

Protocol for Island Propagation Projects

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PROTOCOL FOR ISLAND PROPAGATION PROJECTS

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INTRODUCTION

As red wolf recovery progresses and with more projects being added, the potential for strained or inadequate budgets exists. As a result, some decisions may need to be made in the future as to where we will spend our money. These decisions will likely be made based heavily on cost/benefit analyses. The captive propagation and wild reintroduction phases of the recovery program operate on established protocols with regard to what, when, and how things are to be done; the objectives of the project; and a reporting system for evaluating the results. These results can then be weighed against costs to determine costs/benefits. Currently, the island propagation projects operate without an established protocol or reporting system. Therefore, these island propagation projects are more vulnerable in times of budget cuts. This *Protocol for Island Propagation Projects* (Protocol) was developed to correct this deficiency by documenting what is expected of red wolf island propagation projects. This would include what to do when the animals are in acclimation pens, what to do when they are in the wild on the island, what frequencies are assigned to each task, and what reports are expected.

Island propagation projects serve as a bridge between captive and wild red wolf populations. Their purpose is to provide an opportunity for animals to obtain wild experience before being released into mainland reintroduction areas and thereby, hopefully, increase survival rates and wild behavioral traits. Therefore, animals will normally be funneled through the island projects and on to reintroduction projects. This means that animals will normally stay on the islands for approximately 1 year.

Secondary objectives of island projects are prey population control, public relations, information dissemination, and education in the local area. Such projects can be important in laying the groundwork for potential future mainland reintroductions in the vicinity.

The overall goal of island propagation projects is to determine if island-reared wolves are better suited for life in the wild at mainland reintroduction sites than captive-reared wolves. To test this hypothesis, island-reared wolves will be given top priority in mainland reintroductions. This testing is complicated by the usual reintroduction techniques, which involve an acclimation period in captivity at the reintroduction site. Such acclimation runs counter to the effort to release wild experienced animals but has proven beneficial to prevent wolves from dispersing prematurely from the release site. Obviously, the longer the acclimation period the greater the adverse effect on the "wildness" of the animals. The number of wolves that can be released each year in wild reintroductions varies tremendously, depending on the availability of accessible habitat, the presence of wild wolf groups, and the local political and public support situation.

All of these variables make it very difficult to plan a test of the hypothesis in terms of the number of animals to be included in the sample, the history of the animals with regard to the amount of time in captivity versus the amount of time in the wild, the amount of time elapsed since the wild experience was obtained, the sex and age ratios of the animals, and the time frame needed to complete the test. Therefore, only a general

sample size and an approximate time frame can be given. A sample size of 25 to 50 animals should be sufficient. It is hoped that the wild reintroduction situation will be such that this sample size will be reached within the next 5 years (by 1999).

This Protocol is based on the general needs of the recovery program for this species. Individual land managers should get prior approval from the red wolf coordinator before spending red wolf funds on data collection not addressed in this Protocol.

There are two primary phases involved in island propagation. One is the captive-management phase and the other is the wild-management, or free-ranging, phase. Both phases are addressed in this Protocol. However, a husbandry manual is being prepared and may replace the captive-management section of this Protocol when it is completed.

No protocol can cover the myriad of events that might arise at an island project. Procedures described herein may need to be modified due to weather conditions, unusual wolf activities, public use, or professional visitations. Unusual events and unforeseen management needs should be handled on a case-by-case basis in consultation with the captive-breeding coordinator, field coordinator, site manager, and project veterinarian.

The various data sheets (Figures 2, 4, 5, and 6) in this document can be copied for use at the project sites. You may want to cover up or white-out the figure designation before copying. You can also request copies from the red wolf coordinator.

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CAPTIVE-MANAGEMENT PHASE

Maintenance of the genetic and demographic health of the red wolf population is one of the primary goals of the red wolf breeding program. Another main objective is propagation and management of red wolves that are representatives of their species in appearance and behaviorally suitable for reestablishment in the wild. While no "blueprint" exists to guarantee which animal(s) will be used for release, the purpose of the island propagation projects makes animals from these facilities the primary candidates for release into the wild. Attention to this Protocol should benefit the facilities by producing animals that are perhaps more predictable, which should make capture, handling, transport, and medical examinations less stressful on personnel and the animals.

Avoiding socialization or familiarization of the wolves with humans is a basic element of this Protocol and is a philosophy to be maintained in every aspect of captive red wolf husbandry. Individuals involved with any aspect of red wolf husbandry (especially on a day-to-day basis) must not attempt to modify the animals' behavior in such a way that they no longer represent their species.

Housing and Enclosure Requirements

Red wolves are first placed in an acclimation pen on the island prior to the breeding season. The purpose is to acclimate them to the local climate, habitat, prey, and specific site and to allow them to breed. The wolves should receive as much privacy as possible. Human disturbance must be kept to a minimum--feeding, cleaning, periodic maintenance, and health checks only. The pen area should accomplish a few things; notably, it should keep the wolves from escaping and secure them from intruders. If possible, pens should be designed in an area that drains well in order to prevent the collection of water in the yard, especially in the vicinity of the dens. Soil, grass, plantings (for hiding and shade), log hollows, and similar materials should be included in the pen design to promote natural activities for the wolves.

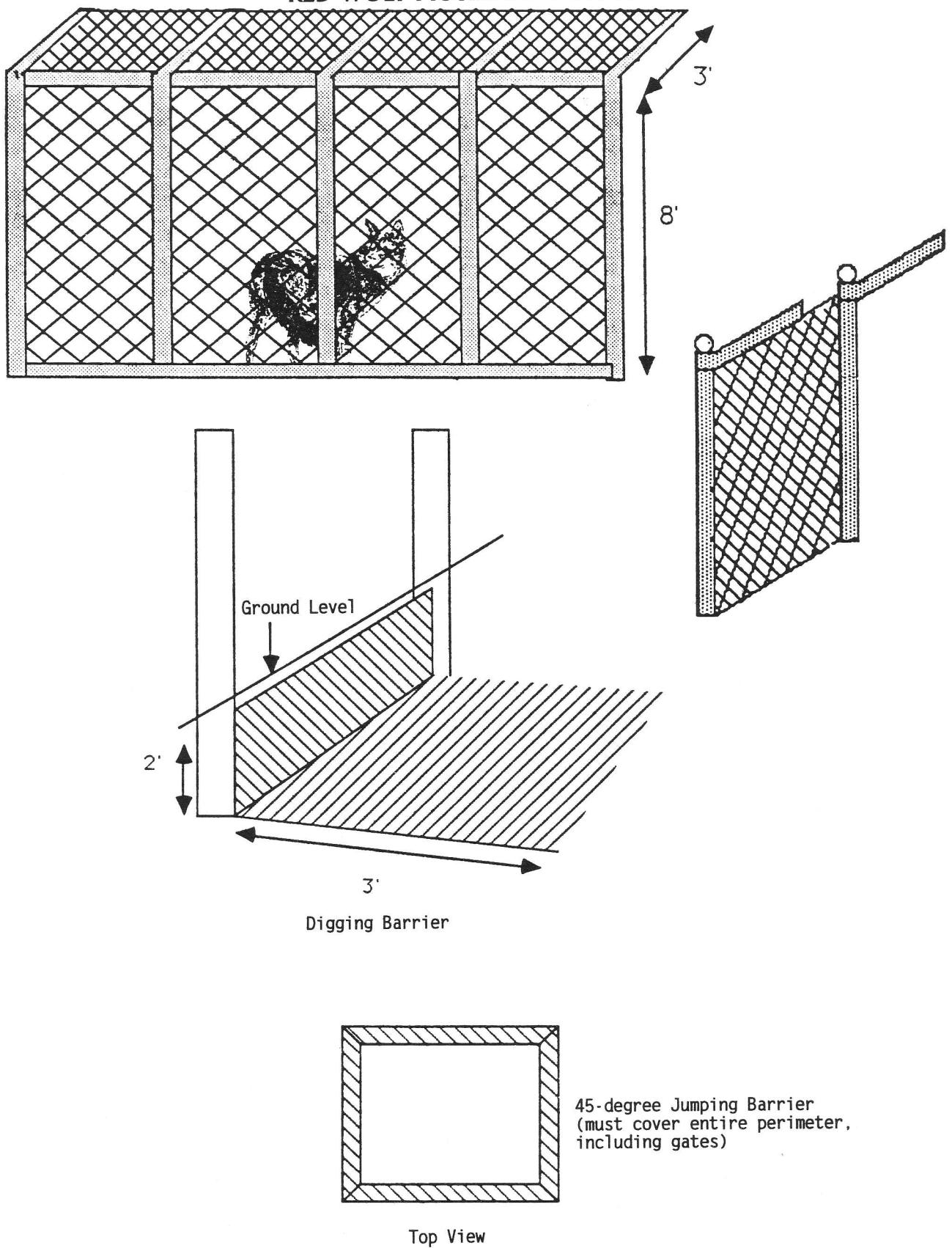
Ideally, each island should be capable of temporarily housing at least one pair of red wolves and their pups. The minimum pen space requirement per each adult pair (with or without pups) is 2,500 square feet. However, isolation from similar or the same species is not a requirement for the successful management of red wolves. The acclimation pen should be in a secluded area away from human activity, and some form of shade should be provided.

Fencing must be constructed of 9-gauge, 2-inch chain-link non-vinyl coated mesh suspended on 2-inch vertical metal pipes. Setting the vertical pipes in concrete is recommended, where feasible, and when the pen is to be used more than one time. The height should be at least 8 feet, with the addition of a 3-foot-wide overhang that is slanted in at a 45-degree angle and supported by support rods at each fence pipe. The overhang should be extended at the corners, as this is the likely spot for the wolves to attempt to jump from the enclosure. Hot wire can also be used as added insurance when there is a wolf that habitually tries to escape by jumping out of the pen. An electric fence may also be installed around the pen, if needed, to keep out other carnivores, such as bears (Figure 1 - Red Wolf Acclimation Pen).

When using 2-inch mesh chain-link fencing, one pen should never share a common fence line with an adjacent pen containing wolves, dogs, or coyotes. Past experience has taught us that both young and adult wolves have sustained serious injuries when they stuck a leg through the fence that housed another wolf. When the fence line must be shared, a strong (8-gauge) 1-inch mesh wire must be used. An alternative is to create at least an 18-inch buffer between the two pens. Gates that may join adjacent pens must also include similar precautions, as should holding areas and areas used to shift animals between pens.

Red wolves will habitually dig at the base of the vertical fence; such areas should be filled in to prevent escape. Also, a 2- to 3-foot-wide digging barrier of chain-link fencing should be installed, lacing it with smooth wire to the base of the vertical fencing. This digging barrier should meet the fence at an approximate right angle to the upright fence and should be buried from more than 3 inches below ground level. For pens that will be used more than one time, a concrete footing (approximately 8 inches wide) could be poured at the gate to prevent digging at this area.

FIGURE 1
RED WOLF ACCLIMATION PEN



where a digging barrier cannot be installed. Pens, especially the fence lines, should be inspected weekly to detect any need for repairs and to fill any substantial holes. A log should be kept for recording information about pen maintenance, visual checks, and feeding (Figure 2 - Red Wolf Daily Log). Of course, this information can simply be recorded in a notebook. In addition to the information requested on the daily log sheet, the following parameters should be discussed in the "Comments" section when applicable: (1) condition of pen and any repairs made; (2) location and status of any holes that have been dug; (3) number, color, and consistency of scats (firm, mud pie, loose mud pie, diarrhea) of scats; (4) number of fecal samples collected; (5) appearance and behavior of individual wolves; (6) type and amount of medication administered; and, (7) weather conditions. A note regarding the need to record these parameters in the "Comments" section should remain in the binder containing completed log sheets.

Female red wolves may whelp in a den provided or in a place of their own choosing. Unlike enclosure size, den boxes need not be spacious, but they must be readily accessible to keepers. Den boxes constructed of wood are recommended. Again, these dens should be accessible to keepers for capturing wolves with a noose or for drawing blood, giving injections, etc., which eliminates the difficulties associated with hand-catching wolves with a net. As a guideline for red wolf den boxes, measurements can be 4 by 5 by 4 feet high at the front of the den (entrance of box) to 3 feet high at the back, which will allow for water runoff. The roof should be removable, allowing access for animal handling and cleaning procedures. An entrance dimension of 18 by 18 inches (with a guillotine door) should be sufficient (Figure 3 - Red Wolf Den Box). A minimum of two den boxes should be provided in each pen. The floor of the box should be covered with more than 6 inches of dirt for at least the first 1 to 2 weeks to prevent foot pad abrasions. After 2 weeks the foot pads are toughened sufficiently to prevent abrasions, and other materials, such as wood shavings, can be used.

A security wall can also be incorporated into the inside of the box to block wind and rain from entering the main part of the den. This should be done at a right angle (perpendicular) to the entrance of the den. While the security wall can present some problems in removing animals from the box, when placed in this location, medical procedures can be accomplished by using this wall as a baffle (with the head of the wolf secured with a noose, away from the door, and the hindquarters outside the entrance). Also, the security wall can facilitate the maneuvering of an animal into a transport crate if removal is necessary for transporting or for performing medical procedures that require anesthesia.

Normally, captive wolves should not be allowed to dig their own dens, as inspection or removal of the pups or adults will be difficult. There is also a real possibility that wolf-made dens will collapse. Because of the prevalence of parasites and the high temperatures at island sites, natural dens may be acceptable. It will have to be judged on an individual basis. Contact the captive-breeding coordinator for input if there is doubt. All the islands have sandy soil types, so digging pups out for processing should not be difficult. Excavating dens has to be done carefully and in a manner that prevents the den from collapsing on the pups. Advantages to natural dens are the isolation of the pups from people and the possible contentedness of the adult wolves.

