

Thought again: fair criticism or a muddle-headed grandstanding?

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A response to 'THINKK again: getting the facts straight on kangaroo harvesting and conservation' by Cooney R, Archer M, Baumber A, Ampt P, Wilson G, Smits J, Webb G. (2011) in *Science Under Siege* (Banks P, Lunney D, Dickman C eds.), pp.? (Royal Zoological Society of NSW, Mosman).

Introduction

The THINKK mission

The mission of THINKK (the kangaroo Think Tank at the University of Technology Sydney) is to foster understanding among Australians about kangaroos in a sustainable landscape, through critically reviewing the scientific evidence underpinning kangaroo management practices and exploring non-lethal management options that are consistent with ecology, animal welfare, human health and ethics. Five Australian states operate kangaroo management programs that collectively commercialise the killing of four species of large kangaroo (QLD, NSW, SA, WA), a wallaby and a pademelon (TAS). In its inaugural year THINKK pursued its mission by releasing two reviews in the form of reports on law and policy governing this commercial killing and an evaluation of claims of the ecological benefit from the mainland commercial killing. In each of these reports questions are raised for further analysis and research and the mission continues with further reviews and the release of reports on their findings. Thus THINKK does not claim that any single report represents the totality of views on the commercial killing of kangaroo fauna or non-lethal options; nor that such views cannot be refined by reasoned debate and the evaluation of the findings of targeted and adventitious research.

The Critics

A group, who appear to identify themselves as the "CSU researchers" (CSU is conservation through sustainable use), have chosen the forum of a publication about 'Science Under Siege' (Cooney *et al.* 2011) to criticise one (Ben-Ami *et al.* 2010) of two reports (Ben-Ami *et al.* 2010; Boom and Ben-Ami 2010) released by THINKK in November 2010. The Royal Zoological Society of NSW held a Forum about 'Science Under Siege: Zoology under threat' in November 2008 and so this critique is a much later contribution to that topic. The Society has been a platform for the promotion of consumptive use of some species in the kangaroo fauna from the publication of 'Kangaroos and Men' (Marlow 1971), 'Kangaroo Harvesting and the Conservation of the Arid Lands, a symposium' (Lunney and Grigg 1988), to 'A Zoological Revolution: Using Native Fauna to Assist in its Own Survival' (Lunney and Dickman 2002).

Cooney *et al.* seek to discredit the report, entitled 'Advocating kangaroo meat: towards ecological benefit or plunder?', by claiming failures in scholarship such as errors of fact, inaccurate representation of published research, and invalid and misleading comparisons. Further they challenge the scientific integrity of the authors by making an unsubstantiated claim that their views are likely captive to a supporter of THINKK, namely Voiceless: the animal protection institute. They pursue their critique with highly emotive language claiming that in our analysis of the environmental credentials of kangaroo meat and the assumptions underlying them we are on the *attack*. This

seems only designed to inflame public attitudes towards THINKK and not inform scientific debate. As we demonstrate in the following, the critique itself makes frequent errors of scholarship, unsubstantiated generalisations about our report and lapses into hyperbole. The authors claim an “arm’s length” relationship with the kangaroo industry, some having taken funding from an intermediary the Rural Industries Research and Development Corporation (RIRDC) which itself receives levies from said industry. As we shall demonstrate, the Kangaroo Industry Association of Australia (KIAA) acknowledges RIRDC as a champion of their enterprise.

Synopsis of the report

The critique distils the finding of our report as follows: that THINKK ‘...evaluates the idea that eating wild harvested kangaroo meat is environmentally beneficial, compared to other meats produced on rangelands... It finds in the negative’ (Cooney *et al.* 2011:1). This misrepresents the report which evaluates whether the commercial killing of kangaroos and the consumption of their products (predominantly meat but some hides) has led to or could realistically lead to substantial replacement of traditional livestock industries (mainly sheep and wool production) and the magnitude of the expected (but as yet unproven) environmental benefits that accrue. We make no claims about meat qualities except the yield and division into prime cuts. We take Grigg’s (1987) clearly stated and well-publicised ‘sheep-replacement therapy’ for the rangelands, which advocates de-stocking in favour of an adequate economic return from the commercial killing of kangaroos, as a launching point. Similar advocacy is made by (Archer and Beale 2005) as ‘Going Native’ and evaluated by Wilson and Edwards (2008) in relation to greenhouse gas emission reduction. We find in opposition to this viewpoint a convoluted series of statements about the CSU researchers’ perspective on sheep replacement. These include no replacement but rather diversification of farm income through a tandem commercial kangaroo industry, or some de-stocking of landscapes for various environmental benefits in which kangaroos remain and are killed for their products, or removal of some proportion of all ruminant livestock in favour of carbon pollution reduction but retention of ‘non-polluting’ kangaroos and killing them for their products. Furthermore they claim that replacement, if it occurs, is in the rangelands, the marginal lands or the sheep rangelands and not across the whole of the Australian flock. However, they then state that in the sheep rangelands sheep are principally used to produce wool (which kangaroos do not produce) so if kangaroo meat displaces sheep meat in the market then destocking of sheep would presumably occur elsewhere (the ‘inside’ country). We sought an endpoint, replacement of sheep in the rangelands, in our evaluation but the CSU researchers have failed to clarify their endpoint. Perhaps they envisage that their ‘environmentally friendly’ product will come to dominate in markets where this is part of consumer evaluation. But does that mean the alternative livestock product will not be produced, or will it continue to be produced and marketed elsewhere in a ‘hungry’ world?

The detail

In the following, the page references are to Cooney *et al.* (2011) unless otherwise stated.

Getting the quotas right

Cooney *et al.* (2011) state that “Annual harvest quotas are set by state conservation agencies and are generally limited to around 15% of the estimated population in the harvested areas (Department of Sustainability, Environment, Water, Population and Communities 2011).” (p 1). This is incorrect and misrepresents the variation in harvest quotas. The current reference

actually states “The scientific community and state wildlife management agencies consider that annual harvest levels in the order of 15 per cent of the populations for grey kangaroos and wallaroos, and 20 per cent for red kangaroos, are sustainable. The sustainable harvest quotas are set at or below these rates,...” (<http://www.environment.gov.au/biodiversity/trade-use/publications/kangaroo/quotas-background.html> [Accessed 31/7/2011]). The quotas published at <http://www.environment.gov.au/biodiversity/trade-use/wild-harvest/kangaroo/stats.html> and the population estimates published at <http://www.environment.gov.au/biodiversity/trade-use/wild-harvest/kangaroo/population/index.html> reveal significant variation from 7% of the population for eastern grey kangaroos in 2001 to 27% of the population for red kangaroos in 2003. Inspection of readily available 2011 Quota reports from SA, QLD and NSW Governments (Department of Environment and Resource Management 2010; Department of Environment and Resources 2010; Department of Environment Climate Change and Water 2011) demonstrate that quotas vary between States for the same species and between zones within a State.

Sustainability – are there risks?

Cooney *et al.* (2011) contend that “Ben-Ami *et al.* (2010) repeatedly imply that the sustainability of commercially harvested kangaroos is in question – that is, that the commercial harvest may pose some sort of threat of extinction to harvested kangaroos...” (p. 2). This is exaggeration and misrepresentation. What we said in relation to the national commercial harvest of kangaroos was “A species-dependent MSY of between 15% and 20% of the estimated population in the previous year is used to calculate the quota for the following year, and is governed by precautionary statistics (risk analysis and harvest statistics) and prevailing ecological relationships. Although conservative and **thus far proven to be sustainable**, it is not fail-proof...” (p. 11). This is consistent with Cooney *et al.*'s (2011) interpretation of their Fig. 1 (wrongly treated as if four species of kangaroo are a single stock – see next heading). What we add is that there is risk and this is entirely consistent with the modelling that underpins the kangaroo management programs as these include an assessment of risk (usually expressed as quasi-extinction) (McCarthy 1996; Hacker *et al.* 2004; Pople 2008). When we discuss ‘extinction’ it is in reference to modelling outcomes discussed on pages 13-15 such as “Overexploitation or **extinctions** may occur when the discount rate (the value of the product-in-hand as opposed to in the paddock) is greater than the harvested population’s intrinsic growth rate (Clark 1976 in McCallum 1995).” We also mention **localised** declines or population collapses again in reference to models or the following on p 15 “Although **localised** examples exist of closures of harvesting zones where the decline of kangaroo populations became a concern, trigger points have not so far been instituted outside of NSW.”

