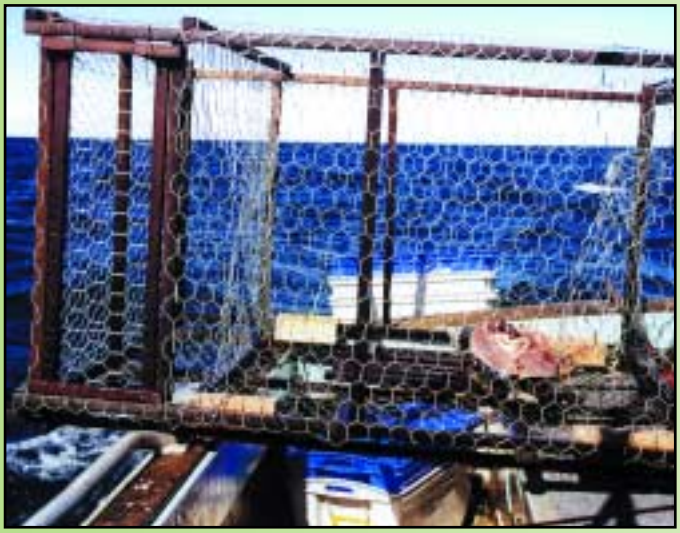

The 'parlour' trap has two sections separated by an experimental mesh panel.

People and biodiversity linked

PERHAPS unexpectedly, recent reports have indicated a positive correlation between human population density and species richness across the tropics. That is, people and biodiversity coincide.

When Dr Miguel Araújo of the University of Évora, Portugal, investigated this in Europe, his results also provided some support for the suggestion of a positive relationship between human density and bio-diversity in that part of the world, but with some important exceptions.

His broad-scale, statistical analyses reveal positive correlations between human population density and plant, mammal, and reptile/amphibian species richness. Contrary to previous studies, the correlation between people and breeding bird species richness was weak. Combined European endemic species richness increased with human density, but two other measures of endemism did not. What do the findings mean and what are the implications for conservation?

These patterns could be accidental, says Araújo. But the similarities between the European and African results support the possibility that mechanisms causing an area to be suitable for people, say climatic stability, seem to make it suitable for many other species. Or, some kind of human actions might somehow boost total numbers of species per unit area, for example due to landscape heterogeneity.

A closer look reveals that although areas with the highest human densities generally have more species than areas with very few humans, those with intermediate human densities tend to top score in species richness. This is consistent with the idea that highly urbanised places such as London and southern England or Paris and its surrounds are not renowned for their species diversity!

Regardless of the underlying mechanisms, the observed pattern has interesting implications in that important areas for biodiversity conservation might coincide with those under considerable pressure from humans. Other evidence supports this prediction. One scientist has pointed out that 16 of the 25 global 'biodiversity hotspots' listed in *Nature* in February 2000, had more people than the world average. Another showed that 110 of the 235 areas needed to represent all species of African terrestrial vertebrates belong to the 25% of sub-Saharan Africa that is most densely populated.

Araújo MB (2003) The coincidence of people and biodiversity in Europe. *Global Ecology and Biogeography*, 12:5–12.

Steve Davidson

Fish by-catch dilemmas

WHEN commercial trap fishers raise their wire traps from the sea floor to sort the catch, many of the fish are undersize and so discarded. Landings of trap-caught snapper in New South Wales have more than halved from 1992–2000, and most are now close to the minimum size of 28 cm. This has prompted interest in reducing by-catch of undersized snapper, the most valuable species in the state's fishery.

The standard 50 mm hexagonal mesh is a problem. It retains *all* sizes of snapper, rubberlip morwong and silver trevally in the NSW fishery. In view of this, Dr John Stewart and Dr Douglas Ferrell of NSW Fisheries have tested the selectivity of various meshes as escape panels at the back of fish traps.

They designed a new trap for the research. Their parlour trap has two sections rather than one, separated by an experimental mesh panel about 50 cm from the back of the trap. The idea is that once a fish has entered the baited trap it will either pass through, or be retained, by the experimental mesh panel when the trap is being hauled to the surface.

