Guide to the kangaroos of Fowlers Gap

Introduction

Fowlers Gap contains a large population of Red Kangaroos and Euros. The abundance of these species varies with the run of the seasons but averages around 6,000 Red Kangaroos and 2-3,000 Euros. In addition, the Station supports smaller populations of Eastern and Western Grey Kangaroos of around 100 and 500 individuals, respectively.

Throughout the Western Division these four species are shot by a commercial industry set up to cull populations in order to mitigate perceived damage to agricultural production. This practice has not been pursued on Fowlers Gap since the University took over the lease. Initially researchers required an undisturbed population to examine aspects of reproduction, ecological physiology and behaviour. Subsequent research on competitive interactions between sheep and kangaroos has shown that negative interactions between these species is rare and only when pasture biomass is extremely low. At such times kangaroos suffer high mortality and fail to reproduce unlike sheep. Kangaroos typically avoid areas of high usage by sheep if given the opportunity and without shooting maintain natural age-structured and relatively stable populations.

Kangaroos are marsupials and belong to the Family Macropodidae (i.e. big feet) that is grouped with the Potoroidae (potoroos, bettongs, rat-kangaroos) in the Super-Family, Macropodoidea. This comprises around 48 species in Australia and a dozen or more in New Guinea. Some of the smaller species, such as Yellow-footed Rock-Wallabies, Burrowing Bettongs, accompanied Pig-footed and Golden Bandicoots, Bilbies and possibly Hairy-nosed Wombats into extinction from what is now Fowlers Gap with the advent of pastoralism. However, the largest species remain in much of their original range with the grey kangaroos expanding inland as grazing habitat increased and coastal habitat was lost in clearance for agriculture. The defining feature of the kangaroo family is that they are the largest vertebrates to hop (both currently and from what we know from palaeontology).

The species commonly called the 'kangaroos' are the result of an arbitrary division of the Macropodidae based on a hind foot longer than 250 mm. The kangaroos then comprise six species of which four are found on Fowlers Gap. The remaining two are less well-known and include the Antilopine Wallaroo (*M. antilopinus*) from the Kimberley, Top-End and Far-north Queensland, and the Black Wallaroo (*M. bernadus*) from Arnhem Land. The Red Kangaroo is the most recently evolved, appearing in the Pleistocene (1-2 million years ago), whereas relatives of the grey kangaroos and wallaroos arose in the Pliocene (4-5 million years ago). A common feature of this group is that they are grazers.

Fowlers Gap is near the heart of the densest population of Red Kangaroos in Australia. The relatively treeless floodplains provide an exceptional opportunity to view all individuals from a joey taking its first uncoordinated hops from its mother's pouch through to 80-90 kg males, the largest of their kind. Yet Fowlers Gap offers much more because it provides a rare opportunity to see not one but four species of kangaroos with unparalleled clarity. However this brings a challenge in identification for the novice, as the common names are confusing. Most female Red Kangaroos are

in fact blue-grey, Eastern Grey Kangaroos are grey through to brown and Western Grey Kangaroos are dark grey through to black. Common Wallaroos, of which the Euro is a sub-species, are grey, grey-brown, dark grey or even black.

This guide will lead you through the identification process as there are distinctive facial and other morphological features to each species and they typically segregate to some extent amongst habitats. The guide will illuminate interesting differences in their biology and highlight some of the remarkable behaviour you may see. We hope you leave Fowlers Gap better informed about kangaroos, and with a desire to not only come back to appreciate more but to go on a quest around Australia to see the other 42 species of Macropodoids.

Red Kangaroo

Macropus rufus ('red long-foot')

Identification

Red kangaroos have a white facial stripe from the corner of the mouth towards the ear. The amount of hairless rhinarium (skin on the tip of the nose) is dusky coloured and intermediate between the narrow band of grey kangaroos and the broad one of euros. Males continue to grow through life and may reach 90 kg in weight. A 90 kg male was caught at North Johnstones Tank on Fowlers Gap and this remains the largest individual in the many studies on the Station. They are typically red coloured

(lighter in summer and dark rusty red in winter). Females may grow to 40 kg but usually range around 25-30 kg. They are typically blue-grey. However, the colouration of the two sexes grades into each other with small percentage of grey males and red females and some intermediate shades. To confirm the sex of an individual you need to view the abdomen where the pouch opening of females or the scrotum of males is usually obvious.

