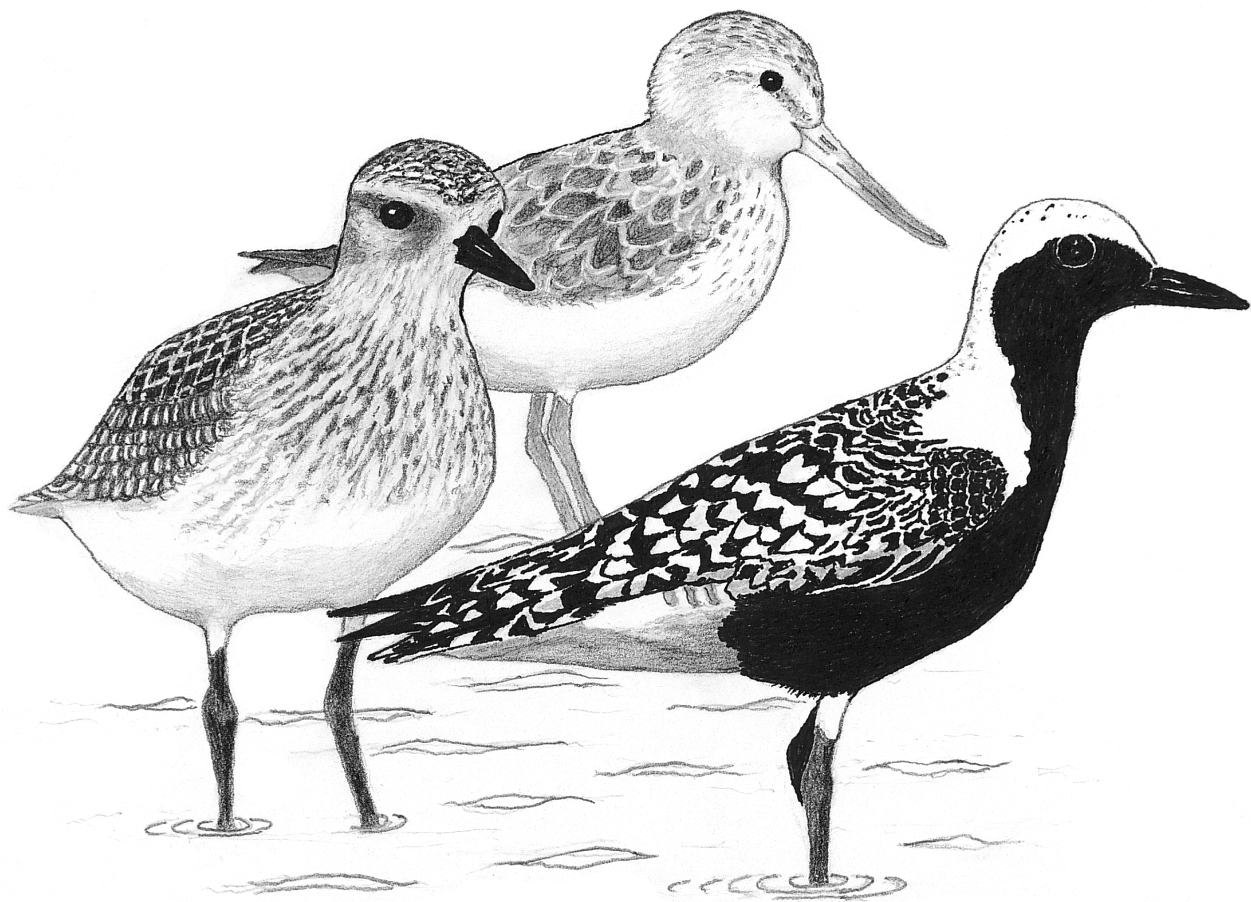


Stilt

The Journal for the East Asian-Australasian Flyway



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MISSION STATEMENT

To ensure the future of waders and their habitats in Australia through research and conservation programmes and to encourage and assist similar programmes in the rest of the East Asian–Australasian Flyway.

OBJECTIVES

- Monitor wader populations through a programme of counting and banding in order to collect data on changes on a local, national and international basis.
- Study the migrations of waders through a programme of counting, banding, colour flagging, collection of biometric data and use of appropriate scientific instruments.
- Instigate and encourage other scientific studies of waders such as feeding and breeding studies.
- Communicate the results of these studies to a wide audience through its journal *Stilt* and membership newsletter the *Tattler*, other journals, the internet, the media, conferences and lectures.
- Formulate and promote policies for the conservation of waders and their habitat, and to make available information to local and national governmental conservation bodies and other organisations to encourage and assist them in pursuing this objective.
- Actively participate in flyway wide and international forums to promote sound conservation policies for waders.
- Encourage and promote the involvement of a large band of amateurs, as well as professionals, to achieve these objectives.

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MEMBERSHIP OF THE AUSTRALASIAN WADER STUDIES GROUP

Membership of the AWSG is open to anyone interested in the conservation and research of waders (shorebirds) in the East Asian–Australasian Flyway. Members receive the bulletin *Stilt* twice a year, and the quarterly newsletter *Tattler*.

Please direct all membership enquiries to the Membership Manager at BirdLife Australia, Suite 2-05, 60 Leicester St, Carlton Vic 3053, AUSTRALIA.

Ph: 1300 730 075, fax: (03) 9347 9323

Email: membership@birdlife.org.au

Annual Subscriptions: Australia & New Zealand A\$40
Overseas A\$40
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Published in May 2021

EDITORIAL

Greetings from New Zealand. After an enforced holiday at home, I'm reminded of how fortunate we are to live in the southern hemisphere, but also of how fragile our world is. In December 2021, my local beach was visited by an endemic subspecies of fairy tern, *Sternula nereis davisae*, officially New Zealand's rarest bird. It is normally only found in a small area north of Auckland. So, it was with surprise that a female juvenile made its way some 650 km South to the Manawatu Estuary. Not a huge distance compared to that covered by the migratory waders passing through the flyway, but still remarkable. It was a summer highlight for me and left me wondering about the fate of this small bird, one of a population of only 40.

The opportunity to work as editor of Stilt is important to me. That's why I volunteer.



Fairy Tern, *Sternula nereis davisae*, at Manawatu Estuary 21/12/2020 (by Imogen Warren).

As professionals, volunteers, fundraisers and people who care, our work is so valuable. In order to influence the governmental decision-making process, wader research needs to be published in a rigorous and timely manner. At the Australasian Wader Studies Group, there is a dedicated team who collate, process, review and edit the papers, reports, articles and notes we receive for the Stilt. The AWSG community work very hard to facilitate the translation of wader research findings into government policy.

I would like to acknowledge [Professor Judit Szabo](#) (Universidade Federal da Bahia, Brazil), our Scientific Editor whose phenomenal knowledge and attention to detail puts me to shame.



Judit Szabo birding (Miranda Shorebird Sanctuary, 2013).

Judit is a conservation biologist interested in optimal birds' monitoring and management. She holds a Master's degree in Theoretical Ecology and a Doctoral degree in Environmental Toxicology (Texas Tech University, US). Judit has been fascinated by birds since her childhood and has been working with threatened species, in particular migratory birds in Australia and East Asia, and recently in Brazil. She has experience with capacity-building and training of wetland managers in Asian countries, as well as training of bird banders (ringers) in Europe, South America, the USA and Australia.

Ms Van Nancy Nieuwenhove (Monash University, Australia) commenced as Production Editor for the Stilt in September 2013 and is the last handler of our editions.



Nancy Van Nieuwenhove (left) and volunteers banding Wrybill *Anarhynchus frontalis* (Miranda Shorebird Sanctuary, 2013)

Nancy holds a Master's in Sciences and Environmental Management (ULB, Belgium) and a Master's in Public Relations (IHECS, Belgium). She is currently working for the Monash Energy Institute, focusing on promoting a transition to a low-carbon, sustainable economy. Her interests include the impact of energy resources and infrastructure on biodiversity, ecology and environmental management, sustainable development, citizen science, and learning strategies. In 2014, she helped with the successful up-listing of the Far Eastern Curlew and Great Knot under the UN Convention on Migratory Species, for whom she worked as Senior Public Information Associate in 2009. Nancy is a former Shorebirds 2020 Program educator officer, and monitored multiple species of shorebirds with the Victorian Wader Study Group in Australia, with the Miranda Naturalists' Trust in New Zealand, and with Maritime NZ after the 2011- 2012 Rena oil spill.

We dedicate this Stilt to the First East Asian-Australasian Flyway Shorebird Science Meeting, promoting science to guide and inform conservation management of shorebirds in the East Asia and Australasian Flyway.

We are fortunate to be able to feature the first East Asian-Australasian Flyway Shorebird Science Meeting (EAAFSSM, 2020) in *Stilt* 75. Our thanks go to [Professor Richard Fuller](#) (University of Queensland, Australia), for the huge effort in co-ordinating the abstracts that are included in this issue.

The East Asian-Australasian Flyway Shorebird Science Meeting switched from face-to-face to an online

virtual event because of COVID-19. Lots of work went into its organisation and delivery. So, we also would like to acknowledge all involved with the Meeting. Whether as a professional, academic, administrative or scientific, the amount of background and off the clock organisation was incredible.

Call for unpublished records of Little Curlew throughout the EAAF

[Dr Amanda Lilleyman](#) and [Professor Stephen Garnett](#) are looking for records of Little Curlew (*Numenius minutus*) throughout the East Asian-Australasian Flyway, particularly in Australia, where records haven't made it into Birddata or e-Bird. If you have old records (counts or presence-absence) of the Little Curlew, please consider sending them to Amanda.Lilleyman.bird@gmail.com. All people and organisations sharing their Little Curlew data with Amanda will be fully acknowledged.

Australasian Shorebird Conference 2021

A reminder that the 2021 Australasian Shorebird, jointly organised by The QWSG and AWSG, will be postponed to February / March 2022 due to Covid-19. The 2021 Conference theme is "Global strategies, Local actions".



Conference presenters can apply for financial support to attend, courtesy of the Shorebirds 2020 Conference Scholarship. Volunteer members are particularly encouraged to apply. For more details, please be in touch with David Edwards, Chair QWSG and Alison Russell-French OAM Chair AWSG.

Instructions to Authors

Stilt now includes an updated version of Instructions to Authors, which can be found at the end of this issue. I would encourage all contributors to familiarise themselves with this document before submitting new manuscripts. This document is also available on the AWSG website.

I encourage past contributors and new ones to send in their contributions, whether it is a research article, a short report on their group's activities or a book review. Please, feel free to contact me if you are uncertain about the appropriateness of your material for publication.

Happy wader watching and we hope that you find this issue of Stilt informative and engaging. I am looking forward to publishing *Stilt 76*, which promises more interesting contributions from around the flyway.

Imogen Warren
Editor

TREASURER'S REPORT FOR 2020

At the end of 2020, the balance of funds for MYSMA was -\$2151.18. Other expenses include GFN payment of \$5000, EAAFP payment of \$2798, donation to PMNT of \$10,000 & administration / bank fees of \$657.

**Australasian Wader Studies Group
Income and Expenses
1 January 2020 - 31 December 2020**

Item	INCOME		EXPENSES		
	2020 \$	2019 \$	Item	2020 \$	2019 \$
Balance brought forward	\$ 81,336.93	\$ 81,833.10	Printing	\$ 626.25	\$ 1,265.00
Subscriptions	\$ 9,835.53	\$ 9,846.10	Postage/courier	\$ 798.36	\$ -
Contracts - State Govts.	\$ -	\$ -	- Surveys/reports/monitoring	\$ -	\$ -
Contracts - Other	\$ -	\$ -	- Travel/accommodation/meals	\$ 294.55	\$ 1,229.09
Donations	\$ 13,010.00	\$ 20,390.00	Conferences	\$ -	\$ -
Conference/meetings	\$ -	\$ -	- Donations	\$ -	\$ -
Other income	\$ 205.19	\$ 884.34	Equipment/consumables	\$ -	\$ 20,000.00
			Consultant fees	\$ -	\$ -
			Other expenses	\$ 19,350.39	\$ 19,350.39
Total income	\$ 23,050.72	\$ 31,120.44	Total expenses	\$ 21,069.55	\$ 41,844.48
Total accumulated funds	\$ 104,387.65	\$ 112,953.54		\$ 104,387.65	\$ 147,160.24
Balance carried forward	\$ 83,318.10	\$ 71,109.06			

Membership statistics:

Membership at the end of the year was:	2020	2019
Australia/New Zealand	235	228
Overseas (excl. NZ)	13	7
Institutions	0	0
Complimentary	56	56
Total	304	291

This summary of income and expenses for the past year is not an audited statement. It has been prepared for the information of AWSG members from records of transactions provided by BirdLife Australia relating to the Australasian Wader Studies Group.

The AWSG is a special interest group of BirdLife Australia and members who wish to see the audited accounts of BirdLife Australia should refer to the Concise Financial Report included in the BirdLife Australia Annual Report.

EAST ASIAN-AUSTRALASIAN FLYWAY SHOREBIRD SCIENCE MEETING

It is with great pleasure that we present in this volume of *Stilt* the abstracts from the 1st East Asian-Australasian Flyway Shorebird Science Meeting (EAAFSSM), held online on 3rd – 5th November 2020. More than 400 participants from 39 countries or regions attended the meeting, which comprised live online discussions, workshops, five outstanding keynote talks and 80 presentations across 18 sessions. The meeting addressed a huge range of topics on shorebird ecology and conservation.

The main goal of the meeting was to promote research that provides an evidence base for monitoring, management, conservation and education/outreach relevant to shorebirds in East Asia and Australasia. We also wanted to provide a structured forum to facilitate, coordinate, and enhance the exchange of shorebird information among interested parties. And ultimately, we hoped the meeting would help promote the conservation of shorebirds in the East Asian-Australasian Flyway.

Most presentations were recorded and are available on the EAAFSSM YouTube channel (https://www.youtube.com/channel/UCVIovo52XanA6Bi5_c6KnhA).

The meeting was co-hosted by the National Institute of Ecology (NIE) in the Republic of Korea, the U.S. Fish and Wildlife Service, National Parks Board of Singapore, the Conservation of Arctic Flora and Fauna's International Secretariat (CAFF), and the University of Queensland. Funding to cover the organisation of the event was generously provided by the Ministry of Environment of the Republic of Korea.

Originally planned as an in-person event, the conference moved online due to travel restrictions surrounding COVID-19. To help prepare for the event and to handle the transition to an online environment, the Organising Committee had 22 online meetings over 18 months. The Organising Committee developed an information package and program schedule for participants, five newsletters, instructions for chairs, and

designated moderators and IT staff for each session to help ensure the event ran smoothly.

Sponsors generously provided funding to support a variety of competitions. Tracking devices from Migrate Technology Ltd. were awarded to Dr Cheng Yachang, Song Zitan, and Dr Liu Yang to quantify the migratory behaviour and identify critical habitats for the White-faced Plover. Similarly, tracking devices from Druid Technology Co. Ltd were awarded to Philipp Maleko, Dr Vladimir Pronkevich, and Dr Konstantin Maslovsky to investigate the breeding and migratory ecology of Nordmann's Greenshank.

Ying Chi (Ginny) Chan was awarded the best student presentation for her talk entitled "Applications of satellite tracking of shorebirds in coastal conservation", while Sayam Chowdhury was runner up for his talk entitled "Promoting alternative livelihoods in Myanmar and Bangladesh to reduce hunting pressure on Spoon-billed Sandpiper and other shorebird species". They received respectively, \$200 and \$100 prizes, from Lotek Wireless. We also had a video competition to celebrate the flyway's shorebirds. The best video award went to Javica Faye Canage for her video entitled "My EAAF Winged Friends", and she received a \$200 prize from Lotek Wireless.

The conference organising committee comprised Sung-Ryong (Jackie) Kang (General Manager of Dept. of International Cooperation, National Institute of Ecology, Republic of Korea), Joungwon Kim (EAAF Shorebird Science Meeting Coordinator, National Institute of Ecology, Republic of Korea), Courtney Price (Arctic Migratory Bird Initiative's Overall Coordinator, Conservation of Arctic Flora and Fauna), Rick Lanctot (Alaska Shorebird Coordinator, United States Fish and Wildlife Service, and Chair of the EAAF Partnership's Shorebird Working Group), David Li (Conservation Manager, Sungei Buloh Wetland Reserve, National Parks Board Singapore, and Monitoring Coordinator of the EAAF Partnership's Shorebird Working Group) and Richard Fuller (Professor, University of Queensland, Australia).

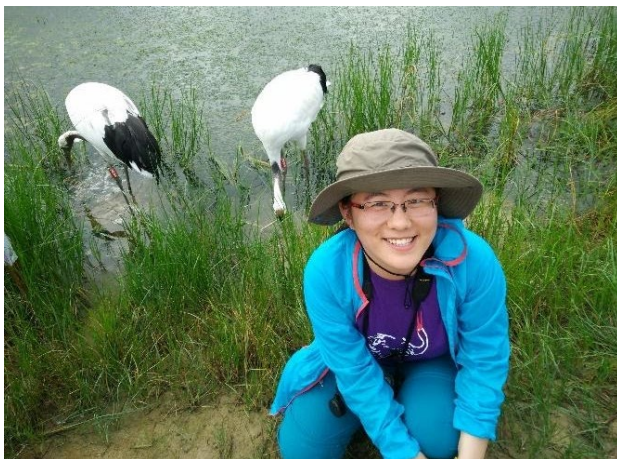


Figure 1. Awardee for tracking competition, Cheng Yachang.



Figure 2. Awardees for tracking competition, Philipp Maleko (left) and Dr Vladimir Pronkevich (right).



Figure 3. Ying Chi (Ginny) Chan, best student presentation awardee (left) and Sayam Chowdhury, second best student presentation awardee (right).



Figure 4. Best video awardee, Javica Faye Canage.

During the closing ceremony, Richard Fuller reflected on some of the highlights of the meeting:

We have witnessed a very exciting line up of shorebird science over the three days of the meeting. There were contributions from almost 100 speakers on every aspect of shorebird science from evolution, behaviour, ecology, and conservation.

We learnt about elegant ecological studies on shorebirds, such as Irin Sultana's study of wintering shorebirds in Bangladesh, new data on the migration of Latham's snipe from Birgita Hansen, and a whole raft of new information from the breeding grounds of the Nordmann's Greenshank from Vladimir Pronkevich.

Technology is driving ever more sophisticated studies of migration, and we were introduced to exciting new tracking data on Far Eastern Curlew, Asian Dowitcher, Red Knot, Black-tailed Godwit and Oriental Pratincole, and multi-species studies from Mongolia and Singapore.

We saw the results of large-scale, long-term studies of shorebird population trends, such as national analyses from China, India and Japan, regional assessments from Russia, Korea and Bangladesh. Projects from Taiwan, Australia, Hong Kong, the Philippines and mainland China showed the power of citizen science to collect data at a scale that would otherwise be impossible.

The threats impacting shorebirds are increasingly well understood, and there were entire sessions focusing on threats, such as hunting, habitat loss and climate change. The sheer quality of the applied science

underpinning these sessions showed that we are getting ever closer to a full understanding of why a number of species are in such rapid decline. We had species-specific sessions on Dunlin, Spoon-billed Sandpiper and Nordmann's Greenshank, which really allowed for a deep dive into the multiple interacting threats operating on those species. Since every species' ecology and migration is different, ultimately such single-species studies will be needed to truly understand the conservation needs of all migratory shorebirds in the EAAF.

And in terms of the conservation response, the sessions showed clearly that our science is steadily growing in quality and impact. We heard conservation success stories from many places, including Malaysia, Korea, Taiwan, China, and Australia, as well as case studies from Europe and North America, from which we might learn.

In his plenary address, Theunis Piersma distinguished two kinds of science – reactive and proactive. The content of this meeting shows we are getting very good at both. The Spoon-billed Sandpiper research is conservation fire-fighting as its finest – where emergency action has helped, at least in part, to stem declines of this Critically Endangered species. Our underlying "sentinel" knowledge base is also going from strength to strength – and progressing both kinds of science puts us in the strongest possible position for the future. I encourage us all to continue this focus on conducting science that can be used to guide and inform conservation management.

