The Koala and its Retroviruses:
Implications for Sustainability and Survival

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Population Management Strategies for Reducing Koala Retrovirus (KoRV) Impacts on Captive Populations

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Abstract. This manuscript summarizes the break-out session held on population management strategies for reducing koala retrovirus (KoRV) impacts on captive populations at the *Koala Conservation Workshop: The koala and its retroviruses: implications for sustainability and survival* held at San Diego Zoo, April 17–18, 2013. The goals of this break-out session were to identify research and population management activities that could facilitate reducing KoRV impacts on captive koala populations. Although both goals were met and suggested activities identified, no long term modifications to current breeding strategies were agreed upon due to current gaps in knowledge about KoRV. Herein, proposed research and population management activities developed at the workshop are described.

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Cooperative breeding programs sponsored by regional zoo associations typically utilize breeding strategies designed to retain gene diversity and limit inbreeding. These goals are accomplished by iteratively breeding individuals with the lowest average kinship (or relationship) within a population; since these animals have the fewest relatives, they are genetically underrepresented and have higher probabilities of possessing genetic variation at risk of being lost. Can current breeding strategies be modified to reduce koala retrovirus (KoRV) expression in captive populations, while still maintaining the genetic and demographic viability of those populations?

KoRV is known to be present in captive koalas throughout the US, Europe, and Australia. Given the regional representatives present at the Koala Conservation Workshop, the break-out session participants focused primarily on the management of populations in the US and Europe. Because additional koalas are expected to be imported into these populations from captive Australian populations in the next five years, ways in which future imports might impact the prevalence of KoRV in the US and Europe were considered alongside breeding strategy modifications.

The discussion on possibilities for reducing KoRV expression in captive populations of koalas was primarily focused around two broad topics. The first topic was the need for additional, collaborative research on KoRV. In particular, it was suggested that increased testing for KoRV is needed and institutions that hold large numbers of captive koalas in the US and Australia should collaborate on both prospective and retrospective research. Studies on the association between disease and KoRV status are greatly needed to better inform modifications to population management. The second topic of focus was the implication of multiple KoRV variants being present in captive koala populations. Both KoRV-A and KoRV-B are present in the captive US population, with KoRV-A being the predominant variant. Because many break-out session participants were particularly concerned about disease associated with KoRV-B, actions or strategies that would limit or eliminate this variant in captive populations in the US and Europe were of particular interest.

Proposed research activities

Short term (2–3 years)

- Testing for KoRV should be continued, particularly throughout captive and wild populations in Australia. Australian samples from an initial study are currently waiting testing in the US, with results expected in April 2013. Additional testing would better quantify the prevalence and distribution of the KoRV-B variant.
- The US has initiated a pilot study to investigate KoRV-related mortality in approximately 23 animals, but a larger test group should be identified. Further characterization of KoRV-related disease and mortality is needed to better quantify the risks to captive animals.
- Wildlife biologists working on koalas should be trained on proper biological sampling techniques, so that wild populations can be tested for KoRV. Increasing veterinarian involvement in field research would help generate additional KoRV-related data on wild populations.
- Research results should be widely disseminated to facilitate international involvement in both generating KoRV-related data and identifying actions and strategies that globally reduce KoRV expression in captive koalas.

Intermediate term (3–5 years)

- Research projects related to determining if there are management practices that may be contributing to KoRV-related disease in captive koalas should be initiated. For example, some factors that could be investigated include general husbandry, nutrition, harem size, and transfer of animals between institutions. Determining if any management practices contribute to KoRV-related disease could identify alternate methods, which might be unrelated to breeding strategies, for reducing KoRV expression in captive populations.

Long term (10+ years)

- Methods for better integrating ex-situ and in-situ research should be developed to improve global koala conservation and population viability.

Proposed population management activities

Short term (2–3 years)

- KoRV-A and KoRV-B koalas in the US should be managed as separate subpopulations. Temporarily managing the KoRV-B koalas as a separate subpopulation would allow additional data on the prevalence and health impacts of the variant to be collected, while limiting the spread of KoRV-B in the US population.

Intermediate term (3–5 years)

- Cooperative, global management of captive koala populations should be encouraged and facilitated by both regional zoo associations and institutions holding captive koalas. In order for population management strategies to be effective at reducing KoRV expression in captive populations, regions that exchange animals must collaborate to adopt similar management strategies.
- A business plan should be developed that would provide funds to support continued research and KoRV testing. If population management strategies are to be modified based on the KoRV status of individuals, all individuals participating in breeding programs must be tested.

Long term (10+ years)

- Gene diversity of captive koala populations in the US and Europe should be improved. The current levels of inbreeding in these populations suggest that increasing gene diversity is necessary for these populations to remain genetically viable over the long term.
- If KoRV-B continues to be of particular concern, the possibility of establishing a captive population that is KoRV-B negative should be considered. This population could then serve as a reservoir of animals that are free of the KoRV-B variant.

Conclusion

The goals of this break-out session were to identify research and population management activities that could facilitate reducing KoRV expression in captive koala populations. Although both goals were met and the preceding activities identified, no long term modifications to current breeding strategies were agreed upon due to the current gaps in knowledge about KoRV. Because many break-out session participants were particularly concerned about disease associated with KoRV-B, a proposed short term activity was to manage KoRV-A and KoRV-B koalas in the US as separate subpopulations. Managing the KoRV-B koalas as a separate subpopulation would limit the spread of the variant in the US population while additional data on the prevalence and health impacts of the variant are collected. However, a number of break-out session participants cautioned that managing two separate subpopulations of koalas in the US is not a sustainable option; there is not enough space for koalas in US zoos to manage two subpopulations that are of suitable sizes to be both genetically and demographically viable over the long term. In fact, the inability to maintain two subpopulations was previously demonstrated when a portion of the US population was separately managed due to concerns related to hip dysplasia. Although long term options for reducing KoRV expression in captive koala populations are yet to be identified, the proposed research is expected to significantly inform possible population management modifications.

Acknowledgments. Many participants in the Koala Conservation Workshop contributed to the discussion on activities to reduce the impacts of KoRV on captive populations. Thank you to everyone who participated and shared their ideas.