Recent advances in the scientific knowledge of kangaroos.

Program

Time	Activity	Chair
0900-0905	*Opening Address* Dr John Pickard, NPWS	
0905-0930	*Research towards management of kangaroos: 2002 and beyond* Joshua Gilroy, NPWS	Prof. Terry Dawson
0930-0955	*Alternative management strategies for harvested kangaroos in the Murray-Darling Basin* Dr Steve McLeod, NSW Agriculture	
0955-1020	*The management of large kangaroos: four species not one* Dr David Croft, UNSW	
1020-1045	*Kangaroos in tourism: Research in wildlife tourism at the CRC for Sustainable Tourism* Dr Karen Higginbottom, Griffith University	
1045-1115	*Morning Tea*	
1115-1140	*Red plague: Grey plague – Kangaroo myths and legends* Dr John Auty	Prof. Terry Dawson
1140-1205	*Population monitoring for kangaroo management* Dr Tony Pople, UQ	
1205-1230	*The Facts: survivorship of Red Kangaroo young to weaning and its effect on population dynamics* Amanda Bilton, UNSW	
1230-1245	*Immunocontraception: Can it be used to control kangaroo populations?* Prof. Des Cooper, Macquarie University	
1245-1400	*Lunch*	
1400- 1425	*Management and behaviour of Eastern Grey Kangaroos* Prof Peter Jarman, UNE	Dr Martin Denny
1425-1450	*Long-acting contraceptives – another tool to manage kangaroo populations?* Cathy Adderton, Macquarie University	
1450-1515	*Genetic effects of kangaroo harvesting* Dr Peter Hale, UQ	
1515-1540	*Do kangaroos exhibit water-focused grazing patterns in semi-arid New South Wales? A case study examining artificial watering points in Sturt National Park.* Rebecca Montague-Drake, UNSW	
1540-1600	*Afternoon Tea*	
1600-1700	*Plenary session*	Dr Judy Messer

Abstracts

LONG-ACTING CONTRACEPTIVES – ANOTHER TOOL TO MANAGE KANGAROO POPULATIONS?

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The management of overabundant kangaroo populations raises a series of contentious issues, especially because of their status as national icons. Social and political factors are becoming increasingly important in the decision making process and now dictate that in many instances population size be regulated by non-lethal control methods, particularly for populations in close proximity to urban areas. For this reason we are investigating the possibility of using a gonadotrophin releasing hormone superagonist (deslorelin) incorporated into slow release implants. This contraceptive acts by switching off the production of pituitary follicle stimulating hormone (FSH) and luteinizing hormone (LH), both required for male and female reproduction. Results from published studies on several domestic species and humans have shown that this form of contraception works well on females but its efficacy on males is less certain.

Experiments have been initiated on both sexes of two macropod species: eastern grey kangaroos (*Macropus giganteus*) and tammar wallabies (*Macropus eugenii*). Trials already completed on the female tammar wallaby have demonstrated that application of this contraceptive inhibits follicular development and ovulation. Results to date from ongoing experiments on eastern grey kangaroos have found that deslorelin inhibits reproduction in 92% of females (n = 13) for a period of at least one year. These results will be discussed in terms of the potential of this compound to manage large kangaroo populations.

RED PLAGUE: GREY PLAGUE KANGAROO MYTHS AND LEGENDS

Dr John Auty

The conventional wisdom amongst kangaroo killers and their epigones is that kangaroos were not numerous at the time of white settlement due to predation by aborigines and the dingo.

The historical record shows that in fact kangaroos were abundant and that aborigines and dingoes had little effect on their populations.

The development of the grazing industry on native pastures enables the population of kangaroos to be estimated prior to the development of this competition. The population at white settlement was probably in hundreds of millions rather than the tens of millions now present.

THE FACTS: SURVIVORSHIP OF RED KANGAROO YOUNG TO WEANING AND ITS EFFECT ON POPULATION DYNAMICS.