The last few days have also shown me that the voice of female scientists is now being heard loud and clear in our flyway, and female representation in flyway science has increased enormously over the last 10 years. While the senior ranks of scientists in this field remain significantly male biased, something we all must work to address, we are also seeing a rapidly growing movement of outstanding young female scientists. Thank you all for overcoming significant barriers to get to where you are today.

The meeting was also characterised by a wonderful mix of folks from a variety of different kinds of organisations. While there were many from academic institutions, a substantial number of folks represented environmental NGOs of various kinds, many of whom are running inspiring citizen science projects from Bangladesh to China, from Indonesia to Mongolia. We also had a number of representatives from government departments, and it is heartening to see a meeting that is focused on science and evidence promoting these discussions among such a wide range of people.

We are aware of a number of ongoing activities and new collaborations as a result of the meeting, and we are very much looking forward to sharing our experiences again when we meet for the 2nd East Asian-Australasian Flyway Shorebird Science Meeting.

Professor Richard Fuller
University of Queensland

THE USE OF AVIAN SENSITIVITY MAPPING TO RECONCILE BIRDS AND RENEWABLE ENERGY EXPANSION IN ASIA

TRIS ALLINSON

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A swift transition from CO₂ emitting fossil fuels to renewable sources of energy is essential. However, renewable energy facilities, such as wind and solar farms, can have a detrimental impact on wildlife if poorly sited. Shorebirds are particularly at risk in Asia, where coastal locations are often favoured for renewable energy expansion. Fortunately, with careful, strategic and proactive planning, it is possible to meet renewable energy targets without adversely affecting shorebirds and other wildlife. BirdLife International are increasingly working with the energy sector in Asia to develop spatial planning tools to facilitate responsible energy expansion. Supported by the Asian Development Bank (ADB), BirdLife has embarked on an ambitious two-year project to develop an online mapping tool covering four key emerging Asian markets — India, Thailand, Nepal and Vietnam. The tool will provide a detailed assessment of avian sensitivity in relation to wind energy infrastructure (on- and offshore), photovoltaic (PV) solar infrastructure and overhead power lines.

OPPORTUNITIES AND CHALLENGES FOR THE DEVELOPMENT OF FLYWAY-WIDE SHOREBIRD INDICATORS

TATSUYA AMANO

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Bird population indicators have been playing a critical role in informing scientific communities, decision-makers and the wider public about the status of biodiversity. To develop such indicators, however, we need to address various challenges, ranging from field surveys, data management and statistical analysis to dissemination. Failure at any stage of these processes could lead to misinformed decision-making based on unreliable indicators. I summarise the opportunities and challenges for the development of shorebird indicators in the East Asian-Australian Flyway. I propose a framework for collecting data, developing indicators and informing decision-making. Then, I list the potential challenges in each of the processes, including, but not limited to standardising survey methods, mobilising and maintaining survey efforts, developing a system for centralising data, establishing statistical approaches, and identifying a mechanism for integrating developed indicators into the decision-making processes. The ultimate goal of this presentation is to start up a discussion among the speakers and audience on the proposed

framework and challenges, and pave the way for the development and implementation of effective indicators.

Theme: Monitoring (Oral Presentation)

A MIGRATION OF ASIAN DOWITCHER *LIMNODROMUS SEMIPALMATUS* FROM EASTERN MONGOLIA

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TSERENBAT¹, BAASANSUREN ERDENECHIMEG¹,
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⁴ *Hangzhou Yuehai Technology Co., Ltd.*

The Asian Dowitcher *Limnodromus semipalmatus* is a rare, medium-sized wader, listed as Near Threatened on the IUCN Red List. They breed in the grassy wetlands in south eastern Siberian steppe regions to Mongolia and north-east China. The non-breeding area is from east India through South East Asia, but the exact migratory route is still a mystery. This species is always found in coastal areas during migration and the non-breeding season. The Eastern Mongolian river valleys used to be one of the most important breeding places of the species. In the 2019 autumn migration period, we observed several flocks of Asian Dowitcher at “Chukh” Lake in north-eastern Mongolia. We captured seven individuals, three adults with the average weight of 130g and four juveniles of 140g on average. We placed tracking devices on two adults and three juveniles. The trackers were programmed to collect data while in the international roaming range and a signal transmission mode was modified in real time. We successfully tracked migration routes during the autumn from Eastern Mongolia. All tracked individuals crossed the Bohai Bay in China, which was their first stopover site. After that, the dowitchers migrated through one of two different routes - along the coast or through lakes in the mainland. Another important stopover site was recorded in the east coast of Vietnam and in the northern Philippines. One adult dowitcher from Eastern Mongolia spent the non-breeding season in northern Sumatra and one juvenile in southern Indonesia. To understand the exact migratory route and the importance of stopover sites along the East Asian-Australian Flyway is very important for the conservation of the Asian Dowitcher.

Theme: Migration Ecology (Oral Presentation)

MOTUS NETWORK FOR THE EAST ASIAN - AUSTRALASIAN FLYWAY: CURRENT STATUS, CHALLENGES AND FUTURE

CATALINA AMAYA-PERILLA

Lotek Wireless Inc. Email: camaya@lotek.com

Satellite trackers have answered movement ecology questions about some of the species that use the East Asian-Australasian Flyway (EAAF). However, for small species that are not able to carry these technologies, it is a challenge to understand their movement. Archival devices are still used on small species, although there is a high likelihood of non-retrieval of information when you do not recapture tagged individuals.

The Motus Network is an international collaborative research network that uses a coordinated automated radio telemetry array to track the movement and behaviour of small species. It uses automated receivers that work 24/7 and receive the signal of coded transmitters that give a broader spatial scale of animal movement. This array has been established in the Americas and recently in Europe (<https://motus.org/>). It has successfully helped track large insects, bats, small and large migratory birds.

I explain how the Motus network works, the advantages that it will bring to the EAAF, the challenges and how we can work together to understand better the movement of all species that use the flyway.

Theme: Migration Ecology (Oral Presentation)

THE IMPORTANCE OF AQUACULTURAL PONDS ON THE WESTERN COAST OF TAIWAN IN SUPPORTING SHOREBIRDS IN THE EAST ASIAN-AUSTRALASIAN FLYWAY

MEI-LING BAI, WEN-CHIEH CHIH AND YU-YI LIEN

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Email: meilingbai@fnhi.com.tw

Laying in the middle of the East Asian-Australasian Flyway, the western coast of Taiwan serves as an important stop-over and non-breeding site for many shorebird species. The intertidal flats along the western coast of Taiwan used to be relatively intact, but few natural areas remain above the high tide line. Thus, managing suitable high-tide roosts is crucial to support shorebird populations. Since 2011, we have conducted monthly shorebirds counts at several sites on the central western coast. We found higher shorebird abundance and species richness at sites with intensive clam aquaculture and less fragmentation. The dykes of the aquacultural ponds were utilised by 37 shorebird species as high tide roosts. The edge of the ponds and the ditches between ponds provided foraging habitat for some species. When the ponds were drained after harvest, large quantities of foraging shorebirds were attracted. Through the study period, overall shorebird abundance remained relatively stable. Some species appeared to have increasing numbers at some sites. Further investigation into how aquacultural

practice affects the habitat use of shorebirds may promote the development of optimal local management plans. As large-scale offshore wind power projects are on-going along the western coast of Taiwan, such management plans may provide potential ecological compensation for shorebird populations.

Theme: Monitoring (Oral Presentation)

THE CHINA COASTAL WATERBIRD CENSUS

QING-QUAN BAI

Forestry Bureau of Dandong, Dandong, China

China's coastal wetlands are among the most threatened ecosystems worldwide. The loss and degradation of these wetlands seriously threatens the waterbirds that depend on them.

The China Coastal Waterbird Census is organised by volunteer birdwatchers in China's coastal region. Waterbirds were surveyed synchronously once every month at 14 sites, as well as irregularly at a further 18 sites, between September 2005 and May 2020.

A total of 75 waterbird species met the 1% population level Ramsar listing criterion at least once at one site, including 33 shorebirds. The number of birds of the following species accounted for over 20% of the total flyway populations at a single site: Far Eastern Oystercatcher *Haematopus osculans*, Bar-tailed Godwit *Limosa lapponica*, Spotted Greenshank *Tringa guttifer*, Great Knot *Calidris tenuirostris*, Spoon-billed Sandpiper *Calidris pygmaeus* and Far Eastern Curlew *Numenius madagascariensis*.

A total of 26 sites supported at least one species of which their number met the 1% criterion. Many sites identified as being of international importance to waterbirds along the Chinese coast currently lack any formal protection and many are immediately threatened by reclamation projects. For example, there are 26 species, including 20 species of shorebirds, which meet the 1% criterion at the Lianyungang coast, Jiangsu.

The results highlight the international importance of China's coastal wetlands for waterbirds. This study also demonstrates that participation of local birdwatchers in waterbird surveys provides data invaluable not only for understanding the current status of waterbirds in China's coastal regions, but also for waterbird conservation and management.

CURRENT POPULATION TRENDS OF SHOREBIRD SPECIES WINTERING IN INDIA WITH MIGRATORY CONNECTIVITY WITH EAST ASIAN-AUSTRALASIAN FLYWAY

S. BALACHANDRAN

Bombay Natural History Society

The non-breeding and staging sites along the east and west coasts of India are globally important for several shorebirds, especially the Lesser Sand Plover

Charadrius mongolus, Curlew Sandpiper *Calidris ferruginea*, Little Stint *Calidris minuta*, Broad-billed Sandpiper *Limicola falcinellus*, Marsh Sandpiper *Tringa stagnatilis* and Black-tailed Godwit *Limosa limosa*. Individual populations of these shorebird species in India vary between 100,000 and 300,000. Most of the migratory wader species occurring in India are also commonly observed in the East Asian-Australasian Flyway (EAAF). The migratory connectivity between India and the EAAF was established through ringing and color flagging for the following 10 species: Curlew Sandpiper *Calidris ferruginea*, Little Stint *Calidris minuta*, Ruff *Calidris pugnax*, Wood Sandpiper *Tringa glareola*, Common Snipe *Gallinago gallinago*, Terek Sandpiper *Xenus cinereus*, Broad-billed Sandpiper *Limicola falcinellus*, Great Knot *Calidris tenuirostris*, Sanderling *Calidris alba* and Asian Dowitcher *Limnodromus semipalmatus*. Though the numbers of most coastal wader species are reported to decline both globally and nationally, in India the decline is pronounced in species that prefer intertidal mudflats, such as Grey Plover *Pluvialis squatarola*, Common Greenshank *Tringa nebularia*, Terek Sandpiper and Bar-tailed Godwit *Limosa lapponica*. Other Near Threatened species that have been frequenting coastal wetlands in India in substantial numbers in recent years are Great Knot, Red Knot *Calidris canuta* and Eurasian Curlew *Numenius arquata*. In recent years, the sightings of color-flagged Curlew Sandpiper, Asian Dowitcher and Great Knot marked in India in the Bohai Sea, South Korea and Thailand, and the sightings of color-flagged Great Knots from Kamchatka and Sakhalin Island in India have reconfirmed the migratory connectivity of India with the EAAF.

CLIMATIC FINGERPRINTS ON BREEDING DYNAMICS AND NEST FAILURE OF PLOVERS ACROSS THE GLOBE

UDITA BANSAL^{1*}, ZSOLT VÉGVÁRI², PLOVER BREEDING TIME CONSORTIUM³ & TAMAS SZÉKELY⁴

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² MTA Centre for Ecological Research, Danube Research Institute Hungary

³ Multiple affiliations

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Environmental variables, such as temperature and precipitation, are known to affect bird prey abundance and hence influence their breeding phenology. Studies in the past have addressed the potential effects of the global increase in temperatures due to climate change on the breeding phenology of birds over large time scales. But within seasonal effects of global warming and climate change, due to extreme stochastic events have not been studied till date. To identify the impact of such events, we first need to explore the associations between local climatic conditions and the breeding dynamics of the birds. For this, we used an ecological model system of

plovers (family *Charadriidae*) as focal organisms, and collated data from 26 populations of plovers belonging to 12 different species across the globe. We compared the breeding characteristics across latitudes using generalised linear mixed modelling, tested two main hypotheses regarding the effects of temperature and precipitation on breeding season progression and nest failure of these birds. The number of nests initiated per week was correlated with the average temperature of the previous two weeks in a non-linear fashion: at optimum temperature, the number of nests being initiated is the highest, on either side of which it decreases. Probability of nest failure showed the most significant correlation with average temperature and cumulative precipitation over three days prior to the fate date. It was lowest at an optimum range of temperature but increased on both sides of the optimum. On the other hand, it increased linearly with increases in precipitation. This shows that stochastic environmental events might cause a drastic decrease in the number of successfully breeding plovers in a given season due to effects on two key stages: breeding decisions and egg development. Thus, within-year patterns allow the prediction of long-term changes in nesting dynamics of ground-nesting birds, such as plovers.

Theme: Breeding Ecology (Oral Presentation)

MIGRATION TIMING IN A CHANGING WORLD: INSIGHTS FROM NEW ZEALAND-WINTERING BAR-TAILED GODWITS

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Long-distance migrants are often assumed to be unable to respond to environmental change due to their timing being under strict endogenous control. Here we provide insights from the migrations of Bar-tailed Godwits *Limosa lapponica* that spend the non-breeding season in New Zealand and make a single major stopover in East Asia on their northward migration. Our studies over the past decade show that individual timing reflects both geography on the breeding grounds (northern versus southern Alaska, presumably via endogenous control mechanisms) and also latitude in New Zealand (presumably in response to local photoperiod). This response to photoperiod may generate population-level schedules across the entire non-breeding range. The length of stay of birds in Asia tracked in 2008–2009 point to a complex pattern of individual timing, in which southern breeders arrived over a long period but departed quite synchronously, whereas northern breeders arrived synchronously but departed over a long time. Length of stay therefore declined with arrival date for southern breeders (early arrivers stayed longer), but more northerly breeders extended their length of stay to generate individual schedules that matched the pattern of thaw in Alaska. This clear and obvious relationship had largely disappeared in birds tracked in 2013–2014, as late-

migrating birds advanced their departure dates from New Zealand (a trend that has continued), yet they departed no earlier from Asia for Alaska. It appears as if conditions in the late 2000s enabled godwits to migrate in a 'leisurely' manner with strong endogenous control of timing, but changing conditions have disrupted this system and birds are adjusting their migration schedules, probably as a response to deteriorating food supplies in the Yellow Sea. Godwits therefore illustrate both the well-regulated control of migration timing we might expect in a stable ecological system, but also the capacity to adjust migration timing in response to past experience.

Theme: Migration Ecology (Oral Presentation)

MIGRATION STRATEGIES AND TIMING: INSIGHTS FROM NEW ZEALAND- WINTERING RED KNOTS

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The general pattern of migration in the East Asian-Australasian Flyway (EAAF) is assumed to be that birds migrate quickly to East Asia, particularly the Yellow Sea region, where they have a prolonged stopover, and for many species this is unequivocally true. For other species, the details are less clear and this assumption may be less true. Here, I provide insights from the migrations of a long-distance migrant shorebird, the Red Knot *Calidris canutus*, migrating north from New Zealand. The migrations of Red Knots are surprisingly poorly documented in the EAAF, but geolocator tracking from New Zealand showed that they have a major stopover in the Gulf of Carpentaria/Papua New Guinea region. On average, birds spent 33 days on this stopover, but the range of 19–65 days across individuals indicates substantial variation in migration strategy. Once in Asia, while many birds evidently did refuel in the well-known knot concentration in Bohai Bay, most did so for only a short period (mean 14 days), having moved progressively up the China coast. The most extreme migration was shown by a bird of the subspecies *piersmai* that migrated to the New Siberian Islands. This bird departed New Zealand around the same time as individuals of the *rogersi* subspecies that would migrate to Chukotka, but spent 65 days in Australia or West Papua. Despite being at the staging grounds in the southern hemisphere in early June it still reached the breeding grounds in time to breed. These results show that for some individuals of this species, the major stopover on northward migration may not even be in Asia, and the variation in migration pattern between and within subspecies warrants further attention.

Theme: Migration Ecology (Oral Presentation)

SHOREBIRDS SURVEY AT KOH KAPIK RAMSAR SITE, CAMBODIA

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The Koh Kapik Ramsar site is located in the southwestern coast of Cambodia near the Thailand border. The area consists of extensive coastal mangroves and intertidal mudflats and was designated as a Ramsar site in 1999 under criteria 1 (representative or unique wetlands), 2 (rare and endangered species) and 8 (fish spawning ground, nursery and/or migration path). The Koh Kapik Ramsar site currently covers an area of 12,000 hectares. The site was also identified as an Important Bird and Biodiversity Area by BirdLife International (IBA criteria A1, A4i) in 2003 supporting significant populations of Nordmann's Greenshank *Tringa guttifer* and Asian Dowitcher *Limnodromus semipalmatus*. The survey aimed to confirm the presence of Spoon-billed Sandpiper *Calidris pygmaea* and other migratory shorebirds in the Koh Kapik Ramsar site. The outcome of this survey is expected to be useful to various governmental and non-governmental institutions, including researchers, and policy makers for developing future conservation and management strategies in the Koh Kapik Ramsar Site. Moreover, it will also raise the international profile of Koh Kapik as a wetland in its importance to the Spoon-billed Sandpiper.

Shorebird surveys were conducted from 06h00 to 17h00 daily over 11 days from December 2017 to May 2018. We split the counting during high and low tides to avoid double counting the same birds.

We found small shorebirds more strongly associated with sandbars while larger shorebirds with longer bills tended to forage or rest inside the mangrove forests at the fringes of the mudflats at high tide. Due to difficulty to access and unfavourable tidal conditions, we could not survey the tidal channels and creeks in the mangrove forest although we were able to identify a flock of Common Redshank *Tringa totanus* in an open clearing in the mangrove forest during high tide. We also surveyed the southwestern coastline of the Koh Kapik Ramsar site during high tide and observed flocks of waders roosting under the young mangrove. At low tide, we surveyed exposed mudflats on the southwestern shore (Koh Kapik mudflat) of Koh Kapik Ramsar site and close to Cham Yeam. We also covered the southeastern part of the Ramsar site (Chrouy Pras), which was identified by topographic maps to have extensive mudflats, but we could not find them, even during low tide. According to the site manager, the area might be converted by sand mining, even though the Cambodian government banned sand exports from Koh Kong Province in 2017. We recorded two Great Knot *Calidris tenuirostris* (non-breeding plumage), one Asian Dowitcher *Limnodromus semipalmatus* (breeding plumage) and three Grey-tailed Tattler *Tringa brevipes* (non-breeding plumage) feeding on that mudflat. We did not detect Spoon-billed Sandpiper during our four surveys even though the species was recorded at the Koh Kapik Ramsar Site in 2014. Our

survey recorded 1,247 individuals of 20 shorebird species based on maximum count per day of each species from all surveys. Sandpipers, *Charadrius* spp., were the most common, estimated at about 64% of total shorebird numbers.

We observed push-net fishing along the shoreline of Koh Kapik on mudflat exposed during low tide. This technique is illegal and possibly destroys the mudflat. Combined with the encroachment from the newly recruited mangrove trees on the mudflat, this decreases the availability of open mudflats, reducing habitat for shorebirds. We also noticed more than ten wooden posts along the mudflat in the Koh Kapik Ramsar Site, which need to be further investigated as they may be fishing posts or bird hunters' nets. Based on informal interviews with local people we suspect bird hunting, targeting large waders for food. Plastic waste was also almost everywhere on the beach. We recommend the following immediate actions:

- Awareness raising activities on migratory birds to local villagers, students, and local authorities
- Engaging local people and local authority in law enforcement
- Providing alternative livelihoods to communities, such as bird watching, wetland education center or ecotourism.

