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Raccoons and Relatives (Carnivora, Procyonidae) (25-Mar-2002)

R. H. Evans

Wildlife Pathology Services, Laguna Beach, CA, USA.

Introduction

The Carnivore Family Procyonidae is confined to the New World and includes 6 genera and 18 species (Table 1). The Red Panda (*Ailurus fulgens*), a Procyonid-like native of the high (6,000 - 12,000 feet) deciduous forests of the Himalayas and southern China has historically been jockeyed back and forth between the carnivore Families Ailuridae and Procyonidae (Sub-family Ailurinae). Recent genetic analyses have excluded the Red Panda from Procyonidae, placing it in a sister group in a clade with the Procyonidae, Mustelidae and Mephitidae in the Superfamily Musteloidea [1,2]. The Giant Panda (*Ailuropoda melanoleuco*) of China, once placed in the Procyonidae has now been firmly established in the bear Family Ursidae.

Typically, the Procyonids are small to medium-sized with long to moderately long tails (prehen-sile in *Potos flavus*) with dark rings (excepting *Potos flavus*) and obvious facial markings [3]. They have 5 digits with short to long, compressed, recurved, non-retractable claws (semi-retractable in *Bassariscus astutus*) [4,5]. Procyonid dentition is adapted to an omnivorous diet by transformation of the typical, sheering-type, carni-vore carnassial teeth into high-cusped crushing forms [6].

With the exception of the diurnal Coati (*Nasua*) (Fig. 1), Procyonids are most active during the evening and early night (crepuscular to nocturnal). Procyonids are either plantigrade (walk on the soles of their feet with the heel touching the ground) or semi-plantigrade (partly on the sole and digits like a bear). They are extremely agile, readily climbing tall trees to avoid predators and Procyon with hind legs that will support its body weight can climb down trees headfirst (Fig. 2). Having very dexterous hands, they are well adapted (especially *Procyon*) for grasping and manipulating objects. Procyon are excellent swimmers.

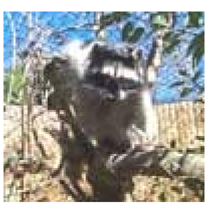

Figure 1. *Procyon lotor*, the Raccoon is extremely agile, readily climbing tall trees to avoid predators and with hind legs that will support its body weight can climb down trees headfirst. - To view this image in full size go to the IVIS website at www.ivis.org . -

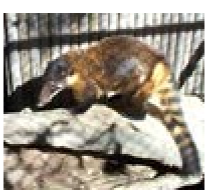

Figure 2. *Nasau nasau*, the South American Coati ranges from extreme southern Arizona, New Mexico and Texas into Mexico (except Baja), Central America, Western Columbia, Ecuador and northern Peru. - To view this image in full size go to the IVIS website at www.ivis.org . -

Procyonidae have adapted to a wide variety of arboreal and terrestrial habitats, including tropical rain forests, deciduous forests, arid or semiarid desert regions and chaparral, usually near water [4,7]. While they are classified as carnivores, none are truly carnivorous but rather omnivorous, with a strong preference for fruit (especially *Potos flavus* and *Olingos*). The *Procyon* are without a doubt the most environmentally adaptable Procyonids. They have survived and proliferated after being introduced into Asian Russia, two Alaskan islands and Germany in ~1900 and 1936 from which they have spread into France and the Netherlands [7,8]. In the last 20 years they have adapted well to life within suburban and urban areas with populations significantly exceeding those found in "wild areas" [9].

The lineage of the Procyonidae is an offshoot of the common ancestor of the Canidae. Procyonidae fossil records dating back to the early Oligocene in North America [6,10] and late Miocene in South America [5]. The genus *Procyon* appeared first in western North America in the early Pliocene, about 3 million year ago and by the early Pleistocene ranged from California to Florida [6,10,11]. At the end of the Pliocene and through the Pleistocene the wide land bridge in Central America promoted interchange of South American and north American Procyonids, i.e., *Procyon* down into Central America and *Nasua* and *Potos flavus* up into Central America.

