





MASTERLY marauders

THE CAT AND THE FOX



by Jack Kinnear

The urban and the feral cat jostle with the fox for first place among introduced species in the predator supremacy stakes.

Jack Kinnear tells us something of the delicate knife-edge existence of those that stalk, those that are stalked and the effect they have on other fauna.

Predators, the stuff of pure, action-packed drama; mention the word and one immediately conjures up images of great cats ambushing and stampeding their prey, of howling wolf packs on the prowl, and 70-mile-an-hour cheetahs pursuing hapless Thomson gazelles. But action-packed drama aside, where do predators fit in the grand scheme of things we know as nature? Are they bit-actors or major players in the great ecological theatres of the world? Or are they merely a spectacular side-show?

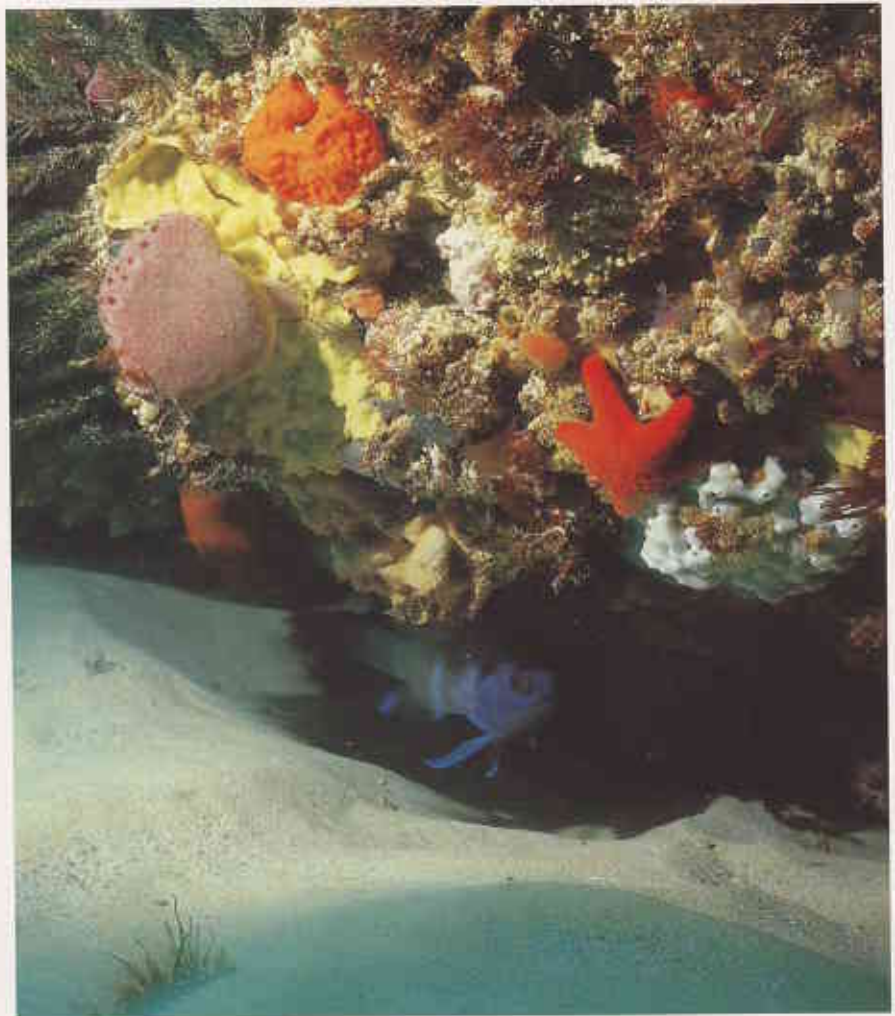
Surprisingly and perhaps regrettably, ecologists have long treated predators as a minor side-show. That predators simply don't matter has been a prevalent view for decades. But new knowledge about predators, and how they affect their prey and how they influence wildlife communities, is beginning to erode such entrenched views. Carl Walters, a prominent theoretical ecologist, who holds few doubts about the importance of predators, has been known to say: 'Predation rules the world.'

The scientist who was perhaps most responsible for the view that predators are of no consequence was Paul Errington, an American ecologist whose writings first appeared in the 1940s and whose views shaped the minds and attitudes of biologists over the next four decades.

