

INCREASING KANGAROO VALUE THROUGH IMPROVED QUALITY, PRODUCT DIVERSITY AND CONSISTENCY

DEVELOPING THE KANGAROO INDUSTRY

A REPORT TO THE SOUTH AUSTRALIAN
KANGAROO PARTNERSHIP PROGRAM

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1. SUMMARY

Kangaroo populations boom-and-bust in cycles with implications for animal welfare, drought management, grazier emotional, physical and economic stress, social licenses of pastoral industries, responsibilities of government, waste management, landscapes, soil, ecosystems and biodiversity.

Commercial harvesting is the strategy that has the capacity to manage kangaroos populations at scale while cost effectively lowering adverse implications.

Returns from kangaroos are low compared to domestic livestock enterprises which makes harvesting them commercially an unviable management option for most landholders. However, if returns were higher, it is likely that some would have a greater interest in harvesting. The question this report addressees is how can kangaroos be worth more?

We examined opportunities to see if there was scope to increase the value of kangaroo. We looked at the potential to improve quality, deliver consistency and increase product diversity by reviewing current research, investigating innovations, and examining the successes of other red meat industries.

We found potential for the producer or landowner, the harvester, and the processor to increase the value of the total kangaroo and reduce waste along the supply chain. While some work is being done at the processor level, and a little at the harvester level, there are other approaches that could be implemented, especially at the landowner and harvester level. The question remains can they be done with current cost structures?

To make kangaroos more valuable, harvesters could implement selection or harvesting techniques that produce better quality meat and skins and sell them for a premium price. For example, premiums for kangaroos destined for human consumption could come from selected smaller or younger animals, red kangaroos, and from implementing the practice by which carcasses are hung by the pelvis rather than a leg which provides more tender meat.

Harvesters and processors could also age or condition carcasses; however, this practice would need to remain within the constraints of the game meat standards.

Premiums for kangaroos destined for skins and leather could come from selecting grey kangaroos, harvesting in specific areas where there are no ticks or barbed wire fences, and by harvesting during winter.

Processors could seek premiums for quality and specialty cuts or through supply to specialist outlets. Both the harvester and processor could charge premiums for better describing the product and pass the information along the supply chain within the framework that already exists.

Several innovations are available to make kangaroos more valuable. Environmental programs which maintain or restore the environment, biodiversity, soil or ecosystems on lands where kangaroos are harvested could be incorporated into product promotion to fetch a premium for stewardship. Specific kangaroo best practice frameworks, including kangaroo friendly carbon methodologies, water consumption savings, or a reduction in lead bullet scatterings within remains, could be developed along with additional guidelines and standards which go beyond general State and Federal regulations.



The development of accurate descriptions and method of tagging and traceback could also be improved beyond the existing framework to deliver information along the supply line.

Kangaroo products could also diversify into biomedical, bio actives, nutraceuticals, render and fertiliser.

Research and development could improve packaging, travel and storage to further improve quality and consistency.

Preparation of this short report has led us to consider a number of deficiencies and constraints to the task of increasing the value of kangaroos to the landholder or producer. These include a deficit of information and transparency about costs and benefits of kangaroo production. Incentives for landholders to become more involved in kangaroo management are currently limited. The kangaroo resource is owned and populations managed by third parties - government agencies.

The question is, can the licensing and quota setting procedures be varied to create a sense of proprietorship so that kangaroo numbers can be incorporated into consideration of total grazing pressure alongside conventional livestock which are owned by the landowner.

While the Kangaroo Industry Association of Australia exists, it is processor driven. Other red meat industries are underpinned by councils and associations which include producers. Levies raised are matched by governments and used to fund research and develop industry programs, just as they are in the kangaroo industry. A larger investment from both the processors and landholders could enable assurances for health, safety, the environment, animal welfare, traceback, identification systems, declarations, improved production systems, communications, standards, guidelines and marketing.

A number of organisations could support these initiatives and increase in value of kangaroos to incentivise population management. They include CSIRO, AgriFutures, Meat & Livestock Australia, Food Agility Cooperative Research Centre (CRC), Food Waste CRC and Economic Participation of Indigenous Communities CRC. However, achieving such cooperation needs drive, guidance and recommendations from all constituents along the supply chain coupled with wildlife managers and state government representatives. It could be a component of the development of the National Kangaroo Conservation Strategy.

We are ready to discuss our report with stakeholders and conduct workshops. The goal would be to convert these observations into practical outcomes.



2. BACKGROUND

Kangaroo populations follow cycles with detrimental outcomes during both irruptive growth and sharp declines. During the irruption there is the increased risk of proliferation of pathogens (Olsen and Braysher, 2000) and the decline results from mass mortalities due to environmental stress (Olsen and Low, 2006, Read et al., 2021). When drought makes water and food scarce the scale of the drop in kangaroo populations can be extreme. The Queensland (Qld) population fell by about 12.1 million between 2013 and 2020 while the New South Wales (NSW) population fell by about 7.1 million between 2014 and 2019. These declines include substantial numbers of kangaroos dying from starvation and causing land degradation (Wilson and Edwards, 2019) (Figure 1).

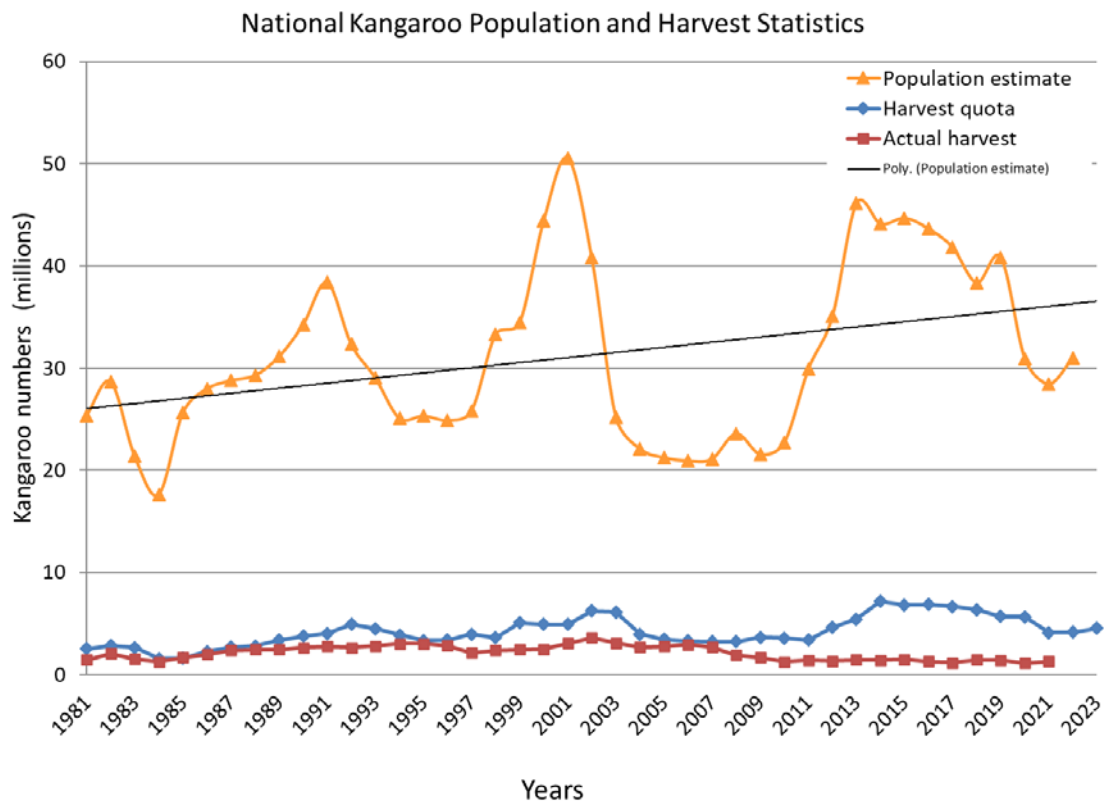


Figure 1 National kangaroo population and harvest statistics (DAWE 2022).

Kangaroo irruptions bring forward the severity of drought, compromising landholders’ capacity to manage total grazing pressure on their farms which damage landscapes, biodiversity and ecosystems. During drought, the die offs are a serious animal welfare issue to which there are no governmental countermeasures. The die offs also cause severe emotional and physical stress to landholders and threatens the social licence of livestock industries (Zanker, 2021, McMurtrie and Kerle, 2021, Sinclair et al., 2019).

Figure 1 (National) and Figure 2 (South Australia (SA)) show that only a tiny proportion of the populations is harvested commercially – red line - and that this in turn is a small proportion of the permitted quota – blue line. The populations fluctuate as seasonal conditions change. Damage mitigation culling or pest culling is undertaken on kangaroos which are considered a pest. Waste is therefore substantial, at a time when government policies and investment seek to ensure agriculture

Only a tiny proportion of the populations is harvested commercially.



production increases. The protein demand for 7.3 billion people in the world is currently at around 202 million tonnes and expected to increase by 76 per cent by 2050 (Henchion et al., 2017).

In Qld from 2018 to 2020, there were between 84430 and 294300 kangaroos culled under damage mitigation permits, which accounted for 15 to 33 per cent of total kangaroos killed (Qld DES 2022). This is between 3 and 10 per cent of the allowable quota, while harvesting made up 18 to 27 per cent of the allowable quota. Together culling and harvesting make up between 21 and 37 per cent of the allowable quota.