Colouration of red kangaroos is not uniform. The abdomen and lower parts of the limbs are light grey to white but the nails of the feet and forepaws are black. The tail tip is always a light ochre colour that clearly distinguishes it from the black-tipped tailed of grey kangaroos. Red kangaroos hop with their back almost parallel to the ground and their head low.

Habitat

Red Kangaroos are found throughout the Station and are both the most abundant and most commonly encountered species. They prefer open, sparsely treed habitat and find adequate shelter at the base of large shrubs but may move into acacia thickets and the trees along the margins of creeks during the height of summer. They prefer short green grass or winter forbs (small annual dicotyledons) for forage and thus are most often found on run-on zones (e.g. flood plains of creeks and terminal parts of drainage channels). However, they may move onto higher stony ground after rain to avoid the boggy clay soils.

Foraging behaviour

The first preference of Red Kangaroos is green grass, followed by green forbs and mature grass. Grass can provide bountiful energy, but it is tough to digest. Thus anatomical and physiological adaptations have evolved to exploit this abundant food sources, and these parallel similar adaptations in sheep, goats, deer and antelope. All the kangaroo species have a specialised dentition to crop grass, and progressively wear out and shed their pre-molars and then molars as the silica in grass abrades the teeth. They have large and

complex fore-stomachs where they garner the assistance of specialised bacteria and a few protozoa and fungi to break down plant fibre in a fermentative chamber. They gain about 70% of the available energy in the process and digest the end-products, short-chain fatty acids.

Red Kangaroos feed selectively amongst the pasture, nipping off grass blades or small forbs with incisors at the front of a small delicate mouth. They can push aside shrubs with their manipulative forepaws to get out small green plants growing in the protective shade. During drought they more move up to 50 km to a local rain shower to feed on 'green pick' but, at least mature females, return to their normal home range after widespread rain. Only young males and some young females disperse over long distances.

☞You should watch Red Kangaroos feeding (their most common activity) and note how they work the moister run-on zones in the landscape. They often squint while feeding during the day and so must follow their nose and taste in selecting plants once they have hopped to a favourable patch. Most foraging is in the late afternoon through into the night and then in the early morning around dawn. Arid-adapted plants have more moisture in their leaves during the cooler hours around dusk and dawn and the latter period may add dew to the leaves so that the kangaroos satisfy more of their water requirements by foraging at these times in hot weather. The rate of passage of food through their gut is relatively slow so that they rest in the night and during the day to digest a filled gut. They do not ruminate like sheep but grind their forage more finely at initial intake and so feed more slowly than stock. Sometimes you may see them stand up, pump their forearms, arch their head and regurgitate a bolus of fibrous plant matter in a behaviour known as merycism.

<u>Reproductive behaviour</u>

Female red kangaroos become reproductively mature at around 18-24 months and males at about 36 months. However, males compete with each other to mate with females and so only reach a competitive size at about 7 years and are in their prime at around 10 years.

There is no breeding season for Red Kangaroos. The only time that females may be in synchrony is after the breaking of a long hard drought. Typically females have a production line of overlapping generations. The oldest is a 'young at foot' that has permanently left the pouch but is still dependent on a drink of lipid-rich milk from an elongated teat in its mother's pouch. It will be finally weaned at about 12 months age. The pouch is reserved by a smaller unfurred sibling of the next generation, who grips a second teat and suckles on milk more balanced in carbohydrates, proteins and lipids as suits its age. Unformed in the mother's uterus is a third generation sister or brother, waiting for a pouch vacancy. When that is imminent, its development is renewed but it is born in an embryonic form little resembling its final body shape. This birth triggers oestrus (receptivity to a male's mounting attempts) in the mother who has attracted a bevy of competing males from which the largest will emerge as consort. If not, then the female may seek out large males as a potential partner ensuring the 'best genes' for her offspring.

