New York State
Department of Environmental Conservation

Division of Fish and Wildlife
Bureau of Wildlife

Updated April 2025

CHEMICAL IMMOBILIZATION
QUICK GUIDE

***Acknowledgement*:**

This Quick Guide is a short version of the NYSDEC Chemical Immobilization SOP and serves as an aid when in the field conducting a chemical immobilization on New York wildlife. For complete reference material, please review the full, desk version in the Technical Documents library.

Purpose

The purpose of the Chemical Immobilization Standard Operating Procedures (CISOP) is to identify the best management practices, training requirements, safety measures, and legal requirements for employees of the New York State Department of Environmental Conservation (DEC), Division of Fish and Wildlife (DFW), Bureau of Wildlife (BOW) who use controlled substances and other drugs in wildlife management activities, including ensuring public safety and/or for wildlife research. The CISOP is applicable for the routine chemical immobilization of protected and unprotected wildlife in New York, which most commonly will include large and medium-sized mammals. BOW staff should not attempt chemical immobilization of non-native or escaped captive animals without prior consultation with the Wildlife Health Program veterinarian and BOW chief.

***Objective*:** To standardize training and methodologies to maximize professionalism of staff, ensure public safety and animal welfare, and improve capacity to respond to animal emergencies and conduct research.

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Administering Immobilizing Drugs, Equipment Maintenance, and Use

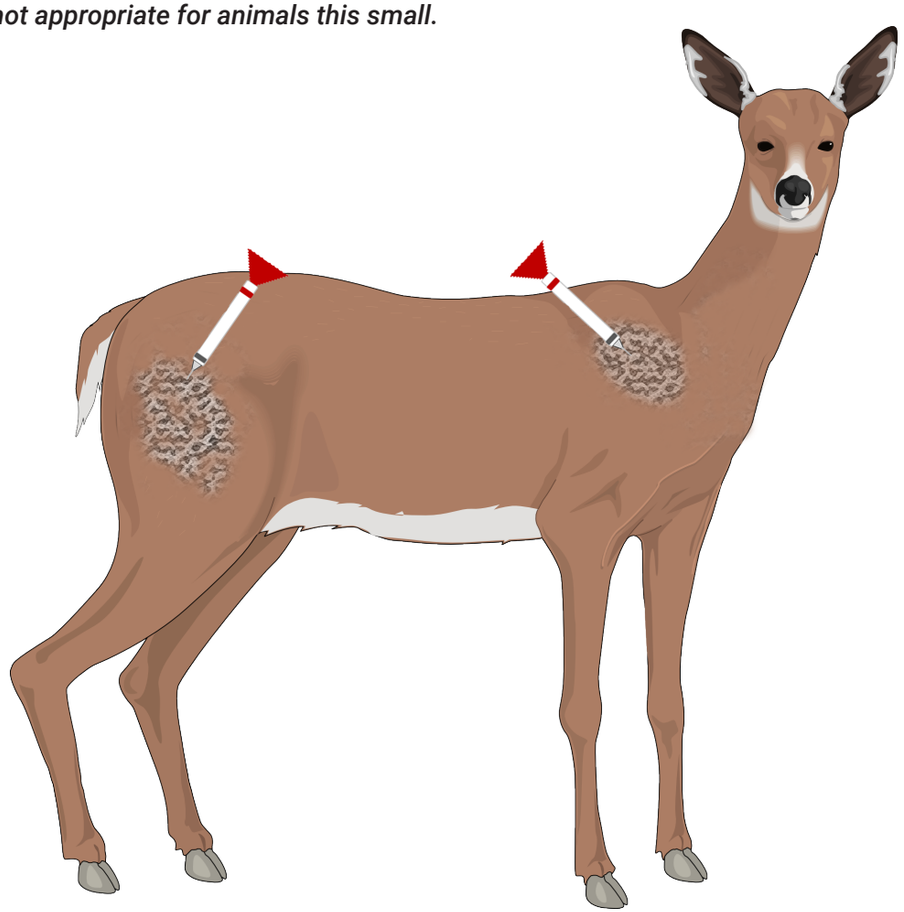
Remote drug delivery systems can malfunction and are often the weakest link in the chemical immobilization process. Hand injection and use of pole syringes, when possible, provide greater assurance of accurate and complete drug delivery with less risk of animal trauma than remote delivery with blow guns or dart projectors. BOW staff should seek to use the delivery system most appropriate for the chemical immobilization situation. If an animal is in an elevated position (e.g. up a tree), and immobilization is necessary, a crash pad/net should always be placed underneath the animal to break a potential fall.

Failure of remote delivery systems or inappropriate animal trauma can result from inaccurate placement of darts, excessive force of propelled darts, inadequate force to trigger drug injection, or dart mechanical failure. Thus, the success of remote delivery systems can be enhanced by a thorough knowledge of the equipment, frequent practice, routine equipment maintenance, cataloging the equipment before each field operation, and post-application evaluation of procedures and outcomes. Staff should develop a technique chart for each dart projector which identifies the appropriate .22 powder load and pneumatic pressure setting for each dart size and distance likely to be needed in the field. Additionally, staff are encouraged to use transmitter darts, particularly in urban environments and whenever the target animal may run out of view after being darted.

Dart Choice and Placement

When delivering drugs remotely, the goal is for intramuscular administration. Needle lengths should be chosen accordingly, with consideration given to seasonal changes in fat thickness. Immobilizing drugs are injected into an animal's larger muscle groups, which are usually located in the hindquarters, dorsal part of the neck, and shoulder areas. Injection into the neck provides more rapid drug induction than injection into the hindquarters, however extreme caution should be used because the target area is smaller and injection into vital structures near that area can be fatal. Darts should strike an animal perpendicular to the target area. The head, front of the neck, thorax, abdomen, and lower portions of legs should be avoided to prevent darts from penetrating organs, sensitive tissues, and bones.

When using a remote drug delivery system with animals weighing <50 lbs., air-powered systems should be used. Remote delivery systems using explosive charges are not appropriate for animals this small.



Evaluating Effects

The first signs of chemical immobilization often are half-closed eyes and drooping ears. Next, the animal may begin to lick its lips and slightly sway its head. As drug effects become stronger, the animal's entire body may begin to sway; bears in a tree may start to lose their grip. Free-ranging animals may run for significant distances before succumbing to the drug. Extremely excited animals may not become immobilized enough for handling. Animals should not be handled before they are completely immobilized except to administer additional drugs as needed. Ketamine/xylazine and Telazol® anesthesia usually last at least 30 minutes, so there is little need to rush in after the drug is administered, unless there is a danger to the animal that needs to be addressed (e.g., water hazards).