FIGURE 2
RED WOLF DAILY LOG

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Date _____ Caretaker _____ Pen _____

Time Pen Tended _____ Wolf Numbers _____ M _____ F

Amount and type of food provided _____

Amount of food present from previous day _____

Amount of water provided _____

Comments: _____

Date _____ Caretaker _____ Pen _____

Time Pen Tended _____ Wolf Numbers _____ M _____ F

Amount and type of food provided _____

Amount of food present from previous day _____

Amount of water provided _____

Comments: _____

Date _____ Caretaker _____ Pen _____

Time Pen Tended _____ Wolf Numbers _____ M _____ F

Amount and type of food provided _____

Amount of food present from previous day _____

Amount of water provided _____

Comments: _____

Date _____ Caretaker _____ Pen _____

Time Pen Tended _____ Wolf Numbers _____ M _____ F

Amount and type of food provided _____

Amount of food present from previous day _____

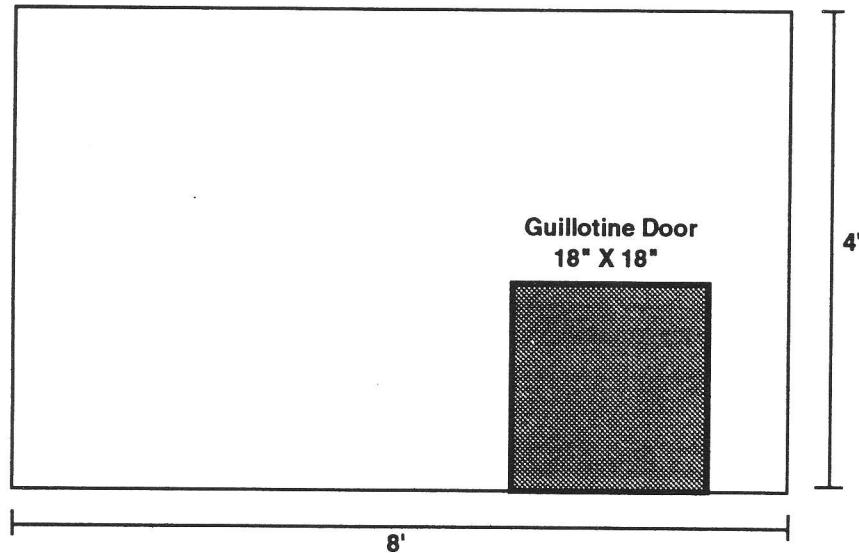
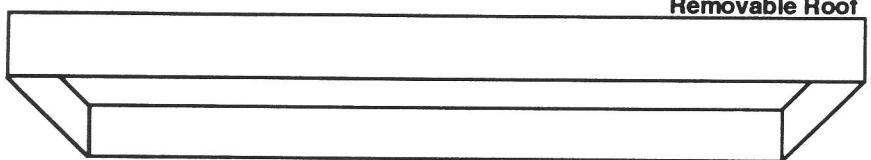
Amount of water provided _____

Comments: _____

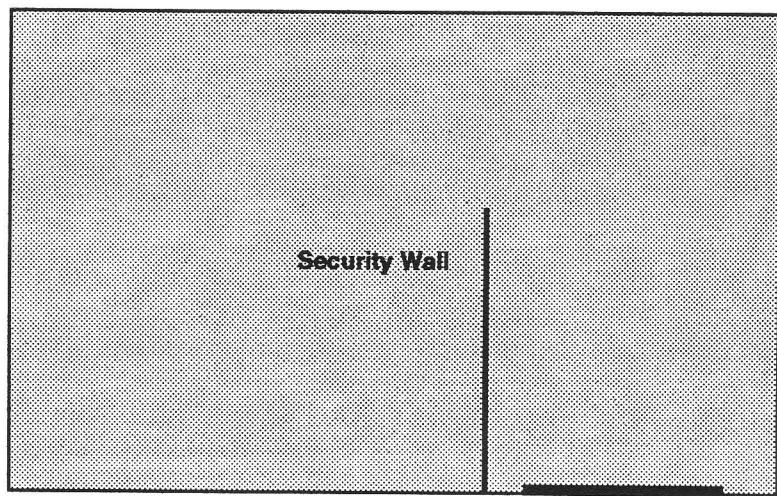
FIGURE 3
RED WOLF DEN BOX
Removable Roof

7

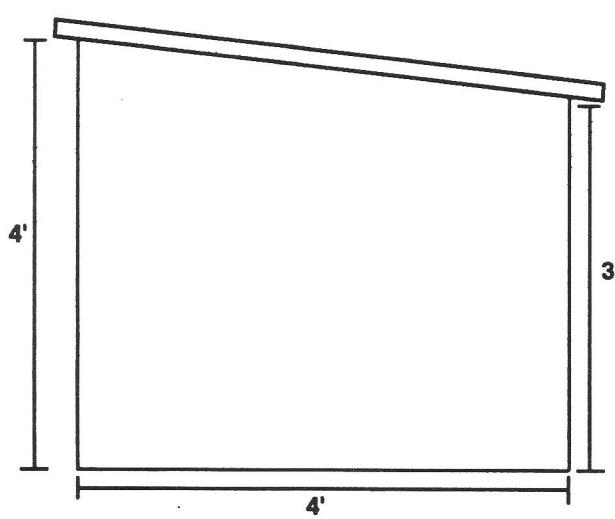
Front view



Top view



Side view



Digging around the outside of a den should be monitored and filled. Attaching and burying a digging barrier of chain-link fencing to the skirt of the den can prohibit this activity in much the same way the digging barrier to the enclosure does.

Normal zoological procedures should be used on a routine basis. Removal of fecal material, area clean-up, landscape maintenance, etc., should follow established and acceptable procedures. In general, feces and any uneaten meat should be removed when entering a pen for any purpose and should be done at least twice a week. All cleaning aids, disinfectants, and chemical agents must be safe, nontoxic, and biodegradable. Annually, while vacant, the pen and area should be inspected and thoroughly cleaned. Debris should be raked from the pen, and repairs to the structure should be made as necessary. The bedding (dirt) should be removed and replaced just prior to each new occupancy. All supplies should be inspected, and all damaged equipment should be repaired or replaced.

Management

Identification Methods and Records. Properly marking animals for identification and maintaining complete records on each animal are important functions in the management and husbandry of captive animals. Adults should be tattooed, inside the pinna, with assigned studbook numbers. The most distinct and long-lasting mark can be made by an electrical tattoo needle. Although one may be certain as to which animal he or she is working with, the tattoo number should be confirmed when an animal is handled. Adult animals arriving at island sites will be properly marked for identification. Young wolves should not be tattooed until they are at least 9 months of age. If they are tattooed at a younger age, subsequent growth usually spreads and distorts the tattoo.

In addition to the tattoo, an aluminum tag, stamped with the animal's tattoo number, should be prepared. The tag should be at least 3 inches long and 1 inch wide, with a small hole punched in one end. A 4-inch-long wire can be inserted in the hole to facilitate attachment of the tag to the animal's pen. This tag will accompany the animal the rest of its life. Initially the tag should be conspicuously placed on the door of the pen in which the animal is being maintained. Each time the animal is transported, even if it is within the institutional facility, the tag should be attached to the animal's transport or shipping crate as a confirmation of the animal's identity. When the animal dies, the tag should be secured to the base of the tail and should accompany the animal through the autopsy and eventual placement in a museum collection. Once the skull is cleaned, the tag should be attached to the zygomatic arch.

Transponders will probably be used more in the future for identification purposes. The Red Wolf Species Survival Plan (SSP) uses the Trovan/A.E.G. transponder system as a permanent identification method for the red wolf population. This identification method is meant to be a supplement to ear tattoos, meaning that the wolves should continue to be tattooed. The expense of purchasing this equipment may be prohibitive for some facilities. The SSP coordinator will send, upon request, the

transponders and implanter syringe to those facilities that do not have the equipment. All this is required is to borrow a reader from a nearby facility to read the transponder to ensure that the chip has been properly installed. InfoPet, the company that distributes the system, has a list of zoological facilities, universities, and agencies that have the equipment. Transponder numbers should be sent to the SSP coordinator for inclusion in the SPARKS (Single Population Analysis and Records Keeping System) data base and should accompany the paperwork when a wolf is being transferred to another facility. It is not necessary to anesthetize the wolves to perform this procedure; however, if the wolf is scheduled to be anesthetized for any reason, this is a good time to implant the chip. The area of implant is between the scapulas.

Health, medical, dietary, reproductive success, and mortality records should be kept for each animal (Figure 4 - Red Wolf Individual Log). Written reports should be maintained for each day the animal is observed (i.e., feeding, cleaning, tracking, and medical examination days), indicating general condition, food consumption, bowel habits, activity, and animal interactions. A veterinarian or an experienced keeper should inspect the animals visually on a routine basis and should provide physical examinations for each animal at least annually. Animal keeper and veterinary staff must coordinate all activities concerning the animals in a well-planned manner.

Copies of pertinent records should accompany each animal whenever it is transferred to another facility. Copies of the records should also be provided to the captive-breeding coordinator upon request, or whenever the institution feels it has something of significance to report. Reports on reproductive success, mortalities, and transfers should be made monthly to the International Species Inventory System (ISIS) record keeper for the species. Births and/or mortalities should also be reported to the captive-breeding coordinator within 48 hours.

Recommended Methods of Capture, Handling, and Restraint. It is difficult to characterize an individual wolf's response to capture, except that they are frightened. Some respond by lying quietly, without much struggle; others act defensively by snapping at anything close to their mouth. Project personnel who may handle wolves should first participate in a "handling workshop" organized by the field coordinator. A small storage shed should be located near the acclimation pen and should be stocked with the following: Vari-kennel shipping crates (one per wolf), catch-poles (one per wolf), capture nets (at least four), muzzles (at least four), extra dry and canned dog food, can opener, shovel, and plastic garbage bags. Project personnel should coordinate, in advance, all captures in a well-planned manner.

Stress and heat are the two main concerns when capturing red wolves. To achieve a quick and successful capture of the animal, keepers familiar with the habits of the wolves are vitally important to this operation. Also, the capture should be coordinated with temperature in mind, as canids are extremely susceptible to overheating when stressed at temperatures above 80°F. The first indication that a canine is becoming overheated is generally the appearance of excessive panting and drooling or a white frothy foam around the mouth, reddened eyes and gums, and, in extreme

FIGURE 4 RED WOLF INDIVIDUAL LOG

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Location _____ Birth Date _____ Sex _____

Sire _____ Dam _____ Studbook No. _____

Transponder No. _____ Tattoo _____

DATE	COMMENTS

cases, vomiting. If this occurs, attempts at capture should cease immediately, until such time as the animal's respiratory and heart rates have returned to normal. Further attempts at capture may need to be postponed until another time. Once captured, a wolf should be cooled by splashing water on the belly and fanning the animal, or it should be placed in a well-ventilated cage in a shaded area or air-conditioned building. The cage should be no larger than is necessary for the animal to lie down or turn around. The animal may be further calmed by loosely covering the cage with a light tarpaulin to restrict sights and sounds that may further excite the animal. If covered, the animal should be monitored periodically.

If the animal has become comatose, or there is a fear that it soon will, it can be submerged in cool, not cold, water to aid in reducing its body temperature. The animal, in its cage, can also be cooled with a fine spray of cool water from a garden hose. Ice packs may be placed on the extremities or between the rear legs in the groin area. The chemical restraint procedures in Appendix A provide detailed guidelines for monitoring and treating animals in distress. These guidelines are appropriate whether drugs are being administered or not.

To reduce the stress associated with handling, animals are normally captured in the den box with a catch-pole. The animal can then be transferred to a crate. If the animal does not enter a den box, three to four people may be required to catch the wolf with large salmon nets. If the animal cannot be systematically worked into a corner of the pen for capture, it must be caught as it runs the perimeter of the pen. Do not chase the animal; be in a position to place the net in front of the animal as it runs by. To avoid further stress and possible injury from excessive struggling, the animal's head should be immediately pinned to the ground with the metal hoop part of a second net by another member of the catch team. The animal should then be transferred directly to a handling cage that has been brought to the point of capture by one of several methods.

In some cases the transfer crate can be placed in a corner of the pen, typically near the entrance gate, and positioned in such a way that when the animal is forced to that corner, it will seek refuge in the crate and can thereby be captured without a great amount of stress. Sometimes a crate can be positioned along a fence line, with the net opening abutted to the crate opening, and the wolf can then be forced directly from the net into the crate. Another way is to use a catch-pole to pick the wolf up for placement in the crate, similar to the procedure for removing a wolf from a den box. If the wolf is tangled in the net, it may be necessary to grab the wolf firmly by the scruff of the neck by hand and then transfer the wolf into the crate; i.e., the hands substitute for a catch-pole.

One of the safest, quickest, and least stressful ways of capturing a wolf is to allow it to run into its den or other confined area. This underscores the importance of having a knowledge of each individual wolf's habits. To reduce the amount and length of stress to animals that refuse to enter dens, capture them first. When a wolf is observed running into its den, the den entrance should be closed to prevent escape. If the den box does not have a closable door, the entrance must be blocked with material at hand. Immediately, a net can be placed in front of the

entrance to the den to prevent the animal from running out of the den. At this point a keeper who is familiar with the habits of the animal and who is knowledgeable in the use of a catch-pole can noose the animal from the den entrance or by opening the top on a den box that has a removable roof a sufficient distance to insert the catch-pole. The noose of the catch-pole can be slipped over the head of the animal and tightened; the head can then be immobilized by forcing it to the floor of the den. Most procedures (inoculations, drawing blood, etc.) can normally be accomplished without removing the wolf from the den. The top of the den box can be completely removed in preparation for lifting the animal out of the box. If the wolf is to be removed for transport, a crate should already be positioned, standing on its end, outside the den as the animal is pulled or lifted from the den.