As is the way with marsupials, development is relatively slow through nourishment of the young by lactation rather than a placenta. Kangaroos overcome this limitation by overlapping the generations to speed recruitment into the population. Even so, most young will die through inadequate high quality forage in the unpredictable and unproductive arid zone and, though equal numbers of sons and daughters are produced, male mortality is higher and

populations are female-biased. Populations boom in a run of good years and then crash with a hard drought.

☞You should watch mothers, particularly those with large pouch young in the late afternoon. At this time you may see the first unsteady excursions of the young as it overbalances or is dumped out of the pouch. As they gain coordination, they play around the mother, hopping in quick excursions from her as a safe base, and sometimes returning to briefly batter her head in play.

☞If you see several males in the vicinity of a female who all seem intent on keeping her in close range then you will be in for an interesting insight into mating behaviour. You should note the largest male positioning himself as consort and stroking the base of the female's tail to test her readiness to mate. Other males may challenge him and the female may hop off with a trail of importunate males in tow.

Males often approach a female and sniff her cloaca. In fact, they do more and gently nudge it with their nose stimulating a reflex to urinate (useful when they were residents of their mother's pouch so that she could remove their waste). They then aspirate a little of this urine stream into a specialised nasal cavity (the vomeronasal organ) which has receptors for oestrogen. Thereby the male can test a female's likelihood of oestrus.

Social organization

Young Red Kangaroos may disperse from their natal area of a hundred or more kilometres but adults typically remain in home range of around 1.5 square kilometres. They do not use these ranges exclusively but overlap with individuals of both sexes and different age classes. No permanent groups are formed but rather individuals aggregate in loose associations around shelter, forage or water. They are more often within 50 m of another kangaroo than alone but only mothers and their young-at-foot or oestrous females and their consorting male keep close proximity.

You may see a female, her joey and an accompanying male and think they are a family group. In reality the female's three generations of young may each have a different father although the most powerful male (the alpha male) in her home range will typically mate with half the females, more than any other male. He needs to conserve some of his energy to maintain dominion over two or three years since a drought could wipe out any of his offspring in a given year.

Males move through their local population of females, regularly checking their oestrous status. Those with very large pouch young are most attractive since permanent pouch exit is the cue for birth and a post-partum oestrus. However, death of a pouch young could equally trigger these events so males are always checking.

Euro

Macropus robustus erubescens (robust long-foot with a ruddy nape)

Identification

The Euro is the arid-zone sub-species of the most widespread kangaroo, the Common Wallaroo (or Hill Kangaroo). Euros have a large naked rhinarium giving them a dark shiny 'button nose' like koalas and wombats. They have no facial stripe but they do have large rounded ears. Their coat is coarser and shaggier than the fine down of Red

Kangaroos. Females are relatively short and small and rarely exceed 25 kg. Their coat colour varies from light grey through light tan to dark grey. Males are short but very stocky with pronounced forearm musculature when mature. They reach around 50 kg and show a similar variation in coat colour to females but are distinguished by a rufous-brown nape and may often be darker coloured than females. The underparts are lighter and the tail tip is not black.

Euros hop on their short legs in an upright posture, which seems less elegant than Red and Grey Kangaroos on flat ground, but comes to the fore as they effortlessly bound up rocky slopes.

Habitat

The Euro is a hill-dweller and so occupies

the slopes and ridges, using rocky overhangs and shallow caves as shelter in summer. Males sometimes follow more densely vegetated drainage channels out onto the plains in drought. Thus Euros are most common on the hills of the Barrier Range as it passes through Fowlers Gap. Any of the slopes and ridges around the homestead are a good places to see them close up. Females tend to be more easily alarmed by people than males who sometimes tolerate quite close approach.

Foraging behaviour

Euros have similar diet preferences to Red Kangaroos but eat both young and mature grass in favour of forbs or shrubs. Competition is reduced by segregation of the two species between the hills and plains, respectively. However, on Fowlers Gap this is only marked on the steep slopes and ridges as both species may occupy the footslopes. Male Euros follow creeks and deep drainage channels onto the plains during drought.