Tagging for Drug Withdrawal

The Food and Drug Administration maintains standards for use of pharmaceuticals to prevent drug residues in food for human consumption, although the FDA does not have specific guidance for wildlife species. In general, drugs administered to an animal will be metabolized and excreted at different rates that depend on the species' physiology, age, dosage, means of administration (oral, injectable, topical) and the drug itself. The FDA tests tissues from domestic animals extensively for drug residues in order to calculate withdrawal times (how long after an animal is treated with drugs that it's safe to eat). This information is lacking for wildlife. Consumers of wild game may have an expectation that, unlike domestic animals, wildlife are naturally free of drug residues. Because of the lack of information, it becomes difficult to put a "safe to consume by" tag on any wildlife that is treated with chemical immobilization drugs.

Therefore:

- Any game species that may be consumed by humans that is treated with pharmaceuticals and released must have a tag applied that says "Do not consume" and a WHP contact number to call for further information.
- BOW staff should state that the animal has been treated with drugs, and that BOW can't advise if the animal is clear of drug residues or safe to consume.
- BOW should provide the hunter with a replacement tag if desired.
- The carcass of any animal treated with drugs should be disposed of in an approved municipal landfill, buried >3ft to avoid secondary toxicosis to scavengers, or Regional BOW staff should obtain the carcass for proper disposal or necropsy if needed. If desired, parts (e.g. fur, skull, etc.) may be kept as long as consumption is avoided.

Releasing the Animal

BOW staff will help the animal return to full and normal function as quickly as possible after chemical immobilization. An animal should not be released in an uncontrolled situation under the strong influence of the immobilizing drugs. The effects of some drugs can be reversed with a “reversal” agent which is specific to the anesthetic drug used. There are no reversal agents for ketamine or tiletamine. If ketamine/xylazine is used, the effects of xylazine should only be reversed after a waiting period of at least 40 minutes to ensure that the ketamine has worn off. If Telazol® alone is used and processing is complete, continue to monitor the animal as quietly as possible until the animal appears ambulatory or is otherwise secured in a position and location (e.g., bear in a den) where it can safely recover with low risk to itself or the public.

Before releasing the animal, all equipment and personnel should be moved away from the area as quickly and quietly as possible. BOW staff can then observe the animal from a safe distance to ensure it is recovering safely.

Best Practices for Calculating and Using Immobilization Drugs

The following charts were made for your convenience and are based on the premise that the user has had significant training in the use of chemical immobilization for handling wildlife.

The charts are made based on the drug concentrations shown, but other concentrations may be available. Be in the habit of checking the label and concentration of the drug you are using EVERY TIME that you prepare to immobilize an animal.

Know the formula for calculating dosages and compare calculated dosages against a chart to see if it makes sense.

When reconstituting Telazol, the drug solution must be completely clear in order for the drugs to work properly. At low temperatures the powder may precipitate, making the solution cloudy. This is more likely when making the most concentrated solutions (using the smaller volumes of water or xylazine to reconstitute). Keep the drugs warm and minimize the shooting time.

Ketamine can be used to supplement other drug protocols when there is need to extend the time or depth of sedation. A maximum of 2 doses of ketamine can be given in addition to the initial drug combination.

The effects of xylazine can be reversed, but the reversal agents are only effective for that specific drug, and don’t work on other drug types. If you use the reversal before the other drugs have worn off, negative side effects can result. Always check the recommended minimum waiting times before you reverse an animal.

Many of the smaller carnivore species can be dosed with ketamine at 5 mg/kg combined with xylazine at 1 mg/kg. Consult the ***Handbook of Wildlife Chemical Immobilization***, Safe Capture manual, or other reference materials for the best immobilizing agents and dosages.

Drug Dosage Calculations

Accurate calculations are necessary to administer the proper amount of drug in any situation. You may prepare a chart in advance if you intend to frequently immobilize the same species with the same drugs.

To calculate the proper volume of drug you must have 3 things:

1) Weight of the animal. You will need to estimate. If expressed in pounds, convert to kilograms by dividing the pounds by 2.2.

2) Dosage of drug needed. Usually expressed in milligrams per kilogram (mg/kg). In other words, what quantity (mass) of drug do I need to deliver per kilogram of animal?

Note: *The weight of the animal and the dosage must always be expressed in the same units - both must be either pounds or both must be in kilograms. It is generally easier to convert the weight of the animal from pounds to kilograms.*

3) Concentration of drug in the vial. Almost always expressed in milligrams per milliliter (mg/ml).

Once you have these things available, it is a simple matter of doing the math using the following formula:

$$\frac{\text{Weight (kg) x dosage (mg/kg)}}{\text{Concentration of the drug (mg/ml)}} = \text{Drug volume (ml)}$$

For example, volume of Telazol® for a raccoon given:

1) Weight = 7 kg
2) Dosage of Telazol® for raccoon = 6 mg/kg
3) Telazol® = 100 mg/ml solution

So: $\frac{\text{7 kg x 6 mg/kg}}{\text{100 mg/ml}} = \text{0.42 ml of Telazol®}$

Drug Charts for Common Species

Black Bear – Telazol®

NOTE: Dosages for Telazol® in black bears range from 4 – 7 mg/kg. The low dose option should be used for calm, captive bears, and the high dose for more fractious or free-ranging animals. For smaller volumes, the drug can be reconstituted at higher concentrations (see Telazol® Alternates 1 and 2).

TELAZOL®			
Reconstitute: 5 ml water mixed in vial with 572 mg Telazol® powder = 5.7 ml of solution; Telazol® concentration: 100 mg/ml			
Weight		Telazol® Volume (mL)	
Lbs.	Kg	**LOW** dose (mL) @ **4** mg/kg	**HIGH** dose (mL) @ **7** mg/kg
50	22.7	**0.9**	**1.6**
100	45.5	**1.8**	**3.2**
150	68.2	**2.7**	**4.8**
200	90.9	**3.6**	**6.4**
250	113.6	**4.5**	**7.9**
300	136.4	**5.5**	**9.5**

Black Bear – Telazol® Alternate 1 (> 38°F)

NOTE: At higher temperatures, Telazol® can be made more concentrated for lower dart volumes.

