

Assessing waterbird habitat quality in the Coorong

This research explored the most useful measures of habitat quality for 10 key waterbird species in the Coorong. We gathered knowledge by reviewing other studies from around the world, analysing data collected in the Coorong over the last 20 years, and doing a field study in 2021-2022. Based on these learnings, we suggest indicators of habitat quality that can be measured across key waterbird species in the Coorong.

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The Coorong region of South Australia is culturally, environmentally and economically important, but has experienced a long-term decline in its ecological condition due to reductions in inflows and sustained periods of drought. Waterbirds are one of the key natural values of the area. The Coorong, Lower Lakes and Murray Mouth region regularly supports 100,000 to 300,000 waterbirds, including both migratory and resident shorebirds; piscivores (fish-eating birds), for example pelicans and terns; and, herbivores (plant-eating birds), for example swans and ducks. Waterbird abundance and diversity is a primary reason the region is recognised as a wetland of international importance. However, significant declines in the abundance of waterbirds have been observed in the Coorong since the 1980s, making them a priority for conservation efforts.

An important conservation goal is to improve habitat quality for target species. Measuring breeding success and/or survival is the most reliable way to measure habitat quality, but doing so can be challenging or impossible if the target species moves widely through the landscape, as is the case for waterbirds. Most waterbirds do not breed in the Coorong, and some migrate thousands of kilometres every year while others disperse through the landscape in response to the availability of food and breeding habitat. As a result, other measurements beyond breeding success and survival are generally needed to assess the habitat quality of the Coorong for waterbirds. However, there is no widespread consensus on the most effective indicator of habitat quality for waterbirds, and the best approach generally needs to be determined based on available information and local factors.

KEY FINDINGS

- Key waterbird species are distributed differently within the Coorong because they have different habitat requirements.
- Annual survival (i.e. proportion of birds that survive each year) is an ideal measure of habitat quality, but requires individual birds to be caught and marked so that they can be identified when they are resighted. This is unlikely to be feasible for most key waterbird species in the Coorong.
- Breeding success (i.e. chicks raised successfully to independence) is an ideal measure of habitat quality, but can potentially be measured in the Coorong for only a small number of key waterbird species that breed locally, including fairy tern and Australian pelican.
- Coorong-wide waterbird abundance (i.e. a count of all of the individuals of each waterbird species) is one important indicator of habitat quality for waterbirds, but its interpretation is complex because abundance can change in response to factors external to the Coorong. For example, the Coorong acts as a drought refuge because it is a permanent water body, so waterbird abundance may increase during dry years when other wetlands dry up. Or, the number of migratory waterbirds in the Coorong may increase or decrease due to conditions elsewhere along their migration route. Nonetheless, measuring Coorong-wide abundance at least annually (and ideally more often) is important for detecting drastic changes to local populations that are likely to be linked to local habitat condition.
- Another widely-used measurement of habitat quality is how much food is available. This is a useful approach for piscivores (e.g. terns, pelicans) and herbivores (e.g. ducks, swans) but more challenging for shorebirds because their prey (mainly invertebrates that live in the mud or water column) can be difficult to reliably sample at the waterline where the birds feed.
- Water levels and flow (and therefore available feeding, resting and/or breeding habitat) are useful measures of habitat quality in the Coorong for shorebirds and fairy tern, with shorebirds preferring large areas of shallow water that are not too close to shoreline vegetation, while fairy terns require stable water levels during the breeding season so that their nesting islands aren't flooded or become connected to the mainland allowing foxes into the colony.

KEY WATERBIRD SPECIES OF THE COORONG

This project focused on ten species of waterbirds that rely on the Coorong South Lagoon. They can be considered important and representative species for the Coorong, keeping in mind that over 40 waterbird species are regularly present.

MIGRATORY SHOREBIRDS

These four species migrate to breeding grounds in the Northern Hemisphere each autumn. In spring they return to Australia and spend the summer in wetlands including the Coorong.

Red-necked stint

Calidris ruficollis

A small shorebird with short, black legs and a straight black bill. Red-necked stints are usually the most numerous migratory shorebird species in the Coorong, especially in the South Lagoon.



