



SHORT CONTRIBUTION

Chemical immobilisation of wild banteng (*Bos javanicus*) in northern Australia using detomidine, tiletamine and zolazepam

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IUCN International Union for Conservation of Nature
and Natural Resources
IM Intramuscularly

An unusual combination of wildlife management issues is found in the Northern Territory of Australia, where a potentially endangered,¹ yet feral, non-native ungulate, the banteng (*Bos javanicus*), has proliferated on one small (220,000 ha) peninsula. Approximately 20 individuals were introduced to the Cobourg Peninsula in 1845 during the earliest phase of European settlement² and today the population numbers approximately 8,000 to 10,000 (K Saalfeld, unpublished data). The area where this population resides is both a National Park (Garig Gunak Barlu, Northern Territory) and aboriginal land. Individuals are harvested occasionally by aboriginal land owners and recreational safari hunters.³ Banteng are classed as endangered under IUCN criteria,⁴ with less than 5000 remaining in their native habitat,⁵ so the Australian population possibly represents the largest extant population in the world.

Effective management of this species requires extensive biological data, especially in the face of increasing public and government interest. Field capture and immobilisation of wild endangered animals are often required for conservation purposes,⁶ and a thorough investigation of the most appropriate techniques is warranted. Although there are many different combinations of drugs used to immobilise large terrestrial animals,⁷⁻¹¹ often, drug availability, expertise and species-specific recommendations are lacking. Thus, in this paper we report on a successful chemical immobilisation procedure used during preliminary field capture of wild banteng in an attempt to provide useful baseline information for future work. All handling procedures were approved by the Charles Darwin University Animal Ethics Committee, and authorised under a Parks and Wildlife Service of the Northern Territory Permit to Take Wildlife for Commercial Purposes (No. 18275).

From June to September 2004, four reproductively active male banteng were captured through remote IM injection of a combination of detomidine (Dormosedan[®], Novartis Animal Health Australasia Pty Ltd, North Ryde, NSW) and tiletamine:

zolazepam (Zoletil-100[®], Virbac Australia Pty Ltd, Peakhurst, NSW: 250 mg tiletamine + 250 mg zolazepam). Initially, 10 mg/mL Dormosedan was combined with 300 mg/mL Zoletil in powder form, however, this dose proved to elicit an excessive plane of anaesthesia followed by a lengthy recovery (see below) and so was reduced to 10 mg/mL Dormosedan + 200 mg/mL Zoletil.

Target animals were identified during night-time spotlight surveys of open areas in Garig Gunak Barlu National Park. Individual animals were isolated using a utility vehicle and/or 4-wheel motorbike. A 2.5 m spring-loaded pole-syringe (Westergun[®], Westco Farm Products, Rangiora, New Zealand) was used to inject the drug combination IM into the rump during pursuit. Chase times ranged from 2 to 20 minutes (Table 1), but did not include consistent chasing throughout this period (that is, animals were 'herded' to keep from entering thick forest cover). A weighing of two animals during immobilisation using a tripod-sling system modified from previous work on large phocid seals,¹² and an estimate of mass for the others, enabled a calculation of the mass-specific dose for varying durations and planes of anaesthesia. Mass was estimated for two individuals on the basis of additional morphometric measurements (head length, body length, girth; data not presented) and a comparison of general size of captured individuals by experienced field personnel. While under anaesthesia, the animals were fitted with GPS/radio-collars, tagged for identification (two cattle ear tags), tissue (skin biopsy) and parasites (ticks) were sampled, and relevant body measurements were taken.

Mean mass was approximately 513 kg, and the dose per unit mass ranged from 0.11 mg/kg Dormosedan + 2.18 mg/kg Zoletil to 0.19 mg/kg Dormosedan + 5.58 mg/kg Zoletil (Table 1). Induction (defined as time from injection to recumbency) occurred between 3 and 15 minutes after injection. Period of chemical immobilisation and sedation was restricted to 1.5 to 3.0 hours using a drug combination of 0.19 mg/kg Dormosedan + 5.58 mg/kg Zoletil. The first animal took 8.5 hours to recover fully (stand without assistance) following administration of 10 mL of maximum dose as given above. This occurred even after IM administration of the alpha₂-adrenergic agonist reversal agent atipamezole (Antisedan[®], Novartis Animal Health Australasia Pty Ltd, North Ryde, NSW) at a mean dose of 1.32 mg/mg of Dormosedan injected 0.9 to 1.4 hours after induction of the Dormosedan:Zoletil combination (Table 1). There is no reversal agent available for Zoletil.⁹ Reducing the concentration and amount of total drug administered resulted in a decrease in the period of immobilisation and sedation to 1.5 to 2.0 hours (Antisedan[®] administered at 0.14 to 0.23 mg/kg; Table 1) which was adequate for all physical manipulation and sampling required.