TELAZOL® ALTERNATIVE 1 (> 38°F)			
Reconstitute: 2.3 ml water mixed in vial with 572 mg Telazol® powder = 3.0 ml of solution; Telazol® concentration: 190.7 mg/ml			
Weight		Telazol® Volume (mL)	
Lbs.	Kg	**LOW** dose (mL) @ **4** mg/kg	**HIGH** dose (mL) @ **7** mg/kg
50	22.7	**0.5**	**0.8**
100	45.5	**1.0**	**1.7**
150	68.2	**1.4**	**2.5**
200	90.9	**1.9**	**3.3**
250	113.6	**2.4**	**4.2**
300	136.4	**2.9**	**5.0**
350	159.1	**3.3**	**5.8**
400	181.8	**3.8**	**6.7**
450	204.5	**4.3**	**7.5**
500	227.3	**4.8**	**8.3**
550	250.0	**5.2**	**9.2**

Black Bear – Telazol® Alternate 2 (> 60°F)

TELAZOL® ALTERNATIVE 2 (> 60°F)			
Reconstitute: 1.8 ml water mixed in vial with 572 mg Telazol® powder = 2.5 ml of solution; Telazol® concentration: 229 mg/ml			
Weight		Telazol® Volume (mL)	
Lbs.	Kg	LOW dose (mL) @ 4 mg/kg	HIGH dose (mL) @ 7 mg/kg
50	22.7	**0.4**	**0.7**
100	45.5	**0.8**	**1.4**
150	68.2	**1.2**	**2.1**
200	90.9	**1.6**	**2.8**
250	113.6	**2.0**	**3.5**
300	136.4	**2.4**	**4.2**
350	159.1	**2.8**	**4.9**
400	181.8	**3.2**	**5.6**
450	204.5	**3.6**	**6.3**
500	227.3	**4.0**	**6.9**
550	250.0	**4.4**	**7.6**
600	272.7	**4.8**	**8.3**
650	295.5	**5.2**	**9.0**

Black Bear – Telazol® + Xylazine

NOTE: This protocol yields smaller dart volumes by reconstituting the Telazol® with the xylazine. This protocol yields ~3 mg/kg Telazol® and 2 mg/kg xylazine.

TELAZOL® + XYLAZINE		
Reconstitute: 3.8 ml xylazine (@100 mg/ml) mixed in vial with 572 mg Telazol® powder = 4.5 ml of solution; Telazol® concentration 127 mg/ml, xylazine concentration 84 mg/ml		
Weight		Total Volume (mL)
Lbs.	Kg	Telazol® @127mg/ml Xylazine @ 84 mg/ml
50	22.7	**0.6**
100	45.5	**1.1**
150	68.2	**1.6**
200	90.9	**2.2**
250	113.6	**2.7**
300	136.4	**3.2**
350	159.1	**3.8**
400	181.8	**4.3**
450	204.5	**4.8**
500	227.3	**5.4**

Black Bear – Ketamine + Xylazine

NOTE: This chart includes options using standard or high-concentration formulations of both ketamine and xylazine.

KETAMINE + XYLAZINE					
Weight		Ketamine Volume (mL) @5 mg/kg		Xylazine Volume (mL) @1 mg/kg	
Lbs.	Kg	Ketamine @100 mg/ml	Ketamine @200 mg/ml	Xylazine @100 mg/ml	Xylazine @300 mg/ml
50	22.7	**1.1**	**0.6**	**0.23**	**0.08**
100	45.5	**2.3**	**1.1**	**0.45**	**0.15**
150	68.2	**3.4**	**1.7**	**0.68**	**0.23**
200	90.9	**4.5**	**2.3**	**0.91**	**0.30**
250	113.6	**5.7**	**2.8**	**1.1**	**0.38**
300	136.4	**6.8**	**3.4**	**1.4**	**0.45**
350	159.1	**8.0**	**4.0**	**1.6**	**0.53**
400	181.8	**9.1**	**4.5**	**1.8**	**0.61**
450	204.5	**10.2**	**5.1**	**2.0**	**0.68**
500	227.3	**11.4**	**5.7**	**2.3**	**0.76**
550	250.0	**12.5**	**6.3**	**2.5**	**0.83**
600	272.7	**13.6**	**6.8**	**2.7**	**0.91**

Black Bear Xylazine Reversal with Atipamezole

NOTE: Reverses xylazine only; wait 40 minutes after the last administration of ketamine before using. Doses are for 100 mg/ml xylazine.

XYLAZINE REVERSAL WITH ATIPAMEZOLE	
Atipamezole (Antisedan) Standard Concentration: 5 mg/ml	
Xylazine Given (mL)	Atipamezole (mL)
100 mg/ml	**Dosage 1 mg per 10 mg xylazine administered**
0.23	**0.46**
0.45	**0.90**
0.68	**1.4**
0.91	**1.8**
1.1	**2.2**
1.4	**2.8**
1.6	**3.2**
1.8	**3.6**
2.0	**4.0**
2.3	**4.6**
2.5	**5.0**
2.7	**5.4**

White-tailed Deer – Telazol® + Xylazine

NOTE: Dosages for Telazol® in white-tailed deer range from 3.5 to 5 mg/kg. The low dose option below approximates 3.5 mg/kg Telazol® + 2.5 mg/kg xylazine. The high-dose option below approximates 5 mg/kg Telazol® + 2.5 mg/kg xylazine. In these examples, the Telazol® is reconstituted with water, and volumes of Telazol® and xylazine are calculated separately before being combined into one syringe. As with bears, the low dose option should be used for calm, captive deer, and the high dose for more fractious or free-ranging animals. At higher temperatures, Telazol® can be made more concentrated for lower dart volumes, following the same guidelines described above for bears.

TELAZOL® + XYLAZINE							
Reconstitute: 1.8 ml water mixed in vial with 572 mg Telazol® powder; Telazol® concentration: 229 mg/ml, xylazine concentration: 100 mg/ml							
Weight		**LOW** DOSE Telazol® + Xylazine (calm animals)			**HIGH** DOSE Telazol® + Xylazine (fractious or free-ranging animals)		
Lbs.	Kg	Telazol® (mL)	Xylazine (mL)	Total Volume (mL)	Telazol® (mL)	Xylazine (mL)	Total Volume (mL)
		LOW dose @ **3.5** mg/kg	**LOW** dose @ **2.5** mg/kg	**LOW DOSE**	**HIGH** dose @ **5.0** mg/kg	**HIGH** dose @ **2.5** mg/kg	**HIGH DOSE**
75	34.1	0.5	0.9	**1.4**	0.7	0.9	**1.6**
100	45.5	0.7	1.1	**1.8**	1.0	1.1	**2.1**
125	56.8	0.9	1.4	**2.3**	1.2	1.4	**2.6**
150	68.2	1.0	1.7	**2.7**	1.5	1.7	**3.2**
175	79.5	1.2	2.0	**3.2**	1.7	2.0	**3.7**
200	90.9	1.4	2.3	**3.7**	2.0	2.3	**4.3**

Calculations

$$\frac{\text{Weight (kg) x dosage (mg/kg)}}{\text{Concentration of the drug (mg/ml)}} = \textbf{Drug volume (ml)}$$

White-tailed Deer – Ketamine + Xylazine

NOTE: A combination of ketamine and xylazine can be used to immobilize tame deer. For older animals, 3 mg/kg ketamine plus 2.5 mg/kg xylazine is often sufficient. For younger deer or mildly excited penned deer, 6 mg/kg ketamine plus 2.5 mg/kg xylazine may be used.