Sharp-tailed sandpiper

Calidris acuminata

A medium-sized shorebird with a straight black bill with an olive base and a chestnut-coloured crown. Regularly encountered in the Coorong, especially in the North Lagoon.



Curlew sandpiper

Calidris ferruginea

A medium-sized shorebird with a long, down-curved black bill and black legs. This species is listed nationally as Critically Endangered and has declined drastically in the Coorong since the 1980s.



Common Greenshank

Tringa nebularia

A medium-sized shorebird with long legs and a slightly upturned bill. It occurs regularly in the Coorong but in smaller numbers than other key migratory shorebird species.



NON-MIGRATORY WATERBIRDS

These species spend the whole year in Australia, but some make largescale movements in response to food resources or breeding habitat availability.

Australian pelican

Pelecanus conspicillatus

A large fish-eating waterbird with distinctive black and white feathers, a huge pink bill and yellow eye ring. Pelicans breed each year at a large colony on Pelican Island in the South Lagoon of the Coorong.



Chestnut Teal

Anas castanea

A small duck, the male of which has distinctive green head feathers and chestnut chest feathers during the breeding season. Moves widely through the landscape but generally favours coastal regions. Rarely breeds in the Coorong.



Black Swan

Cygnus atratus

Unmistakable. A large, plant-eating, all-black waterbird with bright red bill and extremely long neck. While black swans do breed regularly in the region, they have not been recorded breeding in the southern Coorong for over 50 years.



Fairy Tern

Sternula nereis

A small tern with a yellow bill and legs and a black crown during the breeding season. Fairy terns regularly breed in the summertime in the South Lagoon and around the Murray Mouth, provided there are sufficient food resources and available breeding islands.



Red-necked Avocet

Recurvirostra novaehollandiae

A medium-sized shorebird with long legs, a chestnut-brown head, white and black body and distinctive upturned bill. It breeds in the interior of Australia and makes largescale movements, largely in response to rainfall. Rarely breeds in the Coorong.



Red-capped Plover

Charadrius ruficapillus

A small shorebird with black legs and a short, fine black bill. The male has a bright reddish-brown cap. The most common and widespread of all Australian beach-nesting shorebirds, occurs on the coast and inland. Small numbers breed in the Coorong.



WHAT IS HABITAT?

This project focused on identifying the most useful ways of measuring habitat quality for ten key waterbird species in the Coorong.

But what exactly is “habitat”?

Broadly speaking, a habitat is the physical surroundings of an organism at a particular point in time. Habitat includes factors like water chemistry and air temperature as well as biotic elements like food (i.e. prey items) and predators.

It is common for species to require different habitats at different times. For example, many shorebird species migrate to the Northern Hemisphere because there they can find large areas with a super-abundance of insects where they can easily blend in and avoid predators while nesting on the ground. When the breeding season is over, migratory shorebirds migrate back to Australia where coastal areas provide non-breeding habitat, including favourable weather and muddy areas where they can use their unique bills to probe for food in shallow water.

“Habitat quality” refers to how well a given habitat is meeting the needs of organisms that depend on it. The most reliable way to assess habitat quality is to measure the breeding success and survival of the organisms using the habitat, however this may be difficult or impossible for species like waterbirds that migrate to other regions to breed and use multiple different habitats at different times of the year. In this case, it is necessary to measure other factors beyond breeding success and survival to assess habitat quality at a given place and time.

This project helped to clarify some of the elements of habitat in the Coorong that can be measured to assess how well it is supporting ten key waterbird species. It is important to remember that different species have different habitat requirements, so measures of habitat quality also vary between species.

One important feature of habitat quality for all species is the availability of their preferred food source(s). In the Coorong, chestnut teal and black swan are more likely to forage when the aquatic plant *Ruppia* is more abundant, and other research has shown that *Ruppia* is a large component of the diet of chestnut teal, making *Ruppia* abundance an important indicator of habitat quality for these two species. To breed successfully, fairy tern require an abundance of small fish near their breeding colony. In the Coorong, fairy tern abandon breeding sites in the South Lagoon if small-mouthed hardyhead (a small, salt-tolerant fish) are not present, making hardyhead density an important habitat quality indicator for fairy tern. Australian pelican abundance also increases with overall fish density, making fish density an important habitat quality indicator for pelicans.

