**Science** for Saving Species

Research findings factsheet

Project 6.1

Threatened Species Recovery Hub

National Environmental Science Programme

# Bittern-friendly rice farms

## In brief

Rice is one of the world's key human food crops, and the conservation opportunities offered by rice fields as agricultural wetlands are increasingly acknowledged.

The Australasian bittern *(Botaurus poiciloptilus)* is a cryptic, highly threatened waterbird that relies on wetlands for breeding grounds, with the most significant Australian population of the bird found in the rice fields of the New South Wales Riverina in the southern Murray-Darling Basin.

We assessed the size of the Riverina population, developed guidelines for bittern-friendly rice growing, identified rice growers' preferences for incentive programs, investigated consumer values of bittern-friendly rice products and explored novel water policy options that can help support rice growers to conserve bitterns in their crops.

We found that Riverina rice fields support around 60% of the national population of the bird (40% of the global population) and that rice growers were willing to adjust their growing methods and implement other measures to help bitterns breed successfully, including providing sufficient ponding periods. Consumers were found to be willing to pay a premium for bittern-friendly rice products.

*The Riverina's rice fields support 500–1000 Australasian bitterns, about 40% of the global population. Image: Matt Herring*

## Background

The Australasian bittern (*Botaurus poiciloptilus*) is a globally endangered waterbird, with a total population of around just 2000 individuals. South-eastern Australia and the North Island of New Zealand provide the most important areas of habitat for remaining populations of the bird.

The bittern is a cryptic species that relies on wetland plant cover to hide in, and has suffered greatly from widespread habitat loss. For thousands of years, Indigenous Australians have associated the deep booming call of this secretive bird with the mythical bunyip. For rice growers, that distinctive sound has been synonymous with the rapid growth of their crops during summer. It turns out that the way rice is grown provides bitterns with the right conditions to breed: shallow water and, about two months after sowing, plenty of cover, plus aquatic prey like fish and frogs.

While agriculture is a major driver of biodiversity loss, novel agricultural habitats are increasingly recognised for the conservation opportunities they present. Agricultural land is being reimagined for its potential to support habitat and ecological function alongside food production. Rice fields show particular promise for waterbirds

## Background (continued)

such as the Australasian bittern, and for "wildlife-friendly" farming initiatives.

Australia's rice fields are concentrated in the New South Wales Riverina, in the southern part of the Murray-Darling Basin, around towns including Griffith, Leeton, Coleambally, Finley, Deniliquin and Wakool. The annual Riverina rice crop ranged from 4000 to 113,000 hectares from 2010 to 2020, with the area determined by water allocations, water costs and competition with other crops like cotton.

There has been a trend away from traditional rice growing methods toward delaying the commencement of ponding, resulting in a shorter ponding period. This has been driven by concerns for water-use efficiency, but while saving water and increasing yield per megalitre are good aims, they come at a cost to bitterns because it limits their window to breed successfully before season's end. Our research is centred on addressing this trade-off. How can rice farms be managed to ensure bitterns are able to breed successfully? How can bittern-friendly rice be economically viable for rice growers?

*Scott Williams, is one of the first bittern-friendly rice growers through Riverina Local Land Services' incentive program. Image: Matt Herring*

## Research aims

Our research had five distinct aims:

1. To determine the size and significance of the bittern population breeding in rice crops
2. To develop guidelines for bittern-friendly rice growing
3. To identify rice growers' preferences for incentive programs
4. To understand consumer values of bittern-friendly rice products
5. To explore novel water policy options that can help support rice growers to conserve bitterns in their crops.

