MOUNTAIN QUAIL TRANSLOCATIONS IN
EASTERN OREGON

Project Report: 2003

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Executive Summary

Mountain Quail populations have declined in many areas of the western Great Basin, particularly across former ranges in southeastern Washington, western Idaho, and eastern Oregon. Strategies for restoring declining wildlife populations have been largely reactive with recovery programs typically initiated only after populations or suitable habitats reached critically low levels. Restoration plans were often implemented without a clear understanding of the life-history or habitat requirements of a species. Griffith et al. (1989) suggested conducting research and testing restoration techniques on species before populations reached crisis levels. Mountain Quail are an excellent candidate for translocations given the criteria proposed by Griffith et al. (1989). This species is highly productive with large clutches (10-12 eggs/clutch), and has a highly varied, mostly herbivorous diet. Currently, western Oregon has abundant and easily accessible populations of Mountain Quail that could be a source for re-establishing or supplementing populations in areas of eastern Oregon where populations are rare or have been extirpated.

In 2001, the Oregon Department of Fish and Wildlife, the U.S. Forest Service, and the Game Bird Program at Oregon State University initiated a Mountain Quail translocation and research program for eastern Oregon. The goal of this project was to implement a restoration plan for Mountain Quail in eastern Oregon based on translocations of Mountain Quail from western Oregon to former ranges in eastern Oregon. A critical component of this program was the post-release monitoring of radio-marked, translocated Mountain Quail. Data from the monitoring effort will be used to refine procedures for future translocations and to evaluate the success of translocations.

In winter of 2001, 69 radio-marked birds and 47 banded but un-radioed birds were translocated from southwestern Oregon to 3 sites near the south fork of the John Day River in north-central Oregon. Radio-marked Mountain Quail were monitored from early March-July 2001 to determine survival, movements, and reproductive characteristics. In winter 2002, 93 Mountain Quail captured in southwest Oregon were released in Cabin and Jackass Creeks in the Murderer’s Creek Coordinated Resource Area (MCCRA) and the Maury Mountains in north-central Oregon (Jackle et al. 2002). Seventy-five of the 93 translocated quail were radio-marked and monitored until 30 July 2002.

In 2003, 271 Mountain Quail were captured in southwest Oregon and released in Cabin Creek, Black Canyon, Jackass Creek, and Flat Creek in MCCRA in north-central Oregon and Fly Creek in the Deschutes National Forest (DNF), northwest of Sisters in central Oregon. Seventy-five radio-marked Mountain Quail were translocated to Fly Creek on 4 March, 8 and 15 April. Fifty-seven radio-marked Mountain Quail were translocated to Cabin Creek in MCCRA near the south fork of the John Day River on 4 March and 8 April. Radio-marked quail were monitored primarily with ground telemetry from time of release until 30 July 2003. One hundred and thirty-nine banded (without radios) Mountain Quail were released in Cabin Creek, Black Canyon, Jackass Creek, Flat Creek on 4 March, 8 and 15 April. This report summarizes the information collected on radio-marked Mountain Quail in spring-summer 2003.

For radio-marked Mountain Quail in 2003, the mean distance from release sites to breeding ranges was 2.6 km. Juvenile and adult quail had similar movement patterns, but
males moved further than females to breeding ranges. Males and females, and juvenile and adult quail had similar survival rates. Twenty-two nests of translocated quail were located with a mean clutch size of 10.5 eggs and a mean hatch size of 7.9 chicks. Eighteen nests successfully hatched chicks. Male-incubated nests had similar (to females) clutch sizes but produced fewer chicks and had more infertile or unhatched eggs. Sixty percent of nests were produced by birds released on 4 March. Mean hatch date was 24 June. All radio-marked Mountain Quail released in Fly Creek that produced nests were paired with un-marked native quail.

