

Rock Wallabies and Their Struggle for Survival

According to the prevailing opinion of experts, sixty-eight species of kangaroos and wallabies, which are categorized into the subclass Marsupials (*Marsupialia*) and belong to three families (Wilson et Mittermeier 2015), live on Earth. The smallest is the musky rat-kangaroo (*Hypsiprymnodon moschatus*), with a maximum body and tail length of 45 cm and a weight of 0.5 kg at most. The biggest is the eastern grey kangaroo (*Macropus giganteus*). Males of this species measure more than 3.3 meters from the nose to the tip of the tail and weigh over 65 kg. However, the heaviest are red kangaroo males (*Macropus rufus*), which can weigh up to 85 kg.

In the course of evolution, kangaroos adapted to various types of biotopes. Today we can see them, for example, in red-hot deserts, tropical rain forests, or mountains which are covered part of the year by snow. They are consumers of grassland, and so, in the Australian ecosystem, occupy a similar position to ruminants (antelopes) in Africa. Rock wallabies are one group which are bound to a specific habitat. Only these wallabies will be discussed in the following paragraphs.



The short-eared rock wallaby (Petrogale brachyotis), as well as other species of rock wallabies, hides between almost inaccessible rocks during the day, and at dusk travels up to several hundred meters for food, which consists of plant leaves. This species lives only in northern Australia.



The brush-tailed rock wallaby (Petrogale penicillata), an endemic species of southeastern Australia, used to be common. But, in the late 19th and early 20th centuries, over half a million these animals were killed, as they were considered agricultural pests. Also, a brisk trade in their fur blossomed. A decrease in their numbers continues (today mainly due to loss of habitat), and the species survives in isolated and mostly small populations, and there remains a high risk of local extinction, which has already occurred in many places.

Habitat, Which Cannot Be Used by Other Larger Animals

All seventeen species of rock wallabies belong to one genus, *Petrogale*. They live only on the Australian mainland, not on the surrounding islands. They inhabit barely accessible rock faces and rocky ridges. The specific habitat in which they live initiated the establishment of a number of customizations, enabling them to survive in areas that are difficult for other similarly large mammals. Due to the nature of the occupied habitat, many kinds of rock wallabies live throughout disjointed distribution areas. Besides providing a view of, and refuge from, predators, the rocks fulfill one other important function: Big rocks and deep rock crevices protect animals against the summer heat, which can exceed 40 degrees Celsius. As an example of the adaptation of rock wallabies, we can mention the behavior of the mothers. Because the young are more sensitive to the high temperatures, the females lick the feet of the joeys (which is what baby kangaroos are called). The evaporation of the saliva cools the young ones.

Before we outline the situation of rock wallabies in the contemporary world as it has been affected by people, it must be pointed out that greater specialization brings higher risk. In cases of a change in the environment, a specialized type is not capable of responding flexibly and thus becomes sensitive to sudden changes, which then can have disastrous consequences.

Behavior

Rock wallabies have developed the ability to eat difficult-to-digest plant material, particularly grasses. Grassland in Australia spread only recently in evolutionary terms, and it is likely that the current species diversification of kangaroos and wallabies is a response to this change, which provided enough food for many species. Animals that feed on grasses are dependent not only on quantity, but mainly on the energy and nutritional value of the available food. Like other herbivores, wallabies try to get the most energy out of their food, so they are picky when grazing. Kangaroos and wallabies, like ruminants, are able to regurgitate digested food, which they can then chew again. Unlike ruminants, however, kangaroos



Wind-power plants are not very widespread in Australia, but they demonstrate another form of annexing land for human needs, which negatively affects the lives of rock wallabies in many ways. There are remnants of the original forest in the background of the image. The flat landscape is laced with roads which often lead through corridors that wallabies use to move to pastures at night. Networks of barbed-wire pasture fences represent a further threat.

and wallabies do not have a divided stomach, so the food must be mechanically pulverized more intensively. By this means, they can start to break down difficult foods; plus, chewing promotes saliva production, which is the first step in a chemical digestion process.

The ability to vomit food has one more crucial implication for kangaroos and wallabies: Especially in the dry season, females help the joeys with their water intake by allowing them to lick whatever regurgitated food remains around the mother's mouth. The juveniles thus acquire minerals, digestive enzymes, and water. In their natural habitat, continuously available water is often scarce or nonexistent. As a result, rock wallabies have developed a unique strategy for survival: Rain, when it comes, is usually in the form of torrential storms. During these downpours, a wallaby is able to drink an enormous amount of water - more than 10 percent of its weight, which is the equivalent for a man of roughly 10 liters.