The type of catch-pole recommended is a 5-foot pole from the Ketch-A-11 Company. The ends of these particular catch-poles have swivels that prevent the noose from twisting down around the wolf's neck as the wolf is pulled from the den. The person holding the catch-pole is the one in control and is the coordinator of this operation. As the wolf is pulled or lifted from the den, one person should be on each side of the den to assist the person controlling the catch-pole. The people on each side of the den should not grab for the wolf until the person holding the catch-pole indicates "OK," meaning he or she has control of the animal's head and that it is safe to grab the wolf by the tail. The wolf should never be grabbed above the base of the tail, as control of the head by no means ensures that the wolf is not capable of turning sideways to bite. With all things proceeding correctly--the person with the catch-pole having control of the animal's head and another person having the animal by the tail and hind legs--the person with the catch-pole says "1-2-3," and the wolf is lifted in a coordinated manner for placement into a crate. When the animal's hindquarters are above the crate, the keeper holding that end releases the wolf, pushing himself away from the wolf as the person holding the catch-pole allows the weight of the wolf to drop into the crate. The crate door should be shut immediately, and the person holding the catch-pole should release the noose from around the animal's neck. Once the door is securely fastened, the crate can be lowered to its proper position. Once the wolf is lifted out of the den and a person has the animal by the tail, it takes no more than a few seconds to transfer the animal into the crate. The entire operation, if it goes smoothly, should take no longer than a few minutes.

When handling an animal on site for health checks (not immediately placing the animal in a transfer crate), the technique is slightly modified. After the animal is secured with a catch-pole and the head is under control, a second person can grab the animal from the back, by the scruff of the neck, and help lift and control the head when removing the animal from the den box. This person then maintains control of the head during processing. Once the animal is on the ground, the catch-pole can be removed, with the person holding the head then in charge of all future handling and moving.

For some procedures, a wolf may require muzzling. To muzzle a wolf, one handler should be in control of the head with a catch-pole or his or her hands. Using a strong 4-foot piece of gauze, the center point of the

gauze is brought under the animal's chin, at a line approximately between the nose and the eyes, and is then tied with a half-hitch or single knot over the top of the nose. The trailing ends are then brought under the animal's muzzle and behind the animal's head where it is tied in a bow for ease of removal. As a precaution, the animal's jaws can be tied a second time. A nylon muzzle (wolf size) may be slipped over the gauze muzzle if needed, or the nylon-type muzzle may be used alone. To remove the gauze and/or muzzle, pull one of the trailing ends of the bow and/or the loosened end of the muzzle and pull the gauze or nylon muzzle away, allowing the muzzle to slip away from the wolf's mouth.

While the wolves are to be treated with respect, they should not be feared. If the animals sense fear in their handlers, they may attempt to show dominance and begin "testing" to determine how much control they have over their daily situations and may eventually become more aggressive and unmanageable. Keepers should have a rake, shovel, etc., when entering the pen, and they should visually inspect the wolves when servicing the pen. In general, wild wolves become ill at ease when intently stared at from within their confines.

Should an animal approach a keeper, whether out of curiosity or aggression, the wolf should be held in check with whatever tool is at hand while being sternly told "no." Under no circumstances should the keeper retreat. After a few tests the animal will usually give up such confrontations; however, keepers should take care that such activities do not become a game for the animal.

Whenever touched by humans, the animals should be handled firmly but humanely. It is imperative that the animals find the experience distasteful each time they are touched by humans. During periods when the animals are being restrained, given inoculations, having blood taken, or having a physical examination, they should not be stroked, petted, or scratched behind the ears. A quick visual check should be done approximately 30 minutes after handling to be sure the wolves are okay. Data collected when handling a wolf should be recorded on standard forms (Figure 5 - Red Wolf Processing Log).

Anesthesia is rarely used when handling red wolves. However, it should be an available alternative for wolves that commonly become overly excited and prone to injury, highly stressed, and/or overheated in handling. The following drugs and doses are deemed safe for any canid: (1) ketamine (10.0 milligrams [mg] per kilogram [kg]) plus promazine (1.0 mg/kg), (2) talazol (10.0 mg/kg), and (3) ketamine (10.0 mg/kg) plus xylazine (2.0 mg/kg) (T. J. Kreeger. 1992. A review of chemical immobilization of wild canids. Proceedings of American Association of Zoo Veterinarians and American Association of Wildlife Veterinarians Meeting). If not anesthetized within 10 to 15 minutes, give one-half of the ketamine dose but no additional tranquilizer. For example, when using talazol, supplementary doses of ketamine only (at 5 mg/kg) should be administered, with no additional talazol. These doses should result in anesthesia, not sedation. Complications from these drugs at these doses are extremely rare.

FIGURE 5
RED WOLF PROCESSING LOG

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Date _____ Time _____ Transponder No. _____

Studbook No. _____ Tattoo No. _____ Sex _____

WEATHER CONDITIONS: Temperature _____ Precipitation _____

Cloud Cover _____ Lunar Phase _____

Capture Method _____ Location _____

Handlers/Observers _____

Easting _____ Northing _____ Transmitter Frequency _____

Drug Administration:

DRUG	TIME	TEMP	PULSE (15 SEC)	RESPIRATION (15 SEC)	SIGNS/COMMENTS

General Appearance _____ Dentition _____

6-Way Vaccination - Yes ____ No ____ Rabies - Yes ____ No ____

Ivermectin - Yes ____ No ____ Blood Sample - Yes ____ No ____ Amount _____ cc

Antibiotic - Yes ____ No ____ Type _____ Amount _____ cc

Fecal Sample - Yes ____ No ____ Surgery Performed - Yes ____ No ____

Ectoparasites _____

Foot Caught - Left Front ____ Left Rear ____ Right Front ____ Right Rear ____

BODY MEASUREMENTS (CM): Weight _____ Ear (Interior, Base to Tip) _____

Hind Foot _____ Tail _____ Body _____

Front Foot Pad - Length _____ Width _____

Shoulder Height _____

Genitalia (Testis/Vulva): Length _____ Width _____



Comments/Procedures _____

However, more specific chemical restraint procedures have been worked out for red wolves by Terry Kreeger and Mike Phillips, with the objective of inducing light anesthesia of a captured wolf rather than achieving heavy anesthesia, which is necessary only for the purpose of surgery. The procedures call for a very light administration of ketamine (4.0 kg/mg) and xylazine (2.0 mg/kg), accompanied by physical restraint if necessary. A 16-page "reference manual" for these procedures is included in each drugging kit used in the field at the Alligator River National Wildlife Refuge (Alligator River). Appendix A provides the basics from this "reference manual," including a summary of the procedures, a detailed presentation of the procedures, and a presentation of the drug mixture process and labels for drug bottles. Not included in Appendix A, but available from Alligator River, are two pages of specifics about ketamine and xylazine copied from a drug manual and a six-page summary of the general aspects of the chemical immobilization of furbearers (U. S. Seal, and T. J. Kreeger. 1987. Chemical immobilization of furbearers. In M. Novak, J. A. Baker, M. E. Obbard, and B. Malloch, editors. Wild Furbearer Management and Conservation in North America. Ontario Ministry of Natural Resources, Toronto, Ontario).

Training in the chemical immobilization of animals is recommended for anyone contemplating the use of chemical restraint for red wolves. Such training can be obtained through Safe-Capture International, Inc., P.O. Box 206, Mount Horeb, Wisconsin 53572 (Telephone 608/767-3071).

Recommended Transport and Shipping Procedures. For adult red wolves that have experience in being crated, the normal response when being transported is to lie quietly in the crate. Young wolves that have not been crated may thrash around or periodically bite at the crate. This reaction can be reduced by loosely covering the crate with a light tarpaulin. For local transport (for example, to another pen or to the veterinary clinic), place the crate in a well-ventilated vehicle. Under no circumstances should a wolf be left in a crate for any period of time in direct sunlight or in areas where there is excessive noise and/or commotion.

Red wolves need not be sedated for shipment and should fast for 12 hours prior to shipment. Water should be provided up until the time the animal is crated for shipment. Considerations when arranging animal shipments include the length of time the animal is confined to the shipping crate and the amount of extra handling required by the airline. Federal and internal airline regulations will sufficiently address the welfare of the animal; however, animal facility personnel should still monitor the shipment and do everything possible to coordinate with the airline. When possible, nonstop flights should be scheduled between the shipping points. Few airlines will have direct flights to where animals need to be shipped or flights in which a change of planes is not required. Most shipments have a change of planes, which means a layover time for the animal. Most airlines require at least a 2-hour layover to guarantee transfer to the new plane. Layover times can vary from the minimum 2 hours to 6 hours or more. For this reason, personnel making arrangements should always try to find the airline with the shortest total flight time, including layover time. Some airlines will try to make an earlier transfer if they have more than

one flight per day to the end destination. If at all possible, inter-airline transfers should be avoided because they require greater coordination and increase the risk of an animal missing its flight.

Another factor to be considered is the time of arrival at the new facility. Most facilities have personnel who will pick up arrivals at any time. These arrangements must be confirmed with the receiving facility before shipping times can be confirmed with the airline in case there is a conflict at the receiving facility.

The airline will require that a reservation to ship the animal be made several days in advance. Once the shipping arrangements have been confirmed, the shipper, as a precaution, should contact (by phone) each airline freight manager who will be involved in the shipment. This contact is necessary to inform the freight manager about the nature of the animal and any special precautions, such as avoiding heat by keeping the animal's cage in a well-ventilated and shaded area during periods that it is on the ground. All airlines have specific time requirements for receiving animals for shipment. Most require that the animal be at the airport at least 2 hours in advance. During certain times of the year (such as before Christmas), they may change that requirement to 3 or more hours before the scheduled departure. Shippers must always be alert to these changes and the fact that sometimes airline personnel may make a mistake and give out wrong information. A call to the airline an hour before leaving for the airport is advisable to confirm times and check for cancellations due to technical problems or weather conditions. Carriers will periodically place a ban on animal shipments through certain locations if the temperature is considered too risky. These bans are beyond our control and have delayed many shipments by days or weeks. The sending facility should contact the receiving facility to confirm that the shipment has begun and to inform them of any changes in arrival time.

The receiver should call the airline to confirm that the animal made its connection, if the plane will be arriving on schedule, or if the animal was loaded on a flight that will arrive earlier. If the intended connection cannot be made, other arrangements would have to be made (i.e., catching a later flight on the same airline or changing to another airline that would be arriving sooner). Most airlines require at least half an hour to unload and process an incoming animal. After an animal has arrived and been transported to the receiving facility, the receiving facility should call the shipper to inform them that the animal arrived safely.

It has been standard procedure for the receiving facility to pay shipping costs. It has also been understood for several years that because of the volume of wolves that the red wolf captive-breeding facility at Graham, Washington, ships and receives, the Graham facility does not pay any shipping costs. If there are any questions pertaining to this, representatives may call the captive-breeding coordinator for further details.

Because of the amount of shipping that takes place in the red wolf recovery program, facilities that are shipping wolves can usually count on receiving a crate from another facility. However, this may not occur

equitably if a facility is shipping multiple wolves but is receiving only one in return. Therefore, if a facility requests that their crates be returned, please honor their request.

When received, the animal should be placed in holding and should be given ample food and water. After 24 hours the animal can be placed in its pen if it does not appear to have suffered any ill effects from the shipment. If other animals occupy the pen, it is recommended that the new arrival be held for several days in a kennel adjacent to its new pen, where it can have contact with the other animals through the fence. This procedure will allow all of the animals to become accustomed to each other and allow the new arrival to become familiar with its new surroundings. All of the interactions between the animals should be observed during this period to determine the likelihood of aggressive behavior once the new animal is placed with the other wolves.

The paperwork that is required to accompany the animal includes, but may not be limited to, two copies of a health certificate from the shipper's veterinarian stating the date of the animal's last rabies vaccination and that the animal is in good health, two copies of a U.S. Department of Agriculture (USDA) animal transfer form, health records, and an endangered species permit. Animal data transfer forms, available through the American Association of Zookeepers (Bernie Feldman, Burnet Park Zoo, 1 Conservation Place, Syracuse, New York 13204; Telephone 315/435-8511), plus the animal's transponder number, if applicable, should also be included. Labels for the outside of the crate showing the shipper's name and address, the receivers name and address, and any additional instructions should be attached to the crate. Copies of all necessary documents, as well as all pertinent records and any special instructions concerning the animal, should be forwarded to the receiver if they are not attached to the shipping crate.

A standard 500 size Vari-kennel or equivalent should be used for shipment. In the past, wood-slatted bottoms that were screwed to the bottom of the crate were used in the shipment of red wolves to allow urine and feces to be kept away from the animal during shipment. This procedure has been stopped because some wolves will chew on and splinter the wood, increasing the chance of injury during shipment. All that is required is an appropriate amount of straw or similar material for

bedding. Persons making shipping arrangements should contact the airline as the cargo doors on some aircraft models may require the use of a 400 size crate.

Water and/or food containers are not to be placed in the crate for shipping. Wolves can and will chew the small plastic dishes supplied with the crates. Some airlines or individual airline personnel may argue the need for this based on USDA guidelines and/or their own airline policies. If the shipping facility has had difficulty with a particular airline strictly enforcing this policy, refer to Subpart F, Section 3.139(c), "A sufficient quantity of food and water shall accompany the live animal to provide food and water for such animals for a period of at least 24 hours, except as directed by hibernation, veterinary treatment, normal fasts, and other professionally accepted practices." A letter written by the

facility's veterinarian stating this may help alleviate some delays or refusals to ship. If transport exceeds 24 hours, an attendant from the shipping facility must accompany the wolf.

