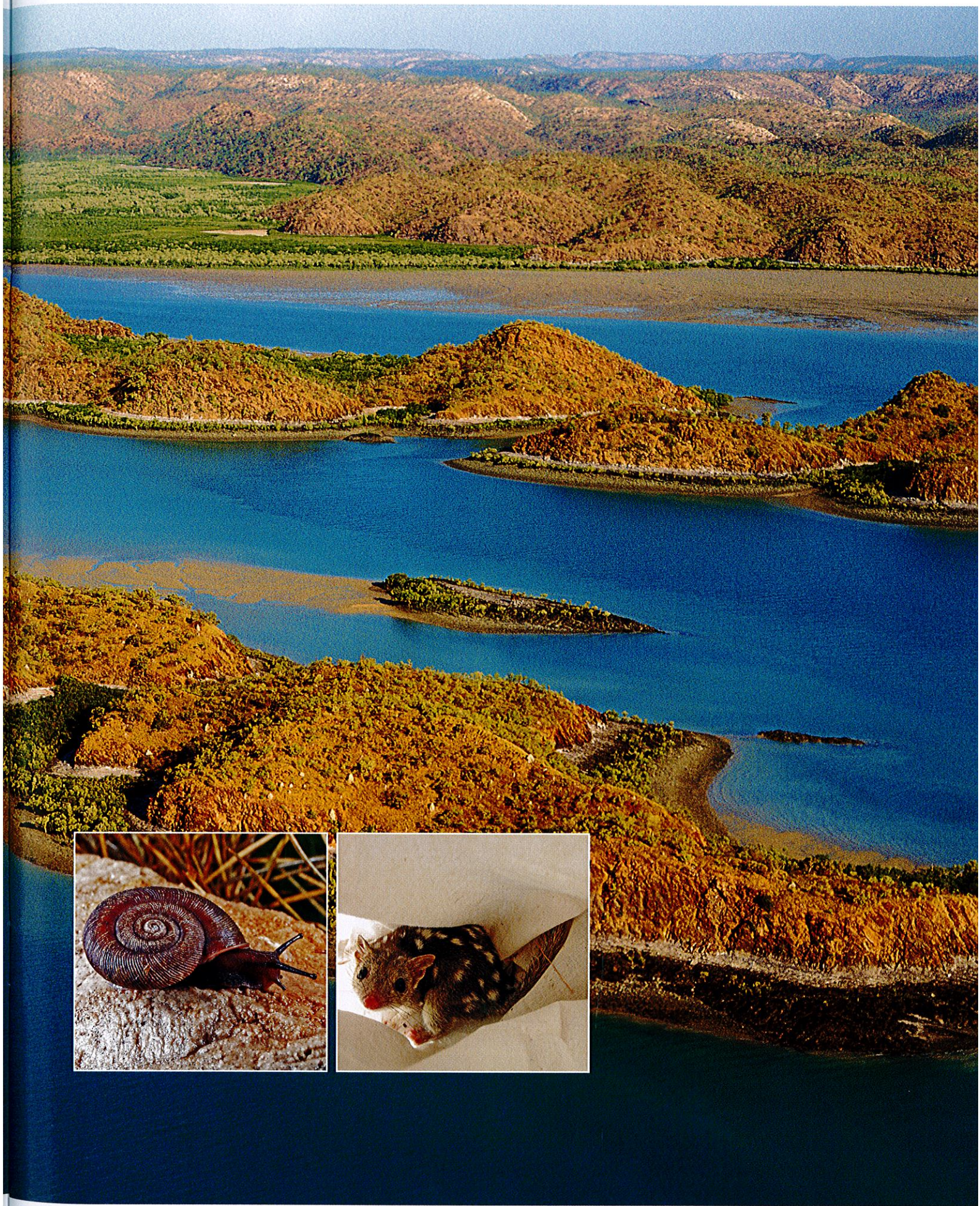


Treasures revealed: Kimberley islands biodiversity

Scientists have now pooled together data from four years of often gruelling biological survey work on the remote Kimberley islands. This has revealed a remarkable suite of animals, including several new species of land snails, many of which inhabit nowhere else but a single Kimberley island.