Tame deer >1 year old

KETAMINE + XYLAZINE				
Ketamine concentration 100 mg/ml Xylazine concentration 100 mg/ml				
Weight		Ketamine (mL)	Xylazine (mL)	
Lbs.	Kg	@**3** mg/kg	@**2.5** mg/kg	Total Volume (mL)
75	34.1	1.0	0.9	**1.9**
100	45.5	1.4	1.1	**2.5**
125	56.8	1.7	1.4	**3.1**
150	68.2	2.0	1.7	**3.7**
175	79.5	2.4	2.0	**4.4**
200	90.9	2.7	2.3	**5.0**

Tame deer <1 year old or mildly excited penned deer

KETAMINE + XYLAZINE				
Ketamine concentration 100 mg/ml Xylazine concentration 100 mg/ml				
Weight		Ketamine (mL)	Xylazine (mL)	
Lbs.	Kg	@**6** mg/kg	@**2.5** mg/kg	Total Volume (mL)
25*	11.4	0.7	0.3	**1.0**
50*	22.7	1.4	0.6	**2.0**
75	34.1	2.0	0.9	**2.9**
100	45.5	2.7	1.1	**3.8**
125	56.8	3.4	1.4	**4.8**
150	68.2	4.1	1.7	**5.8**
175	79.5	4.8	2.0	**6.8**
200	90.9	5.5	2.3	**7.8**

*Remote delivery systems using explosive charges are not appropriate for animals this small; air-powered systems should be used.

White-tailed Deer – Xylazine Reversal with Tolazoline or Atipamezole

NOTE: Reverses xylazine only. Wait 40 minutes after the last ketamine dose to administer. Yohimbine is not consistently effective in white-tailed deer and moose.

XYLAZINE REVERSAL WITH TOLAZOLINE		
Tolazoline Standard Concentration: 100 mg/ml		
Weight		Tolazoline (mL)
Lbs.	Kg	3 mg/kg administered IV or IM
25	11.4	**0.3**
50	22.7	**0.7**
75	34.1	**1.0**
100	45.5	**1.4**
125	56.8	**1.7**
150	68.2	**2.0**
175	79.5	**2.4**
200	90.9	**2.7**

XYLAZINE REVERSAL WITH ATIPAMEZOLE	
Atipamezole (Antisedan) Standard Concentration: 5 mg/ml	
Xylazine Given (mL)	Atipamezole (mL)
100 mg/ml	**Dosage 1 mg per 10 mg xylazine administered**
0.3	**0.6**
0.6	**1.2**
0.9	**1.8**
1.1	**2.2**
1.4	**2.8**
1.7	**3.4**
2.0	**4.0**
2.3	**4.6**

Moose – Telazol® + Xylazine

NOTE: This protocol yields smaller dart volumes by reconstituting the Telazol® with the xylazine. This protocol yields ~3 mg/kg Telazol and 1.5 mg/kg xylazine.

TELAZOL® + XYLAZINE		
Reconstitute: 2.8 ml xylazine (@100 mg/ml) mixed in vial with 572 mg Telazol® powder = 3.5 ml of solution; Telazol® Concentration: 163 mg/ml, xylazine Concentration: 80 mg/ml		
Weight		Total Volume (mL)
Lbs.	Kg	Telazol® @163 mg/ml Xylazine @ 80 mg/ml
300	136.4	**2.5**
400	181.8	**3.4**
500	227.3	**4.2**
600	272.7	**5.0**
700	318.2	**5.8**
800	363.6	**6.7**
900	409.1	**7.5**
1000	454.5	**8.4**
1100	500.0	**9.3**
1200	545.5	**10.0**

Moose – Xylazine Reversal with Tolazoline

NOTE: Reverses xylazine only. Wait 40 minutes after the last ketamine dose to administer. Yohimbine is not consistently effective in white-tailed deer and moose.

°XYLAZINE REVERSAL WITH TOLAZOLINE		
Tolazoline Standard Concentration: 100 mg/ml		
Weight		Tolazoline (mL)
Lbs.	Kg	3 mg/kg administered IV or IM
300	136.4	**4.1**
400	181.8	**5.5**
500	227.3	**6.8**
600	272.7	**8.2**
700	318.2	**9.5**
800	363.6	**10.9**
900	409.1	**12.2**
1000	454.5	**13.6**
1100	500.0	**15.0**
1200	545.5	**16.4**

Marten – Telazol®

TELAZOL®	
Reconstitute: 5 ml water mixed in vial with 572 mg Telazol® powder; Telazol® Standard Concentration: 100 mg/ml	
Weight	Telazol® (mL)
Lbs. / Kg	**8** mg/kg administered IM
0.9 / 0.4	**0.03**
1.1 / 0.5	**0.04**
1.3 / 0.6	**0.05**
1.5 / 0.7	**0.06**
1.8 / 0.8	**0.06**
2.0 / 0.9	**0.07**
2.2 / 1.0	**0.08**

Marten – Ketamine + Xylazine

KETAMINE + XYLAZINE				
Ketamine concentration 100 mg/ml Xylazine concentration 100 mg/ml				
Weight		Ketamine (mL)	Xylazine (mL)	
Lbs.	Kg	@**18** mg/kg	@**1.6** mg/kg	Total Volume (mL)
0.9	0.4	0.07	0.01	**0.08**
1.1	0.5	0.09	0.01	**0.10**
1.3	0.6	0.11	0.01	**0.12**
1.5	0.7	0.13	0.01	**0.14**
1.8	0.8	0.14	0.01	**0.15**
2.0	0.9	0.16	0.01	**0.17**
2.2	1.0	0.18	0.02	**0.20**

Marten – Xylazine reversal with Tolazoline

XYLAZINE REVERSAL WITH TOLAZOLINE	
Tolazoline Standard Concentration: 100 mg/ml	
Weight	Tolazoline (mL)
Lbs. / Kg	**3** mg/kg administered IV or IM
0.9 / 0.4	**0.01**
1.1 / 0.5	**0.02**
1.3 / 0.6	**0.02**
1.5 / 0.7	**0.02**
1.8 / 0.8	**0.02**
2.0 / 0.9	**0.03**
2.2 / 1.0	**0.03**

