The Cascades Carnivore Connectivity Project: Evaluating highway barriers to carnivore movement

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Abstract

Washington’s North Cascades Ecosystem (NCE) presents a rare opportunity to host all carnivores native to the region. Unfortunately, I-90, Route 2, and Highway 20 are potential barriers to carnivore movement in the Cascades. The Cascades Carnivore Connectivity Project (CCCC) is using noninvasive methods (i.e., methods that do not require that study animals be captured) to collect genetic material from two focal species: American black bears and martens. DNA extracted from hair and scats will allow us to assess connectivity for carnivores across the NCE, to identify barriers to animal movement, and to detect rare carnivores such as grizzly bears and wolves. This collaborative research effort will help to ensure that transportation planners, land managers, conservationists, and citizens have the scientific information necessary to make sound decisions on highway projects in the region. CCCC is coordinating an extensive survey to detect grizzlies now occupying Washington’s NCE. The results of this survey will assist the US Fish and Wildlife Service in evaluating potential options for grizzly bear recovery in the region.

Introduction

Landscape-scale connectivity, which allows animals to move within ecosystems and provides genetic exchange with outside populations, is a crucial component of carnivore recovery and conservation. Washington’s North Cascades Ecosystem presents a rare opportunity to host all carnivores native to the region. Unfortunately, I-90, Route 2, and Highway 20 are potential barriers to carnivore movement in the Cascades. The Cascades Carnivore Connectivity Project (CCCC) is using noninvasive methods (i.e., methods that do not require that study animals be captured) to collect genetic material from two focal species: American black bears and martens. DNA extracted from hair and scats will allow us to assess connectivity for carnivores across the NCE, to identify barriers to animal movement, and to detect rare carnivores such as grizzly bears and wolves. This collaborative research effort will help to ensure that transportation planners, land managers, conservationists, and citizens have the scientific information necessary to make sound decisions on highway projects in the region. CCCC is coordinating an extensive survey to detect grizzlies now occupying Washington’s NCE. The results of this survey will assist the US Fish and Wildlife Service in evaluating potential options for grizzly bear recovery in the region.

Methods

In recent years, noninvasive survey methods have enhanced our ability to collect genetic samples from elusive carnivores across expansive landscapes (Long et al. 2010). Today’s landscape genetic approaches (Holderegger and Wagner 2008) allow efficient use of samples collected via these survey methods, and enable researchers to assess patterns of gene flow and to visualize the results of movement barriers on the genetic structure of populations. Our project exploits the synergy between noninvasive sampling and landscape genetics to explore barrier effects at a very large scale.

We used hair collection methods to acquire DNA samples from black bears, grizzly bears, and martens. For bears, we deployed two barbed wire corral-type hair snare (Kendlle and McKelvey 2008) within each sample unit. Corrals comprised a single strand of barbed wire stretched around four or more trees at a height of 45.5 cm, with one line of liquid scent lure (cattle blood and fish oil) poured onto a pile of debris at the center of the corral (Fig. 3). Corrals were revisited at 14 days and (a) removed if a sufficient sample was present or (b) rebaited and left for another 14 days if no sample was present. For remote areas identified as priority grizzly bear corridors, foxes were rebaited after two weeks and deployed for the full 28 days. Hair samples from American martens were collected with gun cleaning brushes attached to a plastic enclosure that was baited with chicken and fish oil (Fig. 3B). Marten collection devices were selectively placed in presumed marten habitat. We deployed digital remote cameras at 1,414 stations across the NCE to detect carnivore movement and take photographs of carnivores and their environment.

We also employed two scat detection dog teams (Working Dogs for Conservation, Three Forks, MT) to conduct 15 pilot surveys near I-90 in summer/fall 2008 and 20 surveys near Highway 20 in summer/summer 2009. These efforts were part of a United States Fish and Wildlife Service (USFWS) project (Gaines et al. 2000) designed to assess barriers to genetic exchange among subpopulations, and (3) the location of habitat linkages and connectivity zones for these species throughout the NCE.

Goals and objectives

The major goals of this project are to assess habitat connectivity for carnivores and to advance carnivore conservation in Washington. More specifically, our primary objectives are to:

1. Map occurrences of black bears and martens within the study area;
2. Identify fracture zones and potential habitat linkages across them;
3. Gather genetic data from black bears and martens to identify barriers to genetic exchange among subpopulations, and (3) the location of habitat linkages and connectivity zones for these species throughout the NCE.

Figure 1. A corral-type hair snare deployed in October 2009. Photo: P. McKelvey

Figure 2. In the US NCE, I-90 is traversed by three major highways. (A) I-90, (B) Route 2; and (C) Highway 20. Photo: P. McKelvey

Figure 3. Remote camera photos of a hair marking project 2009 (USFWS 2009). Photo: P. McKelvey

Figure 4. A scent detection dog alerts her handler to fresh black bear and martens scat (Working Dogs for Conservation). Photo: P. McKelvey

Preliminary results and discussion

Over three field seasons (2008–2010), we deployed 274 cors through the US NCE (Fig. 5). We extracted DNA material from a subset of the 1414 hair samples collected, from which 334 individual bears (152 males, 171 females, 12 undetermined) were identified via microsatellite analysis. After attempting unsuccessfully to sample martens in summer/fall 2008–2009, we switched to winter sampling during 2009–2010 and achieved pretty consistent results. To date, we have identified 52 individual martens from 58 detections at 302 locations. Presuming funding is available, we plan to conduct additional marten surveys during winter 2011-12.

During our 2008 pilot dog surveys, we collected 37 black bear scats and 3 marten scats, with 6 bear scats having been identified to the individual level. Our pilot survey results suggest that scats are an adequate source of DNA for conducting landscape genetic analyses with black bears at this time.

In 2011, we will conduct a final season of hair sampling for black bears, black bears, and martens. Once genetic results are available in spring 2012, we will explore a number of methods (e.g., STRUCTURE, Prichard et al. 2000) to test for genetic structuring of carnivore populations. CasualMeeting (Cushman et al. 2006) will be used to test whether observed population structuring (if any occurs) is a result of barrier effects of highways, or may alternatively be a response to other types of landscape features (such as human development, topography, elevation, water bodies, or habitat. Least-cost path models (Singh et al. 2002) and circuit theory models (McRae et al. 2008) derived from our causal analysis results will ultimately be used to identify landscape and management activities that best suit the movement needs of focal species.

Literature cited


Do not hallucinate.