by Lesley Gibson



Tropical islands bring to mind thoughts of white sandy beaches, crystal clear blue water and, for some, cocktails by the pool. But along with providing sun, sand and surf, islands also play a significant role in the conservation of plants and animals. Not only do they act as refuges for species that have suffered major contractions of their distributions on the mainland, but some islands are also important for the endemic and threatened species which inhabit them. Some islands also provide secure breeding sites for seabirds and turtles. Unfortunately, islands are also susceptible to dramatic changes to their ecosystems when exposed to environmental disturbances such as grazing by feral herbivores, fire, and invasion by non-native species. Globally, extinction rates are much greater on islands, with well over half of bird, mammal, reptile and plant extinctions being island species. It is vitally important to protect islands from undesirable disturbances.

Thousands of islands

Just under a third of all Australia's islands are situated along the remote Kimberley coast of north-western Australia. In excess of 2,500 islands



along this visually stunning coastline were formed as a result of rising sea levels up to 10,000 years ago. These near-pristine islands have been relatively isolated from many of the threats affecting the adjacent mainland, including changed fire regimes and feral animals. The Kimberley islands also represent part of the traditional lands of Aboriginal people in the region and are of great significance to them. Many of the islands have been subject to native title determinations or are under native title claim. We know these islands have high conservation values but for most of them we have only limited biological knowledge. There is an urgent need to gain a better understanding of their biodiversity.

A biological survey

In late 2006, scientists from the Department of Environment and Conservation (DEC) and the Western Australian Museum, in partnership with Balangarra, Unguu, Dambimangari, Mayala and Bardi-Jawi traditional owners (coordinated by the Kimberley Land Council), embarked on a biological survey of the Kimberley islands (see 'Treasures of a sunken coastline', *LANDSCOPE*, Winter 2008). This logistically challenging survey aimed to expand knowledge of six ecologically and biogeographically different components of biodiversity across the variety of islands. The information gained was to provide the knowledge base for decisions on conservation, recreation and sustainable development. The survey focused on species groups believed to be most at risk from threats to biodiversity on the Kimberley mainland, and included mammals, reptiles, frogs, land snails, birds and plants.

During four dry season (winter) and three wet season (summer) surveys from 2007 to 2010, field teams documented the occurrence of plant and animal species they encountered from 24 islands ranging in size from 300 to 19,000 hectares. Since the completion of field work, scientists have been busy identifying species, compiling and analysing the data and presenting the results in scientific papers and spoken presentations.



Previous page

Main The island-studded Kimberley coastline at Strickland Bay.

Photo - Col Roberts/Lochman
Transparencies

Inset left The snail species *Retroterra discoidea* is endemic to the Kimberley islands.