APPLICATIONS OF SATELLITE TRACKING OF SHOREBIRDS IN COASTAL CONSERVATION

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Many coastal habitats in east Asia are being degraded and shorebird populations relying on these habitats show rapid declines. Tracking shorebirds with satellite-based technologies could rapidly map spatial and temporal patterns of occurrence to help galvanise conservation actions. Here, we introduce four applications of spatio-temporal distributions generated from shorebird satellite tracking data in East Asia. At the flyway scale, the tracking data of Great Knot *Calidris tenuirostris* have accelerated the identification of coastal sites of conservation importance in the East Asian-Australasian Flyway. In particular, we highlighted coastal habitats in

South China and Southeast Asia that are potentially important for shorebirds, but lack ecological information and conservation recognition. In Lianyungang, an important, but unprotected shorebird staging site in the Yellow Sea, the tidal movements of satellite-tagged Great Knot and Bar-Tailed Godwit *Limosa lapponica* mapped high-tide roosts and low-tide foraging areas, and some of them are inaccessible on-ground. These movements can also be used to evaluate whether roosts and foraging areas are close enough to each other, and to direct where to create new roost sites. In Tongzhou Bay, distributions of satellite-tagged shorebirds were used in hydraulic modelling of the bay to show the 'ecotopes' (defined by hydraulic conditions) that are most important for shorebirds. This allows the quantification of the ecological impact of current and future reclamation projects in terms of the amount of shorebird habitat loss. Another study incorporates the distribution of the tagged shorebirds in hydraulic engineering port design based on the 'building with nature' approach. Alternative port configurations were designed and assessed simultaneously by (1) the usability for potential port development, and (2) the degree to which the existing high-value 'ecotopes' for shorebirds could be preserved, or even facilitated through their natural development (by increasing siltation). We discuss the role and great potential of applying tracking data in the conservation of coastal wetlands.

Theme: Migration Ecology (Oral Presentation)

SOCIAL PARTICIPATION PROVIDES A SOLUTION FOR THREATENED SPECIES CONSERVATION

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Spoon-billed Sandpiper *Calidris pygmaea* is a critically endangered species undergoing extremely rapid decline with an extremely small population. Action is urgently required to prevent its extinction. Scientists and conservationists have developed numerous projects to learn about its status and improve its situation. In 2018, the Mangrove Conservation Foundation (MCF), Center for East Asian-Australasian Flyway Studies and the Beijing Forest University jointly initiated a project for the conservation of Spoon-billed Sandpiper:

1. organize and coordinate the SBS winter census to better understand this species;
2. establish the first SBS Conservation Alliance, involve protected areas, research institutes, NGOs, environmental activists and enterprises in conservation activities, as well as developing CEPA activities for the public;
3. promote the management of key habitats like Tiaozini, Leizhou Peninsula. For example, in Leizhou Peninsula, we clear *Spartina* and

evaluate the effectiveness and involve local communities in the conservation work;

4. support the monitoring and conservation work on EAAF, especially in key regions, such as Russia and Myanmar.

Social participation, from scientists to local communities, may help the systematic change needed for nature conservation.

Theme: Conservation Management (Oral Presentation)

KAPAR WATERBIRDS SURVEY 2015/16 AND 2016/17 (SUPPLEMENTARY MATERIAL)

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Kapar Power Station (KPS) ash ponds are located in the north-central Selangor Coast. It has been designated as an Important Bird and Biodiversity Area MY011, and an East Asian-Australasian Flyway Network Site. The man-made ash ponds with shallow water are roost sites for waterbirds during high tide.

The site was first identified as an important roost site for migratory waterbirds in Malaysia by the Asian Wetland Bureau in 1988. In 2008, monthly counts of waterbirds were carried out for nine months (except for February, October and November), the first consistent coverage throughout a calendar year. The result was published in the KPS Waterbird Report 2008. Then, the Kapar Waterbirds Survey (KWS) 2015/16 was conducted for 12 months from April 2015 to March 2016) to assess the latest status of the site and its occupants.

Wintering (December to March) population comparisons showed a 41% increase with 25,006 birds in 2015/16 compared to 17,743 birds in 2008. For the oversummering (June to September) birds, a decline of 36% was noted compared to 2008. For both the 2008 and 2015/16 surveys, most months registered 15 or more wader and waterbird species. Ten of the 29 species increased trend (four markedly), while eight species declined (three markedly), and the remaining 11 species showed a stable trend. The north-central Selangor Coast is threatened mainly by coastal development; the increase in bird population in KPS highlighted the lack of other roost sites along the coast.

The survey stressed the continued importance of KPS ash ponds as a prime high tide roost site in north-central Selangor Coast for migratory waders and other waterbirds, not only during migratory months, but throughout the year.

Theme: Monitoring (Poster Presentation)

EVALUATING HABITAT QUALITY FOR THREATENED MIGRATORY SHOREBIRDS

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Many migratory shorebird populations are declining worldwide. Substantial effort and resources are being invested in shorebird surveys while relatively little effort is being allocated to monitoring the quality of their habitat. With mounting concerns of shorebird habitat deterioration, it is increasingly important to monitor habitat quality effectively. In this study, we evaluate habitat quality for shorebirds on a regional scale across six tidal flats along an ~100km coastline in tropical Queensland, Australia. We combined results from benthic sampling with prey choice and energy requirements of shorebirds to estimate the habitat quality for the six coastal tidal flat systems, using two different approaches.

The simpler approach, which compared the energy requirements and availability without taking prey density into consideration, suggests that our survey areas contained 1.2-2.4 times more food than needed by the current number of birds using the sites. However, habitat quality evaluation also taking prey selection and functional responses into consideration yielded considerably lower habitat suitability and an improved correlation with observed shorebird densities.

The second approach, which had a higher computational cost, indicated that many of the study areas were not profitable to migratory shorebirds, especially for large-sized species that tended to have a negative energy balance in those areas. Our approach also identified profitable areas for shorebirds with relatively higher prey density on the upper tidal flats, which are thus available for a longer duration within the tidal cycle. Losing such areas to land claim activities will have a disproportionately higher negative impact on shorebirds.

The approach used in this study could be applied to other important sites for shorebirds to monitor and evaluate habitat quality and facilitate urgent conservation measures when shorebird habitat is deteriorating.

Theme: Conservation Management (Oral Presentation)

IMPORTANT SHOREBIRDS SITES OF BANGLADESH - STATUS, THREATS AND CONSERVATION

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The Ganges–Brahmaputra–Meghna River Delta is situated in the heart of the 710 km long coastline of Bangladesh. This is the largest delta in the world that receives nutrient-rich sediment input from three major river systems, making the coast of Bangladesh biologically diverse and extremely productive. Moreover, Bangladesh lies at the junction of the Central Asian and East Asia–Australasian Flyways. These characteristics and the dynamic nature of intertidal mudflats of Bangladesh, attract thousands of migratory waterbirds each winter (December to March), including 19 species of international conservation concern, such as the critically endangered Spoon-billed Sandpiper *Calidris pygmaea*, and the endangered Nordmann's Greenshank *Tringa guttifer* and Great Knot *Calidris tenuirostris*.

It was suspected that important shorebird wintering sites may still be undiscovered, hindering conservation efforts. Since it is expensive, time consuming and somewhat impractical to survey the entire coastline of Bangladesh, targeted surveys were conducted in order to determine unrecognised shorebird sites in 2009-2019 throughout the Bangladesh coast with special focus on Meghna. The survey areas were identified based on a species distribution model developed by Spoon-billed Sandpiper Task Force and from satellite images freely sourced from the Landsat Programme and Google Earth to determine potential shorebirds sites.

A total of 55 coastal shorebird sites were surveyed – key sites were identified, threats assessed and conservation measures taken. We present the results of these shorebird surveys in previously known and unknown coastal shorebird sites in Bangladesh including counts, threats, conservation interventions and habitat preference of threatened shorebirds with notes on the global importance of these sites.

Oral Presentation

PROMOTING ALTERNATIVE LIVELIHOODS IN MYANMAR AND BANGLADESH TO REDUCE HUNTING PRESSURE ON SPOON-BILLED SANDPIPER AND OTHER SHOREBIRD SPECIES

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Intertidal mudflats along the East Asian–Australasian Flyway (EAAF) support more than 50 million migratory birds each year, including 33 globally threatened species. These mudflats are also among the most threatened

habitats on Earth, due to infrastructure developments and hunting of shorebirds. The critically endangered Spoon-billed Sandpiper *Calidris pygmaea* breeds in Russia and winters (December to March) in South and Southeast Asia. It is a flagship species for the EAAF, being the most threatened species of the flyway and evolutionarily distinct. The global population was declining rapidly and projected to be extinct by 2020 without intervention. The most imminent threat was hunting on the non-breeding grounds, particularly in Myanmar and Bangladesh, but also habitat lost on the non-breeding grounds, such as China. Action has been taken throughout the flyway by a broad partnership through the Spoon-billed Sandpiper Task Force (SBS TF) - EAAFP. Since 2009, Bangladesh SBS Conservation Project (BSCP) and Biodiversity & Nature Conservation Association (BANCA) have been working in Bangladesh and Myanmar in collaboration with SBS TF, RSPB, ICFC, WWT and BirdLife International on threatened shorebirds with a special focus on the Spoon-billed Sandpiper. Hunting of shorebirds is being addressed by providing alternative livelihood support to individual shorebird hunters at the Gulf of Mottama and Nan Thar Island in Myanmar and Sonadia Island in Bangladesh. Non-hunting agreements signed with over 50 ex-hunters, who have been provided alternative, sustainable and legal livelihoods in both countries. In addition, local communities are further engaged through various outreach events. There are encouraging signs that these conservation measures are working so far, but these need to be continued and expanded.

Theme: Hunting Mitigation (Oral Presentation)

SITE FIDELITY AND INTER-RELATIONSHIPS BETWEEN FEEDING AND ROOSTING SITES OF MIGRATORY SHOREBIRDS IN THE NON-BREEDING SEASON IN MORETON BAY, QUEENSLAND AUSTRALIA, WITH PARTICULAR FOCUS ON THE IMPORTANCE OF ARTIFICIAL ROOSTS

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Since 2016, the Queensland Wader Study Group, in collaboration with the University of Queensland and Fudan University have fitted Platform Terminal Transmitters (PTTs) to five shorebird species in Moreton Bay, Queensland, Australia. These species were Bar-tailed Godwit *Limosa lapponica* (n=4), Black-tailed Godwit *Limosa limosa* (n=2), Far-Eastern Curlew *Numenius madagascariensis* (n=8), Pacific Golden Plover

Pluvialis fulva (n=4) and Whimbrel *Numenius phaeopus* (n=6). Although the aim of this work was primarily to obtain previously unknown information on staging and breeding sites, it has also allowed a detailed examination of the spatial behavioural patterns of these species on their non-breeding grounds.

We describe the results from several thousand time-stamped position locations in Moreton Bay, covering all times of the day and night and all stages of the tide cycle. For some species, data were available for more than one consecutive non-breeding season allowing comparisons between years.

The results highlighted a series of interdependencies across the localised sites used by each species. Birds rarely changed their home ranges and where they did, these were typically short-lived relocations with the individuals returning to their normal locations relatively quickly. We discuss the factors that drive the variation in foraging area extent and distances commuted to foraging areas, and include tidal cycles and heights, disturbance at feeding and roosting sites, densities of conspecifics and heterospecifics, and the local availability of intertidal foraging habitat.

We also discuss implications for shorebird conservation in these non-breeding grounds. With increasing levels of development and human disturbance throughout Moreton Bay, an internationally important Ramsar site for shorebirds, these data provided important information on the non-breeding movement ecology and the factors important for shorebird conservation at the edge of a growing urban environment.

Theme: Non-breeding Ecology (Oral Presentation)

GENETIC POPULATION STRUCTURE OF LONG-DISTANCE MIGRATORY SHOREBIRDS ON THE EAST ASIAN-AUSTRALASIAN FLYWAY: INSIGHTS AND FUTURE PROSPECTS

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Conservation of migratory species requires knowledge of their year-round movements, demography, and ecology. In the East Asian-Australasian Flyway (EAAF), many migratory shorebirds are represented by multiple subspecies with varying degrees of spatial and ecological overlap throughout the year, which complicates population estimates and strategies to conserve them. Black-tailed Godwits *Limosa limosa*, Bar-tailed Godwits *L. lapponica*, and Red Knots *Calidris canutus* are all declining in the EAAF, and each includes 2–4 distinct flyway populations with imperfectly described geographic separation in the non-breeding season, and some evidence of cryptic populations with unknown year-

round distributions. Here, we describe recent efforts using high-resolution genetic techniques (thousands of genome-wide single-nucleotide polymorphisms; SNPs) to explore the population structure, evolutionary history, and degree of isolation among EAAF populations of these three long-distance migratory species. For each species, we describe our revised perspective on population structure on the EAAF, and propose future work, in both genetic and individual-tracking approaches, to solve the remaining mysteries regarding migratory connectivity and geographic overlap of non-breeding populations.

ASSEMBLAGE, ABUNDANCE, THREATS AND CONSERVATION ISSUES OF NON-BREEDING SHOREBIRDS AT NIJHUM DWEEP NATIONAL PARK, BANGLADESH

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The Nijhum Dweep National Park, an area of 16,352 hectares, is located in the central coast of Bangladesh and is an important non-breeding site for migratory waterbirds including species of global concern, such as Spoon-billed Sandpiper *Calidris pygmaea*, Spotted Greenshank *Tringa guttifer* and Great Knot *Calidris tenuirostris*. The park lies within the Ganges-Brahmaputra-Meghna delta, which has been recognised as an Important Bird and Biodiversity Area by BirdLife International. The Government of Bangladesh announced the adjacent water area as Marine Protected Area in 2019, due to the presence of important marine megafauna and pelagic birds. We have been conducting regular winter surveys since 2015 to monitor the assemblage and abundance of shorebird species at this site by conducting high tide roost counts. We also collected data on the non-breeding ecology of threatened shorebirds including limiting factors, habitat use, foraging ecology, prey availability, and threats. We have conducted 17 field surveys since 2015 and recorded 36 wader species. The peak count was 59,331 individuals in January 2018. An average of 27,175 shorebirds was counted during winter (December to March). Lesser Sandplover *Charadrius mongolus* was the most dominant shorebird species with a peak count of 42,548, followed by Black-tailed Godwit *Limosa limosa* (8269 individuals), Curlew Sandpiper *Calidris ferruginea* (470), Eurasian Curlew *Numenius arquata* (422), Bar-tailed Godwit *Limosa lapponica* (167), Great Knot (22), Asian Dowitcher *Limnodromus semipalmatus* (15), Spoon-billed Sandpiper (4), and Spotted Greenshank (3). Among benthic organisms, 14 taxonomic groups were recorded: Bivalvia (9264/m²) and Polychaete (6181/m²) formed 50% of the macrobenthic community, crab density was 4198/m² and Annelida had the lowest density at 261/m². The values for Shannon-Wiener (2.28) and Simpson's Diversity Index (0.8) indicate high benthic community diversity at Damar Char within Nijhum Dweep. Vessel traffic, cattle grazing, intense fishing activities and hunting have been recorded

in the area as threats. We will provide more details based on 5 years of study and indicate required conservation actions at the site.

Theme: Non-breeding Ecology (Oral Presentation)

KHAIRUSOVA-BELOGOLOVAYA ESTUARY AS A KEY SITE FOR LONG-DISTANCE MIGRATING WADERS IN THE NORTHERN OKHOTSK SEA

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EAAF shorebird stopover sites in Russia are poorly investigated. Since 2015, we have been studying the largest wader stopover site in the Okhotsk sea region. Our study site, the Khairusova-Belogolovaya estuary is the largest mudflat on the west coast of the Kamchatka peninsula, covering 45-50 km². This area hosts the largest number of waders during stopover in the northern Okhotsk sea. For many species of shorebirds, this is the first stopover during southward migration.

We conducted annual fieldwork from the end of June until mid-August to study the southward migration of shorebirds. We also analysed Landsat 8 satellite images and conducted a literature review. We focussed on the most numerous waders, Great Knot *Calidris tenuirostris*, Black-tailed Godwit *Limosa limosa* and Bar-tailed Godwit *Limosa lapponica*. We also included other long-distance migrants, such as Red Knot *Calidris canutus* and Far Eastern Curlew *Numenius madagascariensis*. In 2016, we started banding shorebirds, mainly Great Knots, with engraved leg flags.

During peak migration, we counted up to 28,000 individuals of 32 wader species in the study area. Maximum counts were 23,000 Great Knot, 9,000 Black-tailed Godwit, 4500 Bar-tailed Godwit, 300 Red Knot and up to 500 Far-eastern Curlew.

In 2016-2019, we marked 929 Great Knots with engraved leg flags. We received a large number of resightings between December and March from the whole non-breeding range ranging from the main Australian non-breeding grounds to less known areas in the United Arab Emirates and India.

Today, this important staging area does not have any protection status in Russia. Neither is it included in the lists of key sites for migrating waders. Management actions should be taken to protect the Khairusova-Belogolovaya estuary. This high-quality stopover site at the beginning of the southward migration is critical for the survival of shorebirds, and hence, it is an important part of bird protection throughout the whole flyway.

Theme: Migration Ecology (Oral Presentation)

SITE ACTION PLANS: A NEW TOOL TO PROTECT IMPORTANT MIGRATORY SHOREBIRD HABITAT

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In Australia, protecting important habitat for migratory shorebirds is a key conservation goal defined by the Environment Protection and Biodiversity Conservation Act 1999. The Revision of the East Asian-Australasian Flyway Population Estimates for 37 listed Migratory Shorebird Species (2016) provided the basis for a systematic identification of nationally and internationally important shorebird habitat. A detailed overview of the most important areas around the country has been published in the Directory of Important Habitat for Migratory Shorebirds. However, identification of important habitat is a crucial first step to improve conservation outcomes for migratory shorebirds, knowledge of the current state of the sites must be applied and lead to improved site management. BirdLife Australia thus set out to develop a new approach for important sites, the "Site Action Plan for Migratory Shorebirds". The purpose of the plan is to identify threats and key management needs for migratory shorebirds for some of the important sites identified in the Directory.

So far, 11 Site Action Plans for priority internationally and nationally significant habitat areas in the Australian states of South Australia and Victoria have been finalised. The plans have been produced in collaboration with a wide range of stakeholders and communities, such as local land managers, indigenous groups and environmental organisations. While the tool of a Site Action Plan is relatively new and it is continuously refined using the feedback received, it is evidently becoming a significant tool to facilitate concrete change.

Our long-term goal is to see the development and implementation of Site Action Plans for as many important migratory shorebird habitat areas as possible across Australia. We believe the approach has great potential for application in communities all along the flyway.

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Theme: Conservation Management (Oral Presentation)

EXTENT AND IMPACT OF HUNTING ON MIGRATORY SHOREBIRDS IN THE ASIA-PACIFIC: IS THERE ENOUGH EVIDENCE?

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Migratory shorebirds are declining in the East Asian-Australasian Flyway (EAAF). While many factors are at play, there is concern that hunting might be contributing to their decline. However, our understanding of hunting (by any method, including legal and illegal take) as a threat in this flyway is currently insufficient to inform policy, as no study has considered it at a flyway scale. Hence, we present a synthesis and analysis of the state of knowledge on hunting of migratory shorebirds in the EAAF. We ask: i) What is the temporal, spatial, and taxonomic extent of hunting? ii) What are the potential population-level effects? and, iii) What are the knowledge gaps?

We conducted an exhaustive literature search from 1970 to 2017 and aggregated data focusing on uncertainty in different dimensions (i.e., spatial, temporal, taxonomic, and demographic). We discovered that hunting has been pervasive temporally, spatially, and taxonomically. We

found 224 spatially explicit records of shorebird hunting from 97 references corresponding to 166 geographic locations or areas in 17 countries. In all, 46 of the 61 species occurring in this flyway, including 12 of the 14 species of conservation concern, have at least one record of hunting since 1970. When considering the number of records of hunting per species, 12 are within the upper quartile of the frequency distribution, which includes six species of conservation concern. Based on thresholds of sustainable harvest, we discovered that hunting has likely occurred at unsustainable levels for at least two species. Furthermore, and given our data limitations and emerging information, the hunting of shorebirds is likely to be far more widespread in the flyway and affecting a wider suite of species.

An important next step is to undertake further ground surveys to gather new empirical data, which can in turn form the basis of coordinated monitoring programmes.

