3

Darting, anesthesia, and handling

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3.1 Introduction—the role of capture in primate field studies

One of the most invasive things that field primatologists do is to dart or trap wild individuals (Wilson and McMahon 2006). Given its traumatic impact, it is vital that each researcher evaluate the pros and cons of capture. Does the research question(s) require capture or is there another less stressful option? What are the benefits and costs the animals being captured and to the researcher (Table 3.1)? These categories have very different goals, but often can be combined for the benefit of the targeted species.

Capture of non-human primates permits standard measurements and samples to be taken from immobilized animals (see Chapter 4). In addition, capture is the

Table 3.1 *Justification for capture*

Unequivocal identification
Management/translocation
Conservation/rescue
Veterinary intervention
Zoonosis
Morphometrics
Collect biological samples
Dental casts
Satellite tracking
Biotelemetry
Re-introduction
Population structure
Gender determination
Dispersal and ranging
Recovery of cadavers via mortality collars
Education/ecotourism

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only way to take advantage of the ongoing revolution in miniaturization that allows the effective exportation of lab-based technologies in a field setting for wild primates. Trapping or darting is required for the application of these formerly lab-based-only technologies: (1) blood glucose levels, (2) core and subcutaneous body temperatures, (3) heart rate, (4) activity levels, and (5) the actual three-dimensional distance traveled. All of these can be continuously recorded and monitored (i.e., in real time) over 24-hour periods and matched with similar continuous recording of environmental parameters of the animal's natural habitat, such as solar radiation, wind speed, air temperature, humidity, and forest canopy temperatures across both space and time.

Collectively, these environmental and physiological data can then be analyzed to better understand how behavior is related to weather conditions, available energy, and food choices, thus relating environmental variation to behavioral and physiological data from free-ranging primates. The behavior and physiology of free-ranging primates results from the interaction of numerous factors that cannot be adequately replicated in the laboratory. These factors include food supply, food quality, predation, social interactions, and three-dimensional variation in forest weather conditions. Thus, existing data from lab studies (e.g., Maho *et al.* 1981; Müller *et al.* 1983; Wurster *et al.* 1985) may not provide an ecologically, and therefore evolutionarily, relevant explanation of most primate behavior or physiology in response to environmental variation.

Additionally, certain research questions can only be addressed with unequivocal individual identification; for example, those relating to individual strategies that require consideration of complete life histories (Merila and Sheldon 2000; Grant and Grant 2000). However, much of the current research on different life stages remains primarily cross-sectional and of short duration. The same marked individuals have rarely been followed through time (but see Alberts *et al.* 2006; Altmann *et al.* 2010; Glander 2006). Furthermore, questions about individual strategies often require a large sample size that is longitudinal rather than cross-sectional. The best way to accomplish this type of data set is to have marked subjects that are followed for their lifespan. Visible marking provides unambiguous identification but does require capture, and collars and tags, for example, require replacing for continued accuracy. To ensure that precise, secure, and permanent identification is not compromised, implantable RFID (Radio Frequency Identification) microchips should be used.

Positive identification without marking may be possible when studying terrestrial primates that can be closely approached (Swedell *et al.* 2011), but unambiguous identification is rarely possible for arboreal primates. In fact, there are justifiable reasons beyond identification for capturing terrestrial primates as well (Jolly *et al.* 2011; see also Table 3.1). Even though technology has advanced to the degree that blood or tissue samples are no longer absolutely needed to perform genetic or health analyses, fecal samples do not yet provide unquestionable genetic results nor do they yield useful data on individuals that may or may not be unequivocally identified, whether they are arboreal or terrestrial. Safe capture of animals for these and other studies does provide better biological samples and allows research questions about individual strategies.

If capture is justified, then every effort must be made to minimize the trauma to the animal and maximize the data gathered. While using the safest capture drug and the proper capture equipment can reduce stress and injury, the most important factor may be the researcher's compassion for the individuals being captured. Human ego must be suppressed to reduce the trauma and stress of capture: the shot not taken is often better than the one taken in haste or pride.

