



# Medicine of Australian Mammals

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# 1. Veterinary considerations for the rescue, treatment, rehabilitation and release of wildlife

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The rescue, treatment, rehabilitation and release of wildlife serves three important purposes. Firstly, it provides an opportunity to learn about wildlife and our environment. Secondly, it may contribute to the conservation of species. Finally, and probably most importantly, it addresses the welfare of an animal that may be suffering from injury or illness or has been orphaned. It is our duty as decent human beings (and certainly as veterinarians and wildlife professionals) to relieve the suffering of animals. This may be as simple as providing first aid or facilitating euthanasia. It is essential, however, that attempts at relieving suffering do not perpetuate an animal's suffering. For a wild animal, simply being in the presence of a human being, or being placed in a confined foreign environment, may induce suffering. This is an important consideration and one of the key factors that influence differences in ones approach to management of injured wildlife compared with domestic animals.

Caring for wild animals provides an opportunity to learn more about their biology, natural history, habitats, abundance, behaviour, husbandry and care. It inspires people to develop compassion and an understanding of our wildlife and our natural environment. It educates people, and it is perhaps through this that wildlife rescue and rehabilitation contributes most to

the conservation of wildlife and the environment. Despite the many benefits, it is rare that the rehabilitation and release of an individual animal contributes directly to the conservation of a species. However, this may well be the case in situations where a population is so critically endangered that each individual is crucial to its survival. Rehabilitated animals may contribute to re-introduction programs, reinforce or supplement existing populations and can be a powerful tool for conservation (IUCN 2000; Woodford 2001).

Veterinarians have several key responsibilities with respect to the rescue, treatment, rehabilitation and release of wildlife. These include animal welfare, disease risk assessment and management, human health protection and provision of euthanasia and appropriate legal advice. They must also maintain accurate records, assist with wildlife emergencies and become involved in policy development. They also have a responsibility to provide sound, rational and scientifically based advice to various groups, from members of the public to politicians. Frequently, wildlife agency personnel are trained biologists who generally consider the dynamics and welfare of populations and ecosystems as a greater priority than the individual. They therefore frequently dismiss the perspectives and expertise of wildlife carers who focus on the individual. Conversely, wildlife carers

frequently do not appreciate the mandate and responsibility of wildlife agencies toward population management. This may result in strained relationships between these groups (Clark 2002). Veterinarians are well placed to act as mediators in these situations.

Decisions to treat and rehabilitate wildlife must be based on a sound practical knowledge of veterinary medicine, individual and population biology and ecology, disease risks and legal requirements. Other issues must also be considered to ensure the ongoing welfare of the individual (during rehabilitation and after release), to avoid disappointment after emotional attachment to individual animals by carers and to protect wild populations and ecosystems (Sikarskie 1992).

## 1 ANIMAL WELFARE

The welfare of an injured, sick or orphaned wild animal must be considered from the time of rescue until well after release. A wild animal is already likely to be suffering a degree of stress or pain when it is first discovered and determined to be in need of assistance. To be approached and handled by a human invariably compounds this. It is crucial that appropriate and humane methods are employed to accomplish the capture of the animal. In some cases veterinary assistance may be required to facilitate capture, for example, if the animal needs to be darted. Initial care and first aid may take place *in situ* as, for example, with stranded, entangled or trapped marine mammals or other species. Immediate intervention, with or without first aid, may be all that is required and the animal can be released or, if indicated, euthanased immediately. Even if it is obvious that the animal requires euthanasia it is important to ensure that it is not exposed to additional stressors such as large numbers of onlookers, people touching and talking to it, domestic animals, noise (helicopters and other vehicles) and extremes of temperature. The animal must be made as comfortable as possible. This may require moving it a short distance, providing shade or keeping it cool or moist.

If an animal is to be transported to a care facility or veterinary clinic, care must be taken to ensure that the method of transport is appropriate and as stress-free as possible. Most animals travel well in a dark, quiet, well-ventilated and cool environment. Cardboard boxes or bags (pillowcase, hessian sack) in an air-conditioned vehicle are adequate for most species. It is generally not

recommended to offer the animal food or water, however this depends on the time between rescue and delivery to a care facility. The type of food and the method of administration should be appropriate to the species. The duration of the trip should be as short as possible. Animals should be checked frequently.

The ultimate aim of rescue and treatment of wildlife should be to rehabilitate and release the animal as quickly and effectively as possible. When first presented with a rescued wild animal, it is important to make an early assessment of its prognosis and suitability for rehabilitation and release. This is essential, to avoid unnecessary suffering and stress. It also avoids disappointment after substantial effort and emotional attachment to the animal. When large numbers of animals are involved in an incident such as an oil spill, bushfire or mass cetacean stranding, it is critical to triage animals. Triage ensures that maximum resources are put into animals that are most likely to survive. Human nature leads people to assist animals that are in the worst condition. The worst-affected animals—those with the least chance of survival—would thus take up time and resources that could be spent saving animals with a more realistic chance of survival. Effective triage avoids prolonged suffering in animals that clearly require immediate euthanasia.