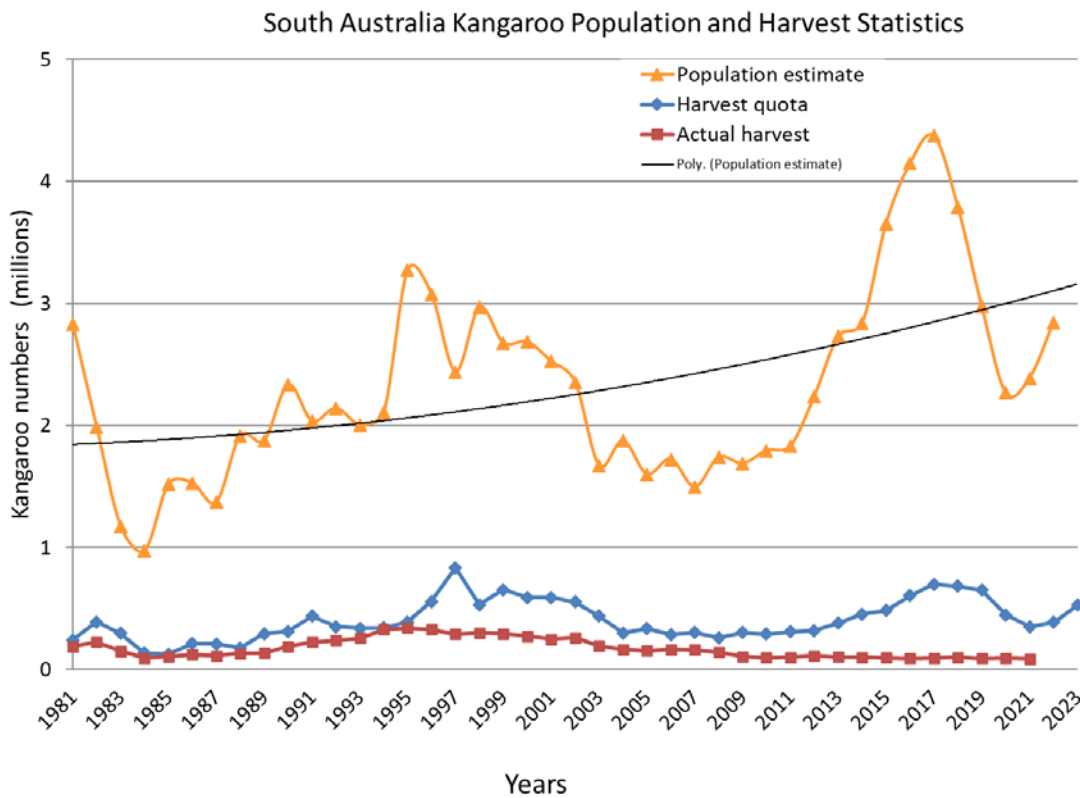


Figure 2 South Australia kangaroo population and harvest statistics.

Kangaroos that are commercially harvested are currently sold for domestic and export pet consumption and human consumption. Facilities for export are registered and production is overseen to ensure food safety meets export standards, while pet and human domestic consumption processors must comply with state requirements. A facility processing kangaroos for human consumption to export, meets all the requirements of domestic consumption but a domestic consumption processor does not need to meet all of the requirements for export.

Payments are not recorded and publicly available as they are for sheep, cattle and goats by industry agencies on a weekly basis (e.g., Meat & Livestock Australia (MLA)) or government organisations annually (Australian Bureau of Statistics (ABS)). Our records are based on kangaroo processors and harvesters that are willing to divulge the information. Sources indicate that products for human consumption are currently around \$1.30 - \$1.40/kg in 2023 which can rise to \$1.50 - \$1.60/kg if supply can be consistent or a specific number can be met (e.g., approximately 90 per week).

Products for pet consumption are as high as \$1.70/kg with harvesters selling carcasses to carnivore breeding programs at \$5.00/kg.



The current payments for other red meats are detailed in Table 1. Cattle (over the hooks) were \$3.83 – 5.80/kg carcass weight (cwt) with yearling cattle at \$5.60 – 6.28/kg cwt in April 2023. Sheep and lambs were \$3.13 – 3.30/kg cwt and 6.25 – \$6.48 respectively, and goats were \$2.30 – 2.80/kg cwt (see www.mla.com.au/prices-markets/oth/). These values are well above the payments for kangaroos, and include premiums paid for younger animals and for different sexes, breeds, and ages as these correspond with differing qualities; yet retail price of kangaroo appear to align with the price of similar beef products. See Figure 3 as a guide.

Table 1. Commodity over the hooks and price paid per kilo in 2023 (see www.mla.com.au/prices-markets/oth/).

Species	Kangaroo	Goat	Mutton	Beef	Lamb
Price	\$1.30-1.70/kg	\$2.99/kg cwt	\$3.25/kg cwt	\$5.56/kg cwt	\$6.77/kg cwt



Figure 3 A comparison of the ‘farmgate’ price paid for kangaroos and retail sale price (HC = human consumption).

Kangaroo is usually sold to processors at one price point with no distinction between attributes and practices that produce carcasses with varying qualities, which are not described in the supply chain. Nevertheless, surveys show quality and integrity are key issues (Chudleigh et al., 2008). Furthermore, there is demand by the processors for a reliable supply of kangaroos which meet known consumer preferences; restaurants and high-end wholesalers cannot get the diversity available for other meats.

There are global trends to a reduction in meat consumption, especially red meat. According to a 2021 Choice survey, 11 per cent of Australians were considering becoming vegan in the next five years, and Australia is the world’s third fastest growing market for plant-based foods. While some of this trend is health related, much is due to animal welfare concerns in intensive animal production and ‘factory farming’. Wild caught fish are deemed to be the exception by many with this view. They call themselves pescatarians and they are joined by some “*kangatarians*”. If a wider range of



kangaroo products were available the number of kangatarians could increase and further increase the demand and value for kangaroo products. Figure 4 Cuts of kangaroo routinely available in retail service centres. Figure 4 shows some of the limited number of kangaroo products readily available in retail supermarkets.



Figure 4 Cuts of kangaroo routinely available in retail service centres.

3. PROJECT OBJECTIVE AND METHOD

This report examines the opportunities that are available to increase the value of kangaroo products. We envisage that doing so will lead to better population management with positive environmental and animal welfare outcomes, reduced waste and improved employment plus financial and mental health for many individuals and communities.

The report is targeted at:

1. Harvesters and processors who would like to implement existing knowledge and practices to generate different price points for kangaroos varying in desirability.
2. Landholders, harvesters, and processors who would like to explore innovative ideas for increasing the value of kangaroos.
3. Industry associations who would like to implement standards and best practices.
4. Research and political organisations targeting both kangaroo specific questions and big picture agricultural issues, such as sustainability, protein shortages and carbon abatement and storage.

3.1 Outcomes sought

Describe options and mechanisms for delivery, to the market, of a wider range of kangaroo products that have more detailed description of their attributes with quality consistency.

Describe procedures for increasing reliability of supply, a reduction in costs incurred by pastoralists in management and the opportunity to integrate kangaroos into rangeland production systems, both to benefit themselves and increase income for rural communities.

Describe procedures for tracking species, ages and origin to enable consistency.

Draw on previous work by kangaroo processors, the Kangaroo Industry of Australia Association, AgriFutures, Food Agility Cooperative Research Centre (CRC), CSIRO, Meat and Livestock Australia (MLA), Meat Standards Australia and the Goat Industry Council to guide development of the kangaroo industry through improved management.

3.2 Research undertaken

Prepare a (short) overview with the resources available to:

- Identify current innovations available for higher value kangaroo products.
- Consider innovations that can be developed for higher value kangaroo products.
- Consider developments in other red meat industries that could be applied to the kangaroo supply chain to aid in increasing demand and value.
- Identify potential collaborators.

3.3 Consultation

Consultation was undertaken with members of the SA Kangaroo Partnership Program (KPP), processors, harvesters, and landholders. Resources available for this overview did not enable in person contact or workshops. We remain ready to conduct further discussions with stakeholders.



We also exchanged information with the other projects in the KPP; The Arid Rangelands Collective Project and Kate Greenfield (South Gap Station), and the Kangaroo Management Awareness Project by Nature Conservation Council of SA, Kirsty Bevan, Rhys Abbot, and Madeline McShane.

Members of Kangaroo Partnership Program

- Landscapes South Australia
 - Arid Lands
 - Northern and Yorke
 - Eyre Peninsula
 - Murraylands and Riverlands
- Bush Heritage Australia
- Ecological Horizons
- Jumbuck Pastoral
- Kokatha Pastoral
- Livestock SA
- Macro Meats Group
- South Gap Station
- SA Water
- SA Drought Resilience and Innovation Hub
- SA Professional Field Processors Organisation



4. INNOVATIONS AND OPPORTUNITIES CURRENTLY AVAILABLE TO INCREASE DEMAND AND VALUE

4.1 Field harvesters and landowners

4.1.1 Selective harvest practices to improve meat quality

Age and size

Research results suggest that leg cuts derived from lighter, younger animals are of higher eating quality than those from older animals destined for human consumption. Palatability of silverside and topside decrease in heavier carcasses and there is a similar relationship for tenderness, flavour and overall acceptability with the smaller size considered as a superior quality of meat irrespective of species (Wynn et al., 2004).

A premium for smaller or younger animals.

We acknowledge that there are minimum weight limits in some states and that the structure of the industry generally encourages larger animals to be harvested (e.g., harvesters are paid per kg). In NSW a dressed carcass must weigh more than 14 kilograms and any other carcass must weigh more than 20 kilograms. In Qld, Victoria, SA and Western Australia there are no weight limits.

Species

A premium could also be attracted for red kangaroos. The sensory evaluation of commercially important muscles obtained from red and western grey kangaroos identified flavour as the predominant factor influencing the acceptability of grilled kangaroo. Red kangaroos are more palatable and juicier than western grey kangaroos; noting that all red kangaroo cuts were palatable and tender while in the western grey the loin fillet was more palatable and tender (Wynn et al., 2004).

A premium for red kangaroos.

Transport and carcass suspension

The musculature associated with a suspended leg is tougher than that from the “free” leg on the same carcass. A single leg for carcass suspension by field harvesters has led to the finding that this practice results in increases in toughness of up to 50 per cent in commercially important hind limb muscles in the suspended leg relative to the free limb (Wynn et al., 2004). Thus, field harvesters who hang carcasses by one leg post-slaughter are in effect adding to the variability in product quality even from the same carcass (Wynn et al., 2004). Hanging by the tail or from the pelvic bone so that both legs swing freely to stretch muscles of the hind limb is a technology easily adopted by the industry which improves the quality of kangaroo product if done pre-rigor after rapid exsanguination and evisceration.

A premium for pelvic hung carcasses.

4.1.2 Selective harvest to improve skin quality

Species

There is variability in tear and tensile strength between red and grey kangaroo skins. Grey kangaroo skins produce thicker leather and are stronger for chrome tanned leather (Looney et al., 2002). The strength properties of male and females of the same species were approximately equal. This work was based on chrome-tanned leathers produced from frozen NSW skins.

