

Educational Curriculum Packet

Eastern Coyote Project: Radio-telemetry

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Introduction and Methodology

Congratulations, you/we have now finally captured a coyote. Because we have attached a radio-collar to the coyote we can now track its movements and activities whenever we wish for the next 3 years (that is the life of the collar's battery). Despite all of the hard work spent to finally catch these animals, the work has yet to begin. Radio-telemetry is a very time demanding, costly (in terms of gas expenses), and, at times, difficult endeavor to undertake when following a large, wide-ranging, predatory animal like the coyote.

Radio-telemetry is a technique by which a biologist is able to monitor an animal by remotely tracking a radio signal emitted from a transmitter (i.e., radio-collar) attached to the animal. A researcher can track the signal, and thus the animal's location, by tuning a specifically designed receiver to the transmitter's specific frequency and scanning the surroundings with a directional antenna. (Note: You will be given the frequencies of the coyotes that you will radio-track when the need arises. We do not want to randomly broadcast the frequencies in the best interest of protecting the coyotes as much as possible.) It is also important to note here that the fine tuning part of the receiver can vary for each coyote depending on the weather, thus it is important to know the range of the frequency for each coyote that you are following (this will also be given to you).

An analogy to the process of radio-telemetry comes from your car or home when you tune and listen to different radio stations. In this light, think of each radio station as an individual coyote (the transmitter) and your car stereo/radio as the receiver. You only need one receiver to find numerous radio stations (or coyotes). Generally, the closer one is to the transmitter, the stronger the signal reception. By radio-collaring animals,

biologists can identify individuals, and as I have already mentioned, follow them at any time of the day. In our study we try to sample location points of radio-transmitted coyotes evenly throughout a 24-hour period with at least one location find/coyote/day being the goal. Thus, we attempt to track from midnight through 4 AM almost as much as we do from noon to 4 PM. This unpredictable schedule makes the life of a coyote researcher very demanding and time consuming, but provides key insights into our study subjects. Besides, high school and college kids are always looking for a reason to stay up late. What a perfect fit: nighttime staying up late, normally bored kids, coyote tracking!

The receivers that we use are portable (model CE-12) and weigh about 5 pounds each. The antennas that we generally use are called 3-element Yagi antennas and are about 3 feet long. There are many different types of antennas, so do not be surprised if we use different antennas while you work with us. Both are made by Custom Electronics, Urbana, Illinois and the total cost of a receiver and antenna unit is about \$1,000. The radio collars we use are made by Telonics Inc., Mesa, Arizona. They are supposed to be the top of the line transmitters and cost almost \$300/collar (or implant). They have an active life of almost 3 years. The receivers can be kept from running by having a magnet taped to the collar. This magnet causes a switch (called a reed switch) in the transmitters circuitry to disconnect the battery from functioning, thus conserving battery power by turning it off. Obviously when you catch and collar an animal it is very important to take the magnet off and check to make sure that the collar works.

Typically, we affix an antenna (connected to the receiver which is on the researcher's lap) to the outside of a moving vehicle's closed window until a signal is received. We develop search patterns for each coyote or group of coyotes that is radio-collared. Therefore, it is imperative that, at all times, you have a road map with you while you are tracking so that you can note the roads and directions off the roads of coyote locations. In the "Coyotes that we have known" packet there is a description of the search patterns for existing collared coyotes on Cape Cod; any new coyotes captured

in Boston and/or on Cape Cod will need search patterns developed and, you, the student or teacher, may help us develop them. Once a signal is obtained, the antenna should be removed from the window and a hand held fix used to determine the direction of the signal. This process should be repeated until the animals are pinpointed by using the loudest-signal method. Due to the urban environments and the associated high density of roads, once a signal is obtained for a given coyote we are generally confident that these successful radio-fixes are recorded to within 50 m of their actual locations.

Controlled experiments need to be conducted in Boston to determine the effects of buildings on radio-signals. This can be done by putting collars (i.e., not on an animal) in known places and having students locate them and record their findings.

The method we use for recording data and recommend that you follow is to keep a notebook with a description of all of your activities. In the back of your notebook you should have a hand written spreadsheet of locations/coyote. A separate page should be used for each coyote. On one line you should have the date, time, and description of a single location find (e.g., direction from a number of roads). Locations should be at least 15 minutes apart from one another when tracking coyotes. These data can then be entered into a spreadsheet noting individual coyote, date, time, and coordinate of each location using Universal Transverse Mercator (UTM) X and Y coordinates recovered from a digitized mapping software program (Terrain Navigator, Maptech, Greenland, NH). The digitized mapping program literally allows you to drag a pointer to the exact location where you thought the coyote was for a given location and take a coordinate (we use UTM coordinates which measures every location on earth to the nearest meter, but there are many different systems used to take this location measurement) of that location. Take a look at the example at the end of this packet. These data eventually are used for home range analysis and mapping using specific software programs.