For 2004, 100 Mountain Quail will be translocated to Fly Creek in the Deschutes National Forest with approximately 50 birds radio-marked. Another 100 Mountain Quail will be translocated to Wolf Creek in the Malheur National Forest near Burns and released with approximately 50 birds radio-marked for monitoring. Project protocols require that 100 Mountain Quail be released at each site for 3 consecutive years. Information taken from radio-marked birds on habitat use, survival, reproductive success, and movements at each site will provide data essential for the evaluation of the translocation program and allow for refinements of site selection procedures and monitoring protocols.
INTRODUCTION

Mountain Quail (*Oreortyx pictus*) are the largest of 6 species of New World quail in North America. They are secretive birds that inhabit a diverse range of habitats, but typically are associated with early seral, shrub vegetation. Males and females have identical plumage and size characteristics. Mountain Quail are the least studied of the New World quail in North America with much of the biological knowledge based on incomplete or anecdotal sources (Pope 2002).

Mountain Quail populations have declined in many areas of the western Great Basin during the past century (Brennan 1990, 1994, Vogel and Reese 1995, Gutiérrez and Delehanty 1999, Pope 2002). Their current geographic range extends south to the Baja Peninsula, north to Vancouver Island in British Columbia, and east to western Idaho and Nevada (Crawford 2000). Historically, there were accounts of Mountain Quail in every county in Oregon (Jobanek 1997). Currently, Mountain Quail are common in the Coast and Cascade Mountain Ranges of western Oregon, and are less common or have been extirpated in many areas east of the Cascade Mountain Range (Pope 2002).

The lack of information on Mountain Quail and their apparent decline in many areas of eastern Oregon prompted the Game Bird Research Program at Oregon State University (OSU) to initiate a research project on Mountain Quail ecology in 1996. This research compared the life history attributes (habitat selection, survival, reproduction, and movement patterns) of a sample population of Mountain Quail in southwestern Oregon in the lower Cascades where populations are stable and abundant with a resident population near Hell’s Canyon in northeastern Oregon where Mountain Quail may be declining. An additional goal was to translocate a sample of Mountain Quail from southwestern Oregon...
to northeastern Oregon, and compare the life history of these transplanted quail with the
resident populations in Hell’s Canyon and in the Cascades.

Results from this research were used to develop a Mountain Quail translocation
and research plan for eastern Oregon (Pope et al. 2002) with translocations as a major
pro-active component of this plan. The first phase of this translocation effort included the
release of wild Mountain Quail (captured in the southwestern Cascades) into multiple
sites in the John Day River Basin in north-central Oregon. The research objectives of the
first phase were to monitor a radio-marked sample of quail released at sites selected in
historic ranges of Mountain Quail in eastern Oregon to:

1) determine habitat use, survival, reproduction parameters, and movements of
   translocated quail in areas that differ ecologically,
2) to determine if translocated radio-marked Mountain Quail can be used to
   locate resident populations of Mountain Quail in eastern Oregon, and
3) to refine and evaluate protocols for future translocations and post-release
   monitoring procedures.

The first phase was initiated in the winter of 2001 with the translocation of 69
radio-marked birds and 47 banded but un-radioed birds to 3 sites in MCCRA near the
south fork of the John Day River. In winter of 2002, 66 radio-collared birds were
released in 2 of the 3 release sites used in 2001 near the south fork of the John Day River,
and 27 birds (9 radio-collared, 18 banded) were released in the Maury Mountains near
Prineville. During the spring of 2003, 271 Mountain Quail (132 radio-marked and 139
banded) were captured in southwest Oregon and released at four sites in MCCRA and at
Fly Creek in the Deschutes National Forest northwest of Sisters. This report is a summary
of the translocations and post-release monitoring of radio-marked Mountain Quail
completed in 2003.
In 2001, the Oregon Department of Fish and Wildlife, the U.S. Forest Service, and the Game Bird Program at Oregon State University began a mapping effort to record Mountain Quail locations taken from survey forms sent to state, federal, and private organizations in 1996, 1998, and 2002. The primary objective of this work was to better understand current distributions of Mountain Quail in eastern Oregon. A secondary objective was to review the literature to determine historic locations and distributions of Mountain Quail in eastern Oregon. Included in this report is an updated accounting of Mountain Quail locations on current and historic distributions in eastern Oregon (See Appendix 1).

