Tools of the trade

How do we learn what we need to know about threatened animals? Department of Conservation and Land Management (CALM) wildlife researcher Tony Friend describes some 'tools of the trade'.

by Tony Friend

Techniques to study wild mammals are many and varied. Each species has its own characteristics that make it easier, or more difficult, to find, observe or catch. Western grey kangaroos are large, communal and feed in open country, so are easy to find, observe and count. Gilbert's potoroos, by contrast, are almost impossible to observe as they are very shy and remain in almost impenetrable cover, where they can find all of their needs. Opportunist foragers like brushtail possums, boodies and bush rats are easily lured into cage traps, as they are attracted to a wide range of smells that might be food. On the other hand, numbats feed only on termites. These insects occur widely throughout the woodland habitat, so termites or termite smells are a poor inducement to enter a trap.

In many cases, it is possible to study the animal directly, by watching or catching it. Indirect methods of study may be used if an animal is particularly secretive or rare. For example, some mammal species can be detected using 'hair tubes'. A tube, pipe or arch is placed in the animal's habitat in such a way that the mammals will move through it and leave their hairs on double-sided tape placed inside. Depending on the species, bait may be used to attract the quarry. Microscopic examination reveals which mammal species the hairs came from. Recent developments in molecular biology mean researchers can now sex animals or identify individuals from their hairs. These techniques have been vital in studying the critically endangered and extremely secretive northern hairy-nosed wombat in Queensland. Whereas live traps need to be checked daily, hair tubes can be left for weeks before being checked, a significant advantage in poorly accessible areas.

Indirect methods are often less time-consuming and therefore less costly than direct methods. Census and survey techniques include recording evidence of animals rather than the animals themselves. Distinctive scats (droppings), diggings or other evidence of feeding may be used to record the presence and sometimes the abundance of a particular animal. Surveys for diggings and scats are used in CALM's numbat reintroduction program to monitor the spread of the animals into their new habitat. Scat counts have been used to estimate numbers of kangaroos. Pellets are cleared from marked plots and their rate of accumulation is used, in comparison with data from known populations, to calculate abundance.

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Main: Radio-tracking nocturnal animals at Shark Bay.
Insets clockwise from top:
Brush-tailed phascogale wearing a radio-collar.
CALM researcher Bill Muir checks a pitfall trap for small creatures.
Photos – Jiri Lochman
Pygmy possums are often caught in pitfall traps. Here a female and her young were captured together.
Photo – Bill Bachman

Left: Pitfall traps catch many small reptiles such as this gekko *Heteronotia binoei*.
Photo – Neville Passmore

Below: A radio-collared female numbat emerges from her burrow in Dryandra Woodland.
Photo – Jiri Lochman

GOT YOU!

Capture-and-release methods are usually used for studies of population size and rate of change, because a wide range of information can be gathered by handling individuals. Population size is measured by comparing the ratio of previously marked to unmarked individuals caught in a given trapping period. The sex, size, weight and reproductive condition of the captured animals can provide detailed information on the health of the population. Hair follicles or small clippings of ear tissue may be taken to sample the individual's DNA. The DNA samples can be used to compare populations, to determine levels of inbreeding or to find new species. They also provide a host of other information useful in managing and conserving species. Blood can be sampled to determine the health of individuals and populations. Capture is also necessary if radio-tracking is to be used to learn more about the animals and their habitat.

How are mammals caught for study? Most Western Australian mammal researchers use two types of traps. Australian-made Elliott© traps are collapsible aluminium box traps. A treadle releases an inward-folding door to trap the unsuspecting small mammal. Twenty or 25 medium Elliott© traps pack into a carry-case for easy transport through the bush. Wire cage traps ('possum traps') are made by several local manufacturers and catch mammals from the size of a mouse to a quokka. Bait containing peanut butter is most commonly used, as it is an amazingly universal attractant. In fact, 'universal bait' containing this olfactory treat in one form or another features in mammal research all over the world. A concoction of peanut butter, oats and sardines is most commonly used in Western Australia. Some variation is necessary for targeted trapping—Gilbert's potoroos, like eastern Australian potoroo species, are attracted to bait containing pistachio essence, presumably reminiscent of the truffles that form their staple diet. Where chuditch and woylies coexist, the chuditch capture rate can be artificially low because a woylie is caught in almost every trap. A chuditch bait with a high fish meal content was designed to discourage woylies and attract more chuditch.

Some situations or study species require modifications to the standard traps or the development of new traps, and CALMScience technical officers have been at the forefront of this process. Wambengers are small enough

Right: Elizabeth Sinclair, a researcher who rediscovered Gilbert's potoroo, sets a quokka trap in Two Peoples Bay Nature Reserve.