Table 1. Subfamilies, Genera and Species of Family Procyonidae [4,11]

Genus/Species (Common Name)	Geographical Distribution	Wt-kg
Subfamily Procyoninae		
- *Bassaricyon alleni* * (Allen's Olingo) - *Bassaricyon beddardi* * (Beddard's Olingo) - *Bassaricyon gabbi* (Bushy-tailed Olingo) - *Bassaricyon lasius* * (Harris's Olingo) - *Bassaricyon pauli* *(Chiriqui Olingo)	- Ecuador east of Andes, Peru, Bolivia?, Venezuela. - Guyana & possibly adjacent Venezuela & Brazil. - Nicaragua, Costa Rica, Panama, W Colombia, W Ecuador & Venezuela. - Central Costa Rica. - W Panama (Chiriqui).	0.9 - 1.5 0.9 - 1.5 0.9 - 1.5 0.9 - 1.5 0.9 - 1.5
- *Bassariscus astutus* (North American Ringtail or Cacomistle, Miner's or Civet Cat) - *Bassariscus sumichrasti* (South American Ringtail or Cacomistle)	- SW Oregon, California, SW Wyoming, S Nevada, S Utah, Arizona, New Mexico, Oklahoma, Texas & Mexico (Guerrero, Oaxaca & Veracruz). - S Mexico, Costa Rica, Honduras & Guatemala. Panama (extinct?).	0.8 - 1.4 ~ 1
- *Nasua nasua* (South American Coati) - *Nasua narica* (White-nosed Coati) - *Nasua nelsoni* # (Nelson's or Island Coati)	- South America east of the Andes. - Extreme S Arizona, New Mexico & Texas, Mexico (except Baja), Central America, W Colombia, Ecuador & N Peru. - Cozumel Island, Mexico.	3 - 6 3 - 6 3 - 5
Nasuella olivacea # (Mountain Coati)	Ecuador, N Colombia, W Venezuela and N Peru	1.5 - 2.5
- *Procyon cancrivorus* (Crabeating Raccoon) - *Procyon gloveralleni* ** (Barbados Raccoon) - *Procyon lotor* (Raccoon; ~25 subspecies)	- SE Costa Rica, Panama, NE Argentina & Trinidad - Barbados Island, Lesser Antilles. - S Canada through US (excepting Rocky Mountains & Great Basin) to Panama. Introduced into W Germany (~1900, 1936) & Russia (1934 - 36), now ranging throughout Germany, France, Netherlands and European & Asian Russia (Turkestan, Azerbaijan, Uzbekistan, Kirgiz, Belorussia, Ukraine & Caucasia).	3 - 7 ? 2.5 - 10
- *Procyon insularis* (Tres Marias Raccoon) - *Procyon minor* ** (Guadeloupe Raccoon) - *Procyon maynardi* ** (Bahaman Raccoon) - *Procyon pygmaeus* (Cozumel Raccoon)	- Tres Marias (Maria Madre Island), west coast of Mexico. - Guadeloupe Island, Lesser Antilles. - New Providence Island, Bahama Islands. - Cozumel Island, Mexico.	? ? ? 3 - 4
Subfamily Potosinae		
- *Potos flavus* (Kinkajou or "Honey Bear")	S Mexico, Central America, Colombia, Bolivia, Peru, Surinam, Guyana, Ecuador & Venezuela to Mato Grosso, Brazil.	1.3 - 4.6

* Probably conspecific with *Bassaricyon gabbi* and/or *Bassaricyon alleni*.
# Many authorities considered this species conspecific with *Nasau nasau* and *Nasuella* a *Nasau* sp.
** Recent genetic studies found *Procyon minor* conspecific with *Procyon lotor*, *Procyon gloveralleni* extinct, last seen alive in 1964.