Sustainability from a mixed stock

Cooney *et al.* (2011) present their Fig. 1 to discuss sustainability of a mixed stock of four species of kangaroo. The figure misrepresents the true nature of the stock used by the commercial kangaroo industry. By conflating four species in to one population they mask any variation in a single species. Only one state management program (NSW) allows commercial use of all four species and even there effort for the common wallaroo relative to its distribution in the state is small when compared to the other three species killed. If one judged the sustainability of the stock based on this figure then one or more species could well have become extinct in the management area as it only requires one (perhaps more abundantly) to persist. An aim of the kangaroo management plans of the four states is to maintain each of the species harvested throughout their range. For example, the NSW Plan states “The overarching goal of the New South Wales Commercial Kangaroo Harvest Management Plan 2007 - 2011 is: **To maintain viable populations of kangaroos throughout their ranges in accordance with the principles of ecologically sustainable development.**” (p: 27) (Department of Environment and Conservation

(NSW) 2006). Consistent with this goal we examine risks at the level of a management zone where localised collapse of a population of a single species would compromise this goal. Cooney *et al.* (2011) brand themselves as the Conservation through **Sustainable** Use researchers but hold a very narrow view of a complex and often misrepresented subject, namely sustainability (Morse 2010). Sustainable use of the kind they envisage involves far more than the persistence of the stock (mixed stock in the case of kangaroos). We examine these other elements of the use industry including threats to its market from a poor quality product (contamination) through to deceptive marketing (green-washing?) of its products. THINKK receives advice on sustainability issues from experts in the field and is located within the Institute for Sustainable Futures at the University of Technology Sydney.

Common sense understanding of 'sheep replacement'

Cooney *et al.* (2011) claim "The analysis of Ben-Ami *et al.* (2010) rests on an unsubstantiated basic premise, expressed in its first line, that Australian consumers believe eating kangaroo is encouraging destocking in the rangelands" (p3). We have accepted that 'sheep replacement' meant the replacement of sheep, that kangaroo meat as "an excellent environmental choice compared to other red meat alternatives" (p 3) implies consumer should choose this meat over those alternatives and not eat more meat. The moderator guide used by (Ampt and Owen 2008) included the presentation to the focus group of the following proposition "A stronger kangaroo industry and greater consumer demand for kangaroo could help drive change towards more sustainable farming systems that use kangaroos and manage land for survival of roos and other native species." (p 56). We ask the 'CSU researchers' to clarify what the implications of 'use kangaroos' means, what the less sustainable farming practices are and if it would be unreasonable for a consumer to assume this meant a reduction in use of livestock. On page 4, they summarise the 'sheep-replacement' proposal of (Grigg 1987) as "... investment in marketing kangaroo products would increase their price, allowing graziers to maintain their income [presumably from sale of kangaroo products] while **decreasing** sheep numbers...". We find other authors making similar interpretations about livestock replacement. For example, in ECOS (Oct-Nov 2008, pp. 144-145) in an article entitled "Is kangaroo really a more sustainable choice?" the following appears: "It has even been suggested that Australia could entirely replace its beef industry with kangaroo. Dr Ritchie agrees, saying, 'it is a possibility; kangaroos produce less meat than cows but they breed faster and can reproduce in drought conditions which cattle can't. Also, if we got rid of the livestock, there would be more resources to support a much higher number of kangaroos.'" Well not sheep but clearly the notion of replacement of livestock. (Jackson and Vernes 2010) include a chapter on kangaroos as a commodity in a popular book about the fauna. In their final chapter, they write "The consumption of kangaroo meat can not only provide significant benefit for the individuals who eat it, because the meat is so lean, but also for the Australian environment if a proportion of domestic livestock were to be **replaced** by kangaroos." (p 260). This sentence makes two points: (1) there may be a health benefit, and (2) an environmental benefit will accrue with replacement of some domestic livestock. In the latter they are in agreement with our proposition.

Under the heading "Sheep replacement therapy for rangelands: fundamentally flawed, or fundamentally misrepresented". Cooney *et al.* (2011) present three views of sheep replacement, (1) the one by Grigg (1987) reproduced above, (2) "a decrease in sheep and cattle numbers with a commensurate increase in kangaroos" is a potential [desirable?] outcome of the application of the policies proposed by two of the authors (Ampt and Baumber 2006; Ampt and Baumber 2010), and (3) one of the authors (Wilson and Edwards 2008) suggested replacement of not just sheep but also cattle (30% of the national herd) on the rangelands. Two of these clearly have a goal of sheep replacement so to suggest that we erect a 'straw man' because two authors do not have this as a necessary goal is fatuous. They erect their own straw man (or is it a 'bogey man?')

on the basis that we cannot review what some have said because others haven't. They then go on to exaggerate and misrepresent our discussion of sheep replacement as meaning "wholesale substitution" or "complete substitution". Our focus is likewise the rangelands where "graziers" operate and we model a meat replacement scenario based on a consumption of 250 g of kangaroo meat per Australian per week (i.e. 273,000 tonnes). We equated this to the yield from kangaroos (22 million) and sheep (8 million). The sheep flock is around 70 million so clearly we are not making a 'wholesale' substitution of sheep! In the Wilson and Edwards (2008) scenario 1,200,000 tonnes of meat is replaced. This would require about 40.7 million sheep by our calculations but of course we allow that meat from both cattle and sheep was in their scenario. As we will discuss further the sheep industry is complex with wool producers in the rangelands often running dual-purpose sheep (e.g. Merino with traits from meat breeds like Border Leicester and Suffolk, South African Mutton Merinos, Dohne), taking off wether lambs in some years for slaughter or finishing in the wheat-sheep belt, and meat producers running breeds like Dorper and Damara (Roberts and Croft 2006).

Policy inertia or exaggeration?

Cooney *et al.* (2011) claim a "distortion" in relation to the inertia in policy change to realise the environmental benefit of (some) livestock replacement from a market of products from kangaroos. We granted 20 years for such change to manifest and found in the negative. In reality the policy goes back 44 years to the (Australian Conservation Foundation 1967). It was further canvassed in the West Darling region of NSW by (Chudleigh 1971). He notes "Kangaroo farms were regarded as completely unfeasible by all pastoralists..." (p 18). At that time the only feasible alternative enterprise pastoralists agreed with was beef production. Cooney *et al.* (2010) go on further to compare the inertia in policy change of kangaroo enterprises over domestic livestock to similar inertia in "votes for women, the end of slavery, and currently, reductions in greenhouse gases" (p 5). They may see their policy as being of global significance and have some supporters. Jackson and Vernes (2010) head a section in their chapter on kangaroos as commodities "Save the Planet – Eat Kangaroo" (p 184). Both are a gross exaggeration.

Cooney *et al.* (2011) criticise our contention that kangaroo numbers have failed to bounce up in a period when sheep numbers have decreased in the rangelands. They agree with our contention that the latter has been subject to market forces and cite some of the same sources. Perhaps they are correct that there has been a compensatory increase in other enterprises such as beef and cropping. Clearly as further evidence of the failure of 'CSU researchers' to gain market penetration with their policies, such compensation did not include the commercial kangaroo industry. We make the point in our review that there are risks to graziers entering a kangaroo industry in reliance on a stock of free-ranging wildlife (e.g. you cannot buy in breeders or agist stock). They state here "...that kangaroo numbers would be encouraged by decreasing stock numbers, thereby making more resources available to encourage kangaroo abundance" (p 5). Surely this implies that expansion of the kangaroo industry (a greater offtake) requires more kangaroos (Wilson and Edwards 2008) and this is likely achieved by less livestock (especially sheep in the **sheep** rangelands).

A framework to review the 'greening' of the kangaroo industry

Cooney *et al.* (2011) criticise the framework (a set of four assumptions about generating an environmental benefit from kangaroo meat) by which we have structured our report as spurious and misrepresentative. Even so they partially agree with the first and last of these planks. In part, dissension arises because they claim certain health and economic benefits of eating (and presumably wearing) kangaroo products, as well as an environmental gain. We examine health and economic benefits not in their own right, but as risks or inputs/outputs to achieve an

environmental benefit (if realised). In criticising our review of assumption 1 they make some interesting observations on relative prices of kangaroo and sheep products at the 'farm gate'. Further they agree that demand will lead to higher prices for kangaroo meat but currently supply is relatively too great. With the latter in mind, the relativities of the two meats can be examined from the valuation by consumers. At Coles online store for the postcode for Randwick (NSW), prime cuts (fillets) in July 2011 were \$19.80 for kangaroo and \$44.00 for sheep. Kangaroo steak was \$15.95 and lamb leg steak was \$28.99. A significant price differential pertains as we sought to imply. Perhaps we would have achieved greater clarity and less contention if we had used 'benchmarks' as the label for our 'assumptions'. Even so meeting assumptions or reaching benchmarks require a similar review of the evidence.

Defining the kangaroo meat market - a moving target?

