Science for Saving Species

Research findings factsheet

Project 5.1.1

Threatened Species Recovery Hub

National Environmental Science Programme

Far eastern curlew movements and habitat use in Australia

In brief

The far eastern curlew is a Critically Endangered migratory shorebird, whose global population has recently declined by up to 80%. Loss of intertidal habitat across its range has been a significant driver of this decline.

In Australia, the curlew's habitat requirements for feeding and roosting sites are poorly understood. We used GPS and satellite tracking to monitor the habitat use of 22 individual far eastern curlews over a three-year period. Combining this with geospatial and tidal data, we characterised the habitats and substrates used by the curlews in non-breeding seasons across four regions around Australia.

We found that curlews prefer to feed in soft substrate in intertidal zones, both seaward of the mangroves where these are present and on and around saltpans when these are moist.

The curlew's average core home range size varied between each of the study regions, but some individual home ranges overlapped, suggesting highly valuable, shared resources and shelter sites.

Some birds travelled significant distances to find higher-quality sites when tides restricted roost availability. We saw high site fidelity, with consistent use of non-breeding sites year after year.

While curlews may make use of artificial habitats for roosting, conserving natural habitat in their existing core home ranges is essential, especially for feeding. Our results suggest that increasing protections for core non-breeding habitat, and as much of the surrounding secondary habitat area as is feasible, will have significant positive impacts for conserving the far eastern curlew in Australia.

A curlew is fitted with a GPS tracker. Image: Amanda Lilleyman

Background

One of the world's largest shorebirds, the globally Endangered far eastern curlew (*Numenius madagascariensis*) occurs only along the East Asian-Australasian Flyway. This bird belongs to the Numeniini tribe, which contains the world's most highly threatened shorebirds, with seven species of conservation concern. The global population of Critically Endangered far eastern curlews has declined precipitously – by up to 80% in just three generations.

Recent research on a related species, the Ruddy Turnstone (*Arenaria interpres*), has highlighted the importance of high-quality non-breeding habitat to migratory shorebirds. In Turnstones, and possibly all shorebirds, a decline of just 10% in non-breeding season food intake caused a 30% reduction in breeding success. Similarly, a 20% decline in food intake resulted in 100% mortality on migration. Thus, even though the major threats to migratory shorebirds are currently further north along the flyway, the non-breeding habitat is still highly significant.

So far, however, providing strategic guidance to coastal developers and decision-makers in Australia has been hampered by a lack of knowledge about the ecological requirements of the far eastern

Charles Darwin University Australia · Larrakia Nation · Darwin Port (Part of the Landbridge Group) · The University Of Queensland Australia

LEFT: Development proposals should consider the high site fidelity and home range sizes displayed by curlew. Regularly used areas should be avoided for development because they are impossible to offset. Image: Amanda Lilleyman

Background (continued)

curlew, particularly for their feeding and roosting habitats.

The far eastern curlew is the subject of an international action plan, largely led by Australia, and acts as a flagship species for an entire assemblage of migratory shorebird species. It is often explicitly mentioned in conditions under *Environmental Protection and Biodiversity Conservation Act 1999* approvals for coastal developments. Thus, understanding its ecology in Australia has immediate implications for conservation decision-making.

Research aims

We aimed to:

- Analyse the movement of far eastern curlews at feeding and roosting habitats and determine the relationship between these habitats and the requirements of the curlews.
- Understand habitat use across different habitat types and climatic zones, and to compare preferential habitat use across the study regions.
- Examine the changing availability of intertidal, non-breeding habitats across these study regions.
- Provide evidence-based guidance for coastal developers, planners and regulators on the site-based management of far eastern curlews.

What we did

Researchers from Charles Darwin University and The University of Queensland, along with volunteers from the Australasian Wader Studies Group, Victorian Wader Study Group and Queensland Wader Study Group, investigated habitat use of the Critically Endangered far eastern curlew over the years 2017–20.

We studied the curlews at four non-breeding regions in Australia: Darwin Harbour on Larrakia country in the Northern Territory, Roebuck Bay on Yawuru country in Western Australia, Moreton Bay on Quandamooka country in Queensland, and Western Port on Boon Wurrung country in Victoria. The latter three are Ramsar sites (wetlands of international importance).

We captured 22 far eastern curlews at the four regions using cannon nets in the daytime and mist nets at night. We attached GPS or satellite tracking tags to individual curlews to track their movements on the non-breeding grounds and subsequently when they migrated to the northern hemisphere to breed.

We used the fine-scale movement and migration data we collected to estimate home range size. We also used these data to calculate metrics about bird movements, such as the cumulative distance travelled each day, or the maximum distance travelled in a single journey between sites.

We modelled the extent and availability of intertidal habitat zones in the non-breeding regions using tidal data. We used this to explore the effect of changing tides on habitat use.

We used geospatial data to characterise the habitat types preferred by the far eastern curlews.

Researchers setting up mist nets to capture curlews for attaching GPS and satellite tracking tags. Image: Amanda Lilleyman

RIGHT: Curlews feeding in Darwin Harbour. Image: Amanda Lilleyman

Key findings

We discovered that far eastern curlews repeatedly used familiar roosting and feeding sites intensively, with a strong preference for intertidal habitats with a soft substrate. This is because the curlews use their long bill to probe in soft sediments for prey. Soft substrate is therefore critical to the survival of the species.

Soft substrate habitats made up 23% of the tracking points for GPS-tagged curlews in the Northern Territory, 81% in Western Australia, 64% in Queensland and 88% in Victoria. The remaining habitat types primarily used by the curlews were saltpans, saltmarshes and coastal wetland habitats.

