



Kakadu Research News

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NERP research comes to a close

The Northern Australia Hub of the National Environmental Research Program has undertaken eight research projects within Kakadu National Park over the past four years. Many people within Kakadu have worked with us on this research. So what do we know now? And how will this research support decision making in the park?

In this edition of Kakadu Research News we will discuss some of the key outcomes from our research projects. Although the projects have come to an end, NERP's research and knowledge exchange activity is still going strong. The lessons learnt from NERP will be built on in the new Northern Australia Environmental Resources (NAER) Hub. This is one of six hubs funded by the Australian Government's National Environmental Science Programme (NESP). Our Director, Professor Michael Douglas, and many other NERP researchers will continue to work with stakeholders in Kakadu as we enter this new phase of research.

What's fuelling Kakadu's wetland animals?

Visitors to Kakadu National Park will notice the abundance of aquatic life in the park. But do you know why these aquatic ecosystems are so productive? A Hub research team, led by Professor Stuart Bunn and Dr Doug Ward from Griffith University has been sampling everything that can eat or be eaten in the park's rivers and wetlands to better understand food webs in northern Australia's freshwater ecosystems.

Using a technique which traces the chemical signatures of different plants and algae up through the food chain, the researchers found that the most important food source in Kakadu's wetlands is the film of attached algae which grow on the surfaces of aquatic plants, like water lilies. This algae is a nutritious and productive source of food for small insects and fish which are in turn food for bigger animals.



Given how important this algal film is to supporting the aquatic food web, the team looked at the conditions and locations where it grows best. The best type of plants to support the production of algae are the types that grow completely underwater because they provide a surface for the algae to grow on, while still providing sufficient light into the water. Submerged plants supported up to four times more algae than thick grasses, like para grass, that grow partly underwater and partly above the surface.

This information helped the research team to identify the most productive part of the floodplain: these are the back water swamps on the edges of the floodplains, like Nourlangie, Yellow Water, Boggy Plains and the Magela Creek floodplain. These areas are the most productive areas because they are deeper, with more submerged plants and hold water for much longer than other areas.

The team also found that as fish get larger they become more reliant on moving around during the wet season to access food on floodplains. At the end of the wet season many fish return to their home billabongs. As they are bigger after feeding on the floodplains, their movement is a way of bringing resources from the floodplains back to the billabongs. Interestingly, although crocodiles are the biggest aquatic predator in the system, they rely heavily on animals from the surrounding savanna, such as wallabies and pigs.



Sampling fish tissues - Photo by Michael Lawrence-Taylor

Fish dynamics of Kakadu estuaries

Fish play an important role in the aquatic habitats of northern Australia. This is especially true in Kakadu National Park, which is only around 1% of the total area of northern Australia, but has more than half of the estuarine fish species of the Northern Territory, and a third of all freshwater fishes recorded from northern Australia present. The true variety of fish found in Kakadu estuaries was uncertain and one NERP project led by Dr Mark Kennard from Griffith University and Dr Bradley Pusey from the University of Western Australia set out to fix this.



The research team used fine-meshed nets in both the wet and dry seasons to collect small fish in the estuary of the South Alligator River and compared the results with previous dry season research in the river. Among their collections they found 26 species not previously recorded from Kakadu, most of which were sampled during the wet season. They collected a significant number of young fish from many species, reinforcing the importance of estuaries as nursery areas.

The team also noticed big differences between what fish were found in the wet and the dry

seasons, with 63 species recorded during the wet season and only 43 recorded in the dry. Although two families, croakers and anchovies, were the most common, the species present within each family changed greatly between seasons.

A total of 76 types of fish were recorded over the study. The researchers believe that the large number of new fish species recorded from Kakadu during the project shows that we could expect to discover more species in the future, especially during the wetter months. You can find the full inventory of fish species on our website.



A wet season sample and 3 common species (streamer threadfin, threadfin scat and paperhead) discovered during fish sampling - Photos by Brad Pusey

Taking cane toads off the menu

The northern quoll is a small marsupial predator that was once abundant in Kakadu National Park. Sadly, quolls started disappearing from many parts of Kakadu after cane toads invaded the park in 2003. The naturally curious quolls readily attack cane toads, but have little resistance to the toxins they carry in their skin glands, and die after mouthing large toads.

Cane toads can't be eradicated from Kakadu, but new research has shown that we can train quolls to avoid eating toads in the first place. How can we do that? Hub researcher Dr Jonathan Webb from the University of

Technology Sydney came up with an effective solution – train quolls to feel sick when they taste or smell cane toads so that they won't want to eat them.

To trial this, captive reared quolls were fed a small dead toad coated with a nausea-inducing chemical. The quolls that ate the toads became mildly ill and as a result, they associated the smell of toads with illness, and refused to attack live toads. Importantly, Dr Webb also discovered that adult quolls that were trained to avoid cane toads were able to pass this characteristic onto their young. Therefore, training one generation can also increase the survival of future generations.