Thickened leathery pads on their hind paws help them move about on rocks, and even enable them to climb trees. During the high daytime temperatures, they remain in the shadow of rocky crevices. Only in cold weather do they regularly bask in the vicinity of their favorite hideouts. At twilight, they will forage up to several hundred meters away.

Some species of rock wallabies form stable couples for up to several years. The coherence of the couple is shown by such things as the mutual cleaning of fur, their joint

night expeditions to graze, and the shared defense of their hideaway. Since females are smaller, the territory is usually defended by larger males, who also fight among themselves for the favor of females.

The bright colors of rock wallabies are seemingly noticeable; but in their natural environment, they are perfectly camouflaged for protection against predators. Undoubtedly the most colorful of the Australian kangaroos and wallabies is the yellow-footed rock wallaby (*P. xanthopus*). The hue for most rock wallabies depends on pigment in the hair itself. Only the pinkish red hair color of the purple-necked rock wallaby (*P. purpureicollis*) is caused by a substance secreted in the skin glands which sticks to the hair as it grows and can be easily washed off.

Breeding

Like other marsupials, rock wallabies reproduce in a unique way. Mothers give birth after only about one month of pregnancy. The embryo weighs less than one gram and is in a very early stage of development. Before the birth, the female licks her belly to lead the way to her pouch. The neonate remains attached to its mother's body and begins immediately, and without the mother's help, to climb up the moistened belly toward the pouch. This arduous journey takes from one to four minutes.

The embryo then sucks the mammary gland teat, which is in the pouch. The female has two teats, yet is able to simultaneously take care of three offspring in different stag-

es of development. The oldest may have already left the pouch, but still returns when it is looking for protection or milk. The next oldest is permanently attached to one of the nipples; while the youngest one is held in a stage called diapause, when its development is temporarily stopped. The triggering mechanism for diapause is the sucking of the older baby in the pouch, the development of the embryo being resumed only after the weaning of the oldest of the three. The composition of the milk produced by the mother varies: If the young in her pouch are of different ages, the milk supplied to each nipple will be different in order to match the biological need of each joey's particular stage of development.

The bigger the female is, the more likely it is that the offspring will be male, though the exact mechanism that affects the sex ratio is not known.

Main Enemies: Goats, Sheep, and Rabbits

The European colonization of Australia that began during the 18th century dramatically changed the landscape of the continent. Living conditions for some species of kangaroos and wallabies improved with this gradual transformation. This was the case for species that began to graze pastures (which replaced native forests) and to use watering places (which had been man-made for livestock). However, the trend was not positive for many other groups of animals, such as



The allied rock wallaby (*Petrogale assimilis*) occurs in a small wooded area on the east coast of Australia. Despite their name, they live mostly in couples. This species is very tough, and is able to survive even when a permanent source of water is lacking. Like other kangaroos and wallabies, the female gives birth to one joey at a time, with twins having been reported only rarely.

most of the smaller species of kangaroos and wallabies. In Australia, four species of kangaroos died out and the population size of many others dramatically dropped. The endangered species groups now include some rock wallabies, which fight for survival in the wilderness of Australia.

Today it is hard to imagine that these rare and shy animals were so common in the early 20th century in some areas that people had to build fences to protect their gardens from them. During this time, rock wallabies lived in groups which could number in the hundreds. But, as recently as the late 19th century, high prices for kangaroo fur were given, and so began a massive slaughter in which trophy hunting (especially for the distinctively colored yellow-footed rock wallaby) had its share. All forms of hunting have led to a dramatic decline in numbers, and to the complete extinction of some populations.

The competition by the grazing of already sparse vegetation by feral rabbits and domesticated ruminants ruinously impacted on the declining population of rock kangaroos. Besides rabbits and sheep, goats also dealt a mighty blow because they are able to occupy the rock wall biotope, which is inaccessible to other herbivores. Similar food requirements make them major competitors. During prolonged droughts, populations of some species of rock wallabies might drop to half of the original number, after which they can achieve the baseline again only when they do not have



A couple of yellow-footed rock wallabies (*Petrogale xanthopus*). This species inhabits the arid outback of the Australian continent in a few scant and mutually isolated populations linked to canyons and rocky ridges. The male is on the right. All male rock wallabies fight among themselves for territory and for the favor of females, and are more robust than females.