Errington's productive research career began at a time when the theory of predation was simple: it was believed that since predators killed prey, the removal of predators should always result in more prey. Sounds familiar.

This view had a wide appeal - and why not? It was plain common sense. Moreover, it was argued, if predators were killed, then there should be more game to hunt. Not surprisingly, sportsmen and their ammunition suppliers championed this view. So predators became bad news; after all, they were varmints and the only good varmint was a dead varmint. Bounty payment systems flourished. Most certainly, for varmints, life really wasn't meant to be easy.

Then along came Errington, who challenged this reasoning. He maintained that removing predators achieved nothing. He argued that predators simply take surplus animals that would have died anyway from a



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Main: A cat with its latest victim.
 Photo - Richard Woldendorp
Inset: Cat tracks in the sand.
 Photo - Rod Annear

Top: A coral reef epitomises biodiversity.
 Photo - Eva Boogaard/Lochman
 Transparencies

Right: Crown of thorns - destroyer of biodiversity.
 Photo - Clay Bryce/Lochman Transparencies



variety of other causes - disease, starvation and so on. Predators preyed on the 'doomed surplus' of the prey population. By that he meant those individuals that could not secure a territory or mate or were too old or too sick to breed, so it did not matter if they died. Indeed, predators were doing their victims a favour since they would have suffered a lingering death from starvation or disease anyway.

This argument had some positive effects; it challenged the need for bounties and it helped to stop the persecution of predators. Life became a bit easier for varmints.

But criticisms of Errington's ideas began to appear in the scientific literature as findings from new predator-prey studies were published. Nature was proving to be more complex; predators were not simply executioners of the doomed surplus - some were doing a great deal more.

One such study was performed by Robert Paine, now an eminent marine biologist, who made a startling discovery about the role of predators. He showed in a deceptively simple way that predators can be more than bit-players; he removed a predator - a starfish - from a seashore community comprising numerous

URBAN BUSHRANGERS



Photo - Fiona Walden/DP

Miss Anne Drysdale living near Geelong recorded in her diary (1841): "I dined on a couple of quail caught by the cat ... she brings every day numbers of quail, miner, a variety of small birds besides lizards and guanias".

Another settler observed (1850): "The domestic cat sometimes wanders away from a station and turns bushranger ..."

"Let a cat out the house door and it should immediately be regarded as feral!" is Victorian scientist B. J. Coman's firm opinion.

John Seebeck of the Victorian Department of Conservation and Environment has declared that it is high time these marauding bushrangers were locked away.

With the assistance of the Australian National Parks and Wildlife Service, an extraordinary document has been produced entitled *The Cat Kit: Protect Your Cat, Protect Your Wildlife*. It contains some staggering statistics. In Victoria, it is estimated that there are about 900 000 owned cats and 300 000 strays. Questionnaires completed by householders with cats have shown that an average of 25 wild animals per year are brought home by cats. The loss of native wildlife - mammals, birds, reptiles and frogs - amounts to millions annually.

In Melbourne, six animal shelters receive 45 000 cats per year; 38 000 are put down. On two consecutive days, one shelter received 39 ringtail possums, victims of cat attacks; all had to be destroyed.

The kit contains articles written by wildlife biologists from every State and Territory in Australia. All agree that a great deal of research is needed.

Clearly, Australians need to get serious about cats - especially when the time comes around to put the cat out.

species of marine invertebrate animals. Gradually, as time passed, he noted that many species became rare and one species became super-abundant. In a nutshell, what he demonstrated was this: when his species-rich marine community lost its predator, it lost a large part of its biodiversity.

From this simple experiment ecologists learned that predation can permit more species to co-exist in a community. Predators achieve this by culling dominant species, so preventing such species from excluding other species. Paine suggested that they be known as keystone species in reference

to the key role they played in maintaining diversity.

Soon, however, it was clear that not all marine predators were guardians of biodiversity. In a more spectacular manner, another starfish predator, the crown of thorns, was having an even greater impact on marine communities but in a profoundly different way. It was a keystone predator in the reverse sense, because it was a destroyer of biodiversity as it ravaged coral reefs across wide areas of the South Pacific.