Marten – Xylazine reversal with Atipamezole

XYLAZINE REVERSAL WITH ATIPAMEZOLE	
Atipamezole (Antisedan) Standard Concentration: 5 mg/ml	
Xylazine Given (mL)	Atipamezole (mL)
100 mg/ml	**Dosage 1 mg per 10 mg xylazine administered**
0.01	**0.02**
0.02	**0.04**

Fisher – Ketamine + Xylazine

KETAMINE + XYLAZINE				
Ketamine concentration 100 mg/ml Xylazine concentration 100 mg/ml				
Weight		Ketamine (mL)	Xylazine (mL)	
Lbs.	Kg	@**25.7** mg/kg	@**5.35** mg/kg	Total Volume (mL)
5	2.3	0.59	0.12	**0.71**
7	3.2	0.82	0.17	**0.99**
9	4.1	1.05	0.22	**1.27**
11	5.0	1.29	0.27	**1.56**
13	5.9	1.52	0.32	**1.84**
15	6.8	1.75	0.36	**2.11**

Fisher – Xylazine reversal with Atipamezole

NOTE: Reverses xylazine only; wait 40 minutes after last ketamine dose to administer. Calculations using 100 mg/ml xylazine.

XYLAZINE REVERSAL WITH ATIPAMEZOLE	
Atipamezole (Antisedan) Standard Concentration: 5 mg/ml	
Xylazine Given (mL)	Atipamezole (mL)
100 mg/ml	**Dosage 1 mg per 10 mg xylazine administered**
0.12	0.24
0.17	0.34
0.22	0.44
0.27	0.54
0.32	0.64
0.36	0.72

Bobcat/Raccoon – Telazol®

TELAZOL®		
Reconstitute: 5 ml water mixed in vial with 572 mg Telazol® powder; Telazol® Standard Concentration: 100 mg/ml		
Weight		Telazol® (mL)
Lbs.	Kg	**6** mg/kg administered IM
5	2.3	**0.14**
7.5	3.4	**0.20**
10	4.5	**0.27**
12.5	5.7	**0.34**
15	6.8	**0.40**
17.5	8.0	**0.48**
20	9.0	**0.54**
25	11.4	**0.68**
30	13.6	**0.82**
35	16.0	**0.96**
40	18.2	**1.09**
45	20.5	**1.23**
50	22.7	**1.36**

Coyote – Telazol®

TELAZOL®		
Reconstitute: 5 ml water mixed in vial with 572 mg Telazol® powder Telazol® Standard Concentration: 100 mg/ml		
Weight		
Lbs.	Kg	Telazol® **10** mg/kg administered IM
5	2.3	0.2
7.5	3.4	0.3
10	4.5	0.5
12.5	5.7	0.6
15	6.8	0.7
17.5	8.0	0.8
20	9.0	0.9
25	11.4	1.1
30	13.6	1.4
35	16.0	1.6
40	18.2	1.8
45	20.5	2.1
50	22.7	2.3
55	25	2.5
60	27.3	2.7

Bobcat – Ketamine + Xylazine

KETAMINE + XYLAZINE				
Ketamine concentration 100 mg/ml Xylazine concentration 100 mg/ml				
Weight		Ketamine (mL)	Xylazine (mL)	
Lbs.	Kg	@**10** mg/kg	@**1** mg/kg	Total Volume (mL)
5	2.3	0.2	0.02	**0.22**
10	4.5	0.5	0.05	**0.55**
15	6.8	0.7	0.07	**0.77**
20	9.1	0.9	0.09	**0.99**
25	11.4	1.1	0.11	**1.2**
30	13.6	1.4	0.14	**1.5**
35	15.9	1.6	0.16	**1.8**
40	18.2	1.8	0.18	**2.0**
45	20.5	2.1	0.21	**2.3**
50	22.7	2.3	0.23	**2.5**

Bobcat – Xylazine reversal with Atipamezole

NOTE: Reverses xylazine only; wait 40 minutes after last ketamine dose to administer. Calculations using 100 mg/ml xylazine.

XYLAZINE REVERSAL WITH ATIPAMEZOLE	
Atipamezole (Antisedan) Standard Concentration: 5 mg/ml	
Xylazine Given (mL)	Atipamezole (mL)
100 mg/ml	**Dosage 1 mg per 10 mg xylazine administered**
0.02	0.04
0.05	0.10
0.07	0.14
0.09	0.18
0.11	0.22
0.14	0.28
0.16	0.32
0.18	0.36
0.21	0.42
0.23	0.46

Raccoon – Ketamine + Xylazine

KETAMINE + XYLAZINE				
Ketamine concentration 100 mg/ml Xylazine concentration 100 mg/ml				
Weight		Ketamine (mL)	Xylazine (mL)	
Lbs.	Kg	@20 mg/kg	@4 mg/kg	Total Volume (mL)
5	2.3	0.5	0.1	**0.6**
7.5	3.4	0.7	0.1	**0.8**
10	4.5	0.9	0.2	**1.1**
12.5	5.7	1.1	0.2	**1.3**
15	6.8	1.4	0.3	**1.7**
17.5	8.0	1.6	0.3	**1.9**
20	9.1	1.8	0.4	**2.2**
25	11.4	2.3	0.5	**2.8**
30	13.6	2.7	0.5	**3.2**

Raccoon – Xylazine reversal with Atipamezole

NOTE: Reverses xylazine only; wait 40 minutes after last ketamine dose to administer.
Calculations using 100 mg/ml xylazine.

XYLAZINE REVERSAL WITH ATIPAMEZOLE	
Atipamezole (Antisedan) Standard Concentration: 5 mg/ml	
Xylazine Given (mL)	Atipamezole (mL)
100 mg/ml	**Dosage 1 mg per 10 mg xylazine administered**
0.1	**0.2**
0.2	**0.4**
0.3	**0.6**
0.4	**0.5**
0.5	**1.0**

Calculations

$$\frac{\text{Weight (kg) x dosage (mg/kg)}}{\text{Concentration of the drug (mg/ml)}} = \text{Drug volume (ml)}$$

Coyote – Ketamine + Xylazine

KETAMINE + XYLAZINE				
Ketamine concentration 100 mg/ml Xylazine concentration 100 mg/ml				
Weight		Ketamine (mL)	Xylazine (mL)	
Lbs.	Kg	@4 mg/kg	@2 mg/kg	Total Volume (mL)
5	2.3	0.1	0.05	**0.15**
10	4.5	0.2	0.1	**0.3**
15	6.8	0.3	0.1	**0.4**
20	9.1	0.4	0.2	**0.6**
25	11.4	0.5	0.2	**0.7**
30	13.6	0.5	0.3	**0.8**
35	15.9	0.6	0.3	**0.9**
40	18.2	0.7	0.4	**1.1**
45	20.5	0.8	0.4	**1.2**
50	22.7	0.9	0.5	**1.4**
55	25.0	1.0	0.5	**1.5**
60	27.3	1.1	0.6	**1.7**

Coyote – Xylazine reversal with Atipamezole

NOTE: Reverses xylazine only; wait 40 minutes after last ketamine dose to administer.
Calculations using 100 mg/ml xylazine.