Below right: A brush-tailed possum peers out of a modified Elliott© trap.
Photos – Jiri Lochman

Below: Radio-collars allow both dead and live animals to be located. By the use of forensic methods, the cause of death can generally be determined from the remains.
Photo – Tony Friend

to be caught in medium Elliott© traps but strong enough to pull the door open after hooking their claws around its edges. CALM Senior Technical Officer Brent Johnson designed a simple catch for these traps that prevents the trap being opened so easily. Black-flanked rock-wallabies bash themselves around in cage traps, often losing young. CALM Technical Officer Bob Bromilow designed a 'soft' trap with walls of rope netting suspended from but held away from the metal frame. In the two 10-hectare 'Return to Dryandra' breeding enclosures, several species of locally extinct marsupials have been released for breeding. Easily stressed mala share an enclosure with bilbies and marl (western barred bandicoots). Cage traps are ideal for catching bilbies and marl but mala knock themselves around in them. CALM Senior Technical Officer Neil Thomas modified the standard cage traps to exclude the larger mala but not the bilbies or marl.

Another common capture technique is pitfall trapping, which employs a smooth-sided pipe or bucket dug into the ground. For some unknown reason, perfectly healthy, wary animals seem unable to resist jumping down inside the unbaited pit. The smaller ones can't jump or climb out again and are retrieved during a daily check of the pit-trap. Some mammals, such as dunnarts, pygmy possums and honey possums, are more readily caught in pit-traps than in baited box or cage traps. Small reptiles such as geckos are also most easily caught this way. Capture rates can be increased by the use of a low fly wire fence, 20 to 30 metres long, that guides animals towards the pit or line of pits.

No such easy methods are available to catch numbats, contemptuous of baited traps as they are. The standard method is still to drive around until one is seen, whereupon someone jumps out of the vehicle and runs after it, keeping the animal in sight until it enters a log. Then, if the hollow is too deep to

Above left: A black-footed rock-wallaby is released from a Bromilow trap.
Photo – Jiri Lochman

Left: CALM volunteers record details of animals captured by pitfall trapping.
Photo – Neville Passmore

retrieve the numbat, a specially-designed trap with a canvas shroud that fits around the log is set over the entrance until the numbat decides to come out.

It is also rare for western ringtail possums to enter traps, whether set on the ground or in a tree. Capture also relies on sighting an animal then removing it from its perch. A dart-gun that fires an anaesthetic dart has been used to catch these arboreal marsupials. A laser sighting device removes some of the guesswork involved in delivering the dart at a safe low velocity, while compensating for its drop over distance. Shortly after being hit, the possum falls from the tree into a waiting blanket.

WHO'S WHO IN THE MAMMAL WORLD

The importance of tagging captured animals with a unique mark cannot be understated. It enables researchers to estimate population size. The fate of an individual can be followed through successive trappings, revealing its growth rate, the development of its young, the rate at which it produces young and other details. In fact, anything that changes over time can be traced, including the movement of individuals between traps set at fixed points.

Methods of marking are varied, but the most appropriate minimise the effect on the animal while remaining readable for its lifetime. Tattooing and notching ears according to a numerical pattern are two long-standing methods. A newer technique employs an implant known as a Passive Integrated Transponder (PIT), developed for marking domestic stock and pets. A small glass capsule (10 x 1.5 millimetres) is injected under the skin from a sterile needle and remains there for life. A portable reader is used to scan each animal on capture. If an implant is present, the reader displays a unique 10-digit code. Using PIT technology removes doubt from animal identification, but the cost of around $9 per implant makes it too expensive for some studies.

SPYING ON PRIVATE LIVES

The development of radio-tracking in the late 1950s provided a powerful tool to delve into the private lives of wild animals. A miniature transmitter is attached to a captured animal. The transmitter emits a signal for a set period of days, weeks or years, allowing the animal to be relocated by the researcher during that time.

Radio-tracking allows individual animals to be tracked remotely, so their behaviour is not affected by human presence. This allows nesting sites, movement patterns, habitat use and many other facets of the animal's biology and behaviour to be studied. Species that are hard to catch, like numbats, can be caught at intervals by locating them and removing them from their refuges. This method yields the same type of information as periodic capture through successive trapping sessions. Dispersal of young or translocated animals can be followed, as radio-tagged animals can be located from the air using a light aircraft equipped with receiving antennae.

Miniaturisation and the development of more efficient batteries mean that smaller radio-tags can now produce stronger signals for longer periods. A seven-gram numbat radio-collar with a battery life of six months can be detected from a kilometre away with an easily portable antenna and receiver. Tiny transmitters with shorter lives can even be attached to small bats without a detectable effect on their flight or foraging behaviour.

With the arrival of the microprocessor, quite sophisticated functions can now be programmed into radio-tags. 'Smart' transmitters can turn themselves off and on at

Above: A tiny ear-tag on a quenda allows its future reidentification for research purposes.
Photo – Ann Storrie

Right: Numbats are radio-tagged so they can be recaptured regularly to monitor their condition, growth and reproduction. This numbat was found with four-day-old joeys.
Photo – Tony Friend

predetermined intervals so that they only use normal power levels when needed, greatly extending their life. Motion detectors built into tags vary the time between signal beeps if the animal is active. Combined with a clock circuit, the transmitter can be set to emit a different beep rate at a set time (say 12 hours) since last movement, indicating that the animal wearing the tag has died. Advances in technology mean it is now possible to determine the time of death of a radio-tagged animal.