METHODS

STUDY AREA

The 43,193 ha MCCRA (Figure 1) is jointly managed by the Bureau of Land Management (BLM) and the Oregon Department of Fish and Wildlife (ODFW), and includes the 9256 ha Phillip W. Schneider Wildlife Area managed by ODFW. Historical records indicated heavy livestock use on the Murderer’s Creek flats from 1912-1972, with public land permits allocating 50,000 AUM’s compared with 6,000 today (ODFW, unpublished report). In 1972, ODFW purchased part of Murderer’s Creek to provide winter range habitat for mule deer, control wildlife damage, and protect riparian zones. Current grazing practices combine high density, short duration grazing with a rest/rotation system.

Four sites in MCCRA, Black, Jackass Creek, Flat Creek, and Cabin Creek, were selected as release locations based on vegetation complexity and diversity. Jackass Creek, a tributary of the south fork John Day River, has steep, rugged, slopes dominated
Figure 1. Murderers Creek Cooperative Resource Area and Fly Creek in the Deschutes National Forest Mountain Quail translocation sites in north-central and central Oregon, spring 2003.
by western juniper with diverse understory shrubs, dominated by mountain big sagebrush
(*Artemisia tridentata vaseyana*) and bitterbrush (*Purshia tridentata*). Cabin Creek
(tributary of Murderer’s Creek), Flat Creek, and Black Canyon, are characterized by
gentle-sloped, grassy uplands dominated by western juniper (*Juniperus occidentalis*) and
bitterbrush and riparian zones dominated by red alder (*Alnus rubra*) and willow (*Salix*
ssp.). Upland and ridge-top forests are dominated by stands of ponderosa pine (*Pinus*
ponderosa), Douglas-fir (*Pseudotsuga menziesii*), mountain mahogany (*Cerocarpus*
*betuloides*), and grand fir (*Abies grandis*). Elevations range from 701 m at canyon
bottoms to 2130 m on the top of Aldrich Mountain. Temperatures in 2003 averaged from
a monthly high of 32.7° C in July to a low of -3° C in January. Most of the moisture in
this area falls in the form of snow, and the average annual moisture accumulation is 29
cm (Oregon State Climate Center, Oregon State University).

The Fly Creek translocation site (Figure 1) is 30 km northwest of Sisters, Oregon
and is in an area primarily managed by the Deschutes National Forest. Fly Creek drains
into the Metolius arm of Lake Billy Chinook and is 1.5 km from the edge of the Eyerly
fire that burned an estimated 23,573 acres in 2002. Fly Creek is characterized by gentle-
sloped, grassy uplands dominated by ponderosa pine and western juniper with bitterbrush
the dominant shrub. Ridge-top forests are dominated by ponderosa pine, white fir (*Abies*
amabilis), and Douglas-fir with ceanothus (*Ceanothus* sp.) and manzanita
(*Arctostaphylos* spp) being the primary understory. Elevations range from 600 m on the
shore of Lake Billy Chinook to 1460 m on the top of Green Ridge. Temperatures in 2003
averaged from a monthly mean high of 29° C in July to a low of –4° C in January.
Annual precipitation for 2003 was 26 cm (Oregon State Climate Center, Oregon State University).

CAPTURE AND RADIO TELEMETRY

We captured Mountain Quail from November 2002-February 2003 in southwestern Oregon using treadle traps baited with grain. A total of 271 birds were captured in Douglas County and Jackson County. Captured birds were weighed, banded, identified by plumage as hatch year (HY) or after hatch year (AHY) (Leopold 1939), and blood was extracted for gender identification (Wildlife Genetics International, Nelson, B.C.) from birds selected for radio-marking. Captured quail were held in a holding facility specifically constructed for captive wild Mountain Quail at the Southwest Regional office of Oregon Department of Fish and Wildlife (ODFW) in Roseburg, Oregon. One hundred and thirty-two Mountain Quail were fitted with necklace-style radio transmitters that weighted approximately 3.6 g (Model PD2C, Holohil System Ltd., Woodlawn Ontario, Canada) (Table 1). Fifty-seven radio-marked birds were released at Cabin Creek in MCCRA on 4 March and 8 April 2003. One hundred and thirty-nine banded but un-radioed translocated Mountain Quail were released in Black, Jackass Creek and Flat Creek in MCCRA on 15 April 2003. Seventy-five Mountain Quail were released at Fly Creek in the Deschutes National Forest on 4 March and 8 and 15 April 2003. One hundred and eighty-two of 271 (67%) translocated Mountain Quail were HY (hatch year) birds and 67 of 132 (51%) radio-marked birds were females (Table 1).
Table 1. Number of radio-marked and banded translocated Mountain Quail released at Fly Creek in the Deschutes National Forest and 4 sites in Murderer’s Creek Cooperative Resource Area (MCCRA) during March and April 2003.