Under our assumption 1, they claim we have overestimated the proportion of kangaroo meat recently going to pet food (we gave a range 60-80%). We acknowledge that an accurate value is difficult to obtain and it is unlikely to be static. A recent published value with some credibility comes from (PacALLIANCE(Australia) Pty Ltd 2002) who state "The pet meat market absorbs over 75% of the volume of kangaroo harvested each year" (p 1). The Department of Foreign Affairs and Trade publish rounded weights of kangaroo meat exported and we do not dispute these values. However, similar values in the domestic market are difficult to access publicly. Cooney *et al.* (2010) do not assist in this matter. To claim values of 60-73% of the total offtake of kangaroo meat as being sold for human consumption, they cite an unpublished conference paper by Payne in 2010. The abstract of this paper is published but makes no mention of any weights of kangaroo meat for any purpose. The values they produce simply do not add-up. We calculated the total potential yield of meat at 12 kg per carcass (this figure is agreed by our protagonists) from the numbers of kangaroo killed over the last decade. For the Queensland kill figures, we discounted the skin only harvest by taking the higher of the two values available to us from harvest reports published online (http://www.derm.qld.gov.au/wildlife-ecosystems/wildlife/wildlife_permits_and_licences/kangaroo_harvesting.html [accessed 25/7/2011]), namely those from 2009 (Red kangaroos 5.7% skin-only, Eastern grey kangaroos 4.3%, Common wallaroo 0.5%). There is a very large shortfall in Payne's meat tonnages (Fig. 1). They are inaccurate and the estimate by Cooney *et al.* (2010) of the proportion of meat used for human consumption is likewise unsubstantiated. Even so we sought further advice from ABARE-BRS (information provided to a related entity) and the trend for increased yield designated for human consumption is correct (Fig. 2). It increased for 39% in 2002-3 to 65% in 2007-8. Based on partial 2009 figures the trend was holding at 71% for human consumption. Interestingly, this small dataset suggests an inverse relationship between the number of kangaroos killed (and likewise for meat yield) and the proportion of meat designated for human consumption (Fig. 3). Presumably the more lucrative human consumption market is serviced when the supply of product contracts. The pet food market was likely well serviced by the destocking that occurred in the face of extended drought from 2002.

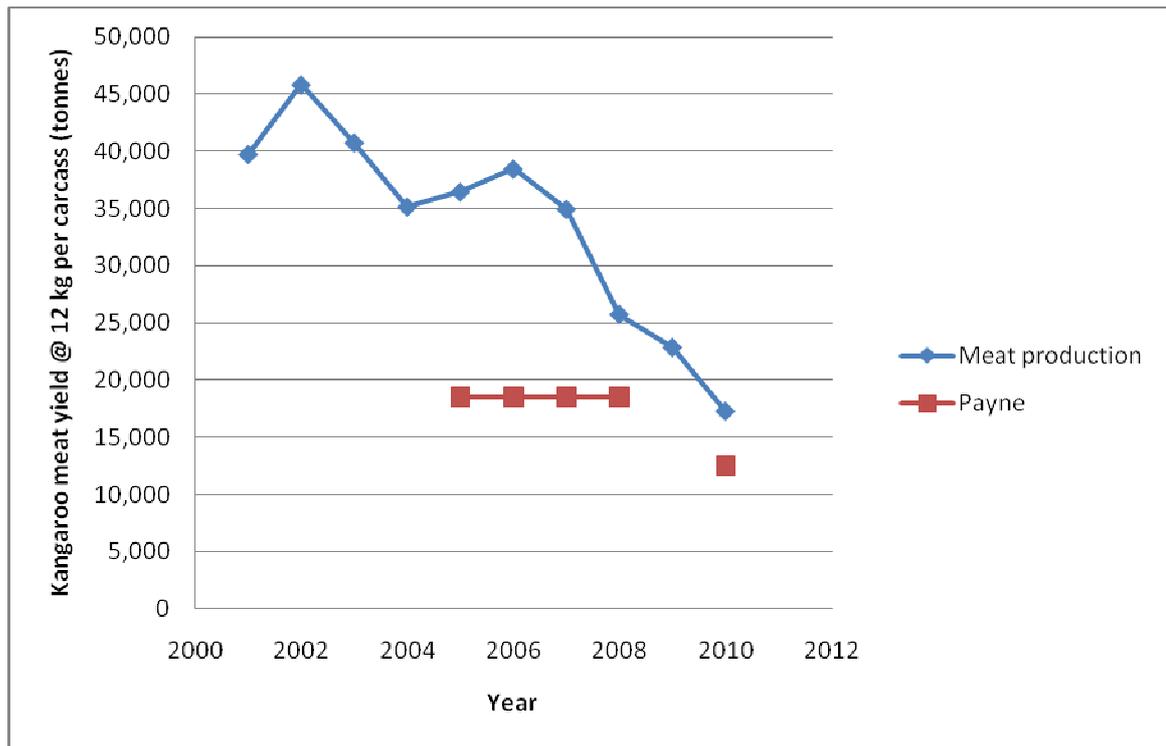


Fig.1. Comparison of expected meat yield from kangaroos killed (discounted by skin-only shooting in Queensland) against unpublished values cited as Payne (2010)

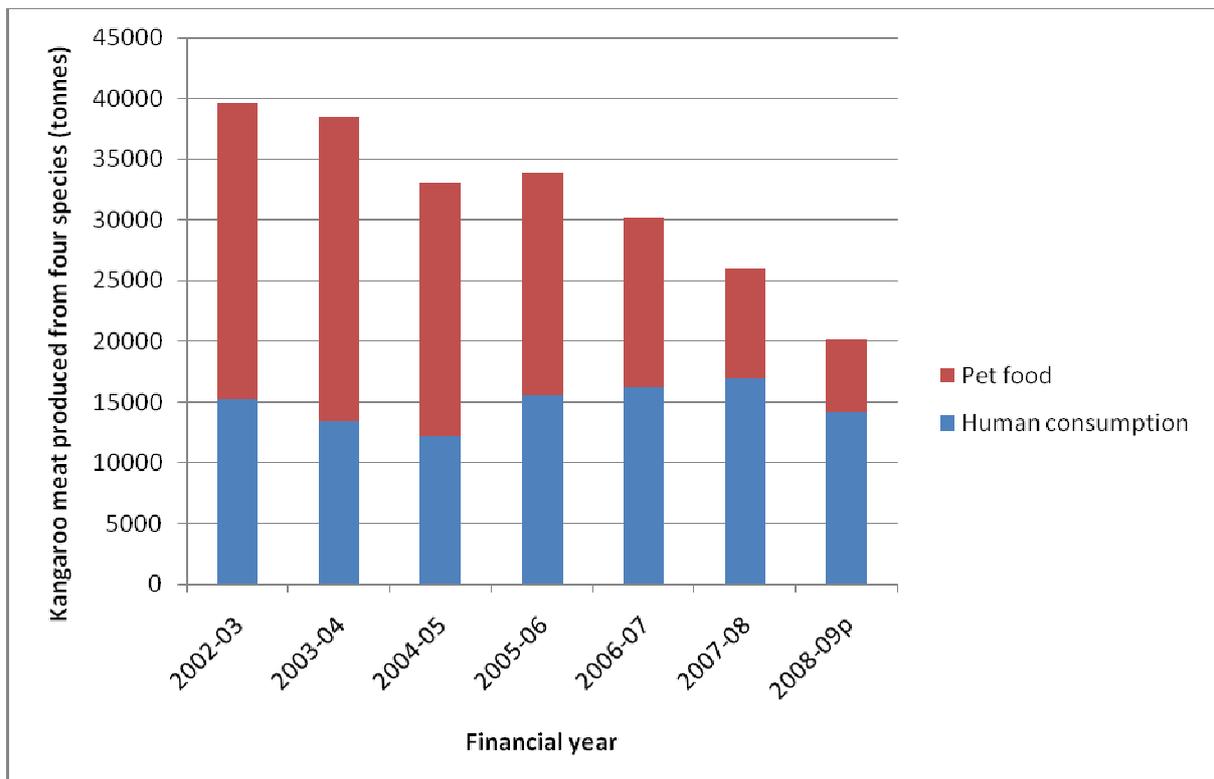


Fig. 2. Yield of kangaroo meat from four species designated for human consumption or pet food. (Source: ABARE-BRS, note partial figures for 2009).