Manual Restraint
One should never underestimate the ability of even the smallest members of the Procyonidae to resist manual restraint and inflict serious bodily injury. As a result, manual restraint can not be adequately and safely employed for procedures such as blood sampling, ear tagging, and physical examination. Rather, it should be reserved only for injection of medications and chemical restraint agents and if you are skilled and experienced enough, quick trap removals or cage relocations. Protective gloves should be worn during attempts at manual restraint. As added protection a butcher's chain-mail glove may be used as an insert in a welder's or monkey handling glove. However, it should always be remembered that gloves decrease tactile

sensitivity and may encourage an excessive pressure to be applied to maintain grip on the animal [12].

NEVER try to restrain any Procyonidae by picking them up by the scruff-of-the-neck. The *Procyon, Bassaricyon* and *Bassariscus* generally have enough "extra" skin to twist almost completely around, while *Nasau* and *Potos flavus* have insufficient skin to allow a good "purchase". *Bassaricyon, Bassariscus* and *Potos flavus* may be captured with gloved hands by quickly and firmly grasping around the dorsolateral cervical area immediately caudal to the skull with one hand (avoid compressing the jugular groove and/or trachea), while restraining the legs and tail with the other hand. An assistant is now able to give an injection in one of the extended rear legs. In the *Nasau* and *Procyon*, such restraint attempts are a daunting and dangerous under-taking because of their "Houdini-like" ability to very aggressively resist restraint. With lightening speed and agility they flex their limbs to the body, hunch up their necks and proceed to roll side-to-side and front to back into a ball, while emitting blood-curdling snorts, growls and screams and biting at anything within reach. At this point the uninitiated handler usually drops his charge and bleeding profusely tries to escape, but frequently finds the animal had made a bee-line toward them in the hopes of gaining "the high ground" by climbing up their legs - old habits of climbing trees in defense die hard.

Considering the above problems with manual restraint of Procyonidae, it is recommended that a net or snare pole (Ketch-all™) be the preferred method of capture. Tapered nets about 30 - 50% longer then the animal and mounted on a flexible loop (at least 24" in diameter) with a strong metal handle are best, since they allow the animal to "burrow" deep into the net, twist around and become firmly lodged. Once netted, make sure the tail is not hanging out under the hoop of the net. Next, with gloved hands, apply firm pressure to the neck and rump so as to pin the animal to the ground. Great care must be used in this step to avoid unnecessary trauma to the animal. Avoid the "death grip" which may lead to strangulation or compromise of thoracic expansion during breathing. A second worker can now manipulate a hind limb through the net to obtain an appropriate sight for injection of a medicine or chemical restrain agent.

The snare pole is an excellent device for manual restraint, while keeping the animal at a safe distance from the handler. The noose on the Ketch-all™ snare pole is able to swivel around the top of the pole and there is a quick release mechanism for the snare. These features are incorporated to prevent the captured animal from twisting in the noose and suffocating itself. The aforementioned contortionist agility of these species seldom allows the snare to be properly seated around the neck; rather at least one front limb almost always ends up out of the snare. However, if the snare is cinched in moderately tight it will work fine. Snaring the animal around the chest or abdomen is an inappropriate use of the snare pole and may cause trauma to these areas and leaves the head free to inflict injury on the handler.

Once secured in the snare, in very quick succession, the swiveling metal knob from which the snare emits is placed firmly on the ground (preferably in a corner), pinning the animal on the ground. Immediately, the hind limbs and tail are secured by holding them along or against the pole while gently stretching the animal out along the pole. This last step requires quick, coordinated action and is the most difficult to master, as your subject is usually violently snapping, growling, spitting and hissing, while rolling and jumping about trying to free itself. You must be cognizant of these contortions and be ready to quickly release the animal if it twists the snare loop to the point of tracheal compression.

Chemical Restrain, Sedation and Anesthesia

For chemical restrain-immobilization of Procyonidae, the cyclohexanone, dissociative agents such as ketamine (with or without xylazine or diazepam) and Telazol® are effective choices. While ketamine has enjoyed much popularity, Telazol® a further refinement of this class with the admixture of the tranquilizer zolazepam offers significant advantages.