Wild animals are very susceptible to stressors such as confinement, close proximity to other animals (particularly predators such as dogs and cats), noise and handling. If the prognosis is poor or the animal is unsuitable for release, a decision to euthanase must be made quickly. It is important that the decision to treat and rehabilitate an animal is not made to satisfy personal gratification, which may be to the detriment of the animal. If an animal is unsuitable for release but has legitimate educational or scientific value if kept in captivity, approval to do so can be sought from the relevant wildlife authority.

During initial treatment, careful consideration should be given to the judicious use of analgesics, sedatives or neuroleptic drugs to ensure that the animal is as comfortable and stress-free as possible. After initial treatment, most wild animals will require a period of rehabilitation prior to release to ensure they are restored to their former capacity. The treatment and rehabilitation period should be kept as short as possible and the environment in which the animal is held should be stress-free and provide for all its physical and

psychological needs. Stress and stress-related illness are the most common causes of failure of treatment or death when treating and rehabilitating wild animals. Veterinarians are now fortunate that there is a network of experienced wildlife carers and rehabilitators who can assist with care and rehabilitation. This reservoir of knowledge and experience must not be ignored. It is important, however, that veterinarians have input into the rehabilitation process to ensure the ongoing health and welfare of the animal. This may be in the form of providing advice on nutrition and other preventative medicine or regular veterinary examinations.

Considerable time, effort and expense often goes into the treatment and rehabilitation of animals, but significantly less attention is often given to preparation for release, the release and post-release monitoring (Hall 2005). When making a pre-release assessment, veterinarians must keep in mind that the release of a native animal back into the wild must always be in the best interest of the animal. It must have recovered completely, both physically and behaviourally, to its former capacity to survive (Walraven 1994; Hall 2005). If an attempt has been made to treat animals by the application of prostheses these animals should not be released, as it is unlikely that any prosthesis will remain attached for the natural expected life of the animal. Some countries have laws and policies relating to the release of animals with disabilities, with strong recommendations not to do so (Hall 2005). Even though animals with disabilities are seen in the wild, apparently doing well, the long-term effect of the disability is difficult to assess. If an animal is released with a minor disability that appeared not to affect it during rehabilitation, it may be being committed to a life of long-term suffering and struggle for survival.

In many cases, the ultimate effect of release may be suffering and death. Many studies have demonstrated that mortality is high in animals released after rehabilitation (Brown & Tribe 2001). Despite this, it is considered by some that returning wildlife to the wild is more humane than a life in captivity. However, if not done properly animals may succumb to predation or disease or die from starvation or maladaptation to an unfamiliar or inappropriate environment (IUCN 2000)—something that may not be justifiable. With our increasing knowledge and improved treatment, rehabilitation and release techniques, post-release survival has now improved and there is often minimal

impact on animal welfare. In many cases this has been due to an assessment of treatment, rehabilitation and release techniques against information gained from long-term post-release monitoring studies.

Animals should always be released as close as possible to the rescue site. Many animals adapt to a particular environment, habitat or geographic area. Releasing them elsewhere may result in suffering due to maladaptation. Similarly, the release of new individuals to a geographical area may pose genetic and disease risks to the resident population (Brown & Tribe 2001). The introduction of non-endemic disease or infection by the released animal may also result in considerable suffering.

## 2 ANIMAL HEALTH

The emergence of new infectious diseases in humans and other animals has been highlighted in recent years. Diseases such as severe acute respiratory syndrome (SARS), Australian bat lyssavirus, Hendra virus, Nipah virus, West Nile virus, monkeypox, avian influenza, rabbit haemorrhagic disease, pilchard herpesvirus, sarcoptic mange in various species, canine distemper in lions and seals, Tasmanian devil facial tumour disease and chytridiomycosis, to name a few, have had a devastating impact on animal and human populations. Wildlife populations play an important role in initiating and maintaining many of these diseases (Bunn & Woods 2005). A number of risk factors and processes have been identified, including geographic translocations of hosts and pathogens, new and or intensified contacts between hosts and pathogens, genetic change and environmental change (Daszak et al. 2005; Leighton 2005). The rescue, rehabilitation and release of wildlife, if not done properly, may contribute to these processes and lead to the disruption or disturbance of the natural balance between the host, environment and pathogens. When releasing rehabilitated wildlife, the health of the wild population and the ecosystem into which that animal is being released must take precedence over the welfare of the individual animal (IUCN 2000). Great care must be taken to maintain the balance of organisms naturally found within an animal and not introduce foreign organisms during the rehabilitation process. Each individual animal, rather than being a single organism, is a package of organisms (Woodford 2001). When releasing an animal we are releasing not

only that individual but all the other organisms within it and on it.