Theme: Conservation Management (Oral Presentation)

MIGRATION ALTITUDE OF FAR EASTERN CURLEW AND WHIMBREL IN RELATION CONDITIONS ALOFT

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Understanding flight-altitude selection of migratory shorebirds is crucially important in predicting the effects of climate change on migration and in mitigating bird strikes with aircrafts and man-made structures. We tracked the migration, including flight-altitude, in Far Eastern Curlew *Numenius madagascariensis* and Whimbrel *Numenius phaeopus*. We revealed what drove their flight-altitude selection by testing the effects of wind, humidity, temperature, clouds, and altitude on flight-altitude using a conditional logistic mixed effect model. We found that in both species flight-altitude selection primarily depended on altitude itself, birds preferentially

flying low and only next showing a preference for tailwind support. Our study confirms earlier hypotheses that birds select flight-altitudes with conditions that are favourable to their energy and water balance. However, contrary to the common notion, birds seem to prioritise flying low and limit climbing costs and water loss rather than primarily flying at altitudes that yield most wind support.

AUTUMN MIGRATION OF BLACK-TAILED GODWITS *LIMOSA LIMOSA* FROM EASTERN MONGOLIA TO SRI LANKA AND SOUTHERN ASIA TRACKED BY GSM TRANSMITTER

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Mongolia is located on the inland route for migratory shorebirds between non-breeding grounds in Australia, southern Asia and breeding areas in the Asian tundra. Fifty-eight shorebird species have been recorded in Mongolia, most of which migrate along the East Asian-Australasian Flyway. However, our knowledge of shorebird populations that use this route is still deficient. For instance, Black-tailed Godwit *Limosa limosa melanuroides* breeds in the valleys of northern rivers in Mongolia and spends the non-breeding period in southern Asia. We tracked four Black-tailed Godwits from the Chukh Lake, Ulz River in north eastern Mongolia, in 2019 using 6g mobile based GSM (YHGTG0306) transmitters on two adults and two juveniles. All tracking devices were programmed to collect data while in the international roaming range and a signal transmission mode was modified in real time. We successfully tracked autumn migration routes from eastern Mongolia. The godwits spent the non-breeding season in different sites in southern Asia and two adults used southern Bangladesh as a stopover site during migration. One moved to southern Thailand and another to Sri Lanka for the non-breeding season. The two juvenile godwits also spent the non-breeding season in different sites, one in southern Myanmar and the other in Bohai Bay in eastern China.

Theme: Migration Ecology (Oral Presentation)

COUNTING WADERS DURING NORTHWARD MIGRATION AS A METHOD OF NUMBER ESTIMATION AND MONITORING

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Counts of waders during northward migration have been conducted on Kamchatka for the last 30 years. We counted waders as they flew past and subsequently added up the numbers. We conducted 17 counts at 13 different points of Kamchatka during a 15–30-day period. Northward migration of waders on Kamchatka is very fast compared to the southward. Over 90% of waders migrate during one or two days without long stops anywhere. Migration occurs almost exclusively during daylight hours, which is 18–24 hours in different areas of Kamchatka at the end of May. This allowed us to summarise the number of passing and short-stopping waders on a daily basis in order to get the total number of waders migrating through any point. The maximum count for one point for all species together was for Dunlin *Calidris alpina* – 124,000, Great Knot *Calidris tenuirostris* – 36,000, Red-necked Stint *Calidris ruficollis* – 19,500, Ruddy Turnstone *Arenaria interpres* – 7,200, Whimbrel *Numenius phaeopus* – 5,300, Black-tailed Godwit *Limosa limosa* – 3,700, Wood Sandpiper *Tringa glareola* – 3,600, Bar-tailed Godwit *Limosa lapponica* – 2,700, Mongolian Plover *Charadrius mongolus* – 2,100, Common Greenshank *Tringa nebularia* – 1,700, and for Eastern Curlew *Numenius madagascariensis* – 700. Comparing the number of counted waders at different points and observing the direction of migration allowed us to determine the main migration routes of different species and their minimum total number during northward migration through Kamchatka. The use of these counts for monitoring the number of waders is only possible for the largest species and when counts are conducted at one point during several years.

Theme: Migration Ecology (Oral Presentation)

IMPORTANT STAGING PLACE FOR WADERS DURING SEASONAL MIGRATION IN THE SEA OF OKHOTSK REGION

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We summarised data on known areas of concentration of waders while preparing a monograph on seasonal migration of waders in the Sea of Okhotsk region. We have compiled our own results since 1978, along with published and unpublished data from other researchers. Spring migration of waders in the Sea of Okhotsk Region is very fast when most of the coast is still covered in ice. Significant concentrations of waders are known mainly

from the western coast of Kamchatka. Important staging sites for waders are mostly known during southward migration. The main stopover sites are located in lagoons and estuaries on the west coast of Kamchatka, northeast coast of Sakhalin and Bays near the Amur River mouth. For instance, in the Penzhina River Estuary in Kamchatka, the peak count was 40,000 Dunlins and the minimum total estimation 190,000 individuals. In the Khayryuzova-Belogolovaya River estuary peak counts were 21,000 for Black-tailed Godwit *Limosa limosa* and 20,000 for Great Knot *Calidris tenuirostris*. In Moroshechnaya River estuary the peak count for Black-tailed Godwit was 7,000. In Bolshaya Vorovskaya River Lagoon the peak count for Mongolian Plover *Charadrius mongolus* was 1,300. In Odoptu Bay (Sakhalin) the peak count for Dunlin *Calidris alpina* was 26,000 and for Red-necked Stint *Calidris ruficollis* 22,000. For Great Knot, peak count was 15,000, in Konstantina Bay (Khabarovsk) and 26,000 in Ulbanskiy Bay. There are other staging sites with smaller numbers that are also internationally important and many areas in the Sea of Okhotsk coasts still remain unexplored.

Theme: Migration Ecology (Oral Presentation)

BOLSHAYA VOROVSKAYA RIVER LAGOON, WEST KAMCHATKA AS STAGING PLACE FOR WADERS

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The Bolshaya Vorovskaya River lagoon is located in the central western coast of Kamchatka. In July–September 2013–2019, we surveyed a 5-km section of the southern part of the lagoon. In 2014–2018, we made 171 counts of waders at low tide. Over seven years of research, we have registered 36 wader's species with maximum counts of about 12,000 individuals in 2014, 17,080 in 2015, 10,530 in 2016, 7,310 in 2017 and 14,430 in 2018. The international significance of the lagoon as a staging place for waders during the southward migration was confirmed for nine species: the Spoon-billed Sandpiper *Calidris ferruginea*, which was observed there regularly, Mongolian Plover *Charadrius mongolus* (maximum count can reach 10% of total estimation for *stegmanni* subspecies), Whimbrel *Numenius phaeopus* (2.3% of flyway population estimation) Red-necked Stint *Calidris ruficollis* (1.4%), Dunlin *Calidris ruficollis* (1.0%), Black-tailed Godwit *Limosa limosa* (0.8%), Great Knot *Calidris tenuirostris* (0.8%), and Ruddy Turnstone *Arenaria interpres* (0.6%). We also observed a number of waders flying over the lagoon and the direction they were heading to. In 2014, we counted over 32,000 Whimbrels flying over, 28,000 of them within five hours on the same day, representing about half of the flyway population estimate. In 2014–2018 we also ringed and flagged 11,300 waders, including 31 Spoon-billed Sandpipers. We

received more than 300 recoveries and resightings from Japan, Korea, China, Taiwan, the Philippines, Thailand, Australia, New Zealand and Oman. Observations of northward migration were conducted in May 2018. In spring waders are mainly flying past or stopped for a short time at the lagoon. This gave us the opportunity to summarise the counted number and get the total number of migrated waders. In total, we counted 155,600 waders of 24 species, including 124,000 Dunlins, 12,200 Red-necked Stints, 6,500 Great Knots, 3,100 Whimbrels, 2,600 Bar-tailed Godwits, 2,100 Mongolian plovers, 1,500 Black-tailed Godwits, 654 Eastern Curlews. Interestingly, 91% waders migrated during two days (22 and 23 of May).

Theme: Migration Ecology (Oral Presentation)

BANDING AND COUNT SURVEY OF DUNLIN ON KAMCHATKA

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Dunlin *Calidris alpina* is one of the most common shorebird species in Kamchatka. Over the past 30 years, we have collected information about Dunlin migration through the peninsula, including their numbers and important staging sites. We conducted shorebird surveys in Kamchatka on southward migration for 13 seasons and on northward migration for 16 seasons. In May, Dunlins arrive from Sakhalin at various points of the southwestern coast of Kamchatka. The main migration route is along the west coast. In the central coast, we counted up to 124,000 Dunlins in one season. In the central and northern western coast Dunlins cross the peninsula at various places and then move along the north-eastern part of the peninsula. On the south-eastern coast, the intensity of migration is relatively weak - here we counted not more than 1,500 Dunlins in May. On southward migration, the routes are similar, but more individuals cross the northernmost part of the western coast. In the spring there is almost no migration here, since the coast is covered in ice until early June. In 1990-2000s, Dunlin numbers decreased on Kamchatka during northward migration, but the breeding population has been stable. We estimated the total number of Dunlins at main staging places during southward migration on western Kamchatka as 300,000 in the Penzhina River Estuary, 120,000 in the Moroshechnaya River Estuary and 80,000 in the Vorovskaya River lagoon. In total, about 11,600 Dunlins were banded and flagged on Kamchatka in 1990-2020, including 6,900 in the Vorovskaya River lagoon in 2014-2020.

Theme: Migration Ecology (Oral Presentation)

SPREADING THE SHOREBIRD LOVE - USING ART TO ENGAGE, EDUCATE AND INSPIRE

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Over the past decade I have initiated three major art projects to engage artists and audiences with migratory shorebirds and the East Asian-Australasian Flyway, and I have found art to be an effective and lasting way to engage communities with migratory shorebirds and their habitat.

I have found that artists and audiences are quickly and readily engaged with the story of migratory shorebirds. Furthermore, some artists continue long after my initial contact to independently promote awareness of migratory shorebirds in their own work and through exhibitions.

I discuss the challenge of engagement faced by those involved in migratory shorebird conservation, how art can help address these challenges and whether behavioural change from involvement in shorebird-related art projects can be measured.

INSIGHTS FROM 10 YEARS OF GEOLOCATOR STUDIES IN AUSTRALIA WITH PARTICULAR REFERENCE TO CHANGING MIGRATORY BEHAVIOUR OF RUDDY TURNSTONE

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Australia was one of the first countries to utilise light-level geolocators for tracking the movements of migratory shorebirds. Since 2009, these instruments have been used on a range of species at non-breeding locations around the country, including coastal Victoria, King Island (Tasmania), SE South Australia, NW Western Australia, and SE Queensland. This extensive program has gathered a wealth of information on the movements of nine of Australia's long-distance migratory species. The migratory tracks obtained, including multi-year tracks, allow us to detail both spatial and temporal strategies used along the East-Asian Australasian Flyway. In addition, they have also enabled assessment of breeding locations and incubation strategies, many of which were unknown given the remote, low-density breeding sites used by these species. Given the extended duration of this program, studying potential changes in migration behaviour in

response to global change processes is now also within reach. As a prime example of this possibility we present a longitudinal study of geolocator-carrying Ruddy Turnstones (*Arenaria interpres*) that spend the non-breeding season on King Island, Tasmania, and appear to have changed their migration behaviour dramatically over the past decade. All the insights gleaned from geolocator data prove to be an important addition to count and banding data that have informed and continue to inform conservation measures flyway-wide, including the development of initiatives for the Yellow Sea region and on a local scale within Australia.

Theme: Migration Ecology (Oral Presentation)

TRACKING OF LATHAM'S SNIPE PROVIDES NEW EVIDENCE OF PAPUA NEW GUINEA AS A KEY STAGING SITE ON MIGRATION

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Latham's Snipe *Gallinago hardwickii* is one of two Gallinago species confirmed in Papua New Guinea, the other being Swinhoe's Snipe *Gallinago megala*. Both species are essentially identical in the field, and extreme care and perseverance is required to differentiate them based on observations alone. As a consequence, where the species overlap, sight-based records are often unable to be verified and the distribution of each species in overlap zones is difficult to determine. This is the case for Papua New Guinea, where Swinhoe's Snipe is considered the dominant species, and the majority of accepted records for Latham's Snipe stem from coastal locations near the capital of Port Moresby. Between 2016 and 2020, light-level geolocators and satellite transmitters were deployed to obtain migration information for the species. Two geolocator retrievals in south-eastern Australia indicated use of Papua New Guinea on northward and/or southward migration, although the resolution of the data was insufficient to determine stopover locations. Three satellite transmitter deployments (two in Canberra, Australia, and one in Hokkaido, Japan) have provided high-resolution location information, and the first conclusive evidence of staging by Latham's Snipe in the Papua New Guinean highlands (between 1500-2500m ASL). The two Canberra-tagged snipe used modified

wetlands and agricultural areas near human habitation in the highlands, while the Hokkaido-tagged snipe stopped on the Papuan coast near the border with Papua New Guinea. While these represent only a small sample size, they nevertheless demonstrate that Latham's Snipe distribution is significantly broader than officially documented. These findings also highlight the importance of this region for migrating snipe. Targeted investigation of the population extent, habitat use and priority areas for conservation in New Guinea is urgently required.

CLIMATE CHANGE RISK ASSESSMENT FOR SHOREBIRD STOPOVER SITES IN THE WESTERN TIDAL FLATS IN SOUTH KOREA

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Yellow Sea tidal flats on the east coast of China and west coast of Korea have been known as the main habitat for shorebirds that travel to and from breeding areas in Siberia. These tidal flats have received attention due to habitat loss caused by human activities. Concerns with regard to the impact of climate on biodiversity have also increased. Even though political efforts to reduce human threats on these coastal areas have increased, the effects of climate change, such as sea level rise and temperature increase are uncertain, making it difficult to plan strategic adaptation to conserve the habitat.

In this study, we extracted key climate change risks for coastal wetland ecosystems based on a literature review and expert opinion. The key risks were 1) the inability of species to track changing climate space, 2) habitat disturbance caused by sea-level rise, and 3) food-web mismatch. Then, we developed a quantitative assessment method for each risk considering data availability. With regard to the impacts of climate change on shorebirds, the assessment of the three key risks focused on the tidal flats on the west coast of South Korea, as these represent key stopover sites and contain invertebrates, the main food source for shorebirds. We identified climate change factors related to each risk, inspected the current status of species and habitats exposed to the threats, and diagnosed possible consequences under future climate predictions. We found the risk of invertebrate species losing their climate space due to temperature increase very low. Nevertheless, sea level rise may affect this food source due to significant habitat loss. Fortunately, the most important shorebird habitats in South Korea do not seem to be the most vulnerable to sea level rise, but the impact is still uncertain due to severe lack of data.

Theme: Climate Change (Oral Presentation)

CITIZEN POWER – SHOREBIRD MONITORING BY THE PUBLIC

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Consistent monitoring of shorebird populations is vital for detecting early signs of changes and developing conservation decisions. The Asian Waterbird Census (AWC) and national monitoring programmes are conducted in many countries. However, the resources are not always sufficient to fully cover the range and frequency of counts required. To fill the gap, citizens with basic skills can be strong contributors to important monitoring schemes. Working together with other stakeholders, notably researchers and scientists, citizens can both support monitoring and contribute to conservation proposals.

In Sabah, Malaysia, the AWC has not been conducted. In 2015, local photographers and nature guides were invited to participate in the AWC with an NGO, the main implementing organisation there. The photographers and nature guides constituted a significant resource, armed with basic identification skills and equipment. Lectures about shorebirds served to increase awareness and interest.

In Incheon, the Republic of Korea, a citizen group started monitoring shorebirds in 2009 to better understand species, population sizes and distribution in local wetlands. The group comprises local science teachers and general citizens. After 10 years of regular monitoring, they were able to use the information to convince the local government to modify its development plan, which would have destroyed an important shorebirds habitat, to instead provide a roosting site.

Common factors identified to encourage the participation of citizens in monitoring include understanding of the need for regular monitoring, feeling a sense of contribution, encouraging participants' interest and enjoyment, and a coordinator to provide necessary information and encourage participation. We would like to invite people who are trying to involve citizens in monitoring to share experiences and ideas to promote sustainable citizen monitoring and encourage more citizens to participate in shorebird conservation.

Theme: Monitoring (Oral Presentation)

CALL FOR THE CONSERVATION OF DUNLIN THROUGH THE EAST ASIAN-AUSTRALASIAN FLYWAY

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Dunlin (*Calidris alpina*) is one of the most abundant shorebirds that spends the non-breeding season in East Asia. The connectivity among its breeding, staging and non-breeding areas has been partly identified by long-term banding/recovery efforts through the EAAF. However, monitoring has revealed its decline, and the AMBI-EAAF Workplan lists Dunlin as a conservation priority species.

In Japan, nationwide shorebird monitoring surveys have been conducted since 1973. Now the monitoring is done at over 140 sites in three seasons per year. Dunlin is dominant in spring and winter. Its main subspecies in Japan is *C. a. arctica*, but population analysis based on the monitoring has shown the possibility of other subspecies occurring in Kyushu Island in certain migration seasons. The population of Dunlin shows a continuous decline for the past 40 years. The population currently is about 30% in spring, and about 15% in the autumn compared to its numbers in the 1980s.

In January 2020, an expert workshop was organised on the conservation of small shorebird species that migrate among Russia, the USA and Japan to seek opportunities to develop cooperative research and conservation actions, especially for Dunlin. Experts shared existing knowledge including migration patterns, monitoring schemes and population trends of Dunlin in their countries to identify the knowledge gaps and listed necessary research actions to fill in the gaps. The participants wished to share the workshop outcome with a wider audience to invite more people from the rest of the EAAF to join in the initiative. Dunlin is a potential flagship species to further develop cooperative shorebirds conservation throughout East Asia.

Theme: Breeding Ecology, Migration Ecology, Non-breeding Ecology, Monitoring (Oral Presentation)

***SPARTINA ALTERNIFLORA* THREATENS IMPORTANT SHOREBIRD HABITAT IN COASTAL CHINA**

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China's coastal wetlands are critically important to shorebirds. *Spartina alterniflora* (smooth cordgrass) was intentionally introduced to the Chinese coast in 1979 and expanded rapidly thereafter. Its encroachment has occurred almost entirely on intertidal flats. *S. alterniflora* poses a significant risk to shorebirds because its spread

onto intertidal flats renders the mudflats unavailable for foraging and it also restricts nearshore and occasionally supratidal roosting habitat. Further loss or degradation of intertidal shorebird habitat from *S. alterniflora* encroachment is likely to compound shorebird population declines, particularly when it occurs at important shorebird sites, where intertidal flat extent is declining due to other factors (e.g. land reclamation or sea level rise). However, the distribution and intensity of the overlap between *S. alterniflora*, important shorebird habitat and intertidal flat change in China is not yet well studied. We mapped the extent of *S. alterniflora* coverage in 2015 of coastal sites that are used by internationally significant numbers of shorebirds, estimated change in the spatial extent of intertidal flats between 2000 and 2015 at the same set of sites, and investigated where these two threats to shorebird habitat intersected. We found that across all sites, the total area of intertidal flats decreased by 15% between 2000 and 2015, intertidal flats decreased between 2000 and 2015 at 37 of 52 sites (71%), and found direct overlap with *S. alterniflora* in 28 of 52 sites (54%) in 2015, which exceeded 5% of the total area at five sites. Combined pressures from *S. alterniflora* and loss of intertidal habitat were most severe in Jiangsu, Shanghai, Fujian, Zhejiang, Tianjin and Hebei provinces. These results underscore the urgent need to develop a comprehensive control program for *S. alterniflora* in coastal areas of China that are important for shorebirds.

Theme: Conservation Management (Oral Presentation)

ANNUAL AND LONG-TERM BREEDING SUCCESS OF MIGRATORY SHOREBIRDS THAT SPEND THE AUSTRAL SUMMER IN AUSTRALIA.

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Juvenile percentages in shorebird flocks at the terminus of their migration provide insights into annual and long-term variations in reproductive success. The juvenile percentage of migratory shorebird populations spending the austral summer at selected sites in Australia were calculated using data from cannon-net catches made by the Australasian Wader Studies Group in northwest Australia (NWA) (1982-2018, 25 years of data) and the Victorian Wader Study Group in southeast Australia (SEA) (1979-2018, 39 years of data). The data included for each species considers the differences in migratory arrival and departure dates for each species.