After many trials during which fish of many species and sizes were captured and measured, the scientists reluctantly concluded that it is going to be very difficult, if not impossible, to come up with a single trap mesh to select fish of a desired size for all the commercial species in the NSW fishery. Not only are the important species various shapes, (which affects selectivity of meshes), they also have widely differing legal size limits, and differ in their 'escape' behaviour.

Experimental data and predictions based on fish morphology indicated that designing a trap mesh to mini-mise the capture of, say, undersized snapper would lead to large losses of other commercial species.

On the other hand, forcing fishers to harvest species such as rubberlip morwong, ocean leatherjackets and silver trevally at larger sizes, through changes to mesh selectivity, may achieve increased yields – as occurred in the Caribbean. There, fish yields increased in just three years.

Stewart J and Ferrell DJ (2002) Escape panels to reduce by-catch in the New South Wales fishery. *Marine and Freshwater Research*, 53:1179–1188.

Steve Davidson

Lizards cool under fire

WHILE wildfires can be devastating to animals, little is known about the impact on fauna of low-intensity burns of the type used in forest management.

Sarinda Singh and two colleagues at The University of Queensland decided to investigate the immediate impact of a controlled burn on ground-dwelling lizards in an open eucalypt forest in south-east Queensland. Their experiment looked at the effect of a low-intensity fire on the composition of the lizard assemblage and the structural environment and habitat preferences of two focal species.

The intensity of the fire, 40 kilowatts per metre, was very low given that controlled burns can reach intensities as high as 500 kilowatts per metre. In all, 70% of the experimental plot was burnt in the fire. A control plot was left unburnt and comparisons were made with the impact plot before and after the fire.

Eight species of lizards were recorded during pitfall trapping and time-constrained searches, mostly skinks and dragons. The scientists' analyses showed that lizard species richness was not affected by the control burn and nor was abundance of most species. Only the rainbow skink, *Carlia vivax*, suffered reduced abundance after fire, probably due to indirect effects of the fire as this species prefers grassy habitats.

While some lizard species, such as the rainbow skink, may be negatively affected by fire, others cope with fire

David Curl

Termites: masters of orientation.

in innovative ways. Frill-neck lizards increase their use of large trees and empty termite mounds for shelter as fire intensity increases and some *Carlia* species are known to use empty spider holes as effective shelters during fire. The slow rate of spread of the fire and presence of unburnt areas would have helped lizards avoid the fire.

The study is a snapshot of the responses of lizards to a one-off fire event. Despite the coolness of the burn, it significantly reduced shrub, ground and litter cover, and litter depth. No single habitat feature determines the presence of different lizard species and no one management plan will benefit all species.

Perhaps fire management regimes for conservation purposes should target species of particular concern, such as rare and threatened ones, rather than attempting to maximise species richness. Trade-offs between conservation goals and fuel-load management for prevention of wildfire further complicate the issue.

Singh S Smyth AK and Blomberg SP (2002) Effect of a control burn on lizards and their structural environment in a eucalypt open-forest. *Wildlife Research*, 29:447–454.

Steve Davidson

Termite magnetism

ONE of the natural wonders of the Northern Territory is the mound of the magnetic or compass termite (*Amitermes meridionalis*).

The mounds of these grass-feeding termites are built on seasonally flooded plains, resemble massed mud tombstones and stand 1.5–2 metres tall. Remarkably, all are oriented in a north–south direction. Studies indicate that one of the benefits of this alignment is a stable temperature for the termites, but how does a colony of small blind termites manage to orientate the mound during construction? What cues does it use?

An obvious cue is the Earth's magnetic field, in particular the magnetic declination, or the direction of the horizontal component of the magnetic field. Many animal species, including insects and migrating birds, rely on cues from the geomagnetic field as it provides reliable and constant directional information. In some bacteria, magnetic forces acting on tiny grains of magnetite (magnetised iron oxide) within the bacterium can literally orient the whole organism, much like a compass needle!