<table>
<thead>
<tr>
<th>Release Location</th>
<th>Date</th>
<th># Radio-Marked</th>
<th># Banded Only</th>
<th>Male(^1)</th>
<th>Female(^1)</th>
<th>HY(^2)</th>
<th>AHY(^3)</th>
</tr>
</thead>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Fly Creek</td>
<td>4 March</td>
<td>32</td>
<td>11</td>
<td>21</td>
<td>26</td>
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<td></td>
<td>8 April</td>
<td>31</td>
<td>17</td>
<td>14</td>
<td>22</td>
<td>9</td>
<td></td>
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<tr>
<td></td>
<td>15 April</td>
<td>12</td>
<td>7</td>
<td>5</td>
<td>9</td>
<td>3</td>
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<tr>
<td>Sub-totals</td>
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<td>35</td>
<td>40</td>
<td>57</td>
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<tr>
<td>Cabin Creek</td>
<td>4 March</td>
<td>33</td>
<td>18</td>
<td>15</td>
<td>36</td>
<td>12</td>
<td></td>
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<tr>
<td></td>
<td>8 April</td>
<td>24</td>
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<td>12</td>
<td>26</td>
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<tr>
<td>Black Canyon</td>
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<td></td>
<td>16</td>
<td>9</td>
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<td></td>
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<td>Jackass Creek</td>
<td>15 April</td>
<td>27</td>
<td></td>
<td>19</td>
<td>8</td>
<td></td>
<td></td>
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<td>Flat Creek</td>
<td>15 April</td>
<td>44</td>
<td></td>
<td>28</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-totals</td>
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<td>57</td>
<td>139</td>
<td>30</td>
<td>27</td>
<td>125</td>
<td>71</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td>132</td>
<td>139</td>
<td>65</td>
<td>67</td>
<td>182</td>
<td>89</td>
</tr>
</tbody>
</table>

\(^1\) Gender determined only for radio-marked birds  
\(^2\) HY = hatch year birds  
\(^3\) AHY = after hatch year birds

Mountain Quail with transmitters were relocated from time of release in early March to the last week in July. Telemetry methods included monitoring from fixed winged aircraft, mobile tracking by vehicle/ATV, and ground monitoring. Flights were generally bimonthly April-May. We recorded, for all ground-monitored radio-marked birds, location (UTM), habitat associations (based on plant assemblages), topographic characteristics (slope, elevation, and aspect), and distance to road and water.
Nest sites were located by tracking and visually identifying radio-marked Mountain Quail that were incubating clutches. The birds were flushed off nests to count number of eggs, and we installed temperature-sensitive data-loggers (Model HOBO-pro, Onset Computer, Pocasset, MA) to determine nest attendance patterns on most nests. Data loggers measured nest temperatures with 0.2-cm thick thermistors placed under eggs, and ambient temperatures with monitors positioned <15 m from nest sites. All nests were flagged for later identification. Nests were checked and data collected from loggers once a week. We limited disturbance by observing birds from >8 m distances to confirm incubation. After hatch, eggshell membranes, shells, and unhatched eggs were counted to determine number of hatched chicks. Successful nests were defined as those in which ≥1 egg hatched and unsuccessful if abandoned or depredated and no eggs hatched.