Amanda Bilton, School of Biological Science, UNSW

Quantifying recruitment of juvenile animals to the adult population is vital to understanding population dynamics. To date, popular belief holds that Red Kangaroos are fast, efficient and successful breeders, as deduced from their so-called 'high' population densities. Contrary to this, results on the reproductive success of a population of free-ranging female Red Kangaroos in Western NSW, show that survivorship of juvenile young is actually very low. This information needs to be taken into consideration when assessing population dynamics and the best management practice for the species.

IMMUNOCONTRACEPTION: CAN IT BE USED TO CONTROL KANGAROO POPULATIONS?

Prof. Des Cooper, Australasian Fauna Laboratories, Department of Biological Sciences, Macquarie University

The question of how to control the numbers of animals in some wild species is a vexed one. Kangaroos, koalas and possums are well known local examples. Shooting, poisoning and translocation are no longer acceptable to a large proportion of contemporary western societies, especially urban ones.

Fertility control has therefore received a great deal of attention and research fund. One much advocated method is immunocontraception. This involves vaccinating the animal against its own eggs, sperm or reproductive hormones. Temporary contraception or complete sterility may result. The method is ostensibly humane.

Closer examination reveals major practical and ethical problems. It is very difficult to vaccinate against a self component. These immune responses are usually weak or absent. Successful immunocontraception has only been achieved in one of two ways:

1. Using Genetically Modified Organisms (GMO). The issues surrounding the safety of the use of those agents are complex. The fact that a mouse immunocontraceptive GMO proved to be lethal has raised fears that the technology could be used in biological warfare. It is unlikely that the recently established Gene Technology Regulator will allow this method of delivery to be used.
2. By vaccinating with an adjuvant. Adjuvant is a mixture of substances which up-regulates immune responses. The most widely used kind often leads to painful lesions at the site of vaccination. Some Animal Ethic Committees no longer permit its use, even on animals which can be monitored daily and are destined to be killed at the end of the experiment. Its use on wild animals whose condition cannot be monitored and which are expected to live for the rest of their natural lives would therefore be even more questionable.

Other problems are apparent. The effectiveness of the method to control population size is also questionable. It is not possible to achieve 100% successful immunocontraception, and so rapid genetic selection for non-responding animals which will breed normally is likely. Their offspring will have altered immune responses, and may therefore be more susceptible to pathogenic agents in their environment e.g. bovine tuberculosis in New Zealand possums or for chlamydia in koalas. Another concern is that they could become more tolerant of microorganisms which are their commensals but which are pathogenic to other species living in the same ecosystem. There is little direct evidence to assess these risks although indirect evidence on the spread of infectious agents ("Emerging Infectious Diseases") through human activity in the last few decades suggests that they must be taken seriously. The precautionary principle embodied in the Gene Technology Act (2000) is likely to inhibit the practical application of immunocontraception for some time at least.

Other methods of contraception are being developed by our laboratory and the laboratory of Professor Marilyn Renfree in Melbourne. These are not open to the same objections, and in my view the relatively scarce resources for such work should be directed to these programs.

THE MANAGEMENT OF LARGE KANGAROOS: FOUR SPECIES NOT ONE!

Dr David Croft, School of Biological Science, UNSW

This paper emphasises the need to address the management of large kangaroos from the perspective of each species and its place in the herbivore community. I will discuss the behavioural, ecological and life history differences of red kangaroos, eastern and western grey kangaroos, and euros with examples from Fowlers Gap where they are found in sympatry. I will illustrate how some misconceptions and contradictions in research on kangaroos arise because these species differences are ignored. I will present numerically intensive modelling of euro and red kangaroo populations from empirical life history data as examples of alternative approaches to the study of kangaroo population dynamics.

THE DRAFT PLAN OF MANAGEMENT OF KANGAROOS FROM 2002 IN NSW.