Most wildlife rehabilitation and release and wildlife translocations are undertaken with complete lack of awareness or little regard for disease risks (Kirkwood & Sainsbury 1995; Griffith et al. 1993; Woodford 1993). Animals being rehabilitated may be exposed to new pathogens while in captivity and act as carriers when released, transmitting disease into a wild population with potentially devastating consequences for the population and the ecosystem in which it exists. Pathogens may be carried by released animals without causing disease in that species but causing severe disease in other species. Infectious disease may also be introduced to wild populations when animals with endemic disease are released into an area where those diseases do not occur. The released animal may also be exposed to diseases to which it has not developed immunity (IUCN 2000). These immunologically naive animals may become infected and die, or become carriers shedding large numbers of organisms and infecting endemic animals (Kirkwood & Sainsbury 1995; Griffith et al. 1993; Viggers et al. 1993; Woodford 1993). The release of an animal back into the wild is a stressful time for that animal and others in the area, due to competition. When animals are stressed disease can have a significant impact.

It does seem surprising that the incidence of disease introduction through the release of rehabilitated or translocated wildlife or the disease-related failure of wildlife releases or translocations is not higher, considering the large number of releases or translocations. However, it is highly likely that these scenarios go undetected or are underestimated given the general lack of post-release monitoring or surveillance of wild populations into which animals are released (Griffith et al. 1993), and the absence of veterinary involvement in some of these programs. The disease risks associated with wildlife translocation are frequently overlooked by many wildlife agencies responsible for these programs.

## 2.1 Disease risk assessment

Adequate disease risk assessment when dealing with wildlife presents considerable difficulty for two reasons. Firstly, there are few reliable tests for the detection of many wildlife pathogens. Secondly, many species of wild animals carry infectious agents of which we have little or no knowledge (Kirkwood & Sainsbury 1995). Although there have been surveys of the health of wild

populations of some species, for the majority of species we have little knowledge of the organisms and pathogens they may naturally harbour. For these reasons appropriate measures must be taken to reduce the risk of disease during the rehabilitation and release of wildlife, including initial and ongoing clinical assessment, laboratory tests (haematology, biochemistry, serology, faecal examination, microbiology), screening tests for specific diseases (e.g. tuberculin testing), prophylactic procedures and treatments, quarantine, enclosure design and husbandry (Viggers et al. 1993; Kirkwood & Sainsbury 1995; IUCN 1998). An understanding of disease processes and the measures required in preventing disease transmission and spread is essential for all veterinarians and others involved in the rehabilitation and release of wildlife.

It is important to determine if the reason for presentation of a rescued animal is an infectious disease. Wildlife may require rescuing as a result of a natural event (disease, old age, predation, weather conditions, natural disasters such as fires or floods) or some form of human activity (hit by car, dog or cat attack, oil spills, poisoning, contamination, collision with man-made objects, trapping, shooting). The latter are far more common, but an animal that has succumbed to trauma or predation may have been weakened by a pre-existing disease process. In general terms, animals suffering from an infectious disease rather than a traumatic injury alone are poorer candidates for release and possibly pose a greater risk to other patients in the rehabilitation facility and to the population if released. It is important to screen all incoming rehabilitation patients for the presence of clinical or subclinical infectious disease (see 2.1.1).

### 2.1.1 Clinical assessment

Ideally, the initial clinical assessment of all rehabilitation patients should be carried out by a wildlife veterinarian. In each case, however, a disease risk (and cost-risk) assessment can be made by the wildlife rehabilitator. In some cases it may be clear that there is no underlying disease process (e.g. orphaned marsupial pouch young) and a clinical assessment by a veterinarian may not be necessary. If a clinical assessment is made it should include a physical examination, haematology and serum biochemistry analysis, serology, faecal examination for bacteria and parasites, evaluation of the blood smear for parasites and other sampling or testing as appropriate

to the species (e.g. chlamydia in koalas and birds, cryptococcus in koalas, circovirus in psittacine birds, tuberculosis in pinnipeds). In some cases it may be appropriate to collect serum or plasma to be stored at  $-70^{\circ}\text{C}$  for retrospective disease investigation.

Wildlife may also be infected with exotic or notifiable diseases (e.g. avian influenza, Newcastle's disease, West Nile virus, Pacheco's disease, monkeypox). It is quite possible that an animal rescued by a wildlife carer may be the first case of one of these diseases in a country. Monitoring wildlife health may facilitate early detection of threats to biosecurity and rescued wildlife should be included as part of wildlife health surveillance systems. Monitoring the emergence of wildlife diseases is an important contribution that wildlife veterinarians and wildlife carers can make (Clark 2002; Woods & Bunn 2005). Consideration must also be given to the possibility that the animal may be harbouring a zoonotic disease such as Australian bat lyssavirus, Hendra or Menangle virus, avian influenza, chlamydia, mycobacteriosis, ringworm or salmonellosis.