3.2 Permits, licenses, and approvals

The Animal Welfare Act (AWA), passed in 1966, requires that an Animal Use Committee (often referred to as the Institutional Animal Care & Use Committee or IACUC) must approve all proposed research. Each Animal Use Committee generally has forms that can be quite detailed and often have many parts that focus on laboratory rather than field studies. Regardless of their complexity or parts that are not relevant, they must be completed and approved before any research may take place. Some institutions, such as Duke University, have modified their IACUC form to include a shortened "main form" plus a separate form specifically for "field capture/field studies." Fedigan (2010) lists several other institutions that also have "field forms" (McGill, York, Stony Brook). In addition to IACUC approval, many institutions require training in safety, animal handling, and working with primates plus an annual negative TB test. It is advisable to seek institutional help and allow ample time to complete the necessary Animal Use forms and to determine what shots and training may be required by your institution.

Many countries have specific requirements and approvals that must be obtained before they permit research. These requirements range from host country forest or wildlife ministry permits, to entry fees for national parks and reserves. In most instances, permits are required even if the research will be done on private property. Working on private property adds another layer of permission needed from the owner. It is advisable to find local assistance to legally, economically, and expeditiously obtain the necessary permits and/or pay the fees.

Working with most capture drugs requires a Drug Enforcement Agency (DEA) license. Application can be made online (<http://www.deadiversion.usdoj.gov/>). The DEA may also require the researcher to acquire a state license. Check with your local state. There are fees for both of these licenses.

Permits from the private property owner and the local government agency to carry out the research do not include the collection or exporting of biological samples. Additional permits from local agencies are often needed to collect the samples, and an export permit is then required to take them out of the country of origin. Many local government agencies demand a copy of the permit to import the samples to the United States (US) before issuing the export permit. This means, at minimum, a Center for Disease Control (CDC) <http://www.cdc.gov/od/eaipp/importApplication/agents.htm>, and US Fish and Wildlife document <http://www.fws.gov/permits/applicationforms/ApplicationIJK.html> giving the researcher permission to import biological samples into the US. A CITES export permit from the host country is also required for all samples from live animals <http://library.fws.gov/IA_Pubs/CITES_permits-certs.pdf>. The application process should be initiated well before the fieldwork is expected to commence as it may take as many as 9–12 months to obtain these permits.

3.3 Public relations

Establishing a positive relationship with the local people is equally important to the success or failure of a research project. This is true whether the research occurs inside or outside the US and it is vital if animals are going to be captured. Making contact and hiring local individuals to assist in the research provides an avenue to establish trust and understanding. Ignoring this step in the process of doing any research will inevitably lead to misunderstanding and likely failure. Making the effort to involve the local population often results in them becoming invested in the animals and habitat to the extent that they protect both in the short- and long-term.

3.4 Trapping vs. darting

The method chosen for capture depends almost entirely on whether the target is terrestrial or arboreal. Trapping does not succeed for arboreal species unless they can be baited to the ground or to platforms in the canopy (Garber *et al.* 1984; Aguiar *et al.* 2007; Rocha *et al.* 2007). Even then, trapping of arboreal species is limited to situations where preferred foods are in limited supply and there are few if any other species present to "steal" the bait or to keep the targeted species away from the trap (Aguiar *et al.* 2007). Advantages are that traps yield multiple animals at a time, there is no danger from falling, and traps can be the only effective method for capturing terrestrial primate species (Jolly *et al.* 2011). The primary disadvantages of trapping are stress from the close proximity of other individuals, the length of time the primates are held in the trap before being tranquilized, and possible wounding from individuals outside or inside the trap. The use of multi-chambered traps and frequent monitoring can significantly reduce these negative effects (Garber *et al.* 1993; Savage *et al.* 1993).

An alternate method of capture via trapping is the use of netting that is either: hand-thrown or rocket-propelled over individuals attracted to a baited site; spread on the ground after felling isolated trees; or set out in a sheltered area such as a cave. Nets also are used to rescue primates and other animals from rising water due to dam construction (de Thoisy *et al.* 2001). Netting is not applicable for arboreal primates, unless they are in the above-mentioned situations.