Annual averages are presented for selected species (i.e. species with enough representative data available) with 95% binomial confidence intervals. For species with

over 1000 individuals caught, we also conducted a logistic regression to study trends in juvenile percentages over time.

The data confirm the well-known massive variations in breeding success of migratory shorebird species. However, probably as a result of rapid climate warming on their breeding grounds and major changes to their preferred staging sites along the flyway, we also see significant long-term trends, which may be positive or negative depending on species and population. Declines in long-term breeding success were found for Arctic breeding Bar-tailed Godwit in NWA *Limosa lapponica menzbieri*, Great Knot *Calidris tenuirostris*, Red Knot *C. canutus*, and sub-arctic breeding Greater Sand Plover *Charadrius leschenaultii*. An increase in the percentage of juvenile Bar-tailed Godwit *L. l. baueri* in SEA, Grey-tailed Tattler *Tringa brevipes* in NWA and Curlew Sandpiper *Calidris ferruginea* at both locations was detected.

Theme: Monitoring (Oral Presentation)

CITIZEN SCIENCE IMPROVES OUR KNOWLEDGE AND HELPS THE CONSERVATION OF GLOBALLY THREATENED SPECIES IN CHINA

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Spoon-billed Sandpiper *Calidris pygmaea* is a globally Critically Endangered species, and a flagship species of East Asian-Australasian Flyway. Recently, Spoon-billed Sandpiper have undergone extremely rapid decline and currently have an extremely small population. In 2019, the Center for East Asian-Australasian Flyway Studies (CEAAF), Beijing Forestry University and Mangrove Conservation Foundation (MCF) jointly initiated a project for the conservation of Spoon-billed Sandpiper. We simultaneously surveyed Spoon-billed Sandpiper and food resources along coastal wetlands in China. We invited over 30 Chinese Spoon-billed Sandpiper conservation organisations, including governments, NGOs, research institutes, reserves, and birdwatching societies to work together. Based on the result of the census, we learned about the status of the species and improved its situation. We found several new stopover and non-breeding sites. Citizen science could highly improve our knowledge of Spoon-billed Sandpiper in China.

NUMBERS AND DISTRIBUTION OF DUNLIN IN THE REPUBLIC OF KOREA

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Shorebird monitoring has been conducted in the Republic of Korea since 2001 at 8-20 sites along the western and southern coastline. Dunlin is the shorebird species with the largest number of migrating and wintering individuals in the Republic of Korea.

The number of migrating Dunlin was 65,567-100,786 in the spring, and 14,913-36,114 in the autumn in the last five years. The most important site with 23.6% of the total population size was Yubu Island. Other important sites were Asan Bay, Yeongjong Island, Namyang Bay, Geum Estuary and Cheonsu Bay. The migrating Dunlin population has been declining since 2001.

Based on 21 years of data, the average number of individuals in the winter was 10,932, ranging from 2,624 in 2018 to 21,955 in 2010. Wintering Dunlin have been recorded at 74 of the 200 Winter Waterbird Census sites since 2000, but only 20 sites reached over 1,000 individuals as maximum count. The main wintering sites were Nakdong Estuary, Yubu Island, Saemangeum region, Namyang Bay and Suncheon Bay. The habitat types of wintering Dunlins were intertidal mudflats, bays, estuaries, sandy beaches and inland wetlands.

Because Dunlin is a common shorebird species with a large population in the Republic of Korea, there are no specific conservation efforts for its protection, but efforts are being made to protect its habitat that is also used by other waterbirds.

SURVIVAL OF LONG-DISTANCE MIGRANTS EVALUATED FROM 40 YEARS OF AUSTRALIAN BANDING DATA

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Many long-distance migratory waders along the East Asian-Australasian Flyway spend their non-breeding season in Australia. Forty years of count data have revealed that a large proportion of these species have been experiencing population declines and notably so in the southern half of their non-breeding range. Whether these declines are due to decreased survival and/or decreased reproductive success remains largely unresolved. Using up to 40 years of catching and metal banding data from north-west and south-east Australia from the Australasian Wader Studies Group and the Victorian Wader Studies Group, respectively, we present a first survival analysis for a large number of waders that call Australia “home” during the non-breeding season. Although providing important insights in the potential mechanisms explaining the observed population declines, studies relying on catching and metal-band data suffer from (1) the fact that local rather true survival is being estimated, (2) the impossibility to study seasonal variations in survival (e.g. survival during northward versus southward migration and during the breeding and non-breeding season) and (3) low recovery rates requiring banding many individuals.

To address these issues, leg-flag data may provide an alternative, requiring a revitalisation of leg flagging and, notably, of leg-flag reading. Important steps to facilitate leg-flagging are currently being taken, on which we will also report.

Theme: Monitoring (Oral Presentation)

FIRST ATTEMPT TO EVALUATE SHOREBIRD HUNTING IN KAMCHATKA

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Hunting of shorebirds in north-eastern Russia (northernmost part of the EAAF) may negatively impact shorebird populations, especially threatened species. The first ever attempt to evaluate hunting pressure (legal and illegal) on shorebirds was started in the Russian Far East in January 2019. In the first year, we focused on Kamchatka and tried to get a general idea where, how and how many shorebirds are harvested. Special attention was given to Whimbrel *Numenius phaeopus*, the most commonly shot shorebird and to the endangered Far Eastern Curlew *Numenius madagascariensis*. We developed a methodology that includes analysis of ring recovery data (thanks to the Russian Bird Ringing Center) to identify places of active hunting for shorebirds. We also conducted anonymous social surveys of hunters, as well as informal interviews with specialists of the Forestry and Wildlife Protection Agencies and leaders of hunting societies. Our preliminary evaluation shows an annual harvest of 45,000 shorebirds in Kamchatka by legal hunters, of which 37,000 were identified by hunters as Whimbrel. This number includes young Far Eastern Curlews, which still have short bills in August and possibly other larger shorebirds. There were also about 1,600 large and medium-size shorebirds, which were definitely not Whimbrels and about 6,000 small shorebirds of different species. In addition, shorebirds are also shot by poachers. As 90% of the interviewed legal hunters had difficulties identifying shorebird species, they may shoot Bar-tailed Godwit *Limosa lapponica* and Far Eastern Curlew along with Whimbrel. These hunters were also unaware of shorebird declines and their conservation needs.

Considering that Whimbrel are also harvested elsewhere, our results suggest that the flyway population estimate of 55,000 individuals is 3-4 times lower than the real number. Our observations of Whimbrels during migration in Kamchatka also confirm this. In the future we hope to visit areas of possible shooting of Spoon-billed Sandpiper *Calidris pygmaea*, other key shorebird hunting areas in Kamchatka. We plan to verify Far Eastern Curlew shooting by participating in autumn hunting sessions and start surveying Sakhalin.

Theme: Conservation Management (Oral Presentation)

THE DIRECTORY OF IMPORTANT MIGRATORY SHOREBIRD HABITAT IN AUSTRALIA: TRANSLATING SHOREBIRD SURVEYS INTO OPPORTUNITIES FOR CONSERVATION ACTION

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Habitat is key: Australia's Environment Protection and Biodiversity Conservation Act has established 'Important Habitat' as a key concept for migratory species, including those areas recognised as nationally or internationally important. The Australian Government's Wildlife Conservation Plan for Migratory Shorebirds subsequently identified the creation of a Directory of Important Habitat for Migratory Shorebirds as a high priority action. BirdLife's Directory Project set out to analyse long-term shorebird data to identify important habitat for migratory shorebirds, using data from Australia's National Shorebird Monitoring and its precursors. Around 1,600 volunteers counting 2,882 count areas of 520 shorebird areas have provided 100,000 surveys to date. The effort was based on a revision of the Flyway Population Estimates and highlighted all sites in Australia that meet national and international significance criteria. A total of 381 areas meeting one or more of the criteria were identified using recent surveys from 2005 to 2018, receiving a detailed account and data summary in the Directory. Identification and mapping of important habitat for migratory shorebirds are required to deliver a scientifically robust basis for political decision-making and improved targeting of conservation investments. It is a key component in the delivery of the Migratory Shorebird Conservation Action Plan coordinated by BirdLife. The project also contributes to practical, on-ground delivery of threatened priority bird species. Based on the Directory, species and site-specific action plans can now be developed to address conservation issues in key areas around the continent, ultimately translating the most recent shorebird survey data into opportunities for conservation action.

Theme: Conservation Management (Oral Presentation)

WATERBIRD ABUNDANCE CHANGES AT CHINESE COASTAL SITES IN 2008-2017

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Coastal development is a major threat to coastal waterbird species around the world. The large-scale coastal reclamation along the Chinese coast and in the Yellow Sea area is believed to be the main reason for recent declines in populations of waders and other waterbirds of the East Asian-Australasian Flyway, the flyway with the highest number of threatened wader species of the four global waterbird migratory flyways. However, there is limited direct evidence of a relationship between tidal flat loss and waterbird abundance change along the Chinese coast.

Using waterbird survey data collected by the China Coastal Waterbird Census Group and remote sensing data on tidal flat area, we quantified the abundance change of 90 waterbird species and nine species groups in 2008-2017 at six coastal wetland sites along the Chinese coast and estimated the rate of abundance change of each species. We tested the relationship between the abundance changes at each site and the percentage loss of tidal flat within 10km radius of each survey site in 2007-2016, estimated using remote sensing. Lastly, we tested the associations of the rate of abundance change of the 90 species using four species characteristics: mudflat-dependence, migratory status, body mass and breeding/resident range.

The rates of abundance change of the 90 study species varied between species and sites. All wader species combined, and four individual species (Eurasian Curlew *Numenius arquata*, Kentish Plover *Charadrius alexandrinus*, Red Knot *Calidris canutus* and Whimbrel *Numenius phaeopus*), had higher rates of abundance decline at sites with more tidal flat loss in 2007-2016. Wintering mud-flat dependent species, non-mudflat dependent passage migrants and species with smaller body sizes had the highest abundance declines.

These results suggest that tidal flat loss at these key sites along the flyway appears to be linked to local abundance changes in several wader species and may therefore be contributing to the overall population declines of these species. Coastal protection in China is therefore crucial for conserving these waterbirds in China and EAAF, and the recent act of Chinese government toward coastal protection is an important step to stop the decline of coastal waterbirds in EAAF.

Theme: Monitoring (Oral Presentation)

DEMOGRAPHY AND MIGRATORY DYNAMICS OF DUNLIN IN THE EAST ASIAN-AUSTRALASIAN FLYWAY

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Dunlin *Calidris alpina* is one of the most abundant shorebirds that spends the non-breeding season in East Asia. Populations in East Asia include four different subspecies, each with their own distinct breeding range in the Arctic with population sizes between ~900 and 500,000 birds. Since 1975, declines of up to 80% have occurred in the Japanese non-breeding range. Losses in other areas are likely, as the species stages or spends the non-breeding season in areas of past large-scale reclamation. Demographic models for Dunlin breeding in North America indicate the *arcticola* subspecies has much lower mean annual survival rates than other subspecies that spend the non-breeding season in North America. Species differences suggest that losses are occurring outside of the breeding range. At present rates, the population will reach 3% of its 2014 level within 20 years. Band resightings indicate *arcticola* Dunlin primarily use areas in Japan during migration and the non-breeding season, with some visiting the Yellow and the China Sea. In contrast, observations of *actites* and *sakhalina* Dunlin almost all occurred in the Yellow and China Sea regions. Up to 83% of *arcticola* Dunlin exhibited inter-annual site fidelity to specific non-breeding sites, suggesting that loss of specific sites could lead to declines. Light-level geolocation data indicated the nonbreeding range of *arcticola* Dunlin was primarily at the eastern edge of the flyway (western Alaska and central Japan), whereas *sakhalina* and *kistchinski* Dunlin were found along the western edge of the flyway (Bohai Bay and inland China). However, all four subspecies used the same core regions at the center of the flyway (Sakhalin Island, Yellow Sea, and East China Sea). Dunlin subspecies co-occurred temporally in core flyway regions during the non-breeding season and northward migration, but did not co-occur during southward migration. Variation in migration patterns indicate that conservation can occur at the subspecies level; identifying threats to *arcticola* and the very rare *actites* subspecies should be a top priority.

Theme: Migration Ecology (Oral Presentation)

EFFICACY OF SHOREBIRD CHICK RADIO-TRACKING

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Monitoring the survival of free-living precocial avian young is critical for population management. Perhaps the most promising technique available to track survival is the deployment of devices, such as radio-transmitters or data loggers, which allow for tracking of the individuals. Here,

we aim to understand if the deployment of radio-transmitters or the process of radio-tracking negatively impact chick survival by analysing survival of tagged chicks. Fifty Masked Lapwing *Vanellus miles*, 42 Red-capped Plover *Charadrius ruficapillus* and 27 Hooded Plover *Thinornis cucullatus* chicks were radio-tracked. Mortality between tagged and untagged chicks within broods was compared to examine whether radio-telemetry influenced chick survival. We found no statistically significant difference in survival between chicks with and without radio-transmitters and the radio-transmitters enabled the determination of cause of death for 0–28% of radio-tagged chicks. The survival of shorebird chicks does not appear to be affected by attachment of transmitters, thus radio-tracking remains a promising way of studying the movement and survival of shorebird chicks, and is helpful but not reliable for assigning the cause of mortality.

Theme: Monitoring (Oral Presentation)

SALTPANS CAN BE ALTERNATIVE FEEDING HABITAT FOR PELAGIC-FORAGING AND SMALL-MEDIUM SIZE SHOREBIRDS: A STUDY IN BOHAI BAY, CHINA

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As environments are altered rapidly by humans, animals may either adjust their behaviour to the environment or disappear. In many parts of the world, natural habitats (e.g., tidal flats) have been turned into artificial habitats (e.g., saltpans). The question is what determines whether shorebirds adjust to using artificial wetlands, such as saltpans. In this study, we used a combination of counts in the two habitats in the Luannan coastal complex in Hebei, China and stable isotopes in different tissues to examine differences among species and guilds. Stable isotopes ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) in tissues reflect the food sources from which they were built over shorter (plasma) or longer

periods (red cells). In our study area, where extensive tidal flats occur along with one of the largest areas of saltpans in the world, we made daytime low tide counts, i.e., during a time when tidal foragers get their fill. We also captured individuals of the study species and retrieved blood samples. The results from counting and stable isotopes were highly correlated. Pelagic-foraging species did not commute between intertidal flats and saltpans, and exclusively used saltpans to meet their high energy requirements during migration. Food items from the saltpans also contributed significantly to the diet of small-medium visual and tactile-foraging species, which were equipped with needle-shaped bills similar to pelagic-foraging species. Large visual and tactile-foraging shorebirds ignore a disproportionately large amount of small prey, maybe because of low handling efficiency for small prey. Pelagic-foraging species together with small-medium visual and tactile-foraging species may be pre-adapted to newly created saltpans habitats having needle-shaped bills. The conservation managers of artificial wetlands should think in terms of guilds, to increase management effectiveness.

HABITAT USAGE AT STOP-OVER SITES DURING MIGRATION OF THREE SATELLITE-TAGGED SHOREBIRD SPECIES FROM NORTH-WEST AUSTRALIA

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Shorebirds require a series of wetland habitats to stop-over and refuel during migration. These wetlands could be natural or artificial, coastal or inland, protected or non-protected. Understanding the timing of shorebirds' arrival and departure at these stop-over sites could provide valuable information for effective protection of the birds, as well as the wetland resources on which humans rely at these sites.

Since 2015, the Australasian Wader Studies Group (AWSG) has been deploying solar-powered satellite transmitters (PTT - Platform Transmitter Terminal) on various shorebird species during the North-west Australia Expedition, aiming to understand the migration strategy and breeding ground for wader species. In 2016-2018, five 5g PTT were deployed on Grey Plover *Pluvialis squatarola*, five 5g on Whimbrel *Numenius phaeopus* and ten 2g on Grey-tailed Tattler *Tringa brevipes* at Eighty Mile Beach and Roebuck Bay, Broome, Australia. From these 20 transmitters, 13 full northward migration tracks and four full southward migration tracks have been recorded so far.

Highly diversified migration tracks and stop-over sites were recorded inter and intra-specifically. The majority of the tracked individuals used the southern China coast as their first stop following continuous single flight from north-western Australia. Whimbrels generally migrated along the coast, while Grey Plover and Grey-tailed Tattler

used both coastal and inland routes. We compared the migration strategies of these three species, with particular focus on their habitat use at stop-over sites across Asia.

Theme: Migration Ecology (Oral Presentation)

PRELIMINARY RESULTS OF SATELLITE TRACKING OF MIGRATORY SHOREBIRDS IN SINGAPORE

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Migration routes of shorebirds in Southeast Asia are generally less known due to limited studies. Previous studies suggest that most shorebird species in this region use the East Asian-Australasian Flyway although there have been a few reports of Curlew Sandpiper *Calidris ferruginea* and Common Redshank *Tringa totanus* found in Central Asia and in northwest China during the breeding season, which form part of the Central Asian Flyway. A study on Common Redshanks using 1-g geolocators in 2014-2016 found that all six adult birds bred in the Tibet-Qinghai Plateau in China.

To further understand the migration routes of shorebirds that spend the non-breeding season in Singapore, we deployed 20 Solar-powered PTTs weighing 9.5g and 5g, on five species of shorebirds from March 2017 to December 2018. The tagged individuals were 11 Whimbrels *Numenius phaeopus*, two Grey Plovers *Pluvialis squatarola*, four Common Redshanks *Tringa totanus*, two Common Greenshanks *Tringa nebularia* and one Pacific Golden Plover *Pluvialis fulva*. Preliminary results found that all Common Redshanks and one Whimbrel followed the Central Asian Flyway instead of the East Asian-Australasian Flyway, with some individuals undertaking a direct route across the Himalayas. Other than the Common Redshanks that bred in the Qinghai-Tibet Plateau, all other shorebirds bred in Northern Russia. Important stopover sites that have been identified include the Inner Gulf of Thailand, the Mekong River Delta in Vietnam, the Gulf of Mottama in Myanmar and the Yellow Sea coast in China and North Korea. Inland wetlands were also found to be critically important, including wetlands along the Yangtze River, Northern China and Southern Siberia. Until October 20, 2020, seven satellite trackers continue to provide active signals giving insights on the migratory path and staging sites for the 2nd year going into the 3rd year. Additional details are being analysed and the findings will be shared when complete.

LARGE POPULATIONS OF ASIAN DOWITCHER *LIMNODROMUS SEMIPALMATUS* FOUND DURING SHOREBIRD SURVEYS IN LIANYUNGANG, JIANGSU PROVINCE, CHINA

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The coastal wetlands of Lianyungang in northern Jiangsu province are located near the mid-point of the East Asian-Australasian Flyway. Not only are they key stopover sites for migratory shorebirds, but also some of the most heavily developed regions in the world. Previous shorebird surveys in the area were mostly conducted by a single surveyor, with limited spatial and temporal coverage. To better understand how shorebirds are using the coast, we carried out synchronous shorebird surveys on the Linhonghe, Qingkouhe and Xingzhuanghe mudflats on the Lianyungang coast from 9 to 13 May, 2019. We recorded 30 shorebird species with a conservative estimate of 109,028 individuals in total. The maximum single-day count of ten species exceeded 1% of their EAAF population limits. On 13 May, we recorded 22,432 Asian Dowitcher *Limnodromus semipalmatus* on the Qingkouhe mudflat, representing 97.5% of the global population estimate. We also recorded 42 flagged Black-tailed Godwits *Limosa limosa*, most of which had only been previously observed in northwest Australia. The current conservation status of Asian Dowitcher is Near Threatened, and the population trend is decreasing. However, the global population estimate of this species has not been updated since 2008. Our survey results suggest that a reassessment of the species' global population is urgently required, and the highly concentrated distribution of this species probably meets the Vulnerable criteria on the IUCN Red List. The high resighting rate of 42 flagged Black-tailed Godwits in just five days indicates that the area is crucial for this species, at least during their northward migration. Our surveys shed light on the two species' stopover sites and migration strategies. These findings support previous studies and confirm that the coastal wetlands of Lianyungang are critically important stopover sites for shorebirds during northward migration.

