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 contributing in 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 on during both northward and southward migration. Despite the potential for habitat loss anywhere along a migratory route to limit a population, no study has investigated the exposure of entire migratory routes to habitat loss. Here, we built a framework by utilizing 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 high-resolution remote sensing dataset 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 between 1988 and 2018 for each site visited by the birds, and then 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 bird, 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 is needed for effective conservation. The framework we built can be applied to improve understanding of habitat changes across the migration network and to provide better support for conservation planning and actions.

Theme: Migration Ecology

Preferred option: Oral Presentation

Response of shorebird habitat selection to coastal reclamation and urbanization 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 population declines along the East Asian-Australasian Flyway. When existing tidal flats undergo greater anthropogenic disturbance from intensive urbanization, 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 urbanized coasts. We compared the differences between old and newly-formed tidal flats in terms of habitat characteristics and shorebird communities, analyzed 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 urbanization level. The greatest difference of shorebird communities between two tideland types occurred in winter. Artificial shoreline rather than high rise buildings had direct and negative impact on shorebird communities. The habitat factors relieved shorebirds from surrounding urbanized environment were vegetation coverage within tidal flat and adjacent grassland areas. Under the pressure of rapid urbanization, 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 primary focus on maintaining the extent of current tidal flats, with emphasized management on reducing anthropogenic disturbance around tidal flats.

Theme: Non-breeding Ecology
Preferred Option: Oral Presentation

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 galvanize conservation actions. Here we introduce four applications of spatial-temporal distributions generated from shorebird satellite tracking data in East Asia. On a flyway scale, the tracking data of great knots 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 knots and bar-tailed godwits 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
Preferred Option: Oral Presentation

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 with Australia's human population 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 southeastern 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: 1 Non-breeding Ecology; 2 Conservation Management

Preferred option: 1 Oral Presentation; 2 Poster

The use of Avian Sensitivity Mapping to reconcile birds and renewable energy expansion in Asia

A swift transition from CO_2 emitting fossil fuels to renewable sources of energy is essential. However, renewable energy facilities, such a 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 Viet Nam. 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.

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