Photo - Vince Kessner

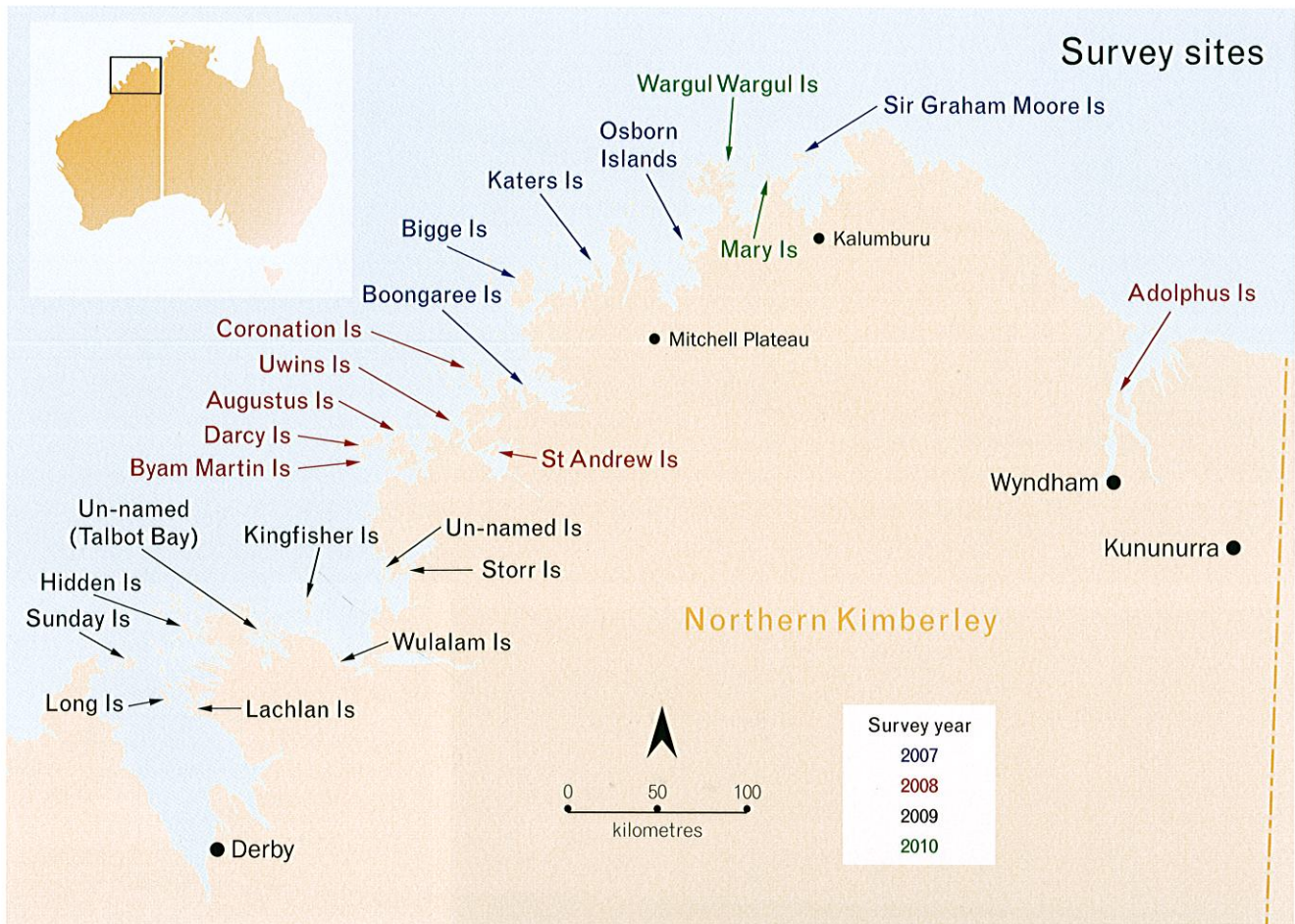
Inset right Northern quoll.
Photo - Lesley Gibson/DEC

Above Golden bandicoot (*Isoodon auratus*).

Photo - Mark Cowan/DEC

Left The survey helicopter approaches Hidden Island.

Photo - Lesley Gibson/DEC



Right Traditional owner Jahni Isaac and zoologist Duncan Sutherland set a funnel trap line for reptiles on Long Island.
 Photo - David Pearson/DEC



Now near completion, the papers are being made publicly accessible on the Western Australian Museum website at www.museum.wa.gov.au/research/records-supplements/supplements/supplement-81 as they are finalised. Traditional owners, with assistance from the Kimberley Land Council and consultant anthropologists, also contributed a paper that describes Aboriginal connections, values and knowledge of the Kimberley islands. This paper emphasises the importance of research partnerships with traditional owners in the Kimberley region, and describes a research agreement that provided for managed access to cultural sites, participation in the field work alongside scientists, data sharing, and input into the final publications.

Biodiversity values

Field work on the Kimberley islands is physically demanding. This is due in part to the hot and humid tropical

climate, but also to the rugged terrain which makes these islands very difficult to traverse on foot. Nevertheless, all the hard work paid off, with species lists more than doubled for most of the islands where historical information existed, and a significant amount of new information gathered for those islands not previously surveyed.

