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Seed-bank sleuths

EXOTIC plants have gained a stronghold along the edges of many native vegetation reserves in urban areas. But are their seeds also restricted to the edges? And does the above-ground vegetation match the contents of the seed bank?

To find out, Scott King and Rod Buckney, of the University of Technology in Sydney, assessed the soil seed bank at 10 urban bushland sites in northern Sydney. Soil samples were collected from quadrats 0–10, 20–30 and 50–60 metres from the edge of each site and germinated, and the resulting seedlings identified. Plant species at each quadrat were also recorded.

The scientists found that exotic species were concentrated near urban edges in both the vegetation and the seed bank. They also found that the above-ground vegetation was a poor indicator of the contents of the seed bank, for both native and exotic species.

'Most exotic species found in the seed bank were not found in the immediately surrounding vegetation,' King says. 'And some exotic species were found in the seed bank at sites where no exotic species were present in the vegetation.'

Indeed, 84% of the exotic species that germinated from the seed bank were not found in any vegetation quadrat, suggesting the seeds may have come from further afield.

These findings suggest that it is a lack of suitable conditions, rather than a lack of seed, that confines the invasion of exotic species to bushland edges. This has implications for habitat regeneration, particularly when using natural germination from the seed bank. 'As a general rule, alterations to natural conditions should be minimised throughout urban bushland to prevent invasion,' King says.

King SA and Buckney RT (2001) Exotic plants in the soil-stored seed bank of urban bushland. *Australian Journal of Botany*, 49:717–720.

Wendy Pyper

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Fishy issues

WORLDWIDE concern about the state of fish stocks and a widely held view that fisheries management has been un successful are putting fisheries science and management under increasing scrutiny. Concern also surrounds the impact of fishing on ecosystems, the capture of non-target fish, and the effects of fishing on threatened species.

Australia's South-east Fishery, which covers waters from just north of Bundaberg, Queensland, to the Western Australia-South Australia border, including water around Tasmania, is one of the country's oldest and most valuable fisheries. The bulk of the fishing occurs between Sydney and Kangaroo Island.

In a special issue of CSIRO's Journal of *Marine and Freshwater Research* devoted to the South-east Fishery, Dr Tony Smith of the CSIRO Division of Marine Research, and Dr David Smith of the Victorian Department of Natural Resources and Environment summarise important issues relating to the fishery. They say that since commercial fishing began in 1915, it has evolved from a simple trawl fishery targeting a few species into what could be dubbed a 'multi-everything' fishery.

'The key external challenge to the fishery during the next five years will relate to environmental effects of fishing,' they say.

Two pieces of federal environmental legislation are having an important influence on Australia's fisheries.

A decision to remove automatic exemption of commercial fish species from the *Wildlife Protection Act 1984* means all Australian fisheries will require approval from the Federal Minister for the Environment to export fish products. This environmental certification will require an assessment not only of the status of fish stocks and the sustainability of exploitation, but also the impact of fishing on the wider ecosystem.

The *Environmental Protection and Biodiversity Conservation Act 1999* will require environmental impacts of all federally-managed fisheries to be assessed and will audit fishery management plans for compliance with the Act.

Recent responses in the South-east Fishery have included development of an industry code of conduct and a bycatch action plan. A plan to bring together the existing trawl, non-trawl and shark fisheries under a single management plan will prove especially challenging.

A new advisory committee has been set up to deal specifically with ecological issues in the fishery.

Smith ADM and Smith DC (2001) A complex quota-managed fishery: science and management in Australia's South-east Fishery. Introduction and Overview. *Marine and Freshwater Research*, 52:353–59.

Steve Davidson

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Coral cuisine

FOLLOWING the annual mass spawning of corals on the Great Barrier Reef, planktivorous fish indulge in a feeding frenzy among the slicks of nutritious gametes. Some marine invertebrates, such as sponges, employ chemical defences against predation of their propagules, reducing their palatability. But little is known about the chemical defences, if any, of coral propagules.

To test whether the eggs of some common coral species on the reef are equally palatable to common planktivorous fish and, if not, whether the differences have a chemical basis, scientists at James Cook University and the University of New South Wales fed captive fish (*Pomacentrus moluccensis*) a selection of coral egg pellets.

The eggs from eight species of coral were harvested from captive colonies and made into hard, dry pellets by mixing with water and sodium alginate. Control pellets were made using macerated squid mantle flesh.

Stuart Pearson

Stick-nest rat middens can provide a window to the past.

Groups of two to three fish were offered a palatable control pellet and when that was consumed, a coral egg pellet was offered. This sequence was repeated and the number of control and treatment pellets consumed was recorded. To determine whether rejected eggs were chemically defended, a crude extract from the eggs was then combined in the palatable control pellets.

The scientists found that the eggs of five acroporid and two faviid corals were readily consumed (80–95%). This result confirmed suggestion that fish predation plays an important role in the mortality of coral propagules of many species, but only 60% of pellets made from the eggs of one agariciid coral (*Pachyseris speciosa*), were consumed however.

