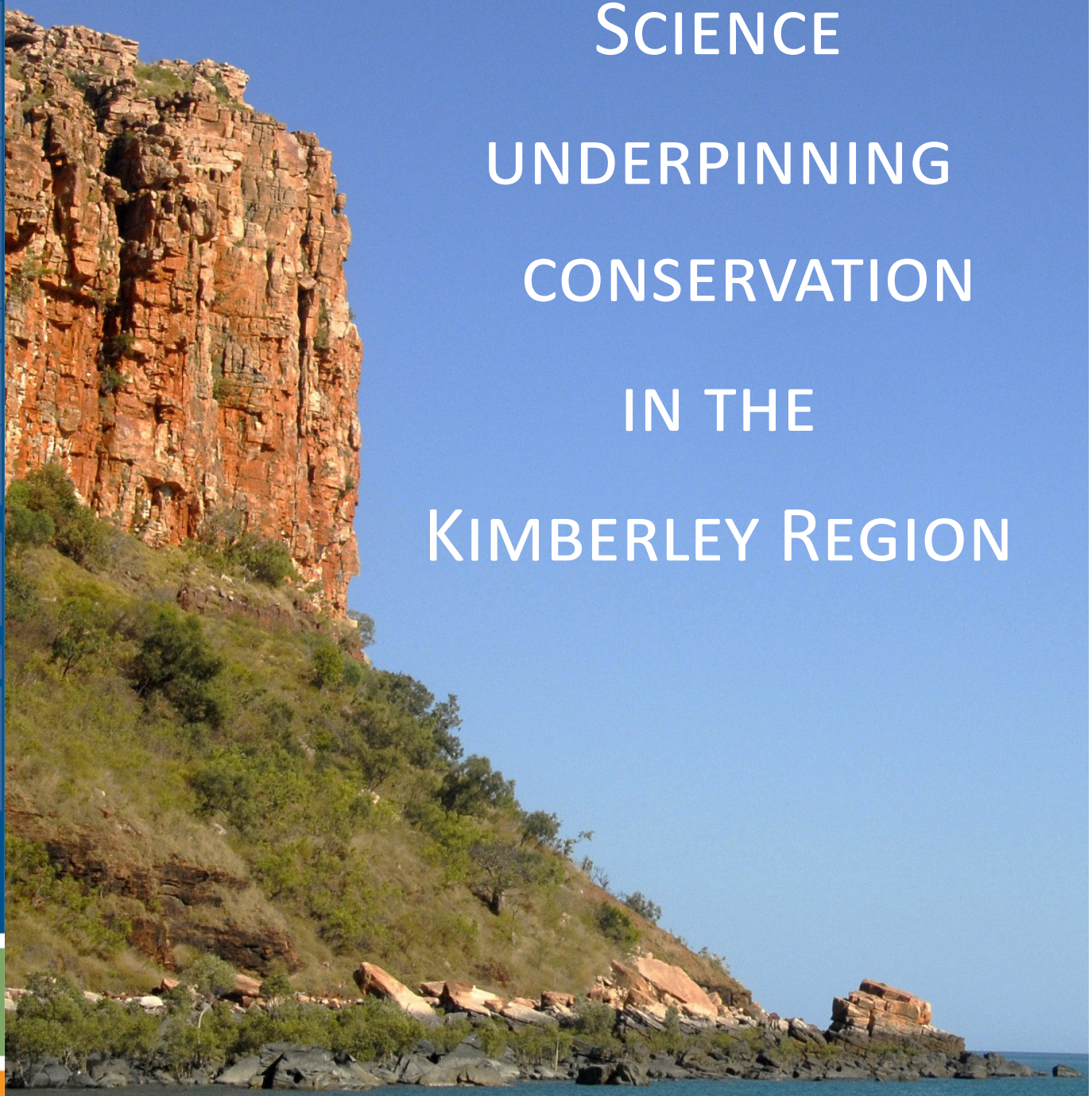
Science and Conservation Division

Science underpinning conservation in the Kimberley Region



Department of
Parks and Wildlife

Lesley Gibson

FOREWARD

Effective communication of the outcomes of science is particularly important for ensuring the results inform conservation policy and wildlife, forest and parks management practice. Science undertaken in the Science and Conservation Division is carried out in collaboration with staff in the regions and our research partners, which include CSIRO, universities and industry. We highly value these partnerships, which deliver immense benefits in providing a scientific, evidence-based approach to conservation.