The home range size estimates varied markedly among the four study regions. The core high-use areas in curlew home ranges were, on average: 2.0km^2 in the Northern Territory; 22.3 km^2 in Western Australia; 32.4 km^2 in Victoria; and 39.6 km^2 in Queensland. We found that the curlews rarely fed outside their usual feeding home range. The tightness of the home range and the high site fidelity means that any site used by curlew in the non-breeding season is likely to be valuable, and not easily replaced. However, we do not know what happens to individual birds if their regular feeding habitat is rendered unsuitable.

Further, we found considerable overlap in the home ranges of far eastern curlews within each region. This suggests that these sites of overlap have a high availability of food resources and roosting space. At the study sites in the Northern Territory and Queensland, the home ranges of some far eastern curlews also overlapped with significant working port operations.

Birds moved from regular roost sites to regular feeding areas daily. Both feeding and roosting sites were used repeatedly by each individual curlew over multiple seasons without any change in home range size. We expected this behaviour, as migratory shorebirds are known to show high site fidelity.

During spring tides, habitat availability was constrained. Some individuals travelled up to 30 km to roosting sites, indicating that spring tide roost sites are likely candidates for protection, or even creation. It is also evidence for just how strongly attached birds are to their regular feeding home ranges.

Implications and recommendations

This study has increased our understanding of the ecological requirements and habitat use of the far eastern curlew across four significant regions in Australia. The home range estimates we present, of where birds roost and feed based on tidal cycles, should inform conservation of areas that are required for the ongoing protection of this Critically Endangered migratory shorebird. Given the flagship status of the far eastern curlew, we also anticipate that such strategic planning for this species will also benefit other threatened migratory shorebird species.

By improving our understanding of the movements and home range sizes of individual curlews across their non-breeding grounds, this research will help planners and managers mitigate any potential effects from coastal development on the far eastern curlew. Our results can also be used in strategic guidelines by governments to inform far eastern curlew conservation that will provide more certainty to developers, planners and regulators.

The findings about individual birds' regularity of habitat use and the overlap between feeding and roosting sites will greatly benefit more strategic management and planning. This is because the areas occupied by curlews when they are roosting and feeding are likely to be required by the species at all times. Both foraging and roosting habitat types need protection, and both must be planned for and managed simultaneously, since birds commute between them on each tide change. Additionally, all roost sites within 30 km of the home ranges identified by our study should be managed for protection of shorebirds.

The high site fidelity displayed by far eastern curlews is particularly important to consider for coastal developments. Developers and planners should consider the estimates of the curlews' core and secondary home range sizes when proposing any coastal development and mitigate the potential impact to the species and the intertidal habitat that it uses.

Importantly, the availability and extent of suitable habitat types (soft substrate, saltpans and saltmarsh habitat, coastal wetlands) and the

LEFT: Loss of intertidal habitat across its range has been a significant driver of the decline of far eastern curlew. Image: Amanda Lilleyman

Implications and recommendations (continued)

home range estimates reported here should be considered in assessing the impacts of development on the species.

Areas used regularly by feeding curlews should be avoided for development, since they are essentially impossible to offset. Any development footprint should have a minimum setback distance of 250 m from known roosting and feeding areas of the far eastern curlew.

Surveys of habitat to detect the presence of feeding curlews should be undertaken at least three times over the non-breeding period (September to March) to assess numbers and limits to the home ranges of any curlews using a site. Surveys need to determine the location of likely roost sites that also need protection, potentially by assessing direction of travel (in the absence of tagging and tracking) of any curlew departing feeding areas as the tide rises.

Work is still to be done to investigate the bird's prey preferences and densities across the non-breeding range.

Previous work has shown that curlews use artificial roost sites. Therefore, degradation or loss of natural roosting habitat could potentially be offset by creating alternative roost sites that the birds can use at all tide states and are as close to feeding areas as existing roost sites. To be effective, these artificial sites must have similar properties in terms of protection from disturbance and to allow curlews the visibility they need to detect potential predators.

Offsetting the loss of natural sites by protection of potentially suitable sites not currently used by curlew is not recommended given our findings about high site fidelity.

Given the active selection of soft mud exposed by the lowest tides, rapidly rising sea levels caused by climate change may soon affect curlew habitat, increasing the value of any they continue to use. What is not yet known is whether the curlew prey will be able to move towards dry land as the sea rises.

Overall, if we want to improve the chances of birds migrating successfully, then we must protect suitable and high-quality habitat for the populations of shorebirds that visit Australia.

The single most important management action to conserve migratory shorebirds on the non-breeding grounds is to conserve key roosting and feeding habitats. This will involve working with governments and site managers at all levels, from local councils, Indigenous land and sea managers through to state, territory, and federal governments.

Appropriate management of migratory shorebirds on the non-breeding grounds will involve:

- Identifying key areas used by birds during all stages of the Australian summer period
- Identifying the connectivity between roosting and foraging habitat used by shorebird species
- Minimising threats through holistic development and conservation planning to protect key sites and reduce impact on shorebirds
- Minimising disturbances (e.g., from boats and airboats) to important shorebird habitat
- Constraining dredging activities so that important intertidal foraging areas are not disturbed
- Limiting construction of any development to a time when the impact on shorebirds will be minimal.

Citation

Lilleyman, A., Bradley, K., Woodworth, R., Fuller, A., and Garnett, S., (2020) Strategic planning for the Far Eastern Curlew. NESP Threatened Species Recovery Hub Project 5.1.1 final report, Brisbane. December 2020.

Further Information

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