



Who counted the kangaroos?

Dr Graeme Caughley last year received CSIRO's highest honour, the Chairman's medal. The prize was the latest in a series of scientific accolades which saw the one-time deer hunter rise to the top ranks of the world's most-respected researchers.

David Mussared

If it's big, it's alive, and it's got a backbone, the chances are that Dr Graeme Caughley has written a paper about it. And there's an even better chance that he met it face to face in the wild.

From Australia to South America, from New Zealand to East Africa, from Antarctica to Canada, Caughley's pathfinding work on the ecology of big mammals shed light in many dark corners. Along the way he helped to rewrite the history of New Zealand, to halt the slaughter of elephants in Africa and to fill many of the vast, blank spaces on the map of Australia's own big animals.

One of Caughley's greatest strengths was his uncanny ability to explain complicated concepts in deceptively simple and lucid writing. This skill helps to explain the success of his books and papers. *Analysis of vertebrate populations*, for example, published almost 20 years ago, remains essential reading for wildlife managers.

Dr Hugh Tyndale-Biscoe, who comes from the same CSIRO division, (Wildlife and Ecology) knew and worked with Caughley for many years. He says Caughley's talent for combining complex ecological theory with down-to-earth applications took him to the top of his profession.

'He was the world's leading scientist in the field of large mammal ecology,' Tyndale-Biscoe says. 'He was acknowledged around the world for his ability in that area.'

'This was based on a very, very profound theoretical knowledge of the way populations behave. As well as that, his work has had a tremendous amount of application.'

Caughley had another ability as well: one which sometimes unnerved other scientists. He had a reputation for sifting through data published in the scientific literature and sorting out the diamonds from the dross. Some of his most telling papers came from putting together old data in unexpected ways, or from a scintillating re-examination of existing figures.

Caughley's long-time technical assistant was David Grice. Among other things, Grice spent many hundreds of hours staring out of small aeroplane windows during Caughley's marathon surveys in the 1980s of Australia's large animals.

Grice remembers clearly the mammoth task Dr Caughley undertook in developing a new survey technique for Australia's kangaroos.

Whenever someone tells you there are 19 million kangaroos in Australia (or

13 million, depending on the season), they only know it because Caughley, Grice and a small team of others counted them. They spent 1500 of hours flying over some of the most remote terrain in Australia tallying up kangaroos, camels, emus and even bush bustards. It was sometimes, Grice remembers, a case of 'vomiting and counting at the same time'.

Grice guesses they counted several hundred thousand individual animals in the survey, which gave Australia for the first time solid data on how many kangaroos and other big vertebrates lived in the outback. Just as importantly, the survey was done under standardised and repeatable conditions.

The technique Caughley developed, flying at a standard height (not altitude) and speed while counting within a standard area, has since been adopted for big animals in other countries. Altogether, the survey covered some 75% of Australia, much of it twice.