Dissociative anesthesia induced by these agents resembles the cataleptoid state, being characterized by loss of sensory perception and consciousness without producing a deep-sleep, open eyes with a nystagmic gaze, intact corneal, pharyngeal, laryngeal, pedal and pinnal reflexes and varying degrees of hypertonus of skeletal muscles with good but short term, analgesia (superficial pain) that is insufficient for visceral surgery. This state appears to be the result of the interruption of the ascending transmission from the unconscious to conscious parts of the brain [12,13] (Fig. 3).

Figure 3. *Bassariscus astutus*, the North America Ringtail or Cacomistle with ascites under Telazol® sedation for radiology. Note excellent muscle relaxation and open eyes. - To view this image in full size go to the IVIS website at www.ivis.org . -

Table 2. Dosages of Intramuscular Dissociative Agents for Procyonidae.						
Drug	**Dose (mg/kg)**	***N*=**	**Induct (Min)**	**Duration (Min)**	**Comments**	**Ref**
Raccoon (*Procyon lotor*)						
Ket	7 - 16	41	3.2 ± 1.8	42.3 ± 14.5	25 F (14 ad & 11 juv) & 16 M (12 ad & 4 juv). 19.5% abnormal reactions: "tucked body position, extended extremities, extreme muscle rigidity, and lips drawn away from clinched teeth…. at dosages varying between 8 to 14 mg/kg…." Tonic/clonic convulsions in 14.6%.	[18]
Ket	5 - 7 8 - 10 11 - 13	5 15 6	0 - 8 2 - 5 1 - 3	0 - 24 20 - 50 39 - 63	*N*=number of trials involving 113 animals. 8 - 10 mg/kg considered optimum dose. Deep anesthesia at 10 - 13 mg/kg.	[19]
Ket	20 - 29	64	5 - 15 (10)	2.5 - 4.5 (3)	*N*=8 Animals anesthetized 8 times each. Full recovery 720 - 1140 min, average 840 min. Adequate anesthesia & muscle relaxation, allowing mouth to be opened & tonsilar fossa swabbed. Constant tongue licking during induction. Excessive salivation.	[20]
Ket	11 - 33	N/A	N/A	N/A	Recommended by manufacturer (Parke-Davis)	[21]
Ket	16.7	NR	5.2	107	Used by biologists in western US.	[21]
Ket Ace	8 - 10 2.2	11	2 - 5	20 - 59	Ace given 5 - 25 min prior to Ket, resulted in increased muscle relaxation & recovery times.	[19]
Ket Xyl	26 5.2	N/A	6.5 ± 5	48 ± 3	Recommended for caged & wild raccoons. Using 5:1 combination of 200 mg Ket to 40 mg Xyl/ml (Capture All-5).	[21]
Ket Xyl	10 2	N/A	3 - 5	60 - 90	Analgesia & anesthesia last 15 - 20 min.	[15]
Ket Xyl	10 2	123	3 - 7	45 - 90	65 F (45 ad & 20 juv) & 58 M (46 ad & 12 juv). Good immobilization & anesthesia, analgesia 15 - 20 min. 3% exhibited unusual neuromuscular rigidity or tonic/clonic convulsions. 3 mortalities.	[16]
Tel	4.3 - 25 (11.8)	10	3 - 11 (4)	17 - 65 (45)	Poor muscle relaxation at lower dosage levels. Surgical anesthesia at 10 mg/kg.	[26]
Tel	6.6 13.2 22	672	2.8 - 14 1.5 - 8 1.5 - 7	38 - 102 46 - 135 43 - 320	321 F (222 ad & 99 juv) & 351 M (288 ad & 162 juv). Low dose; good immobilization, sedation, muscle relaxation & ~10 - 15 min analgesia. Mid dose; good anesthesia, muscle relaxation & ~20 min of analgesia. High dose; good anesthesia, muscle relaxation & analgesia up to 30 - 40 min, excessive salivation, prolonged recovery, ~3% unusual neuromuscular rigidity and/or tonic/clonic convulsions, frequent initial apnea & bradycardia.	[16]
Tel	6.6 - 14.8	?	?	?	Immobilization at lower doses to anesthesia at higher doses.	[22]
Tel	5.9 - 13.7	7	?	?	Authors note this was "desirable" dose.	[25]
Coati (*Nasau sp.*)						
Ket	10 (Ad) 12 (Juv)	63 20	3 - 6.4	21 - 89	35 F (24 ad & 11 juv) & 48 M (39 ad & 9 juv). Good immobilization, fair-good anesthesia & 8 - 10 min of analgesia. 17% exhibited unusual neuromuscular rigidity and/or tonic/clonic convulsions.	[16]
Ket Ace	12 2	20	3 - 5.5	35 - 80		[23]
Tel	6.6 13.2 22	12 8 6	2 - 6	30 - 75	8 F (6 ad & 2 juv) & 18 M (16 ad & 2 juv). Low dose; good immobilization, sedation, muscle relaxation & ~10 - 15 min analgesia. Mid dose; good anesthesia, muscle relaxation & ~20 min of analgesia. High dose; good anesthesia, analgesia ~30 - 40 min, excessive salivation, prolonged recovery in 67%.	[16]
Olingo (*Bassaricyon gabbi*)						
Tel	6.6 13.2	4 1	2 - 5	32 - 85	1 F (1 ad) & 4 M (2 ad & 2 juv). Low dose; good immobilization, sedation, muscle relaxation & ~10 min analgesia. High dose; good-excellent anesthesia, muscle relaxation & ~15 - 20 min analgesia.	[16]