A premium for grey kangaroo skins.



Season

The properties of the crust leather prepared using commercial tanning/re-tanning processes is also affected by season with winter harvest preferable as the skins from the summer harvest were of lower quality (Looney et al., 2002).

A premium for winter skins.

Unblemished

Barbed wire and ticks can damage skins especially the butt area of the carcass. The skins affected with tick and pock also tend to have other damage such as scratches and marks consistent with the kangaroo clawing the infected areas or rubbing against hard objects. The scarring of the skins can affect the physical strength of the skins (Looney et al., 2002). Kangaroos with fewer marks could attract a premium.

A premium for kangaroos harvested in locations where skins are unblemished.

4.2 Current innovations available to processors

4.2.1 Quality prescriptions

Dry carcass conditioning and aging

Carcass conditions while hanging or aging before butchering allow the natural enzymes in the meat to begin to break down the cell fibres in the meat making it softer. Hanging also allows the meat to lose moisture (up to 20 per cent) which would otherwise leach out during cooking (see <https://kangarobiemeats.com/blog/stress-and-ageing/>)

A premium for aged or conditioned carcasses.

The time can vary anywhere between a couple of days to a month or more, but to be successful it must be long and "dry".

The storage of carcasses in field chillers for 1 to 10 days provides a mechanism for the aging of carcasses to improve tenderness by the breakdown of the myofibrillar structure of muscle, thereby improving eating quality (Spiegel and Greenwood, 2019).

Wet carcass conditioning and aging

Kangaroo meat shows potential for value adding through the extended, chilled ageing of boned, vacuum packaged products. Significant decreases in peak shear force were found in 21-day aged product as compared with ageing for 7 days when muscle temperatures were at ~24°C upon commencement of rigor (pH 6) (Wynn et al., 2004). A curvilinear response of peak force with the temperature at pH 6 indicated that ageing potential was adversely affected when muscles entered rigor at temperatures higher or lower than the optimum of 24°C (Spiegel and Greenwood, 2019). In summary, if the meat is not aged more than 7 days, temperature doesn't matter, but if aged more than 21 days the closer to 24°C the better. Between 7 and 21 days, the best temperature is varying.

Associated potential problems with shelf-life (e.g., microbial contamination) may be alleviated through further development of successful Modified Atmosphere Packaging (MAP) methodologies.

4.2.2 Product description – better describing what we already know

There is scope for the processors to pass on product descriptions from harvest including age (young premium for specific cuts), species and specific cut (with the latter done by some processors); for example, strip loin, loin fillet, knuckle round, tail portion, osso bucco, forequarter, leg bone in, rack. Currently kangaroo products are described as kebab, steak, roast, diced, fillets, jerky, rump, sizzle steak,

A premium for better described products.



sausage, meatballs, loin medallions, diced, salami, mince and burgers, but there is scope for further development with a list of examples of different cuts in Table 2 and Figure 5.

Table 2. Different cuts of kangaroo and associated muscle (Spiegel and Greenwood, 2019).

Cut	Muscle
Tenderloin (fillet)	<i>Musculus psoas minor</i>
Loin set	<i>M. longissimus dorsi</i> and <i>M. iliocostalis</i>
Striploin	<i>M. caudal dorsolateral sacrocaudalis</i>
Long fillet	<i>M. cranial dorsolateral sacrocaudalis</i>
Rump	<i>M. gluteus medius</i> , <i>M. caudofemoralis</i> and <i>gluteus superficialis</i>
Knuckle	<i>M. vastus lateralis</i>
Silverside	<i>M. biceps femoris</i> and <i>semitendinosus</i>
Topside	<i>M. adductor</i> and <i>semimembranosus</i>

Kangaroo meat also has a lower fat and cholesterol content than lean beef and lean lamb. It provides more protein than beef, lamb, pork and chicken and has a higher iron content than lamb, pork and chicken (Food and Fogerty, 1982) which could also be better described on products.



KANGAROO MEAT CUTS

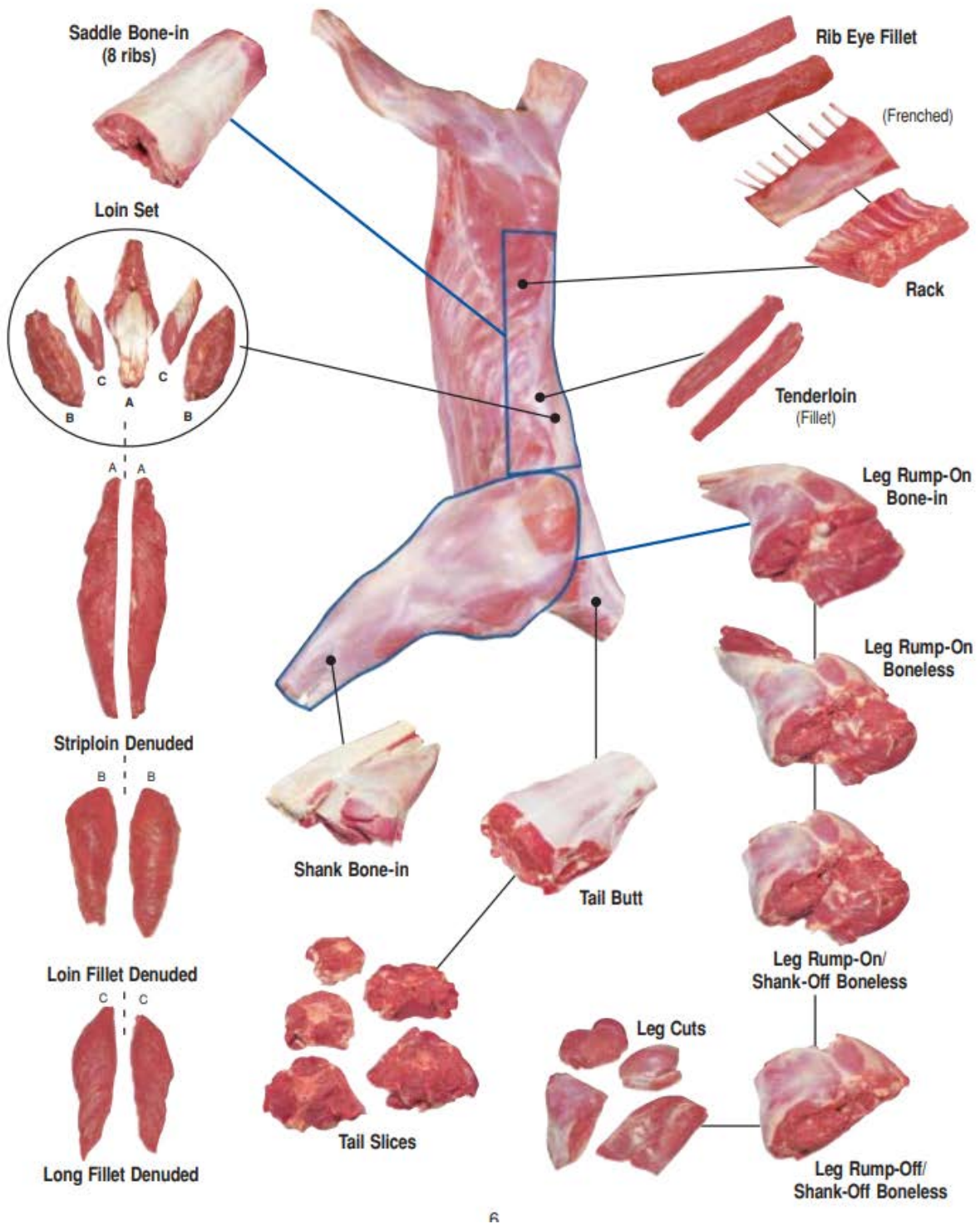


Figure 5 Kangaroo meat cuts from 'Kangaroo Specification and Selected Meat Cuts' (KIAA, 2002).

4.2.3 Innovative and premium products

Product guarantee and direct delivery can attract a premium. Kangaroo products could be supplied direct to selected outlets such as suppliers and restaurants depending on their preferred cuts. For example, specific cuts suitable for Indian curries would go direct to Indian restaurants while traditional bush foods could go to Indigenous communities.

A premium for direct delivery of innovative and quality products.

Paroo premium

Paroo Premium Kangaroo from Macro Group, supplies the food service market direct to restaurants. The objective is to focus on food safety and consistent quality with external auditing to ensure compliance to high standards. Kangaroo carcasses from selected species and regions are graded and trimmed into standardised portions within strict weight ranges, enabling optimal cost control and consistent cooking times.

Bone-in cuts

There would appear to be opportunities for bone in cuts and whole carcasses to supply rotisseries and slow cooking. Kangaroo tails are available as dog treats and have previously been a feature of Australian cuisine. Frozen tails are available in stores in Indigenous communities particularly in central Australia. Bone in shoulders and lamb racks could be more readily available.

A premium for special cuts, including bone and tail.

Jerky, smoked products and sausages

Red-Hot Roo is an example of a specialty kangaroo jerky (see www.redhotroo.com.au). There is scope for expansion of jerky products along with other processed meats such as salami, cabanossi, droëwors, biltong, and sausages.

A premium for supplying specialist outlets.

4.3 Marketing and promotion

4.3.1 Potential collaborators and influencers

Indigenous

Engagement with Indigenous leaders and chefs such as Mark Koolmatrerie, Mark Olive and Damien Coulthard from Warndu based in Clare Valley could promote kangaroo use.

Connecting with the **National Indigenous Culinary Institute** (NICI) which is an industry inspired and initiated program to create highly skilled indigenous chefs, would be beneficial. The NICI was established in 2012 as a not-for-profit partnership committed to finding and training the next generation of culinary leaders, and is now the leading Indigenous chef training program in Australia.

Investment in marketing to promote the kangaroo product and increase its demand and popularity.

Politicians and policy formers

Red Meat Advisory Council organised a special tasting of beef, lamb and goat in the Speaker's Courtyard in National Parliament House. It was a joint exercise with the Parliamentary head chef David Learmonth. This is the sort of engagement kangaroo needs with influencers.