*BELOW: Bittern-friendly rice growing aims to maximise breeding success. Image: Matt Herring*

## What we did

Building on the survey work done through the *Bitterns in Rice Project* that began in 2012, we used occupancy modelling to estimate how many bitterns were using the Riverina's rice crops for breeding. The surveys had been done on randomly selected farms, providing confidence that our modelling would reflect the true size of the population. We then used bittern nesting data to estimate how many days after ponding commenced bitterns began breeding in the crops. We combined this information with known ponding periods to predict which crops could potentially support successful breeding before the end of the October–May rice season. Traditionally, rice is grown in the Riverina with ponding beginning at the start of the season ("early permanent water"), whereas the new water-saving methods – direct-drill and "delayed permanent water" – involve periodically flushing water and not ponding until after germination, typically from mid-November or December.

Our next step was to survey Riverina farmers who grew rice during the 2017–18 season about their preferences for potential incentive programs for bittern-friendly rice growing. We used a choice experiment to see how growers valued the payment rate against various management requirements, compliance monitoring and contract flexibility. We also assessed levels of in-kind contribution that growers could make.

After this, we surveyed over 1500 Australian consumers to assess their willingness to pay a premium for bittern-friendly rice products. We wanted to see how they might value additional costs against endorsement and certification from various organisations, whether or not the rice was sourced directly from bittern-friendly rice farms, and level of pesticide use.

Because people tend to overstate their generosity and willingness to support worthy causes, even in anonymous surveys, we included inferred valuation methods: using the same questions, we asked what choices rice growers and consumers thought their nearest neighbour would make.

## Key findings

Occupancy modelling across the Murrumbidgee and Coleambally irrigation areas produced population estimates ranging from 368 to 409 bitterns in the traditional early permanent water crops. Using conservative estimates for the unsurveyed Murray region, and for the direct-drill and delayed permanent water crops, we calculated that in most years the Riverina's rice crops support between 500 and 1000 bitterns. This equates to around 60% of the national population and 40% of the global total, the largest known population of the Australasian bittern.

In crops with traditional, early permanent water, bitterns began nesting about 77 days after flooding and sowing, when rice heights were around 55 cm. This gave 65% of nests sufficient time for all chicks to fledge before harvest. From this, across the full range of rice crop practices, we predicted that only 20% of nests would have been potentially successful before harvest. Our breeding success model showed that when permanent water was applied by early November, giving a ponding period of at least 149 days, 100% of nests could be successful before harvest.

During the course of our study, drill-sowing and delayed permanent water, with their contraction of the ponding period, became the rice industry standard in Australia. In 2014, only 34% of crops were grown with these new methods, while during a drought in the 2019–20 season the proportion reached 91%. This represents water savings of 1.5 to 4.5 megalitres/ha per year, but likely hinders opportunities for successful bittern breeding.

We found no evidence that rice fields are operating as ecological traps for bitterns, as they do not show preference for them over natural wetlands. There is potential, however, that a lack of successful breeding could cause populations to decline, unless rice growers are supported to integrate bitterns into their management. We found that rice growers are very supportive of bittern-friendly rice incentive programs, with 84% indicating they'd be willing to adjust their growing methods and implement other measures to help bitterns breed successfully. Their primary motivations to participate were to help an endangered bird and to improve the public image of rice farming through wider recognition of the habitat values of the crop.

Potential in-kind contributions were high, with the average amount of annual profit margin that a grower was willing to forgo to help bitterns being $2271, with $1109 for the inferred valuation (their nearest neighbour). Collectively this equates to $1.42 million and $693,000 per year for the 625 rice growers during the 2017–18 season.

The incentive type most popular with growers was incorporating public environmental water, where no money is exchanged, to create a sufficient ponding period and provide wetland refuges. This was followed by bittern-friendly rice products, where premiums are paid by the consumer to fund the works. The third-most popular was a government-funded incentive program; while a pledge based on goodwill, and a tender where the most cost-effective bids are funded, were the least popular.

When payments were involved, larger sums were found to be important, but growers preferred less demanding management requirements. For early permanent water crops, ponding commencement by 31 October was strongly preferred over 20 October. Those 11 days can be precious to both growers and bitterns. Rice growers also avoided choosing scenarios with an adjacent habitat refuge, while they favoured more contract flexibility; but compliance monitoring, whether through self-assessment or an independent project officer, was not found to be important.

