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LA Urban Coyote Project Volunteer Training Protocol [↗](#)

PLOS One

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ABSTRACT

This scat survey protocol has been developed for use by National Park Service staff of the Santa Monica Mountains National Recreation Area to facilitate the training of citizen science volunteers to collect and analyze coyote scat for the Los Angeles Urban Coyote Project. This protocol provides instructions for the scat project managers to supervise volunteers and train them on how to:

- Walk a scat transect and collect scat
- Identify coyote scat in the field
- Dissect scat
- Identify major prey items

In addition, sections of this protocol detail actions carried out by NPS staff, such as volunteer supervision and quality control, and the protocol for sterilizing and washing scats. We hope this protocol is an effective tool for others who are interested in starting a citizen science scat collection/dissection project in their own research.

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LA Coyote Project Scat Survey Methodology

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Abstract:

This scat survey protocol has been developed for use by National Park Service staff to facilitate the training of citizen science volunteers to collect and analyze coyote scat. Coyote scat will be collected from survey blocks within green spaces in Los Angeles and Ventura Counties on a monthly basis over the next two years. Twenty five survey blocks will be identified which represent a fairly even spatial distribution over the city. Access to these spaces will be secured through communication with landowners. Coyote scat will be collected as thoroughly as possible from a transect within each of these blocks by a team of trained volunteers using rubber gloves and paper bags once monthly. The paper bag corresponding with each scat sample will be labelled with site name, date, and either GPS coordinates or a location estimate, along with the name of the volunteer collecting. The scats will be sterilized by baking them for 24 hours at 60°C, washed and dried, and then analyzed by a combination of NPS and trained volunteers to identify diet. Results will be compiled and analyzed.

Goal: Obtain sufficient coyote scat samples to study the diet of coyotes within the urban and suburban landscapes of Los Angeles and Ventura counties, and how this changes seasonally.

Study Area: Los Angeles (~34°3'0" N, 118°15'0" W; Los Angeles County); the Conejo Valley cities of Thousand Oaks, Westlake

Survey Blocks: Within each green space identified, we will select one or more survey block. These green spaces range greatly in size.

Frequency of Surveys: Volunteers will be asked to survey their assigned survey blocks once monthly. Volunteers will be asked to spend at least 30 minutes to survey sites and not more than an hour, and to record how long each site took them to survey for possible use in analyzing data.

Methodology

Surveying

1. Scat surveys are to be performed once every month. The same transect should be walked monthly.
2. Every scat along the transect will be collected with a separate pair of plastic gloves and placed into one paper bag (two paper bags if it is wet).
3. The outside of the paper bag will be labeled with the volunteer's initials, the date of collection, the name of the site where the scat was collected, and GPS coordinates or a written description of the location where the scat was found.
4. If a volunteer can not survey one of their sites for a month, and their backup also can't, NPS staff will have to do it for them. Find out exactly what the transect is that the volunteer walks and do the same transect.

Coyote Scat Identification



Coyote scat is often twisted and rope-y. Dog scat is blunt and homogenous.



Bobcat scat has characteristic "ball-and-socket" patterns.

Coyote scats are $\frac{3}{8}$ " - $1\frac{3}{8}$ " (1.0 - 3.5 cm) in diameter and 5" - 13" (12.7 - 33.0 cm) long. They will usually contain animal bones, fur, claws, or teeth; seeds; vegetation; or evidence of human food (e.g., candy wrappers, string, tin foil). Coyote scats are typically tapered on the ends, and often have a characteristic twisted appearance. Coyote scat are usually deposited on trails or paths, or in other areas that wildlife are using to travel (likely not in thick dense brush).

The main issue in Los Angeles is differentiating between dog scat and coyote scat. **Dog scat is not to be collected.** For the purposes of this study, only collect scat which contains a significant amount of animal fur or vegetation, or any bones, claws, teeth, seeds, or obvious signs of human-related items. Volunteers are encouraged to gently pick apart scats to aid identification as long as all of the contents make it into the paper bags. Dog scat is usually larger (but can also be smaller or the same size), is more blunt at each end, and will be very uniform in consistency due to the diet of dog food. Some dog scat will have a small amount of dog hair in it, because dogs lick themselves. Some dog scat will also contain little flecks of corn, a component of most dog food, which ends up looking a lot like small seeds- the corn will be more randomly assorted shapes and sizes, and will usually be tan to orange.