Because of several recent incidents of red wolves pulling the doors and windows off their shipping crates, modifications to existing Vari-kennels may be required. The most cost-effective solution has been to fabricate aluminum frames for the windows. PVC-coated (14-gauge) 1/2 inch by 1/2 inch welded wire is cut to size and sandwiched between the aluminum frame and the inside of the window and is then secured to the crate with pop rivets. The insides of the doors are covered with the same gauge wire, attached with "J" clips or hog rings. After the animal is in the crate, the door is tied to the crate by way of predrilled holes through the plastic entrance. Burlap is fitted over the doors and windows to reduce stress on the animals during shipment. The time required to modify each crate for shipment is about 2 hours. An aluminum tag with the animal's studbook number should be conspicuously attached to the exterior of the crate door.

Behavioral and Social Characteristics

Literature on canid social behavior has been well documented. Available information with respect to free-ranging red wolves indicates an affinity to social organization. This is normally exhibited in the form of a family group consisting of a dominant (breeding) pair and their offspring from current or previous litters. Young males normally disperse from the family group at about 2 years of age to find mates. This type of social structure is difficult to maintain in the captive setting. Inherent limitations in pen space dimensions and the need to relocate designated wolves to other facilities, supersede maintaining strict adherence to long-term red wolf social groupings. Therefore, scenarios of possible social groupings per pen that could exist include: (1) an adult breeding pair, (2) an adult pair with offspring from 0 to 1 year of age, (3) litter mates up to 24 months of age, and (4) animals from separate litters that would not be expected to breed based on their age.

There appears to be little, if any, outward effect from the removal or separation of siblings from siblings, siblings from adults, or adults from adults. There have been occasions at the Graham facility where a single pup was removed from its adult pair and successfully introduced to another adult pair with pups so that the single pup would derive the benefits of growing up with litter mates. Removal of specific adults or pups from their parents is variable and can be dependent on several considerations; e.g., the flexibility of a facility and their ability to hold an adult pair and/or that pair's pups for an extended period of time, the objectives of the SSP and associated breeding plans, and the needs of the reintroduction program.

Red wolf interactions, upon first association, are generally uneventful; however, these interactions should be monitored for the first few days to get a general idea of compatibility. There have been a few reports of a resident wolf reacting to a newly introduced wolf as though it were intruding on an established territory. This can be particularly evident in the case of wolves that were born at and remain at a facility.

There have been several reports of females in this scenario dominating an introduced male, thereby minimizing the chances for successful breeding. The degree to which established wolves will dominate introductions may be minimized by holding the resident (established) animal in an adjacent holding pen and allowing the newly introduced wolf access to the pen while having visual contact with its new mate or by removing the resident wolf and allowing the new wolf a few days to become familiar with its new surroundings.

Reproduction

Red wolves are monestrous, with breeding occurring from February through March and not deviating based on the latitudinal location where the animals are being maintained. Gestation is 60 to 63 days, with pups being whelped in April or May. The average litter size is four to five pups, with the earliest litter born to date occurring on April 14 and the latest litter occurring on May 25. Pairing red wolves as close to the breeding season as early January has resulted in successful breeding.

Male wolf genitals recede in the spring and are quite reduced in size throughout the summer. They will begin to develop in the late fall, as indicated by the distinct enlargement of the scrotum and general hair loss from the scrotal area. The breeding status of the female is generally not as easily detected. During the short period that the female is in estrus, depending on the individual, there may or may not be a detectable enlargement of the teats and/or vulva and/or detectable blood spotting from the vaginal area. If known, backdating from prior whelping dates may aid in the determination of the period when the animal is most likely to be in breeding status. It appears that once a female has whelped, she will generally whelp near the same date each year.

Occasionally, determination of a female's breeding status can be aided by noting changes in the behavior of the male toward her and/or observing copulation. Although some individuals may show obvious signs of being pregnant shortly after the breeding season, some may not appear pregnant until just prior to whelping. Apparent "false" pregnancies have been observed.

It is important to remember that excessive vaginal discharge during the breeding season, continued spotting after the season, spotting shortly after whelping, or spotting at any other time of the year may indicate that the animal has a uterine or bladder infection. As with other canids, uterine infections can be fatal but can be effectively treated if detected early. Contact the project veterinarian for advice and/or treatment if infections are suspected.

Most healthy captive-born female wolves will at least appear to undergo estrus during their first breeding season, at about 9 months of age; however, in some cases this may be a "false estrus." Although some captive-born female wolves have successfully bred during their first "season," it is generally accepted that female red wolves are not reproductively viable until their second season, at approximately 21 months of age. Captive-born males have successfully bred during their third breeding season, at approximately 31 months of age, and it is generally

accepted that this is the age at which they first become reproductively viable. However, viable sperm have been collected from males as early as 2 years of age, and on at least two occasions, 21-month-old males have produced litters in the wild.

It is generally accepted that wolves exhibit "strong" pair bonding. However, it is not uncommon for wolves to breed with new mates, even when former mates occupy an adjacent pen. To enhance the chances of breeding, it is best to allow the animals to become accustomed to each other and their surroundings by placing them in the pen prior to the breeding season.

Breeding wolves should be examined and have their inoculations updated in the fall, prior to being paired for the breeding season. During the examination they should also be checked for internal parasites and treated as prescribed by the project veterinarian. Taking such actions in the fall will lessen the need to disturb the animals during the breeding season as well as reduce the chances of young offspring contacting dangerous parasite loads shortly after birth. Parasite infestations should be monitored and treated, particularly just prior to breeding in February and March and again just prior to whelping. During these periods, monitoring may be accomplished by veterinary examination of stool samples. Treatment of mild infestations can usually be accomplished orally through the animals' food.

Feeding

Wolves should be fed two to three times a week. A high-quality dog food (21 to 22 percent protein, 8 to 13 percent fat, and 2 to 6 percent fiber) should be provided for most of the acclimation period (2 to 2½ pounds per wolf per day). Lower fat content or products with low zinc content may cause skin problems in some animals. Try not to switch brands; this can cause digestive problems in some wolves. Canine diet or indigenous prey can also be provided, if affordable or available, on the same frequency. As release approaches, the wolves should be weaned from dog food and fed an all-meat diet (preferably local prey items). The weaning process should begin 6 weeks prior to release by providing the all-meat diet at the rate of 2 to 2½ pounds per wolf per day. Prey carcasses should be eviscerated, and the abdominal cavity should be dusted with a vitamin supplement (e.g., clovite) before being given to the wolves. Providing several carcasses spread around the pen or dividing the carcasses will assure that the dominant wolf does not get all of the food.

Kibble should be provided until 3 weeks prior to release or until the wolves start to rely solely on the all-meat diet. Eventually the feeding schedule should be varied to expose the wolves to "feast or famine." One way to accomplish this is to provide larger portions of food (5 to 10 pounds per wolf) beginning about 2 weeks prior to release. This will provide food for 2 to 4 days and allow for fasting between feedings. Bones and carcasses should be removed only when they are infested with fly eggs or larvae and begin to rot. At this point the wolves are probably finished with them. A variety of local prey should be provided, if possible, to acquaint the wolves with as much of the local prey base on the island as feasible. Live prey need not be provided. The day prior to release the wolves should be provided with a substantial meal.

Breeding wolves can be fed higher protein (25 to 27 percent), small-kibble food in mid-February, but it is not necessary as long as high-quality food is used. If a female produces a litter of pups, this higher protein diet can be continued until the family is switched to a local prey diet. Occasionally, the wolves can have very large bones (beef variety), on a random basis. If bones are provided, the animals should be monitored because stomach problems can occur in some individuals. Because of the potential problems from bone shards that could perforate intestinal linings, it is best to provide bones as part of local prey carcasses.

When the pups are about 5 to 6 weeks of age, liberal amounts of puppy dog food can be placed in three to four bowls positioned throughout the pen. Dog food should be made available even when carcasses are being provided. It is better to waste a bit of meat and/or dog food than to delay a release because of underweight pups.

Fresh water should be provided *ad libitum* in 2-gallon stainless steel buckets or bowls or a 25-gallon or larger metal water trough. If buckets or bowls are used, more than one per pen should be provided. Water should be changed at least weekly or as needed if the water gets dirty. If buckets are used, water should be changed every other day. The trough or bowls are cleaned each time the water is changed. If water is not available at the pen, a station fire truck can be used to transport water to the pen, provided the tank has not been contaminated with chemicals. In addition to drinking water, in areas of the Southeastern United States where it gets very hot in the summer, A shallow area of water that the wolves can lie in to cool off could be provided. However, if adequate shade is provided, this would not be necessary, and it could cause health, maintenance, capture, and handling problems.

Stainless steel bowls should also be used for puppy food. Dunns automatic dog feeders (25-pound size) are good for dog chow (two per pen). However, the station can make a gravity-fed feeder that provides constant access to food (Paul and Marya Butler, "Gravity-Fed Feeder," *Outdoor Life*, January 1992, pp. 22-23) (Appendix B). The authors of this Protocol gratefully acknowledge *Outdoor Life* and the writers of the article for their permission to use the article in this Protocol. Wolves will dig food out of the feeders. Spilled food should be cleaned up weekly or as needed in order to prevent mold build-up.

Health Checks

Visual Checks. A careful visual check of each adult should be accomplished each week for evidence of health and/or behavioral abnormalities. This check of general health is very important since the number of scheduled handlings should be kept to two (one at the beginning of the acclimation period and one before release). Often this check can be most effectively done while the animals are in the den box. If the visual check indicates a major problem, the keeper should contact the project veterinarian first and/or the captive-breeding coordinator. Checks are to be as brief as possible in order to reduce exposure to humans. No unnecessary activity is allowed in the vicinity of the pen. Each captive wolf should have a working radio collar to facilitate recapture in the event of escape.

Parasite and Disease Control. Adults should be provided ivermectin as a microfilaricide every 30 to 45 days at the rate of 0.1 mg per 5 kg (11.0 pounds); i.e., about 200 micrograms per kg of body weight (or 1 cubic centimeter per 55 to 100 pounds of body weight) subcutaneously (if being handled for other purposes) or orally in their food. To assure that both wolves are treated with the proper dose, one wolf can be locked in a den box with its dose being put on a half can of dog food and placed inside the den box. The other wolf's medicine should be put on the other half can of dog food and left outside the pen. The dog food will be readily eaten, and the caretaker can return in about 30 minutes to release the wolf being held in the den box back into the pen if both have eaten the food. A blood sample should be inspected for microfilaria and heartworm antigen (via difil filter and occult tests, respectively) at the beginning of the acclimation period. If heartworms are present, the decision to treat should be made after consultation with the project veterinarian and the captive-breeding coordinator.

Every 30 to 45 days, stool samples should be collected and inspected by the project veterinarian (using the fecal flotation technique) for parasite eggs. Parasites are treated as prescribed by the project veterinarian. Intestinal parasites can be controlled using Ivermectin (100 micrograms per kg of body weight for hookworms, 200 micrograms per kg for whipworms, and 250 micrograms per kg for roundworms).

Since the number of scheduled handlings should be kept to two, most ectoparasite problems will initially be detected during the weekly visual check. Infestations of ectoparasites should be monitored and controlled on a case-by-case basis as directed by the project veterinarian and captive-breeding coordinator. Look for signs of infestation, such as hair loss, scratching, and engorged ticks around the head and ears or ectoparasites on keepers during visits to the pen. Tick infestations can be devastating to pups. Two weeks prior to occupancy, the acclimation pens should be sprayed with an approved commercial insecticide, in consultation with the project veterinarian, to reduce the number of ectoparasites.

During prerelease health check, adults should be vaccinated subcutaneously against coronavirus (killed virus); leptospirosis, canine distemper, canine parvovirus, canine hepatitis, and parainfluenza (DA₂P+Pv, modified live virus; Fort Dodge Laboratories, Inc., Fort Dodge, Iowa 50501); and rabies (killed virus only) (Rabcine3, Beecham Laboratories, Bristol, Tennessee 37620). Booster rabies shots should be based on the local rabies risk and State requirements, which vary from 1 to 3 years; other booster shots are annual, when possible.

A head count should be made of pups on the day of birth or the first day they are discovered. Mothers usually run from the den site. If the mother does not leave the den site, she may still be in the process of whelping; the keeper should return in 3 to 4 hours. On rare occasions, the female will not leave and will need to be carefully moved and held securely while the pups are checked. Care should be taken during the process so that the female does not track around and injure the pups. If at all possible, wait until the female exits the den to check the pups. Check the number of pups, their sex, functioning of external organs and features, overall appearance, and for staph infection on the feet and stomach. Any

questions about the appearance of the pups or their health should be directed to the project veterinarian and the captive-breeding coordinator. The captive-breeding coordinator must be called as soon as possible and informed of the date of birth, number of pups, sexes, etc. If it is necessary to monitor individual pups, they can be marked (hair clipped or marked with tatoo ink) so that individuals can be identified. Pups should be checked every day for the first week to ensure their health, paying particular attention to the bottoms of the feet for evidence of staph infection (ulcerative pododermatitis), which is evident by a slight to noticeable reddening on the pads. This is caused by abrasions from movement on rough surfaces, such as the wooden or concrete den floors. After the first week, check the pups once a week for staph infection. If staph is present, wash the sores and apply a topical antibiotic (e.g., Panalog) daily. This procedure should be followed until the staph infection is under control (i.e., sores are healed). For severe infection, use a topical and an oral antibiotic (Lincocin Aqua drops or Claramox, for example) twice a day. Other ailments should be managed on a case-by-case basis in consultation with the project veterinarian and the captive-breeding coordinator.

An examination of the pups by an experienced keeper or veterinarian should be scheduled as soon as possible after whelping. Following the veterinarian's exam, the worming and vaccination schedule recommended in this Protocol should be followed, subject to modification by the project veterinarian as he or she sees fit, based on local conditions. By the time the pups are old enough to eat solid food, the parents should be on a totally local prey diet. The parents will regurgitate food for the pups until they are able to handle prey themselves.