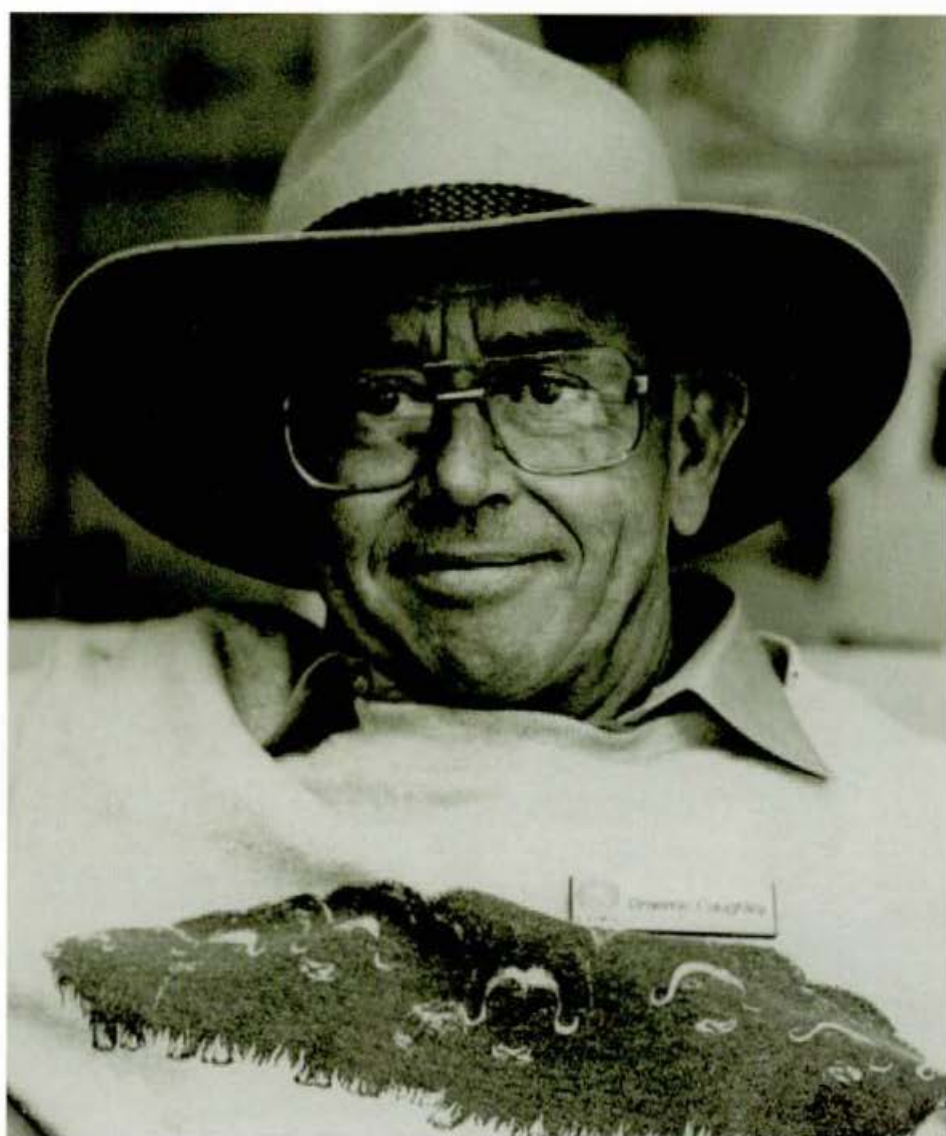
Exploding myths

Kangaroo hunting has always been controversial. Several years ago European and United States green groups started pushing for the international trade in kangaroo to be banned. It was Caughley's survey data which convinced them otherwise.

'We were just annoyed that they weren't looking at the facts,' Caughley said. 'We showed them the information. And that was the end of the matter.'

Caughley's name – and that of 'John Macnab', an alias he shared with three other wildlife researchers from around the world – pops up in all sorts of unexpected places. The four authors published three papers under the Macnab alias which took wildlife managers to task for uncritical application of concepts and failure to heed the discipline of scientific method.

For example, Caughley was able to show for the first time that culling of elephants during the 1960s in African game parks was not in the interests of the species. Park managers, presiding over booming numbers of elephants within the boundaries of their reserves, believed they had to cull the animals heavily for the animals' own survival. Elephant numbers in the parks seemed so large they were threatening their own food supply of woodland bushes.



Dr Graeme Caughley: helped to rewrite the history of New Zealand, to save Africa's elephants and to survey Australia's camels and kangaroos.

Caughley's re-analysis of the data revealed a different trend altogether. What was happening, he said, was that elephant numbers were increasing slightly in the parks, but falling everywhere else. The park managers were seeing increases over a short time within their own boundaries, but in the long run elephants were in deep trouble.

He examined statistics on the ivory trade out of Africa, which showed it was accelerating unsustainably. Elephant populations outside park boundaries were declining alarmingly. The time frame the park managers were using to assess the sustainability of their herds was too short; records over 100 or 200 years showed elephant numbers tended to rise and slump regularly, and

their acacia food supply with them.