Findings from the consumer survey are preliminary, but it's already clear that a substantial proportion of Australians are willing to pay a premium for bittern-friendly rice products. For example, most respondents said they'd be willing to pay 50% more for a 1 kg packet of rice if it was bittern-friendly, from $3.00 to $4.50. However, most also said that their nearest neighbour would be willing to pay only 17% more, from $3.00 to $3.50. Still, these levels suggest such premium products are feasible at a broad scale. So far, the analyses also indicate that consumers value endorsement and certification, especially when it involves a group of organisations. The source of the rice, whether it was direct from a bittern-friendly rice grower, or a generic rice product with funds flowing back to a program, was also important but strong preferences were found for both. The consumers' choices were also affected by level of pesticide use, with a preference shown for organic and reduced pesticide use over conventional levels of pesticide use.

## Cited material

Herring, M.W., Robinson, W., Zander, K.K., Garnett, S.T., 2019. Rice fields support the global stronghold for an endangered waterbird. Agriculture, *Ecosystems & Environment* 284, 106599.

Herring, M.W., Robinson, W., Zander, K.K., Garnett, S.T., Under review. Increasing water-use efficiency in rice fields threatens an endangered waterbird.

## Key findings (continued)

The final part of our research will explore policy options that can help support rice farmers to conserve bitterns. These options include:

- creating specially designed wetland refuges adjacent to rice fields
- carefully amalgamating private agricultural water with public environmental water (which is currently not permitted)
- developing a separate water allocation for integrated use.

*Research has revealed much about the cryptic Australasian bittern. Image: Matt Herring*

## Implications and recommendations

The Riverina's rice fields have previously been overlooked for the key role they can play alongside natural wetlands in bittern conservation.

We recommend "bittern-friendly" incentives for rice growers to encourage early nesting and maximise breeding success. These should be centred on ensuring an early and sufficient ponding period. Ponding that commences in October and continues for at least 149 days will give bitterns the best chance of success. Wetland habitat refuges adjacent to rice fields, such as dedicated reserves, and vegetated channels and storage dams could complement the crops and provide bitterns with additional areas of habitat to use at the end of the rice season. Maintaining grassy banks between rice bays rather than spraying them with herbicide is also recommended, particularly because of the cover they offer roaming chicks. Trials of bittern nesting "patches", where taller, thicker vegetation has grown earlier in the season could also be beneficial, as could gaining a better understanding the efficacy of controls in rice fields for introduced predators such as feral cats and red foxes.

Working closely with growers and agronomists, and getting the whole industry behind the Australasian bittern, is proving to be a success. After a decade of community engagement and awareness-raising through the *Bitterns in Rice Project*, the Australian rice industry is poised to make an important contribution to recovering this threatened species. Already, our research has been used to help design a bittern-friendly rice grower incentive program, managed by Riverina Local Land Services, and supported by funding through the Australian Government's National Landcare Program. Results from our consumer survey are being used by SunRice® to help develop potential bittern-friendly rice products, while government and industry have expressed interest in novel approaches to water management and policy.

The bitterns are not alone in their association with the Riverina's rice fields – they are part of a suite of cover-dependent waterbirds that breed in these agricultural wetlands, such as the globally Endangered Australian painted snipe, which can use rice fields in significant numbers. The habitat values extend beyond birds, with, for example, the threatened southern bell frog inhabiting the rice fields of the Coleambally and Western Murray regions in large numbers. The potential for simultaneously managing rice fields for food production and wetland biodiversity remains largely untapped in Australia. Agricultural habitats are often overlooked for their potential conservation value, and rice farming in Australia is usually framed negatively when the environment is considered in the Murray-Darling Basin. But by working together and applying novel thinking, we can find fresh ways to recover threatened species.

## Further Information

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