Pups should be wormed at 2, 4, 6, 8, and 10 weeks of age. This can be accomplished with Ivermectin, Strongid-T, or any number of anthelmintics. Specific questions about anthelmintics should be directed to the project veterinarian and captive-breeding coordinator. During each worming, pups should be carefully examined and weighed.

Pups should be vaccinated subcutaneously at 6, 9, 12, and 16 weeks against coronavirus (killed virus), leptospirosis, canine distemper, canine parvovirus, canine hepatitis, and parainfluenza. Pups should be vaccinated subcutaneously against rabies at 16 weeks. If possible, these pups will then be given a second rabies vaccine at approximately 12 months of age, when captured to relocate or replace the radio collar.

If abdominal transmitters are to be used, they should be implanted in the pups at 9 to 11 weeks of age by the project veterinarian. The keeper should consult with the project veterinarian concerning needs specific to this surgery (e.g., how long to keep food away from pups before surgery, etc.). Pups should be checked about every 3 days for a 2-week period after surgery to ensure that problems have not developed. Specifics about implant transmitters should be decided upon in consultation with the field coordinator. The incision must be allowed to heal before release. Healing is normally complete in 10 to 14 days.

Small radio collars, outfitted with spacing material to ensure a proper fit, can be used instead of implant transmitters. Specifics about the telemetric equipment used on pups should be decided upon in consultation with the field coordinator.

Prerelease Health Checks and Instrumentation. Prior to release, adult animals should be weighed, measured (length of ear, hind foot, tail, and body and shoulder height); inspected for ectoparasites; vaccinated against coronavirus (killed virus), leptospirosis, canine distemper, canine parvovirus, canine hepatitis, parainfluenza, and rabies; wormed (with Ivermectin); and outfitted with radio collars. Additionally, a blood sample should be collected and checked for heartworm antigen and microfilaria (i.e., conduct occult and difil filter tests), and a stool sample should be collected and inspected for parasite eggs. Release should be postponed until blood and stool samples are tested and confirmed negative. The wolf must be treated prior to release if any tests are positive.

Each wolf should be fitted with a radio transmitter; the transmitter should be tested prior to release. Adult wolves are fitted with radio collars that are equipped with a motion switch and an inactivity switch that is triggered if the collar is inactive for 5½ hours. Specifics about radio collars should be decided upon in consultation with the field coordinator. Pups should be weighed and wormed and the implant site should be inspected prior to release.

FREE-RANGING PHASE

Release

After the wolves have met all the criteria described for prerelease, the wolves can be released using the soft-release technique. This is accomplished by leaving the door to the acclimation pen open on the day of release. This allows the animals to leave at their leisure, exploring surroundings as they go, for familiarity and comfort. The pen can be checked later in the day to see if the wolves have left. The specifics of a release should be defined on a case-by-case basis in consultation with the field coordinator. The release normally occurs in late summer (July through August) but could be delayed, if problems arise, into early fall (September through October).

Supplemental Feeding

Local prey carcasses (eviscerated and the abdominal cavities dusted with a vitamin supplement) should be provided twice a week, at locations where the wolves can find them, for about 4 to 6 weeks after release. They should be provided at the rate of 2 to 2½ pounds per wolf per day to ensure that they have the opportunity to find enough food to maintain a positive energy balance. Several locations should be used to be sure all wolves have the opportunity to feed. Placing carcasses at the intersections of roads and trails is recommended. The carcasses should not be placed in the open in order to reduce the chances of vultures scavenging them. The wolves will find the carcasses if placed under trees or brush. These

locations should be checked the following day to determine if the wolves found the carcasses and fed. Tracks, scent-marking, and other signs can provide clues as to whether the wolves fed there.

From about 6 to 9 weeks after release, a commercial carnivore diet (i.e., horse meat) should be used instead of carcasses. Starting around the seventh week after release, field personnel should inspect fresh scat to determine if the wolves are consistently securing live prey. Supplemental feeding should be discontinued around the ninth to eleventh week after release.

If the land manager desires or needs information on food habits, scat should be grossly examined to determine the types of prey utilized. The scat should then be placed in plastic bags, labeled with the date and location, and frozen for future detailed analysis. Such studies of the food habits are to be charged to the red wolf recovery budget only with the approval of the red wolf coordinator.

Radio-tracking

Standard commercial telemetric collars provide the best results because of a lack of problems with them and a battery life of about 18 months. Capture collars have great potential but currently are a second choice because of numerous equipment problems, short battery life, and expense. Capture collars have gained the attention of the public and convinced them that it is the only way to have complete control over released wolves. In reality, if the locations of wolves are known from regular telemetric equipment, the animals can be recaptured by other means, but not as quickly as with a capture collar if it is working properly. At the present time capture collars are used occasionally as a public relations tool or to address a particular problem but are not the standard telemetric and recapture equipment for red wolves.

Abdominal transmitters are used as the telemetric system in pups too small for collars. They can also be used as a back-up system in case of telemetric collar failure in adults, if a particular situation makes this desirable. New collar techniques using spacing material to obtain a proper fit may supplant the abdominal transmitter system in pups in the future if the results of tests are positive.

The radio-tracking regime described in the following paragraphs is considered intensive and may at times be supplanted by a less vigorous schedule. However, a less vigorous schedule should still be extensive enough to ensure that island personnel have a "good feel" for what the wolves are doing.

After the wolves are roaming free on the island, they should be monitored daily for 7 to 10 days to determine their initial reactions to release, any attempts to leave the island, and initial indications of habitat utilization.

After 7 to 10 days the wolves should be located frequently enough to ensure their presence on the island. For Bulls Island and St. Vincent Island, two to three locations per week should be adequate; on Horn Island,

one location every 7 to 10 days should suffice. If hunts occur on the island, locate the wolves three to four times during the first day and at least once a day thereafter. Personnel must not crowd the wolves when radio-tracking. Location data should be referenced relative to U.S. Geological Survey (USGS) 7.5-minute quadrangle maps and coded according to the Universal Transverse Mercator (UTM) projection system. Weather parameters, data, time, and comments should be recorded on a standard form (Figure 6 - Red Wolf Radio-tracking Form). The land manager should be notified of any strange behavior or anything that might adversely affect the wolves. Do not inform the public of the location of the wolves. Information on charging and care of the receiver should be posted in the storage shed or other prominent location or provided to each person doing the tracking.

If wolves are roaming free on the island during whelping season, the monitoring schedule may be changed to 5 to 7 days per week during the whelping season. The procedures for den monitoring begin 2 to 4 weeks prior to expected denning (approximately mid-April), when routine day and night movements have been established, and continue at least 10 weeks beyond whelping. Monitoring prior to denning consists of obtaining a fixed location for each wolf five times each day (i.e., dawn, midday, dusk, and twice during the night). Approximately 2 weeks before whelping, the female will begin localizing her movements near the den site. This should be easily identified. When sufficient data are available to indicate that a den site has been chosen, the monitoring is increased in order to determine the whelping date and to monitor behavior during the denning period.

Determining the den location can be established while maintaining a distance of more than 400 meters (.25 mile) from the den site. Extreme caution must be observed so that the natural behavior of the wolves is not disrupted. The wolves may relocate their den site if they are disturbed; this could result in the death of pups.

Monitoring after denning has occurred (approximately May through mid-July) will consist of limiting the daytime tracking to twice each day and increasing the nighttime tracking by one of three methods. One method is to track once each hour within a 4- to 6-hour time period in order to obtain fixed positions for both the male and female. A second method is to track the male continuously within a given 4-hour period and locate the female once during this time period (she will probably be at the den site). The third method is to conduct stationary telemetric tracking of the den site within a given 4-hour time period and to note the arrivals and departures.

Whichever monitoring method is used after denning, the time slot will vary each night (i.e., 1900 to 2300 hours on Monday night, 2000 to 2400 hours on Tuesday night, 2100 to 0100 hours the next night, etc.).

Once it appears a den site has been chosen, there are only two occasions when approaching the den site is justified. One is to investigate the area due to a mortality signal. The second occasion

FIGURE 6
RED WOLF RADIO-TRACKING FORM

NOTE: FILL OUT A NEW SHEET FOR EACH WOLF.

ALSO NOTE: SEE BACK OF THIS FORM FOR KEY TO ALL HEADINGS AND ACRONYMS.

WOLF NO. _____

FREQUENCY _____

TR	DATE	TIME (24-HR. CLOCK)	WEATHER				TM	RECEIVER LOCATION		EASTING/ NORTHING	BEARING TO WOLF	DISTANCE TO WOLF	TRANSMITTER LOCATION EASTING/ NORTHING	95% CE	ACTIVITY			OTHER WOLVES PRESENT	COMMENTS
			T	LP	CC	P		NO.	NAME						MC	AC	SF		

KEY TO HEADINGS AND ACRONYMS:

AC = Activity Category¹
CC = Cloud Cover²
CE = Confidence Ellipse
LP = Lunar Phase
MC = Mode Changes³

P = Precipitation⁴
SF = Signal Fluctuations⁵
T = Temperature (Celsius)
TM = Tracking Mode⁶
TR = Tracker (Initials)

¹ - Activity Category (AC)

1 = inactive
2 = ? listen again
3 = active

² - Cloud Cover (CC)

1 = clear
2 = up to 1/4
3 = 1/4 to 1/2
4 = 1/2 to 3/4
5 = 3/4+

³ - Mode Changes (MC)

0-1 = inactive
2 = ? listen again
3+ = active

⁴ - Precipitation (P)

1 = none
2 = light to intermittent rain
3 = constant rain
4 = hail
5 = snow
6 = thunderstorm

⁵ - Signal Fluctuations (SF)

Y = Yes
N = No

⁶ - Tracking Mode (TM)

1 = truck
2 = on foot
3 = boat

could occur after the 10-week post-whelping season. If at that time tracking indicates both adults are leaving the den site (for hunting or taking the pups foraging), it may be possible to locate the den in their absence and to collect pertinent data.

Visual observation may be difficult, but staff should report all sightings to supplement the telemetric data. The time, location, activity, and general health and condition of the animal should be recorded for visual observations.

Parasite Control

About every 30 to 45 days, Ivermectin (about 200 micrograms per kg body weight) should be injected in pieces of meat placed near free-ranging wolves. Baiting the wolves for about a week before treating the bait may provide better control over the bait and assurance that wolves, not other animals, are getting the bait. The drop sites should be inspected the next day to determine whether the "Ivermectin burgers" were found and eaten by the wolves. The intent of the prophylactic parasite control program is to get each wolf to ingest about 200 micrograms of Ivermectin per kg of body weight about every 30 to 45 days.

Recapture

Recapture, including recapture for relocation, should be managed on a case-by-case basis in consultation with the project veterinarian and field coordinator. The wolves should be checked by the project veterinarian or an experienced keeper as soon as they are recaptured. The acclimation pen can be rigged as a trap. After trapping one wolf in the pen, the captured animal must be secured within a den box, or a partition of the pen, or transferred to another pen or kennel for the pen to be reused for additional trapping. If personnel are not successful in capturing the wolves in the pen, modified leg-hold traps are normally set in travel lanes or around carcasses. Personnel from the wild reintroduction projects will conduct the leg-hold trapping. Travel costs for wild reintroduction project personnel have normally been absorbed by the wild reintroduction projects. However, this is negotiable, and, in the event of funding shortages at the wild reintroduction projects, these travel costs may need to be paid by the island projects. Of course, animals with workable capture collars would be recaptured by firing tranquilizer darts via radio signal.

Mortality

A complete necropsy should be performed on any red wolf that dies. Mortality should be reported to the captive-breeding coordinator immediately. The carcass and location should be photographed before it is moved. If the circumstances suggest possible foul play, the U.S. Fish and Wildlife Service's Special Agent having jurisdiction for the area should be notified and should investigate the scene before any disturbance occurs in the vicinity. Once the carcass is retrieved, the radio collar should be removed.

The carcass should be tagged with the date, location, identification number, sex, and contact person (shipper) and should be placed in durable plastic bags. Dead wolves should be significantly cooled, but not frozen, immediately after collection and kept cooled until and during shipment. Although the carcass can be chilled in a freezer before packaging, it must not be frozen as this may damage tissues.

Field personnel should arrange shipping in consultation with a courier service (e.g., Air Freight, United Airlines, Federal Express, etc.) and the National Wildlife Health Research Center (NWHRC) (Telephone 608/264-5411 or 4640). The carcass can then be put in a suitable cooler with frozen blue ice and shipped to NWHRC, 6006 Schroeder Road, Madison, Wisconsin 53711, as soon as possible. A description of the carcass, scene, and other notable information should be included with the shipment papers. A copy of the wolf's personal history and medical records should also be included if possible. After the shipment is picked up by the courier, NWHRC should be notified by phone as to when they can expect the delivery.

TRAINING

Island project personnel should be trained by experienced personnel in the following areas: captive husbandry and red wolf handling procedures, red wolf radio telemetry, and trapping and recapture techniques for large canids. Necessary training should be coordinated with the field coordinator. This training is usually done on the islands, but Alligator River National Wildlife Refuge provides the best opportunity for hands-on experience. A workshop at Alligator River, to include all island personnel needing training, would be the most cost effective and efficient way to provide this training.

REPORTS AND ADMINISTRATION

Reports

Personnel associated with the island projects should provide monthly activity reports to the species coordinator, field coordinator, captive-breeding coordinator, project veterinarian, and site manager. This report does not need to be lengthy but should simply provide significant information or changes. A telephone call could substitute for a report during months when there is little or nothing to report.

If monthly reports are not received, this will be interpreted as a negative report (i.e., nothing significant to report). An annual report must be prepared and distributed to the above personnel, as well as to the other island and wild reintroduction projects.

