Genetic Diet Analysis of Coyote Scat from Populations in Long Beach

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Abstract

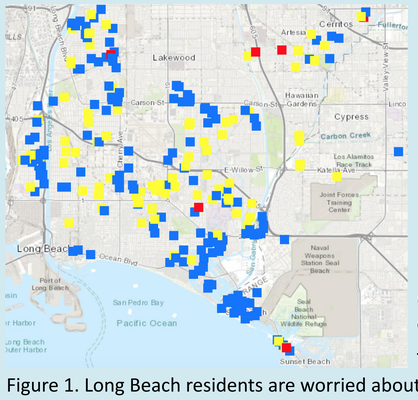
Interactions between humans and local wildlife are inherent to urbanization and have created a demand for wildlife/human management solutions. Coyotes (*Canis latrans)* are prominent in urban ecosystems and can cause a variety of residential threats. The aim of this study is to monitor coyote distribution and activity in Long Beach, CA to better understand urban predatory behavior and develop local wildlife management techniques. One method for better understanding urban coyotes is through scat analysis, which provides insight into the specific animal species that comprise their diet. This study focuses on prey species identification using DNA isolated from coyote scat samples. DNA was isolated using a modified Chelex method, in which scat material was suspended in a higher volume and lower percentage Chelex solution than the standard method. A 1,000 bp portion of the mitochondrial genome, which contains part of the cytochrome b gene and D-loop region, was amplified using PCR. The PCR primers flanked the cytochrome b/D-loop region at sequences that are conserved in nearly all mammals (Foran *et al.* 1997). Since the amplified region is variable between species, restriction enzymes digest the region into different sized fragments. These fragments were visualized using gel electrophoresis and the banding pattern was read to determine species composition. The amplified DNA was digested using the BfaI restriction enzyme. Determining dietary information on coyotes allows us to take effective steps towards managing wildlife and educating Long Beach residents on the predators that share their neighborhoods.

Introduction

- Understanding Long Beach coyote diet is important for developing an informed and effective wildlife management plan.
- Previous research in Southern California showed that urban coyotes acquire up to 25% of their food from anthropomorphic sources, such as garbage, pet food and pets (Riley *et al.* 2003).
- It is difficult to determine coyote diet through observation (Klare *et al*. 2011), so scat analysis is the preferred method (Marucco *et a*l. 2008; van Dijk *et al*. 2007).
- A novel approach to analyzing coyote diet is utilizing genetics to identify DNA of prey items deposited in their scat.
- A 1,000 bp portion of the mitochondrial genome, which contains part of the cytochrome b gene and D-loop region, was amplified using PCR.

Question: What prey items are present in Long Beach urban coyote diet? Do domesticated pets such as cats and dogs make up a significant proportion of the diet?

Hypothesis: Domesticate pets do not make up a large portion of urban coyote diet, which is instead significantly comprised of naturally occurring mammals.



Last updated June 2018, map courtesy of Long Beach Animal Care Services

Figure 1. Long Beach residents are worried about the impact of coyotes on the safety of their pets. This map of the Long Beach area shows different locations of coyote incidents, raising the question if coyotes are consuming domestic cats and dogs.

Methods

- Scat samples were collected near fire station 19 in Long Beach, CA; Latitude: 33-49'22'' N, Longitude: 118-08'03'' W
- Two methods of extractions
  - Modified Chelex
  - QIAmp DNA Stool Mini Kit
- A 1,000 bp portion of the mitochondrial genome, containing part of the cytochrome b gene and D-loop region, was amplified using Polymerase Chain Reaction (PCR)
- Restriction enzyme BfaI digests the amplified DNA, cutting the region into different sized fragments
- Banding pattern was observed via gel electrophoresis to determine diet composition

Data

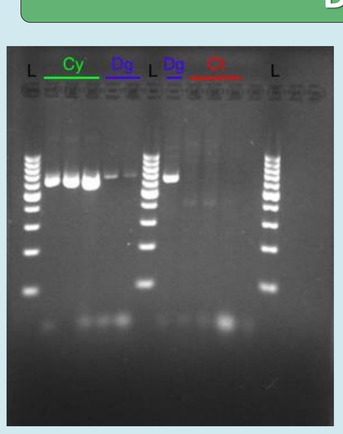


Figure 2. PCR products from coyote, domestic dog and domestic cat tissue DNA using cytb/D-loop primers. Abbreviations are Cy = coyote (*Canis latrans*); Dg = domestic dog (*Canis lupus familiaris*); Ct = domestic cat (*Felis catus*).

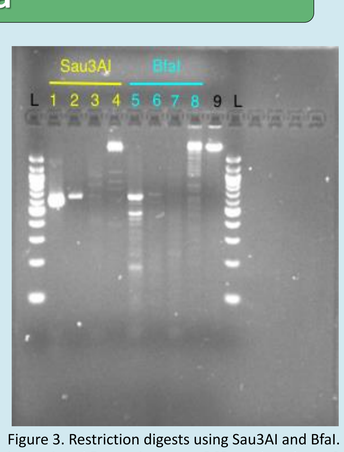


Figure 3. Restriction digests using Sau3AI and BfaI. Lanes 1 and 5 contain coyote PCR product; lanes 2 and 6 contain domestic dog PCR product; lanes 3 and 7 contain domestic cat PCR product; lanes 4 and 8 contain lambda DNA; lane 9 contains undigested lambda DNA.

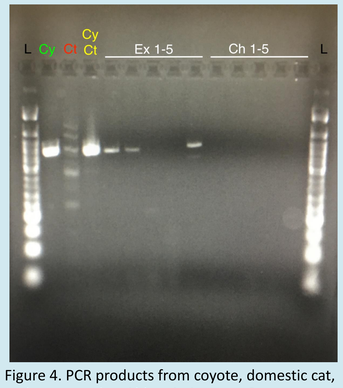


Figure 4. PCR products from coyote, domestic cat, and scat samples. Abbreviations are Cy = coyote (*Canis latrans*); Ct = domestic cat (*Felis catus*); Ex = extraction kit; Ch = Chelex

Results

- 3 out of the 5 scat extraction kit samples amplified, while no modified Chelex samples amplified (Fig. 4)
- Sample five contains domestic dog DNA based off the band size of ~700 bp (Fig. 2)
- Samples one and two contain coyote DNA based off the band size of ~650 bp (Fig. 2)
- BfaI restriction enzyme cuts a ~200 bp coyote-specific fragment and a ~250bp domestic cat-specific fragment (Fig. 3)

Discussion

None of the tested scat samples were determined to contain domestic cat DNA. One of the five scat samples was determined to be from domestic dog and two of the five samples were determined to be from coyote. The Foran et al. 1997 primers are effective in differentiating these three species from differences in PCR product size alone. Future work will entail further use of the BfaI enzyme in order to determine the full scope of the coyote diet.

Characterizing the diet of urban coyotes is essential for developing proper management techniques. Importantly, residents are concerned that coyotes prey on household pets. This concern leads to anxiety amongst residents and to potentially dangerous urban "solutions", such as shooting, trapping or poisoning coyotes (Weckel et al. 2010). Accurately determining the composition of Long Beach coyotes' diets can help the city of Long Beach to educate its residents, mitigate some of their anxiety from urban predators and reduce dangerous population control techniques.

Literature Cited

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Acknowledgements

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