Despite this new knowledge about the possible impact of predators, many ecologists still clung to Errington's ideas;

indeed it might be said that he brainwashed a generation of biologists into doing nothing about predation. Ecology is a lot simpler if one can ignore processes such as predation, and likewise, so is wildlife management.

This attitude made mistakes in wildlife management inevitable. A fascinating example was the case in South Africa's Kruger National Park where an experiment in wildlife management was set in train. A near disaster almost occurred but in the end, the outcome provided new insights into the predation process. A brief description of this revealing experiment follows.

Kruger National Park was in the grip of a prolonged drought. As each year passed, the rangeland deteriorated more and more, and the risk of overgrazing by herds of zebras and wildebeest became uppermost in the minds of the park ecologists. It was feared that overgrazing might irreversibly damage the vegetation leading ultimately to a catastrophic decline of wildebeest due to starvation. Culling the wildebeest was the only solution to this problem. This was done in the belief that following the end of the drought, the herds would recover.

Eventually the drought broke and the grasslands rebounded. But gradually, it was realised that something had gone wrong; the wildebeest herd, instead of recovering, continued to decline despite an abundance of food. Six years after the end of the drought, the wildebeest herds had dropped by 50 per cent!

What had gone wrong? Eventually, the answer became clear - the park managers had neglected to cull the lions! The Errington legacy was alive and well in South Africa.

What had happened was this: unknown to the park managers, the wildebeest-lion predator-prey relationship was balanced on a knife edge. Before the cull, the number of wildebeest was more or less constant and as long as things stayed that way, the herds could support the lion population. For every wildebeest killed by lions, the herd could replace the loss because the birth rate was high enough. But this was true only if animal numbers did not decrease. The cull of wildebeest by park rangers upset the balance and forced the population into a downward spiral.

Ironically, this was what the



sense view but, again, only in certain circumstances. More importantly, predation cannot be dismissed as a conservation problem on the basis of observations alone, but regrettably, this is still sometimes done in Australia. To fully assess the importance of predation, it is necessary to manipulate populations of predator and prey by adding or removing individuals to either or both populations. Mathematical models should not be shunned. After all, theoretical biologists have been predicting the existence of knife edges for years.

THE AUSTRALIAN PREDATION SCENE

Two introduced predators, the fox and the domestic and feral cat, dominate the Australian scene. Virtually nothing is known about native predators (see 'Return of the Chuditch' in this issue of *LANDSCOPE*) and their impact on their prey. Until recently, biologists and wildlife managers have generally adopted an Errington view.

At this stage the fox appears to be a keystone species in the reverse sense - a terrestrial crown of thorns. Perhaps a more appropriate term would be a tombstone species!

The tombstone impact of the fox has been revealed by simple field experiments. Foxes have been removed by frequent baitings with the result that several marsupial species have increased appreciably. These results support the pre-Errington view where common sense prevailed, i.e., since predators kill prey, killing the predator should result in more prey. Call it a victory for common sense.

Theoretical biologists have found these results to be intriguing, but they find the common sense approach far too simple and restrictive. In their eyes predation is a more complicated process.

To borrow some of their more colourful jargon, theorists would say that the fox has driven the surviving fauna into a predator pit where they are confined. By that they mean that depredated species can only exist at low numbers and that the only way the fauna can be helped to climb out of the pit, and so increase, is to remove foxes.

But how many foxes do we have to remove and how often must we remove them? Can the modellers tell us? The

Above: The introduced fox - a keystone predator of Australian marsupials.
Photo - Ford Kristo



Left: A rock wallaby with an abbreviated tail, thanks to predators. It subsequently disappeared, presumably another fox victim.
Photo - Babs and Bert Wells

Bottom left: A fox skeleton in Dryandra State forest, where wildlife now thrives - evidence that CALM's fox control is working.
Photo - Babs and Bert Wells



Below: A juvenile fox - a marauder in the making.
Photo - Jiri Lochman



managers were trying to avoid in the first place, yet their actions caused a population decline because they wrongly believed that predation did not matter in wildlife management.

It seems evident from the foregoing that the predation process is more than an ecological side-show. Predators can enhance or destroy biodiversity, which means that some predators, directly or indirectly, can determine where species may live and their abundance as well. But predator-prey relationships can be precariously balanced, as the Kruger Park wildlife managers inadvertently discovered.

