REINTRODUCTION BIOLOGY OF YELLOW-FOOTED ROCK-WALLABIES

(*PETROGALE XANTHOPUS CELERIS* AND *P. X. XANTHOPUS*)

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ABSTRACT

Based on the recommendations of both the 1993 Reintroduction Biology of Australasian Fauna Conference and the 1994 Rock-wallaby Symposium, captive-bred Yellow-footed Rock-wallabies (*Petrogale xanthopus*) were re-introduced into areas of their former ranges in both South Australia and Queensland. The aim of the initial South Australian re-introduction was to trial re-introduction methods for the genus *Petrogale*; the aim of the latter Queensland re-introductions was to gain insight, through extensive pre- and post-release monitoring, into how captive-bred animals adjust ecologically and physiologically to their unpredicatable semi-arid environment. The establishment of a database on various biological parameters of captive animals allowed the monitoring of individual animal adjustment to the wild upon release. Findings from the current study are compared to wild *P. xanthopus* and other mammals, and the appropriateness of the conservation technique for *P. xanthopus* is discussed.

Twelve *Petrogale x. xanthopus* bred by the Royal Zoological Society of South Australia (Adelaide Zoological Gardens and Monarto Zoological Park) were re-introduced to the arid-zone Aroona Sanctuary (30°36'S, 138°21'E), Leigh Creek, in the northern Flinders Ranges of South Australia on September 26, 1996. The Royal Zoological Society of South Australia, NRG Flinders and the South Australian Department of Environment and Heritage undertook the re-introduction. The author conducted post-release monitoring discussed herein unless otherwise stated. Twenty-four *P. x. celeris* bred at the Queensland Environmental Protection Agency (Charleville) were re-introduced to Lambert Pastoral Station in the semi-arid Wallaroo Ranges (25°23'S, 145°51'E) on August 9, 1998. The author conducted all aspects of the re-introduction with assistance from the Queensland Environmental Protection Agency. Three releases, each comprised of eight animals, occurred to three separate mesas on the property. All re-introductions were undertaken in accordance with published and original re-introduction guidelines.

Reintroduced *P. x. xanthopus* were generally older and larger than reintroduced *P. x. celeris*. Age, mass or condition at the time of release did not significantly affect short-term survival post-release. Survival of re-introduced *P. x. xanthopus* was slightly lower than that

of *P. x. celeris*, likely due to natural attrition of the older *P. x. xanthopus*. Survival of re-introduced *P. x. celeris* did not differ significantly from captive *P. x. celeris*. Pouch young survival was high in both sub-species, but survival of juveniles to adulthood was low (20% for *P. x. xanthopus* and 30% for *P. x. celeris*). Wild-born sub-adult and adult survival (73%) was higher than that reported for natural *P. x. xanthopus* colonies (58%). No major cause of death was detected for re-introduced *P. x. xanthopus*, although physiological parameters implicate dietary inadequacies. The major cause of death for re-introduced *P. x. celeris* was predation by the introduced European fox (*Vulpes vulpes*).

Twenty-six pouch young or independent wild-born *P. x. xanthopus* have been recorded since release in a sex ratio close to unity (12 :14). Fecundity was 53% and directly related to vegetation abundance. Re-introduced *P. x. celeris* have bred continuously since release (100% fecundity), with 37 pouch young recorded in a female-biased sex ratio (13 :24). Fecundity of re-introduced *P. x. celeris* was higher and sexual maturity earlier than captive *P. x. celeris*. Significantly more births occurred for both sub-species in autumn and spring than summer and winter, indicating that the species is a semi-seasonal breeder, possibly to avoid times of peak thermoregulatory demands. Findings support the theory that sex of offspring was determined by population density and local resource competition.