If pathogens are detected in the absence of clinical disease this state may be assessed as typical for a particular species, thus increasing our knowledge of wildlife health and helping us to determine what is normal for a species and what is not. Screening and clinical assessment must continue throughout the rehabilitation process as diseases that may not initially have been evident may become evident later. The stress of rehabilitation may trigger diseases, and animals may be exposed to new pathogens during the rehabilitation process (Daszak et al. 2005; IUCN 1998).

Once the disease status of an incoming rehabilitation patient has been assessed and a disease is diagnosed, a decision must be made as to whether the disease can or should be treated or whether the animal may pose a risk to other animals in the rehabilitation facility or once released. If the risk is assessed as too high (taking into account the conservation value of the animal), the animal should be euthanased. If the treatment option is chosen, we must consider if the pathogen can be completely eliminated or whether the animal may remain a carrier. It may not be necessary or beneficial in every case to eliminate all infectious agents. Wild animals harbour many organisms as part of their normal flora. All wildlife have viruses, bacteria, fungi and parasites within and on their bodies that under most circumstances do not cause disease and may in fact be beneficial

to the animal. Certainly, when animals become stressed or succumb to disease, numbers of organisms may increase and cause disease or debilitate the animal even further. For example, most sick animals have increased numbers of parasites. This may be due to immunosuppression allowing parasite numbers to increase, and less grooming or preening by the animal to remove these parasites. It is beneficial in these cases to reduce the numbers of, or eliminate, the parasites in order to aid recovery. If the parasite load is low it may not be necessary to treat the animal, but simply monitor the parasite load. Many parasites are difficult to eliminate. However, testing and/or treatment for parasites should be considered in all animals presented for rehabilitation. This may need to be performed a number of times during the rehabilitation process (Zsivanovits 2004).

### 2.1.2 Pre-release assessment

Prior to release all animals must undergo a thorough clinical examination and health assessment as well as assessment by an experienced rehabilitator. There must be no evidence that the animal is harbouring an infectious agent that may be detrimental to it or other animals once released. All animals being released will be carrying infectious agents, but if these are endemic to the species and to the area or population into which the animal is being released there should be no concern. The presence of parasites should not preclude an animal from release providing it is known that these parasites naturally occur in that species and are endemic in that species in the area where the animal will be released. Animals should not be released into an area where diseases to which they are not immune are endemic. Testing prior to release is not totally reliable in preventing the introduction of new pathogens to the wild. This may be the case when we have little knowledge of disease or are unable to test for specific pathogens (Woodford 2001). Tests cannot be conducted on unknown pathogens and there are probably many more than the known number (Spielman 2001). In some situations and with some species it may be preferable not to release animals. This has been highlighted with examples such as the complete moratorium on the release of all rescued marine mammals in Canada, and the strong recommendation by the Scientific Committee on Antarctic Research in Australia not to release any Sub-Antarctic or Antarctic species of seals after rescue. This has been adopted as policy by the Department

of Environment and Conservation in NSW. Ideally, a detailed clinical assessment similar to the initial assessment on arrival should be performed by a wildlife veterinarian. If possible, serum or plasma should be stored at  $-70^{\circ}\text{C}$ . This is useful for retrospective disease investigations.

## 2.2 Disease risk management

While in captivity for treatment and rehabilitation, animals may be infected with pathogens from other animals, from the environment or from food or water. The risk of transmission of pathogens can be minimised by following basic principles of preventative medicine—quarantine, enclosure design, husbandry, nutrition, routine testing and treatments, pest prevention and control and post mortem examination.

The majority of wildlife rehabilitation in Australia is undertaken by individuals who care for and accommodate the animals in their own homes. Most have an area for more intensive care within the home and aviaries or similar enclosures outside for longer-term rehabilitation. No matter how large or small a facility, these basic principles of preventative medicine apply.

### 2.2.1 Quarantine

Quarantine is the isolation and health screening of animals with the objective of preventing or controlling introduction or spread of infectious diseases. During the quarantine period, incubating diseases may be detected. Animals may also shed infectious organisms. Quarantining animals will minimise the risk of transmission of pathogens between animals, either from a newly introduced animal or from other animals within or near the facility to animals being rehabilitated. The quarantine period is often arbitrary, given our lack of knowledge of many diseases. However, it is preferable to keep an animal in captivity for as short a period as possible.

The quarantine of wildlife undergoing rehabilitation and release serves two purposes. Firstly, it is a period of isolation during which subclinical disease may become clinical or be detected before new arrivals enter a facility and contact other rehabilitation animals. Secondly, all animals destined for release should be quarantined from animals not of the same health status or other species not destined for release. Animals that are not to be released in the same location should be kept separate from each other to avoid the transmission of pathogens that may not be endemic to a particular area. Ideally,

rehabilitation animals should not come into contact with domestic animals.

All rehabilitation facilities should have an isolation area. Depending on the species and reason for presentation, barrier nursing should be practised between animals and enclosures. Barrier nursing is the use of dedicated protective clothing (gloves, gowns or overalls, gumboots), cleaning and feeding utensils and the use of footbaths and disinfection.