NEST SITE AND RANDOM SITE CHARACTERISTICS

Protocols for nest-site sampling were derived from Pope’s (2002) research on Mountain Quail. To limit disturbance, we conducted vegetation sampling in July after eggs had hatched. Two random sites for each nest were selected using random numbers to select azimuths (°) and distances (≤ 500 m) from nest bowl. Nest site characteristics were defined by an 8-m radius plot (0.08 ha) centered on the nest. Twenty-one characteristics were recorded from the nests and random sites. Overstory (canopy closure) was measured with a convex spherical densiometer (Lemmon 1957) at nest center and at 4 points, 8 m from nest center in each of the cardinal directions (Pope 2002). Densiometer readings were averaged to estimate percent canopy coverage. Shrub composition and density were determined using line-intercept estimates (Canfield 1941),
and ground-level characteristics were derived from 20-x 50-cm Daubenmire frames (Daubenmire 1959) centered on the nest and placed at 2 and 4 m points along 4, 8-m transects that radiated from the nest center in each of the cardinal directions (Pope 2002). Foliage height and cover was estimated from 220 cm Robel poles (Robel et al. 1970) placed 8m from nests in the 4 cardinal directions (Pope 2002). Elevation and distances to nearest road and water source was determined by Arcview GIS. All means reported in this summary are ± SE.

RESULTS

BREEDING RANGE MOVEMENTS

Summaries of movements during the breeding season were based on 49 translocated radio-marked Mountain Quail (26 females and 23 males) that survived until or after 1 May. Thirty-six quail were from birds released in Fly Creek and 13 from MCCRA. The mean distance from release sites to breeding ranges was 2.5 ± 0.4 km (range 0.5 – 16.4). The mean distance that females moved to breeding ranges was 2.2 ± 0.3 km (range 0.2 – 13.9), and the mean distance that males moved was 3 ± 0.7 km (range 0.4 – 16.4). Mean distance moved to breeding ranges from release sites for translocated quail in MCCRA was 2.4 ± 0.6 km, and for translocated quail in Fly Creek the mean distance was 2.6 ± 0.5 km. AHY (after hatch year) (n = 14) birds moved a mean distance of 2.7 ± 0.5 km and HY (hatch year) (n = 34) birds a mean distance of 2.5 ± 0.5 km. For translocated birds from the first release (4-5 March), mean distance moved to breeding ranges was 1.7 ± 0.7 km, mean distance for birds from the 2nd release (8 April) was 3.1 ± 0.8 km, and from the last release (14-15 April) the mean distance moved was 5.1 ± 1.8 km. Sixteen of 49 (33%) translocated quail moved in southwest direction
(181-270°) to breeding ranges from release sites, 13 (27%) in a northwest direction (271-360°), 11 (22%) in a southeast direction (91-180°), and 9 (18%) in a northeast direction (1-90°).

Three translocated quail moved down in elevation while migrating to breeding ranges from release sites with a mean decline in elevation of 4 ± 2.5 m, and forty-six translocated quail moved higher in elevation with a mean elevation gain of 160 ± 24 m. Mean elevation change for birds that migrated to breeding ranges in MCCRA was 255 ± 75 m, and in Fly Creek, the mean elevation change was 113 ± 14 m. Mean elevation change for HY birds was 150 ± 24 m and for AHY birds 187 ± 59 m. Migrating males had a mean elevation change of 164 ± 36 m, and females had a mean elevation change of 140 ± 32 m. Birds from the 1st release had a mean elevation change of 90 ± 18 m while moving to breeding ranges. Quail from the 2nd release had a mean elevation change of 207 ± 52 m, and from the 3rd release the mean elevation change was 220 ± 30 m.

**SURVIVAL**

We determined survival for only the radio-marked translocated quail (Table 2). Forty of 132 (30%) Mountain Quail lived until the end (30 July) of the study, 41 (31%) died, and 51 (39%) disappeared or their transmitters failed prematurely. Twenty-nine of 97 (30%) HY quail lived, 31 (32%) died, and 37 (38%) disappeared. Eleven of 35 (31%) AHY Mountain Quail lived, 10 (29%) died, and 14 (40%) disappeared. Twenty of 62 (32%) males survived until the end of the study, 17 (27%) died, and 25 (40%) disappeared or their transmitters failed. Twenty of 70 (29%) females lived, 24 (34%) died, and 26 (37%) disappeared or their transmitters failed. Of the radio-marked quail released at Fly Creek, 31 of 75 (41%) lived, 30 (40%) died, and 14 (19%) disappeared or
their transmitters failed. Monitoring of translocated Mountain Quail in Cabin Creek in MCCRA was less intensive than for translocated Mountain Quail in the Deschutes National Forest and estimates of survival were biased by a high proportion of missing birds. For Cabin Creek in MCCRA, 9 of 57 (16%) quail survived, 11 (19%) died, and 37 (65%) disappeared or their transmitters failed. Eighteen of 65 (28%) Mountain Quail survived from the 4 March release, 15 of 55 (27%) lived from the 8 April release, and 7 of 12 (58%) from the 15 April survived until the end of the study.