Kangaroo could also be on the menu in Parliament House. South Australian MPs, including Nicola Centofanti could deliver something similar.



Premium restaurants

Kangaroo should be featured at premium restaurants in SA and nationally.

TV Chefs

Kangaroo could be promoted more widely through famous chefs such as Khanh Ong - wild food, Mathew Evans - Gourmet Farmer and Maeve O'Mara - Cooking with fire. The Cook and the Chef promote kangaroos intermittently.

Social media experts

Kangaroo harvesting is controversial. Some animal rights activists and opponents of the commercial kangaroo industry, although a minority, are very vocal, and criticise and attack kangaroo or land management groups, or those that are developing research ideas or trying to better inform the public. Experts in social media have proved to be resilient and professional in their ways of managing such criticism.

The KPP Kangaroo management awareness project by Nature Conservation Council of SA, Kirsty Bevan, Rhys Abbot, and Madeline McShane, is making a valuable contribution to understanding the complexity and generational differences in understanding how social media works and its impacts and opportunities.



5. INNOVATIONS REQUIRING FURTHER DEVELOPMENT

5.1 Actions to improve environmental impact

Develop practices that improve environmental quality and sustainability through integration of kangaroos into production systems. Monitoring of these practices and benefits will enable quantification and payment of premiums.

5.1.1 Stewardship and biodiversity conservation

Where kangaroos are harvested from land that has projects in place to improve landscape and biodiversity values, the landholder could pass on the information to harvesters and then down the supply chain to inform consumers that they are buying from environmentally improved habitats and create added value for kangaroo products.

Integrate kangaroo production into pastoral industries and other sustainable grazing activities earning premium products payment.

Integrating kangaroo production into other pastoral enterprises to eliminate pest status is proposed by Wilson and Edwards (2021b). The model and the proposed trial fits well with the work undertaken as part of the KPP Arid Rangelands Collective project and Kate Greenfield (South Gap Station).

The Sheep and Beef Sustainability Frameworks (see also section 6.4.1) and Accounting for Nature (AfN) are useful models. AfN is a transparent, affordable, verifiable and certifiable environmental accounting framework to inform better investment, policy and management decisions in natural capital. These include carbon co-benefits, green bonds, environmental offsets and impact investments (see <https://www.accountingfornature.org/>). Others include programs such as Landcare, biodiversity or carbon certification and markets.

Include kangaroo production as part of programs earning stewardship payments.

In SA, the Native Vegetation Heritage Agreement Grant Program provides increased support to landowners to help them manage biodiversity on their properties (see <https://www.environment.sa.gov.au/topics/native-vegetation/protecting-enhancing/heritage-agreements/heritage-agreement-grant-program>).

5.1.2 Carbon savings

Kangaroos emit little methane (Kempton et al., 1976, von Engelhardt et al., 1978, Dellow et al., 1988, Hume, 1999) which is an important greenhouse gas liability from current agricultural practices (Figure 6). Improved grazing management of kangaroos can also increase sequestration of carbon in soil. Value could come from marketing these attributes.

Higher value from protein with less greenhouse gases.

Plus, there is scope for carbon credits through current soil methodologies or growth in international methane methodologies. Kangaroos emit between eight and 11 times less carbon dioxide equivalents than beef cattle, per kilo of meat produced. Instead of increasing cattle and goat populations (the cattle herd is the highest it has been in a decade), the question is, can this difference lead to carbon credits for the landholder. A domestic methane methodology incorporating kangaroos could be developed if propelled by the red meat and kangaroo industries.

Carbon credits from low emission kangaroo meat



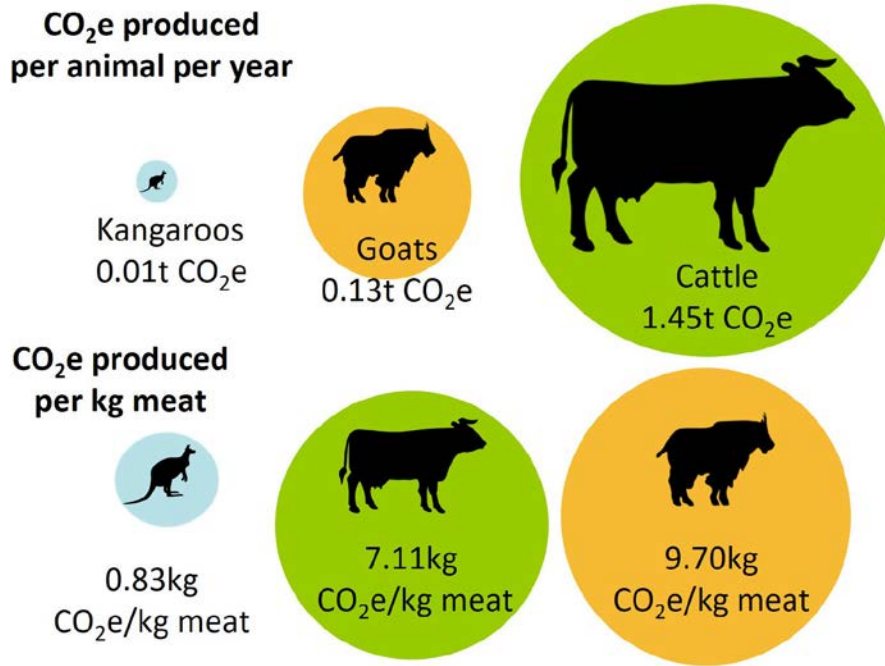


Figure 6 Kangaroos produce much less methane than beef cattle and goats as they have different digestive systems (Wilson and Edwards, 2021a).

5.1.3 Water consumption

Per individual, kangaroos have a low impact on water reserves at approximately, 1.5L/day or 91L/kg meat (Figure 7) (Wilson and Edwards, 2019). This is an important savings for Australian environments and could be used to promote the importance of kangaroo use, especially in times of drought, when the effects of excessive water use are evident.

Higher value can come from producing protein with less water.

Kangaroos need less water

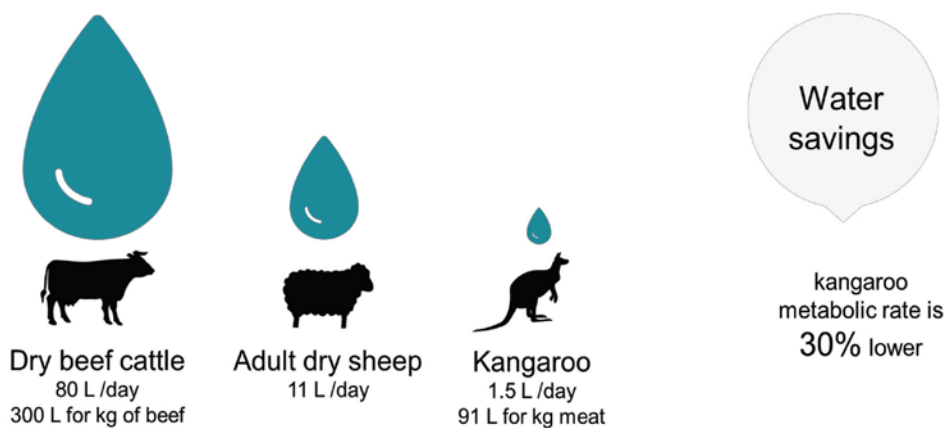


Figure 7 Kangaroos consume less water than beef cattle and sheep; they are adapted to survive Australia's erratic climatic (Wilson and Edwards, 2019).



5.1.4 Lead bullets

Lead-based bullets currently used for all macropod shooting can lead to small lead fragments embedded in the meat. However, research has shown that visible fragments are absent in commercially available kangaroo products. While meat lead concentrations (mg/kg wet weight) are 0.01 ± 0.01 for kangaroo, 0.02 ± 0.01 , and well within the Australian food standards threshold for livestock meat (0.1 mg/kg w.w.) (Hampton et al., 2023), lead based rifle bullets frequently fragment, and can be harmful to the health of wildlife scavengers (carrion eaters), if shot animals, or parts of them (trimmed tissue or offal), are left in the environment (Jordan et al., 2018).

Value can be added through the development of best practice for reducing environmental lead contamination.

Non-toxic alternatives (e.g., copper-based bullets) are increasingly being used overseas. However, Australia has no comparable research. Many vulnerable species of scavenging wildlife (carrion eaters), notably predatory birds, are also at risk of harmful lead exposure through ingesting bullet fragments when carcasses are trimmed and left in the field for scavengers to find (Jordan et al., 2018).

Copper bullets have not been researched in kangaroos, and their use would need to align with the specifications for firearms and specification. Another alternative would be to remove any remains that could contain lead to reduce its occurrence in the environment and its effect on wildlife.

5.2 Sharing information along the supply chain – adding new information

5.2.1 Accurate descriptions

A kangaroo harvester must comply with standards for quality assurance and food safety, including the implementation of a Hazard Analysis Critical Control Points (HACCP) program, compliance with the Australian Standard for the Transportation of Meat for Human Consumption and holding game animal certificate of competency/approved qualification. These programs and licences are applied and required for all harvested kangaroos. Under these programs some attributes such as species and weight are required to be recorded.

We suggest including more detailed and accurate descriptions that correspond with the harvest of kangaroos and make them more desirable and therefore more valuable. Different price points could be generated for accurate descriptions that improve quality or meet demands, including the attributes listed above, which are already recorded by the harvester (e.g. species, sex, age/weight/size), but also new production processes such as:

- Pelvic hanging
- Silent, stress-free harvest
- Season harvested
- Environmental improvements
- Location
- Less waste produced and sustainability

There is also scope to promote the current regulations that underpin kangaroo harvesting such as:

- Licensing of commercial harvester, dealer and processor
- Adherence to National Code
- On-plant-supervision to ensure hygiene outcomes overseen by On-Plant veterinarian and on-plant area technical manager.



5.2.2 Tagging and tracing

Tagging and reporting are mandatory, and every kangaroo can be traced back to harvest location with the assurance that it was sourced humanely and sustainably. Two tags on each identify the licensed harvester, the harvest zone, the property on which the kangaroo was harvested, the issuer, the date, place and time of the harvest, the field chiller, the unique carcase number and the harvester’s signed declaration.

Innovations in tagging and tracking enable value adding through accurate descriptions (for current and new attributes and processes) and brands for products.

