"Environmental Lab Skills"
Earthwatch Institute APES Lab (adapted from Jack Ashton)

This lab requires a formal lab report. Follow the APES Formal Lab Report guidelines carefully.

Objectives

To work with metric units.
To review the purpose of lab work and general lab methods.
To create and analysis graphs from collected data.

Materials: ruler, measuring tape, sand, cup or beaker, graduated cylinder, funnel

Introduction

In the summer of 2005, Jack Ashton participated in a field research team studying endemic carnivores of Madagascar. This lab will help students understand some of the basic skills involved in environmental research. The following are excerpts from the briefing about this field work.

Project Background

(Note: Be familiar with the 20 underlined terms. See Pre-Lab Question #1.)

Despite the unique ecology and enigmatic evolutionary history of Malagasy carnivores, members of this family have been the subject of few in-depth field studies. The carnivores of Madagascar, like many other members of the island's biota, display a particularly high degree of endemism among modern taxa. Seven of the eight species of carnivore found on Madagascar have no extant representatives anywhere else in the world. No felid, hyaenid, and canid representatives are commonly recognized within Madagascar's endemic mammalian predator guild. As in most biodiversity hotspots, nonendemic species encroach upon the natural habitats of Madagascar's top endemic predator. Investigating and identifying how both endemic and invasive predators divide their resources and otherwise affect one another provides significant information to increase our understanding of both ecological and conservation issues in Madagascar and abroad.

The current conservation status of the Malagasy carnivores, noted by the International Union for the Conservation of Nature and Natural Resources, ranges from "vulnerable" to "unknown," and many of these species are targeted for persecution by indigenous human populations and continue to decline in numbers. Carnivore populations have been identified in more than twenty protected areas throughout Madagascar (Kohncke and Leonhart 1986), but most of these populations have not been monitored for almost thirty years.

The focal site for this proposed project is the Ampijoroa Research Station and its surrounding area in Ankarafantsika National Park, Madagascar. This project consists of trapping surveys of carnivore populations to estimate their current distributions and relative abundances. Our study focuses on an in-depth examination of the natural history and behavioral ecology of Madagascar's largest carnivore, the puma-like *Cryptoprocta ferox*, commonly known as the fossa. Only three species of Malagasy carnivore are thought to occur at Ampijoroa. These are *Cryptoprocta*, a recently discovered (yet taxonomically unidentified) species of wild cat, and the smaller, nonendemic *Viverricula indica*. We are particularly interested in how invasive, competing species affect the behavioral ecology of the large, endemic *Cryptoprocta*.

The trapping portion of the research project, in which volunteers most actively assist, is merely a portion of the research and conservation activities that are included in this project's priorities. Research pursuits associated with this project range from natural history to veterinary to genetic studies. In addition, the presence of our well-established field team also lends assistance to and promotes the development of other biodiversity studies in the region. The conservation aspect of this work ranges from direct wildlife based educational activities and community outreach to the development of multiple

sustainable alternatives to traditional activities that previously contributed to Madagascar's current biodiversity crisis.

Our conservation and research efforts are in close collaboration with ANGAP, the Department of Water and Forests of Madagascar, the Institute for the Conservation of Tropical Environments, Conservation International, the World Wildlife Fund, and the University of Antananarivo, among other entities currently active throughout the region. Our research provides baseline assessments of current carnivore populations including data on their behavior, abundance and distributions in Ankarafantsika National Park in addition to an established monitoring program on the overall biodiversity of Ankarafantsika. This has established and facilitates long-term monitoring of these populations. In this way, we are developing important scientific results and also help ensure the conservation and maintenance of the endangered species and habitat of Ankarafantiksa and the surrounding Mahajunga basin.

Methods

With the assistance of Earthwatch volunteers, the Principal Investigator, Luke Dollar, conducted his first field season at the Ampijoroa Research Station in 1999 to investigate the research site and lay the groundwork for this ongoing project. The PI led a trapping and radiotelemetry study in the Lac Tsimaloto region of Ankarafantsika (22 km east of the Ampijoroa Research Station) the year before, in 1998. At the Lac Tsimaloto site, six different *Cryptoprocta* were trapped in 12 trapping events during 400 trap-days. More than 300 hours of radiotelemetry data were also collected during this 3.5 week survey. While the biomass of predators found in the Lac Tsimaloto (1998 and 2001 surveys) and Ampijoroa (1999-present) regions of Ankarafantsika National Park was relatively constant, the composition of Ampijoroa's top trophic level was completely unexpected.

Primary Objectives and Their Methods

1) Conduct trapping surveys to further locate and identify the carnivore populations and trends in the Ampijoroa Research Station area of Ankarafantsika National Park, Madagascar, collect anatomical data on each species of carnivore at this site, and to collect carnivore scat samples for analysis of diet composition/contents.

2) Establish baseline indices or indicative measures of relative abundance of *Cryptoprocta ferox* and additional carnivore populations in the dry, deciduous forests of Ankarafantsika.

Animal handling, processing, and measurement

Captured *Viverricula* will be released from the trap into a handling bag. Drug is administered via intramuscular injection with the animal still in the handling bag. Captured *Cryptoprocta* and wildcats are tranquilized while still in the trap using the Pneu-dart drug delivery system. Using the Pneu-dart system, a trained staff member blowpipes the trapped larger carnivores using procedures outlined by Glander, et al. (1992). Anesthesia is delivered via dart in the hindquarters and only if the animal is facing away from the shooter so as to reduce the risk of damage resulting from shots in the face, abdomen, shoulder, or neck.