Ring-tailed or Cacomistle (*Bassariscus astutus*)						
Ket	15	*	4	31	*12 animals immobilized 14 times.	[24]
Ket	12	6	3 - 5	35 - 65	2 F (2 ad) & 4 M (4 ad). Good immobilization & sedation with fair-good muscle relaxation. Fair-good anesthesia & 10 - 15 min of analgesia. 20% exhibited unusual neuromuscular rigidity and/or tonic/clonic convulsions.	[16]
Tel	6.6	12	2.5 - 6	35 - 75	4 F (3ad & 1 juv) & 8 M (8 ad). Excellent immobilization, sedation, muscle relaxation & ~10 - 15min of analgesia.	[16]
Kinkajou (*Potos flavus)*						
Tel	6.6	7	2.5 - 5.5	30 - 55	5 F (4 ad & 1 juv) & 2 M (2 ad). Good immobilization, sedation, muscle relaxation & ~10 min of analgesia.	[16]

Ket=Ketamine, Ace=Acetylpromazine, Xyl=Xylazine, Tel=Telazol®

Table 2 is an edited compilation of data on the use of dissociative agents in the Procyonidae from the author's files and published literature. In general, it is noted that as the dose of these agents is increased, taming, then immobilization and finally anesthesia occur. Heart and respiration rates may also increase. Telazol®, partially because of admixed tranquilizer zolazepam, is associated with much less aberrant muscular tonus, convulsive activity, less injection site discomfort and smoother but significantly longer recoveries then ketamine with or without diazepam or xylazine. Additionally, as little as 11 mg/kg of Telazol® have been reported to produce anesthesia in raccoons, while 33 mg/kg ketamine are needed [14].

For the past 6 - 8 years the author has routinely used Telazol IM (see Table 2) and found it to give consistent and reproducible results for varying degrees of chemical immobilization and anesthesia. For general immobilization, sufficient to allow physical examination, blood sampling, ectoparasite collection, cystocentesis, fecal sample collection by rectal palpation and ear tagging, etc., 6.6 mg/kg of Telazol® IM is an appropriate dose. However, it should be remembered that this dose is accompanied by less than 15 minutes of analgesia. A dose of 13.2 mg/kg gives sufficient anesthesia and analgesia for skin or testicular biopsies, small mass removal, digit removal and even uncomplicated castration. Higher doses (22 mg/kg) may give surgical anesthesia lasting as long as 30 - 40 minutes, but are associated with a higher risk of complications such as with shallow, apneustic breathing, hypoxemia, excessive salivation, tremors or convulsions and prolonged, sometimes rough recovery periods requiring close patient monitoring.