Records

All records should be entered into a computer in a timely manner and should be copied onto magnetic disks for permanent storage. Each station should have a copy of the current red wolf studbook. All natality, mortality, and shipment of animals needs to be reported to the captive-breeding coordinator so that the studbook can be kept current.

Each island project should have an individual log for each animal and all activity, background history, and health records should be recorded (see Figure 4). This record, along with health and other records, should be kept in a separate file for each wolf.

Telemetric data should be recorded and kept in an orderly fashion, citing, at a minimum, (1) wolf identification, (2) date, (3) time, and (4) location and bearing of fixes (see Figure 6). Each location should be plotted on USGS 7.5-minute quadrangle maps. Data should be summarized annually.

A log should be maintained for recording information about pen maintenance, visual checks, and feedings. Figure 2 provides a sample form for recording this data. Data collected when handling a wolf, whether the animal is in captivity or captured in the wild, should be recorded on standard forms. Figure 5 provides a sample form that can be used. However, different forms for processing captive wolves and wild wolves can be used and thus eliminate unnecessary data entries.

PUBLIC RELATIONS

It is important to strive to keep the public, especially local residents and supporters, informed as to the status of the red wolves and the project. Over the years, the concern and interest of the public in red wolf recovery has continued to grow. We continue to get good local and national exposure. Public acceptance is the overall key to the success of the recovery program. Input should be solicited from the public on important issues. Problems must be solved successfully, quickly, and efficiently. The public must be made to feel like they are a part of the program. Local people must believe the project is a net benefit, considering biology (adds an endangered species to local animal populations) and economics (visitors attracted by red wolf presence and project personnel pumping money into the economy). Island projects can be a steppingstone to mainland reintroductions in the general area if the local people are supportive.

COSTS

This attempt to estimate costs based on the procedures outlined in this Protocol is necessary in order to evaluate cost/benefits and to project and negotiate budget needs for each project. Because the costs are general and based on certain assumptions that may or may not hold true for each project, they are subject to change and should not be considered as a final budget figure for each project. For example, if the time estimates (workload) cannot be accommodated by station positions, it may be necessary to fund a new position. However, if the red wolf project completely funds a position, the red wolf coordinator's desires (considering position description and grade level) should be accommodated. If a full-time position is funded by the red wolf project and a full-time red wolf workload is not present on the island, it would be appropriate to assign other red wolf duties from other red wolf projects as needed (e.g., data analysis, temporary emergency personnel).

needs, etc.). These cost figures do provide a starting point for budget negotiations and may, in time of budget shortfalls, be close to the bottom line.

Assumptions included are that the wolves on the islands will be in captivity for 6 months and in the wild for 6 months. However, an estimated cost is also given for a situation whereby the wolves are in captivity for 2 months and in the wild for 10 months, including the whelping period. The costs are based on a GS-7 position at step 5, with 25 percent added for benefits and rounded to the nearest \$0.50, as of September 1, 1994. However, if a full-time red wolf position is funded, it would normally be at a GS-5 technician level. An attempt was made to be liberal in time estimates. A minimum of 1 hour is allotted for each activity, even if only a few minutes are needed. For example, an assumption is made that it takes 1 hour each way to get to and from the islands. Thus, 2 hours are added to the time estimate for each activity for travel to and from the islands. However, overall time estimates are not a summary of all time estimates. Many of the activities can be accomplished within the overall time estimate for other activities. Following is a list of activities, frequencies, time and personnel needs, and estimated costs.

General Costs

Hours of Training: One person, 1 week = 40

Hours of Report Preparation:

Monthly - 1 hour per month =	12
Annual - 4 hours =	4
Total number of hours =	<u>56</u>

Training/Report Preparation Cost at \$16.00 per hour - \$ 896.00

Miscellaneous Expenses	1,000.00
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Veterinarian Cost - 6 days at \$250 per day -	<u>1,500.00</u>
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TOTAL COST -	\$3,396.00
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Six Months in Captivity/Six Months in the Wild

Captivity. It is assumed that three people are needed when handling adult wolves for any purpose and that two people are needed to handle pups until they have transmitters surgically implanted at 10 weeks of age, at which time three people are used. Processing of adults (arrival, prerelease, shipment, administration of Ivermectin) and pups older than 10 weeks (surgery, inspection of surgery site, original examination by the veterinarian) is estimated to take 4 hours. This 4 hours would also accommodate other routine duties. For cost estimation purposes, a severe staph infection requiring two treatments per day for 2 weeks is included. Because it requires two treatments per day, 8 hours (counting travel) is allotted. Although treatment does not take that long, it would not be practical to leave the island and return. Therefore, the extra time on the island during this 2 weeks could be utilized in other activities.

The visual checks, worming, and vaccination of pups requires two people for 2 hours. However, no time is allotted for worming and vaccination because they are accommodated in other allotted times for other activities (staph infection, visual checks, surgery, inspection of surgery site, and prerelease processing).

The activities requiring more than one person total 41 days as follows: (a) 1 day each for arrival processing, veterinarian's examination of pup, abdominal surgery, prerelease processing, and shipping; (b) 4 days for administration of Ivermectin to adults (two treatments made on arrival and during prerelease processing); (c) 7 days the first week for visual inspection of pups; (d) 14 days for treatment of staph infection; (e) 5 days for inspection of surgery site; and (f) 3 days for visual inspection of pups after first week (2 of 5 weeks included in treatment of staph infection). An additional day is allotted for the annual pen inspection, for a total of 42 days. Subtracting the 42 days from 183 days (6 months in captivity) leaves 141 days, or approximately 20 weeks. An additional 7 days are subtracted for activities under general costs (training, report writing, etc.), leaving 19 weeks for routine activities. The remaining routine activities can be accommodated by one person, three times a week, for 2 hours. This estimate is shown under feeding but also includes weekly pen inspection, removing feces and spoiled food, visual checks of adults, and stool checks of adults. The table on page 34 represents estimated costs for the captivity phase of the alternative of "Six Months in Captivity/Six Months in the Wild."

TASK	HOURS
General: Annual pen inspection, cleaning, changing den bedding, etc. - 1 person, 6 hours	8
Weekly pen inspection - 1 person, 1 hour	*
Remove feces and spoiled food - 1 person, 2 times per week, 1 hour	*
Feeding - 1 person, 3 times per week, 2 hours	228
Prerelease processing - 3 people, 4 hours	18
Shipping (includes processing) - 3 people, 4 hours	18
Adults: Arrival processing - 3 people, 4 hours	18
Ivermectin administration - 3 people, 1 time per month, 4 hours	72
Visual checks - 1 person, 1 time per week, 1 hour	*
Stool checks - 1 person, 1 time per month, 1 hour	*
Pups: Veterinarian exam, after whelping, and processing - 2 people, 4 hours	12
Visual check - 1 person, 1 time per day for first week, 2 hours	14
Visual check - 1 person, 1 time per week after first week for 5 weeks, 2 hours	12
Worming (at 2, 4, 6, 8, and 10 weeks of age) - 2 people, 2 hours	*
Vaccination (at 6, 9, 12, and 16 weeks of age) - 2 people, 2 hours	*
Rabies vaccination (at 16 weeks of age) - 2 people, 2 hours	*
Staph infection treatment - 1 person, 2 times per day for 2 weeks, 6 hours	112
Surgery to implant abdominal transmitter (at 10 weeks of age) - 3 people, 4 hours	18
Inspection of surgery site - 3 people, every 3 days for 2 weeks, 4 hours	60
TOTAL NUMBER OF HOURS	590
TOTAL COST AT \$16.00 PER HOUR	\$9,440.00

*These activities can be accommodated during other activities and do not require additional time.

Wild. Recapture trapping is estimated to take two people 1 week (7 days), and processing of the recaptured wolves takes three people 6 hours (total of 8 hours, counting travel). The remaining time involved is for radio-tracking. For the first 10 days following release, tracking will require about 2 hours maximum each day (4 hours, counting travel). Provision is made for more intensive tracking during two 7-day hunts on the two refuge islands, with the first day requiring three to four fixes per wolf and a total of 6 hours (8 hours, counting travel). This more intensive monitoring on the first day is for the purpose of determining if hunter activities are affecting the wolves (movements, mortalities, etc.) and also to positively influence hunter behavior by having refuge personnel frequent the area. The remaining 6 days of each hunt require one fix each day per wolf or 2 hours per day (4 hours, counting travel). The remaining monitoring is estimated at 12 hours per week on the refuge islands (three times per week, 2 hours monitoring, plus 2 hours travel per day) and 4 hours per week on Horn Island (one time per week).

The recapture trapping (7 days), processing (1 day) and initial monitoring (10 days) totals 18 days. If this amount is subtracted from the 183 days (6 months in the wild), 165 days (24 weeks) of routine monitoring is needed on Horn Island, requiring one time per week. Two hours is sufficient to determine general locations of wolves on Horn Island when working from a boat and when the wolves are together. However, monitoring time could double when the animals are not together, when a more specific location is needed, or when the work must be done on foot or from an all-terrain vehicle. Therefore, an average of 3 hours monitoring time is used in the calculations, for a total of 5 hours per day (including travel). For the refuge islands, an additional 14 days for more intensive monitoring during refuge hunts is included. Therefore, a total of 32 days of more intensive monitoring is required. Subtracting this from 183 days leaves 151 days (22 weeks) of routine monitoring, requiring 12 hours per week (three times per week at 4 hours each time, including travel). No extra time is allotted for providing food (including baiting for Ivermectin treatment), because it can be accomplished within the time allotted for monitoring. The table on page 36 represents estimated costs for the wild phase of the alternative of "Six Months in Captivity/Six Months in the Wild."

TASK	HOURS
<u>General:</u> Provide food - 1 person, 2 times per week for 10 weeks, 2 hours	*
Recapture trapping - 2 people, 1 week, 6 hours per day	112
Recapture processing - 3 people, 4 hours	18
Radio-tracking - 1 person, daily for 10 days, 2 hours	40
<u>Bulls Island and St. Vincent Island:</u> Radio-tracking - 1 person, 3 times per week after 10 days, 2 hours	264
During hunts (two 7-day hunts) - 1 person, 4 times per day for first day, 6 hours	16
During hunts (two 7-day hunts) - 1 person, 1 time per day for 6 days, 2 hours	48
<u>Horn Island:</u> Radio-tracking - 1 person, 1 time per week, 3 hours	120
REFUGE ISLANDS - TOTAL NUMBER OF HOURS TOTAL COST AT \$16.00 PER HOUR	498 \$7,968.00
HORN ISLAND - TOTAL NUMBER OF HOURS TOTAL COST AT \$16.00 PER HOUR	290 \$4,640.00

*These activities can be accommodated during other activities and do not require additional time.

Two Months in Captivity/Ten Months in the Wild

Captivity. The general assumptions and time estimates are included in the write-up on the previous alternative. All activities regarding pups are eliminated. A total of 5 days are allotted for intensive activities (1 day each for annual pen inspection, arrival processing, prerelease processing, shipment, and administration of Ivermectin). Ivermectin will be administered during the arrival and prerelease processing, so only one additional administration after 1 month is needed. Subtracting the 5 days from 62 days (2 months) leaves 57 days, or 8 weeks, of routine activities requiring 12 hours per week (three times per week, 2 hours, plus 2 hours travel per day). The table on page 37 represents estimated costs for the captivity phase of the alternative of "Two Months in Captivity/Ten Months in the Wild."

TASK	HOURS
<u>General:</u> Annual pen inspection, cleaning, changing den bedding, etc. - 1 person, 6 hours	8
Weekly pen inspection - 1 person, 1 hour	*
Remove feces and spoiled food - 1 person, 2 times per week, 1 hour	*
Feeding - 1 person, 3 times per week, 2 hours	96
Prerlease processing - 3 people, 4 hours	18
Shipping (includes processing) - 3 people, 4 hours	18
<u>Adults:</u> Arrival processing - 3 people, 4 hours	18
Ivermectin administration - 3 people, 1 time per month, 4 hours	18
Visual checks - 1 person, 1 time per week, 1 hour	*
Stool checks - 1 person, 1 time per month, 1 hour	*
TOTAL NUMBER OF HOURS	176
TOTAL COST AT \$16.00 PER HOUR	\$2,816.00

*These activities can be accommodated during other activities and do not require additional time.

Wild. The general assumptions and time estimates are included in the write-up on the previous alternative. This alternative requires the addition of den monitoring. The den monitoring is estimated to require one person, 8 hours per day, for 14 weeks (7 days per week), a total of 116 days (7 days for recapture trapping, 1 day for processing, 10 days for initial monitoring each day, and 98 days for den monitoring). An additional 7 days are subtracted here to account for activities under general costs (training, report writing, etc.), for a total of 123 days. Subtracting 123 days from 305 days (10 months) leaves 182 days, or 26 weeks, of routine monitoring at Horn Island, which requires 4 hours per week (one time per week, 2 hours, plus 2 hours travel, per day).

For the refuge islands, an additional 14 days of intensive monitoring during hunts results in a total of 137 days of intensive monitoring. Subtracting the 137 days from 305 days leaves 168 days, or 24 weeks, of routine monitoring requiring 12 hours per week (three times per week, 2 hours, plus 2 hours travel, per day).

The table on page 38 represents estimated costs for the wild phase of the alternative of "Two Months in Captivity/Ten Months in the Wild."