XYLAZINE REVERSAL WITH ATIPAMEZOLE	
Atipamezole (Antisedan) Standard Concentration: 5 mg/ml	
Xylazine Given (mL)	Atipamezole (mL)
100 mg/ml	**Dosage 1 mg per 10 mg xylazine administered**
0.05	**0.1**
0.1	**0.2**
0.2	**0.4**
0.3	**0.6**
0.4	**0.8**
0.5	**1.0**
0.6	**1.2**

BAM Supplemental

Multi-Species

	To IMMOBILIZE	To REVERSE	
Species	mL of BAM	mL of 25 mg/ml Atipamezole	mL of 50 mg/ml Naltrexone
Black Bear (~250lbs)	1.0 - 2.0	2.0 - 4.0	0.5
Bobcat	0.2 - 0.3	0.4 - 0.6	0.5
Coyote	0.2	0.4	0.5
Fisher	0.1	0.2	0.5
Red Fox	0.1	0.2	0.5
Moose (mature bull)	2.0	4.0	0.5
Moose (mature cow)	1.7	3.4	0.5
Raccoon	0.2	0.4	0.5
White-tailed Deer (buck)	1.5 - 2.5	3.0 - 5.0	0.5
White-tailed Deer (doe)	1.0 – 1.5	2.0 - 3.0	0.5
White-tailed Deer (fawn)	0.3 - 0.5	0.6 - 1.0	0.25

Ketamine Supplemental

NOTE: Ketamine can be used up to **twice** to extend the duration of the anesthetic effect from Telazol®. Given IM or IV.

Small mammals (2.0 mg/kg)

KETAMINE SUPPLEMENTAL		
Ketamine Standard Concentration: 100 mg/ml		
Weight		Ketamine (mL)
Lbs.	Kg	**2.0** mg/kg
1.1	0.5	**0.01**
2.2	1.0	**0.02**
5	2.3	**0.05**
7	3.2	**0.06**
9	4.1	**0.08**
11	5.0	**0.10**
13	5.9	**0.12**
15	6.8	**0.14**

Large mammals (2.2 mg/kg)

KETAMINE SUPPLEMENTAL				***KETAMINE SUPPLEMENTAL***		
Ketamine Standard Concentration: 100 mg/ml				Ketamine Standard Concentration: 100 mg/ml		
Weight		Ketamine (mL)		Weight		Ketamine (mL)
Lbs.	Kg	**2.2** mg/kg		Lbs.	Kg	**2.2** mg/kg
50	22.7	**0.5**		550	250.0	**5.5**
100	45.5	**1.0**		600	272.7	**6.0**
150	68.2	**1.5**		650	295.5	**6.5**
200	90.9	**2.0**		700	318.2	**7.0**
250	113.6	**2.5**		800	363.6	**8.0**
300	136.4	**3.0**		900	409.1	**9.0**
350	159.1	**3.5**		1000	454.5	**10.0**
400	181.8	**4.0**		1100	500.0	**11.0**
450	204.5	**4.5**		1200	545.5	**12.0**
500	227.3	**5.0**				

Doxapram

For respiratory system assistance, not for immobilization

NOTE: Doxapram is ideally administered intravenously but can also be given sublingual (under the tongue) or intramuscularly.

Small mammal (5.5 – 11 mg/kg); can be repeated once after 15 minutes.

DOXAPRAM		
Doxapram Standard Concentration: 20 mg/ml		
Weight		Doxapram (mL)
Lbs.	Kg	5.5 mg/kg
1.1	0.5	**0.14**
2.2	1.0	**0.28**
5	2.3	**0.63**
7	3.2	**0.88**
9	4.1	**1.13**
11	5.0	**1.38**
13	5.9	**1.62**
15	6.8	**1.87**

Large mammal (0.5-1.0 mg/kg); can be repeated in 5-minute intervals for a maximum dose of 2 mg/kg.

DOXAPRAM				***DOXAPRAM***		
Doxapram Standard Concentration: 20 mg/ml				Doxapram Standard Concentration: 20 mg/ml		
Weight		Doxapram (mL)		Weight		Doxapram (mL)
Lbs.	Kg	1 mg/kg		Lbs.	Kg	1 mg/kg
50	22.7	**1.1**		500	227.3	**11.4**
100	45.5	**2.3**		600	272.7	**13.6**
150	68.2	**3.4**		700	318.2	**15.9**
200	90.9	**4.5**		800	363.6	**18.2**
250	113.6	**5.7**		900	409.1	**20.5**
300	136.4	**6.8**		1000	454.5	**22.7**
350	159.1	**8.0**		1100	500.0	**25.0**
400	181.8	**9.1**		1200	545.5	**27.3**

Calculations/Notes page

Calculations

$$\frac{\text{Weight (kg) x dosage (mg/kg)}}{\text{Concentration of the drug (mg/ml)}} = \text{Drug volume (ml)}$$

Complications & Treatment

Respiratory Depression or Arrest

Once sedated, animals may have a reduced breathing rate, and respiratory depression/ arrest are some of the most common complications of chemical immobilization. It is important to monitor the respiratory rate, respiratory quality, and color of the gums (blue or purple color may indicate a lack of oxygen) at least every 5 minutes. Ensure the airway is open and the animal is positioned so that it can breathe with ease. Monitor for bloat, which can cause respiratory depression.

Prevention/Treatment:

- Ensure patent airway (neck is not kinked, no foreign objects or vomitus blocking the airway).
- Administer oxygen.
- Treat with Doxapram injectable. Doxapram is ideally administered intravenously but can also be given sublingual (under the tongue) or intramuscularly.
- If an animal stops breathing completely, the anesthetic should be immediately reversed, and artificial ventilation (chest compressions, endotracheal tube if experienced) should be performed.
- Acupuncture can stimulate breathing in anesthetized animals. Insert a needle between and just below the nostrils on the nose.
- Physically stimulating an animal (moving the legs, turning it over, inserting a needle tip into the nose surface) may also help improve respiratory rate.