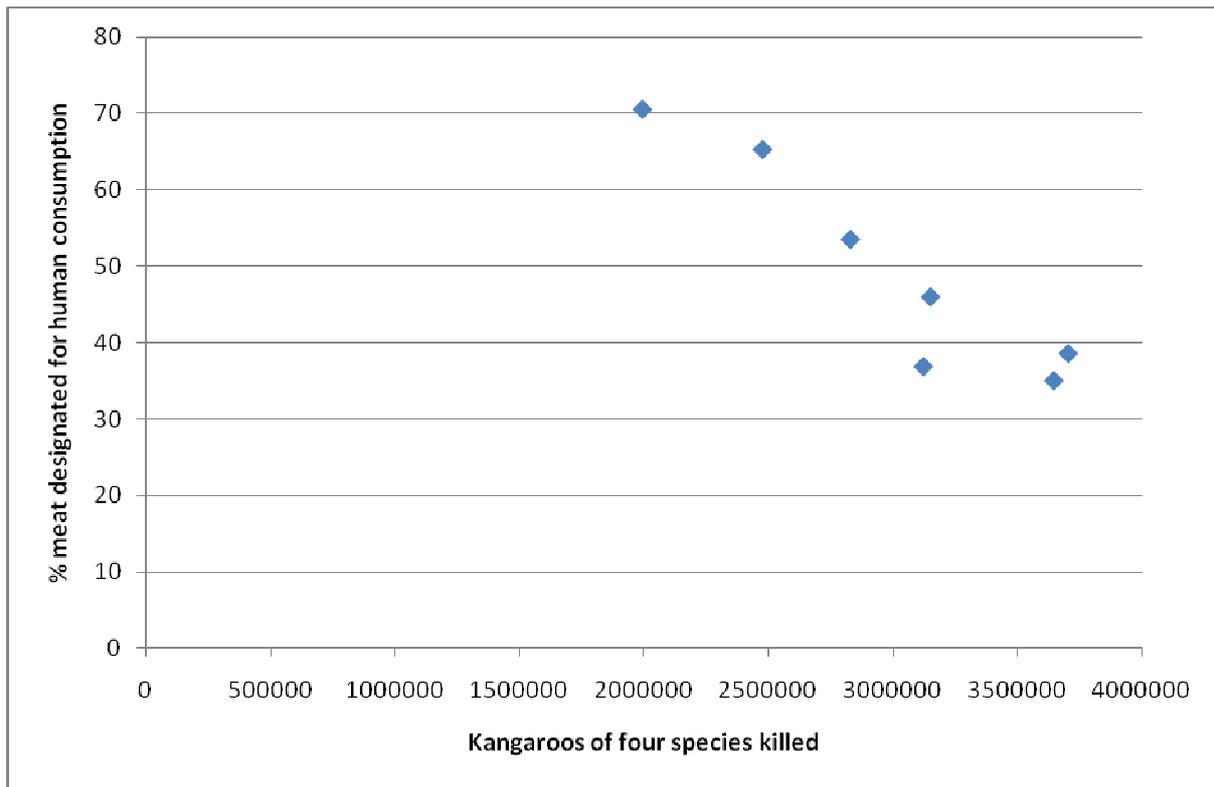


Fig. 3. The relationship between the number of kangaroos of four species killed and the proportion of meat designated for human consumption. (From data supplied by ABARE-BRS).

Recognising meat contamination risk

Cooney *et al.* (2011) question our statements about hygiene of kangaroo meat. We make these statements as a risk in consumer perception of the meat that may hinder the environmental benefits that the 'CSU researcher's and others claim will accrue. We offer suggestions to reduce this risk. Clearly right or wrong, the meat was banned for human consumption in Russia and the market lost. The Australian government responded by funding adjustments in the commercial kangaroo industry. That industry (KIAA) in its 2010 newsletter (Vol. 56) acknowledges this funding as follows "Thanks to a shot in the arm of \$400,000 from Tony Burke via the RIRDC, the Kangaroo Harvester Skill Enhancement training program initiated by KIAA will soon be rolled out nationally in a highly refined program." The training program includes "The course will help update Harvesters on the best methods of field dressing to minimise carcass contamination. It will touch on the importance of hygienic practices to the industry, and importantly, their personal income". Furthermore "Each state meat hygiene authority will make course attendance a requirement for re-accreditation in 2011". If import bans and industry adjustment through training programs in hygiene are evidence of no issues with meat contamination then we stand corrected (please note the irony). Furthermore, (Ampt and Baumber 2010) conclude: "It was clear from discussions with harvesters and chiller operators that variation exists between operators as to what they will accept and how they run their chillers. Also, it is common practice for harvesters to unload carcasses directly into a chiller without the chiller operator being present. This represents a significant risk to the industry as this is a critical point for ensuring compliance" (p 118). They do not clarify 'compliance' but we presume this is both to the Code of Practice for the Human Shooting of Kangaroos and hygiene standards. Regardless they too recognise risks in the current industry and offer solutions. Cooney *et al.* (2011) cite (Eglezos *et al.* 2007) as evidence that the microbiological quality of kangaroo meat in two Queensland processing plants was similar to beef. This is correct but does not negate that contamination of kangaroo meat occurs. In fact (Eglezos *et al.* 2007) write "The association between Salmonella and summer carcass contamination may be related to an animal

carriage effect or to a temperature-sensitive postharvesting practice, e.g., cross-contamination of exposed meat from carcasses hanging on frames in field-harvest vehicles” (p. 1250). This accords with our identification of open field-harvest vehicles as contributing to a contamination risk. Cooney *et al.* (2011) do not cite a further study by (Holds *et al.* 2008) of South Australian kangaroo meat processors. In both the Queensland and South Australian studies muscle excisions for sampling (a requirement for meat export) are made to the carcass exterior and show low contamination. However, contamination often comes from the interior which is exposed to the gut contents and internal decay due to heat. The Holds *et al.* (2008) study, which is more rigorous, takes swab samples (a requirement for the domestic market) from the carcass cavity and find some high contamination by *E. coli* and Salmonella. They open the discussion of their results with “There was great variability in the microbiological condition of kangaroo meats, both between and within plants. The abdominal cavity can be contaminated during evisceration or by contact between carcasses during transport to the field chiller or processing plant. Contamination while the cavity is still warm and moist may result in multiplication of contaminants” (p. 91). Again they identify potential issues with field slaughter and open transport to the chiller.

Qualifying meat quality

Cooney *et al.*'s (2011) final criticism of assumption 1 is a matter of interpretation and emphasis, not misrepresentation as they claim. We say “the kangaroo industry is constrained by the low quality meat that is derived from the older and larger kangaroos” and cite (Ampt and Baumber 2010). They say this is not a constraint but an opportunity to develop a premium line of meat. They indeed discuss a premium meat line but also make the following statements on p. 92 with our emphasis: “Restaurateurs and food service operators that already use kangaroo meat call for more consistent quality and this inhibits them from more active promotion.” “Loin fillet is of consistent quality in terms of tenderness, but other **large cuts are tougher from older (larger) animals**. The industry can easily sell higher quality cuts but sells other cuts at very low prices, impacting on the profitability of the whole industry.” Furthermore they summarise the current industry by including the following (p. 115): “A very small volume of product goes into human consumption either in the domestic market or for export at moderate prices. This product is the large primal cuts such as loins, fillets, rumps, topside and silverside. The bulk of the product, known as manufacturing meat, goes into low priced export human consumption and pet food products.”

Incentives to de-stock and exploit kangaroos

We have used ‘sheep replacement’ as a surrogate for a change in a pastoral enterprise from one reliant on livestock to one reliant on a commercial kill of kangaroos, if the latter were sufficiently profitable. We took our surrogate from Grigg’s (1987) ‘sheep replacement therapy’ for the rangelands. We recognise in our report that livestock will include beef cattle and goats. Cooney *et al.* (2011) variously say livestock like sheep could, would or should be replaced by a more profitable kangaroo industry. Incentives may come from carbon pollution reduction or payments for some conservation benefits that price livestock out of the market but keep kangaroo in. Furthermore they emphasise that high demand will increase the price of kangaroo products relative to the current industry which has an oversupply of product. The endpoint is a higher value for kangaroo products. When we say this is an incentive for sheep (livestock) replacement, they say we erect a ‘straw man’. They then proceed to criticise some of our review. We discuss the outcomes of a model presented in (Ampt and Baumber 2010). They conflate two sentences – one about returns for kangaroo harvesting and one about returns from a conservation stewardship payment and lease rebate – to imply that we understate the total return to the landholder as just the income from kangaroos. Perhaps we could have expressed this more clearly but we can add up. We explicitly state the income from each of the payments. Our point

is that relative to the carbon rebate of \$23 per tonne of CO₂ (Mean \$6182), the stewardship payment of \$20,000 and lease rebate of \$2,548, the kangaroo return of \$1,250-2,707 is low.