Theme: Migration Ecology (Oral Presentation)

MIGRATORY ROUTES AND NON-BREEDING DISTRIBUTION OF FAR EASTERN CURLEW FROM DIFFERENT BREEDING POPULATIONS

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In managing the conservation of migratory species, a first step is to examine the relationship between the species and the environment to establish targeted management actions. Far Eastern Curlew *Numenius madagascariensis* is a globally threatened shorebird that completes a long-distance migration through areas that support some of the highest densities of people in the world. Understanding how this species negotiates the natural and modified environments through the East Asian-Australasian Flyway is core to managing shorebirds across multiple geographic and political jurisdictions. We attached GPS tags to 22 Far Eastern Curlews from four regions in Australia, examining habitat use and local movements during the non-breeding season and tracking their movements from the non-breeding grounds to stopover sites in eastern Asia and breeding grounds in northern China and southern Siberia. We also compared the timing of arrival and departure from the breeding and non-breeding grounds of individuals from the different non-breeding areas. On the basis of these results, we make recommendations for improved management of the species throughout its range.

Theme: Migration Ecology (Oral Presentation)

FILLING IN DATA GAPS FOR MIGRATORY WATERBIRDS IN THE EAST ASIAN-AUSTRALASIAN FLYWAY

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Many species of migratory waterbirds that use the East-Asian Australasian Flyway have seen rapid population declines in recent years. Given the difficulty of collecting data in many parts of the region, it is challenging to find the causes of these declines. Therefore, it is necessary and urgent to launch monitoring programmes in order to fill in these data gaps. Taiwan is one of the most important stopover and non-breeding sites for migratory waterbirds along the EAAF. The Taiwan New Year Bird Count was launched in 2014 as a citizen science project to monitor the status and population trends for the wintering avifauna of Taiwan and its outlying islands. During the event, volunteer teams choose a date in late December or early January to survey birds in a 3-km radius circular sampling area. Organisers also ensure that all wetland hotspots are covered by the survey. In 2019, 1,365 participants observed 312,948 individuals of 325 species in 179 sample areas and accumulated 15,388 records. The datasets created from the results provide a highly synchronous spatio-temporal distribution map of Taiwan's wintering birds. This information gets shared with the International Waterbird Census to fill data gaps for species. Notably, the populations of Kentish Plover *Charadrius alexandrinus*, Common Greenshank *Tringa nebularia*, and Long-toed Stint *Calidris subminuta* showed significant decreases in 2014-2019. During that same period, the loss of rice paddies may have contributed to the sharp decrease in the number of shorebirds that prefer freshwater wetland habitat in north-eastern Taiwan. In conclusion, we suggest that launching a citizen science programme based on local networks, especially wild bird societies, is one of the most effective methods for filling data gaps regarding migratory species. The data collected can be used by scientists and policymakers to properly assess population trends and develop conservation goals and strategies.

Theme: Monitoring (Oral Presentation)

KIVI-KUAKA: MIGRATORY SHOREBIRDS AS POTENTIAL SENTINELS FOR TROPICAL STORMS AND TSUNAMIS IN THE PACIFIC

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Among natural disasters, tropical storms and tsunamis can have dramatic consequences for human populations and infrastructures. Current climate change, associated with sea-level rise and increased storm intensity, is expected to exacerbate these impacts in the Pacific, especially for low elevation islands. After successive recent intense tsunamis, authorities have developed early warning systems to inform people of impending disasters. However, despite continuous advances in predictive modelling methods and technologies, such systems can be further improved.

Birds are indeed particularly sensitive to infrasounds and vibrations and show adaptive specific behaviours when facing hurricanes. Tracking their movements in adverse climatic conditions or after intense earthquakes could reveal their utility to complement existing early warning systems. For example, survivors of the 2004 tsunami in Aceh, Indonesia, reported flights of birds leaving the coast long before the arrival of the tsunami.

In this project, we propose to tag hundreds of shorebirds wintering across the central Pacific in order to detect some potential behavioural responses to intense earthquakes or incoming tropical storms. We will use tags developed within the ICARUS initiative on four model species: Bar-tailed Godwit *Limosa lapponica*, Bristle-thighed Curlew *Numenius tahitiensis*, Wandering Tattler *Tringa incana* and Pacific Golden Plover *Pluvialis fulva*.

Tags will collect meteorological data at high altitudes and in remote areas. Tracking data will also be very valuable to help to preserve shorebirds along the Asian-Pacific Flyway.

DISTRIBUTION AND CONSERVATION STATUS OF DUNLIN IN CHINA

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The coastal regions of south-eastern China are highly important for Dunlin *Calidris alpina* that migrate along the East Asian-Australasian flyway. Each year, large numbers of Dunlin are widely distributed here for stopover and during the non-breeding season. However, due to the lack of studies, the population status and distribution of Dunlin in China is still not clear. In addition, without morphological features to easily distinguish different subspecies, it is difficult to assess the dynamic changes in populations by field monitoring. Here we review the synchronous monitoring results of waterbirds in the Yellow and Bohai Seas for the last ten years to determine the main distribution of Dunlin in China. We identified 24 stopover sites and five wintering sites. Based on the monitoring results of Dunlin in the Yalu Jiang estuary over the past two decades, bird banding records and color flag resightings, we assessed the population dynamics of the species. While the overall distribution seems relatively stable, the populations in some individual areas continued to decline, and the changes of population structure indicated that some subspecies are facing potential threats. Finally, we summarise the conservation status of Dunlin and the threats they face, including mudflat reclamation, the invasion of *Spartina* and the shortage of food resources. We call for the strengthening of monitoring and ecological research on Dunlin to enhance the protection of its populations and habitats.

Theme: Monitoring (Oral Presentation)

SHOREBIRDS AND THEIR HABITATS IN THE YELLOW SEA

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Many shorebirds are highly dependent on tidal areas during their migration and non-breeding periods. Loss of mudflats in the Yellow Sea, the critical stopover site of migratory shorebirds, is the major cause of their population decline along the East Asian-Australasian Flyway. Here I review the studies on shorebirds and their habitats (including food) in the Yellow Sea (mainly China part) in recent decades. Although the importance of the Yellow Sea to shorebirds has been well-recognised and many conservation measures have been implemented, habitat conservation is still facing challenges. There are knowledge gaps in understanding the changes of habitat quality, as well as the responses and adaptation of shorebirds to the changes. Raising the government's commitment and public participation have formed the basis for shorebird conservation. The designation of important shorebird habitats along the coast of the Yellow Sea as a World Heritage Site provides an important opportunity to strengthen conservation action. I highlight that extensive cooperation and communication, both domestic and international, among governments, non-government organisations, researchers, and the public are urgently required to achieve effective conservation.

SATELLITE TRACKING OF THE ORIENTAL PRATINCOLE REVEALS USE OF TWO GLOBAL FLYWAYS

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Effective conservation of migratory birds depends on knowledge of non-breeding sites used by different breeding populations. Eighty Mile Beach located in north-western Western Australia is the most important site in Australia for migratory shorebirds. It is also known for the extraordinary discovery of 2.88 million Oriental Pratincole *Glareola maldivarum* in 2004, while the previous estimated population size of this species for the East Asian-Australasian Flyway was ~70,000 individuals.

Despite the Oriental Pratincole being Australia's most numerous shorebird, surprisingly little is known of its life history, including migratory movements. Catching and banding has been regularly undertaken on Eighty Mile Beach and Roebuck Bay since 1981, with over 620 Oriental Pratincoles being banded in Australia over the years. Yet before this project, there was only one recorded resighting, of a bird marked in northwest Australian breeding in Taiwan.

In February 2019, five Oriental Pratincoles were fitted with 2-gram Microwave Telemetry Solar Platform Transmitter Terminals on the shores of Eighty Mile Beach. Four of the five birds migrated north, two into Cambodia, both showing signs of breeding and with one apparently making two breeding attempts at different locations in Cambodia. One bird migrated to Taiwan and was located in known breeding areas in eastern and western Taiwan, and one bird was recorded in the Central Asian Flyway on breeding grounds in southwestern India. It was previously thought that Oriental Pratincoles in this area were resident. We discuss the movements of these four individuals, the knowledge gained to date and the remarkable conservation outcomes as a result of one bird being discovered in India.

Theme: Migration Ecology (Oral Presentation)

DOGS AND LEASHES, BIRDS AND BEACHES: AN EVIDENCE-BASED CONSERVATION MANAGEMENT APPROACH

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The management of domestic dogs *Canis familiaris* on coasts is controversial, with polarised debate surrounding dog access to public open spaces. Coastal zoning and regulations are often poorly planned in relation to the presence of important shorebird sites, more often focusing on providing dog free spaces, where there are high concentrations of beach users. This can result in off-leash dog areas commonly designated at key shorebird sites. Dogs are demonstrated to impact shorebirds through direct predation, nest crushing and disturbance, the latter being particularly lethal to eggs and chicks of nesting shorebirds. While regulations, such as dog leashing restrictions may exist on beaches for the benefit of wildlife, compliance can be low, resulting in a loss of coexistence opportunities. The Beach-nesting Birds

Program at BirdLife Australia has focused on influencing coastal policy and management to improve outcomes for the threatened Hooded Plover *Thinornis cucullatus*. This has taken an evidence-based approach via the following research projects: a) identifying barriers to dog leashing on Victorian beaches; b) investigating space use by dogs in threatened species beach habitats, and c) reviewing the effectiveness of different dog regulations on Victorian beaches. Key findings include compliance rates as low as 10-30% and high variation across regulation types. Major barriers to compliance were identified as social norms and low awareness of dog-shorebird impacts. Examples of using research to influence change in domestic animal management were presented.

SHOREBIRDS IN PALAU, MICRONESIA: EXPLORING ABUNDANCE AND SEASONAL PATTERNS ON A SMALL PACIFIC ISLAND AND LINKAGES WITH THE EAST-ASIA AUSTRALASIA FLYWAY

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The Republic of Palau is the Pacific island nation closest to Asia, located approximately 875 km east of the Philippines, 975 km north of Irian Jaya and 3,200 km south of Japan. Although Palau is not eligible as a country for an East Asian-Australasian Flyway Partnership, field surveys now clearly demonstrate the importance of the Northern Peleliu sandflats; where congregations of at least six shorebird taxa meet EAAF 1% or 0.25% thresholds for flyway sites. We present survey counts conducted over 2014-2019 that document the species present and give insights into seasonal patterns. We also discuss links with other EAAF sites demonstrated so far by flag records and the characteristics of the site, which is remarkably pristine at present, although threatened by tourism development. Local efforts to protect the site in light of the cultural importance of the Far Eastern Curlew *Numenius madagascariensis* are outlined, and the need to establish mechanisms to align these efforts with the EAAF Partnership is highlighted.

Theme: Migration ecology, Monitoring or Conservation Management (Oral Presentation)

SHOREBIRDS ON THE WEST COAST OF THE DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA – STATUS AND CHALLENGES FOR CONSERVATION

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The coast of the Yellow Sea has suffered greatly since the 1950s, with ~65% lost to land claim, and serious degradation of much of the remaining area resulting from pollution, unsustainable harvesting, aquaculture and invasion by exotic cordgrass *Spartina alterniflora*. These factors, exacerbated by reduced sediment discharge from

major rivers, land subsidence and sea level rise, have largely reduced the area available to waterbirds, in particular migratory shorebirds that use the region for staging on annual migrations. This has been a major driver of population declines reported in many shorebird species in the East Asian-Australasian Flyway. The DPRK still has considerable areas of intertidal flats along the West Sea (Yellow Sea) coast, but little is known of their use by shorebirds. The Pūkorokoro Miranda Naturalists' Trust and the Nature Conservation Union of Korea, have together surveyed much of soft shores of the West Sea during northward migration between 2016 and 2020. The West Sea coast of the DPRK supports internationally important (Ramsar Criterion 6 – 1% of flyway population) numbers of at least five shorebird species on northward migration, including Far Eastern Curlew *Numenius madagascariensis*, Eurasian Curlew *Numenius arquata*, Bar-tailed Godwit *Limosa lapponica*, Great Knot *Calidris tenuirostris* and Dunlin *Calidris alpina*. Access to the coast is difficult, but some additional information is available from satellite tracked birds marked elsewhere. This has, for example, identified one site apparently used for post-breeding moult by the Critically Endangered Spoon-billed Sandpiper *Calidris pygmaeus*. Land claim projects are currently threatening several sites identified in DPRK's Wetland Inventory; future projects are likely to include aquaculture and possibly tidal power generation.

Theme: Conservation Management (Oral Presentation)

TOWARDS THE DEVELOPMENT OF THE EAST ASIAN-AUSTRALASIAN FLYWAY SHOREBIRD INDICATORS RECENT SHOREBIRD DECLINES IN JAPAN

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Since the 1970s, NGOs in Japan have been conducting monitoring surveys of shorebirds throughout the country. Since the winter of 1999, the project has been carried out by the Ministry of the Environment as a citizen science project called "Monitoring site 1000". The survey is conducted at approximately 150 sites across the country during spring migration, autumn migration and the wintering season, and the maximum number of individuals for each species during multiple surveys within a season is recorded. Currently, most shorebird populations in Japan are generally declining. In the early stages of the survey, reclamation and other developments were actively carried out mainly in coastal areas near large cities, and the consequent decrease in tidal flats and other habitats is considered to have caused shorebird declines. However, even after 2000, when large-scale development decreased, shorebirds have still been decreasing in Japan. The declining trend includes species most commonly observed in tidal flats such as Dunlin *Calidris alpina*, species that breed on sandy beaches, such as Kentish

Plover *Charadrius alexandrinus*, and species that winter in paddy fields such as Common Snipe *Gallinago gallinago*. We report population trends of shorebirds in Japan based on the survey from 1975 to 2017, and describe habitat requirements and other species characteristics associated with declining trends.

Theme: Monitoring (Oral Presentation)

UPPER TIDAL FLATS ARE DISPROPORTIONATELY IMPORTANT FOR THE CONSERVATION OF MIGRATORY SHOREBIRDS

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Migratory animals are crucial for the functioning and integrity of global ecosystems, yet many species are in steep decline as a result of human activities. Understanding how migratory species use different habitats is critical to developing effective conservation strategies. Coastal shorebirds migrating along the East Asian-Australasian Flyway have experienced precipitous declines over the past three decades, primarily as a result of rapid and large-scale development of tidal flats along the Yellow Sea that serve as important stopover sites for these birds. However, populations of several species have declined much faster than the rate of loss of the tidal flats. We quantified habitat requirements and usage patterns of 17 species of migratory shorebirds throughout the tidal cycle at two critical stopover sites in the Yellow Sea region of China. We found that shorebirds at these stopover sites exhibited substantial interspecific and even site-specific differences in their use of different portions of the tidal flats. Notwithstanding these differences, the upper tidal zone was used disproportionately often by most shorebird species relative to its availability during the tidal cycle, as measured by the cumulative foraging times of the birds. Because coastal land reclamation projects in China (and elsewhere) typically start near the high-tide line and proceed outward towards the sea, the upper tidal flats are more prone to development than are the lower tidal flats. This may explain why shorebird populations have declined much faster than the overall rate of tidal flat loss in the Yellow Sea. Our work highlights the need to conserve as much of the upper intertidal zone as possible within important stopover sites in order to protect currently diminished populations of migratory shorebirds. Our study also demonstrates the value of understanding the detailed patterns of habitat use by migratory species throughout their journey in order to conserve them.

Theme: Non-breeding Ecology (Oral Presentation)

CLIMATE CHANGE VULNERABILITY IN MIGRATORY SHOREBIRDS

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The world's climate is changing rapidly, but the rate and extent of change are highly variable spatially. Migratory species visit a range of different regions and might be differentially impacted by climate change in different parts of their life cycle. This study analysed climate vulnerability in 24 migratory shorebird species that visit the Arctic to breed, and then migrate to more southerly latitudes during the non-breeding season, exposing them to a range of different climate change dynamics. Climate vulnerability was assessed separately within their breeding, passage and non-breeding ranges. The NatureServe Climate Change Vulnerability Index was utilised because it accounts for all aspects that influence the climate change vulnerability of a species, these being exposure, sensitivity and adaptive capacity. The direct exposure was examined under two global General Circulation models, GFDL-ESM4 and CNRM-ESM2-1. The remaining aspects are incorporated by a list of vulnerability factors, which were scored for each species based on the literature. This study found that the mean climate change vulnerability of shorebirds in their breeding habitat was three-fold that of their passage and non-breeding habitats, under GFDL-ESM4. It appears that passage and non-breeding vulnerabilities are somewhat correlated. Interspecific variation was high, and the data suggest that several of the most climate vulnerable species are not currently recognised as globally threatened. The major threats identified in this assessment suggest that the IUCN Red List status of some species might need to be re-evaluated, and that climate change mitigation be the primary focus of conservation efforts in the Arctic.

Theme: Conservation Management (Oral Presentation)

SHOREBIRDS PENINSULAR MALAYSIA PROJECT: A CONSERVATION INITIATIVE AT TELUK AIR TAWAR – KUALA MUDA COAST, IMPORTANT BIRD AND BIODIVERSITY AREA

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The rich mudflats of Teluk Air Tawar-Kuala Muda Coast (TAT-KM) can attract thousands of migratory shorebirds as they build up fat reserves by foraging as much as they can to fuel the next stage of their journey. TAT-KM is now facing high pressure from habitat reclamation, land conversion, encroachment, and a lack of buffer zone for developed areas, as this site is yet to receive any legal

protection. Shorebirds Peninsular Malaysia Project (SPMP) is an initiative by a group of local researchers to engage stakeholders and encourage public participation in shorebird conservation efforts. The project focuses on conducting regular monitoring of migratory shorebirds and creating programs of conservation awareness among locals. Out of 38 shorebirds species recorded in two years (2017-2019), three (Great Knot *Calidris tenuirostris*, Nordmann's Greenshank *Tringa guttifer*, and Far Eastern Curlew *Numenius madagascariensis*) are globally Endangered and six are Near Threatened. A Great Crested Tern *Thalasseus bergii* and a Great Knot that were observed to stop over at TAT-KM had tags and a Common Redshank *Tringa totanus* had satellite tracker. SPMP also had the second sighting of Black-tailed Gull *Larus crassirostris* in Peninsular Malaysia. Here we present our success stories and challenges during the initial phase of SPMP in engaging local citizens of TAT-KM. We also outline planning and networking opportunities for the upcoming years, especially to involve multidisciplinary approaches for shorebirds conservation. In the long run, we aim to catalyse change in shorebirds and habitat sustainability in Peninsular Malaysia.

Theme: Conservation Management (Oral Presentation)

20-YEAR SHOREBIRD POPULATION TREND IN MAI PO NATURE RESERVE AND INNER DEEP BAY, HONG KONG, CHINA

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Monitoring bird population change is fundamental to assess the conservation status and performance of related conservation actions. Some of the steepest and most widespread declines of shorebirds have been reported in the East Asian-Australasian Flyway (EAAF). To evaluate bird trends in the whole flyway, it is critical to assess and exchange information on bird trends in different areas and latitudes along the flyway. Systematic monthly monitoring of shorebirds has been conducted by the Hong Kong Bird Watching Society in the Mai Po Inner Deep Bay Ramsar Site, one of the key staging and non-breeding grounds in the EAAF since 1997. This initiative is part of the Waterbird Monitoring Programme of the Agriculture, Fisheries and Conservation Department, Hong Kong SAR Government. Data collected in the past 20 years allow examination of both recent and long-term trends, but its relations to the regional and flyway-wide bird trends are yet to be explored. The resulting patterns may give insights to population changes of migratory shorebirds in South China as well. Therefore, in this study, we analysed migratory shorebird trends in the Mai Po Nature Reserve, a well-protected area managed by WWF-Hong Kong since 1983, and the Inner Deep Bay as a whole, by fitting linear models to regularly recorded shorebird species data using TRIM (Trend & Indices for Monitoring data). An alert system will be implemented to reveal species with

strong and moderate declines at different time scales. We also discuss the potential factors affecting the trends.