A livestock app, AgTechdata, is a traceability app which details National Vendor Declarations, transport, data and payment for livestock. A similar app could be developed and used to pass on information that highlights differential features of kangaroo carcasses. It could be used to increase the value of more desirable kangaroo carcasses and their subsequent products. A Longreach kangaroo processor has received \$300 000 to develop a traceability app (see [Longreach roo processor receives \\$300k to develop traceability app | Queensland Country Life | QLD](#)).

5.3 New products

5.3.1 Biomedical

Kangaroo may be used for biomedical research; examples include as transplants of kangaroo derived ligaments and the use of kangaroo pericardiums, for use in the manufacture of heart valves. Kangaroo derived ligaments are being used to address growing demand for reconstructive ligament material following injury (IMCRC 2019). While still in the research phase, research companies require kangaroo resource material. A supplier in the South East NSW zone is establishing a sterile room in order to provide tails to the research facility (Robert Gallina, pers. comm.). The tendons will come from kangaroo tails from kangaroos harvested under the NSW commercial kangaroo management program.

Development of high valued specialty products for the biomedical and nutraceutical industry.

The kangaroo pericardium has been identified as the preferred candidate material for use in the manufacture of the leaflets of percutaneous heart valves (Meng et al., 2019). Kangaroo heart valves have a unique structure and mechanical properties that make them potentially useful for human heart valve replacements. Kangaroo have a higher content of elastin, a protein that gives the valves elasticity, than other animal valves. This makes them more like human valves and could potentially reduce the risk of rejection or complications.

To date, the Therapeutic Goods Administration has not approved use because kangaroos are wild, causing issues with traceback identification (Michael Bennett, pers. comm.). Additionally, there are ethical concerns regarding the use of kangaroo hearts for human purposes.

Currently, the most common sources for human heart valves are from human donors or other animal sources, such as pigs, cows, and sheep. These sources have been used for many years and have a proven safety and effectiveness record. Ultimately, the choice of heart valve source depends on a variety of factors, including the patient's medical condition, age, and preference, as well as the availability of donor valves. Edwards Life Sciences are supplied with beef heart valves by Australian Country Choice from their 42 Queensland cattle properties.



5.3.2 *Bio actives and nutraceuticals*

Offal could also be of value if marketed to the right countries and cultures or used as nutraceuticals and bio actives. However, the Game Meat Standards do not allow the lungs, liver, heart and kidney to be used for human consumption. It is most valuable for pet food.

Many traditional food products contain active components that provide a functional or health benefit. High value bioactive components derived from food and plant products are being used in functional foods, pharmaceuticals for humans and animals, nutraceuticals and as functional ingredients (Stanley, 2008). Red meat and its associated co-products such as blood, cartilage and organs are an excellent source of many of these bio actives. Nutraceuticals are nutrients and non-nutrient compounds in food that have health promoting, disease preventative medical properties and can be taken as a dietary supplement or added to food to increase the amount of those substances in the diet (Stanley, 2008). The market for nutraceuticals in Australia, the US and Europe has experienced strong growth of 10 – 15% per annum. Essence of Kangaroo (3000 mg: 100 tablets) meat powdered food supplement is worth AUS\$29.95 (Stanley, 2008).

5.3.3 *Rendering and fertiliser*

Kangaroos that do not meet human or pet food consumption could also be used for rendering or to generate fertiliser. Currently 80 per cent of the approved kangaroo management quota has been under-subscribed and use of waste will provide another option for value adding. Harvesters currently receive nothing for waste; however, by making use of the waste as fertiliser, harvesters could generate an additional income stream. with significant investment.

Value can come from raw materials for fertiliser and rendering from waste products.

The process has been developed by Returning Organics to Soil and involves taking raw products which are materials from animals which is wasted and converts them into a viable foliar spray which acts as a biostimulant. The process has been used on fish and feral pigs but is yet to be used on kangaroos (see <https://www.gerrygillespie.net/>).

HyPro Pet Foods from Broken Hill and Wilberforce New South Wales is another company rendering kangaroo carcasses.

5.4 Packaging, travel and storage

5.4.1 *Vacuum and nitrogen packing*

Further research to develop an increase in quality or shelf life could come from packaging, including vacuum package, nitrogen packing and life to expiry of package on supermarket shelf, canning, drying, fermentation, irradiation, curing and smoking. The Macro Group packages in nitrogen and irradiates meat to extend shelf life.

Research on packaging, travel and storage to deliver quality consistently.

5.4.2 *Storage, ageing of carcasses and delivery times*

The timing of the onset and dynamics of rigor mortis through to its completion are yet to be characterised in kangaroo meat, additional studies are required to optimise chilling regimes for maximum tenderness (Stanley, 2008, Wynn et al., 2004).

There are variable holding times that may occur between carcass batches, before delivery to the processing plant. This variability may have marked impacts on final eating quality, as already indicated (Wynn et al., 2004). More research is required on chilling, travel and storage times and



travel costs to increase value. This too could address the requirement for consistent supply of carcasses.



6. LEARNINGS FROM OTHER MEAT INDUSTRIES

Bringing in ideas from analogous fields can be a potential source of radical innovation. Below we provide details from parallel industries which could be implemented within the kangaroo supply framework to promote the value of kangaroo.

6.1 Support and policy development

Other meat and livestock industries are supported by councils or associations which advocate policies, positions, markets and research for their respective industry. Goats are a particularly relevant example, as many different initiatives were implemented as they transitioned from a pest to an industry developed resource.

Develop an association which represents under-represented constituents of the supply chain.

The Goat Industry Council of Australia (GICA) is a national body that represents and promotes the national interests of Australian goatmeat, fibre and dairy producers. GICA is designated as a Commodity Council of the Federation by Federal Government and is specifically designated as the organisation that develops collective goat industry policy. GICA works with Government, industry bodies, producers and other peak industry councils to:

- Represent and promote the interests of Australian goat producers.
- Function as a specialist goat industry organisation with concern for the livelihood of all goat producers.
- Carry out activities necessary to advance the goat industry. Collect and disseminate information concerning the goat industry.
- Maintain a high level of liaison and cooperation with its members, relevant government departments and authorities at local, state and federal levels and with other relevant industry organisations.
- Promote the development of the agricultural and pastoral industries of Australia.

The Deer Industry Association of Australia (DIAA) also has wide representation from farmers, processors, transporters, breed organisations and any other party involved in the deer industry. It negotiates with Government agencies on many topics vital to the deer industry, including the use of levy funds and development of protocols for the export of venison and velvet.

The Kangaroo Industry Association of Australia is represented by kangaroo processors, which is different to both the DIAA and GICA. It lacks support for all aspects of the supply chain. An industry which supports all aspects of the kangaroo supply chain or those that are currently unrepresented such as the landholders and harvesters could be formed to provide guidance and advocacy for current and future needs of the kangaroo industry, focusing on landholder and harvester challenges.



6.2 Levies

Australian primary industries can choose to invest in the levies system and prescribe the amount of levy or charge applied to a commodity. Levy and charge revenue can be directed to biosecurity preparedness and emergency plant pest and animal disease responses, residue testing, marketing and research and development. It is the decision of a primary industry to determine the proportion of how a levy or charge is directed to each of these activities.

A levy to support kangaroo value adding at the land and harvest level would be at the decision of a representative Association.

Developed industries pay levies toward marketing, emergency animal disease response and Animal Health Australia with levies being paid by processors, transactions and producers; however, the kangaroo levy is currently \$0.03 per carcase for residue testing and \$0.04 per carcase for research and development for human consumption and \$0.03 per carcase for research and development for animal consumption.

In comparison, the transaction levy for goats is 37.7 cents per head. GICA is responsible for managing and making recommendations to the Minister for the distribution of the goat transaction levy income. The current division of this levy to relevant levy funded organisations is as follows:

- Meat and Livestock Australia (MLA) marketing: 10.5 cents
- MLA research and development: 16.7 cents (which is matched with Australian Federal Government funds)
- Animal Health Australia (AHA): 4.5 cents
- National Residue Survey (NRS): 6 cents

MLA invests levies in the following core areas through its goat industry R&D program (Going into Goats): Increasing the volume and reliability of supply of goats and goatmeat. Developing the number and size of markets for Australian goats and goatmeat.

Animal Health Australia invests levies in the following core programs: National Animal Health Information Service National Arbovirus Monitoring Program National Transmissible Spongiform Encephalopathy Surveillance Program National Ovine Johnes Disease Program Exotic animal disease preparedness Goat Production Conditions.

GICA oversees the investment of industry levies in animal welfare research conducted by MLA, with the ultimate aim of providing tools and knowledge to producers to help them improve the wellbeing of their goats and address issues of community concern.

There is scope for landholder and harvesters to invest in levies to aid in growing kangaroo value. The process could be modelled on the goat industry. While landholders and harvesters are reluctant to pay further levies on a product where the returns are small, the intention is that the investment is used to undertake activities that will make the product worth more in the long run.

6.3 Industry management programs

6.3.1 Livestock Production Assurance

The Livestock Production Assurance (LPA) program is the Australian livestock industry's on-farm assurance program covering food safety, animal welfare and biosecurity. It meets the stringent requirements of export markets, providing an assurance of the safety of red meat grown on Australian farms. Food safety is paramount to consumers in Australia and in the more than 100 countries which buy Australian red meat. LPA provides a food safety assurance to these customers



and in doing so supports the reputation and on-going economic viability of Australia’s livestock producers and industry. The creation and support of ‘best practice harvesting’ standards or guidelines covering animal welfare, food safety and hygiene beyond basic regulation could be developed to generate products with added value. It could be based on the Livestock Assurance Scheme (LPA 2015). There could be sectional options such as drought resilience practices depending on location of harvest.

To improve animal welfare, techniques could include shooting with silencers at night as is done with animals in parks and reserves. According to Territory and Municipal Services, ACT, “a suppressed firearm has less recoil, which promotes shooter accuracy and also protects the shooter from hearing and nerve damage” which reduces stress on kangaroos and nearby animals. However, this is illegal in some States and Territories. Other options include using infra-red and silent electric vehicles. Reducing stress has the added benefit of potentially improving tenderness. To remove the animal welfare impacts of harvesting females with joeys, harvesters could select males. Although this has been known to cause unwanted population increases in the past, improved population monitoring and management could be used to alleviate these pressures.