Camera traps capture an image rather than the individual and are used to verify presence of a secretive or nocturnal species. However, they are not effective in the arboreal environment and the images they capture are random, providing no opportunity for obtaining data other than establishing presence.

3.5 Darting methods and equipment

Darting, the delivery of a drug-carrying projectile, is the primary method of capturing arboreal species, but it cannot be used on large primates such as chimpanzees, bonobos, or gorillas because their fall from the trees is likely to be lethal. Darting also is used to anesthetize individuals in traps or at zoos without squeeze-cages. A pole-syringe is another way to anesthetize animals in traps (Jolly 1998).

In darting with either syringes or explosive darts, the preferred injection site is the hindquarters. The hit must be perpendicular to the target surface to ensure injection of the entire drug dose. Since the chest, thorax, abdomen, shoulder, neck, and head are vulnerable, unsuitable target areas, a shot should only be taken when the subject is facing away from the darter. Thus, if a shot misses the targeted hindquarters, it will miss all vulnerable areas. The use of a jab stick brings other areas such as the shoulder into consideration as target areas because of greater control and lessened impact of the jab.

The darted animal may fall as much as 30 meters. The fall must be cushioned in some manner to prevent injury or death. An effective method is to catch the falling animal in a mesh net or “camper’s hammock” held by two or three people (Fig. 3.1). When the darted animal does not fall, the branch on which the animal is hanging is either shaken or cut down with a saw attached to the end of an aluminum pole. The pole comes in six-foot sections that can be bolted together

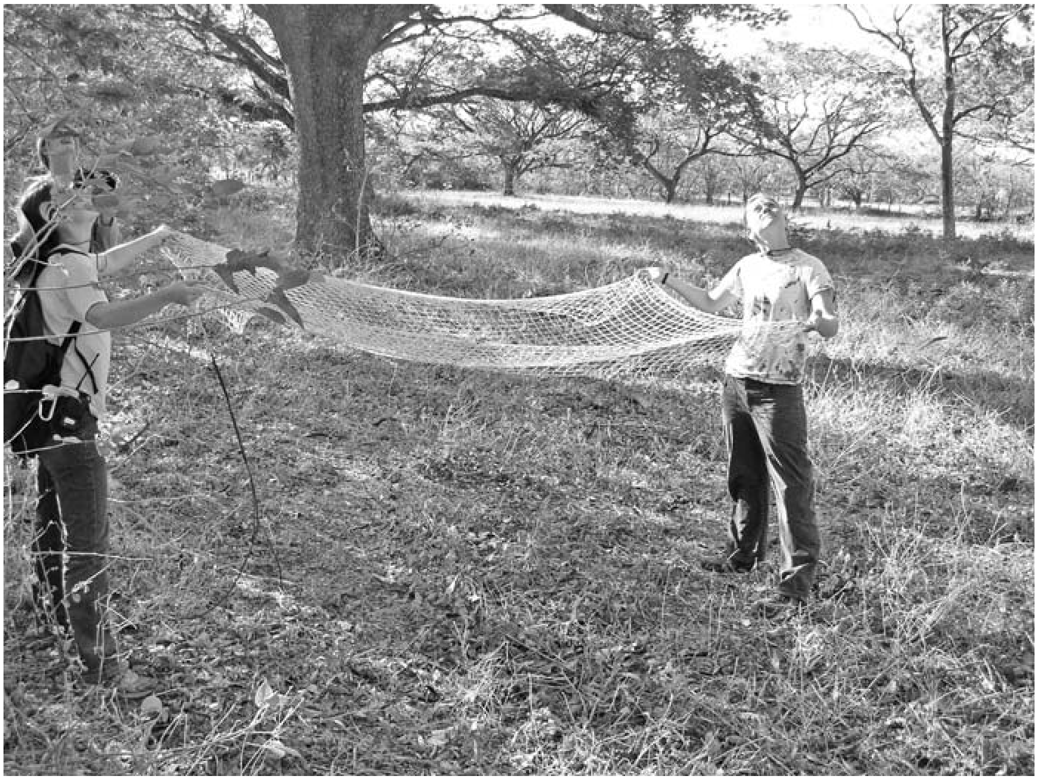

Fig. 3.1 Camper's hammock held in preparation to catch a falling mantled howling monkey in Costa Rica.

until it is long enough to reach the hanging animal (Aazel Corporation, <http://www.aazelcorp.com/>). Catching a falling primate requires an experienced individual to properly place the net and the net holders to prevent injury to both falling primate and each other.