Once the animal appears to be adequately tranquilized, the darter and an assistant remove the tranquilized animal from the trap or handling bag. Anatomical measurements are taken prior to affixing and activation of the radiocollar device to captured fossa. Anatomical measurements collected include weight, total body length, tail length, hind limb length, hind foot length, hind limb girth, forelimb length, forefoot length, forelimb girth, chest girth, neck circumference, height at shoulder, ear length, canine anterior-posterior and lateral diameter, carnassial molar lengths, and genital measurements. All anatomical data are collected by the lead PI so as to avoid bias in interobserver measurement techniques.

The morphometrics selected represent a conglomeration of anatomical measurements used in several different realms of mammal ecology. Definitions for most of these measures are derived from Dayan & Simberloff (1994) and Eason Smith & Pelton (1996). Body length is measured from the tip of the nose to the base of the tail. Tail length is measured from the base of the tail to the tip of the most distal

bony tail segment (tip of the last tailbone). Hind limb and forelimb length is measured from the medial fold of the limb to the tip of the longest portion of the foot pad. Hind foot and forefoot length is measured from the most proximal to the most distal portion of the foot pad (from the maximum points on the foot). Forelimb girth is measured around the widest portion of the brachium. Hind limb girth is measured around the widest portion of the thigh region. Chest girth is measured just inferior to the forelimbs. Neck circumference is measured at its widest point.

After anatomical measurements, ear-tagging, blood and tissue collection and attachment of a unique color-coded radio collar are complete, the study animal is returned to the traps at the location of capture, monitored until free from drug effects, and released.

Pre-Lab Questions

(put in the questions section at the end of the report)

1) Define, preferably in your own words, the 20 underlined terms in the Project Background and Methods sections. You may use reference materials if necessary. Cite your sources.
2) What is the primary purpose of the research described in the pre-lab?
3) Theorize what use may be made of the analytical data collected about individual organisms.
4) What does the pre-lab say is done to make sure the data collected in a precise (conforming to a strictly proper form) manner?
5) Explain how you would take the following measurements on a person:
   A. Height
   B. Wrist Circumference
   C. Neck Circumference
   D. Total Length from right hand to left hand ("wingspan": longest fingertip to longest fingertip)
   E. Volume of cupped hand

Procedure

Individual Preparation

1) The data table column headings are as follows:

I	II	III	IV	V	VI	VII	VIII	IX
Name	Gender	Height (cm)	Wrist, by self (cm)	Wrist, by partner (cm)	Neck, by self (cm)	Neck, by partner (cm)	Hand to Hand,by partner (cm)	Volume cupped hand, by self (cm^3)

2) Write down your height in inches and convert into cm. (2.54 cm = 1 in.) Show work.
3) Use a measuring tape to measure the circumference of your own wrist and neck. Record data.
4) Choose one partner, of whom you will take measurements. They will take measurements of you.

Partner Data Collection

5) Take the measurements in columns V, VII, VIII of your partner and record them. Let them measure you as well. *Do not talk with your partner about the numbers during this time.* You should not let your partner know the numbers you have recorded for them.
6) With your partner, calculate the volume of your cupped hand (not a fist).
   a. Cup your hand and lift out sand from the container. Allow excess sand to flow back into the container. Once you have a stable amount of sand, have your partner place a cup or beaker under your hand so that you may pour ALL the sand into the beaker.

b. Pour the sand into a graduated cylinder for a more accurate volume reading, to 0.1 mL. You may use a funnel if desired. (1 mL = 1 cm^3). Record data.
c. Replace sand into the container, and clean all equipment.

7) Repeat step 6 for your partner.
8) Once you have recorded all the information about you and your partner into your data table, put that information on the class data table.
9) Copy your information into the class data table. Take a picture ot the class data or copy it down. Make sure you have everyone's numbers.

Data Analysis – Graphs

(NOTE: For this lab, do all the graphs by hand on graph paper, one graph per page. You may use the back side of the paper. Remember, you may have to construct a graph on the AP exam.)

Graph #1

Create a scatter plot of the entire class's height (x-axis) vs. hand to hand distance (y-axis). Include scales, labels, and a best fit line.

Graph #2

Create a bar graph of the entire class's neck circumferences. You may choose self or partner measurements, but be consistent throughout the graph.

Graph #3

Create a bar graph of the entire class's (self OR partner) wrist circumferences, separated by males and females.

Graph #4

Create a bar or line graph of the entire class's cupped hand volumes.

Calculations

1) Conversion of your height to cm.
2) Find the percent difference between your wrist and neck measurements and your partner's measurements of your wrist and neck.
3) Using the data for Graph #2, what is the **mean** neck circumference of the class? What is the **median** neck circumference of the class?

Post-Lab Questions

(put in the questions section at the end of the report)

1) Using Graph #1, what relationship can be shown between height and hand to hand distance?
2) From Graph #3, describe the difference between the wrist circumference of males and females. Judging from the data, would you able to identify if a wrist is male or female from the size?
3) From Graph #4, describe the difference between the cupped hand volume of males and females. Judging from the data, would you able to identify if a hand is male or female from the cupped volume?
4) If your measurements and your partner's measurement of your height, wrist and neck were different, explain some possible reasons for the difference. Why would the differences be important to keep in mind when talking about the data we have collected today?