Clarifying the reciprocal competition between kangaroos and sheep

The next paragraph opens with a statement that typifies the exaggeration and misrepresentation inherent in Cooney *et al.*'s (2011) critique; namely, "Ben-Ami *et al.* (2010) repeatedly stress that there is no evidence that kangaroos compete with sheep..." (p. 8). The following are all the references to competition (in bold) in the body (Introduction – Discussion) of our report:

- (i) "Historically, graziers have perceived kangaroos as **competitors** to sheep for resources (primarily food)." (p 4)
- (ii) "Concern for losses in revenue due to perceived **competition** between kangaroos and sheep for resources has been used to justify large-scale culling of kangaroos, including the offering of bounties (Lunney 2010)." (p 4),
- (iii) "First, recent long-term studies indicate that there is only minimal **competition** between sheep and kangaroos (Dawson and Ellis 1994; Edwards et al. 1996; McLeod 1996; Pople and McLeod 2000; Grigg 2002; Witte 2002; Jonzen et al. 2005), which for a marginal industry (Australian Natural Resource Atlas 2002) could lead to an additional rather than a replacement income source. If the lack of **competition** is accepted then kangaroos will be exploited as supplemental not replacement income in livestock industries." (p 7),
- (iv) "There are two primary mechanisms by which current populations of kangaroos may be being suppressed, such that removal of sheep would lead to their increase. These are **competition** for resources and landscape exclusion. Much is made of the competition between kangaroos and sheep, although the scientific evidence from long-term studies suggests that the emphasis on **competition** is misplaced. Where chenopod shrubs are retained under conservative stocking regimes, Red Kangaroos and sheep exploit different food niches (Dawson and Ellis 1994; Dawson 1995). There is little evidence of **competition** beyond very low pasture biomass (Shepherd 1987; Edwards et al. 1996; McLeod 1996); while long-term studies indicate that **competition** is intermittent, occurring only during a period of climatically driven food depletion (Dawson and Ellis 1994; Edwards et al. 1996; McLeod 1996). The presence of kangaroos has been reported to have no negative impact on the number of lambs born to the flock, their body size or growth rate (McLeod 1996), and wool production was unaffected by kangaroos (Edwards et al. 1996; Grigg 2002). When **competition** occurred it was reciprocal and sheep lost condition and kangaroos shifted away from sheep but did not lose significant condition. Therefore, destocking is unlikely to result in substantial increases in kangaroo numbers. Exclusion from resources is another **competitive** interaction (Dawson and Ellis 1994) that may be argued as contributing to the suppression of kangaroo numbers. However, as described earlier it seems probable that large-scale destocking will lead to a marginal increase in kangaroo densities in the short term, but in the long term kangaroo numbers are likely to remain unchanged." (p 12),
- (v) "Long-term studies indicate there is minimal **competition** between livestock and kangaroos." (p 16),
- (vi) "Current scientific knowledge can help quantify (and perhaps predict) when **competition** is likely to occur, how to measure the conditions leading to it, to what extent it may impact graziers, and how to mitigate for it." (p17).

We repeatedly recognise competition but emphasize its minimal effect on sheep and wool production (iv), the income sources of pastoralists. We correctly indicate that competition when it occurs is reciprocal. A point the 'CSU researchers' ignore. If there is some benefit to the livestock industry in removing kangaroos then there is also potentially some benefit to the kangaroo industry in removing sheep but it does not seem to manifest in kangaroos in better condition. The next point of contention is whether it manifests in greater kangaroo abundance.

Kangaroos bounce back after de-stocking?

Cooney *et al.* (2011) claim that we “contend that destocking does not lead to increases in kangaroo numbers” (p 8). This is false. What we say in response to the use of a *single* example (Norbury and Norbury 1993) of an increase used in modelling in (Ampt and Baumber 2010) is the following: “A 300% increase in kangaroo populations following destocking is said to be conservative but is based on a short-term study in Western Australia using dung deposition as a proxy for kangaroo abundance (Norbury and Norbury 1993) or a potential to increase if the kangaroo population grew to exploit all the forage unconsumed after destocking. A 300% increase is in fact an exaggeration where long-term data from far western NSW (including Fowlers Gap) is used (Fig 2). These data show an average difference of + 80% for the more abundant Red Kangaroo and -53% for the western grey kangaroo over three years. Thus kangaroo species do not react equally to access to destocked landscapes.” (p 10). Given the Ampt and Baumber (2010) model was constructed from data for Fowlers Gap station we thought it fair to examine evidence for population increases with de-stocking from the same location not WA. We are criticised that the data is not “long-term” and this is ambiguity on our part. Our intention was destocking had been long-term (>10 y) relative to the short-term WA study (<3 y). Even so the results presented in our report’s Fig. 2 were a segment of a long-term monitoring of kangaroo populations in stocked and unstocked paddocks at Fowlers Gap (Edwards 1990; Moss 1995; McLeod 1996; Witte 2002; Bilton 2004). We showed that (a) increases of 300% were transient local-scale movements, (b) a lower increase could be expected in the long-term and (c) at Fowlers Gap species differences were pronounced. The latter again emphasises that treating kangaroos as a single stock is misleading. Cooney *et al.* (2011) then found a further review of population variation in Sturt National Park “confusing”. Our point again was that increases can occur (after the declaration of the park from former pastoral properties) but they are not necessarily sustained and recent evidence suggests that the Park has densities of red kangaroo commensurate with or lower than neighbouring pastoral areas. They contend (Croft *et al.* 2007) is biased towards watering points but if they fairly represented that publication then it examined watering points that were open (with water) and closed (without water), estimates extended out 5 km from such points and estimates were made where red kangaroos aggregate in the landscape. Cooney *et al.* (2011) criticise us for presenting only two studies and offer five others (two from the same location and one a consultant’s report unavailable to us). Ampt and Baumber (2010) use only one example to support their contention that “300% increase after destocking is conservative” and we respond specifically to that. (Wilson and Edwards 2008) required an increase in the production of kangaroo meat to compensate for destocking driven by carbon pollution (namely, methanogenesis in ruminant livestock) reduction. They envisage this production to come from an increase in the quota for all species in the current harvest and an increase in the abundance of these species after competitive release from livestock. They cite (Caughley 1987) in support of the latter. However, Caughley reports on the results of a modelling exercise and notes “These simulations are not total reality” (p. 167). The simulations potentially explain part of a difference between red kangaroo populations in Kinchega National Park (higher) and a neighbouring pastoral property, Tandou Station. However, Tandou also had kangaroo harvesting (shooting) and these two effects are noted but not explicitly separated by Caughley. Furthermore Caughley concludes “Our findings on the ecological effect of kangaroos on sheep and of sheep on kangaroos are suggestive rather than conclusive” (p 185) and goes on to describe an experiment to test them. Edwards and Wilson (2008) at least balance conclusions from Caughley (1987) with “...we note that there can also be positive rather than negative effect of domestic herbivore density on the population-growth rate of kangaroos (Jonzen *et al.* 2005)” (p 4). Thus their conclusion aligns with ours that evidence of a uniform increase in kangaroo populations with de-stocking is equivocal. We see inconsistency and a double-standard applied here in the criticisms of Cooney *et al.* (2011).

No kangaroo culture amongst a heritage from European herders

Cooney *et al.* (2011) claim (p 9) we inaccurately report the (Chapman 2003) findings in the following statement “Current kangaroo shooting is difficult for graziers to do as harvesting at night time is prohibitive, resulting in a strong preference for augmenting income by harvesting feral goats instead, since they are active during the day (Chapman 2003)”. We add “and amenable to the same handling procedures as sheep” (p 9). Chapman (2003) writes: “...unlike feral goats, kangaroos are nocturnal and thereby more difficult to find and to monitor. More importantly, their nocturnal habits mean that they do not fit easily into the primarily daytime activities of the grazier. Few graziers or their families would wish to put in a full day of work on their properties followed by a night of kangaroo harvesting. Kangaroo shooting is hard, strenuous work and many graziers are now of an age where participating in that type of work has little appeal.” (p. 30). Chapman writes elsewhere in some detail how graziers augment their income from feral goats and the difference in ‘farmgate’ prices of kangaroos (\$9-\$10 to the shooter at the chiller) and goats (\$21 - \$20 for 10-14 kg animal – carcass or liveweight is not specified) in 2000. Cooney *et al.* (2011) further claim our p 9 statement is irrelevant anyway because *their* proposals engage an independent shooter/harvester to the landholder/grazier. We question why this is irrelevant to landholder participation in the commercial kangaroo industry. There is no legislative impediment if the individual meets the requirements for a ‘trappers’ licence. Chapman (2003) reports low participation in the kangaroo industry (as shooters) in her survey of landholders but nonetheless 4% participated part-time. There are examples of shooters and chiller operators who are grazier owners (Brindwilpa Station), graziers in a family trust (Sturts Meadows Station) and partners of managers (The Selection and Marrapina Stations) in the far western area of NSW familiar to some of the authors in Cooney *et al.* (2011). Logically the division of labour between the grazier and the shooter sees them operating at different times to avoid disturbance and significant risk from each activity. If grazing livestock ceases to be the activity on part or the whole of a landholding then the grazier may turn shooter in a kangaroo industry. Shooting at night is not a pre-condition as the various species of kangaroos are active around dawn and dusk, well into daylight in cool months and aggregate around water in the evening in warm months ((Dawson 1995) provides a general overview of such behaviour). Even so there may be cultural resistance to turn from grazing livestock to shooting kangaroos (see (Diamond 1997) for a general review of selection of species of pastoralism). This matter is covered in brief in (Croft 2000) and we view it worthy of more investigation – our point about handling methods familiar to pastoralists. It is not irrelevant.

What meat should we eat?