Caughley was fascinated by New Zealand, the country of his youth. Human settlement in New Zealand was only recent, about 1000 years ago. He said that made it perhaps the most important place in the world for studying extinction, because the evidence implicating humans was still fresh and datable. Anything earlier must have been caused by nature.

'It's one of the few countries where you can actually find out what happened with extinction rates,' he said.

Caughley said that, with the possible exception of Madagascar, New Zealand might have been the only place in the world where it was possible to find out how fast extinctions happened before

humans arrived. Despite all the evidence of extinctions in the fossil record, Caughley said, and all the concern about humans accelerating extinction, no-one knew the natural rate at which extinctions happened before people came on the scene. In fact, he said, there had been no documented case of extinction in the past 8000 years caused by anything other than humans.

A new perspective

It was Caughley's fascination with the 36 extinct animal species in New Zealand which led him to rewrite the island nation's history. Looking more closely at the published radiocarbon dates for early Maori settlements he found an 'error wobble' in the data. At first glance the radiocarbon dates seemed to show New Zealand was settled all at once, but with the errors removed Caughley revealed a different picture.

In fact, he showed, it might have taken the Maoris as long as 400 years to settle the whole of New Zealand. And as Maoris moved in to each new area, the moas which once lived there disappeared. Maoris and moas overlapped for only about 100 years in any one area, Caughley said, with the last of the great birds vanishing around 1500.

Caughley also spent many holidays trying to find evidence in Tasmania that Thylacines had survived their apparent extinction earlier this century. He was convinced there was 'not a hope' the ill-fortuned Tasmanian tiger still lived, despite the frequent claimed sightings. It was one of the world's most carefully searched-after animals, he said, and no firm evidence – not even a footprint – had ever been found.

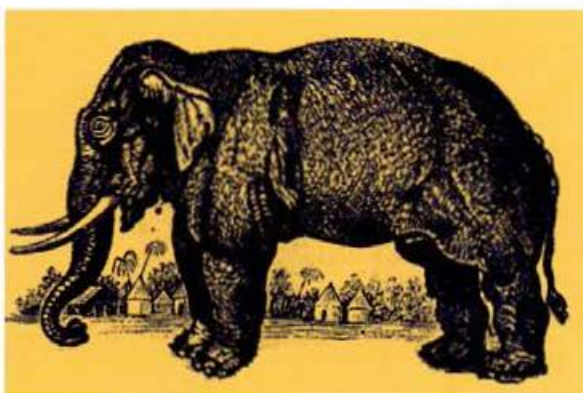
And what about all the sightings? Caughley said most of the clearest, close-up reports happened late at night in the rain, a mistake he almost made once himself. Driving at two o'clock in the morning through rain in south-east Queensland, he said, he saw what he was certain was a Thylacine in the headlights. It was striped, the right size and shape, and with its tail sticking out straight behind the way Thylacines were always depicted.

Realising the absurdity of spotting such a beast in Queensland, even if it had survived in Tasmania, Caughley swung his vehicle around for a second look. The animal stopped, and he got a better view. It was a large dog, with

rainwater plastering its coat to seem like stripes.

'If I'd seen the same thing down in Tasmania I'd probably have made a fool of myself in the media,' Caughley recalled ruefully.

One colleague, Anne Gunn from Canada's North West Territories Department of Renewable Resources, remembers how Caughley was invited to Canada to apply his unrivalled understanding of population dynamics and ecology to review the department's



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wildlife programs for caribou, muskoxen and polar bears in the very different landscapes of the frozen north.

The study included a field trip working with the Arctic's indigenous Inuit (Eskimo) people, a gruelling experience and definitely not one for the squeamish. Caughley, she said, accepted with equanimity the local custom of eating meat raw.