Set up a Kangaroo Production Assurance program.

A Kangaroo Production Assurance Program could address a number of issues associated with kangaroo harvesting and advocate best practice for health and safety, animal welfare, and environmental sustainability.

National Vendor Declaration and Waybill (LPA NVD/Waybill)

The National Vendor Declaration and Waybill (NVD/Waybill) is the main document upholding Australia’s meat and livestock food safety reputation. When an LPA NVD/Waybill is signed, the producer is declaring compliance with LPA, the industry’s food safety program.

Develop declarations to confirm compliance to kangaroo production processes.

The LPA NVD/Waybill enables important information regarding livestock history to be transferred through the supply chain to the end consumer so that they can be confident that the red meat product is safe. The LPA NVD communicates the food safety and treatment status of every animal every time it moves along the value chain – between properties, to saleyards, or to processors. The NVD also acts as movement documentation throughout the value chain.

In a similar way to the NVD, harvesters could sign declarations that correspond to best practice. This information could be passed on to processors and down the supply chain to inform consumers that are buying from best practice supply chains and create added value for kangaroo products.

6.3.2 National Livestock Identification System

The National Livestock Identification System, (NLIS) is Australia’s system for identification and traceability of livestock. It enables cattle, goats and sheep to be traced from property of birth to slaughter for biosecurity, meat safety, product integrity and market access. The NLIS is endorsed by major feedlot, agent, saleyard and processor bodies. It is also underpinned by State/Territory legislation, which forms the regulatory framework for the system. The Integrity Systems Company (ISC) operates the central NLIS database on which livestock movements must be recorded.

The NLIS combines three elements to enable the lifetime traceability of animals:

1. All livestock are identified by a visual or electronic ear tag/device



2. All physical locations are identified by means of a Property Identification Code (PIC)
3. All livestock location data and movements are recorded in a central database

As animals are bought, sold and moved along the supply chain, each movement is recorded centrally on the NLIS database. Using this information, the NLIS is able to provide a life history of an animal's movements.

NLIS have standards which are endorsed by major producer, feedlot, agent, saleyard and processor bodies. In addition to this, it is underpinned by State/Territory legislation, which forms the regulatory framework for the system, NLIS Ltd is ISO9001 certified.

In contrast, every harvested kangaroo for export or domestic commercial sale can be individually traced through state-based tagging and reporting systems.

Traceability requirements include:

- Tagging
- Ability to identify of the field harvester from whom it was received
- The batch in which it was processed, date of processing and the total size of the batch
- Its location at the premises
- All other information necessary to identify whether or not it should be recalled
- Name and address of the person to whom the wild game meat business consigned the wild game meat and date of consignment

Kangaroos are not owned and moved by landholders like traditional livestock. However, innovations in tagging and tracking for kangaroos could follow the advancements implemented by livestock industries which have well advanced standards, recording processes and certifications (see also section 5.2).

6.3.3 Animal Health Declarations

National Animal Health Declarations are a way for producers to provide information about the animal health status of their flocks and herds. Buyers should ask for a copy and use the information provided to determine the health risks associated with the animals offered for sale. For example, the National Goat Health Statement is a nationally agreed declaration form that enables goat vendors to provide assurance about the health status of the goats they are offering for sale. It requires details for a number of significant diseases and parasites, including Ovine Johne's disease, Caprine Arthritis Encephalitis, footrot and lice, as well as drenching and vaccination history. Buyers can check and compare health statements to ensure that any goats they are planning to purchase won't compromise the health of their own herd.

There is scope for health declarations to be developed for kangaroo if the market required them.

6.3.4 Managed production systems

To ensure the continued development of a viable rangeland goat industry, producers have moved from opportunistic harvesting operations to increasingly managed production systems. This involves reducing the buck population within the mob and only retaining or introducing quality bucks for breeding purposes. If breeder numbers are sufficient, does may also be culled.

Develop industry solutions to manage kangaroos so that reliability and consistency can be met.



Improvements in the management of rangeland goats have led to increased returns for producers through increased supply and improvements in quality, carcase weights and consistency.

Reliability of supply is currently an issue for kangaroo processors. The development of management techniques, such as population monitoring or harvesting within barrier fences, to provide consistent supply would increase the value of kangaroo.

Harvesters could work with landholders to develop managed production techniques to ensure reliability.

6.3.5 Fact sheets

The Deer Association provides fact sheets for the deer industry and general public including:

- Standards for the Land Transport of Deer
- Deer farming
- Establishing a deer farm
- Comparison charts
- Fencing
- Laneways
- Handling and Yards
- Venison
- Velvet
- Deer Health

Factsheets could help promote kangaroos, inform the public and assist industry members.

6.3.6 Industry Standards and Guidelines

Meat Standards Australia

Meat Standards Australia (MSA) was developed by the Australian red meat industry to improve the eating quality consistency of beef and sheep meat. The system is based on almost 1.2 million consumer taste tests by more than 171,000 consumers from 11 countries and takes into account all factors that affect eating quality from the paddock to plate.

MLA supports MSA program participants through creating opportunities for businesses to adopt eating quality principles. MSA is a national eating quality grading system for beef and sheep meat. It commercialises 20 years of research incorporating on-farm, processing, carcase attributes, ageing and cooking pathways to determine their combined and collective effect on beef and sheep meat eating quality.

MSA aims to accurately predict eating quality for individual beef and sheep meat cuts in conjunction with cooking method. The complex series of factors throughout the supply chain that impact on eating quality are taken into account in production and processing to MSA Standards. This solves the long-standing consumer problems of selecting beef and sheep meat and choosing an appropriate cooking method.

By understanding and controlling the factors that affect eating quality, the industry has the potential to improve average eating quality and reduce variability in beef and sheep meat products ultimately eliminating meal experience failures. This means consumers can confidently purchase beef and sheep meat of a MSA consistent eating quality that meets their expectations.

Promote quality, consistency and desirability through Industry standards, guidelines and indices beyond state and federal regulations.



Meat Standards Australia index

The MSA Index is a single number and standard national measure of the predicted eating quality and potential merit of a carcass.

The MSA Index is a number between 30 and 80, expressed to two decimal places (e.g., 54.62). It is a weighted average of the predicted MSA eating quality scores of 39 MSA cuts in a carcass.

The MSA Index is independent of any processing inputs and is calculated using only attributes influenced by pre-slaughter production. It is a consistent benchmark, which can be used across all processors, geographic regions and over time. It reflects the impact on eating quality of management, environmental and genetic differences between cattle at the point of slaughter. The MSA Index is calculated once grading data is received from the processor.

The MSA involves grading based on:

- hump height and breed
- hump to weight ratio
- maturity/ossification (cartilage turning to bone)
- sex affect
- Fat coverage and marbling (even carcass fat coverage ensures an even chilling of all muscles and prevention of dehydration and toughening)
- Pre slaughter requirements
- pH less than 5.71
- High pH coarse, not juicy (low water holding capacity), reduced shelf life, cooking inconsistencies
- Increase stress causes increases in pH
- Minimum rib fat of 3mm
- Adequate fat coverage over all major primals
- Hormonal growth promotants
- paddock to plate system to meet critical control points - managed and monitored
- Producer requirements
- MSA vendor declaration
- cattle must reside on property for at least 30 days prior to dispatch
- No entire males to be consigned to MSA
- direct consignment cattle travelling by road to be slaughtered with 48 hours of leaving property
- MSA cattle sold through an accredited saleyard must be slaughtered within 36 hours of leaving the property of dispatch
- carcass feedback available

MSA Opportunity index

The MSA Opportunity Index helps producers focus their attention on where financial gains can be made and it helps benchmark carcass attribute performance. It tells producers what their Index would have been if non-compliant carcasses had met MSA minimum requirements. The MSA Opportunity Index is calculated for all carcasses that don't meet the minimum MSA requirements.

Kangaroos have the National Code of Practice for the Humane Shooting of Kangaroos and Wallabies for commercial purposes and Australian Standard for the Hygienic Production of Game Meat for Human Consumption. Further standards could be developed by industry to incorporate



environmental, food safety, eating quality and potential, and best practice standards which continue to address industry concerns, as implemented for other industries (see <https://www.mla.com.au/marketing-beef-and-lamb/meat-standards-australia/>).

6.4 Description and branding

There are a number of existing brands that could also be applied to kangaroo products such as Australian Certified Organic and Certified Land Management. Kangaroo could also be modelled on existing brands of frameworks, for example, the Beef and Sheep Sustainability Framework.

6.4.1 Kangaroo Sustainability Framework

The Australian Beef Sustainability Framework (ABSF) was launched in 2017 to create a pathway of best practice for the Australian beef industry and track performance against a series of critical indicators aligned to the themes of best animal care, environmental stewardship, economic resilience and people and the community.

The ongoing development of the ABSF is informed by globally accepted standards that require the application of principles including stakeholder inclusivity and responsiveness and materiality. Priorities and indicators will continue to be responsive and refined through materiality and stakeholder consultation. Since its launch considerable effort has been committed to improving the indicators and collecting evidence to substantiate industry's sustainability performance and progress. Currently, the ABSF contains 24 priority issues and 53 indicators to monitor progress against recognised standards and metrics. Its themes are:

- 1: Best Animal Care
- 2: Economic Resilience
- 3: Environmental Stewardship
- 4: People & The Community

See <https://www.sustainableaustralianbeef.com.au/> for more information.

A Kangaroo sustainability framework could form part of the Kangaroo Production Assurance Program as described above.

A Kangaroo Sustainability Framework could be modelled on the Australian Sheep and Beef Sustainability Frameworks.

6.5 Niche company profiles as models

The foodservice industry in Australia is driven by customer demand. Examples of companies developing products to supply niches follow. Landholders, kangaroo harvesters and processors could apply similar models.



6.5.1 Ian Hill Creative Food solutions

Creative Food Solutions (CFS) is the name of the Production Kitchen of Andrews Meat Industries. It is based on growing demand to supply restaurant quality cooked meat products with no preservatives to foodservice customers.