TASK	HOURS
General: Provide food - 1 person, 2 times per week for 10 weeks, 2 hours	*
Recapture trapping - 2 people, 1 week, 6 hours per day	112
Recapture processing - 3 people, 4 hours	18
Radio-tracking - 1 person, daily for 10 days, 2 hours	40
Monitoring: Denning activity - 1 person, every day for 14 weeks Prior to denning - 1 person, 5 times per day for 4 weeks After denning - 1 person, 2 times per day, plus continuous 4 hours for 10 weeks	784*
Bulls Island and St. Vincent Island: Radio-tracking - 1 person, 3 times per week after 10 days, 2 hours	288
During hunts (two 7-day hunts) - 1 person, 4 times per day for first day, 6 hours	16
During hunts (two 7-day hunts) - 1 person, 1 time per day for 6 days, 2 hours	48
Horn Island: Radio-tracking - 1 person, 1 time per week, 3 hours	130
REFUGE ISLANDS - TOTAL NUMBER OF HOURS TOTAL COST AT \$16.00 PER HOUR	1,306 \$20,896.00
HORN ISLAND - TOTAL NUMBER OF HOURS TOTAL COST AT \$16.00 PER HOUR	1,084 \$17,344.00

*These activities can be accommodated during other activities and do not require additional time.

Summary

Total cost estimates for the refuge islands range from \$20,804 for the first alternative (6 months in captivity/6 months in the wild), which includes \$3,396 general costs, \$9,440 captive costs, and \$7,968 wild costs, to \$27,108 for the other alternative (2 months in captivity/10 months in the wild), which includes \$3,396 general costs, \$2,816 captive costs, and \$20,896 wild costs. The total cost estimates for Horn Island range from \$17,476 to \$23,556. The first figure includes \$3,396 general costs, \$9,440 captive costs, and \$4,640 wild costs; whereas the second figure includes \$3,396 general costs, \$2,816 captive costs, and \$17,344 wild costs.. The intensive den monitoring is one aspect that increases costs considerably. If this aspect is eliminated, the costs are reduced for the second alternative (2 months in captivity/10 months

in the wild) to \$17,252 for the refuge islands and \$12,132 for Horn Island. These reductions are based on reducing the 14 weeks of intense monitoring to the routine monitoring level; i.e., 38 weeks for refuge islands and 40 weeks for Horn Island. Therefore, the need for den monitoring must be negotiated with the red wolf coordinator. We will attempt to utilize the islands, as funding permits, until we can determine if the animals from this source are better for wild releases on the mainland. If the results are positive, we will continue the island projects.

CONTACTS

This section lists the contacts that might be required in implementing these projects. Contacts can be kept to a minimum by following these guidelines. All contacts regarding captive situations should be directed to the captive-breeding coordinator, and all contacts regarding wild situations should be directed to the field coordinator. It is the responsibility of these coordinators to notify others when necessary. When contacts with the captive-breeding coordinator are not successful, contact should be made with the field coordinator as a back-up. Likewise, if contact cannot be made with the field coordinator, the red wolf coordinator should be contacted. Following is a list of the primary contacts, with addresses and phone numbers:

Primary Contacts:

Field Coordinator

(Position to be filled)
Alligator River National Wildlife Refuge
U.S. Fish and Wildlife Service
P.O. Box 1969
Manteo, North Carolina 27954
Phone: 919/473-1131; Fax: 919/473-1668

Captive-breeding Coordinator

Will Waddell
Point Defiance Zoo & Aquarium
5400 N. Pearl Street
Tacoma, Washington 98407-3218
Phone: 206/591-5337, Ext. 103; Fax: 206/591-5448

Necropsy

Dr. Nancy Thomas, Pathologist, or Kathy Converse
National Wildlife Health Research Center
6006 Schroeder Road
Madison, Wisconsin 53711
Phone: 608/264-5411 or 4640

Recovery Coordinator

Gary Henry
U.S. Fish and Wildlife Service
330 Ridgefield Court
Asheville, North Carolina 28806
Phone: 704/665-1195, Ext. 226; Fax: 704/665-2782

Other Contacts:Caretaker, Graham Breeding Facility

Sue Behrns
Red Wolf Caretaker
23212 86th Avenue, East
Graham, Washington 98338
Phone: 206/847-4833

Veterinarian, Captive-breeding Program

Dr. Mike Jones
Jones Animal Hospital
3322 South Union
Tacoma, Washington 98407
Phone: 206/383-2616

Veterinarian, Alligator River Project

Drs. Marc Grossman and Mary Burkhart
Roanoke Island Animal Clinic
Highway 64
Manteo, North Carolina 27954
Phone: 919/473-3117

Southern Appalachians Reintroduction Project

Chris Lucash, Wildlife Biologist
U.S. Fish and Wildlife Service
c/o Cades Cove Ranger Station
Townsend, Tennessee 37882
Phone and Fax: 615/448-6835

Bulls Island Project

George C. Garris, Refuge Manager
Cape Romain National Wildlife Refuge
U.S. Fish and Wildlife Service
5801 Highway 17 North
Awendaw, South Carolina 29429
Phone: 803/928-3368 or 3264; Fax: 803/928-3803

St. Vincent Island Project

Donald J. Kosin, Refuge Manager, or
Thomas E. Lewis, Wildlife Biologist
St. Vincent National Wildlife Refuge
U.S. Fish and Wildlife Service
P.O. Box 447
Apalachicola, Florida 32329
Phone: 904/653-8808; Fax: 904/653-9893

Horn Island Project

Jerry Eubanks, Superintendent
Gulf Islands National Seashore
1801 Gulf Breeze Parkway
Gulf Breeze, Florida 32561
Phone: 904/934-2604

Gary Hopkins, Resource Manager
Gulf Islands National Seashore
3500 Park Road
Ocean Springs, Mississippi 39564
Phone: 601/875-9057

Telemetric Equipment

Bill Berger
Telonics
932 E. Impala Avenue
Mesa, Arizona 85204-6699
Phone: 602/892-4444

Handling Equipment (Nets)

North American Sports Products
19669 John Street
Detroit, Michigan 48204
Phone: 313/368-0220

Handling Equipment (Catch-poles)

Ketch-All Company
4149 Santa Fe Road, Number 2
San Luis Obispo, California 93401
Phone: 805/543-7223; Fax: 805/543-7154

Handling Equipment (Muzzles and Vari-kennel Shipping Crates)

Contact Project Veterinarian

APPENDIX A

CHEMICAL RESTRAINT PROCEDURES

These procedures were developed through conversations between Terry Kreeger and Mike Phillips on April 6, 1994, and May 24, 1994, concerning the use of chemical restraint to assist in establishing control of a wolf (i.e., muzzling, removing from a trap, restraining the hind and fore legs, etc.). Always aspirate the syringe before injecting drugs intravenously to ensure that the needle is in the vein. If you cannot "find" the vein for an intravenous injection and you are in an emergency situation, you can administer the drug intramuscularly under the tongue. These procedures are appropriate for use with pregnant wolves.

- I. *Procedures.* The following approach will achieve light anesthesia (via ketamine) and deep sedation (via xylazine).
 - A. Administer a solution of 2 milligrams (mg) ketamine and 1 mg xylazine per pound of wolf. The drug should be administered quickly in order to reduce agitation in the animal. Use a large-bore needle (16 to 18 gauge) to facilitate the injection while the animal is still restrained by the trap.
 - B. Retreat out of sight (while maintaining visual contact) to further reduce agitation in the animal; monitor for 10 minutes to assess the degree of immobilization (the animal may become immobilized within 5 to 10 minutes). Signs to look for are:
 1. Disorientation.
 2. Swaying.
 3. Ataxia (uncoordinated movement).
 4. Drooping head.
 5. Recumbency (lying down).
 - C. If the initial administration of the ketamine/xylazine mixture does not produce the desired effect, administer 2 mg ketamine per pound of wolf and monitor for 10 minutes (immobilization may occur within 5 minutes). **Do not administer additional xylazine.**
 - D. Repeat steps B and C until the animal is immobilized.
 - E. After the wolf appears immobilized, approach the animal quietly (and slowly) and assess the depth of the anesthesia. Spontaneous movement indicates that the animal is not fully immobilized. "Flick" the ear and touch the inside corner of the eye to assess ear twitch and palpebral reflex. Loss of or a slowness of these motor functions indicates immobilization.

- F. Proceed with processing, including physical restraint and muzzling, if needed. Be sure to:
1. Avoid excessive noise or movement.
 2. Cover the animal's eyes to prevent retinal damage from ultraviolet radiation; ophthalmic ointment can be applied to avoid desiccation.
 3. Keep the animal on a flat surface to avoid pressure neuropathy (i.e., degeneration of the central nervous system). Also, inspect the animal's mouth for sticks that may be lodged against the palate. Position the animal to maintain a clear airway, free of saliva drainage, to avoid aspiration.
 4. Monitor the animal's body temperature (about every 5 to 15 minutes, depending on the circumstances) throughout the processing time. The safe range for a wolf is $100^{\circ}\text{F} \pm 4^{\circ}\text{F}$. As the body temperature approaches its limits, take measures to cool or warm the wolf.
 - a. At $105^{\circ}\text{F}+$, take measures to cool the wolf.
 - (1) Pour water over the wolf and fan the animal to promote evaporative cooling.
 - (2) For severe hyperthermia (more than 106°F), total body immersion in water is best.
 - b. At less than 96°F , take measures to warm the wolf.
 - (1) Place the animal in a heated truck or other heated enclosed area.
 - (2) Rub the wolf vigorously and wrap it in blankets, etc.
 5. Monitor the animal's respiration rate. The normal rate for a resting dog is 10 to 20 beats per minute (bpm); 15 to 53 bpm have been reported for resting wolves. Wolves that have been immobilized with a ketamine/xylazine mixture have had respiration rates of $19 \text{ bpm} \pm 7 \text{ bpm}$.
 - a. If respiration slows (or stops) but the animal's color is good (lips and tongue are flesh colored or pink) wait for 30 to 60 seconds. A wolf under respiratory stress will have a muddy colored tongue and gums (due to a lack of oxygen in the bloodstream).
 - b. If breathing doesn't resume, lay the wolf on its side, move the front leg out of the way, place both hands on one side of the thorax, and compress the chest against the ground three to four times during a 5-second period.

You should hear air being exhaled. Compressions should be repeated every 15 to 20 seconds (give the wolf enough time to breath without assistance) for about 2 minutes. (Other techniques for assisting respiration are available but generally require some training, which is available through Safe-Capture International, Inc. [see page 15]. These techniques include AMBU Bag resuscitation via a nose cone or endotracheal tube. Resuscitation via an endotracheal tube is considered the best technique, and the necessary equipment should be made available for personnel who have received proper training in the use of this technique.)

- c. If the wolf doesn't respond, administer 1 mg doxapram (doxapram) per pound of wolf intravenously, which should stimulate the respiratory system within 60 seconds.
- d. If the wolf still doesn't respond, administer 0.1 mg yohimbine per pound of wolf intravenously. Be prepared to physically restrain the wolf until the processing is completed.
6. Monitor the animal's heart rate. The normal rate for resting captive wolves is 49 to 59 bpm; for wolves that have been immobilized with a ketamine/xylazine mixture, the documented range is 80 to 105 bpm. Xylazine depresses the heart rate, but after yohimbine has been administered, the heart rate will increase to 80 to 160 bpm in 2 to 3 minutes.
 - a. If bradycardia (slowing of heart rate) occurs, administer 0.02 mg of atropine per pound of wolf intravenously.
 - b. If cardiac arrest occurs, administer 0.1 to 0.2 milliliter (ml) of 1:1,000 epinephrine directly into the heart. You will be able to determine that the needle is in the heart by noting whether blood is present in the syringe upon aspiration.
 - c. Administer 1 mg dexamethasone per pound of wolf intravenously; inject the drug slowly over a 30- to 60-second period.
 - d. Administer 500 to 1,000 ml ringers solution intravenously or 1,000 ml ringers solution subcutaneously.
7. Monitor the animal for symptoms of shock. Heart rate and capillary refill time (CRT) are physiological parameters that permit shock assessment. An animal in shock has an elevated heart rate and a slow CRT; treat for shock if the CRT is greater than 2 seconds. (The gums should be red or nicely pink; press the gum above the canine tooth and determine the length of time it takes to change back to its

original red or pink color; if greater than 2 seconds, treat for shock.)

- a. If shock occurs, administer 1 mg dexamethasone per pound of wolf intravenously; inject the drug slowly over a 30- to 60-second period.
- b. Administer 500 to 1,000 ml ringers solution intravenously or 1,000 ml ringers solution subcutaneously.
- G. Thirty to forty-five minutes after the last administration of ketamine, carefully assess the depth of the anesthesia. At this point much of the ketamine will have been transformed to inactive metabolites, leaving the wolf immobilized, primarily because of the xylazine. Careful assessment is recommended because wolves can be aroused from the effects of xylazine simply through physical stimulation.
- H. Depending on the depth of the anesthesia, it might be necessary to restrain the wolf.
- I. Administer penicillin (or a derivative), as an infection preventative, at a dosage of approximately 1 ml per 10 pounds of body weight.
- J. Administer 0.1 mg yohimbine per pound intravenously (an intramuscular injection is acceptable, but antagonism takes longer and you can increase the dosage to 0.2 mg per pound). After administering the yohimbine, make sure that all restraining devices have been removed (i.e., muzzle, ropes used to tie the legs, etc.).
- K. Retreat from the area but monitor the wolf to ensure that the animal is capable of coordinated movement. This should occur within 3 to 15 minutes.

DO NOT LEAVE THE WOLF UNATTENDED UNTIL THE ANIMAL IS CAPABLE OF COORDINATED MOVEMENT.

NOTE: IF THERE IS WATER IN THE LUNGS, it is important to force the water out, which is best done by picking the wolf up by the abdomen, elevating the body well above head, and shaking the animal. Water can also be forced out by compressing the lungs.

II. *Drug Information.* It is recognized that other drugs not addressed in these procedures have been used or recommended for wolves. These include ketaset, at an operating range of 5 to 10 mg per pound of wolf, and large animal rompun, at an operating range of 0.5 to 1.0 mg per pound of wolf. Information on the drugs used in these procedures follows.