### 2.2.2 Enclosure design

Rehabilitation enclosures should be carefully designed to prevent disease transmission and minimise stress on animals. Animals should be sheltered from noise, extremes of weather and exposure to domestic animals. There should not be large numbers of enclosures in close proximity as this may facilitate transmission of pathogens. Exposure to sunlight is not only important for animal well-being (vitamin  $\text{D}_3$  synthesis) but also helps to kill bacteria, viruses and fungi. Dark and damp areas should be minimised as these tend to harbour pathogens (e.g. aspergillus spores, mycobacteria). Enclosures and furniture must be easy to clean and disinfect. Disposable furniture (e.g. branches) is ideal. Plants can be kept in pots so they can be easily removed to aid cleaning. Plants should be rotated to limit the build-up of faecal matter and pathogens and to provide exposure to sunlight.

Certain substrates may harbour pathogens and spores of pathogens. For example, straw and some types of mulch may harbour aspergillus spores, grass and dirt may harbour coccidia and other parasites. These should be avoided in susceptible species. Good drainage and regular substrate changes are important as pathogens build up very quickly in damp or wet conditions.

Enclosures must be designed to minimise stress, as stressed animals are more susceptible to infection due to immunosuppression. Enclosures should be suitable for the species, equipped with furniture that provides shelter, privacy, visual barriers and appropriate perches (type, height and quantity), and with appropriate substrate and water bodies for aquatic or semi-aquatic species. The enclosing structures and materials must also be appropriate.

### 2.2.3 Husbandry

Good animal husbandry techniques are essential for maintaining healthy animals and minimising the risk

of disease transmission. High standards of hygiene and sanitation are crucial for the prevention of disease transmission. Hand-washing facilities with soap (with or without antiseptic) should be available. This is not only important in preventing transmission of pathogens between animals and enclosures but in preventing zoonotic infections. Appropriate and proper use of disinfectants is important. All surfaces to be disinfected must be clean, as the presence of organic material inactivates many common disinfectants. Disinfectants must be used in accordance with the manufacturer's recommendations, i.e. dilution rates (stronger does not mean better) and how long they are effective once made up. A regular schedule of cleaning and disinfection must be maintained. Once an enclosure is vacated it should be thoroughly cleaned and disinfected before it is used by a new patient.

Sanitation is the removal of faeces and other waste material, e.g. food scraps, to prevent the build-up of pathogens in the environment. Leftover food and scraps also attract pests, some of which may carry disease. In some cases substrates may also need to be changed. Waste and water should not be flushed from one enclosure into or through another. Heavily contaminated waste material or substrates should be burned or buried to prevent exposure of free-ranging wildlife to pathogens. Though at least daily cleaning is recommended, the level and frequency of cleaning must be balanced against the stress and disturbance it may cause to the patient (Zsivanovits 2004).

If animals are housed in groups, careful consideration must be given to group make-up including age, sex and species. If animals are not compatible or there are too many, intimidation or aggression may result. Overcrowding may cause stress as well as increased contamination of the enclosure and increased risk of transmission of pathogens between animals. In general, animals should be housed individually until a veterinarian or wildlife carer is confident that they do not pose a risk to other animals.

Animals that receive appropriate treatment and optimal care in captivity will recover quickly. The rehabilitation period for any animal should be as short as possible. The longer an animal is in captivity the greater the risk of it being exposed to pathogens and the greater the chance of its natural microbial and parasitic flora changing. There are also many non-disease considerations for keeping animals in captivity for as short a period as possible (Walraven 1994).

#### 2.2.4 Diets and nutrition

Good diet is an important component of rehabilitation. Inappropriate nutrition will lead to an increased susceptibility to infection. Food items may also introduce pathogens. Care should be taken to avoid feeding food items that may be harbouring pathogens. Rodents or birds may harbour pathogens such as salmonella, trichomonas and other parasites or viruses. Fresh fish fed to piscivorous animals may harbour various pathogens. Ideally, laboratory or farm-bred animals such as mice, rats or day-old chicks should be fed rather than wild-caught animals such as pigeons, mynahs, starlings or rabbits. Freezing prey items kills some but not all pathogens. The risk of disease transmission may be lower if birds are fed non-avian food items and mammals are fed avian food items, but this may be impractical or inappropriate depending on the species (Zsivanovits 2004).

Food should always be fresh. Spoiled food may introduce pathogens or toxins. In warm climates food spoils quickly and may need to be removed and replaced regularly. The nutrient value of food may also change if not fresh. Liquid food or gruels should be made up fresh daily or frozen immediately for later use. Frozen food should not be stored for more than three months. Prolonged freezing, inappropriate thawing and refreezing allows bacterial overgrowth, build-up of toxins and loss of nutrients.