Dr Peter Jacklyn of the Northern Territory University, and Dr Ursula Munro of the University of Technology, Sydney, have investigated magnetic mound building cues in *Amitermes*. As part of his PhD, Jacklyn decided to observe magnetic cues during mound repair, so he cut the top 10–15 cm off eight mounds at each of four sites near Darwin and manipulated the magnetic field experienced by the termites by burying powerful bar magnets in the mound, below the cut surface.

Five months later he took photographs of cross-sections through the repaired mound to analyse the orientation of internal mud cells. The cell orientations within untreated mounds tend to reflect the orientation of the mound itself, and the scientists reckoned that the mechanisms used to align the internal cells are likely to be used to help orient the whole mound. They looked at the relationship between the direction of the imposed magnetic fields and the orientation of the many individual 'repair' cells.

At first glance, there was no evidence of magnetic cues influencing termite mound construction, but the story for the internal architecture of the mounds is less clear cut. Cell orientations were definitely altered by the artificial magnetic fields, but not in a straightforward manner.

Shifting the declination by 45° to the east or west shifted the pattern of orientation of internal mound cells, but not exactly corresponding to the 45° shift in the magnetic cues. Jacklyn and Munro say the most likely explanation for this is that the blind termite workers are responding to a combination of magnetic cues and the orientation of the uncut mound.

Jacklyn PM and Munro U (2002) Evidence for the use of magnetic cues in mound construction by the termite *Amitermes meridionalis* (Isoptera: Termitinae). *Australian Journal of Zoology*, 50:357–368.

Steve Davidson

Sea snakes and trawling

SEA SNAKES are just one of hundreds of by-catch species caught by trawlers in Australia's Northern Prawn Fishery (NPF). But unlike most other by-catch species, sea snakes are venomous and need to surface regularly to breathe. These characteristics increase their risk of drowning if caught in a trawl net, or being killed by the boat crew once on board.

In the early 1990s, trawlers in the NPF caught more than 100 000 sea snakes, half of which died from being caught in the trawl net. This level of fishing mortality could put some species of sea snakes at risk.

To assess the susceptibility of sea snakes to trawling, CSIRO Marine Research fisheries ecologist Dr David Milton looked at two groups of susceptibility indicators in 13 species of sea snakes found in the NPF.

The first group of indicators related to the vulnerability of sea snakes to capture and mortality. For example, a snake's preferred habitat will increase its susceptibility to capture if it occurs in soft, muddy sediments typical of prawn trawl grounds. Snakes living outside trawl areas, such as on reefs, will be less susceptible to capture. Other indicators included the time of day sea snakes fed, their diet, and their distribution across bioregions.

The second group of indicators related to the capacity of the population to sustain fishing mortality. For example, large sea snake species are usually longer-lived and populations recover slowly from increased mortality. Low reproductive rates also reduce the ability of a population to bounce back.

The study revealed one species of sea snake, *Hydrophis pacificus*, to be most at risk from trawling. This large, late-maturing species preferred open, unstructured habitat on soft sediments: prawn habitat. Its diet contained the same benthic fish species that were caught in prawn trawls. And it tended to feed at night, when trawlers were active.

Based on conservation criteria devised by the International Union for the Conservation of Nature, Milton believes *H. pacificus* should at least be considered 'vulnerable' or 'data deficient' (in need of study).

The study also revealed that two large, bulky species, the olive sea snake (*Aipysurus laevis*) and Stokes' sea snake (*Astrotia stokesii*), had a limited capacity to sustain fishing mortality. Milton says their large size reduces the likelihood of surviving a trawl net, and both are being caught before they have bred.

While these three species stood out as being most at risk from trawling, all species in the study had at least one characteristic that would make them susceptible to trawling, or reduce their capacity to recover. Help may be at hand, however, with new management measures for the NPF that limit the size of trawl nets and require all nets to contain a turtle exclusion device and by-catch reduction device. These devices reduce the number of non-target animals being caught in trawls and some may even increase sea snake escape by up to 50%.

Milton D (2001) Assessing the susceptibility to fishing of populations of rare trawl bycatch: sea snakes caught by Australia's Northern Prawn Fishery. *Biological Conservation*, 101:281–290.

Wendy Pyper

Sea snakes are susceptible to prawn trawling.