Based on current estimates, 74 per cent of mammal, 59 per cent of reptile, 70 per cent of frog, 69 per cent of bird and 56 per cent of plant

species of the Northern Kimberley bioregion are collectively now known to occur on the islands surveyed. While lower species diversity on the islands was expected, surprisingly some species that are widespread on the adjacent mainland were not recorded on the islands. For example, small insectivorous mammals such as dunnarts and planigales were not detected on the islands. Large mammals, such as the antilopine wallaroo (*Macropus antilopinus*) and euro (*M. robustus*), and reptiles, such as the larger goannas and



Above Traps were set on Long Island.
Photo - David Pearson/DEC



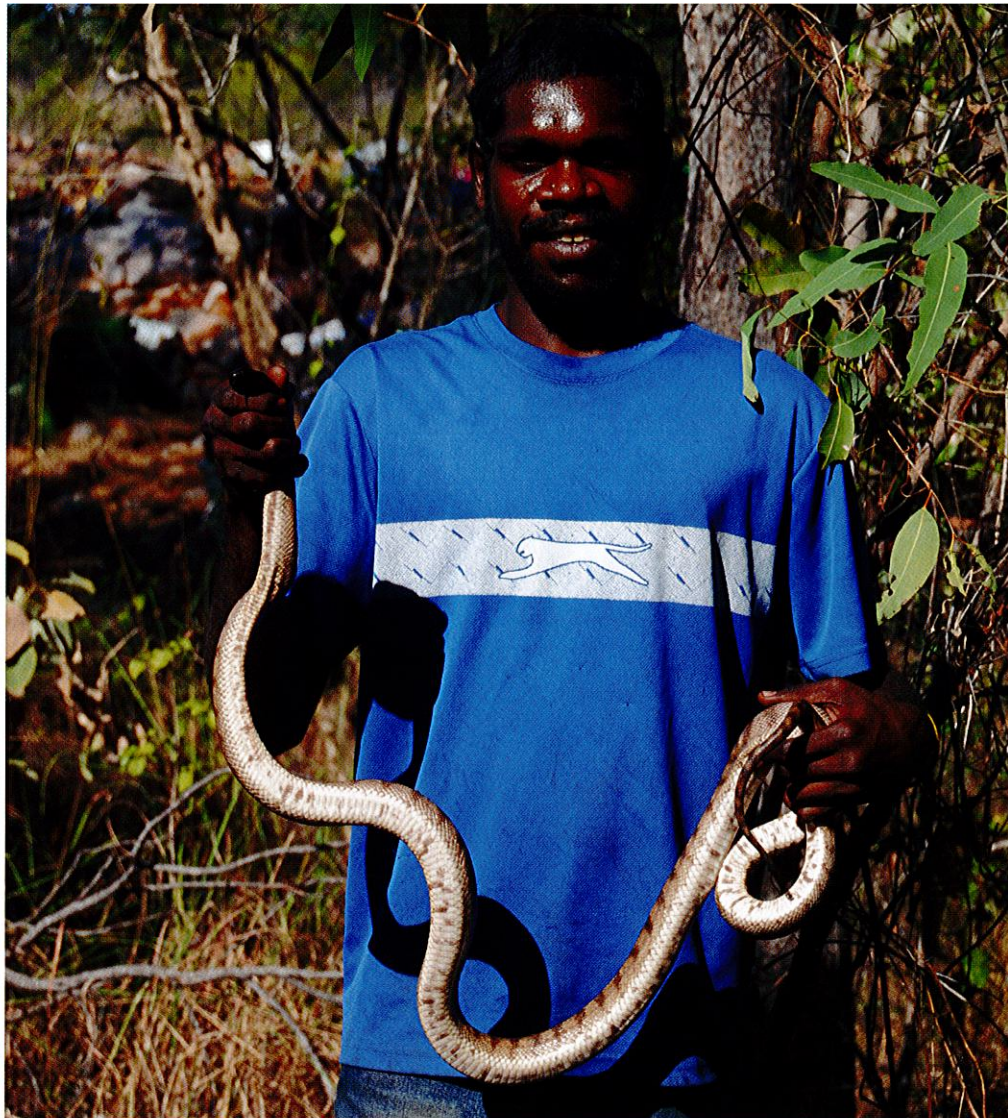
Left An olive python captured during surveys on Saint Andrew Island by zoologist Mark Cowan and traditional owners Jeanine Numendumah and Sonnette Ozies.

Below left A northern quoll is released back into the wild by botanist Tricia Handasyde.
Photos - Lesley Gibson/DEC



snakes, were also apparently absent or rare on the islands. However, the limited resources on islands, such as food, water and habitat, are likely to prevent the persistence of such large animals. There was one exception, the olive python (*Liasis olivaceus*), which was relatively common on the islands. This very large snake (up to four metres long) is a capable swimmer, easily able to swim between some of the closer islands and the mainland. A crew member from one of the expedition vessels was surprised when an olive python boarded his boat anchored 700 metres from the shore. Another unexpected finding was the large number of frog species found on the islands, as permanent freshwater is scarce on all but a handful.