Growth of re-introduced *P. xanthopus* was similar between sub-species, and to that previously reported for captive *P. x. xanthopus*. Greater sexual dimorphism was detected in *P. x. celeris*, as previously reported. Haematological and plasma biochemical parameters of both sub-species underwent significant changes post-release, initially due to the adoption of a natural diet. Blood parameters were also related to thermoregulation, osmoregulation and heat stress and reflected the seasonality of the respective habitats. Plasma vitamin E concentration increased significantly post-release in both sub-species, and is likely related to both the change in diet and a reduction in captivity associated stress, as indicated by other blood parameters such as creatinine concentration.

Home range (95% minimum convex polygon) of re-introduced *P. x. celeris* peaked at 12 months and 15.9±7.1 ha, while core area (50% polygon) continued to increase throughout the two-year post-release sample period (6.0±3.6 ha at 24 months). Core area and home range size of re-introduced *P. x. celeris* did not significantly differ from that of

wild counterparts after 12 months, and was similar to other *Petrogale* species. Male-instigated overlap of female home ranges was the highest type of overlap (rather than vice versa or same sex overlap), with males forming home ranges that overlapped those of females by 65±27%. Male and female *P. x. celeris* were distributed relatively evenly throughout each colony, as indicated by no significant difference in same sex overlaps compared to opposite sex overlaps. Core areas formed by re-introduced *P. x. celeris* two years post-release were 57% free of conspecifics and home ranges 46% free. This finding suggests that *P. x. celeris* are predominantly asocial within the colony. Dispersal of re-introduced *P. x. celeris* was the furthest recorded for any *Petrogale* species, with one male dispersing 7.3 km to join another re-introduced colony. Another male undertook a minimum exploratory movement of 27 km over 12 months, during which he sired progeny at a different re-introduced colony, before returning to the same site. A minimum of three wild *P. x. celeris* males immigrated into a re-introduced colony from a natural colony 17.2 km distant. These findings indicate that the re-introduced *P. x. celeris* are in the process of integrating into a local meta-population.

Total body water, water turnover rate, field metabolic rate and food intake rate were measured in re-introduced *P. x. celeris* during the wet summer and dry winter of 2000. Animals maintained total body water (73.1 ± 5.8%) between seasons despite dehydration during winter. Field metabolic rate (592.8 ± 229.2 kJ $kg^{0.58}$ d^{-1}) and dry matter intake (44.5 ± 0.4 g $kg^{0.75}$ d^{-1}) were similar between seasons and to that previously reported for the species. Water turnover rate was over 350% higher when free water was available in summer due to rain (175.4 mL $kg^{0.71}$ d^{-1}) than during the dry winter (49.0 mL $kg^{0.71}$ d^{-1}); no free water was available without travelling a minimum distance of 500 m to drink from local dams. Mean water influx from drinking was 96.5 ± 6.4 mL $kg^{0.71}$ d^{-1} in summer and 4.7 ± 6.1 mL $kg^{0.71}$ d^{-1} in winter, the latter (if real) likely from dew, both in the air and on foliage. However, general condition and fecundity did not change between seasons. There were no significant differences in water or energy requirements of males and lactating females, suggesting that additional water and energy demands of lactation were minimal, or that insufficient females were in peak lactation, which occurs close to permanent pouch evacuation. These findings indicate that re-introduced *P. x. celeris* adjusted their water and energy requirements to seasonal fluctuations post-release without losing body condition.

Biological parameters measured in the current study suggested that captive-bred animals had adjusted to the wild by 12 months post-release, although many changes had occurred by five months or the first recapture session for re-introduced *P. x. celeris*. General condition and other health indices increased in all surviving *P. xanthopus* post-release. Thus it is concluded that re-introduction of *P. xanthopus* is an appropriate and ethical conservation technique when conducted in accordance with procedures detailed in the current study. Wider applications of current findings to include non-macropodoid marsupials can be anticipated, as findings were similar for other re-introduced mammals previously monitored. The re-introductions of *P. x. celeris* to Lambert Station and *P. x. xanthopus* to Aroona Sanctuary are judged to be successful at the date of thesis submission 2.5 and 4.5 years post-release respectively, however longer-term monitoring will be required to follow the ultimate fates of the colonies.

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Brian Slee (project volunteer)

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