Normal Values

The chart below gives normal TPR for species commonly immobilized by DEC. These values are for awake animals. Under anesthesia, the temperature may vary +/- 5 degrees and the BPM and RR may vary +/- 50%. Always monitor trends and start correcting before you get outside these ranges.

Animal	*Temperature*	*Pulse (BPM)*	*Respiration (RR)*
White Tailed Deer	100-102°F	70 - 80	16-20
Black Bear*	99.6-101°F	60 - 90	15-30
Moose	101-102°F	60 - 90	8-12
Fisher	100-101°F	159 - 190 (Male - Female)	35-45

*Parameters in hibernating animals are expected to be lower.

Hypothermia (Low temperature)

Hypothermia refers to a low body temperature. For practical purposes, hypothermia should be considered and addressed when body temperatures are >2°C (3.6°F) below normal for that species. A rectal thermometer should be used to monitor the trend in the temperature; if the temperature starts falling steadily, start corrective measures before the temperature is below the safe range. Chemically immobilized animals can easily become hypothermic in wet and cold weather because immobilizing drugs, such as xylazine, impair thermoregulation and enhance heat loss. In addition, a sedated animal is usually incapable of shivering for heat production. Strive to keep chemically immobilized animals warm and dry in cold conditions. Prolonged heat loss can result in shock, leading to death. Low body temperatures will also slow the metabolism of immobilizing drugs, contributing to longer immobilization.

Prevention/Treatment:

- Increase insulation between the animal and the ground.
- Be proactive in cold weather and cover the animal with blankets or old sleeping bags. Small animals can be worked up inside a pop-up tent.
- Warm small and medium-sized species with hot water bottles, chemical heat packs, or heaters.
- Administer the reversal agent if one is available and end the procedure if the body temperature is not responding to treatment.

Hyperthermia (High temperature)

Hyperthermia refers to a high body temperature. It is one of the most common veterinary emergencies and is a significant cause of mortality in captured wildlife, particularly large, dark-haired animals. Hyperthermia can occur even in cool or cold weather conditions. For practical purposes, hyperthermia should be considered and addressed when body temperatures are >2°C (3.6°F) above normal for that species. A rectal thermometer should be used to monitor the trend in the temperature; if the temperature starts climbing steadily, start corrective measures before the temperature is above the safe range. With extreme hyperthermia (above 106° F in most mammals), oxygen demand is higher than the body can provide, leading to brain, liver, and kidney damage. Hyperthermia is associated with a rapid heart rate, an irregular pulse, and rapid, shallow breathing.

High body temperatures can be caused by internal and external heat sources. Internal heat sources include physical exertion during capture and muscle tension produced by ketamine or tiletamine. External heat sources include warm weather, sunlight, and human contact. Immobilizing drugs frequently increase the potential of hyperthermia by impairing thermoregulation.

Minimize risk of hyperthermia by minimizing the animal's physical activity during capture and drug delivery.

Prevention/Treatment:

- Provide shade for the animal.
- Cool the animal:
  - Position a warm animal on its chest directly on the cool ground, exposing armpits and groin to cool soil.
  - Apply ice packs, cold water, or isopropyl alcohol to the armpits, groin, and/or foot pads.
  - Wet the animal down thoroughly with water, making sure the water reaches the skin.
  - Administer a cold-water enema.
  - Administer the reversal agent if one is available and end the procedure if the temperature cannot be controlled.

Monitor the body temperature closely, and do not over-cool the animal. Stop treatment when the body temperature decreases to the high end of the species' optimal temperature zone.

Bloat

Bloat can occur in ruminants such as deer and, to a lesser degree, in other mammals. It is an accumulation of gas in the rumen or stomach that can rapidly become life-threatening. Bloat is associated with an inability to belch due to poor body position or xylazine sedation. The most obvious sign of bloat is a distended abdomen. This is visible on the animal's left side behind the last rib. Respiration is shallow and rapid, and the pulse is weak or irregular. Bloat is often life-threatening and must be treated as soon as it is observed.

Prevention/Treatment:

- Keep the animal sternal with the neck straight and chin extended.
- Pull the tongue forward and off to the side, preventing obstruction of the esophagus.
- Pass a stomach tube (if experienced).
- Administer the reversal agent if one is available if not resolving.

Vomiting/Aspiration

Vomiting and the subsequent inhalation of stomach contents (aspiration) is a serious veterinary emergency that must be addressed immediately. Xylazine immobilization, physical exertion and excitement, or poor body position can cause regurgitation. When an animal regurgitates, personnel must quickly clear the mouth to prevent the stomach contents from being inhaled. If the animal inhales its stomach contents, a likely consequence is pneumonia, which can be life-threatening.

Reduce the risk of vomiting or aspiration by minimizing the animal's excitement and stress during capture and drug delivery.

Prevention/Treatment:

- Monitor the animal closely for regurgitation, especially if xylazine is used.
- Listen to the animal's breathing for gurgling sounds indicating fluid or partial obstruction of the trachea.
- If vomiting occurs, position animal on its stomach with its head and neck down, allowing stomach contents and saliva to flow away from the larynx.
- Examine the mouth thoroughly and clear all debris.

Shock

Shock is a circulatory compromise or failure. It is safe to assume that all captured animals are in some degree of shock. Shock is most pronounced in animals that have undergone a stressful or strenuous capture. Physical exertion, physiological and psychological stress, hypothermia, chemical immobilization, and blood loss can cause shock. Signs of shock include a rapid heart rate, hyperventilation (which may be masked by immobilizing drugs), and low blood pressure (as indicated by a weak irregular pulse and slow capillary refill time).

Even though effective treatment of shock is difficult without veterinary assistance, identifying shock is important, so BOW staff can learn how to better prevent it in subsequent field operations.

Prevention/Treatment:

- Minimize stress and physical exertion. Remember that stressful stimuli can be in the form of sight, sound, and touch.
- Monitor TPR and attempt to keep these within healthy ranges.
- Do not use any additional immobilizing drugs.
- Administer the antagonist if it is available.
- Revive and release the animal as soon as possible.

Injuries

The basic treatment for a wound is to clean it, then treat it with a topical antibiotic.

- All wounds should be flushed with either dilute povidone-iodine (Betadine®) solution (1:10 dilution), dilute chlorhexidine (Nolvasan®) solution (1:40 dilution), or sterile saline. Wounds should be flushed repeatedly to remove as much dirt or debris as possible. A topical antibiotic may then be applied.
- Bleeding can be controlled with direct pressure, following human first aid procedures.
- The hair around the wound should be trimmed to prevent the hair from matting over the wound. Wounds should be left open to some extent so they can drain.
- Injectable antibiotics may be administered but should not be used without previous discussion with the WHP Wildlife Veterinarian.
- Never release an animal with a bandage.