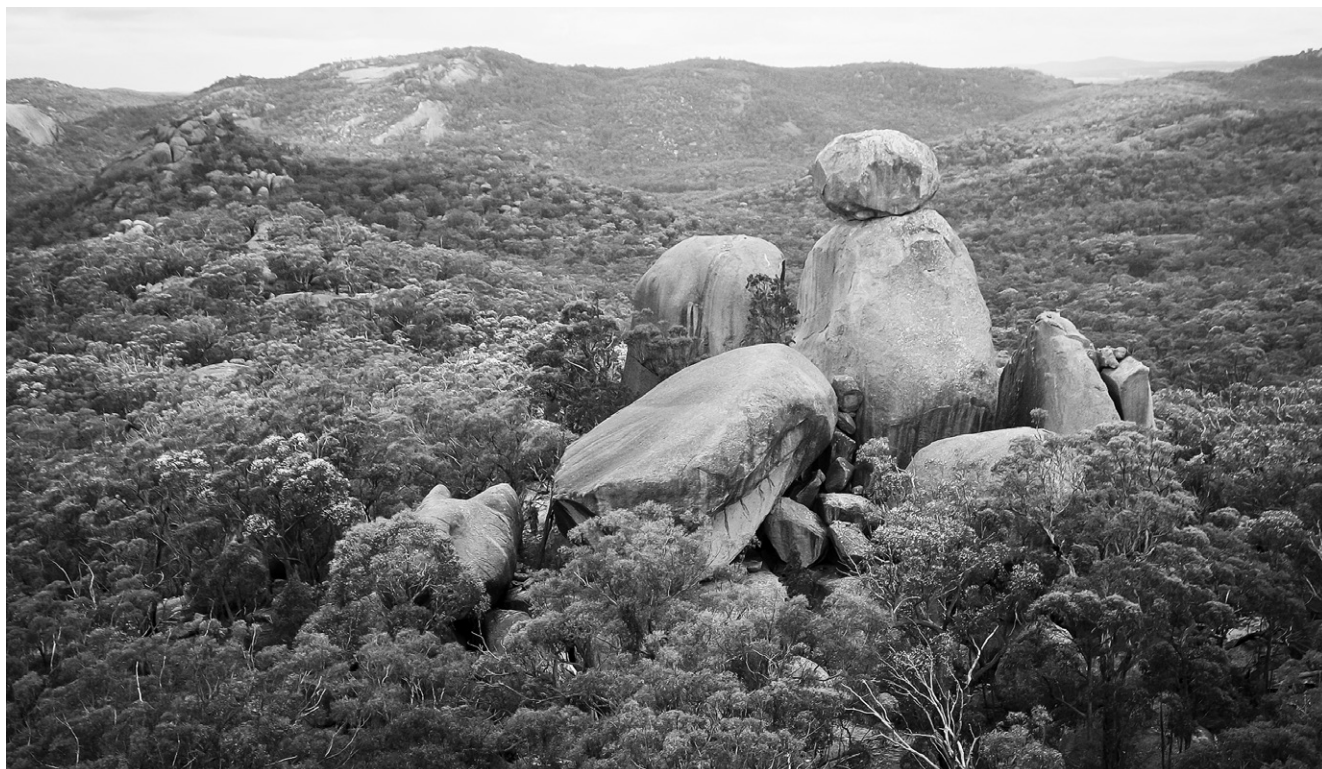
to compete with goats and sheep for access to food resources. Moreover, goats also occupy the rock crevices which are essential as shelter from the summer heat. Among other alien species, feral camels, horses, and donkeys have contributed to the environmental degradation and decline of rock wallabies.

Today, the area inhabited by rock wallabies is often only rocky, treeless, eroded wasteland. Until the arrival of Europeans, many such places were overgrown with loose forests. On rocky subsoil, trees grow very slowly. After their removal, the habitat has only minimal regeneration capacity. But people did not take into account these inherent limitations. Massive felling for the needs of the mining industry and the construction of pasture fences led to deforestation. And, in the plains, vast forest areas have disappeared, being replaced by new pastures for livestock.

