POPULATION SIZE OF THE PENINSULAR PRONGHORN IN BAJA CALIFORNIA SUR, MEXICO

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Peninsular pronghorn, *Antilocapra americana peninsularis*, population survey results from 1979 to 1991 were compared with the results of an April 1993 survey which counted 135 peninsular pronghorns, the highest ever recorded. We identify the probable main factors affecting the subspecies and propose recommendations for additional studies and suggestions for management of the population and its habitat.

INTRODUCTION

The peninsular pronghorn, *Antilocapra americana peninsularis*, is one of the most endangered large mammals in Mexico (Diario Oficial 1994, IUCN 1994). Its historical range encompassed about one-half of the Baja California peninsula (Hall 1981), but presently includes only a fraction of that (Fig. 1). To protect the peninsular pronghorn, it is essential to determine its population size and assess its status.

In this paper we present results of the April 1993 peninsular pronghorn population survey and compare them to those of previous population surveys. In addition, we discuss some factors potentially limiting the recovery of the population. We also suggest potential conservation measures and studies to answer specific habitat relationship questions.

METHODS

The study area is part of the Vizcaíno subdivision of the Sonoran Desert (Fig. 1) (Shreve and Wiggins 1964), consisting of plains with low, scattered vegetation (Brown and Webb 1979, Padilla et al. 1991). Ortega and Arriaga (1991) present a detailed description of this area. The climate is very dry and warm, with mean annual precipitation of 85 cm and mean annual temperature of 18–22°C. Most precipitation occurs during summer (Salinas-Zavala et al. 1991). The soil is mostly of the calcareous Regosol type (Maya and Troyo, 1991), with a sandy texture, little organic material, and high salinity. Vegetation is mainly sarcocaulescent and halophytous scrub (León de la Luz et al. 1991). Sarcocaulescent scrub is dominated by succulent shrubs, *Euphorbia xantii*, *Cercidium sonorae*, and *Jatropha cinerea*. Halophytous scrub is dominated by species with high tolerance to salt, *Euphorbia misera*, *Abronia gracilis*, and *Eriogonum intricatum*. The area is highly influenced by heavy coastal
fog that blankets the area, mainly in spring, and produces abundant epiphytic plants, e.g., *Tillandsia recurvata* and *Rocella tinctoria* (León de la Luz et al. 1991).

From 15 to 20 April 1993, we conducted ground and aerial population surveys of the peninsular pronghorn in the Vizcaíno Desert. The ground survey was performed with 3 teams, each with 1 vehicle and 2 observers. Each team surveyed a different area: the northern, central, and southern desert. To avoid exposure of the remaining peninsula pronghorns to poaching, specific areas surveyed are not shown in Fig. 1. Observers were equipped with 10x50 binoculars. Daily surveys began at 0600 and finished at 1900 hours. Vehicles traveled over the study area, mainly on old roads, at 60 km/hour average speed, with stops at vantage points. A total of 468 personnel-hours was spent in the terrestrial survey, which covered 1,600 km².

Concurrent with the ground survey, an aerial survey was conducted with a Cessna 182 airplane with 1 pilot and 2 observers. It flew at 90 km/hour on east-west transects at 1,000-m intervals at an average height of 100 m. There were 2 flights per day and flights averaged 150 minutes. Approximately 2,500 km² was searched on 207 aerial transects in 27 hours of flight.

The following information was recorded for each peninsular pronghorn observed: date, time of day, group size, sex, and age class (adult, juvenile, or fawn). Location and direction of travel were determined with a Global Positioning System instrument and noted on 1:100,000 maps (Crumpton 1991). Both ground and aerial records were plotted on 1:100,000 maps and compared to avoid duplicate counts.

Figure 1. Location of the Vizcaíno Desert, Baja California Sur, Mexico, showing the current and historic range of peninsular pronghorn and the boundary of the Biosphere Reserve. (Modified from Cancino et al. 1994).
RESULTS

The numbers of peninsular pronghorns observed during the ground and aerial surveys in April 1993 were 51 and 121 individuals, respectively (Table 1). After ground and aerial counts were pooled, the population index of peninsular pronghorn was 135. These 135 individuals were observed in 17 different groups; 7 of these groups were observed in the central area. The sample consisted of 47 adult males, 53 adult females, and 35 fawns. The fawn:female ratio was 66:100 and male:female ratio was 89:100 (Table 1).

DISCUSSION

Fawn ratios differed from survey to survey. Such differences could be a result of the age of fawns. Peninsular pronghorn fawns are born in February and March (Sanabria et al. 1996), so surveys conducted during June and July only count older surviving fawns (Table 1). March and April surveys count new-born fawns that have not yet experienced much mortality.

Our ground survey data were similar to those obtained during previous ground surveys (Table 1). Areas searched and duration of search in most of the past surveys were approximately the same. There is no detailed information on the effort of previous surveys; however, the effort in the present survey is considered the minimum

Table 1. Results of surveys for peninsular pronghorn in the Vizcaíno Desert, Baja California Sur, Mexico. Data from 1979 to 1986 are from Jaramillo1 (1989). Data from 1988 are from Gonzalez-Romero et al. (1991). A = aerial survey, G = ground survey, n/a = not available.

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>Survey type</th>
<th>Total counted</th>
<th>Ratio Male:Female</th>
<th>Ratio Fawn:Female</th>
<th>Sampling area (km²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>Feb</td>
<td>G</td>
<td>83</td>
<td>96:100</td>
<td>43:100</td>
<td>n/a</td>
</tr>
<tr>
<td>1978</td>
<td>Jun</td>
<td>G</td>
<td>80</td>
<td>60:100</td>
<td>17:100</td>
<td>n/a</td>
</tr>
<tr>
<td>1979</td>
<td>Oct</td>
<td>G</td>
<td>54</td>
<td>28:100</td>
<td>88:100</td>
<td>n/a</td>
</tr>
<tr>
<td>1981</td>
<td>Jun</td>
<td>G</td>
<td>47</td>
<td>83:100</td>
<td>56:100</td>
<td>n/a</td>
</tr>
<tr>
<td>1983</td>
<td>Dec</td>
<td>G</td>
<td>46</td>
<td>50:100</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>1984</td>
<td>Apr</td>
<td>A</td>
<td>53</td>
<td>62:100</td>
<td>81:100</td>
<td>n/a</td>
</tr>
<tr>
<td>1985</td>
<td>Mar</td>
<td>G</td>
<td>97</td>
<td>38:100</td>
<td>62:100</td>
<td>n/a</td>
</tr>
<tr>
<td>1988</td>
<td>Mar</td>
<td>G</td>
<td>48</td>
<td>65:100</td>
<td>75:100</td>
<td>n/a</td>
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<tr>
<td>1991</td>
<td>Mar</td>
<td>G</td>
<td>60</td>
<td>88:100</td>
<td>112:100</td>
<td>n/a</td>
</tr>
<tr>
<td>1993</td>
<td>Apr</td>
<td>G</td>
<td>51</td>
<td>94:100</td>
<td>37:100</td>
<td>1,000</td>
</tr>
<tr>
<td>1993</td>
<td>Apr</td>
<td>A</td>
<td>121</td>
<td>80:100</td>
<td>82:100</td>
<td>2,500</td>
</tr>
<tr>
<td>1993</td>
<td>Apr</td>
<td>A-G</td>
<td>135</td>
<td>89:100</td>
<td>66:100</td>
<td>2,500</td>
</tr>
</tbody>
</table>

*These ratios are for juvenile:female peninsular pronghorn born in February and March.

for an adequate census.

Our aerial survey results indicate that the population size in April 1993 was at least twice as large as our ground survey indicated. This indicates that our ground counts missed many animals. Also, our ground surveys were less effective than aerial surveys at detecting fawns. Jaramillo's1 (1989) data from aerial surveys in 1981 and 1984 contradict our results because he found that fewer animals were observed in aerial searches than in ground surveys. Many factors may explain the differences between ground and aerial surveys and among surveys conducted at different times. These include different observers, routes, effort, surveyed areas, topography, and vegetation type, as well as seasonal variation in pronghorn behavior.

Because of the limitations of our study, we cannot determine that every group observed constituted a separate herd. Hence, we do not know the herd ranges or the extent of genetic interchange among herds as the result of seasonal movements. Also, we do not know the extent of migration and its effect on gene flow. Special studies to obtain this information are necessary, including year-round efforts to determine composition, home range, and distribution of herds. Because of the endangered status of the peninsular pronghorn, the genetic diversity of the remaining population should be determined in the very near future.

The high proportion of males in the population suggests that trophy hunting is not a serious problem. However, non-sex-selective hunting for food by local people or opportunistic random shooting by travelers may be a continuing source of mortality. We have no data on hunting mortality, but access to the Vizcaíno Desert is available over many roads and is not controlled. In addition, 4-wheel-drive vehicles can reach off-road areas.

There are positive factors working for the conservation of the peninsular pronghorn. Three measures have been enacted to protect it: 1) hunting has been prohibited since 1922, 2) the Vizcaíno Desert flatland was included as part of a Biosphere Reserve in 1988 (Diario Oficial 1988), and 3) the peninsular pronghorn was added to the list of endangered species in 1994 (Diario Oficial 1994, IUCN 1994). Nevertheless, the threat of habitat degradation, mainly by agriculture, cattle grazing, and mining, remains.

It is possible that the population has increased slightly since the early 1990s. Despite this favorable change, more studies are required to obtain a more complete biological and ecological understanding of the peninsular pronghorn. Systematic population surveys and monitoring of mortality sources and rates, mortality differences by sex, genetic status, availability and quality of forage, and carrying capacity, should be conducted. Studies on interspecific relationships, such as predation (Sanabria et al., 1995, 1996) and competition are also needed.

Absent information from these suggested studies, immediate practical management initiatives are crucial. These include a widely promoted environmental education campaign and, most importantly, stricter protection measures. Immediate protection measures should include patrolling by the local authorities of the current range of distribution, especially the central part where most of the herds are concentrated. Check points should be established at the access to the only paved
road in the area to search for rifles and pronghorn remains. Habitat modification projects for cattle grazing and agriculture should be carefully assessed by the Federal authorities before granting approval.

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