A group in New Zealand is developing transmitters that communicate with each other, recording interactions between animals. One transmitter responds to another that is very close to it, and records the identity of the other animal along with the time of day. Thus, a continuous log of each radio-tagged animal can be created. This project primarily targets the common brushtail possum, introduced to New Zealand and now a serious economic and environmental pest. Knowledge of the possums' habits will greatly assist the development of biological control methods in that country.

BEAM ME UP SCOTTY

While conventional radio-tracking methods require the presence of researchers in the field, the ARGOS system satellite network, set up to record and relay the position of oceanographic buoys, has been used for more than 15 years to provide automatic position logging for animals. A transmitter fitted to an animal emits a signal that is detected by one of at least two satellites passing overhead between six and 28 times per day, depending on latitude (more frequent passes closer to the poles).

The position of the transmitter on the ground is calculated by measuring the change in frequency (Doppler shift) on two or more transmissions during one pass. The locations and other data that can be transmitted via the satellites are sent automatically by the Internet to the researcher. The locations are generally not as accurate as those achieved by conventional radio-tracking, and the transmitters are too bulky to use with mammals much smaller than a fox. The automatic data collection is a great benefit, however, and, though expensive, the cost compares with accommodation, vehicle, aircraft and salary costs needed to monitor conventional radio-tags. Satellite tags really come into their own when deployed on wide ranging or migratory species. They have been used with great success to track albatrosses, marine mammals, caribou and polar bears. A satellite transmitter has been fitted in a recent trial to a fox in the northern jarrah forest of Western Australia.

Above: The signals from even small radio-tags can be detected from kilometres away using an aircraft-mounted tracking system.
Photo – Tony Friend

Above right: Using a portable receiver and antenna, researchers can locate and follow radio-tagged animals in their habitat.
Photo – Jiri Lochman

Right: Measuring a King's skink attracted into a cage trap by 'universal bait'.
Photo – Ann Storrie

Right: Releasing a Gilbert's potoroo at Two Peoples Bay. Pistachio essence helps researchers lure these critically endangered truffle-eaters into traps.
Photo – Jiri Lochman

Below right: This GPS collar provided very accurate location and activity information for a moose in western Ontario for several months before the animal was killed and eaten by a pack of wolves.
Photo – Art Rodgers

GLOBAL POSITIONING SYSTEM

The Global Positioning System (GPS) satellite network enables ground-based receivers to calculate an accurate position anywhere on the globe. Since GPS receivers became available to the public 10 years ago, they have revolutionised all human navigation activities.

Wildlife research has also benefited from the ability to determine location accurately. During the reintroduction of numbats to Karroun Hill Nature Reserve, 450 kilometres north-east of Perth, between 1985 and 1993, the impact of the GPS was particularly apparent. At first, navigating the radio-tracking aircraft over the virtually trackless reserve relied on relating vegetation patterns on the ground to aerial photographs, marking numbat positions onto the photographs, then using them as maps to walk to the site. The first innovation was the use of a powerful transmitter, packed in foam padding, thrown out of the plane over the numbat location. Researchers could follow the powerful signal to the numbat location, then search for the weaker numbat transmitter. With the emergence of GPS, however, researchers merely pushed a button when over the site, saving the location, then used the GPS to walk to the numbat location. All important sites are fixed by GPS to aid mapping.

GPS technology has another interesting use in wildlife research. As the GPS 'engine' is now smaller than a matchbox, it is possible to incorporate one into a collar tag, programmed to take fixes at regular intervals. One manufacturer's product sends data back to base via the ARGOS satellite system, while a rival model can download months worth of data through a radio link to a receiver in an aircraft. Sixty GPS collars have been fitted to moose in two areas in western Ontario with different logging prescriptions. The study aims to evaluate the impact of the two prescriptions on moose movements and biology. These hi-tech collars are extremely expensive, weigh two kilos and run for 18 months. The smallest animal on which the GPS collar has been placed is a lynx in Canada. There is limited use for these devices in Western Australia unless much smaller units can be developed.

As fast as new technology is available, it is being used in wildlife research and management. The fight to save our fauna requires all the support it can get.

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Armed with sketch pad, pencils, pens and paints, an intrepid group of artists set off on a brand new LANDSCOPE *expedition. See 'Awash with Colour' on page 28.*

Most of us only know of the exotic pest ants that invade our kitchens. But what of the great Australian ants? See page 23.

Ningaloo Marine Park and Cape Range National Park lie side by side in our north-west corner. Read about how they are managed on page 17.

Four more conservation reserves now offer greater protection to areas in and around the Mitchell Plateau. See 'Parks of the Plateau' on page 48.

Scientists continue to develop ways to locate, track and trap animals for research. See 'Tools of the Trade' on page 41.

F E A T U R E S

R E G U L A R S

C O V E R

For many years, the decline of frogs in various parts of the world has puzzled conservationists. A breakthrough came in 1996 when scientists isolated a new kind of fungus that infects and may kill frogs. Western Australian research now under way is beginning to answer some initial questions about the fungus and its impact on our unique frogs. See 'In Pursuit of the Frog Fungus' on page 10.

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