Andrews Meat comprises of three key divisions: foodservice; value added - cooked; and export. Across these divisions Andrews Meat supplies to all areas of the hospitality industry including restaurants, cafes, pubs, clubs, hotels and resort groups, as well as servicing a number of other industries including health and aged care, education, aviation and sporting venues.

Specialist companies servicing niche markets are a model and could be developed for kangaroo harvesters and landholders.

Quality Assurance

Andrews Meat Industries (AMI) has developed a comprehensive Quality Assurance program to ensure product is treated with the highest level of safety and care at all levels of the supply chain. AMI has employed a full time Quality Assurance team to ensure the integrity, safety and credibility of all products and development of:

- Food safety policies
- Certified manufacturing practices
- Production and processing review
- Allergen free
- Traceability

Accreditations

Standards in place include:

- HAVCCP
- NSW Food Authority
- Meat Standards
- Safe Quality Certified
- Halal

Other responsibilities

- Best practice farming
- Branding
- Animal welfare,
- 5 step JBS farm assurance,
- Environment initiatives

See www.andrewsmeat.com.au/creative-food-solutions for further information.

6.5.2 Field processing and mobile abattoirs

Provenir

Provenir was founded in 2017 on the belief that the best quality beef comes from livestock that are raised to the highest of welfare standards, right up to the very end. Until now, all stock processed in Australia was done so at a fixed abattoir, often after live transport over long distances and experiencing an unfamiliar environment. In Provenir's view, this system is flawed in that livestock are put through unnecessary stress prior to processing. This is not only bad for animal welfare and farmers; it

On farm processing and mobile abattoirs could be adapted to take field shot kangaroos.



can also negatively affect the eating quality of the meat. The founders of Provenir sought a better way and came up with the solution of mobile on-farm processing. So, instead of the animal being transported to abattoir; the abattoir comes to the farm.

Eliminating unnecessary stress on livestock associated with live transport to the processors, our unique on-farm processing improves animal welfare and produces meat of exceptional quality, taste and tenderness.

Provenir seeks:

- Highest welfare
- Processed on-farm
- Full traceability
- Grass-fed and free range
- Exceptional eating quality
- No added hormones, herd antibiotics, or intensive feed lots

Red 8 Produce

Red 8 Produce also reduces the stress of transport, saleyards, feedlots and traditional abattoirs, allowing livestock to live their whole life on the farm. Red 8 Produce identified that the quality and worth of their animals was being lost in terms of weight, bruising, and stress. They bring the abattoir to their own farms, to produce higher quality, additive free meat, which has been processed ethically, sustainably, with full and open traceability and reduced supply chain inputs. It also generates less costs and enables a higher price for their stock.

Red 8 Produce developed a unique, commercially compliant mobile abattoir system to provide consumers with high quality, sustainably produced meat direct from the farm and enables employment from local staff and supplies and rewards farmers for growing naturally reared animals on sustainable farms.



7. RESEARCH COLLABORATION OPPORTUNITIES

7.1 CSIRO

7.1.1 CSIRO Food security

CSIRO is taking an integrated approach to addressing many of the challenges facing Australian and global agriculture, including the following.

- Providing expertise in participatory design, and value chain analysis that contribute to research for development and policy platforms.
- Researching how agriculture and food systems can transform to achieve sustainable diets for all, contributing to the Sustainable Development Goals.
- Researching global land use and the economic context in which food is produced through contributing to global integrated assessments and international research initiatives.
- Developing technologies and practices to reduce and account for greenhouse gas emissions and mitigation potential across the value chain.
- Providing practical adaptation strategies that will ensure the long-term viability of rural enterprises and communities threatened by climate change.
- Providing in-depth knowledge of systems and innovation to help partners target interventions that deliver the greatest impact.
- Identifying challenges and opportunities for innovation in agri-food systems. Brokering partnerships across agri-food research and business.

Of particular relevance to kangaroo value is the Future Protein Program.

See www.csiro.au/en/research/production/food/food-security for further information.

7.1.2 CSIRO Future Protein

CSIRO Future Protein is supporting innovation and growth for all types of protein. At a meeting in Brisbane in 2022 CSIRO showed interest in kangaroo protein and waste reduction. A researcher Serafina Stone was engaged to prepare a paper for discussion with stakeholders to understand where CSIRO research and technology capabilities could be applied to help improve kangaroo management and the kangaroo industry. In June 2023 the report has not been released.

Diversifying meat products – together with MLA, the CSIRO program is finding ways to utilise lower value cuts of red meat and co-products as ingredients in new products, such as protein powders. This will see animal protein used sustainably in a wider range of settings, such as snacking, convenience foods and personalised nutrition.

Precision fermentation – The Future Protein Mission is also working on creating new complementary protein products derived from precision fermentation – As an example, researchers at CSIRO Food Innovation Centre are working with Eden Brew, a company created with support from CSIRO, to develop new animal-free dairy products with the first product anticipated to launch at the end of 2022. CSIRO is assisting in assessing health, safety, regulatory, and sustainability of novel protein production systems.

Emulate MLA working with the CSIRO precision fermentation initiative to create new hybrid kangaroo products.



MLA is also not seeking to constrain precision fermentation but investing in the initiative to develop meat products that contain a mixture of beef and synthetic meats.

Sustainability frameworks – establishing sustainability metrics for animal protein production that can be used to add value and help consumers assess their options and make informed decisions. An outcome so far has been a benchmark for beef on net protein contribution.

Wealth from waste – working towards reducing the waste associated with current food systems by upcycling protein-rich biomass such as vegetable residues, brewers spent grain, and fermentation biomass. The aim is to establish regional processing facilities to transform these waste streams into higher value protein products.

In addition, the Program is developing new white flesh fish industry – establishing affordable white-flesh fish production in Australia through a circular aquaculture economy. It is working on new sustainable functional feed formulations and additives, as well as looking at recycling approaches to produce feed from waste for Australia’s aquaculture industry. It is also supporting the growth of an emerging insect industry through the delivery of proof-of-concept research and development for using insects to transform waste and optimise animal protein production.

See www.csiro.au/en/about/challenges-missions/future-protein-mission for further information.

7.1.3 Carbon Neutral Future

Australia’s red meat industry has set itself a goal to be carbon neutral by 2030. CSIRO is working with MLA on the science to support this ambition.

7.2 AgriFutures

AgriFutures Australia is one of 15 Research and Development Corporations that service the Research, Development and Extension needs of Australian rural industries. AgriFutures deliver research and innovation that aims to give farmers and producers real returns, as well as prepare them to thrive into the future.

7.2.1 AgriFutures Kangaroo Program

The AgriFutures Kangaroo Program invests in research which aims to further enhance animal welfare, sustainability, communication and extension, nutritional value, food safety, and product value. The Program has two key objectives: The kangaroo industry’s licence to operate is enhanced and the consumer appeal of kangaroo products is enhanced.

A current project is “Determining Optimal Management Strategies for Four Large Macropods in New South Wales” and will fund a Scholarship that addresses the sustainability of the kangaroo industry and focuses on strategy number 1.2 in the AgriFutures Australia Kangaroo Program RD&E Plan 2021-2026. The specific questions to be addressed include:

1. Do kangaroos move between management zones and can our understanding of this improve our understanding of population rates of change?
2. Can drone technology improve the accuracy and precision of population surveys in the NSW Tablelands and are the use of drones economically viable?
3. Can a combination of design and model-based frameworks for population dynamics models guide quota setting in response to climatic variance, and how does this affect the risk of overharvest?



7.2.2 Evoke AG

AgriFutures promotes EvokeAG as Asia Pacific’s premier agrifood tech event, attracting all stakeholders – farmers, innovators, researchers, corporates, government and investors – to one location to connect and collaborate. The 2023 event was held at the Adelaide Convention Centre, and explored how farming, technology, science and people collectively have the power to bring innovative ideas to life. The next one is in Perth on 20-21 February 2024.

7.3 Meat and Livestock Australia

MLA’s purpose is to foster the long-term prosperity of the Australian red meat and livestock industry. MLA is a service provider to the red meat industry, not an industry representative body or lobby group. MLA is the declared industry marketing body and the industry research body under sections 60(1) and 60(2) of the Australian Meat and Live-stock Industry Act 1997, and is a public company limited by guarantee.

MLA works in partnership with the red meat industry and the Australian Government to deliver marketing, research and development products and services to beef, sheep and goat producers, with the core purpose of fostering the prosperity of the red meat industry.

MLA invests in both on-farm and off-farm research and development projects with a wide range of project partners, including producer groups, peak industry councils, the CSIRO, leading Australian universities and international research centres. The research and development program is largely funded by producer levies, with matched funding from the Federal Government. Levies are also collected by the processing, lot feeding and live export sectors, for investment in projects that support the red meat supply chain beyond the farm gate. Non-levy R&D funding is provided by industry partners through the MLA Donor Company. In 2018–19 MLA invested \$170.3 million in a range of research, development and adoption programs. This included \$94.2 million invested through MLA Donor Company.

Program areas include: Animal Health, Welfare Genetics and Genomics, Environmental Sustainability, Food Safety and Traceability, Biosecurity Grazing and Land Management, Feedlot Management, Livestock Production, Product Innovation and Digital Agriculture.

See www.mla.com.au/research-and-development/ for further information.

7.4 Cooperative Research Centres (CRC) Program

The CRC Program is an Australian Government initiative that was established in 1990 and funds industry-led collaborations between industry, researchers and end users. It links researchers with industry and government with a focus towards research application, and offers support through two elements:

- CRC grants – supporting medium to long term industry-led collaborations, up to 10 years.
- Cooperative Research Centres Projects (CRC-P) grants – supporting short term, industry-led collaborative research, up to 3 years.

Some existing and potential CRCs for potential collaboration of the kangaroo industry follow.



7.4.1 Food agility CRC

Food agility CRC create new data-driven technology for the agrifood industry using artificial intelligence, robotics, blockchain, sensors, advanced data analytics and more. They partner with Australian agrifood and Agtech industries and includes eight leading universities and are funded by the Australian Government. They have three pillars Global Digital Farm, AI and Robotics, and Carbon and Natural Capital

Global Digital Farm

The Global Digital Farm is an integrated digital learning, innovation and research environment working within a full-scale, commercial, mixed farm operation. The Global Digital Farm is changing modern farming practices by incorporating digital technology to help farmers make the right decisions at the right time. Hands-free is more than just deploying robots. It also includes static and mobile sensing technologies, telecommunications innovations and data-fuelled insights and decision making - everything that influences the how, the when and the where of day-to-day decision making.