Cane toads and a northern quoll (inset) - Photos by Jonathan Webb



Cat exclusion fence at Kakadu National Park - Photo by Jaana Dielenberg

Feral cats in the spotlight

In late 2013, two very large cat-proof exclosures were set up in Kakadu National Park near Kapalga, to see whether native mammal numbers improve when predators are removed. The exclosure fences are made of cyclone mesh with a floppy top to prevent cats from entering, and each site encloses an area of 64 hectares. To keep an eye on numbers, NERP researchers led by Dr Graeme Gillespie from the Northern Territory Government, used motion detection cameras, as well as traditional trapping techniques such as cage traps, and compared the number of mammals with areas outside the fences.

The researchers had some success in finding and recording a range of small mammals. They discovered a healthy population of northern quolls living in the Kapalaga area, and recorded a sighting of a brushtail possum, which they

believe hadn't been seen in the area for more than a decade. However, because the project has been running for less than two years, it's still too early to draw any conclusions about the impacts of cats on small mammal decline.

The researchers are also investigating the diets of key predators in the park by analysing their scats or poo. They found that a large proportion of a Dingo's diet contained macropods, which includes animals such as agile wallabies and wallaroos. Cats on the other hand, have mostly been eating medium sized native mammals, such as bandicoots and sugar gliders.

Earlier this year, researchers Brydie Hill, Danielle Stokeld and Tim Gentles, as well as local fence maintenance contractor Peter Christophersen gave an update about the project to Parks Australia Staff and Traditional Owners. You can see some of the presentations on our website.

Protecting bush tucker

Floodplain wetlands in Kakadu National Park are important areas for Traditional Owners to collect bush tucker and other traditional resources. Unfortunately, two exotic grasses have spread extensively across these areas and are making it hard for people to access floodplain resources.

Para grass and olive hymenachne were introduced to the region in the 1940s and 1980s respectively, for grazing. Park managers have been working to minimise the impact of these invasive weeds which can replace native grasses, destroy aquatic habitats and reduce food for native animals in the process. To help manage this problem, Hub researchers led by Dr Samantha Setterfield and Dr Sue Jackson, have been working to determine the most effective strategies to manage the weed threat.

By using information on the history of weed invasion and by doing surveys on the current

pattern of invasion, the researchers were able to build a model that predicts where the weeds will spread next. The researchers also sought input from Traditional Owners affiliated with the floodplains of Kakadu to better understand the impacts weeds were having on Indigenous livelihoods. Thirty seven Traditional Owners helped to describe and map areas of cultural and economic importance, such as sites used for hunting and fishing. Using this information, the predictive weed spread model and information about the costs of management actions, the research team were able to evaluate different management strategies. They found that a plan that focused on both containing weed spread and protecting additional areas important to Aboriginal people, delivered the most benefits. This research will help park managers, including Traditional Owners, to plan strategies to protect key values within Kakadu floodplains.



Paragrass on the Magela floodplain - Photo by Michael Douglas and bush tucker - (inset) - Photo by Glenn Campbell

Which fish are at risk of sea level rise?

Kakadu National Park is home to 62 species of freshwater fish. Many of these species are likely to be affected by climate change over the next century, which is predicted to cause saltwater to come onto freshwater floodplain wetlands because of sea level rise and extreme high tides. As this happens, freshwater plants will most likely die, and there will be less high quality areas for freshwater fish to live in.

Hub research by Dr Mark Kennard and Dr Brad Pusey has identified which freshwater fish in Kakadu are most at risk from increased saltwater

into freshwater areas. The most vulnerable species are those that cannot tolerate saltier water and that depend on sensitive floodplain wetland habitats.

There are 11 species of freshwater fish that are considered to be vulnerable to impacts associated with increased salinity over the next century. The fish species assessed as being most at risk because they are both highly vulnerable and widely exposed to this threat, were the poreless gudgeon, two species of blue-eyes, the rainbowfish, the pennyfish and the northern saratoga. You can read more about this project and view the complete list of the fish at risk of sea level rise, on our website.



The delicate blue-eye (pictured) was one of the fishes assessed as being most at risk. This type of fish is intolerant to increased saltiness in the water and prefers lowland freshwater wetlands, unlike other members of its species group - Photo by Neil Armstrong

Parks Australia working with research findings

New science from the National Environmental Research Program is helping Parks Australia to develop several new programmes aimed at the protection of biodiversity and land management across northern Australia.

Research into floodplain wetlands, food webs, flooding, weeds and vegetation mapping could have far-reaching applications for other regions while providing important information for wetland management within Kakadu.

There will be an extension to the trial of cat enclosure fencing to allow enough time to collect more comprehensive results. Meanwhile, Parks Australia is also investigating potential changes to future fire management after research showed existing practices were potentially harmful to small mammal populations. In particular, the research found that hot late season fires destroy more of the vegetation cover that animals use to hide, making it easier for cats to hunt them. Parks Australia will also continue its work with Indigenous land managers on traditional land and fire management in the development of future management practices.

What is the NERP Northern Australia Hub?

We are a research group funded by the Australian Government's National Environmental Research Program (NERP). Over the past four years we have worked to improve biodiversity conservation in northern Australia's tropical savannas and the region's wetlands, waterways and estuaries.

We would like to thank Kakadu National Park staff and Traditional Owners who have supported and participated in our research.

We greatly value the input of Traditional Owners to research happening on their country.

If you want to know more about any of the projects please contact:

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