Table 2. Proportion of radio-marked translocated Mountain Quail by age, gender, location, and release date that survived in Murderer’s Creek Coordinated Resource Area (MCCRA) near the south fork of the John Day and in (Fly Creek) near Sisters, Oregon, spring-summer 2003.

<table>
<thead>
<tr>
<th>Category</th>
<th>% Survived</th>
<th>Release Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4 March</td>
<td>8 April</td>
</tr>
<tr>
<td>HY</td>
<td>0.30</td>
<td>0.28</td>
</tr>
<tr>
<td>AHY</td>
<td>0.31</td>
<td>0.25</td>
</tr>
<tr>
<td>Males</td>
<td>0.32</td>
<td>0.27</td>
</tr>
<tr>
<td>Females</td>
<td>0.29</td>
<td>0.28</td>
</tr>
<tr>
<td>MCCRA</td>
<td>0.16</td>
<td>0.12</td>
</tr>
<tr>
<td>Fly Creek</td>
<td>0.41</td>
<td>0.44</td>
</tr>
</tbody>
</table>

1 No radio-marked birds released at MCCRA on 15 April.

**REPRODUCTIVE AND NEST SITE CHARACTERISTICS**

**Reproductive Characteristics**

During late May and early June 2003, 22 nests of radio-marked translocated quail were located in the Deschutes National Forest near Sisters in central Oregon and in MCCRA near the south fork of the John Day River (Table 3). We located 19 nests in the Deschutes National Forest and 3 in MCCRA. Fifteen nests were from birds released on 4 March 2003, 5 from birds released on 8 April 2003, and 2 from quail released on 15 April 2003. Seven nests were incubated exclusively by males and 15 by females. Sixteen birds
that incubated clutches were HY (hatch year) birds. All radio-marked translocated birds released in Fly Creek that incubated nests were paired with un-radioed resident Mountain Quail. Mean clutch size was 10.6 ± 0.32 eggs (range 7-13) with a total of 233 eggs produced. Mean clutch size for males was 10.9 ± 0.8 eggs (range 9-13) and for females 10.5 ± 0.31 eggs (range 8-12). Mean clutch size for AHY birds was 11.8 ± 0.4 eggs and for HY birds 10.1 ± 0.4 eggs. Eighteen of 22 (81%) nests successfully hatched chicks and 4 nests were completely depredated. Three of 4 unsuccessful nests were incubated by females. Mean hatch size from 18 successful nests was 7.8 ± 0.9 chicks (range 1-12). For males mean hatch size was 6.8 ± 0.6 chicks (range 5-9) and for females 8.3 ± 1.1 chicks (range 1-12). Mean hatch size for AHY quail was 9.3 ± 0.7 chicks and for HY birds 7 ± 1.0 chicks. One hundred and forty chicks hatched, 3 chicks died during hatching, and 14 eggs did not hatch. Thirty-seven eggs from successful nests were depredated or disappeared before hatching. Mean hatch date for nests (n = 11) that contained data loggers was 24 June ± 1.88 days (range 18 June-5 July).

**Nest Site Characteristics**

Nine nests were located in ponderosa pine/bitterbrush/bunchgrass (*Agropyron spicatum*) plant associations; 2 in juniper/bitterbrush/bunchgrass associations, 2 in Douglas-fir/common snowberry associations, 1 in a mixed coniferous stand, 1 in mixed conifer/snowberry(*Symphoricarpos albus*)-manzanita association, and 1 in juniper/Idaho fescue (*Fescue idahoensis*)/bluebunch wheatgrass association. Six nests were found in sites that burned in 2002; 3 nests were in lightly burned juniper/bitterbrush/bunchgrass associations, 2 nests in lightly burned ponderosa pine/bitterbrush/fescue associations, and 1 nest was in a heavily burned ponderosa pine/willow stand. The mean width of nest
bowls was 14.8 ± 0.3 cm and the mean depth was 6.2 ± 0.3 cm. The mean distance of
nest sites to release sites was 2.2 ± 0.4 km (range 0.5 – 5.3). Nine nests were southeast
(91-180°) of release sites, 6 southwest (181-270°), 4 northwest (271-360°), and 3
northeast (1-90°) of release areas. Eight nests (36%) were located on northeast facing
aspects, 8 (36%) on southeast facing slopes, 5 (23%) on northwest aspects, and 1 (5%) on
a southwest facing slopes. Fourteen of 22 (64%) nests were positioned at the top 1/3 of
canyon or mountain ridges.