Fresh drinking water in clean bowls should be provided at all times (even for species that may not usually drink—when they are sick or stressed their desire or need for water may change). Food and water containers must be situated to avoid contamination with faeces. They should be appropriately positioned for the species, i.e. on the ground or elevated. If animals are housed in groups there must be adequate numbers of feed stations to ensure all animals get an opportunity to feed.

#### 2.2.5 Routine and preventative treatments

Before and during the rehabilitation process it may be necessary to provide routine treatments to eliminate or reduce the load of pathogens or to prevent animals from becoming infected with pathogens. Routine treatments are primarily for parasite control. As previously discussed, many animals naturally carry a range of internal and external parasites without harming the host, however, parasite loads may increase and cause

disease when animals are injured or sick. Reducing the number of parasites may be beneficial. It is, however, not always appropriate to eliminate all parasites as it is important for the host to maintain some immunity to them. Indications for intervention for specific species and parasites are presented in the relevant chapters of this volume.

In captivity, some species become susceptible to certain infections. For example, orphaned marsupials have increased susceptibility to infections such as candidiasis, salmonellosis and coccidiosis. This may be the result of immune incompetence, immune suppression and exposure to contaminated environments or other infected animals. These diseases can be prevented by minimising stress, placing animals in clean uncontaminated environments and administering prophylactic drugs.

Although some vaccines (*Bordetella bronchiseptica*, tetanus and other clostridial vaccines, footrot vaccine [protection against lumpy jaw in kangaroos]) are used for captive Australian native mammals, it is not generally recommended to vaccinate Australian wildlife during rehabilitation prior to release.

### 2.2.6 Pest prevention and control

Pest species (rodents, foxes, birds, rabbits and insects) are known to transmit and harbour pathogens. Rodents can carry salmonella, leptospire, encephalomyocarditis virus and parasites. Biting insects may spread blood parasites (e.g. malaria, leucocytozoon) and viruses (e.g. pox viruses). Pests may also disturb animals, particularly at night, which may cause stress. They may also prey on them. Measures must therefore be taken to avoid attracting pests. Shelter and food are the primary attractants. Enclosures should be built to exclude pests and other wild native animals. Animal food should be stored in pest-proof containers and food scraps should be cleaned up regularly. Insect pests such as cockroaches and mosquitoes should be controlled. The judicious use of traps and baits to control pests is important, but exposure of non-target species must be avoided. Traps and baits are best set outside enclosures; if they must be placed within an enclosure, steps should be taken to ensure that non-target species cannot be trapped or poisoned. A variety of appropriate traps and bait stations are available from commercial suppliers.

## 3 WILDLIFE EMERGENCIES

Veterinarians are frequently called on to assist in wildlife emergencies such as oil spills, bushfires or marine mammal strandings. These events attract significant public and media attention. Dealing with wildlife in an emergency may be a significant component of an incident or a very small component of a much bigger operation. Whenever animals are involved there is usually a significant focus on that aspect of the emergency. If there is concern for the health and welfare of the animals involved, veterinary assessment and assistance will be required. Wildlife emergencies can be complex events and some understanding of your role is essential for a successful outcome. Your involvement as a veterinarian may be significant or minor. Veterinarians should concentrate on the animal issues but must consider all other aspects of the emergency. Dealing with wildlife in an emergency is often controversial and often involves philosophical issues which may overshadow practical biological issues (Sikarskie 1992). Veterinarians are frequently caught up in heated debate over these issues. Decisions to rescue and treat wildlife in an emergency must be based on sound conservation and biological principles yet take into account the welfare of the animal or animals, and the emotions of onlookers and people involved in the incident. The veterinarian should contribute in a professional manner. Authority for decision-making at emergencies is usually vested in the relevant government conservation agency representative present (usually under the Incident Control System). The veterinarian should acknowledge this authority, and appreciate that others may know a lot more than they do. If inexperienced, consult with more experienced people, use first principles, listen, learn, assess and plan. Most of all, show compassion for the animal or animals and the people involved. Where emotions are high and volunteers have invested significant effort in the rescue and care of animals, it is prudent for the veterinarian to consider all factors carefully, evaluate the situation, clinically assess animals and perhaps take diagnostic samples (even if it is clear that the outcome or prognosis is not likely to be good) before making decisions or providing advice, particularly if euthanasia is recommended.

The veterinarian's primary responsibility is animal health and welfare, but they may become involved in other aspects of the emergency. The veterinarian must

keep the Incident Controller regularly informed. Statements should never be made to the media or onlookers unless the veterinarian is specifically requested to do so.

## 4 HUMAN HEALTH

Veterinarians have an obligation to have an awareness and knowledge of zoonotic pathogens not only to protect themselves but also to provide accurate advice and information to their staff, clients and wildlife carers. Many wildlife species may harbour zoonotic pathogens such as Australian bat lyssavirus, Hendra or Menangle virus, chlamydia, toxoplasma, mycobacteria, dermatophytes or salmonella. The elderly, children and immunocompromised people are at greatest risk of contracting zoonotic infections. Many wildlife carers are elderly and children frequently have contact with animals in care.