Is there a message here for conservation biologists? The answer is yes, for these reasons. One cannot generalise about predation; Errington was right, but only in certain circumstances. So was the common



answer is no, not at this stage, but if they had more information they could. Scientists reason that a deeper understanding of the predation process may enable CALM to manage the fox more cost-effectively.

A desirable experiment would be, firstly, to control foxes until the prey increased to the carrying capacity of the habitat. As an example, suppose we have a nature reserve supporting 50 animals in the presence of foxes (and therefore languishing in the predator pit), but capable of supporting 500 if there were no foxes. Secondly, we would determine what could happen to the 500 if we stopped controlling foxes, or re-introduced them?

Two outcomes are possible: the foxes could well kill off most of the 500 and cause a population crash. In time we would find the survivors cowering back in the pit. This outcome would signify that the fox is a very efficient predator, which may well be the case.

But suppose the foxes have little impact on the 500. Thus we might find the prey population reduced to about 400 animals or so and stable. This would signify that when prey numbers are high enough, the prey population can cope. It

Above: The mulgara, seen here with young, is a carnivorous marsupial related to the chuditch. They may be preyed by cats or foxes, who also may compete for food.
Photo - Jiri Lochman

Right: Nesting birds are most vulnerable to predators. Foxes depredate ground-nesting birds such as malleefowl.
Photo - Ray Smith



is just as Errington argued, and comparable to the wildebeest situation before culling.

If this latter case proved to be true, then it would not be necessary to control foxes as long as the prey numbers were high enough. But how high is high enough? Theory tells that there must be a knife edge, as was the case for wildebeest and lions. The knife edge is that unstable situation where there is just sufficient prey to withstand predation without a decline in prey. If, however, the prey were to decline beyond that point, then fox depredations would drive the prey into the pit.

This experiment is currently under way in WA. It needs to be done because it may demonstrate that fox control need only be intermittent and hence more

cost-effective. Control would only be necessary when populations collapse into the pit (due to drought etc.) and in knife-edge situations. The tricky part for researchers is finding the knife edge.

PREDATION PATTERNS

In having abandoned the comforting do-nothing teachings of Errington, ecologists are now beginning to realise that the predation process can be a



Top: Knob-tailed gecko - numerous species of lizards are commonly eaten by feral cats.

Photo - Babs and Bert Wells

Above: The western ringtail possum has been heavily depredated by cats and foxes.

Photo - Jiri Lochman

powerful force in nature. Predation, if strong enough, can create patterns in nature and perhaps the most striking examples are population cycles.

In the vast subarctic regions of the Northern Hemisphere, a ten-year cycle of abundance of snow-shoe hares and their predators has been evident from fur trading records dating back for centuries. Hares peak in numbers and then crash, only to peak again ten years later. Their predators do likewise, lagging slightly behind in timing.

It is now realised that the cyclic pattern is predation-driven. Prey numbers increase and peak, only to be driven down by high rates of predation, which is then followed by a crash of predators because they have killed off their food supply. Snow-shoe hare populations routinely end up in the pit, but only briefly, because of the subsequent collapse of the predator populations. Their sojourn in the pit is short - then the cycle repeats.

In Australia, there also seems to be a pattern associated with fox predation, but it is definitely non-cyclic. We observe this pattern: wherever the fox is present a large segment of the mammal fauna has all but disappeared; furthermore,

when we do find species surviving, their numbers are invariably low, that is, in the pit.

The reason for this is that the fox survival is not dependent on the abundance of any particular prey species. When foxes reduce their prey to low numbers, they switch to other food sources and so maintain their own numbers. Foxes are always around in sufficient numbers to prevent many prey species from escaping the predator pit.

THE FERAL CAT: AN ENIGMA

When one looks for patterns associated with the feral cat, none are found. The cat presents a confusing picture. It arrived in Australia earlier than the fox, possibly as the result of shipwrecks. The desert Aborigines have a proper name for it, and it is a valued item of their food. This suggests a long history of association.

The feral cat is more widely distributed than the fox, being found virtually everywhere in Australia including Tasmania and Kangaroo Island, where the fox is absent. Yet unlike the fox, the presence of the cat is not always associated with faunal extinctions or declines. The fauna of these islands



remains largely intact. At a more local level, feral cats live on Garden Island and Rottneest Island apparently without affecting the abundance of the tamar and quokka wallabies.