The urbanization of the landscape is another threat. Many wallabies are killed in collisions with cars. When they search for water and food, wallabies are restricted by ubiquitous fences. But even in an altered landscape, rock wallabies have found replacement environments, using man-made structures that resemble their natural habitat at least in

some ways. These can be dams, roads, or mines, as well as abandoned houses.

But being hunted, the competition of herbivores, and the degradation and fragmentation of their habitat are still not everything rock wallabies have to deal with. The only natural Australian predator of rock wallabies is the wedge-tailed eagle (*Aquila audax*) which, however, does not cause significant losses, as wallabies are not its main prey. Rock wallabies in the past perhaps could have been hunted by the now-extinct thylacine (*Thylacinus cynocephalus*). And, from about 5,000 years ago, rock wallabies were chased by dingos (*Canis dingo*), which arrived in Australia with a late wave of aboriginal settlement, but this did not significantly affect their original habitat. During European colonization, however, predators which made Australia their new home were brought in, and it was a very generous home full of unsuspecting prey. Australian fauna had evolved in the absence of these predators into animals with no innate shyness, nor natural mechanisms of escape and survival. Two species of these predators - foxes and feral domestic cats imported from Europe - represent a major scourge for most Australian mammals, including rock wallabies.



Before the arrival of Europeans, there were vast areas of Australia like the one in our picture, which represents a suitable habitat for rock wallabies. But today, such a hilly wooded landscape with rocky outcrops is a rarity. The erosion of the soil, which was exposed after the massive felling of trees, in many places turned the landscape into a rocky desert with no vegetation.

Good Servant but Bad Master

In the coexistence of Australian nature and humans, fire plays an extremely important role. Even before the arrival of man, this phenomenon, an essential element of the natural cycle, changed the landscape; and later, aided by people, contributed to deforestation in many places. Perhaps in Australia more than anywhere else, is the Czech saying that „fire is a good servant but a bad master” appropriate. It is not easy to manage fire in the Australian landscape in a manner that is not harmful.

Roughly 50,000 years ago, before the first people came to the Australia, fires were a rarity there, as a group of gigantic herbivores called mega fauna took care of the removal of plant biomass, the accumulation of which is a prerequisite of fire. The first inhabitants of Australia (the Aborigines) arrived by way of the Indonesian islands at a time when the distance between the two lands was smaller than it is today. (During global cooling, more ocean water is held in glaciers in the polar regions.) We believe that, at the time of the voyages of Aboriginal colonization, at least two islands were always visible during the journey. The first Australians occupied the entire continent and destroyed the mega fauna through intensive hunting. Without the presence of these large herbivores, plant material accumulated and catastrophic fires

posed a threat to all animals, including humans. Here we must mention many Australian plant species (e.g. Banksias) that need an occasional fire of smaller intensity for reproduction, since only fire can release the seeds from their protective pods.

Aborigines over time learned to handle fire as it is produced in nature. Their regular and mosaic burning of the forest, which facilitated their hunting, replaced the activity of the herbivores. A period of newly established harmony followed, which ended more than 200 years ago with the arrival of the Europeans. They brought with them the belief that fire is not a natural part of nature. The result was the accumulation of dead biomass followed by gigantic catastrophic fires that occasionally destroyed all living things in its path. Today, Australians have learnt once again to manage fires so that they burn in a controlled fashion. In many places, however, irreversible changes to the environment have occurred.

The Population of Rock Wallabies Is Growing

The transformation of the landscape, hunting, and newly introduced predators were the main reasons for the permanent reduction of rock wallaby populations. In many places, they were in danger of extinction. Only in recent decades – by protecting habitats and con-

trolling introduced predators – is the number of rock wallabies rising again.

Private land where wallabies live is now being purchased, and game reserves with strict protection are being established. Existing national parks and game reserves continue to expand. Threats from livestock are being relieved by, for example, the building of special fences that do not allow goats and sheep to escape from farms. But equally important is the reduction of introduced predators, especially foxes, which are able to catch wallabies even in their almost unapproachable rock shelters. Conservationists, including both state employees and volunteers, have also restored springs and ponds, and have planted native foliage. Territory under their care can be partly or entirely owned by volunteers.

These measures are being complemented by conservation programs. Zoo-bred animals or those bred in rescue centers are being set free in the wilderness to strengthen remaining populations or to establish new local populations in areas of original occurrence. Currently, the reintroduction of four kinds of rock wallabies is underway. We can only hope that conservation activities will ensure the survival of rock kangaroos as well as many other unique Australian fauna groups.

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