Previously unknown island populations of many vertebrates were discovered. This included two new populations for each of three threatened species—the northern quoll (*Dasyurus hallucatus*), golden bandicoot (*Isodon auratus*) and golden-backed tree-rat (*Mesembriomys macrurus*). At least three new reptile species were discovered (see 'A little gecko tells a big



story', *LANDSCOPE*, Spring 2011). An astonishing result was the number of new land snail species discovered on the islands, with 74 distinct new species now described (see 'Diversity hot spot revealed: land snails of the Kimberley', *LANDSCOPE*, Spring 2010).

A significant number of species endemic to the Northern Kimberley mainland were also detected on the islands. This included all five endemic mammals, almost all of the frogs and reptiles, and more than half of the birds. A total of 10 vertebrate species, all reptiles, were restricted to islands with no known mainland distributions. However, among the land snails, an amazing 73 of the 89 camaenid land snails discovered (Camaenidae being the dominant family in the Kimberley) are only known from the islands, and 62 of those were endemic to a single island.

Biodiversity patterns

In a major survey like this, the compilation of comprehensive species lists for each island is one important outcome. However, to take it one

step further, an examination of biogeographic patterns—that is, where species occur, with whom, and why—is what helps set conservation priorities. A strong positive relationship between the number of species detected on an island (or its species richness) and its area was apparent; as a generality, the larger the island, the more species occur there. In fact, the species-area relationship is considered to be one of the few 'laws' in ecology. Bigger islands tend to have a greater number of habitats, and more of each one, and so can support a wider range of species.

The most rugged islands of the high rainfall zone (more than 1,000 millimetres on average per year) of the north-west Kimberley typically had the greatest numbers of endemic species, a pattern also observed on the adjacent mainland. Since rainfall determines soil moisture, vegetation growth and productivity, the importance of this climatic variable is not surprising. In turn, spatially complex and rugged boulder country results in diverse habitats that are largely protected from fire and damage due to cyclones.

Top left A swallowtail butterfly and wildflowers (*Spermacoe* sp.) on Boongaree Island.