Radio collared coyotes and companions are often sighted during night tracking efforts because coyotes are mainly nocturnal or active at night. Occasionally, it is

possible to position our vehicles in predicted areas of coyote travel (e.g., railroad tracks, powerlines) and watch coyotes cross (undisturbed) in front of our turned-off vehicles. Spotlighting, however, is the most common technique to observe coyotes. Areas can be scanned for 4-8 seconds when a coyote is believed to be close to your vehicles (try not to spotlight into people's yards/houses). Because coyotes run away from the spotlights, we try to keep the spotlights on for <8 seconds per social group per tracking session to try to reduce altering their behavior. If an individual or group is successfully sighted via spotlighting we typically leave the area for >1 hour and go find a new coyote group. This is done to reduce altering their behavior by continuously following them. If we are able to see an individual or group of coyotes without spotlighting then we continue to follow them with the belief that we have not influenced their behavior. Based on observed coyote movements (via telemetry) before and after sightings it quickly becomes apparent when we are altering their behavior. For instance, if a group of coyotes is moving on a corridor (e.g., powerlines) for >1 mile and suddenly change their course of travel when we sight them, then we typically leave the area realizing that we most likely caused them to alter their travel direction. Because of our potential influence on affecting coyote behavior it is my hope that all people who want to radio-track coyotes go through a mandatory 5-day training process with an experienced radio-tracker before being allowed out on their own. This will ensure that we are not bothering coyotes above a predetermined acceptable threshold level.

When one becomes proficient at tracking and finding coyotes, coyotes can be quite visible, especially in the middle of the night. Therefore, a detailed description should be kept on group size and characteristics of each coyote, especially uncollared animals, in an attempt to aid in individual identification. The end of this packet has a form for recording coyote sightings.

If we are lucky we may eventually have 2 or more coyotes from the same social group (pack) radio-collared. If this is the case, we will now be able to study their intra-

group interactions by percent of locations together. We consider radio-transmitting coyotes together if they are <300 m apart and there are no roads separating them. It is important to record this information. I usually put these data to the left of the date and summarize it by writing, for example, WX (the W stands for with and the X stands for a hypothetical coyote for a general location). Both coyotes should be noted as together with each other in their respective spreadsheets. In the location description in the spreadsheet, if ≥ 2 collared coyotes are together I usually write the location in the space for the coyote that has been collared the longest then for the other coyotes I simply write see X (again the hypothetical coyote). This is done simply so I do not have to write the same location more than once. One more thing: to be sure that we get independent locations, we only count coyotes together or not together after 2 hours. For example, if a group of collared coyotes are found to be moving together and 6 locations are taken from 12:00-1:45 then only count them together once (i.e., put a dash to the left of the date indicating the times when group members are not being counted as being together, or not). Once 2:00 comes around, this hypothetical group of coyotes can then be counted as together/not together again.

Thus, at the end of the month (just like in box trapping) we can calculate many things: 1) total location finds (successful + not successful finds = total finds) for each coyote; 2) Percent together for each radio-collared member of a social group; 3) % all together for ≥ 3 coyotes in a group. (Note: It is a rare event to have at least 3 members of a coyote group radio-tagged at the same time.) All of these data should be tallied every month then entered into a computer spreadsheet for future analysis.

Prior research has discovered...

Using the techniques just described, we have discovered that coyotes have large home ranges (about 12 square miles) in suburban areas on Cape Cod. They have been found to be territorial, that is, coyote groups (called packs) defend these home ranges against other groups. Groups on Cape Cod typically consist of 3-4 coyotes. There is the

breeding male and female, and usually 1 or 2 pups (called juveniles) that stay in their natal home range to help raise the next years litter of pups (their younger brothers and sister, assuming that both parents are still alive). These “helper” coyotes are typically called resident associates or betas once they are a year old. Coyotes that do not belong to a family (typically animals 1-2 years old that have left, or dispersed from, their natal group) are termed nomads or transients. These animals usually roam over large areas until they find a suitable territory and a mate to establish a pack of their own. Individual coyotes have been known to travel hundreds of miles from their place of birth and quite obviously are very difficult for us to locate (most biologists find these individuals via airplane instead of car). Look at a map to see where a coyote from your town could potentially disperse to.