To facilitate communication with all regional staff we have produced a series of non-technical publications that describe the science we are undertaking in each of the regions of the Department. These 'Science in the Regions' publications capture a snapshot of current science activities that support wildlife, forest and parks management in each region, and are available on the website. Please contact any of our scientists if you would like more information on any of the topics described here.

Dr Margaret Byrne, Director, Science and Conservation Division

Lesley Gibson

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Kimberley islands biological survey

The more than 2500 offshore islands along the Kimberley coastline are likely to play an increasingly important role in the conservation of Kimberley ecosystems as environmental and developmental pressures affect the mainland. From 2007 to 2010, scientists from Parks and Wildlife and the Western Australian Museum, in partnership with Balanggarra, Uunguu, Dambimangari, Mayala and Bardi-Jawi traditional owners, undertook four dry season and three wet season surveys on 24 islands ranging in size from 300 to 19,000 hectares. The surveys focused on vertebrate and selected invertebrate groups (particularly land snails) at risk from threats to biodiversity on the Kimberley mainland. Information was also collected on terrestrial flora, soil and other environmental factors that may help explain the compositional patterns of communities.

The survey revealed that 74% of mammal, 59% of reptile, 70% of frog, 69% of bird and 56% of plant species found in the North Kimberley bioregion also occurred on the islands surveyed. Some groups, such as small insectivorous mammals, large mammals and large reptiles, were largely absent from the islands surveyed. The most surprising result was that 74 new species of land snail were discovered, and that 73 of the 89 camaenid land snails recorded in the Kimberley are only known from offshore islands, with 62 of these endemic to a single island. Ten species of reptile are also only known from the Kimberley Islands.

The most rugged islands in the high rainfall zone of the north-west Kimberley had the greatest numbers of endemic species, and these islands will be a particularly important focus for future conservation management. Yet those islands with lower rainfall often supported unique communities of species, and some were considered to be important refuges for the northern quoll (*Dasyurus hallucatus*) and golden-backed tree rat (*Mesembriomys macrurus*). Almost every island contained at least one endemic species of land snail, emphasizing the importance of all of the Kimberley islands as conservation refuges into the future.

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Teaching about toads

The arrival of cane toads in the ecosystems of the Top End has been accompanied by the rapid collapse, and often the local extinction, of native predators such as northern quolls, goannas and brown snakes. As cane toads continue to invade further west into the Kimberley, scientists have been investigating which species of lizards and snakes are most likely to attack and consume cane toads. They found that skinks, dragons, goannas, elapid and colubrid snakes and pythons all attacked cane toads, with the larger-bodied elapid snakes and goannas particularly likely to ingest a toad and die. Many types of skinks and dragons did not attack toads, and many colubrid snakes either did not consume toads or were resistant to their toxin.

Given the high vulnerability of goannas, researchers from Parks and Wildlife and the University of Sydney are working with Balanggara Rangers to see if goannas ahead of the invasion front can be 'taught' not to eat cane toads. The team are working on the Forest River floodplain in the east Kimberley, where they offer small, less toxic, 'teacher' toads to goannas. The amount of bufotoxin in these small toads is enough to make the goanna ill, but not kill them. The research team can then track these goannas and discover if they are less likely than non-trained goannas to eat larger toads when they arrive. The process, known as 'conditioned taste aversion', has also been trialled on northern quolls (*Dasyurus hallucatus*), using sausages made from toads instead of live toads. If the concept works, there is the opportunity to use 'teacher toads' on a wider scale.

Preliminary results suggests that goannas can be trained to avoid toads. While there are significant logistical difficulties in releasing teacher toads across broad areas of the region, this approach can be used to maintain populations of native predators in specific and important locations, such as in areas of critical habitat or on islands where cane toad invasion may be minimized.