Theme: Monitoring (Oral Presentation)

**THE ROLE OF MOLLUSCAN
AQUACULTURE IN THE CONSERVATION
OF MIGRATORY MOLLUSCIVORE
SHOREBIRDS IN THE EAST ASIAN -
AUSTRALASIAN FLYWAY**

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Human-driven deterioration and loss of intertidal mudflats at stopover sites had destroyed more than half of refueling habitats of migratory shorebirds in the East Asian - Australasian Flyway (EAAF), which is implicated in the population declines of many migratory shorebirds. Given that habitat restoration takes a long time, restoring the population of molluscs in the remaining intertidal mudflats is the best way to save and recover these molluscivore shorebirds. We sampled 25 intertidal sites spanning 20 latitudinal degrees and 18,400 km of China's coastline from 2015 to 2019, to recognise the current situation of mollusc biodiversity. We also reviewed the proportion and size of molluscs in the diet of shorebirds to explore the roles of molluscs as food for non-breeding shorebirds. We found that the biodiversity of molluscs was manipulated by aquaculture. Commercial mollusc species selected for economic benefit dominated the Chinese coast, resulting in the homogenisation of latitudinal gradients of both alpha and beta diversity of mollusc communities. Since small and medium molluscs are the main food items of most shorebirds in the EAAF, the harvesting of molluscs used in aquaculture will affect food availability for shorebirds. We propose that aquaculture practices have strongly affected the diversity and amount of molluscs and proper management of molluscan aquaculture, such as reducing the harvest and controlling the timing of reseedling, can increase the food supply food shorebirds during stopover, which will play an extremely important role in the conservation of shorebirds.

**DISTRIBUTION AND ABUNDANCE OF
NORDMANN'S GREENSHANK *TRINGA
GUTTIFER* WITHIN THE BREEDING
RANGE**

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Nordmann's Greenshank *Tringa guttifer* is listed as Endangered on the IUCN Red List of Threatened Species given its small and declining population. Based on counts at migration sites, its population size is estimated at only 600-1300 individuals. The last review of the distribution and abundance of this species at the wintering grounds has increased our knowledge about this rare species. Nordmann's Greenshank is an endemic breeding species in Russia. Using a literature search, we collected distribution and abundance data on Nordmann's Greenshank from 1989 to 2018 in the breeding areas, a significant part of which was not previously available in English. The current breeding range consists of isolated areas on the mainland in the northern and western coasts of the Sea of Okhotsk and in the Nevelsky Strait (Sea of Japan) and on the eastern and western coasts of northern Sakhalin. Since the earliest ornithological research in the breeding range, 26 sites potential breeding sites have been identified, one in the Magadan Region, 13 in the Khabarovsk territory, and 12 on Sakhalin Island. Due to the inaccessibility of habitats, many of them were visited only once. No complete, systematic counts have been conducted at the breeding grounds.

Theme: Conservation Management (Oral Presentation)

**PRELIMINARY RESULTS FROM A
BREEDING ECOLOGY STUDY ON
NORDMANN'S GREENSHANK *TRINGA
GUTTIFER* IN SCHASTE BAY, SEA OF
OKHOTSK, RUSSIA**

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Nordmann's Greenshank *Tringa guttifer* is one of the rarest shorebirds in the East Asian-Australasian Flyway (EAAF), and globally. Based on surveys conducted along stopover sites and in non-breeding areas, the most optimistic population estimate is 600-1300 individuals. The species is a breeding endemic of coastal environments

along the Sea of Okhotsk. V. A. Nechaev collected some of the only breeding biology data in 1976, when he discovered five nests near the mouth of the Evai River in Chayvo Bay on the northeast coast of Sakhalin Island. Little additional breeding information is available on the species, although non-systematic surveys reveal a marked contraction in the breeding range over the last half century.

In 2018 and 2019, we conducted the first phase of a study on the Nordmann's Greenshank in Schaste Bay, critical to protecting the species from extinction. We surveyed the breeding habitat along several sections of coastal Schaste Bay, and estimated the total number of breeding pairs at 28. We believe Schaste Bay should be listed as a site of international importance for supporting >1% of the world's Nordmann's Greenshank population. In 2019, we found a Nordmann's Greenshank nest for the first time on the mainland, and only the sixth ever. We recorded detailed descriptions of parameters of the nest-site and the nesting habitat. We also developed two methods for trapping adult birds during the brood rearing stage, subsequently capturing and banding seven adults and eight chicks. After the 2019 summer field season, observers recorded four of our banded birds at Tiaozini in the Yancheng Wetland Reserve along the coast of the Yellow Sea that was recently established as a World Heritage Site. We plan to revisit our breeding site in 2020 to collect more data on breeding and migration ecology. We will also discuss expanding an existing Russian-based Nordmann's Greenshank Taskforce to the rest of the EAAF, perhaps within the EAAF Partnership.

Theme: Breeding Ecology (Oral Presentation)

TRIALING FLOATING ARTIFICIAL SHOREBIRD HABITAT: A RESPONSE TO LOSSES IN THE UPPER INTERTIDAL ZONE

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Throughout the [East Asian Australasian Flyway](#), high-tide roost sites for shorebirds are increasingly jeopardised by coastal development, disturbance and sea-level rise, reducing the ability for migratory species to maintain a positive energy balance. We found this to be a limiting factor affecting populations staging in Seocheon tidal flat and neighboring Geum Estuary in the Republic of Korea. The provision of artificial roosts has the potential to restore resilience into impacted habitats where habitat restoration is not feasible. Construction of shorebird roosts has traditionally involved significant earthworks or hydrological alteration to create static structures. These interventions are successful in creating habitat, but can come at significant costs, have undesired effects on intertidal ecology and are subject to rapid degradation. The Floating Roost project is trailing artificial roosts modelled on floating, long-line oyster bags (LLOB) as a cheap, low-impact and adaptable alternative. Floating roosts remain consistent throughout the tide cycle and are immune to climate change induced sea-level rise. In

addition, they are resistant to terrestrial predators and vegetation colonisation and can be relocated on, or adjacent to feeding areas. In 2018/19 we deployed 1,080 LLOB in coastal habitats across three Ramsar listed shorebird habitats in the EAAF; Port Phillip Bay (VIC), the Hunter Estuary (NSW) and Seocheon Tidal Flat. In year one of the trial 45 waterbird species were recorded using the roosts including 18 shorebird species and four IUCN listed threatened (vulnerable, endangered and critically endangered) species. Peak roost use was observed during southern migration at Seocheon tidal flat with over 500 shorebirds flocking on one roost. We review floating roost efficacy, microclimate attributes, and influences on intertidal communities, identify how to assess site-specific necessity and feasibility of floating roost installation as a management intervention and outline future directions.

Theme: Conservation Management (Oral Presentation)

MEASURING EXPOSURE TO HABITAT LOSS IN MIGRATORY SHOREBIRDS

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A chain of geographically distinct sites with suitable habitat is crucial for migratory species that travel tens of thousands of kilometers each year as these sites all contribute to sustaining populations *en route*. Along the East Asian-Australasian Flyway, the cause of the rapid population decline of migratory shorebirds is usually attributed to the loss and degradation of stopover habitats upon which they rely during both northward and southward migration. Even though habitat loss anywhere along a migratory route can limit a population, no study has investigated the exposure of entire migratory routes to habitat loss. Here, we built a framework by utilising information from satellite and geolocator tracking of three migratory shorebird species (Great Knot *Calidris tenuirostris*, Sanderling *Calidris alba* and Eastern Curlew *Numenius madagascariensis*) combined with 30-years of high-resolution remote sensing data of their intertidal habitat to investigate the pattern and extent of exposure to habitat loss along the migration routes of individuals. We also calculated the amount of habitat change in 1988-2018 for each site visited by the birds, and estimated mean and maximum rates of loss experienced along each migration route. We found out that for the sites across the migration network of individual birds, the worst annual percentage change is significantly lower than the mean annual percentage change. Our results also show that the rates of habitat change vary largely between sites in the same

region, hence more detailed and accurate studies are needed for effective conservation. This framework can improve our understanding of habitat change across the migration network and provide better support for conservation planning and actions.

Theme: Migration Ecology (Oral Presentation)

THE STATUS, POPULATION AND ABUNDANCE OF NON-BREEDING MIGRATORY WATERBIRDS AT PANTAI CEMARA, JAMBI, INDONESIA

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Pantai Cemara is visited by tens of thousands of migratory waterbirds every year and is one of the most important sites for migratory waterbirds in Indonesia. We conducted a survey at Pantai Cemara on 20-30 November, 2019 during the non-breeding period. We recorded over 30,000 individuals of 31 migratory waterbird species. Based on maximum counts, the most abundant species were Bar-tailed Godwit *Limosa lapponica* (NT) (4,200), Black-tailed Godwit *Limosa limosa* (NT) (3,500), Great Knot *Calidris tenuirostris* (EN) (2,980), Greater Sandplover *Charadrius leschenaultii* (LC) (2,580), and Lesser Sandplover *Charadrius mongolus* (LC) (1,800). We also recorded three endangered species, Far Eastern Curlew *Numenius madagascariensis* (36), Nordmann's Greenshank *Tringa guttifer* (28), and Great Knot *Calidris tenuirostris* (2,980). Based on the total counts, Asian Dowitcher *Limnodromus semipalmatus* (NT) Nordmann's Greenshank, and Great Knot had numbers over 1% of the global population with 2.45%, 2.15% and 1.1%, respectively. We observed three individuals of the Data Deficient White-faced Plover *Charadrius dealbatus*. Sumatra is both the terminus for some migrants, and also a passage zone for waterbirds migrating towards eastern Indonesia or probably Australia. Our study confirms the importance of Pantai Cemara for migratory waterbirds. This area urgently needs to be protected and better managed.

Theme: Monitoring (Oral Presentation)

THE POTENTIAL AND PITFALLS OF HEADSTARTING AS A CONSERVATION TOOL FOR SHOREBIRDS

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Headstarting is a conservation technique, in which young animals are raised artificially and subsequently released into the wild. The technique is most suited to species that experience high mortality during early, growth stages in

the wild, and is most powerful for small populations, where the number of animals released can have a significant impact on the overall productivity of the population. Headstarting can be used 1) to accelerate the recovery of a population after the causes of decline have been addressed, 2) to maintain a threatened population, while the causes of decline are being addressed, or 3) as a cost-effective alternative to more traditional reintroduction techniques, avoiding the need to release captive-bred animals. The technique has been used for reptiles and amphibians for decades (with varying success), but is a relatively new concept in the field of bird conservation. Although headstarting has the potential to play an important role in bird conservation, for long-term viability, it should only be conducted as part of a wider conservation effort. In particular, headstarting requires integration with habitat management and restoration efforts, and coordination between organisations with the relevant *ex situ* and *in situ* expertise. The Wildfowl & Wetlands Trust has been headstarting shorebirds since 2012 and is currently involved in projects for three species – Spoon-billed Sandpiper *Calidris pygmaea*, Black-tailed Godwit *Limosa limosa* and Eurasian Curlew *Numenius arquata*. We provide details on our experience implementing headstarting for shorebird populations, including determining when it is appropriate, setting goals, managing risks and assembling a multi-disciplinary team.

Theme: Conservation Management (Oral Presentation)

MANAGED REALIGNMENT – EXPERIENCE FROM THE UK

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Managed realignment - creating space for natural dynamic processes along the coast - is now a widespread measure employed in the UK. More than 70 managed realignment projects have been completed since 1991, the most of any European country. UK projects though are relatively small scale averaging 31.3 ha compared to other countries such as Germany (167.9 ha).

Managed realignment projects in the UK are driven by the need to address an historic loss of internationally important intertidal habitat caused by coastal squeeze – when coastal habitats are trapped between a fixed landward boundary, such as a sea wall and rising sea levels and/or increased storminess. The UK government has set a target to create 3,000 ha of saltmarsh in the next 100 years.

At 550 hectares, Steart Marshes on the north Somerset coast, is the UK's largest managed realignment project. The marsh is built on low lying improved pasture/cultivated land and over 1 million tonnes of material had to be excavated to create the 2.9 km creek network, flood defences and habitats. 320 ha of saltmarsh was created, 80 ha of freshwater and 50 ha of 'transitional' brackish habitat. The marsh now supports around 18,000

waterbirds, mostly shorebirds, each winter. Twenty shorebird species are typically present across the year.

The saltmarsh vegetation community continues to develop and key indicator species, such as sea aster, have recently colonised. Furthermore, the newly created creeks provide shelter for fish fry including commercially important species, such as sea bass.

Stear Marshes has become a site that demonstrates best practice in public engagement; is an exemplar of landscape wetland design; and provides benefit to people and wildlife. The estimated ecosystem service benefit is £490k - £950k each year.

We will provide detail on the design, planning, construction and operation of Steart Marshes and the multiple benefits it provides.

Theme: Conservation Management (Oral Presentation)

SAVING THE SPOON-BILLED SANDPIPER – FINDING AND PROTECTING UNKNOWN SITES

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The Spoon-billed Sandpiper *Calidris pygmaea* is Critically Endangered on the World Conservation Union's Red List. In 2010, it was thought that the species numbered no more than 100 pairs, was declining at a rate of 26% a year, and could be extinct within 10 years if urgent conservation action was not taken. The international conservation community swung into action. Saving this enigmatic species could act as a flagship for saving the 50 million waterbirds that use the East Asian-

Australasian Flyway – the most important and most endangered flyway in the world.

We do not know where most Spoon-billed Sandpipers breed and or where many spend the non-breeding season. In autumn 2016, we therefore began working with Microwave Telemetry Inc. to try to locate these “missing” sites. Twelve 2g solar -powered PTT-100/5/ZE tags were fitted to Spoon-billed Sandpipers – glued to the birds' backs, the tags were designed to fall off when the birds underwent their annual body moults. Six tags were fitted in China and six in Russia, leading us to new staging, non-breeding and breeding sites, including only the second known autumn moult site in the DMZ of North Korea. We confirmed that birds migrating to Thailand, Myanmar and Bangladesh do so overland, and have addressed the threat of illegal mist netting at sites in southern China with local conservationists informing Chinese authorities who removed the nets – direct and immediate on-the-ground action. Sites on the Yellow Sea coast of China have recently been designated as World Heritage Sites, including the most important staging site for Spoon-billed Sandpiper – Tiaozini in Jiangsu province – which was included after tagging data had confirmed its importance. In autumn 2019, we fitted another four tags to Spoon-billed Sandpipers at Tiaozini to try to locate more of their missing staging and wintering sites.

We present the results of a cluster analysis to identify the sites, known and unknown, used by satellite tagged Spoon-billed Sandpipers through their annual cycle.

Theme: Conservation Management (Oral Presentation)

THE IMPORTANCE OF SUPRATIDAL FORAGING TO COASTAL SHOREBIRDS: A CASE STUDY FROM THE WESTERN TREATMENT PLANT, AUSTRALIA

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Coastal shorebirds are widely considered to forage on intertidal flats and to spend high tide resting at supratidal roost sites. However, roost sites are not only used for resting; some shorebirds in some sites forage in near-coastal wetlands when the tide is high. We studied the importance of supratidal foraging for shorebirds at the Western Treatment Plant (WTP; Victoria, Australia), a site used by 10-15,000 migratory shorebirds during the non-breeding season. Most of these birds forage on productive but small tidal flats at low tide, moving to roosts in nearby non-tidal ponds when the tide is high. Many of these shorebirds forage in the ponds during high tide, and several lines of evidence suggest that they need

to do so to persist at the WTP: (1) Species composition on the tidal flats indicates the site is dominated by species (small sandpipers) known to also use non-tidal wetlands, rather than coastal obligate species such as knots *Calidris* sp. and Bar-tailed Godwits *Limosa lapponica*. (2) Banding studies show that shorebirds of the WTP lose weight during neap tide series. (3) Modelling of intake rates indicates that during neap tide series, the tidal flats of the WTP are not large enough, and not exposed for long enough, for small sandpipers to meet their daily energy requirements.

Much of the coast of eastern and southern Asia is lined by tidal flats that abut artificial wetlands, such as aquaculture or salt ponds, where water levels are controlled by people. Strategic management of water levels in some of these ponds could potentially highly benefit shorebirds populations. We therefore conclude with thoughts on how to identify sites where shorebirds most need supplementary feeding opportunities at high tide, the species most likely to exploit these opportunities, and the attributes a near-coastal wetland needs to have in order to attract foraging shorebirds.

Theme: Habitat management (Oral Presentation)

RAPID POPULATION DECLINE SINCE 2014 WARRANTS A POPULATION REASSESSMENT OF BAR-TAILED GODWITS *LIMOSA LAPPONICA BAUERI*

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Bar-tailed Godwits of the subspecies *Limosa lapponica baueri* breed only in Alaska and are distributed in New Zealand and eastern Australia during the non-breeding season. In 2015, the conservation status of the species was elevated to Near Threatened by the IUCN due to documented declines in the *baueri* and *menzbieri* subspecies. The current population estimate of 133,000 for *baueri* was adopted in 2012, but this estimate derives from counts conducted over 20 years ago. The majority of *baueri* godwits (~65%) occurs in New Zealand, where annual counts conducted since 1983 have documented a significant decline from the mid-1990s until 2004. After this, the population stabilised at about 75,000 birds for the next decade, despite a decline in adult survival after 2010. Since 2014, however, counts in New Zealand have declined to 65,000 birds, a 13% decrease in 4 years. Given these recent demographic trends, a population reassessment is warranted to accurately reflect the

increasingly dire conservation status of *baueri* godwits. To this end, we compare recent counts from New Zealand with results of non-breeding counts from eastern Australia and surveys of post-breeding godwits in Alaska to better understand our ability to characterise the population trajectory of *baueri* godwits. We further identify range-wide research actions to determine constraints in the annual cycle of *baueri* godwits. For now, we recommend adopting the 2012 population estimate of ~110,000 calculated by Studds et al. (2017) for *Limosa lapponica baueri*, and suggest reevaluating the conservation status of the species in light of recent survey results.

Theme: Monitoring (Oral Presentation)

QUPALUK: LESSONS FROM THE NORTHERNMOST FLYWAY NETWORK SITE

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Qupaluk, in Alaska USA, is the farthest north East Asian-Australasian Flyway Network Site. It is fully within the National Petroleum Reserve-Alaska (NPR-A), a vast area facing threats from expansion of oil and gas development. In June 2019, our second season of pilot studies prior to deploying a full season of field work in 2020, we conducted point counts, evaluated nesting shorebird densities, timing of initiation, and determined the best camp location and other logistics. Additionally, we tagged breeding shorebirds as part of a collaboration with the U.S. Fish and Wildlife Service and Manomet to determine post-breeding habitat use of Red Phalaropes *Phalaropus fulicarius* and Pectoral Sandpipers *Calidris melanotos*. During our surveys, we observed 34 bird species using the site. With increasing interest by oil and gas developers in the NPR-A, there is an imperative to provide managers with the information necessary to inform good management decisions. The Bureau of Land Management (BLM) has already worked with regional stakeholders to establish an Integrated Activity Plan for the NPR-A that seeks balance between operational best practices and areas that are too ecologically sensitive to disturb (Special Areas). However, this plan is being reevaluated and data are lacking in many areas and for many species. Our work at Qupaluk can help fill some of these knowledge gaps.

Theme: Conservation Management (Oral Presentation)

MONITORING OF WADERS OF THE FOREST-STEPPE IN SOUTHWESTERN WESTERN SIBERIA

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Our research on forest-steppe was carried out in 1973-2019 in the south-western part of Western Siberia. Here we describe numbers and distribution of shorebirds using the technique of J.S. Ravkina's (1967).

Northern lapwing *Vanellus vanellus*. Breeding migratory species. It is common during migration and in the breeding period. After nesting, its abundance increases 1.7 times.

Ruff *Philomachus pugnax*. Migratory. During migration in the second part of May this species is numerous on the low-salt lakes and is half as common on the Omsk flood-land marshes. During migration Ruffs are common further from Omsk. In the first half of June, its migration continues with less intensity. It is common on the low-land marshes. Starting from early July, Ruffs return and are commonly observed on the low-salt lakes in the end of July and in the beginning of August.

Black-tailed Godwit *Limosa limosa*. It is a breeding migratory species. At the end of the 19th century it was recorded near Omsk in the summer (Slovsov, 1881). Nowadays, it is generally common on low-salt lakes, in meadows and marshes during summer.

Eurasian curlew *Numenius arquata*. Breeding migratory. At the end of the 19th century it was numerous near Omsk (Slovsov, 1881). Two individuals were observed on September 11, 2005 on a small lake in the northern forest-steppe.