Many wild animals are dangerous and can inflict serious injury through bites, scratches and blows. The greatest risk of injury is often during the initial rescue and capture. The emotional drive to rescue animals often overrides common sense. Rescuers or volunteers sometimes show little regard for their own welfare and safety, putting themselves at risk not only by exposing themselves to a potentially harmful animal but also by failing to take due care in dangerous conditions such as extremes of temperature, high seas, icy conditions, climbing cliff faces or negotiating busy roads. Such situations frequently arise during oil spills, cetacean strandings or bushfires. Veterinarians can often remove themselves from the emotion of a situation and are well placed to provide guidance and advice.

## 5 EUTHANASIA

Veterinarians are in the fortunate position of being able to provide and facilitate euthanasia, relieving the suffering of sick or injured animals. Where legislation allows and the operator has received appropriate training, euthanasia may also be performed by wildlife carers, wildlife authority personnel, RSPCA officers or the police.

In some cases the need to euthanase an animal will be obvious. In others a period of observation or further clinical assessment and evaluation or laboratory testing may be required. Consideration should be

given to the status of the species (threatened or endangered), its biology and life history and available resources to provide proper care during treatment and rehabilitation. For example, euthanasia may be an appropriate decision in the case of a stranded healthy neonatal or infant cetacean where the prognosis for release and return to its mother is very poor and the resources required to care for it in captivity are immense. An injured sub-adult male common brushtail (*Trichosurus vulpecula*) may be unsuitable for rehabilitation because it may become ill or suffer injury during a struggle to establish territory if the only area it can be released is already saturated with possums. Releasing such an animal in such an area may just prolong its suffering, and euthanasia may be more appropriate. It should be remembered that euthanasia may be appropriate not only for sick or injured animals, for example in healthy feral animals or orphans where hand-rearing is not feasible.

### 5.1 Criteria for euthanasia

The following criteria can be used as a guide in the euthanasia decision-making process.

- The animal has sustained such severe injuries that it is unlikely to survive even with treatment.
- The animal has sustained injuries that may be treated but will leave it with a disability that preclude it from being released.
- The results of diagnostic tests indicate a poor prognosis for recovery with or without treatment.
- The animal is suffering from an infectious disease that may pose a risk to other animals during rehabilitation or after release.
- It may be a weak or sick animal of common species where there is no evidence of anthropogenic factors contributing to the animal's demise, e.g. flying foxes and shearwaters. Giving these animals a selective advantage through treatment and rehabilitation may be perpetuating 'weaker genes' (Hanger & Tribe 2005).
- The animal is an orphan and the prognosis for successful return to its mother or hand-rearing is poor due to its age or stage of development, the resources required and the potential for imprinting or the development of other behavioural inadequacies that would preclude survival after release.

- Lack of resources (facilities, personnel, finances, food, veterinary care, drugs) to care adequately for the animal. This may be specific to a particular species.
- Geriatric animals.
- It is illegal to release an animal, or there are recommendations not to do so based on disease risk and there is no option for permanent care in captivity.
- The animal is a feral or pest species.
- The animal is behaviourally unsuitable for release (e.g. imprinted).

Lack of interest, low priority relative to treating paying clients' animals, lack of appropriate facilities and insufficient experience or knowledge are no excuse not to attend to a wildlife patient. Many wildlife patients suffer as a result of neglect (left untreated for prolonged periods often in inappropriate housing) or an attempt at treatment and rehabilitation by inexperienced veterinarians or carers. In such cases animals should be referred immediately to an experienced wildlife veterinarian or carer, or be euthanased.

## 5.2 Euthanasia techniques

The objective of euthanasia is to produce immediate or rapid loss of consciousness, followed by death, with a minimum of pain, discomfort or distress. This requires rapid destruction of the brain or chemical suppression of brain activity. The technique should be able to be performed easily and safely, be reliable, preferably not affect gross and histologic necropsy findings, be readily available and cheap and be tolerable to the person performing the procedure as well as onlookers (Hanger & Tribe 2005). The IV administration of pentobarbitone is the most commonly used method and is humane and acceptable, however, there are numerous other chemical and traumatic methods for euthanasia (Cooper et al. 1989; Geraci 2000; ANZCART 2001; Hanger & Tribe 2005; Rose 2005). In some cases it may be impossible to administer euthanasia due to the size of the animal, lack of availability of a humane method or the remoteness of the animal. A good example is a very large stranded whale. In these situations it may be acceptable to allow the animal to die without intervention. After euthanasia, death must be confirmed before performing a necropsy or disposal of the carcass. If the brain has been destroyed this is usually sufficient, but in other cases cardiac arrest must be confirmed (Hanger & Tribe 2005).

Carcasses of animals that have been euthanased using pentobarbitone or prior administration of anaesthetic agents must be disposed of by deep burial or incineration. These carcasses may pose a risk to scavengers. Carcasses of animals infected with a potentially contagious disease must be disposed of in a similar fashion.