Darts carrying a small explosive charge or syringes with compressed air are used to deliver the anesthesia. The explosive charge detonates on impact, quickly injecting the drug while a small plastic collar on the needle of the syringe is pushed back on impact thus exposing a hole through which the drug is injected. Both darts and syringes usually bounce out and away from the target upon impact, and it is important to try and recover these in order to avoid harm to other animals. A barb on the dart or needle would prevent it from immediately falling out, but the resulting tissue damage is unacceptable.

Table 3.2 lists the types of darting equipment. The choice of equipment must be based on which system results in the least injury and is the most effective based on the highest capture rate per hit and the least mortality. Based on 39 years of personal experience, I have found that the safest and most effective choices are CO^2 powered projectors with explosive darts, for distances of 5–20 m, and a blowpipe with explosive darts for distances of 4 m or less. Cartridge-fired projectors are useful

Table 3.2 *Projectors and other equipment (all websites checked and accessible as of September 2012)*

Company and location	Products	
Pneu-Dart™ (Williamsport, PA)	Rifles, pistols, blowpipes	<http://pneudart.com/>
Telinject™ (Agua Dulce, CA)	Rifles, pistols, blowpipes	<http://telinject.com/>
Dan-Inject™ (Knoxville, TN)	Rifles, pistols, blowpipes	<http://dan-inject.com/>
Cap-Chur™ (Powder Springs, GA)	Rifles, pistols	<http://www.palmercap-chur.com/products.html>
Animal Capture, Inc. (League City, TX)	Jab stick or pole	<http://www.ace-cap.com/>
(Army/Navy stores)	Camper's hammock	local

for large-bodied mammals at greater distances, but are much too powerful for the smaller-bodied primates at any distance. Pistols are effective for close-up or zoo-capture, but the blowpipe is just as effective when employed properly and eliminates the sound of the pistol.

The brand choice of darting equipment is often based on expense or personal preference. I prefer the Pneu-Dart® system for its ease of use, safety factors, reliability, and cost. Its reliability comes from the fact that the explosive darts never fail to expel the drug, which frequently happens with syringes. This is because the syringes rely on air pressure to inject the drug when the hole in the needle is exposed and, unless used immediately, the air pressure can bleed off without the researcher knowing, resulting in failure to inject when the syringe successfully hits the target. Under field conditions darts or syringes are frequently not used immediately. This is not an issue with the explosive darts since the explosive cap is inactive until igniting on impact. Even though every explosive dart reliably expels the drug, not every hit may successfully bring the target down because the dart can hit at an angle causing most or the entire drug amount to be expelled into the air. This is due to the darter's skill and not to the reliability of the dart or syringe.

Pneu-Dart® and Cap-Chur® use explosive darts while Telinject® and Dan-Inject® use air pressure syringes. All of these systems have been successfully used in primate capture. Also, they can all be used to administer medication and vaccinations to either wild or captive animals without handling.

Following capture, the marking, measuring, and collection of biological samples proceeds. Since part of the reason for capture is to provide the researcher with a visible way of identifying an individual, brightly colored collars with uniquely colored or shaped tags are used. Nylon webbing with indelible colors is most effective for larger primates, with keychain-like ball-and-chain collars being most effective for marmoset and tamarin-sized primates. Most pet stores carry nylon dog collars or leads of different sizes and colors. The leads can be cut to appropriate size and a D-ring used to attach a tag, or the buckle cut from the collar and the D-ring retained to display the tag. The cut ends of either the lead or the collar are melted and two rivets are used to secure the collar around the animal's neck. It takes experience to provide enough slack to prevent injury while preventing the animal from slipping off the collar. Tags are attached to the D-ring with an S-hook. Tags are available from farm suppliers such as Nasco™. D-rings and S-hooks are available in most hardware stores.