AI and Robotics

Working with international teams across the various companies, this pillar will develop technologies critical in helping businesses manage challenges such as labour shortages and market volatility. Focus areas include: Using accessible cloud-based data for AI analytics to optimise on-farm decisions and management Data security & privacy Real-time data to cloud for AI (e.g. visual optics and microclimate). A live soil moisture sensor network designing robots as effective alternatives for major farming operations Building-in passive in-field data collection.

Carbon and Natural Capital

Through a range of industry partnerships and projects, Food Agility is leading research to underpin and inform the evolution of the Australian carbon farming market as well as incentives and support for natural capital management on farms. This includes:

- Developing and validating more cost-effective methodologies and technologies to measure carbon in soil
- Developing credible and trusted frameworks and technologies that support data sharing
- Driving practices to maximise carbon sequestration, reduce greenhouse gas emissions and improve management of other forms of natural capital
- Developing new approaches to premium carbon and carbon + biodiversity credits
- Understanding opportunities and risks for Australia's agribusinesses associated with
 - diversifying revenue streams,
 - accessing new markets and achieving carbon neutrality through carbon sequestration, emissions abatement and buying/selling offsets

See www.foodagility.com for further information.

7.4.2 Economic Participation of Indigenous Communities (EPIC CRC)

EPIC CRC aims to boost the competitiveness and productivity of Indigenous agribusinesses. It will do this by addressing:

- Technical challenges that limit the growth and scaling of agricultural and fisheries businesses that are producing novel foods and ingredients.
- Supply chain integration and system challenges that limit participation of Indigenous businesses within the agribusiness (including fisheries) sector; and



- Capability building to grow and develop innovative Aboriginal land and water business.

EPIC CRC is supported by a wide range of over 60 partners, including Indigenous businesses, private and public companies, government agencies, community groups, universities, and other relevant organisations.

If successful in its bid EPIC CRC, will provide a channel for Indigenous participation in reducing current waste of kangaroos and engagement in the commercial industry and marketing of kangaroo products.

See www.epiccrc.com/ for further information.

*Reduce waste
strengthen commercial
use and Indigenous
marketing of kangaroos
through CRCs.*

7.4.3 Food Waste CRC

The Fight Food Waste CRC aims to improve the competitiveness, productivity and sustainability of the Australian food industry. The research partners and industry participants undertake high quality research to solve industry-identified problems through outcome-focused collaborative partnerships. They also encourage and facilitate small and medium enterprise (SME) participation in collaborative research through the SME Solutions Centre.

The Fight Food Waste CRC is committed to monitoring its economic, social and environmental impacts and meeting targets in:

- Waste reduction
- Profitability
- Rescued food distribution
- Circular economy
- Future leader
- Industry training Greenhouse gas savings

The Food Waste CRC has three research and development programs

- Reducing Supply Chain Losses
- Transforming Waste Resources
- Education and Behavioural Change

See www.fightfoodwastecrc.com.au/about-us/ for further information.

7.4.4 CRC ‘Projects’ proposal

The CRC Projects Program provides matched funding grants of between \$100,000 and \$3 million for up to 3 years for industry-led research collaboration. Projects must develop a product, service or process that will solve problems for industry and deliver real outcomes, benefit SMEs and include education and training activities.

Projects can include:

- new research
- proof of concept activities
- pre-commercialisation of research outcomes
- industry-focused education and training activities
- conferences, workshops, symposia related to the joint research

*Develop a CRC P proposal
to increase value of
kangaroo products in
collaboration with pastoral
companies and kangaroo
processors.*



- information sharing and communications related to the research.

CRC-P Round 15 opens in July 2023 for a month, outcomes announced: December 2023 and funding commencing: January 2024.

7.5 Natural Resource Management Groups

The goals, connections and funding provided by the 57 Natural Resource Management groups in Australia is essential to delivering improved kangaroo management while reducing the impact of boom-and-bust cycles. The members of district groups are local people who ensure that there is community input into the development and delivery while helping people in the community to care for the environment and use the landscape sustainably by building awareness, skills and networks.

The formation of the NRM Regions Australia Kangaroo Management Community of Practice in 2022 was an important step forward.



8. CONCLUSIONS

8.1.1 Questions and suggestions for further work

This report identifies several opportunities to make kangaroos more valuable. We envisage that doing so will have **many benefits**. It will lead to better population management with positive environmental and animal welfare outcomes, reduced waste and improved employment, plus financial and mental health for many individuals and communities.

In theory, adding value is easily achievable, but in practice there are many hurdles. A large problem lies in **who will implement** these opportunities. Why are currently available options not implemented and how do we implement others which require substantial effort to be developed?

Opportunities for processors include better quality prescriptions, wider range of innovative and premium products and marketing and promotion. However, we do not underestimate the difficulties in passing the increase in value up the supply chain.

Processors are currently paying the same price for both standard and premium carcasses. Harvesters are price takers. Any increase in price paid to the harvester would impact processor profits. In other livestock industries, a representative organisation or association would help to deliver this initiative.

Preparing the report has also led to us to consider **deficiencies and constraints** to adding greater value of kangaroos to the landholder / producer, with only innovative ideas available.

Incentives that would encourage landholders to become more involved are currently limited; change is key. Under current price structures third party kangaroo harvesting is not an enterprise earning income for landholders. Unless the landholder is also the harvester, there are no margins for them.

The kangaroo resource is owned and managed by third parties - government agencies. The question is, can the licensing and quota setting procedures be varied to create a **sense of proprietorship** so that kangaroo numbers can be incorporated into consideration of total grazing pressure alongside conventional livestock which are owned by the landowner.

A related question is, does ownership constrain the rights and ability of landholders to benefit from stewardship and biodiversity initiatives from the land which kangaroos are produced? Or from low water and low emission kangaroo products? And what are the attributes of an **Emissions Reduction Fund** kangaroo methodology?

More information and transparency about **costs and benefits** of kangaroo production is needed for landholders to become involved. For example, to improve efficiency and opportunities for improvement, it would be helpful to know the attributes of best practice of passage of kangaroo carcasses along the value chain, price points and assessment of waste and use alternatives. On first analysis it seems that the retail value of premium kangaroo products already **equals price premium beef and lamb** cuts.

The development of the kangaroo industry lags other red meat industries. Only a small proportion of the kangaroo quota is taken commercially. There is much wastage. Adding value is a key activity to increasing demand. An association which includes the producer and harvester could be formed modelled on the Goat Industry Council which plays a key role in the transition of goats from wild animal harvest to managed production. It could ask and answer questions more widely including:



- Can kangaroo skins be of greater use to **indigenous communities**?
- **Can waste be reduced?** Under current market access constraints skins are worthless. If they can't be exported, what other opportunities are there in Australia?
- What are the opportunities for greater **rendering** and conversion of waste to fertiliser or protein powder?
- Can the costs of regulation and **compliance** be reduced?
- Can an **animal rights alliance** be developed to identify mutual benefits? Are the opponents of the kangaroo industry aware of the animal welfare consequences of their current efforts to shut it down? Would they, or at least some of their constituency, agree to becoming *kangatarians*.

If nothing changes, kangaroo management will be left to pest culling. Under this management strategy, animal welfare issues increase, waste increases and opportunities for economic growth of a low emission red meat are missed. Animal activists will likely turn their efforts to preventing the cull, and if successful, Australia will be left with no strategies to manage a proliferated population during good seasons and mass starvations resulting in death during the drought. The best management strategy really needs to prevail.

It is difficult for wildlife managers to fit into such a strategy, which is so heavily reliant on industry and business. They can contribute to stewardship programs conservation assessments and biodiversity monitoring. They can bring overseas wildlife management experience to bear and assist with integration into production processes. The preparation of a **National Kangaroo Strategy** which includes integrating kangaroos into production systems, as outlined by Read et al. (2021), is deemed a priority by conservation biologists, but will only be successful if the kangaroo can become an integrated production system as the result of increased value. The need could be endorsed, but not run by the interstate committee responsible for national coordination of kangaroo management and needs support. The development of the NKS needs to be a multi-stakeholder process with industry, agricultural, animal welfare and Indigenous contributions.

South Australian Arid Lands Board could advocate development of the NKS by firstly taking a proposal forward with the South Australian Government. The Board could also make a case to be put to the peak **national policy** group, the Red Meat Advisory Council to include kangaroo as a red meat like cattle, sheep and goats. This could lead to collaborative opportunities with MLA and its existing constituent industries.

Unsuccessful proposals have been put to the **Future Drought Fund**. Feedback indicated that the application appeared to be driven by the kangaroo industry, when it was in fact driven by wildlife managers seeking to manage kangaroos through harvest. It shows that management through harvesting may not be seen as favourable even among agricultural industries supply the funding. It is a difficult concept to confer.

Further applications are warranted. They could seek support to test and analyse how improved kangaroo management through precision harvesting and value-adding can:

1. improve economic returns and income from kangaroos
2. reduce costs of pest management,
3. enhance environmental attributes such as increased soil carbon, vegetation and biodiversity
4. improve social wellbeing through reduced animal and human welfare accounts and through contributions to food security.



8.1.2 Recommendations

Landholders

Implementing land management programs – biodiversity, carbon, sustainability to generate desirable products for harvesters and negotiate premium prices with harvesters.

Harvesters

Implementing harvest techniques and selecting kangaroos with desirable qualities and negotiating premium price with the processors.

Together with processors, formulate management goals with landholders to ensure consistency of supply.

Consider a national association in conjunction with landholders as kangaroo producers and land managers. This would be the key group driving most tasks to deliver increased value.

Processors

Implement techniques for premium product and negotiate premium prices with retailers.

Expand the range of products available including bone in and half carcase cuts.

Consider field processing techniques.

Industry Associations

Consider generating fact sheets like the deer and goat associations.

Generate standards and guidelines specific to kangaroo for best practice for environment, animal welfare, health and safety that go beyond state regulations.

Work towards research and development goals with research connections identified in this report.



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