## 6 NECROPSIES

Every animal that dies or is euthanased during rehabilitation should undergo a necropsy. Ideally this should be carried out by an experienced wildlife veterinarian or veterinary pathologist. However, even if conducted by a wildlife carer, valuable information can be gathered (Rose 2005). A necropsy is not only of diagnostic value but provides the opportunity to learn more about the anatomy and physiology of animals. Determining the cause of death provides an opportunity to learn more about the reason the animal required rescuing and any possible underlying disease process. A necropsy may detect an infectious disease that could infect other animals in the rehabilitation facility. This allows measures to be taken to prevent further spread of the disease, thus preventing an outbreak or risk of other animals becoming infected and thus precluding them from being released. Guidelines for necropsy of Australian native mammals are presented in Chapter 4.

The majority of rescued wildlife are common species. Many of these species can be legally and routinely destroyed in pest control exercises or by hunting (Brown & Tribe 2001). The cost of treatment and the rehabilitation effort may be high. Even if the prognosis for release is assessed as good, if an infectious disease is suspected there may be considerably more value in euthanasing the animal and performing a necropsy to obtain an accurate diagnosis. The data obtained may be of significant value in wildlife disease surveillance and management.

## 7 RECORD-KEEPING

Accurate records should be maintained by veterinarians and carers for each animal during treatment and rehabilitation. This information provides useful data on the health of animals during the rehabilitation process and assists in establishing what is normal for a species with respect to physiological parameters and infectious agents. If post-release monitoring data is available, a

useful correlation may be made between post-release survival and treatment, rehabilitation and release techniques. However, before this data can be useful on a broad scale, it must be collected in a uniform and scientifically valid way (Clark 2002). Numerous databases have been developed for wildlife rehabilitation and wildlife health. These should be standardised and adopted nationally so that data is uniform and readily retrievable (Bunn & Woods 2005). With improved documentation of the case histories of the hundreds of thousands of wild animals rescued annually, wildlife veterinarians and carers can dramatically expand the information base upon which wildlife health management is based and contribute to wildlife health surveillance (Clark 2002; Woods & Bunn 2005).

In order to maintain accurate records, each animal must be individually identified. A temporary identification can be applied during the rehabilitation process, but prior to release a permanent identification such as a passive integrated transponder, legband or eartag should be applied. Satellite or telemetry devices may be used in addition to these methods. Post-release monitoring allows retrospective evaluation of the success of rehabilitation techniques and the ability to trace potential sources of infectious disease should there be an outbreak in a wild population.

Wildlife are frequently affected by anthropogenic disasters such as oil spills or malicious activities such as poisonings and other acts of cruelty. Where animals are rescued from these situations (dead or alive) it is particularly important to maintain accurate records as legal proceedings may be taken against the offending party. Records may be required as supporting evidence.

## 8 LEGISLATION

Legislation pertaining to the protection, keeping, treatment, rehabilitation, release and exhibition of native and exotic non-domestic animals varies between countries, states and territories. Different wildlife and/or agricultural authorities (local, state or federal) have legislative responsibility under a variety of different acts for the protection and keeping of native fauna. Wildlife agencies also have policies and guidelines relating to the care, keeping and release of wildlife. It is important that veterinarians are familiar with this legislation so that they work within it and ensure that their clients and wildlife rehabilitators do. Veterinarians should be able

to give relevant and accurate advice on the legislation, or at least know where to find it. In some countries, states or territories, registered veterinarians are required by law to relieve suffering in any animal. Such action may include euthanasia or appropriate treatment. It is unethical, immoral and unprofessional and demonstrates a lack of compassion to refuse to provide care for a sick or injured wild animal (Tribe & Hanger 2005). If treatment is the chosen course of action, in most countries the veterinarian is permitted to keep protected fauna as long as they are in need of, and receiving, veterinary care. Wildlife carers are also required to be licensed with their appropriate wildlife authority or registered with a licensed wildlife care group before being permitted to rescue and rehabilitate wildlife (Brown & Tribe 2001). This may require a demonstrated level of competency through completing an apprenticeship or attending courses before a licence will be issued. The removal and transport of certain protected species (dead or alive) such as marine mammals, migratory birds or endangered species is often highly regulated (Sikarskie 1992).

## 9 DEVELOPMENT OF POLICIES AND PROTOCOLS

Veterinarians should have input into the development of policies and protocols relating to the rescue, treatment, rehabilitation and release of wildlife (Sikarskie 1992). Most government wildlife agencies have developed such policies and protocols. Most relate to wildlife disasters such as oil spills, fires and marine mammal strandings, although some agencies have policies on the rescue, rehabilitation and release of wildlife in other situations. Veterinarians have been consulted in many cases and the documents and manuals that have been produced are a valuable resource for anyone involved in wildlife rehabilitation.

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