Bobcat scat may be present at suburban (i.e., Ventura County) scat lines. It is about the size of coyote scat, but has a very characteristic 'ball and socket' pattern: when broken at a joint, one side of the scat will have a rounded end and the other will have an indentation. In addition, bobcat scat often includes 'token' scats (small spherical scats.) Bobcat scat will always include fur or bones. If the volunteers are unsure whether a scat is bobcat or coyote, have them collect it and add a large, clear, "POSSIBLY BOBCAT" label on the paper bag.

Entering Into the Database and Cross-Checking the Database

Each scat must be entered into the online database. Scats collected by volunteers will be cross-checked with the database.

How to cross-check the database each month:

1. Check each scat collected by volunteers to make sure it is correctly entered in the database. If scats weren't entered correctly (or at all), NPS staff will need to cross check the volunteer roster and email the volunteer whose scats were not entered

properly to see if they need help with the database and to ask them to enter scats in future months.

2. Make sure NPS actually has, in hand, all of the scats that were entered into the database for the month. This can be done at the same time as the first two steps, by coloring the cells for the entries corresponding with each scat in hand as they are checked, and then making sure that all the month's cells are colored. If there are scats entered that NPS does not have, email the appropriate volunteer to ask where the scats are.
3. Make sure that each scat line has at least one entry for the month (either scats or an entry that states "no scats found"). If there are any sites without entries for the month, email the appropriate volunteer to ask to see whether they surveyed their site. If the survey was missed, request that they let you know ahead of time if they need to miss a month in the future.

Sterilizing Scats

All scats must be sterilized. The scats need to be cooked at 60°C for 24 hours.

Confirming & Bagging Scats

All scats must be confirmed as coyote and put into pantyhose ("bagged") so that they can be washed.

1. Pour each scat out of its paper bag onto a paper plate, and, using the information from the 'How to ID Coyote Scat' document, decide whether it is coyote scat.
2. For all scat identified as domestic dog, please photograph the scat(s) and send an email out to all collection volunteers for the month detailing why they should not have been collected. Try to be specific.
3. These scat can be discarded and will need to be removed from the online database. To avoid confusion, please delete all information aside from the site name and the scat number, and type "DOG" into the comments section.
4. For each scat confirmed to be coyote, pour the contents of the paper plate into a section of pantyhose.
5. Look at the bag to see what month the scat was collected in. Each scat needs a label code: a year number (2016 = blank; 2017 = 1; 2018 = 2), a month number (6 = June, 7 = July, 8 = August, etc.) and a two-letter identifier (AA, AB, AC, etc.). For example, the first scat collected in January 2017 would be 21AA and the last could be 21AZ. If the "A-" codes are exhausted, proceed with "BA, BB, B-". Keep track of codes used to prevent duplicates. Create the label code for your scat using an embossing label maker.
6. **Write the label code clearly on the outside of the paper bag the scat came from in red sharpie.**
7. Put the label inside the pantyhose section with the scat and tie a knot in the top of your pantyhose section.
8. At the end of bagging up all scats collected for the month, enter the label codes into the database. **Every scat must have its own unique label code!**

Washing and Drying Scats

Put all pantyhose bundles into the washing machine. Run them through the washing machine once, and then the dryer until they are dry. Scats that are damp will start to mold - be sure they are completely dry before storage.

Dissecting Scats (Volunteers)

1. Select a scat and get a paper towel and scat dissection tools (forceps, dissecting probe, light source, magnification [e.g., dissecting microscope, hand lens; if necessary].)
2. Lay out the paper towel, cut the knot off the pantyhose, and empty the contents of the pantyhose onto the paper towel.
3. Read the **label code** for your scat. It should be a section of label tape from an embossing label maker (for more detail, see the "Confirming and Bagging Scats" section).
4. Match the label code present in the pantyhose with the label code written on a paper bag. Every scat should have a unique label code and match only with its original collection bag. Write the label code on the paper towel.
5. Using forceps and dissecting probes, begin working through the scat from one side to the other, dividing the contents of the scat into piles: fur in one pile, whiskers in a second pile, bones in a third, seed parts in a fourth, etc.
6. **Break apart ALL CLUMPS of dirt and all mats of fur** - dirt and fur tend to get matted around objects such as tiny bones, teeth, or seeds, which could be important to aid identification.
7. Once thoroughly dissected and sorted, get to the detective work of identifying what has been found!
8. Read through the dissection key provided below and look at the example skeletons, museum skins, seed collection, and/or other reference materials provided by NPS. A small sample of any fur should be submitted to Rachel for identification under the microscope. **No blind guessing - make sure you have some evidence to back up your identifications.** If you can't figure it out, please ask NPS staff for help.
9. Take notes of your identifications on the paper towel. You will need to have a list of all the items in your scat to write on the bag once your scat has been double-checked by NPS staff.
10. Once all the separate contents of the scat have identified, a NPS staff member (Justin, Rachel, or the coyote project intern) will need to confirm. They will either give you advice to help you get to the correct identification, or confirm that what you have identified is correct.
11. Once you've had your dissected scat "OK'ed" by NPS staff and your prey item identifications confirmed, write the list of prey items on the paper bag that the scat was originally collected in. NPS staff will write "Checked by [initials]" to confirm the scat's contents are ready to be entered in the database.
12. Wrap up the contents of the scat in the paper towel and replace it into the paper bag. Fold the top of the paper bag down