A more permanent method of identification is needed to prevent loss of information should the visible collar and/or tag disappear. RFID microchips serve this purpose. They are easily implanted under the skin on the back between the shoulder blades and last longer than a primate's lifespan since they have no battery or moving parts. Microchips may not be a viable solution for those primate species that are dextrous groomers. The best known microchip suppliers are AVID™, HomeAgain™, and Pro ID™.

3.6 Drug type and dose

An understanding of the differences between anesthetizing laboratory and wild primates is critical in choosing the best drug and using it safely. Table 3.3 lists the various drugs and dosages. When used under laboratory conditions, an effective

Table 3.3 *Drugs used for capture and/or sedation*

Brand name and drug for capture	Dose for intra-muscular injection (IM)
Telazol®/Zoletil® (tiletamine HCL & zolazepam HCL	20 mg/kg
Ketaset®/Vetalar® (ketamine HCL)	20 mg/kg
Tubarine® (tubocurarine)	Not effective or safe
Sernylan® (phencyclidine HCL)	No longer available
Rompun® (zylazine HCL)	Not effective or safe
Brand name and drug for sedation	
Dexdomitor® (medetomidine HCL)	0.1–0.5 mg/kg
Atipamezole® (atipamezole) Medetomidine reversal	0.1–0.5 mg/kg
Valium® (diazepam)	Not effective for capture
Drug for protection of heart	
PromAce® (acepromazine)	0.5–1.0 mg/kg

dosage is much lower than is required for the effective and safe capture of wild primates; for example, 3–6 mg/kg in the laboratory compared to 20–25 mg/kg in the wild.

The most commonly used drugs for capture are Ketaset® and Telazol® (Vetalar® is a different brand name for the drug known as Ketaset® and Zoletil® is the European/Latin American brand name for Telazol®). I will discuss Ketaset® and Telazol® only, but all descriptions and dosage hold for their other brand names as well.

The recommended dosage for Ketaset® is 10–15 mg/kg IM for immobilization and 25–30 mg/kg for surgery. Since there is no distinction made between the laboratory or field, the assumption is that these doses are effective for immobilization under both circumstances (surgery is seldom done in the field and if it is, it should be done using isoflurine which is much safer and more effective). In reality, the lower dose is not effective for darting of wild arboreal primates, while the lower dose is effective for terrestrial primates (Brett *et al.* 1982; Phillips-Conroy *et al.* 1991).

Ketaset® is not effective for howler monkeys, spider monkeys, or woolly spider monkeys (all have prehensile tails). It is partially effective for *Cebus* who have semi-prehensile tails. The reason it is not effective for primates with prehensile tails is the same reason that makes it a poor choice for use in the capture of any wild primate or for manipulation of laboratory primates, that is, it causes muscle rigidity. The limbs become stiff and non-flexible which greatly increases the possibility of broken bones if the falling animal hits branches. This rigidity also causes the muscles of the prehensile tail to lock onto a branch, preventing an animal from falling even though the drug has completely immobilized it. These animals will hang by their tails without falling until they recover enough to regain an upright posture and move away. Its continued use in both laboratory and field situations is possibly linked to it being much cheaper than the more effective and safer Telazol®.

The recommended dosage for Telazol® is 2–6 mg/kg IM for macaques and 1–20 mg/kg IM for other species. The lower doses are not effective for wild arboreal primates. In my experience, a dose of 20 mg/kg IM is required for the safe and effective capture of wild primates (see Glander *et al.* 1991and Glander *et al.* 1992 for different drugs' use and effectiveness). A dose of 20 mg/kg IM will keep darted individuals immobile for about 30 minutes with subsequent doses of 2–6 mg/kg IM being safe and effective to maintain immobility. Unlike Ketaset®, Telazol® produces totally relaxed muscle tone with completely flexible limbs and tails, resulting in more easily manipulated individuals, greatly reducing the probability of broken bones from falling, and of prehensile-tailed monkeys remaining hanging by their tails. The margin of error for over-dosing is much greater with Telazol®/Zoletil® than any other drug. All of these factors make it the obvious drug of choice for safe and efficient handling of primates in either the laboratory or field.