Photo – Lesley Gibson/DEC

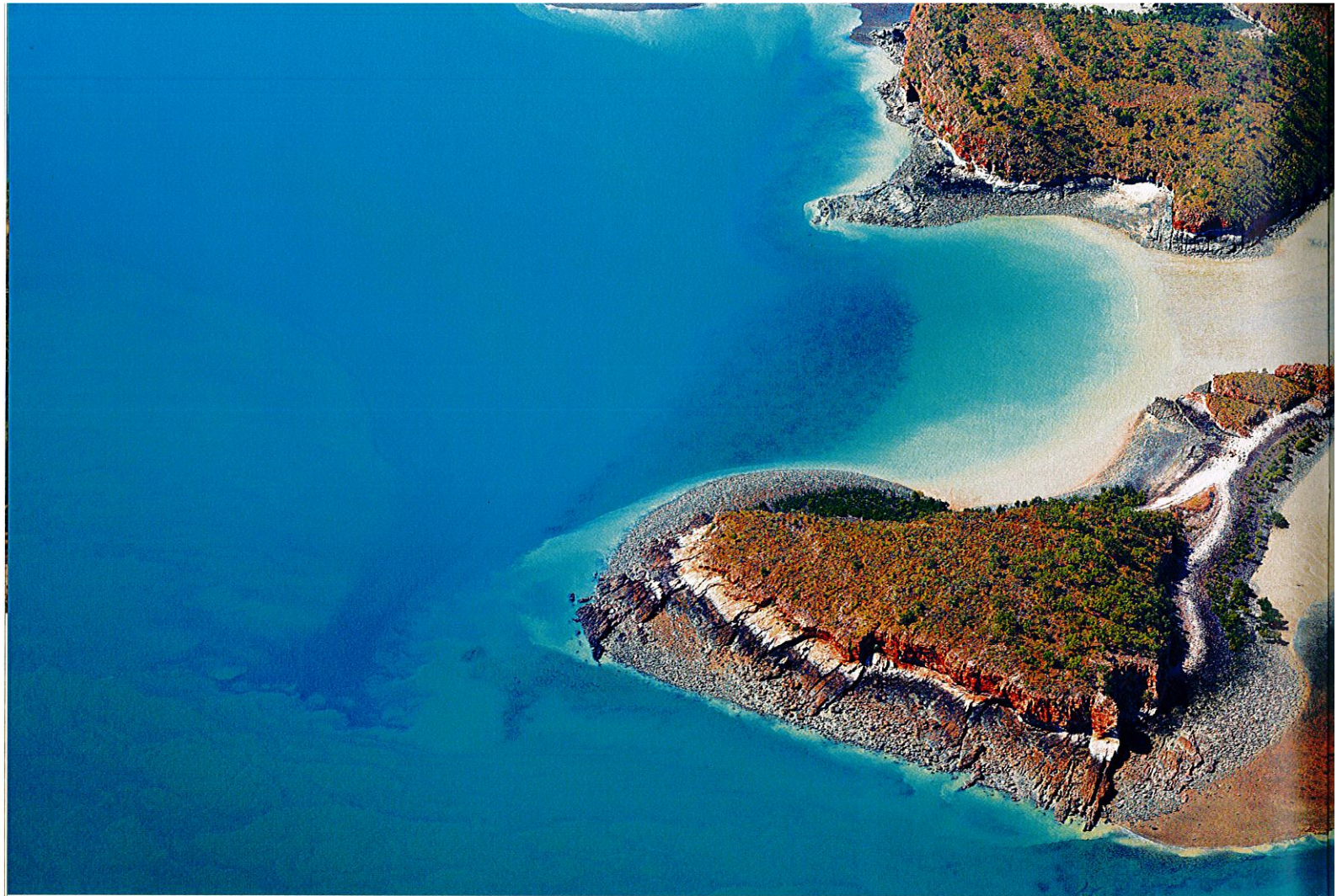
Above Traditional owner Craig Rastus holding a recently caught black-headed python (*Aspidites melanocephalus*) on Storr Island.

Photo – Mike Lyons/DEC

Above left Sticky kurrajong (*Brachychiton viscidulus*) on Wulalam Island.

Photo – Tricia Handasyde/DEC

The number of habitat types in a given area not only influences the number of species, it also affects the suite of species that are likely to occur there. For example, species that prefer monsoonal rainforest are more likely to persist on high rainfall islands, since the extent of rainforest on islands was positively correlated to rainfall. The high rainfall and dissected rocky islands contained species associated with those habitat types on the mainland, whereas drier islands with more subdued topography supported widespread species with more general

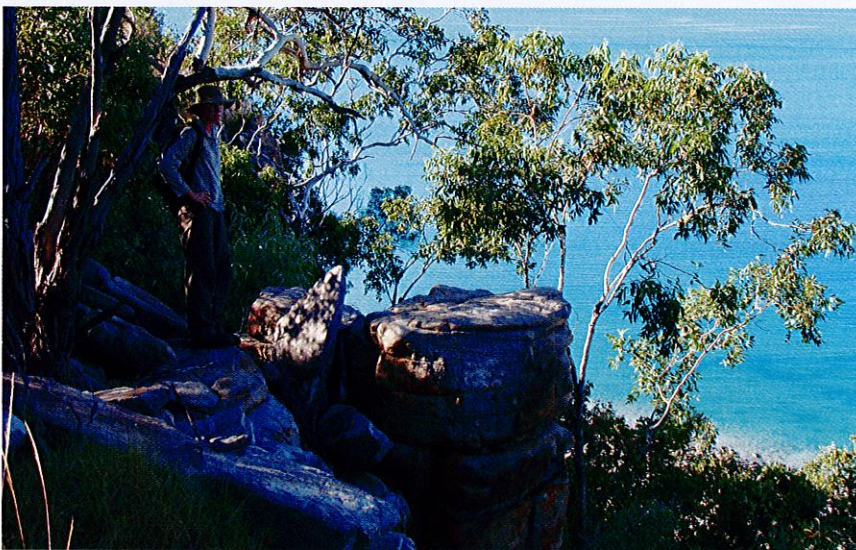


Above More than 2,500 islands line the Kimberley coast.