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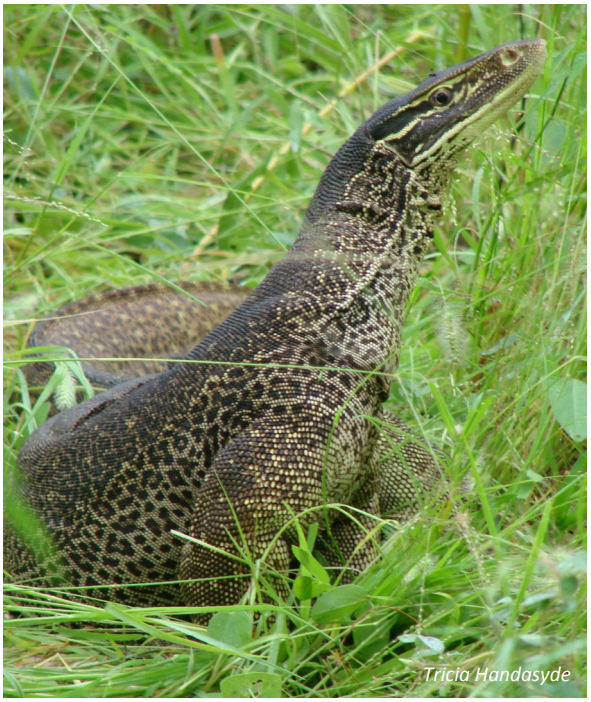
Tricia Handasyde


Norm McKenzie

Fire and cattle management to benefit native mammals

As part of the North Kimberley Landscape Conservation Initiative (LCI), scientists, in partnership with Wunambul Gaambera, Ballangara and Willingan traditional owners, have been monitoring how fire management and the removal of cattle have affected the populations of critical-weight-range mammals in a number of sites in the King Leopold, Mitchell River, Prince Regent and Drysdale River national parks. The LCI has seen the amount of land burnt by late season fires significantly reduced, so that now an equal proportion of land is burnt during the early and later periods of the dry season.

Overall, this shift away from the dominance of late dry season fires has benefitted mammal assemblages, with the number of mammal species and their abundance stable or increasing relative to data obtained from previous surveys in 1981–82, 2003–04 and 2007–10. The removal of cattle has also had significant benefits for mammal populations. The brush-tailed rabbit rat (*Conilurus penicillatus*) and golden-backed tree rat (*Mesembriomys macrurus*) have increased in areas where cattle have been culled over the past four years. Conversely, the diversity and abundance of mammals was found to be lower in the more inland areas of Mitchell River National Park where cattle density is higher and fire has been more frequent in the past decade.

Continuing to actively manage planned burns so that a greater proportion of fires occur in the early dry season, combined with the removal of cattle from conservation areas, will improve conservation outcomes for threatened mammal species in the Kimberley.

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Shannon Armstrong

Effective and reliable surveys of fish communities

Fish communities in shallow coastal waters have traditionally been monitored by underwater visual census—a technique which requires little equipment but a high degree of observer expertise to identify fish species *in situ*. Underwater video camera techniques are increasingly used to assess fish communities in shallow waters, whereby stereo-video is used to capture images of a fish community that are later analysed in the laboratory. Diver operated video theoretically requires less scientific expertise than visual census, takes less time in the field, video footage can be repeatedly screened with access to reference material, and it provides a permanent record of the survey.

Scientists determined the comparability of the data collected using both techniques, as well as their overall utility and cost-effectiveness, for fish communities in the Rowley Shoals Marine Park (Kimberley), Ningaloo Marine Park (Pilbara), Jurien Bay Marine Park (Midwest) and Rottnest Island Marine Reserve (Swan). These locations covered the tropical and subtropical coral reefs and temperate rocky reef systems that characterize shallow coastal waters in Western Australia. Visibility and fish diversity vary across the locations, so the techniques were able to be assessed in waters with low or high visibility and with different fish communities.