Recently, there has been a burgeoning interest in the use of the alpha_2 adrenoceptor agonist medetomidine (Domitor) and it's highly specific antagonist atipamezole (Antisedan) for immobilization, sedation and anesthesia in free-ranging and captive wild mammals. Medetomidine acts by binding to the subclass specific alpha_2 adrenoceptor sites on peripheral or central nervous system (CNS) neurons, interrupting the nerve impulses by blocking the release of the neurotransmitter noradrenaline. This action is specifically reversed by atipamezole. Medetomidine combines sedation with analgesia and has intrinsic muscle relaxation properties (not of general anesthesia quality) as well as anxiolytic effects resulting in decreased anxiety [28]. While the rapid effects produced by medetomidine and its specific antagonist atipamezole give this combination promise for use in field immobilization of wild carnivores (replacing dissociative agents?), a word of caution is in order because of medetomidine's reported ability to result in variable, but significant cardiopulmonary depressive effects, hypertension and initial hyperthermia in some wild and domestic carnivores [28-30].

Heard (Personal communication, 2002) has used medetomidine (30 - 40 µg/kg IM) and ketamine (3 - 4 mg/kg IM) with reversal by atipamezole (150 - 200 µg/kg IM) with "good success for short-term immobilization..." in *Procyon lotor* and *Potos flavus*. In wild *Potos flavus*, medetomidine (0.11+/-0.01 mg/kg) and ketamine (5.5+/-0.6 mg/kg IM) resulted in rapid complete immobilization within 3.0+/-0.9 min with good muscle relaxation and analgesia, allowing minor surgery, while atipamezole (5 mg/mg medetomidine) reversal was rapid (6.9+/-1.2 min) and without adverse effects [31]. In a small number of cases, the author has used medetomidine (50 µg/kg IM) on tamed, captive pet *Procyon lotor*, *Potos flavus* and *Bassariscus astutus* with good success for rapidly induced immobilization (1.5 - 4 min) and sedation [16]. Reversal by atipamezole (250 µg/kg) was very rapid ($\leq$15 minutes) and uneventful. Medetomidine (40 - 50 µg/kg IM) and ketamine (4 - 6mg/kg IM) or Telazol® (1 - 2mg/kg IM) with reversal by atipamezole (200 - 250 µg/kg) has also been successfully used by the author for blood sampling in a small number of wild caught *Procyon lotor* and *Nasau nasau* [16].

Inhalation Anesthesia
Small animal inhalation anesthesia techniques can be readily applied to the Procyonidae, not only in zoological hospitals or clinics but also via portable units in the field. Once immobilized with Ketamine or Telazol , the patient may be intubated and placed on a maintenance dose of Isoflorane by standard methods employed in small animal practice [14].

In the field, for short-term anesthesia of Procyonidae less then 15 - 16 lbs., the author uses a portable, non-rebreathing, inhalation anesthesia field unit. This unit greatly reduces recovery time by not having to chemically immobilize the animal prior to inducing anesthesia. The unit is composed of an induction chamber and portable anesthetic unit. The induction chamber is fabricated from Plexiglas with a hinged door on top, which has a connection for the vaporizer outflow tube (T-piece) installed. The box is of sufficient size to accommodate a medium sized Hav-a-heart live trap with several inches to spare around the trap. The anesthetic unit is made by taking a steel oxygen E tank carrying trolley and welding a plate on its rear on which a precision vaporized (Fluotec) can be mounted. An oxygen E tank with attached pressure-reducing regulator and flowmeter is mounted in the trolley and strapped down tight with C-clamps. An oxygen supply tube is connected between the flowmeter and the fresh gas inflow port of the vaporizer. The unit is completed by attaching an anesthetic gas delivery tube between the anesthetic gas outflow port of the vaporizer and a T-piece. Once the animal is anesthetized and stable it can be quickly removed from the box and trap, place on a portable operating table, intubated and connected to the anesthetic machine via a T-piece.