Photo - David Bettini

Left Senior research scientist Lesley Gibson on Darcy Island.

Photo - Tricia Handasyde/DEC



habitat requirements and distributions extending into semi-arid and arid zones.

Pesky species

Fortunately, there was little evidence of introduced animals on the 24 islands sampled. Despite historical records of the European rat (*Rattus rattus*) on Sunday Island, the species was not detected during the Kimberley island survey (see 'The mysterious case of the black rat on Sunday Island', on page 42).

However, records of feral pigs on Sir Graham Moore Island were confirmed during the dry season survey in 2008. Few weeds were recorded, with no more than three species on most of the islands surveyed. The most significant weed on the islands was the stinking passionflower vine (*Passiflora foetida*) which was ubiquitous, and particularly abundant along drainage lines, rainforest margins and beach swale thickets.

However, the relative lack of introduced species on the islands

gives no reason to be complacent. The rugged beauty of the Kimberley islands, and this section of coastline in general, attracts many visitors each year, who arrive by boat or helicopter. With increasing human activity, the risk of species being introduced to the islands also rises. Many pest species can 'hitch' a ride to islands with people; examples are the cane toad (*Rhinella marina*), the Asian house gecko (*Hemidactylus frenatus*) and introduced rats and mice. Visitors to islands can also inadvertently introduce weeds via seeds hidden in clothing or equipment. Once pest species invade islands, they can be notoriously difficult and expensive to eradicate. Cane toads are a major threat to the biodiversity of some Kimberley islands. As many islands are close to the mainland, and several are



Above Yellow-spotted monitor (*Varanus panoptes*) on Adolphus Island. Photo – Tricia Handasyde/DEC

located in river mouths, the risk of toads rafting or swimming to islands is high.

Cane toads have colonised many islands off the Queensland and Northern Territory coastlines, with severe consequences to the fauna. Several species known to be susceptible to poisoning by ingestion of cane toads were recorded on the Kimberley islands, including the carnivorous northern quoll, six species of goanna, the blue-tongue skink (*Tiliqua scincoides*) and several species of snake including the death adder (*Acanthopis praelongus*). Strategies to prevent cane toads reaching islands are crucial, as are regular surveillance to detect them if they sneak ashore, and eradication programs.

What does it all mean for the islands?

In terms of their value for conservation, the largest islands in the highest rainfall section of the northern Kimberley coast are particularly important due to their high species diversity, including numerous regional endemics. However, while

low rainfall islands generally contain fewer species, they often have unique communities and some are important refuges for threatened mammals such as the northern quoll and golden-backed tree-rat. Probably the most compelling conservation message comes from the remarkable patterns observed in the land snails. They display incredibly high levels of island endemism such that almost every island conserves one or two unique species. Together the islands capture the incredible diversity of these delicate survivors from a time

when the north Kimberley was much wetter than it is today.

The Kimberley Islands Biodiversity Survey has confirmed the immense value of these islands as conservation refuges. The islands are also important culturally and economically for a number of Aboriginal groups along the north Kimberley coast. Future management is likely to be dependent on mutually agreed strategies which protect both the biodiversity and the cultural treasures of these spectacular islands.

Lesley Gibson is a senior research scientist at the Department of Environment and Conservation (DEC) and is the Kimberley Islands Biodiversity Survey project coordinator. Lesley is based at DEC's Wildlife Research Centre in Woodvale. She can be contacted by email (lesley.gibson@dec.wa.gov.au).

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- 49 Slowing the extinction of insects
Translocations of insects and their host plants is helping to conserve biodiversity in the south-west.
- 55 A tree marked B
The shifting sands of Nambung National Park have revealed long-forgotten historical secrets.
- 60 Citizen scientists monitor marine change
Everyday fishers, divers and marine enthusiasts are helping to document marine species distribution as part of a new monitoring program.

Regulars

- 3 Contributors and Editor's letter
- 9 Bookmarks
500 Plants
Australasian Nature Photography
Adventures in Wild and Wonderful Places
- 40 Feature park
John Forrest National Park
- 31 Endangered
Purple-crowned fairy-wren
- 62 Urban Antics
Grass trees

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