Yet in the desert regions predation by cats on hare-wallabies has recently been documented. Attempts to re-establish rufous hare-wallabies failed - firstly because of foxes, and on the next occasion because of cat predation.

The latter observation supports the view that cats were responsible for the extinctions of two marsupial species on some Monte Bello islands. Cats were presumably brought to the islands by pearlers. The marsupials, a hare-wallaby and a bandicoot, once thrived on these islands but they became extinct following the release of cats.

A similar story holds for Dirk Hartog Island. Cats arrived late last century when a pastoral lease was established there; by the late 1920s they had eradicated at least two species of marsupials - the boodie and the banded hare-wallaby.

Elsewhere, especially on islands, feral cats have been shown to be very destructive predators of wildlife. The literature abounds with examples of wildlife extinctions and destruction. The New Zealand experience has been a tragic one. An even more appalling example about the havoc caused by feral cats comes from Marion Island, a sub-Antarctic island noted for its breeding colonies of seabirds. This tragedy unfolded as follows.

Five domestic cats were introduced as pets to Marion Island in 1949. By 1975, it was estimated that there were about 2 000 cats busy killing 450 000 burrowing petrels a year. By 1977, the

cat population was estimated to be 3 400. A common diving petrel became extinct and two other species declined sharply.

Cat control on Marion has been successful in reducing the cat population, but eradication has not been achieved. Eradications on islands have proved possible, as shown by New Zealand biologists, but an enormous effort is usually necessary. CALM plans to eradicate cats on the Monte Bellos in the near future, to be followed by reintroductions of the hare-wallaby and the bandicoot.

Cats are known to eat a wide range of mammals, birds and reptiles but this information is frequently given too much weight. Finding native fauna in the stomachs of cats does not prove that the cat is a serious threat to any particular species. Such data provide information about the range of cats' victims and that is all. What we really want to know is the status of the victim's population, that is, are its numbers high, in the pit, or on a knife edge? What happens to the victim's population following the removal of the cat is another question we would like to be able to answer. Only a major research program can tell us that, and this sort of research needs to be done as soon as possible.

Ironically, it may be sometimes more significant if a species is rarely found in the stomachs of cats. Consider the case where cats might heavily deplete a prey population and drive it into the predator pit; then that species will be rare and perhaps even endangered due to predation by cats. However, because it is rare, it will be eaten infrequently and victims will be seldom found in the stomachs of cats. Such a situation will wrongly create the impression that the

Above left: A feral cat gorges on the carcass of a kangaroo.
Photo - Ford Kristo

Above right: Stomach contents from a feral cat in the Gibson Desert.
Photo - Ray Smith

species is not a major prey item, and therefore not at risk from cats.

To conclude, the absence of a pattern linking feral cats to wholesale faunal declines and extinctions suggests that cat predation is likely to be more species-specific than the fox. Predation by cats may be more general in the arid zone, where a single animal can often dominate a key part of the landscape, such as a waterhole. From a strictly scientific viewpoint, the jury is out regarding cats because the necessary research has not been done. From a common sense viewpoint, the jury is in because, all things considered, it is hard to dismiss this adaptable carnivore as a bit-player in the struggle for existence in the Australian bush.

It's time to get serious about cats!

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Twenty-three captive-bred chuditch were recently released in the Julimar forest in an attempt to establish a new population. The story of the 'Return of the Chuditch' is on page 10.



'Back in the Outback' (page 34) follows the trail of endangered mammals recently reintroduced into the Gibson Desert from Barrow Is.



In a remote corner of the Gibson Desert lies Lake Gregory, a birdwatcher's paradise. See page 16.



A silent workforce of volunteers assist CALM with a multitude of projects. Colin Ingram tells us more about these 'Volunteers for Nature' on page 28.



The urban cat vies with its feral cousin and the fox for top spot in the predator stakes. See 'Masterly Marauders' on page 20.

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COVER

The chuditch (*Dasyurus geoffroii*) was once found in every State and Territory of mainland Australia. Now it is only found in the jarrah forest and parts of the southern wheatbelt in the south-west of WA - about two percent of its former range.

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