Cooney *et al.* (2011) dismiss our assumption 3 in terms such as “fanciful”. They clarify that their position as ‘CSU researchers’ is that kangaroo meat will not meet Australia’s demand for lamb and mutton. The National Farmers Federation (<http://www.nff.org.au/commodities-sheep-meat.html> [accessed 3/8/2011]) summarise statistics from MLA and ABARE for 2009. Australia exported about 50% of lamb and mutton production. Further Australia exported around 4 million sheep as a breeder to finishers in other countries. Thus clearly an analysis of the number of kangaroos required to be harvested to service the meat consumed from sheep is **not** a claim for complete substitution of sheep with kangaroos as Cooney *et al.* (2011) make earlier (see item 5). Furthermore, from the ‘CSU researchers’ perspective the penetration of kangaroo meat into the red meat market will make little difference to the grazing pressure of Australia’s sheep flock. Even so one author Wilson in Wilson and Edwards (2008) modelled a scenario similar to ours; namely, what population of kangaroos is required to supply an equivalent amount of red meat if the sheep and cattle herds in the rangelands were reduced. Their model “removed 7 million cattle and 36 million sheep, or the equivalent of 120 DSE [*sic*] while allowing the kangaroo population to increase by 141 to 175 million” (p 5). We chose to model what population of kangaroos would be required (with a 15% harvest quota not the 22% Wilson and Edwards allow

the quota to increase to at the end of their modelling period) to service the weekly per capita demand for sheep meat (lamb and mutton) in Australia. We choose 250 g which is disputed by Cooney *et al.* (2011) as not the recommended amount “for a healthy adult (Department of Health and Aging 2010)” but is the rounded weekly per capita intake in 2009 (13.2 kg per year or 254 g per week as summarised by the NFF (<http://www.nff.org.au/commodities-sheep-meat.html>) [accessed 3/8/2011]). We agree that we would be better to express this as per capita intake rather than “a meal” to avoid contention. We used a 12 kg yield of meat from the average kangaroo carcass in this calculation with which Cooney *et al.* (2011) seem to agree. We arrived at a population of 151 million kangaroos (summed over the four species in the current commercial industry on the mainland) and noted this was 5-6 times the long-term population size in the commercial harvest zones (summed over QLD, NSW, SA and WA). We consulted the literature and a former butcher familiar with both kangaroo and sheep meat products and estimated the yield from sheep to supply the same 250 g per capita per week. Apart from the supposed ‘fanciful’ aspect the latter is the main matter of contention and we devote the next item to it.

Cooney *et al.* (2011) make a mischievous claim about understating the yield of quality meat from kangaroos (using (Kelly 2005) for weight of prime cuts) and overstating the yield from lamb/mutton. We briefly touched on this but did not use these values as the basis of our main calculations. We note that equating like to like is complex because some prime cuts (at least from the consumer perspective) have bone in for sheep meat (e.g. cutlets and loin chops) but not for kangaroo (fillets). We found considerable complexity in untangling the kangaroo and sheep meat yields and Cooney *et al.* (2011) have some merit in such discussion. On the kangaroo side, the literature is not always clear about whether a carcass is field dressed (including vital organs if for human consumption adding about 1 kg to one field dressed for pet food) as received at the chiller or dressed as dissected in to cuts at the processor. There is also a dressed and fully dressed carcass in the Queensland management plan where dress” means— (i) to skin the macropod; or (ii) to remove the head, paws, tail or an internal organ of the macropod; but (b) does not include to process the macropod.” Fully dressed means “with all of the following parts removed— (a) the head; (b) the viscera; (c) each of the forelimbs, from the elbow joint; (d) the foot of 1 hind limb, from a point below the tarsal joint; (e) the hind limb, other than the hind limb mentioned in paragraph (d), from a point on the tibia midway between the knee and ankle joints; (f) the tail, not more than 160mm from a point where the underside of the tail joins the body in the external urogenital area.” (Nature Conservation (Macropod Harvest Period 2011) Notice 2011). On the sheep side, the product comes from diverse breeds and cross-breeds, different age classes (lamb, hogget and mutton) and is likely to include more bone (and fat) than kangaroo. *Mea culpa* - we did make one potentially misleading mistake when we state “49 kg average dressed weight for sheep” (p 11) when this should have read live weight. We used the correct dressed value in our calculations and have corrected this in further copies of our report. Returning to the issue of quality meat we again draw attention to Ampt and Baumber (2010) who describe the kangaroo meat industry as follows: “A very small volume of product goes into human consumption either in the domestic market or for export at moderate prices. This product is the large primal cuts such as loins, fillets, rumps, topside and silverside. The bulk of the product, known as manufacturing meat, goes into low priced export human consumption and pet food products” (p 115).

Understanding production efficiencies – our critics considerable confusion

Cooney *et al.* (2011) make the following statements in support of their contention that kangaroo meat remains an environmentally beneficial product relative to sheep meat. “In terms of production efficiency and environmental impact, it should also be borne in mind that kangaroos require much less feed than sheep. Recent work suggests that a kangaroo requires around 0.35

as much food as a Dry Sheep Equivalent (DSE) (Munn *et al.* 2008), meaning one sheep eats the same amount of food as almost three kangaroos” (p10). This is a misrepresentation of Munn *et al.*'s findings and a misunderstanding of an instantaneous measure of *energy* use when a lifetime analysis is required to get to the final product, an equivalent yield of meat.

Firstly, Munn *et al.* (2008) measured energy not food. Food comes with different amounts of energy and different conversion efficiencies and so the red kangaroo and the merino sheep used in their study would have to eat exactly the same diet and extract energy at the same efficiency – neither of which are likely true (see Dawson (1995) for general summary).

Secondly, Munn *et al.* standardised on a 25 kg red kangaroo and a 45 kg merino sheep – both female and non-lactating. Therefore in terms of live weight the kangaroo seems more efficient at 71.4 kg per DSE relative to 45 kg per DSE for the sheep. If the proportional yield of meat is the same then the relative energy use is not 0.35 kangaroo to one sheep but 0.63 kangaroo (i.e. 45 kg of kangaroo) to one sheep (or 0.55 if kangaroo has a 10% better meat yield). However, Munn *et al.* express the relative energy use (Field Metabolic Rate) in kJ day^{-1} . Thus from a meat production perspective, time to reach 25 kg or 45 kg for the kangaroo and sheep, respectively, are also important. In a sheep meat production system, efficiency would typically be measured as the weight gain per day (divided into pre-weaning and weaned) to reach a desired slaughter weight (e.g. rangeland Dorpers (Cloete *et al.* 2000)). Further measures might include fecundity, dry matter energy conversion, water use, carcass yield, and meat quality (e.g. muscle and fat scores).

In a sheep meat production system, castrated male lambs typically go to slaughter in their first year and female lambs are retained. Ewes go to a mutton market around 6 years old. In the kangaroo industry, around 70% of carcasses are male (Ben-Ami *et al.* 2011) so again males dominate the meat market. Thus even though the DSE's are calculated for non-lactating females, male offspring (castrated or entire) are the more appropriate comparisons for meat production. (Dawson and Munn 2007) note that a growing male kangaroo (30 kg) may have a larger energy requirement than an adult female (26 kg) (527 vs $385 \text{ kJ kg}^{-0.75} \text{ day}^{-1}$) but sheep are also sexually dimorphic (mature ram ~ 1.5 weight of ewe). Thus it is reasonable to assume that the DSE differential between male sheep and male red kangaroos is about the same but will be some multiple of Munn *et al.*'s (2008) standard kangaroo/sheep.

Age-weight relationships are frequently calculated for meat sheep as these are used for production comparisons and estimates. We have chosen the Dorper breed as this is a specialised meat sheep used in the rangelands (see brief review in the NSW Western Division Newsletter 107 (<http://www.agric.nsw.gov.au/reader/wdn>)). The breed originates in South Africa and we have reviewed publications from trials in the dry Karoo region (Cloete *et al.* 2000) (see <http://www.bswwhitedorper.com.au/doper-economics.html> [accessed 7/8/2011] for Australian production data with ewes). Age-weight relationships for kangaroos in the rangelands are less readily available. However, (Edwards 1990) used a shot sample of red kangaroos at Fowlers Gap Station to derive a field estimate of age from the ratio of forearm length to foot length (the dataset is reproduced in Dawson (1995) Fig. 4.2). (Bilton 2004) tested this against an independent dataset from Fowlers Gap and found a good fit. The long history of kangaroo research at Fowlers Gap has accumulated a database of red kangaroo captures from 1976-1999 where weight was recorded and age can be estimated from Edwards' relationships. For males, $\text{weight}(\text{kg}) = e^{(4.382 - 2.674/\text{age}(\text{y}))}$ ($R^2 = 0.84$, $n = 503$) (Fig. 4) so that the estimated age of a male red kangaroo is 2.3 years at 25 kg and 5 years at 45 kg. Gestation in sheep is typically 5 months (Dorpers average 147 d). Weaning is a production decision and varies from 2-3 months with a pre-weaning weight gain of $0.24\text{-}0.28 \text{ kg d}^{-1}$ in Dorper lambs (Cloete *et al.* 2000). Post-weaning

weight gain is 0.160- 0.230 kg d⁻¹. Using the more conservative weight gain estimates a castrated male Dorper is 54.6 kg at six months (11 months from conception). The carcass yield of meat averages 50%.