Coyotes are very active animals and travel 10-15 miles throughout their home range on a nightly basis. We have found that a single coyote or a group of coyotes can be seen in widely different areas within its/their respective home range during the course of one night. Because coyote groups appear to be territorial, most likely the same individuals are repeatedly sighted in a relatively large area. One dramatic example of long distance movements occurred when a young (resident associate) male coyote in our study traveled off his natal range then back to his family’s home range in one 25-hour span. Although his movement was atypical, in the course of one night, this individual traveled well over 25 miles and moved through five towns – Barnstable, Mashpee, Falmouth, Bourne, Sandwich, and back to Mashpee.

It is now your job to help us in the process of collecting more and more new information on eastern coyotes whether it is in the Boston or Cape Cod area. There are many unanswered, or partially answered, questions that remain. We still need to grasp a better understanding of territoriality and group sizes of coyotes. Are there other coyotes (besides the typical 3-4) that live in coyote home ranges that we just do not document? We have a pretty good grasp that coyotes have large home ranges on Cape Cod. We need

to figure out if this is the case in Boston, and we also need to collect long-term data on both study sites to look for any trends over time. We need to better relate coyote food sources to coyote movements, group sizes, and home range sizes. We need a better understand of sociality in coyotes: that is, why does 3-4 coyotes seem to be the norm for groups on Cape Cod? Is that the case in Boston? We need to collar/implant many more pup coyotes to see how many coyotes simply survive in a given litter (which averages 5 pups/litter). Then we need to understand the dynamics as to why some pups stay with their natal group for over a year while others disperse as young as 6-7 months of age. Interestingly, this is an important question that no one has yet been able to define in the scientific literature.

As you can see there is always much to find out about coyotes. To start, all you need to have are coyotes collared and radio-receivers and cars to find them. The answers will come naturally (albeit, very slowly) over time.

Wariness of the researcher

At this point I think it is important to digress a little in order to talk about how coyotes have reacted to me in the past. This is done so you, the researcher, can understand what you are up against when following this smart, cunning, and elusive predator.

All of the coyotes that I have followed avoid me when possible and seem to disappear into thin air when they become aware of my presence. At the beginning of the study, I suspected that coyotes would associate my scent with a free meal (i.e., via baiting and conditioning them to trap sites) and would rapidly become accustomed to my scent and become comfortable around me. However, because I trap, handle, collar, and track the coyotes, the opposite effect seems to have occurred. They seem to realize that I follow them disproportionately more than the average human does.

For example, one day I was on a golf course approximately 300 meters from a coyote who was lying down on a large rock at the edge of a marsh. This canid was out

in the open (but near brush) and was casually watching as golfers and golf carts traveled within 15-20 meters of him. The moment the wind shifted directions and my scent blew towards the coyote, it immediately stood up and started barking at me. It continued to bark for more than fifteen minutes. Bewildered, the maintenance workers asked me why that coyote was barking directly at me when they were so close to it. I replied that that coyote (and probably all collared groups in our study) must recognize my scent and associate it with danger above and beyond the normal human scent.

It makes sense that the coyotes are wary of me because I am probably the only human that occasionally disturbs them while they are bedded during the day. In addition, I find their dens and pups as I patrol the wooded areas. Interestingly, the incident on the golf course occurred during the denning season. The radio-collared female coyote was in the woods at the den site, and the coyote that barked at me seemed to be guarding and scanning the area for danger. The barking coyote was uncollared but had been sighted several times with the collared female; he appeared to be the breeding male of that group. All of my encounters with coyotes, including disturbing denning sites with multiple adults present, have ended in the same way: the coyotes quickly hightailed it in the opposite direction from me.

Conclusion

You have just been given a description of how radio-telemetry works and what we have learned from using radio-telemetry to study coyotes on Cape Cod. The next packet will give you search patterns and information on all of the coyotes that we have studied on Cape Cod. This information will personalize each coyote and will also help you in finding the existing radio-collared coyotes in the field. Good luck!

Radio-Telemetry Checklist

- _____ Do you have all the frequencies that you will need?
- _____ Do you have a receiver and antenna?
- _____ Do you have a vehicle to travel in?

_____ Do you have a map of the study site?

_____ Do you have a description and/or map of the search pattern for each coyote that you plan on finding?

_____ Have you been trained for ≥ 5 days by experienced personnel?

_____ Do you have a notebook to document coyote locations and coyote sightings?

_____ Have you entered the data into a computer?

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