Euros have the capacity to recycle urea through their saliva and so have a lower nitrogen requirement than the other kangaroos since some that would be excreted in the urine is conserved. Euros have a lower water turnover than Red Kangaroos and choose humid microhabitats in summer such as rock overhangs, shallow caves and the undercut banks of creeks. This behaviour reduces their water loss for cooling. Euros will enter an unoccupied building or shed if the door is left open in mid-summer, using them as pseudo caves, an action that Red Kangaroos would never take. Euros are also not fully dependent on water bodies to drink as they have the capacity to find subterranean water and dig soaks in creek beds.

Euros are adapted to endure drought but may suffer high mortality under such harsh conditions. Males often range out of the hills to find sufficient food to satisfy their larger bulk than females. Red Kangaroos are more mobile and attempt to avoid the extremes of drought by tracking localised rainfalls to gather green pick.

Reproductive behaviour

Euros, like Red Kangaroos, are continuous breeders and the timing of sexual maturity and the progress of offspring development is very similar. However, female Euros tend to shut down reproduction (i.e. enter anoestrus) under less severe drought than Red Kangaroos. As the mother enters drought, her offspring die in order of their energy and nutrient demands. First the

young-at-foot dies, then the pouch young as the mother cannot meet its milk requirement and then the embryo in utero is born. If drought persists the latter's fate is sealed but rainfall and a flush of green vegetation may see it through. If the female loses all her offspring and drought persists then she ceases to come into oestrus.

When female Euros are fat and in good condition they tend to produce a preponderance of sons. At other times the offspring sex ratio is equal or even biased towards daughters. Sons grow more rapidly than daughters once they leave the pouch and so are a greater demand on the mother. However, by investing in her sons when she has energy reserves to spare she may give them a boost in the growth stakes so that they have good survival in their early years and grow large enough to become alpha males. This investment is short-term for the mother since her sons disperse a few months after weaning. In contrast her daughters are 'cheap' to produce but stay in or around their mother's home range and so she has to share some of her resources with them in the long-term. This balances the costs so that even though the ratio of sons to daughters may be biased under some conditions or periods of a female's life, the ratio in the population as a whole is equal.

Male Euros epitomise the extreme dimorphism in the kangaroos as you may see a heavily muscled 50 kg male mating with a diminutive and gracile 15 kg female. Like Red Kangaroos, male Euros compete amongst themselves for consortship with a female who may lead half a dozen or more potential suitors on a chase through the hills. Euro society is somewhat more compact in the hills and individuals more sedentary than the roaming Reds on the broad sweep of the plains. Thus competition amongst male seems more intense and 'mating groups' typically include more males than in Red Kangaroos. The exertion of competing and keeping up with a flighty female takes its toll and large males often temporarily retire to better pasture to re-build condition. Thus one male does not have exclusive dominion but a few large males will mate with most of the oestrous females.

☞You should watch out for aggregations of males around a female, as this is a fascinating chance to see lots of interesting interactions.

Social organization

Euros are typically more sedentary and more solitary than Red Kangaroos. You should expect to see a mother and her offspring foraging at some distance from others. Males move amongst the females checking their reproductive status but only dwell if she is nearing oestrus.

Young males sometimes gather in pairs or trios to box. Males start this behaviour with their mother as sparring partner and it persists through life with a peak in the juvenile and early adulthood period. The combatants meet in vigorous and extended bouts but the goal is practice of techniques and wrestling down an opponent rather than exacting a final and damaging defeat. In other words, it is play-fighting where opponents invite a bout by facing off and vigorously scratching their sides, eventual losers kick more than winners and defeat comes from a strong backwards and downwards push, if at all. In contrast, when the fight is for consortship the battle is

typically swift and the winner delivers hard kicks to its opponent's abdomen while raking its face and biting its ears in a clinch. You can tell something about a male Euro's battles by the nicks out of his ears. The abdomen may be scarred but as in all the kangaroos, the skin is thickened in males to provide some protection against others' kicks.