'The *P. speciosa* pellets were always tasted then rejected, suggesting the fish found them distasteful,' Dr Andrew Baird of James Cook University says. 'This is the first demonstration of chemical defence against predation in gametes of this type of coral.'

Baird suggests that the presence of a chemical defence in the eggs of *P. speciosa* and not the more abundant coral groups, could be related to spawning ecology.

'The Acroporidae and possibly the Faviidae may be the only groups abundant enough to produce enough gametes to satiate predators and ensure the survival of some eggs and larvae,' he says.

Baird AH, Pratchett MS, Gibson DJ, Koziumi N and Marquis CP (2001) Variable palatability of coral eggs to a planktivorous fish. *Marine and Freshwater Research,* 52:865-8.

Wendy Pyper

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Rat-midden records

STICK-NEST rats, once abundant in arid Australia, have the unusual habit of constructing impressive communal nests or middens using sticks, stones, leaves, flowers, bones and droppings. Of the two species, one is now extinct and the other survives only on South Australia's Franklin Island, and in captivity. Surviving middens, however, are scattered in a broad belt across central and western Australia, and these provide a window to the past.

The rats that built the middens are herbivores, but much of their building material consists of bones, hair, scats (droppings), and the like, derived from the prey of carnivores. This means that the middens contain information about the animals that lived in arid Australia before European settlement and the former distribution and community composition of arid-zone species.

Dr Stuart Pearson, of the University of Newcastle, has collected and analysed hair and bone samples from more than 20 stick-nest rat middens located in rock shelters and shallow caves. He used radio-carbon dating to determine the age of the sub-fossils. Most middens were about 2000 years old, not yet achieving the 50 000-year antiquity of some American rat nests.

Collaborators, Barbara Triggs and Dr Alex Baynes, identified hairs, bones and teeth, from middens, by comparison with reference hair and bone collections. They were also able to identify the predator species with a fair degree of certainty.

In the middens, the scientists found material derived from the prey of such predators as small dasyurids (carnivorous marsupials), dingoes, birds of prey, bats, lizards, snakes and feral cats and foxes. Some of these species no longer occur in surrounding areas.

'Our interpretation of the sub-fossil information provided by the rodent middens is still tentative and we need to be cautious because some of the middens are accessible to other species and can be contaminated by digging bettongs, foxes and the like,' Pearson says. 'But the work is stimulating more midden research in this country so that we are gaining additional insights into how arid-zone communities have changed.'

Pearson SG Baynes A Triggs BE (2001) The record of fauna and accumulating agents of hair and bone, found in middens of stick-nest rats (Genus *Leporillus*) (Rodentia: Muridae). *Wildlife Research*, 28:435-444.

Steve Davidson

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Clear-fell versus fire

THE National Forest Policy states as one of its broad goals 'the management of the permanent forest estate in an ecologically sustainable manner so as to conserve the full suite of values, including biological diversity.' Does clear-fell harvesting – the usual forestry system employed in many forest types in south-east Australia – meet this goal?

Keely Ough, of the Victorian Department of Natural Resources and Environment, identified the impacts of clear-felling on the regeneration of understorey plants in the towering Wet Forests of Victoria. These forests are dominated by mountain ash and other eucalypts and are highly valued for their wood, water, recreation and biodiversity.

Clear-felling, favoured since the 1960s, removes in one operation all trees on a coupe other than those retained as possible fauna habitat or for the protection of steep slopes and streams. Regeneration is achieved by burning logging debris, often partially piled into windrows or slash-heaps, to create a heat-sterilised, mineral-earth seedbed. Eucalypt seed is then sown.

Ough compared the recovery of understorey flora after clear-felling with that after natural disturbance by the Ash Wednesday wildfires, about a decade earlier. In 1993–94, she collected data from 29 forest sites burnt in 1983 and from 13 similar sites regenerating after clear-felling.

Results showed that the plant species composition a decade after wildfires of various intensities was significantly different to that in forest understorey regenerating after clear-felling. In clear-felled areas, weed and sedge species occurred more frequently than on wildfire sites and silver wattle was much more abundant. In wildfire regeneration, resprouting shrubs, tree ferns and most ground-fern species were more abundant.

Ough suggests forest management could be improved by retaining areas in the coupe from which machinery is excluded, but timber extracted, broadening seed collection and sowing operations to include some understorey trees and shrubs, retaining of some understorey and overstorey to provide protection and seeds, and minimising weeds.

Ough K (2001) Regeneration of Wet Forest flora a decade after clear-felling or wildfire – is there a difference? *Australian Journal of Botany*, 49:645-664.

Steve Davidson


Keely Ough

To maximise ecological sustainability, forest management and harvesting practices should aim, in their impact, to resemble natural disturbances under which forest ecosystems have evolved.