A. Dosage Administration. The concentration of a drug is listed on the bottle. One milliliter is equivalent to one cubic

A. Dosage Administration. The concentration of a drug is listed on the bottle. One milliliter is equivalent to one cubic centimeter (cc). The concentration of epinephrine is 1:1,000, and the dosage is 0.1 to 0.2 ml, directly into the heart. The concentrations and dosages of the other drugs used are:

DRUG	CONCENTRATION (mg/ml)	DOSAGE (mg/pound)	METHOD OF ADMINISTRATION
Ketamine (anesthetic)	100	1 to 2	IM
Xylazine (sedative)	100	1	IM
Atropine (adjuvant)	0.54	0.02	IM
Yohimbine (antagonist)	2	0.1	IV
Dopram (respiratory stimulant)	20	1	IV
Dexamethasone (steroid)	4	1	IV

B. Characteristics and Effects.

1. **Ketamine hydrochloride** (ketaset) - a dissociative anesthetic that is characterized by producing a cataleptic state (a malleable rigidity of the limbs) in which the eyes remain open with intact corneal and light reflexes. Ketamine is probably one of the most widely used drugs for wildlife immobilization because of its efficacy and high therapeutic index (i.e., safety--the amount of drug causing death versus the amount of drug producing the desired effect). When used alone, ketamine usually causes rough inductions and recoveries, and convulsions are not uncommon. Because of this, ketamine is usually administered with a tranquilizer (e.g., promazine [sparine] or acepromazine) or a sedative (e.g., xylazine). Ketamine is also thought to have amnestic properties. That is, humans (and presumably animals) have little or no recollection of the anesthetic event. There is no complete antagonist for ketamine, although some drugs appear to antagonize some of its effects.
2. **Xylazine** (rompun) - a potent sedative that can be completely antagonized. Sedatives (and tranquilizers like valium [diazepam]) are used in wildlife immobilization as adjuncts to primary immobilizing agents (e.g., ketamine) to hasten and smooth induction and recovery and to reduce the amount of the primary agent required to achieve immobilization.
3. **Atropine sulfate** - adjuvant (facilitator) for ketamine and xylazine mixture. Used primarily to decrease the hypersalivation seen with ketamine and to inhibit the bradycardia associated with xylazine immobilization.

4. Advantages of ketamine/xylazine mixture:

- a. Fast and smooth induction and recovery with the pressor (raising or tending to raise blood pressure) and cataleptic (tending to cause rigidity) effects of ketamine being ameliorated by the depressor, sedative, and myorelaxing (cardiac relaxing) effects of xylazine. One drawback to this combination is the extended recovery or prolonged sedation attributed to xylazine. This drawback is addressed by administering atropine, which reduces salivation and possibility of cardiac arrhythmias, and yohimbine, which antagonizes xylazine.
 - b. Immobilization is almost completely reversible if an antagonist (yohimbine) is administered 30 to 45 minutes after the last administration of ketamine, which (through endogenous biotransformations) is converted to inactive metabolites relatively rapidly.
- C. Drug Mixture Process. Ketamine and xylazine can be mixed so that an immobilizing mixture can be drawn from one vial with the appropriate dosages of each (2 mg ketamine per pound of wolf and 1 mg xylazine per pound of wolf). These two drugs can be obtained in concentrations of 100 mg per ml. A mixed solution totaling 37.5 ml can be made by combining 25.0 ml of ketamine and 12.5 ml of xylazine.

The mixed solution contains a total of 2,500 mg ketamine and 1,250 mg xylazine. This equates to 66.6 mg ketamine/ml solution and 33.3 mg xylazine/ml solution. The mixed solution should be labeled with the date it was prepared. Administer the solution at 0.03 ml per pound of body weight, which provides a dosage of 2 mg ketamine per pound and 1 mg xylazine per pound. The mixed solution should be discarded after 6 months, when a new mixed solution should be prepared.

D. Drug Labels for Vials.

Ketamine/xylazine solution:

Each ml contains 66.6 mg ketamine and 33.3 mg xylazine
Administer 0.03 ml solution per pound of body weight

Atropine

concentration = 0.54 mg/ml

dosage = 0.02 mg per pound

50-pound wolf would need 1 mg solution

administer 2 ml of solution intravenously

Yohimbine

concentration = 2.0 mg/ml

dosage = 0.1 mg per pound

50-pound wolf would need 5 mg solution

administer 2.5 ml of solution intravenously

Dopram
concentration = 20 mg/ml
dosage = 1 mg per pound
50-pound wolf would need 50 mg solution
administer 2.5 ml of solution intravenously

Epinephrine
concentration = 1:1,000
dosage = 0.1 to 0.2 ml per wolf
directly into the heart

Dexamethasone
concentration = 4 mg/ml
dosage = 1 mg per pound
50-pound wolf would need 50 mg solution
administer 12 to 13 ml of solution intravenously slowly over a
30- to 60-second period)

Ketamine
concentration = 100 mg/ml
dosage = 2 mg per pound
50-pound wolf would need 100 mg solution
administer 1 ml of solution

APPENDIX B

Gravity-Fed Feeder

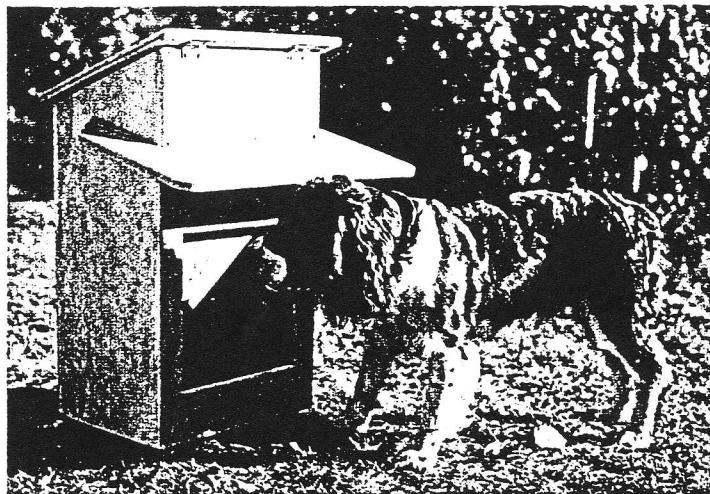
Fill this feeder with dry food and Rover can feed himself for a while. Or, build a larger version to feed wild game.

This gravity-flow feeder can be used to feed a variety of animals including dogs, songbirds and, if you build it large enough, even wild turkeys, deer or other game animals. The feeder will continue to dispense various types of dry food until it is empty, keeping the contents fresh inside as they are released into the bottom tray.

The feeder can be equipped with short legs or placed on stable blocks to keep it off the ground, which will keep it dry and will promote ventilation. It can also be screwed or bolted to a wall, slightly above the ground at a convenient height, using 2x4 spacers between the feeder and the wall to allow room for opening the top.

The feeder shown in the photo and illustration will hold 40 pounds of food or more, but its basic design can be expanded. It can be made taller for additional capacity, or wider, but the chute angle and measurements in relation to the front opening should be maintained approximately the same as shown in the drawing.

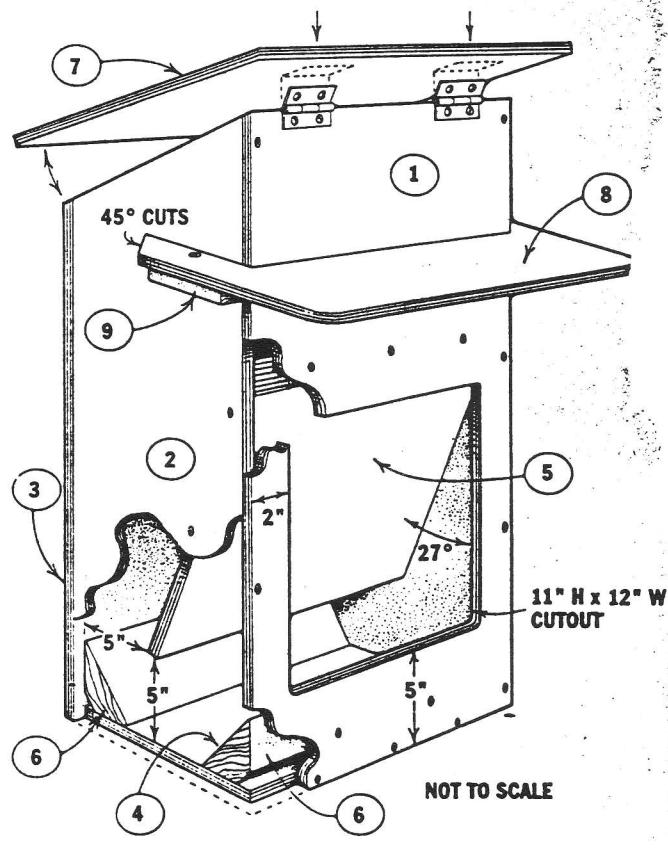
The feeder shown is built of three-quarters-inch-thick CDX plywood with the American Ply-



"Critter," a springer spaniel, licks his chops over this project. The rain hood keeps his food dry, and his begging days are now over.

DIMENSIONS AT A GLANCE

1. Front—16" W x 30 1/2" H
2. Sides—12" W x 25" H (at back); 12" W x 30" H (at front)
3. Back—16" W x 25" H
4. Bottom—12" W x 14 1/2" H
5. Chute—14 1/2" W x 15" H
6. Fillers—(2) 2" W x 6" H x 14 1/2" L with 45x cuts
7. Top—18" W x 16" H
8. Rain Hood—24" W x 7 1/2" H; 16" H overall (optional)
9. Cleats—1 1/2" W x 1" H x 7" L (optional)



wood Association trademark. If the feeder is to be used outside, it is important to use plywood with an "X," or exterior rating, and waterproof glue. Additional weatherproofing can be provided by painting the exterior, but take care not to use toxic paints inside the feeder.

To assemble, first cut out the sides (2), front (1) and back (3), as shown in the drawing. Clamp the four pieces together on a flat level surface using long sliding clamps or have a partner hold the pieces in place. Use two-inch-long self-tapping drywall screws to assemble. Insert screws as required into the corners. Glue is optional. The front and back pieces overlap the sides, so all screws are inserted through the front and back pieces into the side pieces.

After the four pieces are screwed together to form a box, measure and fit the bottom piece (4) and insert screws around the perimeter. Keep it flush with the bottom of the front and back and sides. After the bottom is in place, mark and cut the front opening as shown, using a jigsaw. If you plan to add legs to the bottom, this is a good time to install them, before the chute and top are attached to the feeder. Legs can be made from just about any scrap lumber including equal pieces of 2x4, or nonskid rubber-tipped legs are available.

Next, measure and fit the chute (5) at the correct angle (approximately 27°) and location, and attach with screws through the side of the box. To function properly, the bottom of the chute should be aligned at approximately the same level as the bottom of the front opening. We used three screws on each side to hold the chute in place, but larger versions of the feeder may require more fastenings. For a more professional installation, cut a slight angle on the top edge of the chute, where it attaches to the inside of the front of the feeder. Otherwise the top edge of the chute will form a small ledge that will catch and hold particles of food.

After the chute is in place, attach the top with hinges. Leave a small overhang all around the top to keep water out. Almost any type of small hinge will work, and the hinges can be fastened to the front or back or even to the side of the feeder. You can also latch the top to keep the contents from spilling if the feeder is knocked over.

The angled filler pieces (6) that fit into

the bottom of the feeder can be made by cutting 45° angles on the back side of a 2x6. The 45° angles can be cut on a table saw or they can be formed by hand using a plane. The filler pieces are held in place with drywall screws through the front and back of the feeder. The two pieces keep the food in the bottom of the feeder from lodging and sticking in corners.

The last piece to be attached is the optional rain hood. The hood can prove very useful if the feeder is left out in the weather. The hood is supported by 1 x 1½-inch cleats, positioned on each side

of the feeder as shown. The hood can be attached at any angle that works best to shed water or snow and also does not interfere with the animal's use of the feeder. Have a partner hold the hood at the desired angle and mark the angle. Using screws, attach the cleats to each side of the feeder. The hood is held in place by inserting screws down through the hood into the cleats.

After the feeder is assembled, use a block plane to break all sharp edges, then sand with No. 60 grit sandpaper.



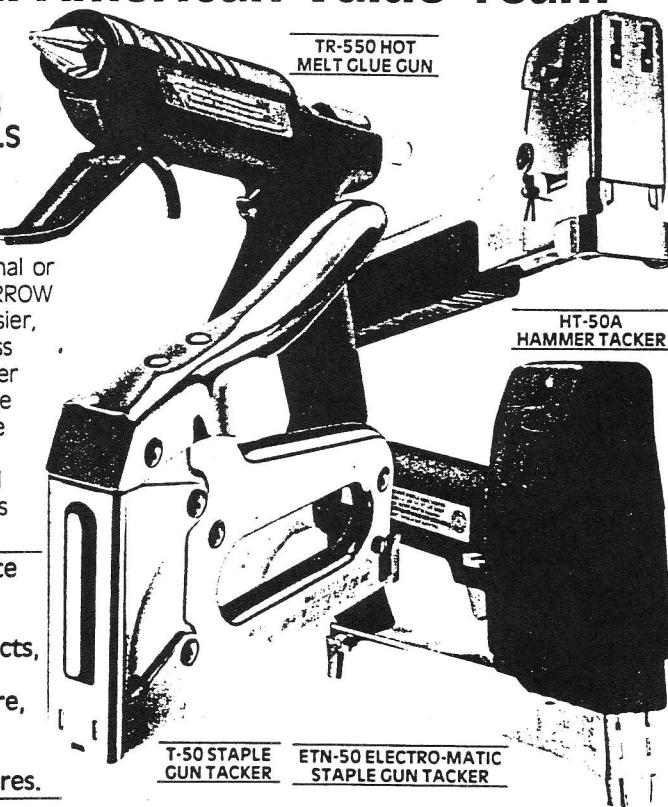
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