Patient Monitoring/Supportive Care
Captive animals should be pre-operatively fasted. Since this is not possible in field situations, the subject should be monitored every few minutes for evidence of vomition. In the author experience this is rare and is usually restricted to subjects that are apparently ill or extremely agitated and aggressive prior to sedation. Standard techniques for airway clearance and supplement oxygen may be necessary in such events.

Since eyes remain open during dissociative anesthesia, a bland (boric acid, etc) ophthalmic ointment should be instilled in the conjunctival sacs and gently messaged around to fully lubricate the cornea and conjunctiva and prevent their desiccation.

Whether in the hospital, clinic or field, one operator should be devoted fulltime to a systematic and regular monitoring of the frequency, pattern and depth of respiration (subjective estimate of tidal volume), heart rate and rhythm, rectal temperature and degree of perfusion via capillary refill time, at least every 5 minutes. Unfortunately there is a paucity of published data on the physiologic parameters in the Procyonidae. In the published literature and on *Procyon* and *Nasau*, normal respiratory rates ranged 15 - 30/minute (peaking to 50 when excited or panting), heart rates from 175 - 200 bpm and rectal temperatures from 37 - 40ºC (98.6 - 104ºF) [15-17,27]. The author's data on file is not as broad as this compilation and considers normal rectal temperature between 37.7 - 39.4ºC (100 - 103ºF) as normal as is the case in equal size domestic carnivores. It can probably be assumed with some degree of accuracy that in the smaller Procyonidae (*Bassaricyon* and *Bassariscus*) these normal values are at least similar, if not somewhat higher in the case of heart and respiration rate.

Especially at higher doses of dissociative agents, hypoxemia and hypothermia are the most common problematic side effects in field immobilization-sedation of Procyonidae. Hypothermia may result in apnea and eventual death if steps are not taken to forestall or correct it. In the author's experience, *Bassaricyon* and *Bassariscus* are especially prone to hypothermia, probably as a result of their large surface area to body mass ratio. Thus, when immobilizing these species, the author routinely wraps the animal in a foil "space blanket" to conserve body heat. Additionally, the "space blanket" is used in all species when ambient temperature is below 65ºF or when rectal temperature starts to drop below normal. When prolonged apnea is manifest, supplemental oxygen can be readily supplied via a rubber nasal cannula from the portable field anesthetic unit and assisted ventilation via Ambu bag or intubation may be necessary.

Hyperthermia is not an uncommon complication especially in warmer climates, especially in the summer. In the California desert in later summer, the author frequently encounters significant problems with hyperthermia even at low doses of Telazol . When body temperature rises to 39.4ºC (103ºF), the animal is sprayed with ice cold water until the temperature drops 0.5 - 1.5ºC. Several 2 gallon garden sprayers filled with cold water and a quantity of small bags of frozen "blue ice" are kept in a large insulated cooler for this purpose.

During recovery the animal should be place in sternal recumbency with the head and neck extended to maintain airway patency. Since recovery is frequently accompanied by hyper-responsiveness and ataxia (emergence delirium) [14], every effort should be made to lessen visual and auditory stimuli during anesthesia and recovery. Communicating in low tones and avoiding shouting and rapid, erratic movements should always be stressed during immobilization of any wild animals. To lessen visual stimulation and protect the operator from being bitten during recovery, the author routinely applies a nylon face mask that restrains jaw movement and covers the eyes. Patient monitoring as noted above should continue until it is no longer safe to handle the animal. In the field, animals should not be left unattended until they are fully awake and able to move sufficiently to avoid predators, etc. Leaving the subject once it is "head-up" may result in dire consequences. The author has recorded instances of attacks and predation by conspecifics (especially in troops of *Nasau nasau*), larger carnivores, raptors and insects such as ants.

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