In some situations, injured or compromised animals can be transported to a veterinarian or rehabilitation facility. BOW staff should have a list of rehabilitators in the Region who can accept certain species.

Seizures

Seizures may occur during chemical immobilization, most commonly as a result of ketamine administration. Seizures are typically a single, short (<2 mins) episode that will not harm the animal. Repetitive or long-lasting seizures may result in hyperthermia if left untreated. The temperature of the animal should be closely monitored, and the area around the animal should be kept quiet and dark.

Treatment

- If available, administer 2.5 – 5 mg midazolam. Midazolam should be given IV if possible, but may also be given intramuscularly at the same dose or intranasally at 0.2 mg/kg.
- If the seizures are due to ketamine and are recurring, a sedative like an alpha-2 adrenoceptor agonist can be added to the protocol.

Capture Myopathy

Capture myopathy is a metabolic condition that results from intense muscular exertion/damage and prolonged stress. Clinical signs of capture myopathy can occur during the capture or hours or even days later. Signs include shivering, rapid breathing, hyperthermia, weakness, incoordination, recumbence, and sudden death. Treatment of capture myopathy is rarely successful, and prevention is key (limit chase and handling intensity and duration, limit stress).

Field Forms

Checklist for Accidental Human Exposure of Animal Immobilization Drugs

For use by responding personnel, on-scene personnel, and NYSDEC dispatch

Name of Individual Exposed: _____ (DO NOT RELAY OVER RADIO)

Age: _____ Sex: _____ Weight: _____

Time of Exposure: _____ Date of Exposure: _____

Location of Incident: _____

Exposed to (mark all that apply, and indicate approximate amount exposed to):

Drug exposed to: _____

Volume Exposed to: ____ ml Concentration: ____ mg/ml Amount Exposed to: ____ mg

Where on the Body was Individual Exposed? _____

How was the Individual Exposed? (Circle One)

SPLASH SYRINGE & NEEDLE DART POLE SYRINGE

Notes on Individual's Reactions to Drugs:

_____

_____

_____

_____

_____

_____

_____

_____

BLACK BEAR IMMOBILIZATION FIELD RECORDS

Date:_____ Processed By:_____

Capture Method: □ Den □ Trap □ Snare □ Free Dart New Capture: Yes No

County:_____ Town:_____

Specific Location: _____

_____

GPS Location: Latitude:_____ Longitude:_____

Release Location:_____

Release GPS Latitude:_____ Release GPS Longitude:_____

1st Dose ☐	2nd Dose ☐	3rd Dose ☐	Reversal ☐
Drug used	Drug used	Drug used	Drug used
Mg/Ml	Mg/Ml	Mg/Ml	Mg/Ml
Dose	Dose	Dose	Dose
Injection Time	Injection Time	Injection Time	Injection Time
Down Time	Down Time	Down Time	
#Vials Used	#Vials Used	#Vials Used	Release Time

Vital Signs: Pulse:(14-23b/15sec)_____ Temp:(100F/37.8C)_____ Respiration:(5-8breaths/15sec)_____

Sex: Male Female

Age: Adult Cub

Total Length ☐

Girth ☐

Weight ☐

Tooth sample: Yes No

Tag # ☐

Cubs present ☐

# of cubs ☐

Lactating ☐

Hair sample: Yes No

Tattoo # ☐

Description of cubs:

_____

_____

_____

_____

_____

Collar Frequency ☐

VHF ☐ Satellite ☐

Notes:

_____

_____

_____

_____

_____

General Immobilization Record

Date:_____ **Crew:**_____

County:_____ **Town:**_____

Location Details:_____

GPS Coordinates:_____

Situation: ☐ Nuisance ☐ Relocation ☐ Euthanasia ☐Study

☐ Injured / Sick ☐ Rehab ☐ Other_____

Species: ☐ Bear ☐ Deer ☐ Moose ☐ Other:_____

Weather	
Ambient Temperature	
Cloud Cover (%)	
Precipitation	

Age: ☐ Adult (≥2 years) ☐ Yearling (1-2 years) ☐ Young of year (<1 year) **Sex:** ☐Male ☐Female (Lactating Y / N)

Drug Dosage Information

Injection	*Method	Time	Drug Name	Volume (ml)	Type	Location Given	Est. Dist. Darted (m)
1	D SP HI				IV IM		
2	D SP HI				IV IM		
3	D SP HI				IV IM		
4	D SP HI				IV IM		
5	D SP HI				IV IM		
6	D SP HI				IV IM		
7	D SP HI				IV IM		
8	D SP HI				IV IM		

*Method: D = Dart; SP = Syringe Pole; HI = Hand Inject

Dart Recovered: ☐ Yes **Eye Salve:** ☐ Yes **Face Mask:** ☐ Yes **Supplemental O_2:** ☐ Yes

Vitals (Every 10-15 min.)

Interval	Time	Temp.	Pulse (beats/min)	Resp (breaths/min)	*C.R.T. (seconds)
1					
2					
3					
4					
5					
6					
7					
8					

*C.R.T: Capillary Refill Time

Measurements (cm)	
Est. Weight	
Actual Weight	
Girth (behind front legs)	
*Total Length	

*Bear-Nose tip to tail base, Moose-Top lip edge to tail base

Normal Vital Ranges

Species	Temp. (F)	Pulse (beats/min)	Resp. (breaths/min)	C.R.T. (sec.)
Bear	99.6 – 101	60-90	15-30	0-1
Deer	100-102	70-80	16-20	0-1
Moose	101-102	60-90	8-12	1-2

Tags

Tag	Type (circle one)	Color	Number	Ear (circle one)
1	Metal Plastic			Left Right
2	Metal Plastic			Left Right
3	Metal Plastic			Left Right
4	Metal Plastic			Left Right

Telemetry Information

Manufacturer:_____

Serial #: _____

Frequency:_____

Magnet removed: ☐ Yes

Device working before release: ☐ Yes

Tattoo Number:_____

Samples Collected

Sample Type	Location of sample	Notes
Tooth		
Blood		
Skin		
Hair		
Parasites		Type:
Feces	N\A	
Other		

Other Capture Notes (i.e body condition, injuries, unique markings, abnormal behavior, etc.)

Release Information

Date:_____ **Time:**_____ **County:**_____

Town:_____ **GPS Coordinates:**_____

Location Details:_____

Release Notes:_____


NEW YORK STATE
Department of Environmental Conservation
CORNELL UNIVERSITY FOUNDED A.D. 1865
College of
Veterinary Medicine
WILDLIFE RESTORATION