While food resources are clearly also important for shorebirds, our research in the Coorong showed that it is difficult to precisely measure the availability of shorebirds’ preferred prey items (which include macroinvertebrates like insect larvae, amphipods and marine worms) in shallow water where the birds feed, but that shorebirds seem to find food more easily in areas of the Coorong where macroinvertebrates are more abundant at the waterline. It is therefore a priority to continue monitoring the prey species of shorebirds but it may be most effective to sample these species in slightly deeper water where density estimates are more consistent. In addition, shorebirds clearly favour areas of the Coorong that have more exposed mud/sand and shallow water, which are the areas where they can look for food. They also tend to avoid places within the Coorong where the waterline is very close to shoreline vegetation, a behaviour that is associated with avoiding predators. These factors are directly related to water levels, which in turn relate to inflows of water into the Coorong, making water levels a key habitat quality indicator for shorebirds.

Other studies have shown that water levels are also important for fairy terns, which breed on small islets in the South Lagoon. Once the breeding season has commenced, if water levels increase the colony can be flooded and eggs or chicks lost. Conversely, if water levels drop to the point that islets connect to the mainland, foxes can predate eggs and chicks. Therefore, stable water levels that are neither too high nor too low is a key habitat quality indicator for fairy tern.

Given that fairy tern and Australian pelican both breed annually in the Coorong, future studies to assess their breeding success would be a useful way to reliably assess the habitat quality of the Coorong for these species.

MORE INFORMATION

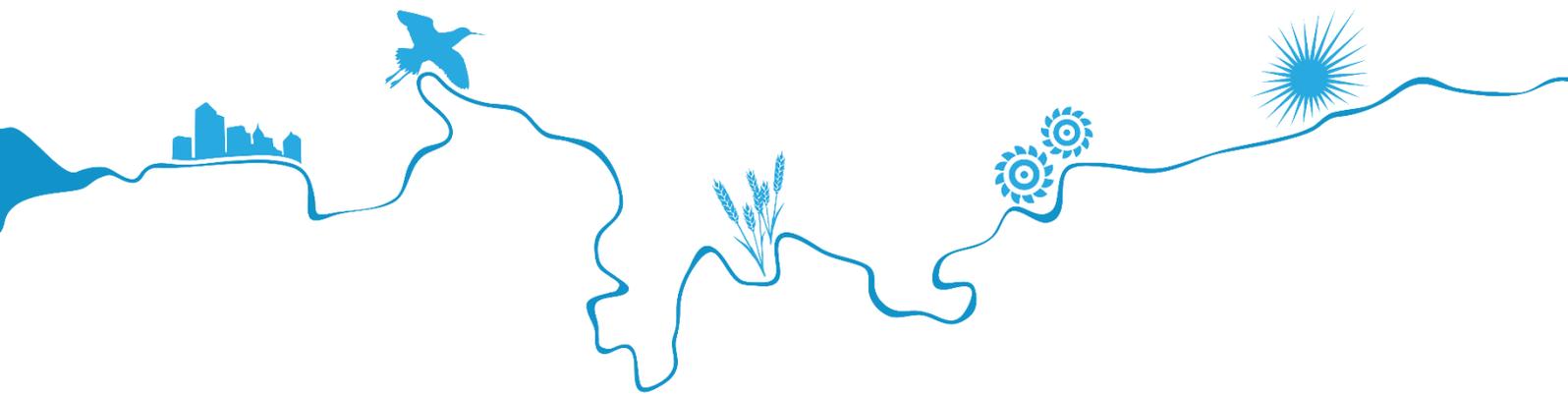
The following technical report associated with this research program is located at <http://www.goyderinstitute.org/publications/recent-publications/>:

Jackson MV, Mott R, Prowse TAA, Delean S, Shu Y, Liu L, Hunt BJ, Sanchez-Gomez S, Brookes J, Cassey P (2022) Recommended habitat quality measures for key waterbird species in the Coorong. Goyder Institute for Water Research Technical Report Series No. 22/05.



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