Datasets from each technique were most comparable in temperate locations where fish diversity was lower, or when the data was assessed at broad functional or taxonomic levels. Visual census consistently recorded higher levels of species richness, particularly at tropical locations where fish diversity is high, and also was more efficient at detecting cryptic species. Data collected by video required extensive post-processing, with up to three times the time investment post-field than census data. While the choice of the most appropriate method to use should be based on both management objectives and resource availability, when significant expertise is available, visual census is considered to be the most cost-effective choice.

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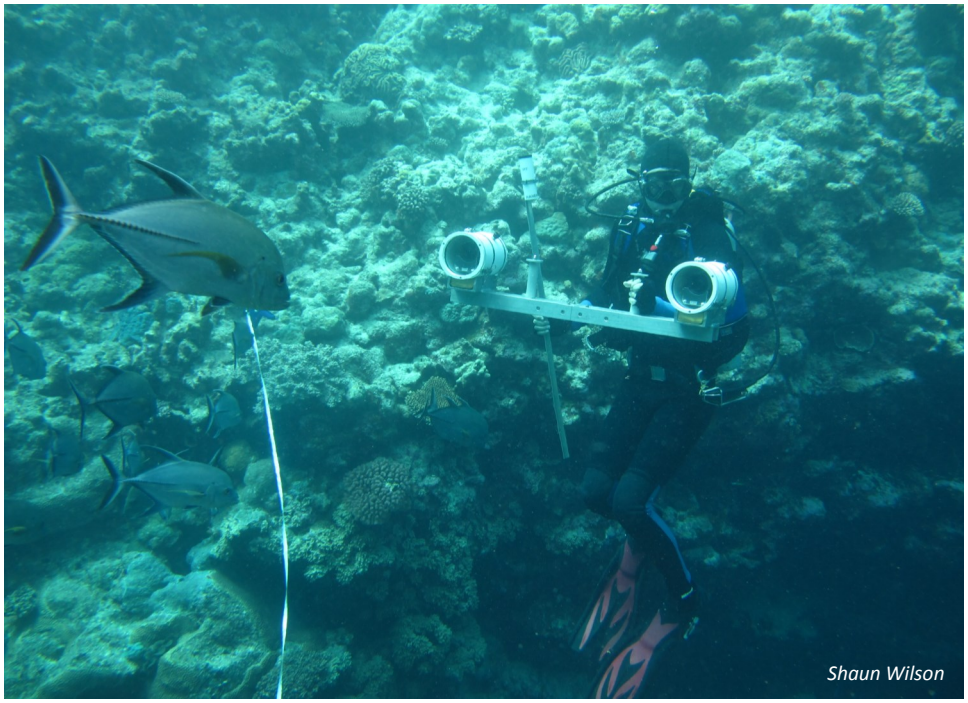

Shaun Wilson

Marine Science Program


Judy Dunlop


Mike Lyons


David Pearson

Patterns of community change in small-scale fire mosaics

Altered fire regimes have been implicated as one of the factors that have led to population declines, and ultimately extinctions, of many native species, particularly the critical-weight-range (CWR) mammals. Scientists have been investigating how fire influences the abundance of fauna in the north and east Kimberley. In particular, they have been examining how fire affects vegetation structure and the availability of food resources, and if this leads to changes in the abundance of CWR mammals, reptiles, frogs and invertebrates.

They found that small-scale fires in savanna vegetation had little direct influence on the abundance of mammals and other fauna. Instead, fires had an indirect trophic effect: the loss of ground-level vegetation led to changes in the prey items selected by predators. Northern quoll (*Dasyurus hallucatus*) and golden bandicoot (*Isoodon auratus*), for example, were more successful at catching and ingesting larger prey at sites that were recently burnt. The loss of the grass layer led to an immediate and large decline (80–90%) of the total number of invertebrates, but invertebrate communities had recovered by the first wet season after the fire, with no detectable changes in invertebrate numbers up to four years after fire. Loss of this food resource is therefore not a factor in the decline of insectivorous predators in areas with altered fire regimes.