Animals that recover from the capture dosage before the research procedures are complete are given injections of 1–3 mg/kg of Telazol, repeated as often as needed. After all procedures are complete the animals are placed in burlap bags until they recover enough to walk or climb unaided. The bags are kept in the shade and are the best means of holding an animal until it recovers because they reduce visual stimulus and stress.

The other drugs in Table 3.3 are either not safe, not effective, or not available for use in capturing arboreal primates. Sernylan® is no longer available nor is it safe for use with primates (Glander *et al.* 1991). The others have been used, or are recommended to be used, in combination with Ketaset® to reduce muscle rigidity. These combinations may be useful in the laboratory, but are not safe or effective for capture of arboreal primates, though they may be safe and effective for immobilizing trapped primates.

Dexdomitor® is safe and effective for maintaining immobilization after capture but cannot be used for capture. Its effects can be reversed by Atipamezole® which greatly shortens the recovery time for captured animals. Neither Dexdormitor® nor Atipamezole® interact negatively with Telazol®. Valium® is not effective for capture, but is recommended in combination with all the other capture drugs in Table 3.3 except Telazol® which already has a tranquilizing agent.

Acepromazine is highly recommended for all wild captures as it is antidysrhythmic, antiemetic, and antispasmodic (Stepien *et al.* 1995). It protects the heart by lowering blood pressure, a factor that is impacted by capture (Muir and Mason 1993).

3.7 Safety considerations while handling a captured animal

Handling an animal carries possible dangers for both the animal and handler. These include the transmission of disease and parasites in both directions (see Chapman *et al.* 2005b for a list of possible exchanges between human and non-human primates). Common sense dictates that the handler should take universal precautions in terms of dress and protective gear such as gloves and masks. Humans should be particularly cautious if blood or saliva samples are being collected from Old World Primates as SIV and herpes viruses are common among these non-human primates. Given those basic preparations, the primary concern has to be for the safety of the animal. The following issues are critical. The order does not indicate relative importance or danger.

1. The animal's body temperature must be closely monitored, as many of the capture drugs interfere with thermoregulation. If the body temperature

increases beyond 39.5 °C, the animal should be immersed in water until the temperature returns to 37.5 °C. Conversely, any temperature below 34 °C must be treated by placing the animal on a heating pad or placing plastic bottles filled with warm water in contact with the animal's inguinal and auxiliary regions. The duration of immobilization and the ambient temperature are the major factors impacting the animal's body temperature.

2. Keep the mouth free of any regurgitate to prevent inhalation. Use a spatula or tongue depressor and not hands or fingers, as spasmodic jaw-closing reflexes are often still intact with dissociative drugs. Carry an anesthetized animal with its head down to prevent either saliva or regurgitate from being inhaled. Holding the animal with its head down and shaking can be effective if no stick, spatula, or tongue depressor is available to clear the airway.
3. Make sure that breathing, heart rate, and oxygen levels are normal. This is best done with a pulse oximeter. Monitoring these should occur during the entire immobilization period. Without this type of monitoring, there may be little or no warning as an animal returns to almost full awareness, resulting in possible harm to itself as well as the handlers.
4. Attend to any bleeding from the dart wound or from recent injury. The treatment should be limited to external care without the administration of antibiotic shots. Wild primates have incredible recuperative abilities and antibiotics will destroy more beneficial gut flora and fauna than bad, thus resulting in further harm rather than assistance.
5. Seizure or severe muscle contractions may occur if using ketamine or phencyclidine. These can be life-threatening and must be treated with diazepam. Telazol® use does not carry this risk as it contains zolazepam.
6. Broken limbs from the fall are possible, particularly with Ketaset® and similar drugs. Unless the break is compound, the best treatment is to ensure that no further damage is done during handling and to release the individual without splinting or casting. This seems counterintuitive, and goes against most veterinary training, but splinting and casting are effective only if the animal is held in a captive situation. In the wild, animals with broken bones resulting from natural events (i.e., not capture) have been observed to reduce their travel for about 2–4 days and then move only enough to acquire food. A similar response occurs with breaks due to capture. Within a period of 6–8 weeks the broken bones heal with no visible evidence of the break.