Joshua Gilroy, Kangaroo Management Program, NSW National Parks and Wildlife Service

The NSW Kangaroo Management Program was last reviewed in 1997 and the current program started on 1 January 1998. Under the current program kangaroos can only be taken on the basis that damage to primary production or the rangelands will be mitigated. However, the current program contains no mechanisms to audit the success of a cull based on damage mitigation.

In 1998 NPWS initiated a strategic planning process with the NSW Kangaroo Management Advisory Committee due to the committee's dissatisfaction with the program review process in 1997 and problems with the operations of the committee. A comprehensive review of the Kangaroo Management Program developed from the strategic planning process. The committee requested various reports including a review of the scientific literature.

A new draft Kangaroo Management Program is being released seeking public comment. The goal of the new program is to maintain viable populations of kangaroos throughout their ranges in accordance with the principles of ecologically sustainable development. Damage mitigation has been removed from the draft program. The draft program has introduced an adaptive management approach and has a more inclusive and transparent consultative program including a process for the next review of the Kangaroo Management Program.

GENETIC EFFECTS OF KANGAROO HARVESTING

Dr Peter Hale, Conservation Biology Program, The Ecology Centre, University of Queensland

Concerns about the effect of harvesting on the genetic makeup of kangaroo species and populations include questions about loss of adaptive genotypes or genetic potential, selection against animals of large size, loss of disease resistance and loss of fitness. Aspects of kangaroo population dynamics, genetic population structure, gene diversity, harvest rates and harvest patterns will be discussed to assess whether the commercial kangaroo harvest is having any effect, negative or positive, on species genetics.

THE ROLE OF KANGAROOS IN AUSTRALIAN TOURISM

Dr Karen Higginbottom, CRC for Sustainable Tourism, Griffith University

The Cooperative Research Centre for Sustainable Tourism has recently conducted four research projects to evaluate the role of macropods in Australian tourism, and to

make recommendations for sustainable development of this sector. The emphasis of the study was on free-ranging macropods.

A survey of advertising materials showed that macropods feature in organised tourism experiences more frequently than do any other type of wildlife. There are currently more than 150 tourism enterprises in Australia that provide such opportunities for visitors to view free-ranging macropods. About half of all commercial tourism activities featuring macropods are tours in which the wildlife (including macropods) comprise only one component of a broader nature-based experience. The remainder comprise predominantly (in descending order of frequency): zoos and wildlife parks, accommodation (other than farms) featuring wild macropods, wildlife tours (mostly involving a variety of wildlife, not just macropods) and farmstays. National parks and other protected areas are also important to macropod tourism: as sites for tours by private operators, by providing their own organised macropod viewing opportunities, and as sites for incidental tourist encounters with macropods.

A number of macropod tourism enterprises were selected as most likely to exemplify best practice and investigated on site. Common weaknesses were identified with respect to business planning, market research, relationships with protected area authorities, quality of interpretation, techniques used to find and observe macropods, and environmental management practices. A detailed list of best practice guidelines for macropod tourism have been developed, and it is proposed that an information and advice kit should be developed for operators relating to interpretation, marketing and management of macropod encounters.

Demand-side issues were investigated using supplementary questions to the International Visitor Survey (IVS), as well as through visitor surveys administered on site. According to IVS results, some international visitors to Australia (18.4%) visit Australia partly because they wish to experience its native animals, though very few would not come otherwise. Kangaroos and koalas are by far the most popular animals among such visitors, with about half of all international tourists wanting to see a kangaroo during their visit. Tourists who have encounters with kangaroos in Australia can be divided into two somewhat distinct segments: those who experience kangaroos only in captivity (more likely to be from SE Asia or on group tours), and those who experience them in free-ranging situations (more likely to be from mainland Europe and to be on a second or subsequent trip to Australia). Most visitors who want to see a kangaroo while in Australia are successful in doing so, and express high levels of satisfaction with their wildlife and kangaroo encounters. However, on-site surveys showed that visitor satisfaction with the numbers of kangaroos and other wildlife seen and proximity to wildlife is only moderate. Most current visitors to such attractions and tours have a generalised interest in nature rather than a specific interest in wildlife or kangaroos. They rate naturalness of their wildlife experience and provision of information as the most important features of the experience.

A preliminary investigation of future opportunities for development of tourism based on free-ranging macropods was undertaken through a survey of “expert” opinion, consideration of the geographical distribution and other characteristics of various macropod species, and evaluation of key criteria relating to tourism potential at different sites. Relatively large, partially day-active, gregarious species of open habitats are expected to deliver the most rewarding tourism experiences for the mass market. Centres of high macropod richness in the forests of northern NSW, tropical QLD, the wet-dry tropics of NT and WA and the forests of southwestern WA offer the greatest potential for macropod-based tourism if examination of the diversity of forms is the goal. If high abundance and the large well-known

macropods are the focus of attention then a number of outback areas would fulfil this goal, especially in the pastoral zones of QLD, NSW and SA. Some of the most abundant populations of large macropods reside off protected areas and so some pastoral properties could exploit this asset, as high abundance is an important attraction in wildlife tourism. Current high-quality sites for macropod viewing do not generally serve tourism markets well, and there appears to be a particular opportunity for developing good sites near Sydney. The emphasis in future macropod tourism development should however probably be in enhancing existing experiences rather than setting up of new enterprises. In order to expose the greatest number of visitors to positive macropod experiences, the emphasis of efforts to develop macropod tourism should probably be on protected areas.

Experiments in which kangaroo images were presented to a sample of Americans were used to assess their use in marketing. The kangaroo was found to be one of the best recognised tourism icons in the world, and so may be a useful image in marketing communications where there is a need to communicate quickly that the message is about Australia. The use of kangaroos in the text or pictures of advertising material leads to various positive responses in American subjects, although the details of these responses depend on the particular form of presentation. A brief assessment of tourism advertising materials suggested that the kangaroo could be used much more effectively than is generally the case.

The CRC for Sustainable Tourism is continuing research to investigate the various environmental, economic and psychological factors that influence the sustainability of tourism based on wildlife. Recommendations arising from this research will help inform future management of Australian wildlife in terms of maximising the benefits and minimising the costs associated with tourism based on wildlife such as macropods.

MANAGEMENT AND BEHAVIOUR OF EASTERN GREY KANGAROOS

Prof Peter Jarman, Ecosystem Management, University of New England

Densities and local distributions of eastern grey kangaroo *Macropus giganteus* have been, and are, sensitive to European land-uses. Development of pastoral agriculture (tree-clearing, pasture improvement, provision of widespread water, and removal of predators including human hunters) was followed by a surge in kangaroo densities in the 1870s. That in turn led to a general attitude that labelled eastern grey kangaroos as pastoral pests whose density had to be limited by culling. That attitude persists and is reflected in our national kangaroo-management program, a quota-based licensed culling organised at national, state and regional scales.

Such coarse-grained management does not always resolve fine-grained problems. This paper investigates a local case of damaging and frightening attacks by kangaroos on people. The attacks were not a product of exceptionally high densities of kangaroos, nor of their having been hand-reared or hand-fed, nor of harassment. Attacks appear to have arisen because for many years kangaroos have been attracted to resources that allow them to live and mingle with moderately high densities of people on foot. Kangaroos have become extremely habituated, and at times appear to respond to the close approach of people as they would to the close approach of other kangaroos. Thus in circumstances in which a kangaroo might attack another kangaroo, people get attacked. The possible solutions include short-term education of both people and kangaroos, and longer-term modification of the resource environment for kangaroos.

This fine-grained problem would not be solved merely by regional culling. It exemplifies the need to understand in some detail the ecology and behaviour of the kangaroos in a particular context, as well as the activities and attitudes of people.

ALTERNATIVE MANAGEMENT STRATEGIES FOR HARVESTED KANGAROOS IN THE MURRAY-DARLING BASIN.

Dr Steve McLeod, Vertebrate Pest Control Unit, NSW Agriculture

Current Kangaroo Management Programs have three objectives; maintain viable kangaroo populations, minimise agricultural damage and maintain a sustainable harvesting industry. Many stakeholders are dissatisfied with the current programs and believe that they are not addressing their needs. At a workshop, stakeholders articulated their objectives and based on this information alternative harvesting strategies were proposed. The likely outcomes, in terms of population dynamics, of the alternative management strategies will be examined using a combination of physiologically structured population models and spatial models. This paper describes the background and objectives of a current study to examine these alternative management strategies for kangaroos in the Murray-Darling Basin.

DO KANGAROOS EXHIBIT WATER-FOCUSED GRAZING PATTERNS IN SEMI-ARID NEW SOUTH WALES? A CASE STUDY EXAMINING ARTIFICIAL WATERING POINTS IN STURT NATIONAL PARK.

Rebecca Montague-Drake, School of Biological Science, UNSW

Knowledge on kangaroo distribution and densities across a landscape is of supreme importance to kangaroo management. If, like has been proven for many other herbivores, kangaroos exhibit water-focused grazing patterns, then manipulation of artificial watering points (AWP) may be a strategic tool for kangaroo management.

With this in mind, many conservation agencies and organisations throughout Australia have begun programs of decommissioning AWP within their reserves to lessen the perceived impacts from kangaroo grazing, amongst other reasons. However, a study in Sturt National Park *"Strategic Management of AWP for Biodiversity Conservation and Nature-based Tourism"* is revealing that kangaroo distribution across the landscape is not related to water-focused grazing patterns but is predominantly synonymous with sites offering the best grazing and resting opportunities. Because kangaroos prefer to drink at specific times of the day, high densities of kangaroos may occasionally be viewed at AWP, however, such concentrations quickly dissipate, as kangaroos prefer not to linger near AWP, but once finished drinking, will travel to the most preferable grazing or resting locations. The current lack of vegetation around AWP can be more correctly attributed to sheep grazing pressure, even twenty years after sheep have been removed, than to kangaroo grazing pressure.

Opportunities exist to design nature-based tourism and community education activities, utilising the high kangaroo densities at AWP during preferred drinking times. Such activities have already been trialed in Sturt National Park with positive comments from all involved.

POPULATION MONITORING FOR KANGAROO MANAGEMENT

Dr Tony Pople, The Ecology Centre and Department of Zoology and Entomology, University of Queensland

In wildlife management, the system of monitoring will depend on the management objective. If the objective is damage mitigation, then ideally it is damage that should be monitored. Alternatively, population size (N) can be used as a surrogate for damage, but the relationship between N and damage obviously needs to be known.

If the management objective is a sustainable harvest, then the system of monitoring will depend on the harvesting strategy. In general, the harvest strategy in all States has been to offer a quota that is a constant proportion of population

size. This strategy has a number of advantages over alternative strategies, including a low risk of over- or underharvest in a stochastic environment, simplicity, robustness to bias in population estimates and allowing harvest policy to be proactive rather than reactive. However, the strategy critically requires an estimate of absolute population size that needs to be made regularly for a fluctuating population. Trends in the population and in various harvest statistics, while of interest, are secondary. This explains the large research effort in further developing accurate estimation methods for kangaroo populations.

Direct monitoring on a large scale is costly. Aerial surveys are conducted annually at best, and precision of population estimates declines with the area over which estimates are made. Management at fine scale (temporal or spatial) therefore requires other monitoring tools. Indirect monitoring through harvest statistics and habitat models, that include rainfall or a greenness index from satellite imagery, may prove useful.

Publication

The proceedings will be published and registered delegates will be advised when the volume is available for purchase.

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