Whimbrel *Numenius phaeopus*. Migratory species. At the beginning of the 20th century, it was rare on migration in the vicinity of Omsk (Shukhov, 1948).

Slender-billed Curlew *Numenius tenuirostris*. Migratory species, previously possibly breeding in the area. In the evening of August 28, 2004, we observed a «light» curlew smaller than a crow, which could not be identified in flight, on a small lake in the northern forest-steppe. In the evening of April 18, 2019, we observed another possible individual flying over a special protected natural area in the Irtysh River valley in Omsk.

Theme: Monitoring (Oral Presentation)

**WORKING WITH GOVERNMENTS TO
MANAGE CRITICALLY IMPORTANT
MIGRATORY WATERBIRD NETWORK
SITES. IS THERE A LACK OF INTER-
GOVERNMENT COOPERATION?**

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The effectiveness of conservation land management varies greatly between countries along the migratory flyways of the world, from Arctic breeding grounds through essential staging sites during migration, to non-breeding grounds. Each stage of a migratory shorebird's life cycle presents different conservation management challenges.

Some of the most effective species and habitat management is carried out by large bird conservation NGOs. For example, the well-funded and highly focused Royal Society for the Protection of Birds in the UK with a membership of ca 1.2 million and the Audubon Society in the USA. Moreover, in these NGOs, commitment by staff and volunteers tend to be the drivers leading to long-term job retention.

By contrast, environmental issues are often not a high priority for governments. Staff too may be less committed and occupy relatively short-term positions, in which promotion does not depend on neither their input to environmental matters nor outcomes they may have achieved. There is also a lack of on-job training in species and habitat priority drivers at any specific site. Inter-governmental efforts can be even less productive due largely to lack of intergovernmental cooperation in a political world. Conflict of priorities and interests can result in serious failures to address environmental issues and thereby adversely affect conservation outcomes. Australia is used as an example of issues relating to intergovernmental conflicts in conservation land management actions, whereas case studies mentioned in this paper are from NSW.

Lessons learned are discussed and proposed solutions are offered.

Theme: conservation management (Oral Presentation)

**ASSESSING LOCAL ECOLOGICAL
KNOWLEDGE (LEK) ON MIGRATORY
SHOREBIRDS AND THEIR LOCAL
THREATS IN LIANGA BAY AND AGUSAN
MARSH WILDLIFE SANCTUARY,
MINDANAO ISLAND, PHILIPPINES**

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Agusan marsh is one of the most ecologically significant wetland ecosystems with international importance in the Philippines. Incorporating local ecological knowledge with the conventional scientific data is significant in conservation management of migratory shorebirds to enhance sustainable use of natural resources both in coastal and marshlands areas. The study aimed to determine the knowledge, perception and attitude of the local villagers living adjacent to coastline areas of Lianga Bay and Agusan Marsh on migratory shorebirds and their local threats. Data were collected from June to November 2019 through interviews using a semi-structured questionnaire and focus group discussion with local

villagers. Key informants in the villages were identified to gather reliable information regarding migratory shorebirds. Most local villagers in the community were aware of the presence of migratory shorebirds including the laws and their protected status. However, a large proportion of local villagers revealed that migratory shorebirds were hunted for bushmeat and trade (55%), food (30%), medicine (10%) and ritual (5%). Migratory shorebirds were mostly observed from August and considerably increased reaching the peak in November every year. Most of the information was not significantly associated with the respondents' demographic profile and length of stay in the village. Currently, changes in the structural and floristic composition are occurring because of forest degradation, such as the conversion of *Terminalia* forest and *Sago* palm into agriculture. Timber poaching, human encroachment and hunting were seen as threats to the migratory shorebirds in the area. Thus, proper monitoring, regular information, education and dissemination of information regarding migratory shorebirds including the local villagers to empower the protection and conservation of Lianga Bay and Agusan Marsh Wildlife Sanctuary.

Theme: Conservation Management (Poster Presentation)

HOW DO WINTERING SHOREBIRDS CHOOSE FORAGING HABITATS WITHIN LARGE INTERTIDAL MUDFLATS IN COASTAL BANGLADESH?

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Migratory shorebirds are known for their spectacular long-distance movements between northern breeding grounds and non-breeding grounds further south. Nevertheless, shorebirds have suffered considerable declines as their migratory habits also make them susceptible to threats in many different parts of the world. Migratory shorebirds are therefore in need of focused conservation initiatives that require a thorough understanding of their ecology in breeding areas, stopover sites and non-breeding areas. Our understanding of their non-breeding ecology is particularly limited, and a key component to inform global conservation action is an understanding of their habitat requirements during the non-breeding season. Do factors, such as available food, risk of predation or disturbance determine where shorebirds aggregate during the non-breeding season? We sought to answer this question by exploring relationships between prey availability and choice of foraging site in 30 200x100m mudflat segments spread across two islands in coastal Bangladesh. To gain insights into a possible mechanism, we also explored whether foraging success

was influenced by prey availability. The study was conducted in two seasons: early (December 2019-January 2020) and late winter (February-March 2020). We detected 31 shorebird species during this study, including the Critically Endangered Spoon-billed Sandpiper *Calidris pygmaea*. As expected, we found that the richness and density of shorebird communities increased with the density of polychaete worms on both two islands. But we also found that one of the islands, Damar Char, hosted more shorebirds than Nijhum Dweep regardless of food availability. As foraging success increased with available food, we suggest that food may be a limiting resource for shorebirds during the non-breeding season. Our study has direct conservation relevance because non-breeding habitats can be assessed for available food and prioritised or managed accordingly for conservation. We however caution that these results are from a single region and can only be generalised after other similar studies are conducted across the world.

Theme: Non-breeding Ecology (Oral Presentation)

THE CONSERVATION OF THE CRITICALLY ENDANGERED SPOON-BILLED SANDPIPER (*CALIDRIS PYGMAEA*) IN THAILAND DURING 2000 – 2020

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Spoon-billed Sandpipers *Calidris pygmaea* were found for the first time in Thailand at Pattani province in October 1984. In October 1998, an individual was sighted at a salt farm in the Inner Gulf of Thailand, Khok Kham, Samut Sakhon province, which turned out to be a key wintering site. Since the early 20th century, The Bird Conservation Society of Thailand has been working on the ground with local villagers to implement projects including educating local villagers on shorebird migration, law enforcement to stop hunting, establishing the local “Khok Kham Conservation Club”, promote “Fleur de sel” to be premium table salt, fight against habitat loss to create factories and solar farming, promote ecotourism by using Spoon-billed Sandpiper as flagship species and propose the site as an East Asian–Australasian Flyway Network Site. A recent project by The United Nations Development Programme (UNDP) “Conserving Habitats for Globally Important Flora and Fauna in Production Landscapes” under The Global Environment Facility (GEF) has selected Khok Kham as a focal area to conserve the species in Thailand.

Another key site for Spoon-billed Sandpiper is Pak Thale, Petchaburi province, which is an existing Flyway Network Site. This is a regular wintering site for 50 shorebird species including the Endangered Great Knot *Calidris tenuirostris*, Spotted Greenshank *Tringa guttifer* and Far Eastern Curlew *Numenius madagascariensis*. The maximum number of Spoon-billed Sandpipers in Pak Thale was 16 individuals in the winter of 2003/04. BCST

has been working with local villagers to promote community engagement through bird tourism, education and awareness-raising since then. Recently, BCST has started a campaign supported by The RainForest Trust and many donors from Thailand and internationally (total of 312,615.40 USD) to purchase a 19.5-acre property. This property will be managed to benefit both shorebirds and surrounding communities. Further support will be used for management including landscaping, water management, construction of facilities, and to survey birds and biodiversity in the area.

Theme: Conservation Management (Oral Presentation)

SHOREBIRDS RINGING ACTIVITIES AT CHUKH BIRD RESEARCH STATION, NORTHEASTERN MONGOLIA IN 2019

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In Mongolia, 58 shorebirds species have been recorded, most of them migratory along the East Asian-Australasian Flyway. However, we have very limited information about shorebirds. There are numerous water bodies scattered throughout the dry steppe in eastern Mongolia that are important for migratory birds as stopover sites during migration. In 2019, we conducted shorebird monitoring at Chukh lake, in northeastern Mongolia. The study area is located in the buffer zone of the Mongolian Daurian Strictly Protected Area which is designated as World Heritage of UNESCO, The Man and Biosphere Reserve, Ramsar Convention, Important Bird and Biodiversity Area (MN066), East Asian-Australasian Flyway Network Site, and Daurian International Protected Area. During the study period, 407 individuals of 31 species have been captured by mist-net, marked by metal rings on the left leg and tagged by color flags (blue over green) on the right leg. Most common species were Wood Sandpiper *Tringa glareola*, Marsh Sandpiper *Tringa stagnatilis*, Common Redshank *Tringa totanus*, Little Stint *Calidris minuta*, Temminck's Stint *Calidris temminckii* representing almost 50% of all captured individuals. The birds were active and captured mostly between 03:00-06:00 am and 21:00-00:00 pm. We also tracked 39 individuals of nine shorebird species using GSM based 5-6 gr transmitters, including near threatened Asian Dowitcher *Limnodromus semipalmatus*, Black-tailed Godwit *Limosa limosa* and Eurasian Curlew

Numenius arquata. We also conducted invertebrates' surveys of the monitored lake to study shorebird diet in the autumn. We identified 3201 individuals of invertebrates from 14 families of 10 orders. Most of them were *Cladocera* and *Hemiptera* collected from more muddy areas.

Theme: Monitoring, Ecology (Oral presentation)

THREATS FROM IRRESPONSIBLE AQUACULTURE OPERATIONS TO SHOREBIRDS IN THE YELLOW SEA ECOREGION AND A POTENTIAL PATHWAY TOWARDS SOLUTIONS

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Using mudflat razor clam stock enhancement practice and sea cucumber pond aquaculture operation along the coastal Yellow Sea as examples, we provide fact-based evidence illustrating the use of harmful chemicals as a threat to shorebirds dependent on this critical ecoregion. In the context of the Bohai-Yellow Sea World Heritage Site Nomination, opportunities and challenges at policies and practices levels will be shared and analysed. We also call for close collaboration between shorebird conservationists, ecotoxicologists and aquaculture experts in order to find feasible solutions.

SHOREBIRD POPULATION CHANGES AT STOPOVER SITES IN THE YELLOW SEA

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Many shorebirds in the East Asian-Australasian Flyway have suffered rapid population declines. This is mainly due to habitat loss at key stopover sites in the Yellow Sea. However, the evidence for shorebird population declines mainly comes from non-breeding sites. Shorebird population changes in the Yellow Sea are still largely unexplored. We compared shorebird population changes at key stopover sites in the Yellow Sea at different periods, analysed the spatial differences in population changes and their relationship with habitat condition. We found that population changes varied among species and were not consistent among stopover sites. We highlighted the importance of high-quality refueling sites to maintain migratory shorebird populations.

Theme: migration ecology (Oral Presentation)

CHANGEPOINT ANALYSIS TO IDENTIFY THE EFFECT FOR SHOREBIRDS FROM THE FOX ERADICATION PROGRAM IN PHILIP ISLAND USING CITIZEN SCIENCE DATA

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In the past, fox predation was the largest land-based threat to the long-term viability of the shorebird colonies on Phillip Island, Victoria, Australia. Regular fox control for 20 years up to 2006 had reduced the fox population, but shorebirds continued to be decimated. Therefore, an eradication program was put in place in 2006. This program targeted the entire semi-isolated fox population taking mainland migrants into account. There were three phases to this program called knock-down, clean-up and post-eradication. Each campaign was arranged to avoid the summer season with a strong emphasis on the winter season. An effective knock-down was declared in 2011. In the clean-up phase, in addition to the island wide baiting effort, more intensive baiting with a range of bait types is being conducted for sites with any sign of foxes. However, the impact of these measures for local shorebirds has never been thoroughly assessed. This study aims to track the effects of the fox eradication program on abundance measures for the eight local shorebird species found on Phillip Island. These include the locally threatened Hooded Plover *Thinornis cucullatus* and Sooty Oystercatcher *Haematopus fuliginosus*. For this purpose, we have used monthly citizen science data for 2002 to 2017, adjusted for possible confounding variables, such as mean temperature, rainfall and resident human population in an attempt to control for some of the biases inherent in our citizen science data. Change point analysis techniques have been used in this context to assess the impact of the fox eradication program and other interventions, such as dog controls. The findings will inform policymaking for future pest eradication programs affecting shorebird populations.

NON-BREEDING DYNAMICS OF DECLINING MIGRATORY SHOREBIRD POPULATIONS

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Many migratory shorebirds are declining in the East Asian-Australasian Flyway. Loss of intertidal habitat in the Yellow Sea has largely driven these declines, but

many species also face pressure from coastal development and disturbance at their non-breeding grounds in Australia. These pressures are expected to increase as Australia's human population is projected to grow by 60-100% in the next 50 years, thus requiring a better understanding of how non-breeding conditions have contributed to past declines and might influence future population recovery. We studied the local dynamics of migratory shorebird populations during the non-breeding season in Australia, focusing on two estuarine systems in south-eastern Queensland that together support > 50,000 migratory shorebirds each austral summer. In the Great Sandy Strait, a comparatively pristine environment, populations changed relatively uniformly across the Strait since the early 1990s, supporting past evidence that remote factors have driven population declines. In contrast, in Moreton Bay, which is situated at the periphery of > 2 million people, a far more complex history of coastal land use points to how local activities could augment declines and limit potential for population recovery. Through our comparative approach we will gain insights into thresholds, at which human activity begins to shape local dynamics of declining populations that can be used to support smarter coastal planning and development in the future.

Theme: Non-breeding Ecology (Oral Presentation)

MOULT SCHEDULE AND POTENTIAL FOOD OF SPOON-BILLED SANDPIPER *CALIDRIS PYGMAEA* AND NORDMANN'S GREENSHANK *TRINGA GUTTIFER* AT A CRITICAL STAGING SITE IN CHINA'S YELLOW SEA

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The extent of coastal intertidal wetlands in the Yellow Sea region has declined considerably in the past few decades, resulting in severe population decline of a large number of migratory shorebirds, which rely on tidal flats in this region during non-breeding seasons. However, the functional roles (resting, fuelling and/or moulting) of these tidal flats to shorebirds remain poorly understood. Through regular field surveys between July and November 2015, we investigated the stopover and moult schedules of the Critically Endangered Spoon-billed Sandpiper *Calidris pygmaea* and Endangered Nordmann's Greenshank *Tringa guttifer* on the southern Jiangsu coast, eastern China during southward migration. We also explored the potential prey items of the two species by collecting benthic samples at their foraging locations. Our results show that a large number of Spoon-billed Sandpiper and Nordmann's Greenshank staged for an extended period of time (66 and 84 days, respectively) in Jiangsu to complete their primary moult. On average, Spoon-billed Sandpipers and Nordmann's Greenshanks started moulting primary feathers on 8 August \pm 4.52 days (SE) and 27 July \pm 1.56 days (SE) respectively, and their moult durations were 72.58 \pm 9.08 and 65.09 \pm 2.40 days. Our results also indicate that Spoon-billed Sandpipers foraged at locations with high numbers of amphipods, suggesting a potentially important food source for this species. Our work highlights the critical importance of preserving the remaining intertidal wetlands in southern Jiangsu and sheds light on the important benthic organisms and foraging locations that warrant long-term monitoring and management efforts to safeguard the future of two highly threatened shorebirds.

Theme: Migration Ecology (Oral Presentation)

RESPONSE OF SHOREBIRD HABITAT SELECTION TO COASTAL RECLAMATION AND URBANISATION IN AN EXTENSIVELY DEVELOPED DELTA: A CASE STUDY IN MACAO, CHINA

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Land-claim and human disturbance are major threats to shorebird populations along the East Asian-Australasian Flyway. When existing tidal flats undergo larger anthropogenic disturbance from intensive urbanisation, newly formed tidal flats may provide alternative habitats for shorebirds. Knowledge of the key habitat factor influencing shorebirds communities is essential for tidal flat restoration and management, especially on intensively urbanised coasts. We compared the differences between old and newly formed tidal flats in terms of habitat characteristics and shorebird communities and analysed the influence of habitat metrics on shorebird species abundance and feeding strategies in Macao, China, from 2006 to 2009. Habitat characteristics and shorebird communities were significantly different between old and newly formed tidal flats, which represented different urbanisation levels. The largest difference in shorebird communities between two tideland types occurred in the winter. Artificial shoreline rather than high-rise buildings had a direct and negative impact on shorebird communities. The habitat factors that relieved shorebirds from the surrounding urbanised environment were vegetation coverage within the tidal flat and the adjacent grassland areas. Under the pressure of rapid urbanisation, the newly formed tidal flat, which had more natural boundaries, adequate vegetation coverage and extensive adjacent undisturbed grassland, provided more suitable habitat than old tidal flats for shorebirds in Macao. Conservation efforts for shorebirds should primarily focus on maintaining the extent of current tidal flats, with emphasised management on reducing anthropogenic disturbance around tidal flats.

Theme: Non-breeding Ecology (Oral Presentation)

DISCOVERING AN UNKNOWN POPULATION OF BLACK-TAILED GODWIT *LIMOSA LIMOSA* IN EAST ASIAN-AUSTRALASIAN FLYWAY

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Occurring across Eurasia, Black-tailed Godwit *Limosa limosa* has three recognised subspecies, *melanuroides*, *limosa*, and *islandica* from east to west, respectively. With the smallest body size, *melanuroides* has been considered the only subspecies in the East Asian-Australasian Flyway. Yet, observations along the Chinese coast indicated the presence of distinctively large individuals. We compared the morphometrics of these larger birds captured in northern Bohai Bay, China, with those of the three known subspecies and explored the genetic population structuring of Black-tailed Godwits based on the control region of the mitochondrial genome (mtDNA). We also tracked the migration of Bohai Godwits using satellite transmitters. We found that Bohai Godwits were indeed significantly larger than *melanuroides*, resembling *limosa* more than *islandica*, but with relatively longer bills as in *islandica*. The level of genetic differentiation between Bohai Godwits and the three recognised subspecies was of similar magnitude as the differentiation among subspecies. In addition, Bohai Godwits bred primarily in Sakha Republic of Russia, spent the non-breeding season in the Gulf of Thailand and Bohai Bay was one of the most important staging sites during their north and southbound migration. Based on these segregating morphological and genetic characteristics, we propose these birds belong to a distinct population, which may be treated as a new subspecies, *Limosa limosa boharii*.

Oral Presentation

STILT - INSTRUCTIONS TO AUTHORS

Stilt is the journal of the Australasian Wader Studies Group. We welcome manuscripts presenting new information on the waders (shorebirds) of the East Asian-Australasian Flyway and nearby parts of the Pacific region from both amateurs and professionals. Authors should send their manuscript by email to the editor at info@imogenwarrenphotography.net. Authors are strongly encouraged to consult these instructions in conjunction with the most recent issue of *Stilt* when preparing their manuscripts. Authors are asked to carefully check the final typescript for errors and inconsistencies to minimise delays in publication. Authors are also encouraged to seek collegial advice on writing style and English before submitting manuscripts.

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Research papers should document the outcome of original research from wader scientific studies and monitoring of waders. Please note at present, *Stilt* does not publish keywords. Research papers should contain the following sections:

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Online material: **Dutson G., S. Garnett & C. Gole** 2009. Australia's Important Bird Areas: Key sites for bird conservation. Birds Australia (RAOU) Conservation Statement Number 15. Available at <http://www.birdlife.org.au/document/OTHPUB-IBA-supp.pdf> (accessed 10 August 2012).

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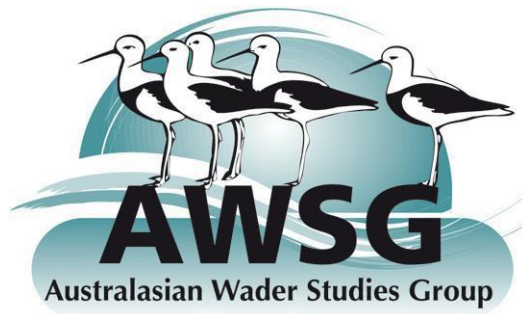
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