Thus it is clear that a specialised meat sheep for the rangelands like the Dorper will reach about 45 kg in a year whereas a male red kangaroo may take around 5 years to reach the same weight (or about 2 years to reach 25 kg). On the basis of lifetime not instantaneous energy use, red kangaroos are likely to use more total energy than sheep in yielding the same amount of meat. In an environment with low primary productivity like the rangelands, going slow (the kangaroo strategy) may be evolutionarily sound but production on the ephemeral bounty described in (Freudenberger *et al.* 1997) favours a fast grower like sheep. Since both species of grey kangaroo have slower growth to weaning than red kangaroos or common wallaroos (1.5 vs 1 year), the total energy use of grey kangaroos for a given meat yield is likely to be even more. The point we make is that meat sheep have been selected for meat production and kangaroos (of any species) have not. With an appropriate lifetime analysis, sheep produce weight for weight a meat product at similar or more likely lower total energy consumption than kangaroos. The differential is **not** three kangaroos to one sheep. The THINKK team is submitting a paper on relative production efficiencies of rangeland kangaroos and sheep that includes reproductive performance. The realised fecundity of red kangaroos is also much less than sheep breeds like Dorpers.

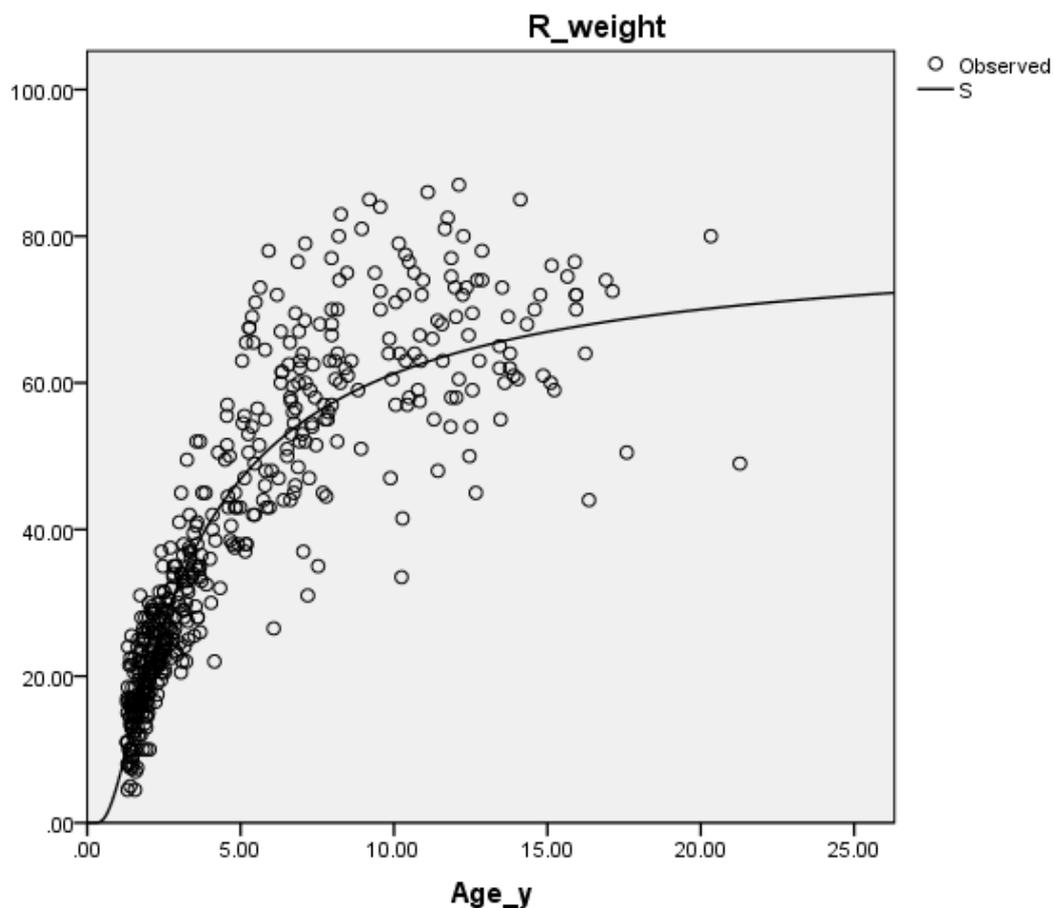


Fig. 2 Relationship between estimated Age (years) and body weight (kg) in a sample of 503 male red kangaroos caught on Fowlers Gap Station between 1976 and 1999.

Regulation and endorsement of management programs

Cooney *et al.* (2011) agree with our assumption 4 about proper regulatory mechanisms to meet an increased demand for kangaroo products but disagree with our emphasis in the review and “negativity”. They claim “the rigour and soundness of the Australian kangaroo management system,...has received repeated endorsement from independent authorities” (p 11). They cite an eclectic mix of literature. Some are reviews of literature under narrow terms of reference for the NSW kangaroo management program (KMP) and not a review of the KMP in this or any other state (Olsen and Braysher 2000; Olsen and Low 2006). Others are position statements by learned and other societies about the principles that underlie management of kangaroos through consumptive commercial exploitation. For example “...THE AUSTRALASIAN WILDLIFE MANAGEMENT SOCIETY: SUPPORTS the commercial use of those species of macropod which are now harvested, subject to adherence to an approved management program and the satisfaction of the other criteria identified in the AWMS position paper on the Commercial Use of Wildlife” (p 2) (<http://www.awms.org.au/pages/positionstatements/kangarooharvesting.html> [accessed 27/7/2011]). This is not an endorsement of the KMP but a requirement that an approved KMP be in place. Since a principle underlying the state KMPs is adaptive management, then Cooney *et al.* (2011) are right on one point – they need **repeated** review and ‘endorsement’.

Eat wildlife and save it

They then claim negativity and bias because we cite no examples of “...sustainable, well-managed use of species to drive wildlife population recoveries and incentives to conserve wildlife species” (p 11). It was not our intention to review consumptive and non-consumptive use of wildlife. (Cooney 2008) has reviewed the former and (King *et al.* 2007) the latter for RIRDC with some perspective on kangaroos. Croft (2000) also provided some perspective on both in the rangelands with kangaroos. They seem to use this criticism to proselytise their ‘CSU researcher’ viewpoint and present some curious examples. We mention two species, koalas and bison, where economic collapse of exploitative industries occurred. The fact that this did not lead to biological extinction and exploitation has commenced again for one species, the bison, is interesting but emphasises that different opportunities for use may emerge (cf. whaling). They then say “Black and southern white rhinoceroses, even under escalating pressure from illegal poaching of rhino horn, continue to increase in southern Africa due in large part to programs of well-managed, sustainable use, with trophy hunting and live sales playing a major positive role...” (p 11). It would surprise and probably appal many contributors to various “Save the Rhino” campaigns and captive breeding programs in zoos that they are supplying trophies. In fact, the trophy hunting system is under review in southern Africa because of evidence that participants contribute to not prevent the poaching (e.g. ‘Moratorium on Rhino Hunting’ at http://www.thenewage.co.za/printstroy.aspx?news_id=24602&mid=53 [accessed 6/8/2011]). Botswana is intending to abandon trophy hunting of all wildlife in favour of camera tourism only <http://www.mmegi.bw/index.php?sid=1&aid=320&dir=2011/July/Friday15> [Accessed 29/08/2011]).

Whose kangaroos are they anyway?

Cooney *et al.* (2011) criticise our ‘awareness’ of the property rights literature. We chose those rights necessary for our arguments (the situations prevailing for kangaroos in Australia) and did not intend a thorough review. Cooney *et al.* (2011) claim that kangaroos in Australia “...belong to the Crown, as established explicitly or implicitly in all state/territory legislation” (p 12). They state that the Crown “...controls all the rights generally viewed as comprising “property rights” (rights to “take”, sell etc.), except (on private land) the right to access.” Cooney *et al.* (2011) further claim that the Crown “exercises those property rights through measures such as licensing, establishing tagging systems and restricting the number of tags issued to control harvest quotas.” However, it is clear that Cooney *et al.* (2001) have failed to examine the whole

body of academic work by THINKK as a report released in conjunction with Ben-Ami *et al.* (2010) provided an analysis of the law and policy governing the killing of kangaroos including this very issue (Boom and Ben-Ami 2010). In fact, there is no absolute property in live wild animals under the common law (*ferae naturae*). If a landholder hunts and kills wildlife on their land, then qualified property rights will arise. Although some statutes and regulatory instruments have asserted ownership by the Crown of wild animals this is contrary to the position at common law. A number of commentators have examined the Crown's assertion of ownership of wildlife (in the Australian context (White 2009); (Cao 2010); (Carey *et al.* 2008); in the US context (Favre 2000); (Favre 2004)) and concluded that there is reason to doubt its validity. The notion that the Crown can claim ownership of wildlife and specifically kangaroos shows confusion between a right of property, which is founded on possession (or control) and a right to direct who may possess wildlife and on what terms, through a licensing or other regulatory system (White (2009); Favre (2004)).