Eastern Grey Kangaroo

Macropus giganteus ('giant long-foot')

Identification

Both the Eastern and Western Grey Kangaroos have a very narrow band of the rhinarium of the nose exposed. The female Eastern Grey Kangaroo is as large but more gracile than the female Red Kangaroo. The fur is long and soft and varies from grey-brown through to dark grey in both sexes. The fur on the abdomen and inner thighs is lighter than the back fur. The forepaws and tips of the hind feet and tail are very dark. The nails on both fore and hind limbs are longer than in Red Kangaroos or Euros and Eastern Grey males tend to have much longer forearms than the aforementioned species. Note the light diamond between the eyes and the light tips to the ears when trying to distinguish this species from the Western Grey. The species is sexually dimorphic with males reaching 70 kg or more and females around 35 kg. However, you cannot reliably distinguish males and females from coat colour although some argue males are a little browner and darker.

Eastern Grey Kangaroos hop with the back at a higher angle to the horizontal than Red Kangaroos and the forelimbs more extended. The curve and swing of the tail is also more pronounced.

Habitat

The Eastern Grey Kangaroo is a more woodland, forest edge species in the heart of its range and so in the arid zone occupies the riparian zone (moist banks) of the ephemeral creeks and acacia thickets on the nearby plains, grazing out from these havens of dense shelter at night.

☞You will see Eastern Grey Kangaroos if you walk out along Fowlers Creek through Saloon paddock. The Eastern Grey is more common on the stony in the riparian zone of the Creek than the Western Grey so chances are that any grey kangaroo in or near the creek banks will be an Eastern.

The species is near its westernmost distribution on Fowlers Gap and this is thought to have been a recent range expansion during some exceptionally wet years in the early 1970's. The species has persisted despite being less physiologically adapted to the arid zone than either the Red Kangaroo or Euro. Some have argued that the permanent water installed in the pastoral era has enabled this but no one has turned the water off to see if they then expire. In fact, the Eastern Grey Kangaroos is probably the most opportunistic and adaptable of all the species. Its range spans latitudes from northern Tasmania to north Queensland and both sides of the Great Dividing Range where it may forage amongst snow. Much of its former habitat

has been lost to croplands, which may have exerted some westwards pressure. We also need to recognise that climate has varied enormously over its evolutionary history and no doubt the species has occupied and perhaps dominated the far west of NSW in wetter periods in the past.

Foraging behaviour

Eastern Grey Kangaroos are also primarily grass eaters and so potentially compete with Red Kangaroos and Euros. Microhabitat differences tying the Eastern Greys to dense lateral cover for daytime shelter keep the species somewhat apart.

Reproductive behaviour

The reproductive biology of the Grey Kangaroos sets them apart from the Red Kangaroos and Euros. Development of the offspring is much slower so that young of comparable size permanently exit the pouch at around 320 days compared to 235 in Red Kangaroos and are weaned at 540 days compared to 360 in Red Kangaroos. Breeding is more seasonable with a broad peak in births from October through to March, although this may be more variable in the arid zone.

Eastern Grey Kangaroos do not mate immediately after birth since the oestrous cycle is around 10 days longer than length of pregnancy. They may also mate while they have a young in the pouch, which is about six months old. The resulting embryo remains quiescent (in diapause) due to inhibition of further development while the female is lactating. It is born when the pouch young permanently exits or dies prematurely.

In temperate habitat, a single alpha male has exclusive dominion over a mob of females that may number 30-40 or more. His tenure is typically a single year and competition for the top rank is especially fierce. Females often aggregate with their female relatives so that a group of daughters, mothers, grandmothers and so on may form. This seems to provide greater reproductive success in the younger females but there may be a limit to how large these matrilineal groups can grow as females may produce dispersing sons later in life and stay-at-home daughters earlier on.

The mating system in the arid zone is less well known as groups are smaller, commensurate with the small populations. However, you see very few very large males and so we suspect that these hold dominion but perhaps for more than a single year. Females remain quite faithful to their home range and only extreme drought may cause them to move temporarily so matrilineal groups probably build up over time.

☞Eastern Grey Kangaroo mothers spend a relatively long period with their young and so offer a good opportunity to observe the affectionate and endearing bond between a mother and her joey. Look out for smaller females nearby, as these may be her daughters.