Animals were monitored closely while under anaesthesia. Body temperature was recorded at least every 5 minutes and a hand-held water sprayer was used to keep the animal cool. Immediately after the initial chase, a 20 L bottle of water was poured over the back of the animal to accelerate cooling. Capture was restricted to late evening to minimise the risk of hyperthermia. Breathing rates were monitored closely and oxygen supplied intra-nasally at 1 to 3 L/min. Sternal recumbency was maintained, the head was raised to help prevent regurgitation and the body checked for signs of bloat. All individuals were given 3.45 to 7.64 mg/kg procaine and benzathine penicillin (Duplocillin[®], Intervet Australia Pty Ltd., Bendigo East, Victoria) IM at or near the time the reversal agent was given. Mean revival time (time from injection of reversal

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Table 1. Drug delivery (total drug administered per individual) and anaesthesia details for four adult male banteng captured and immobilised. Zol = Zoletil® (250 mg tiletamine + 250 mg zolazepam), Dorm = Dormosedan® (detomidine), Antis = Antisedan® (atipamezole). Note that weights are estimated for individuals 2 and 4 (see text for description).

Individual	Date	Chase (min)	Zol (g)	Dorm (mg)	Induction	Reversal (h after induction)	Antis (mg)	Mass (kg)	Zol (g/kg)	Dorm (mg/kg)	Antis (mg/kg)	Total Recovery (h)
1	08 Jun 2004	5	3000	100	3	0.9	125	538	5.58	0.19	0.23	8.5
2	09 Jun 2004	10	1200	60	7	1.1	100	550	2.18	0.11	0.18	2.0
3	10 Jun 2004	2	1000	50	5	0.9	65	443	2.26	0.11	0.15	1.7
4	12 Sep 2004	20	1090	70	15	1.4	75	520	2.10	0.13	0.14	1.5
Mean		9.3	1572.5	70	7.5	1.1	91.3	513	3.03	0.14	0.18	3.4

agent until time animals could walk away) was 3.4 hours (including the high-dosage animal), or 1.7 hours (excluding the high-dosage animal). All individuals were observed several weeks after immobilisation while downloading collar data. All animals appeared healthy with no overt signs of myopathy.

In conclusion, the combination of detomidine and tiletamine:zolazepam proved to be an effective method for chemically immobilising wild *B javanicus*, especially given the propensity for ruminants to withstand over-dosages of other alpha₂-adrenergic agonists⁸ and this species' reported sensitivity to ketamine supplementation.¹³ Average plane of anaesthesia was effective for minor surgery, somatic analgesia was apparently adequate to prevent any overt reaction to tagging and tissue sampling, and muscle relaxation was conducive to effective physical manipulation. However, certain aspects of the combination reduced its effectiveness for remote field situations. For example, the total volume required to sedate a full-sized male banteng (> 500 kg) exceeded 5 to 6 mL, and this can be restrictive if the remote delivery device used does not hold this volume (for example, some types of darts). Induction of the chemical agents can be slow (> 10 minutes), and this can result in excessive chase times and a higher probability of complications resulting from capture myopathy when attempting to restrict animals from entering thick forest cover. The regurgitation of rumen contents was minimal during our captures, although it did appear that increasing the tiletamine:zolazepam dose amplified the propensity to regurgitate.⁹ Nonetheless, a strict maintenance of sternal recumbency prevented any complications due to regurgitation. Although detomidine is readily reversible with atipamezole, the irreversible nature of tiletamine:zolazepam⁹ prolongs recovery times and obliges researchers to monitor sedated individuals for several hours until adequate recovery is achieved. This is consistent with the poor recovery from anaesthesia reported for horses injected with a combination of tiletamin:zolazepam, ketamine

and detomidine,¹⁴ and the re-sedation associated with atipamezole reversal of detomidine in reindeer.¹⁵

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