Despite fire causing large changes in vegetation structure in pindan woodlands, few changes in fauna were observed, indicating that pindan fauna are mostly resilient to fire. Large *Ctenotus* skinks and larger rodent species, however, showed a preference for vegetation that had not been burnt for four or more years. The resilience of the Kimberley fauna to small-scale fire indicates that fire mosaics with patch-burn sizes of less than a square kilometre are most likely to favour the continued survival of the CWR mammals. While not likely feasible at the regional level, fine-grained mosaics could be tested for conservation benefits within targeted management areas.

The final component of the project looked at whether patches of the fire-sensitive white cypress pine (*Callitris columellaris*, formerly *C. intratropica*) acted as fire refugia for other fire-sensitive plants and animals. While *Callitris* stands had a different structure to surrounding vegetation and were important indicators of the severity of local fire regimes, they did not contain greater proportions fire-sensitive flora or fauna. Other known refuges for fire-sensitive species, such as rocky outcrops, sandstone heathlands and rainforest and riparian forest, should be the focus of management actions directed at conserving these species.

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Mike Lyons

Marine monitoring for better management

Long-term datasets help us understand the direction and rate of change in ecosystems, so that managers can identify change related to human activities from underlying natural change. The Western Australian Marine Monitoring Program (WAMMP) aims to provide such information to marine conservation managers, so that they can respond to changes in marine biodiversity and ecosystem condition as they become apparent. The program is a state-wide, long-term monitoring, evaluation and reporting program of both protected areas and threatened marine fauna.

In marine parks that contain coral reef communities, the relative cover of live coral across the entire coral reef system is a key measure of the health of the community. The coral communities of the Rowley Shoals Marine Park (RSMP) are a key ecological and recreational feature of the park. The RSMP experiences a higher incidence of cyclones than any other marine park in WA, with a cyclone coming within 50 km of the park every two to four years. The last cyclone to pass close to the park was in 2013.

The impact of periods of high ocean temperatures, such as occurred in the summer of 2010–11, along with predictions of more frequent and intense storms as the climate warms, have the potential to cause severe degradation of coral communities in the RSMP, despite its relatively isolated location. Yet scientists have not observed any sustained decline in coral health owing to coral bleaching within RSMP, and coral cover has actually increased on Clerke and Imperieuse reefs to 55% and 43% respectively.

The information gained through the monitoring program has shown that the coral communities of the Rowley Shoals are in good condition, and show resilience to periods of ocean warming and wave damage caused by storms.

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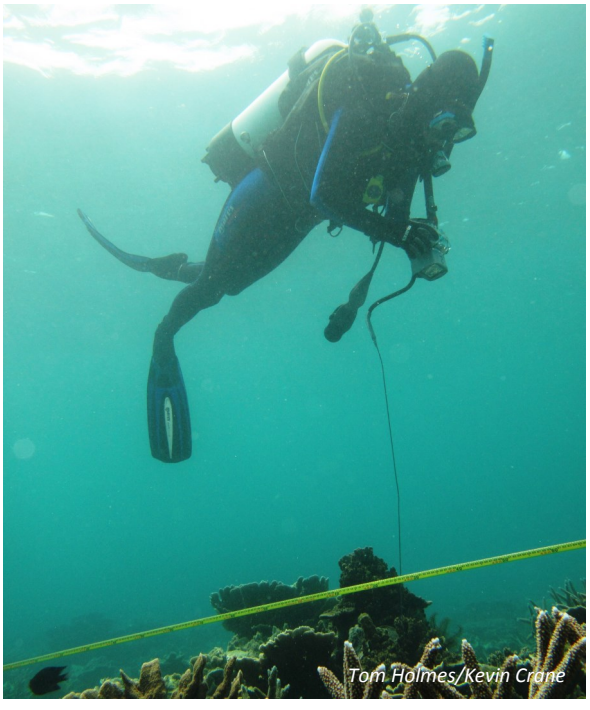
Marine Science Program


Andrea Whiting


Tom Holmes/Kevin Crane