Social organisation

Eastern Grey Kangaroos are the most social of the kangaroos and so it is rare to see one alone. If you do it is likely to be a male in transit to check out the reproductive status of females in some other part of the mob or a mother with her young-at-foot. One good reason to gather together in a group is that more individuals can be more attentive to possible threats from predators. The chance that someone is looking out when the predator makes its attack increases with group size. Likewise when the group flees, the distraction of many individuals following interweaving paths is greater than a single target fleeing alone. It thus seems odd that mothers with their vulnerable young wander off alone from the mob. The explanation seems to be that the mob is a confusing place for a young-at-foot when potential 'mothers' flee in many directions. Thus mothers remove there immature young-at-foot and train them to retrieve the pouch, if not past permanent exit, or follow closely before again associating with their fellows.

Western Grey Kangaroo

Macropus fuliginosus ('Sooty long-foot')

Identification
Western Grey Kangaroos show all the same characters of their Eastern counterparts that enable you to distinguish them from Red Kangaroos or Euros. Thus the problem is how to tell and Eastern and Western Grey Kangaroo apart. The Western Grey is typically a little stockier and much darker. Its fur may grade from a dark chocolaty brown to almost black but with lighter underparts. The diamond between the eyes is typically dark as are the tips of the ears. Their head is a little more solid.

☞The sexes differ in size in a similar range to Eastern Grey Kangaroos but the mature males have a distinctive curry-like odour. This has lead to the common name of 'stinker' in some parts and an aversion to taking this species for human consumption.

Habitat
Western Grey Kangaroos tend to be in the more shrubby areas and Eastern Grey Kangaroos on the grassland. Typical habitat is scrub or mallee in the heart of their range in South and Western Australia. On Fowlers Gap you are most likely to see them around acacia thickets on the 'Gap Flats' in the eastern part of the Station. In summer you will see them drinking at stock troughs and tanks in the evening.

Like Eastern Grey Kangaroos, Westerns are near the margin of the range on Folwers Gap (the north-easterly margin in this case) and are presumed to be relatively recent arrivals in the 1970's. They have suffered substantial habitat loss through the clearing of mallee for crops, which accelerated during this same period so to some extent they are 'refugees'. They are more abundant than Eastern Grey Kangaroos as you approach Broken Hill. In both western NSW and northern South Australia there is some concern that they are 'taking over' from Red Kangaroos. This is likely the result of selective shooting for the human consumption market where Red Kangaroos are favoured as the meat is untainted by a distinctive smell.

Reproductive behaviour
The reproductive biology of Eastern and Western Grey Kangaroos is very similar. However, Western Grey Kangaroos do not show diapause and so only have two dependent generations of young (one in the pouch and one at foot). The pouch must be permanently vacated for the female to mate again.

Western Grey Kangaroos in the woodland refuges in the WA wheat belt, show a decline in fertility from about 8 years so that few 12-year-old females breed. Population sizes may thus remain very stable but the generality of these results to other parts of the range is not known.

Social organisation
Females and their kin are the core of the mob as in Eastern Grey Kangaroos. Males may segregate into different areas during the non-breeding period but this has not been well studied in the arid zone. The Western Grey Kangaroo seems to have an undeserved poor reputation amongst pastoralists who may refer to them as 'black bastards'. However, their behaviour is as

equally fascinating as the other three species and their resilience has been proven by their persistence in small woodland refuges amidst broad-acre crops.

Further Reading

A large number of original research papers and theses have been produced by past and present members of the School of Biological Science and their collaborators. Research papers for the decade 1990-2000 can be found on the Fowlers Gap web site http://www.bios.unsw.edu.au/fgap/fgap.htm.

The following book provides an excellent guide to the biology of kangaroos and draws on research from Fowlers Gap.

Dawson, T.J (1995). *Kangaroos: Biology of the largest marsupials.* Sydney: UNSW Press.

This guide is part of a UNSW research project in collaboration with the CRC for Sustainable Tourism. The aim of this project is to develop and implement products to support a vibrant wildlife tourism industry in the rangelands of the Outback. Some more information can be found at our web site http://www.bios.unsw.edu.au/rootourism/.

Your Notes: