2002

Bobcat Predation on Quail, Birds, and Mesomammals

Michael E. Tewes  
Texas A&M University

Jennifer M. Mock  
Texas A&M University

John H. Young  
Texas Parks and Wildlife Department

Follow this and additional works at: http://trace.tennessee.edu/nqsp

Recommended Citation
Available at: http://trace.tennessee.edu/nqsp/vol5/iss1/9

This Impacts of Depredation on Quail is brought to you for free and open access by Trace: Tennessee Research and Creative Exchange. It has been accepted for inclusion in National Quail Symposium Proceedings by an authorized editor of Trace: Tennessee Research and Creative Exchange. For more information, please contact trace@utk.edu.
BOBCAT PREDATION ON QUAIL, BIRDS, AND MESOMAMMALS

Michael E. Tewes
Caesar Kleberg Wildlife Research Institute, MSC 218, Texas A&M University, Kingsville, TX 78363, USA

Jennifer M. Mock
Caesar Kleberg Wildlife Research Institute, MSC 218, Texas A&M University, Kingsville, TX 78363, USA

John H. Young
Texas Parks and Wildlife Department, Wildlife Diversity Program, 3000 IH 35 South, Suite 100, Austin, TX 78704, USA

ABSTRACT

We reviewed 54 scientific articles about bobcat (Lynx rufus) food habits to determine the occurrence of quail, birds, and mesopredators including red (Vulpes vulpes) and gray fox (Urocyon cinereoargenteus), raccoon (Procyon lotor), skunk (Mephitis spp.), and opossum (Didelphis virginiana). Quail (Colinus virginianus, Cyrtonyx montezumae, Callipepla squamata, C. gambelii, C. californica, Oreortyx pictus) were found in 9 diet studies and constituted >3% of the bobcat diet in only 2 of 54 studies. Birds occurred in 47 studies, but were also a minor dietary component in most studies. Although mesopredators were represented as bobcat prey in 33 of 47 studies, their percent occurrence within bobcat diets was low and showed regional patterns of occurrence. Bobcats are a minor quail predator, but felid effects on mesopredators and secondary impacts on quail need to be studied.


Key words: bobcat, California quail, Callipepla californica, C. gambelii, C. squamata, Colinus virginianus, Cyrtonyx montezumae, depredation, diet, food habits, Gamble’s quail, Lynx rufus, mesomammal, mesopredator, Montezuma quail, mountain quail, northern bobwhite, Oreortyx pictus, scaled quail

INTRODUCTION

The role of bobcat predation on quail is often debated by hunters, wildlife managers, and state agency personnel. Although researchers have studied predators of specific quail populations, a particular quail species was often the research focus while a variety of predators were monitored (Burger et al. 1995, Taylor et al. 2000). Food habit studies focusing on particular predators have often been overlooked by quail researchers and managers. One reason is this information is spread among a variety of literature sources and under titles exclusive of quail. Consequently, quail managers, biologists, and researchers are unaware of these sources that focus on bobcat diets.

Our paper extensively reviews literature about the food habits and foraging ecology of bobcats in North America to determine the relative importance of quail in bobcat diets. The presence of birds in bobcat diets was recorded because some studies failed to identify avian species. Also, the relative use of avian prey relative to mammalian prey is important to understanding bobcat diets and potential for depredation of quail.

Bobcats and other predators (i.e., skunks, raccoons, opossums, and red and gray foxes) in each locale form predator complexes that can have unpredictable and difficult to assess impacts on quail and other bird populations. Bobcats are predators on other mesopredators within their communities, and the reduction of bobcat populations with predator control or fur harvest may have an indirect effect on the population sizes and distributions of potentially more serious quail predators. Consequently, we gathered information on the presence of known mesopredators in the diets of bobcats.

METHODS

We reviewed studies examining bobcat food habits in various locations over North America. Most of the studies were conducted in the United States, although a few occurred in Canada or Mexico.

Sources for ‘data mining’ and information collection of bobcat food habits included journal articles, conference proceedings, books, theses, and dissertations. A Microsoft Excel spreadsheet was developed to organize selected dietary information, including the presence of quail, birds, and mesopredators.

Additional information gathered from each source included study location, dominant habitat or plant community, and method used. Method was recorded as analysis of 1) scats, 2) gastrointestinal tracts (stomach, intestine, and colon), 3) caches or carcasses, and 4) visual observation of depredation events. Sometimes multiple methods (e.g., scat and stomach anal-
Table 1. Selected prey items reported in bobcat diet studies from North America between 1939–2000. Results are reported as maximum percent occurrence for each prey type unless otherwise noted.

<table>
<thead>
<tr>
<th>Reference</th>
<th>State</th>
<th>Method</th>
<th>N</th>
<th>Quail distr.</th>
<th>Quail Grouse</th>
<th>Other birds</th>
<th>Opossum</th>
<th>Racoon</th>
<th>Porcupine</th>
<th>Skunk spp.</th>
<th>Red fox</th>
<th>Gray fox</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NORTHEAST</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fox &amp; Fox 1982</td>
<td>WV</td>
<td>Stomach</td>
<td>172</td>
<td>P</td>
<td>3.5</td>
<td>5.9</td>
<td>5.2</td>
<td>1.2</td>
<td>—</td>
<td>0.6</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Litvaitis, Clark &amp; Hunt 1986</td>
<td>ME</td>
<td>Intestines</td>
<td>170</td>
<td>A</td>
<td>33.3</td>
<td>—</td>
<td>15.4</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Marvillie 1958</td>
<td>MI</td>
<td>Stomach &amp; intestines</td>
<td>8</td>
<td>A</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>P</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Litvaitis, Stevens, &amp; Mautz 1984</td>
<td>NH</td>
<td>Intestines</td>
<td>368</td>
<td>I</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>P</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Nova Scotia, Canada</td>
</tr>
<tr>
<td>Mills 1984</td>
<td>CAN</td>
<td>Scat</td>
<td>47</td>
<td>A</td>
<td>—</td>
<td>8.5</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Stomach</td>
<td>70</td>
<td>A</td>
<td>1.4</td>
<td>4.3</td>
<td>—</td>
<td>2.9</td>
<td>1.4</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Parker &amp; Smith 1983</td>
<td>CAN</td>
<td>Stomach</td>
<td>377</td>
<td>A</td>
<td>7.0</td>
<td>7.0</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Cape Breton Isl., N.S.</td>
</tr>
<tr>
<td>Litvaitis, Major, &amp; Sherburne 1986</td>
<td>ME</td>
<td>Scat</td>
<td>308</td>
<td>A</td>
<td>—</td>
<td>13.3</td>
<td>—</td>
<td>2.8</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Pollack 1951</td>
<td>N. Eng.</td>
<td>Stomach &amp; intestines</td>
<td>208</td>
<td>I</td>
<td>1.4</td>
<td>3.4</td>
<td>—</td>
<td>18.3</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scat</td>
<td>250</td>
<td>I</td>
<td>2.0</td>
<td>1.6</td>
<td>—</td>
<td>6.8</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Rollings 1945</td>
<td>MN</td>
<td>Stomach</td>
<td>50</td>
<td>A</td>
<td>1.0</td>
<td>1.0</td>
<td>—</td>
<td>10.0</td>
<td>1.0</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Frequency of occurrence</td>
</tr>
<tr>
<td>Westfall 1956</td>
<td>ME</td>
<td>Intestines</td>
<td>88</td>
<td>A</td>
<td>6.8</td>
<td>6.8</td>
<td>—</td>
<td>11.4</td>
<td>2.3</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Hamilton &amp; Hunter 1939</td>
<td>VT</td>
<td>Stomach</td>
<td>140</td>
<td>A</td>
<td>—</td>
<td>5.5</td>
<td>1.0</td>
<td>—</td>
<td>7.1</td>
<td>4.4</td>
<td>0.8</td>
<td>0.7</td>
<td>Percentage by bulk</td>
</tr>
<tr>
<td>McCord 1974</td>
<td>MA</td>
<td>Scat</td>
<td>43</td>
<td>P</td>
<td>—</td>
<td>&lt;5.0</td>
<td>—</td>
<td>6.0</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Major &amp; Sherburne 1977</td>
<td>ME</td>
<td>Scat</td>
<td>109</td>
<td>A</td>
<td>—</td>
<td>15.0</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Dibello et al. 1990</td>
<td>ME</td>
<td>Scat</td>
<td>452</td>
<td>A</td>
<td>—</td>
<td>8.5</td>
<td>—</td>
<td>P</td>
<td>—</td>
<td>P</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Litvaitis &amp; Harrison 1989</td>
<td>ME</td>
<td>Scat</td>
<td>346</td>
<td>A</td>
<td>—</td>
<td>9.7</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Litvaitis et al. 1984</td>
<td>NH</td>
<td>Intestines</td>
<td>388</td>
<td>I</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>P</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Litvaitis, Sherburne, &amp; Bissonette 1986</td>
<td>ME</td>
<td>Scat</td>
<td>452</td>
<td>A</td>
<td>—</td>
<td>13.3</td>
<td>—</td>
<td>2.8</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Berg 1979</td>
<td>MN</td>
<td>Stomach</td>
<td>73</td>
<td>A</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>12.0</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Percent frequency</td>
</tr>
<tr>
<td><strong>SOUTHEAST</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kitchings &amp; Story 1979</td>
<td>TN</td>
<td>Scat</td>
<td>31</td>
<td>P</td>
<td>—</td>
<td>14.0</td>
<td>5.0</td>
<td>—</td>
<td>5.0</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Percent frequency occurrence</td>
</tr>
<tr>
<td>Miller &amp; Speake 1978</td>
<td>AL</td>
<td>Stomach</td>
<td>136</td>
<td>P</td>
<td>—</td>
<td>11.1</td>
<td>5.9</td>
<td>0.7</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Story et al. 1982</td>
<td>TN</td>
<td>Scat</td>
<td>218</td>
<td>P</td>
<td>0.9</td>
<td>13.8</td>
<td>5.5</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Progulske 1955</td>
<td>VA</td>
<td>Scat</td>
<td>176</td>
<td>P</td>
<td>—</td>
<td>13.1</td>
<td>20.0</td>
<td>9.0</td>
<td>—</td>
<td>10.0</td>
<td>—</td>
<td>—</td>
<td>Percent frequency of occurrence</td>
</tr>
<tr>
<td>Kight 1962</td>
<td>SC</td>
<td>Scat</td>
<td>317</td>
<td>P</td>
<td>2.6</td>
<td>11.0</td>
<td>0.8</td>
<td>0.4</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Frequency occurrence</td>
</tr>
<tr>
<td>Buttrey 1979</td>
<td>TN</td>
<td>scat</td>
<td>48</td>
<td>P</td>
<td>—</td>
<td>12.2</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Maehr &amp; Brady 1986</td>
<td>FL</td>
<td>Stomach</td>
<td>413</td>
<td>P</td>
<td>6.0</td>
<td>55.0</td>
<td>7.0</td>
<td>4.0</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Frequency</td>
</tr>
<tr>
<td>Wassmer et al. 1988</td>
<td>FL</td>
<td>Scat</td>
<td>146</td>
<td>P</td>
<td>1.4</td>
<td>17.2</td>
<td>3.4</td>
<td>1.4</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td><strong>CENTRAL PLAINS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beasom &amp; Moore 1977</td>
<td>TX</td>
<td>Stomach</td>
<td>125</td>
<td>P</td>
<td>6.0</td>
<td>32.0</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Fritts &amp; Sealander 1978</td>
<td>AR</td>
<td>Stomach</td>
<td>150</td>
<td>P</td>
<td>1.0</td>
<td>7.0</td>
<td>9.0</td>
<td>5.0</td>
<td>—</td>
<td>4.0</td>
<td>1.0</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Leopold &amp; Krausman 1986</td>
<td>TX</td>
<td>Scat</td>
<td>344</td>
<td>P</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>P</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Blankenship 2000</td>
<td>TX</td>
<td>Scat</td>
<td>603</td>
<td>P</td>
<td>0.2</td>
<td>32.8</td>
<td>0.3</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Litvaitis 1981</td>
<td>OK</td>
<td>Scat</td>
<td>40</td>
<td>P</td>
<td>—</td>
<td>27.5</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Mahan 1980</td>
<td>NE</td>
<td>Stomach</td>
<td>57</td>
<td>P</td>
<td>1.8</td>
<td>8.8</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Grouped birds and eggs</td>
</tr>
<tr>
<td>Rolley 1985</td>
<td>OK</td>
<td>Stomach</td>
<td>549</td>
<td>P</td>
<td>—</td>
<td>13.0</td>
<td>P</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Percentage of total prey</td>
</tr>
<tr>
<td>Rolley &amp; Warde 1985</td>
<td>OK</td>
<td>Stomach</td>
<td>145</td>
<td>P</td>
<td>—</td>
<td>11.0</td>
<td>P</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Lehmann 1984</td>
<td>TX</td>
<td>Stomach</td>
<td>—</td>
<td>P</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>Tr</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Trevor et al. 1989</td>
<td>ND</td>
<td>Stomach</td>
<td>74</td>
<td>A</td>
<td>—</td>
<td>6.9</td>
<td>—</td>
<td>1.4</td>
<td>1.4</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
</tbody>
</table>
BOBCAT PREY SPECIES

We examined 54 scientific sources for information on bobcat food habits. This survey included 38 journal articles, 10 symposia proceedings, 3 dissertations, 1 thesis, 1 book chapter, and 1 technical report. Only articles which yielded results from individual studies were used. Previous literature summaries often failed to provide the specific information that we required, and they were not used in the data summaries.

Lagomorphs and rodents were dominant constituents of bobcat diets. Forty-seven studies found either quail, birds, or mesopredators in bobcat diets (Table 1), whereas 7 studies found none of these elements. Dietary studies lacking quail, birds, and mesopredators included Marston (1942), Dill (1947), Cook (1971), Beale and Smith (1973), Litvaitis et al. (1982), Litvaitis et al. (1986b), and Koehler and Hornocker (1991).

The following methods were used in the 47 studies: 18 used scats alone, 22 used both stomachs and intestinal analyses, 6 used stomachs and scats, and 1 used observations of caches, carcasses and predation events.

Of the 35 bobcat diet studies that occurred within known or presumed quail distributions, 9 (25.7%) studies identified quail remains. Four of these studies were conducted in the southeast, 4 in the central plains, and 1 in the northwest. Percent occurrence of quail in the bobcat diets of these studies was consistently low (Table 1).

Birds were identified in 46 (85.2%) of the studies (Table 1) and percent occurrence of this group was usually 10%. Grouse were found in 11 (20.4%) of 47 studies.

Percent occurrence of medium-sized mammalian predators was usually 20% in bobcat diets (Table 1). Opossums occurred in 7 of 8 studies from the southeast and 3 of 10 studies from the central plains (Table 1). Opossums were absent from bobcat diets in the southwest, northwest, and only occurred in 1 of 18 studies from the northeast. Raccoons occurred in 11 of 47 studies, with 6 of these from the southeast. Porcupines (Erethizon dorsatum) were most commonly found in bobcat diets from the northeast (14 of 18 studies). Eleven of the 47 studies identified skunk (Meephitis spp.) remains.

DISCUSSION

Numerous studies have summarized the prey consumed by bobcats through most of their range (Mc-
The occurrence of mesopredators in bobcat diets was also low. However, opossums, raccoons, foxes, and skunks were occasionally encountered. The population densities of mesopredators are usually lower than those of lagomorphs and rodents, and the removal of a few individual predators by bobcats may have relatively greater impacts on the density of mesopredators than smaller mammals.

The interactions of multiple, sympatric predators on one another and their prey form a complex system which has the potential to affect quail as well as other prey. For example, striped skunks (Mephitis mephitis), opossums, and raccoons can be important predators of adult quail and quail eggs (Brennan 1999, Fies and Puckett 2000). These predators are themselves prey for bobcats, coyotes, and mountain lions whose actions may effect the impact on quail and other small prey. Such a complex system is difficult to study and often requires long time periods and considerable resources to obtain reliable data (Blankenship 2000). Although bobcat predation on quail is a direct trophic link, bobcat predation on mesopredators may have subtle and indirect consequences for quail populations.

ACKNOWLEDGMENTS

This is publication no. 02-106 of the Caesar Kleberg Wildlife Research Institute.

LITERATURE CITED

BOBCAT PREY SPECIES

Tewes et al.: Bobcat Predation on Quail, Birds, and Mesomammals

life Federation, Scientific and Technical Series 6, Front Royal, Virginia.