Furthermore, the High Court of Australia has dismissed the Crown's statutory claim to ownership of wildlife in *Yanner v Eaton*ⁱ. *Yanner v Eaton* concerned the *Fauna Conservation Act 1974* (Qld) (now repealedⁱⁱ), which asserted that fauna was the 'property of the State'. Mundaroo Yanner had killed two crocodiles and shared the meat with members of his tribe. Yanner was charged with s 54 of the Fauna Conservation Act 1974 (Qld) for taking a fauna without a licence. Yanner argued that his native title right to engage in non-commercial, personal and communal hunting was protected under s 211 of the Native Title Act 1993 (Cth). The majority of the High Court agreed with Yanner and rejected the Crown's assertion of ownership. The majority stated that:

There are several reasons to conclude that the "property" conferred on the Crown is not accurately described as "full beneficial, or absolute, ownership". First, there is the difficulty in identifying what fauna is owned by the Crown ... Secondly ... what exactly is meant by saying that the Crown has full beneficial, or absolute, ownership of a wild bird or animal? The respondent (and the Commonwealth) sought to equate the Crown's property in fauna with an individual's ownership of a domestic animal ... "Ownership" connotes a legal right to have and to dispose of possession and enjoyment of the subject matter. But the subject matter dealt with by the *Fauna Act* is ... intended by that Act always to remain outside the possession of, and beyond the disposition by, humans. Thirdly ... [t]he property rights of the Crown would come and go ... as open seasons were declared and fauna taken ... [E]ach [of these reasons] tends to suggest that [the Crown's property interest] is an unusual kind of property and is less than full beneficial, or absolute, ownership.ⁱⁱⁱ

The majority further used the example of migratory birds that fly over Queensland, and questioned whether property would exist only so long as the birds were in Queensland's borders, or would the Crown own every bird that had ever flown onto Queensland's territory^{iv}? A similar analogy would apply to kangaroos that cross State and Territory borders. The majority of the High Court concluded that the assertion of ownership by the Crown is 'nothing more than "a fiction expressive in legal shorthand of the importance to its people that a State have power to preserve and regulate the exploitation of an important resource^v.' Thus, it is clear that the assertions by Cooney *et al.* (2011) that kangaroos in Australia 'belong to the Crown', that the Crown 'controls all the rights generally viewed as comprising "property rights"' and 'exercises those rights' through regulatory systems is incorrect and certainly inconsistent with the High Court's ruling in *Yanner v Eaton*. The Crown does not have a right to ownership of kangaroos, although it does have a right to control the possession of kangaroos through regulatory systems.

Activism generates change

Cooney *et al.* (2011) dispute that the Administrative Appeals Tribunal ruled that trigger points be introduced to close the harvesting of a species of kangaroo in a given management zone in NSW when the abundance of that species was below a threshold for the reasons we gave. These included statements to the effect that "...densities of some species were of concern" and

“...prevent over-exploitation of kangaroos”. The Tribunal was presented with expert evidence that the NSW KMP continued to issue quotas in some commercial harvest zones for species that were at densities below the quasi-extinction level (5 kangaroos km⁻² in Hacker *et al.* 2004). Given that Hacker *et al.* (2004) chose this density on the basis of a real risk of localised extinction concern was raised that these quotas were inconsistent with the aim of the KMP to maintain species in their current ranges. Further evidence was presented about quasi-extinction densities as to whether they were arbitrary, aesthetic or biological. However, the Tribunal accepted that a quota should not be issued if a species in a harvest zone was at a density below an agreed trigger point (further review was undertaken on that matter) and went even further to state “we think that it is undesirable to wait until a survey if it is apparent from returns and other information that there is a concerning population decline” (Administrative Appeals Tribunal 2008: 28). Our statements are consistent with the run of evidence that led to the ruling. Further, they emphasise the falsity of treating kangaroos as one stock rather than a mixed stock of four species. The KMP erred in the former direction and there has been an expectation that commercial extinction would precede any biological extinction. However, under the KMP of NSW at the time and the other three states currently, commercial extinction will not take place if one species remains abundant. Through opportunistic exploitation of the remaining ‘at risk’ species, localised extinction of the latter could result. This was what the ruling sought to address. We also make the point that there is inertia in changes to the KMPs and that they have often been reactive to legal and political challenges rather than proactive to achieve better management.

Standards or double standards?

Cooney *et al.* (2011) conclude that credible review of “kangaroo harvesting issues” should follow “high standards of objectivity, independence and rigour”. They claim our scholarship fails to meet such standards in their critique that itself includes false statements of fact, cites unpublished literature (mainly consultants’ reports that are not in the public domain), distorts our analysis, makes exaggerated claims about it and omits our primary recommendations. It follows with innuendo, and not evidence, about lack of objectivity and independence by making spurious claims about bias inherent in our funding bodies.

In the latter regard, it misrepresents the supporters (and funders) of THINKK by reference to page 2 of (Ben-Ami *et al.* 2010). It claims that this states that our “research is funded by Voiceless, a non-governmental “animal protection” advocacy organisation”. In fact it states “We would like to thank Voiceless and ISF for providing the resources for this project”. ISF is the Institute for Sustainable Futures in the University of Technology Sydney. Resources are both ‘in-kind’ and monetary and included the printing costs met by Voiceless. THINKK has many supporters and these are transparently shown on the web site (<http://thinkkangaroos.uts.edu.au/supporters>).

Cooney *et al.* (2010) then use one analysis of the possible effects of funding by external interest groups on University function (Chapman *et al.* 2011) and selected statements from the Voiceless website to claim bias by innuendo not fact. Voiceless has a grants program and sponsors one of the Australian Museum’s annual Eureka awards. Applicants from many Universities in Australia have received grants^{vi} and awards^{vii}. To prove Cooney *et al.*’s (2010) supposition then one would expect a thorough analysis of the outcomes of all of these cases and demonstration of lack of objectivity and independence. This is the standard of scientific analysis they claim we lack. The ‘CSU researchers’ (never actually identified but we presume the authors) demonstrate their own lack of objectivity. They place their own research, largely funded by RIRDC, as the comparator and claim we fail because we review a larger body of research. RIRDC as they state receives

funds through a levy on the kangaroo industry¹. The KIAA believes they get good value as they state in their 2010 newsletter: “This will be the last time most of us see Peter McInnes from RIRDC. Peter is retiring soon. Lindsay Packer presented him with a bottle of Grange Hermitage in appreciation for all he has done for our industry. Peter has been a delight to work with and a stalwart supporter of the kangaroo industry, he will be missed.” Is this evidence of external interest groups intruding on University functions?

Granting bodies of course fund research that meets their criteria. For example, the Australian Research Council, in consultation with the Australian Government, nominates ‘National Research Priorities’ for the Discovery grant program. Are the recipients of grants under these priorities to be accused of political bias by the ‘CSU researchers’?

Our conclusion

Cooney *et al.* (2011) approach their critique with the intention of discrediting THINKK on the basis of one report. They act as if they assume THINKK is an activist organisation and would make certain statements about kangaroo management. When they don’t find them they make out they were said anyway. Then they conclude with the maximum hyperbole about the faults in the report although we have proved above that this is a misrepresentation and exaggeration. They themselves make many errors of the type they claim of us. Mud sticks and they have succeeded there. As to the editors and referees we question whether they ever read our report. It seems they too expected the maximum integrity and accuracy from Cooney *et al.* (2011) and assumed that they have faithfully represented our report. Indeed Science will remain under siege if exaggeration, factual errors and innuendo are accepted as the siege breaker.

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¹ In reference to New Animal Products: The RIRDC contribution is mainly from the Australian Government core funding with support of levies from the kangaroo, buffalo and deer industries. **A statutory levy is in place for kangaroo harvested for human and pet consumption, raising about \$80,000 per annum.** The core funding in the program is currently at 32 per cent, with industry contributing 30 per cent and research agencies 38 per cent. http://www.rirdc.gov.au/RIRDC/programs/new-rural-industries/new-animal-products/new-animal-products_home.cfm

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ⁱ *Yanner v Eaton* (1999) 201 CLR 351

ⁱⁱ The repealed legislation has been superseded by the *Nature Conservation Act 1992* (Qld). Section 83(1) of this Act asserts that 'all protected animals are the property of the State'.

ⁱⁱⁱ *Yanner v Eaton* (1999) 201 CLR 351 at 367-369 (Gleeson CJ, Gaudron, Kirby and Hayne JJ).

^{iv} At 367.

^v At 369.

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