3.8 Recovery

At the conclusion of all procedures the animal is allowed to recover before being returned to its group. This does not and cannot include being left on the ground near the group. Since it takes about 3–5 hours for an anesthetized animal to gain full control of motor and cognitive abilities, it must be protected from predators as well as other group members who may take advantage of a disoriented and uncoordinated individual to gain an advantage because the recovering animal is acting strangely. The best method is to put the recovering individual in a burlap bag that is then placed in the shade or inside an occupied building if it is necessary to keep the animal overnight. The bags are the best means of holding an animal until it recovers because they reduce visual stimuli, prevent hypothermia, and allow free-flow of air. Cages are not effective as they allow the recovering individual visual access to the surrounding environment resulting in over-stimulation and stress that can cause self-inflicted injury and diarrhea or both.

3.9 Release

It is imperative that the animal be fully awake and have full control of motor and cognitive facilities before being released. Burlap bags again are ideal for this as it is easy to determine whether or not an animal is sitting upright. When that is evident, the bag can be held upright, untied, and opened just enough to evaluate the animal's awareness. This viewing does not appear to stress the animals as the bag apparently gives them a sense of security that is not provided when a human checks a primate in a cage (personal experience). Burlap bags have been used for 27 primate species and may have contributed to a low mortality rate (Glander *et al.* 1991, 1992).

Release is simply a matter of placing the bag on the ground at the capture site, untying it, pointing it away from the holder, and gently shaking it if necessary to encourage the animal to exit. The unobstructed view of the opened bag is almost always the only thing needed for the animal to quickly leave the bag without looking back. The bag serves to hide the human(s) who are not visible from the opened end until the animal is out and running toward the trees. An open space with nearby small trees is the ideal release location as this focuses the animal's attention on rapidly climbing the trees. I have found it unnecessary to release individuals near their group as they are much more efficient at finding their group than I am.

3.10 Safety concerns for researchers

In addition to the danger of contracting a disease or parasite from handling non-human primates, there is the danger of injury due to an animal falling from the trees, a bite from a partially anesthetized animal, or personal injury from a fall or accident. All non-human primates have parasites and some of them can and do survive on or in humans. Non-sterile surgical gloves should be worn and hands thoroughly washed after handling the animal or any biological sample. Particular care should be taken when working with blood or saliva of Old World monkeys and apes as they may harbor potentially deadly viruses such as B-virus, SIV, or Ebola. Beware of accidental "sticks" while recapping or disposing of all needles and have a "sharps" container.

Extreme care must be taken when handling the capture drugs, especially when initially loading the darts or filling a new syringe under time constraints during a partially successful darting. It is imperative that strict firing protocols are used before, during, and after a darting procedure. These include never pointing the projector horizontally or putting anyone in the line of fire. Strict protocols are even more critical when more than one darter is employed. These are common sense precautions, yet they are often not practiced; particularly in the moments of disappointment of a failed capture attempt or the celebration of a success. Insufficient respect is given to projectors used for capture because they are not "real" guns. They may not contain bullets, but the darts and syringes that they do contain can cause real damage and a so-called "empty" projector is just as dangerous as an "empty" gun.

3.11 Accountability

Whether trapping or darting is used, there should be an accountability to report the overall success or failure of any methodology employed. This accountability must include mortality rate, impact on the subject's behavior and/or ecology, and local public relations. The reporting of these factors (certainly mortality) are required by most Animal Use Committees, but should be available to the general research community.

3.12 Conclusion

Capture, whether by darting or trapping, has considerable consequences in terms of the dangers to the subjects and humans as well as with respect to alterations in the subject's group, or misunderstanding by the local community which may lead to restriction of researcher access. Thus, it is imperative that there are clear communications with national and local governments; there is a well thought out rationale for capture; all permits are in place; and sufficient and appropriate preparations and contingencies have been made for the safety of the subjects and associated humans.

Given these caveats, a successful capture can produce a range of information that is extraordinary and can be obtained in no other way.