Caughley remembered the episode too, and the diet. 'The nicest thing about eating raw meat is that you don't get scurvy,' he said. 'It surprisingly keeps them (the Inuit) going.'

Caughley came a long way from his days as a deer hunter for the New Zealand Government in the 1950s. In the late 1950s and 1960s, between studying at the University of Canterbury and the University of Sydney, he worked two stints as a biologist for the NZ Forest

Service and spent a year with the NZ Antarctic Division.

After finishing his Ph.D in Canterbury – with a thesis on Himalayan thar (a mountain goat) – Caughley spent two years with the United Nations Food and Agriculture Organisation (FAO) working in Nepal, Afghanistan and Burma.

While studying for his Masters at Sydney in 1962 Caughley worked with Charles Birch, Australia's famous scientist-philosopher. In 1969 Professor Birch recruited Caughley again as a research fellow, and he stayed at the university for 10 years, aside from another two-year break in 1971 when he travelled to Africa to research elephants for the FAO.

In 1979 Caughley was awarded a science doctorate by the University of Sydney. Later that year he joined the CSIRO's Division of Wildlife and Ecology in Canberra. Two years ago he was elected to the Australian Academy of Science.

But despite such honours, and despite his new CSIRO Chairman's medal, Caughley never lost his talent for taking an occasional tilt at sections of the scientific establishment.

Understanding extinction

His last foray was into the highly emotive area of conserving endangered animals. In a review paper destined for an upcoming issue of the *Journal of Animal Ecology* Caughley fires a devastating broadside at those who argue preventing extinction is all about studying what happens within small and shrinking populations.

The paper includes a cutting critique of the theory of 'genetic bottlenecks'. In particular it takes a long, hard look at the data presented for the now-famous case of the cheetah, an animal which some researchers say was once pushed so close to extinction that the entire species today might be descended from a single mother and her cubs.

This long-ago 'bottleneck' is often used to explain the cheetah's apparent vulnerability to extinction. Caughley said the published data on the cheetah showed nothing of the kind; on close reading it didn't prove all cheetahs were inbred and genetically similar as had been claimed.

Caughley's review paper said that most theoretical research in conservation biology now focused on the 'small-population paradigm', which is amenable to

study but which has little to do with conserving species in the wild. Such research addressed the 'trivial' problem of how long a small population can be kept alive, he said, but not the much more important problem of what it was that caused the species to crash in the first place.

'The main approach that's been happening overseas is that they didn't even ask what the problem is' he said. 'The problem is stated as: "There are too few animals". We get in there and find what has caused the problem and then we try and do something about it.'

Caughley argued that the extinction pressures facing small, isolated populations are well-understood. The forces of inbreeding, difficulty finding mates and genetic homogeneity have been studied exhaustively.

'Our line is that that's got almost nothing to do with it,' he said. 'If a species gets into as much trouble as that, something external has changed. When you get to very low numbers it's merely a death rattle.'

'Essentially what we are saying is that if something is happening, something has changed in the environment. We have to find out what has changed.'

What was needed, he said, was richer theoretical understanding of the complex processes which nudge populations toward extinction in the first place. With that in mind he began a series of experiments with fenced-in rabbit warrens at Cooma, testing how rabbit populations fare under different predation levels and changes to their habitats.

Caughley was one of those rare scientists whose best work always seemed straightforward and commonsense in retrospect. He explained it himself by saying his research was no better than anyone else's, rather, 'it's a matter of asking the right questions'.

Asking the right questions is a talent which earned Caughley a healthy respect from many in the scientific community, not least from his technical assistant.

'Graeme tends to have a knack for looking at things from a new perspective and generalising,' Grice said 'And for cutting out a lot of the bullshit.'

Graeme Caughley died on February 16 after a long illness. He was a remarkable man who will be remembered by his colleagues for his vision and scientific contribution. He is a big personal and intellectual loss to the Division of Wildlife and Ecology. David Mussared interviewed Caughley in December, 1993.