo, Peruvian Pelican, Elegant Tern, Peruvian Tern.

- Conservation efforts have three major strategic lines of action: (1) environmental awareness and education directed to local populations; (2) research and bird population monitoring; and (3) environmental management to reduce threats to the integrity of migratory and resident wildlife populations.

Fraser River Delta, Province of British Columbia, Canada. WHSRN Hemispheric site (<http://www.whsrn.org/site-profile/fraser-river-estuary>). Delta Farmland and Wildlife Trust (<http://deltafarmland.ca/>), British Columbia Waterfowl Society, George C. Reifel Migratory Bird Sanctuary (<http://www.reifelbirds sanctuary.com/index.html>), Alaksen National Wildlife Area (<https://www.ec.gc.ca/ap-pa/default.asp?lang=En&n=73907575-1>).

- Area is 31,648 ha; several million shorebirds annually in spring migration, tens of thousands in winter.
- Key shorebird species: Western Sandpiper (> 500,000 in a single day), Dunlin, Black-bellied (Grey) Plover.

Marismas Nacionales, States of Nayarit and Sinaloa, Mexico. WHSRN International site (<http://www.whsrn.org/site-profile/marismas-nacionales>). Pronatura Noroeste (<http://pronatura-noroeste.org/sitios/marismas-nacionales/>). CONANP (<https://simec.conanp.gob.mx/ficha.php?anp=77&=11>).

- Area is about 220,000 ha; > 200,000 shorebirds annually; a large complex of brine coastal lagoons, mangroves, muddy bogs or swamps, and ravines.
- Key shorebird species: American Avocet; breeding habitat for Wilson's Plover, Snowy (Kentish) Plover, Black-necked Stilt.
- Fishing, agriculture, cattle ranching, shrimp farming, and tourism are the main economic activities at the site.
- The site is administered by the Federal Government, which grants concessions for use to numerous Ejidos in both States.
- The primary NGO partner is Pronatura Noroeste AC which is defining restoration, protection, and management needs.

Great Salt Lake, State of Utah, USA. WHSRN Hemispheric site (<http://www.whsrn.org/site-profile/great-salt-lake>). The Nature Conservancy (<https://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/utah/placesweprotect/the-great-salt-lake-shorelands-preserve.xml>), Friends of Great Salt Lake (<https://www.fogsl.org/>), Great Salt Lake Bird Festival (<http://www.daviscountyutah.gov/greatsaltlakebirdfest>), Utah Linking Communities (<http://utahlinking.org/>).

- Area is about 780,000 ha; about 1.4 million shorebirds annually; the largest terminal lake in North America.
- Key shorebird species: Wilson's Phalarope, American Avocet, Black-necked Stilt, Snowy Plover, Marbled Godwit, Western Sandpiper, Long-billed Dowitcher, Red-necked Phalarope.
- Ownership by State of Utah, U.S. Fish and Wildlife Service, The Nature Conservancy, private duck clubs.