twice. On the outside of the paper bag, in addition to the contents, you should write "**Dissected on [today's date]**", **dissected by [your name]**".

13. **Please do not wrap up your scat if you have not gotten your identifications confirmed by NPS staff! To ensure high-quality data, everyone's scat must be looked at at least twice - even NPS staff double-check each other's scats.**
14. **You're done! Go get another scat and start over!**

Identification Terminology

These are the terms you will write on your paper towel and plastic bag, and that will be used in the database, to describe what is found in scat. Try to identify down to the most specific possible answer (e.g., bones are present so you know it's an animal, hair is present so you know it's a mammal, the bones are mouse size but you can't tell which species: you've identified a small mammal).

- **Animal** Use this if you find bone pieces which give you no information about what animal you are looking at, and no fur or feathers.
- **Mammal** Use this if you find fur, but you cannot tell anything about the animal from the fur and there are no other distinguishing items.
- **Small Mammal** Use this if you find small bones, the size of the mice or vole and you cannot identify the animal further.
- **House Mouse** House mouse teeth or fur is present
- **Deer Mouse** Deer mouse teeth or fur is present
- **Western Harvest Mouse** Harvest mouse teeth or fur is present
- **California Vole** Vole teeth or fur is present
- **Shrew** Shrew teeth or fur is present
- **Medium Mammal** Use this if you find medium bones, the size of the bones of rats or pocket gophers and you cannot identify the animal further.
- **Non-native Rat** Black/Norway rat teeth or fur is present
- **Woodrat** Woodrat teeth or fur is present
- **Pocket Gopher** Gopher teeth, claws, or fur is present
- **Large Mammal** Use this if you find large bones or bone shards, the size of the bones of squirrels or larger and you cannot identify the animal further.
- **California Ground Squirrel** Ground squirrel teeth, claws, or fur is present
- **Eastern Fox Squirrel** Fox squirrel teeth, claws, or fur is present
- **Western Gray Squirrel** Gray squirrel teeth, claws, or fur is present
- **Rabbit** Rabbit teeth, claws, or fur is present
- **Raccoon** Raccoon teeth, claws, or fur is present
- **Virginia opossum** Opossum teeth, claws, or fur is present
- **Skunk** Skunk teeth, claws, or fur is present
- **Mule Deer** Deer fur is present
- **Bird** Use this if you find feathers or bird talons
- **Reptile** Use this if you find scales, but the shape and size of the scales or any bones cannot tell you what kind of reptile
- **Snake** Belly scutes (the long scales that cover a snake's belly) or keeled scales (with a raised keel down the middle) are present
- **Lizard** Small, diamond-shaped scales are present
- **Insect** If you find an insect parts that cannot be clearly identified as one of the categories below.
- **Earwig** Earwig pincers are present
- **Jerusalem Cricket** Cricket mandibles or legs are present
- **Figeater Beetle** Iridescent green exoskeleton parts present
- **Anthropogenic**
- **Trash** Items that are obviously related to humans, such as food wrappers, aluminum foil, paper, leather, rubber, plastic, etc.
- **Pet Food** Commercial birdseed (sunflower, millet, etc.) or crushed-up corn.

- **Domestic Mammal** Use this if you find solid white fur, or fur of a solid uniform color / consistency which seems like it could not belong to a wild animal, and you can not identify the animal further.
- **Domestic Cat** Cat teeth, claws, or fur is present
- **Domestic Dog** Dog teeth, claws, or fur are present

- **Seed** Use plant name exactly as it appears on the seed example or in the plant identification book



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