The mean elevation of nests was 971 ± 60 m (range 772 – 1841) and average
slope was 13 ± 3°. The average distance of nests to water was 312 ± 41 m (range 25 –
800) and the average distance to the nearest road was 257 ± 40 m (range 15 – 635).

In nest plots, mean canopy closure was 38 ± 6%, the average percentage of shrubs
in 8-m radius nest plots was 15 ± 3%. Mean composition of bare ground in plots was
23% and mean composition of rock was 23%. Grass accounted for 17% of the mean
composition of ground cover in nest plots. Mean height of parameter (8 m from nest
center) vegetation was 55 ± 8 cm and the mean height of the tallest shrub in nest plots
was 89 ± 11 cm. For plots that contained trees, the dominant species were western
juniper Douglas-fir, or ponderosa pine and the mean height of trees in plots was 3.6 ± 0.8
m. Generally, nests were embedded in grass clumps or shrubs, or between rocks or under
down wood, and were generally well-concealed.
Table 3. Clutch and hatch size, fate, and hatch dates of translocated Mountain Quail nests (n = 22) located in Deschutes National Forest in central Oregon and in MCCRA near the south fork of the John Day River, spring and summer 2003.

<table>
<thead>
<tr>
<th>Band #</th>
<th>Gender</th>
<th>Age(^1)</th>
<th>Clutch Size</th>
<th>Hatch Size</th>
<th>Fate(^2)</th>
<th>Location</th>
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<td>F</td>
<td>J</td>
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<td>8</td>
<td>S</td>
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\(^1\) HY = hatch year birds and AHY = adult or after hatch year.
\(^2\) S denotes successful or nests that hatched ≥1 chick(s) and U are nests that hatched no chicks.
DISCUSSION

Survival rates for Mountain Quail are poorly documented. Little data are available that describe mortality for native or translocated populations of Mountain Quail. The continued decline of Mountain Quail in many areas of the western Great Basin make accurate estimates of survival critical for restoration planning and management. Survival of translocated Mountain Quail released in central Oregon in the Deschutes National Forest area in 2003 was similar to those reported for translocated and native quail in Hell’s Canyon and the lower Cascades (Pope 2002) and higher than for translocated Mountain Quail in the Murderer’s Creek area near John Day in 2002 (Jackle et al. 2002). Our estimates of survival of translocated Mountain Quail in the Murderer’s Creek Area in 2003 were confounded by the disappearance of many translocated birds and the inability to relocate radio-marked birds on a regular basis. We were unable to accurately estimate cause-specific factors for mortality, but most of our mortality sites for all populations and areas appeared to be pluck sites, indicative of avian (raptor) depredations. Similar to Hell’s Canyon and the lower Cascades, the likelihood of survival for translocated Mountain Quail in the central Oregon was greater for males than for females. Translocated Mountain Quail released in early March did not appear to have higher survival than birds released in early and mid-April. Accurate estimates of survival are essential for developing translocation strategies for restoration plans. Without knowledge of mortality of translocated birds, the success or lack of success of reintroductions as a restoration technique cannot be adequately evaluated.

Similar to Pope’s (2002) study on translocated Mountain Quail in Hell’s Canyon and Jackle et al’s (2002) report on translocated Mountain Quail in MCCRA, translocated
quail in north-central and central Oregon in 2003 moved considerable distances to breeding ranges but mean distance moved to breeding ranges was less than reported for translocated Mountain Quail in Hell’s Canyon and in earlier releases at MCCRA. Unlike translocated birds in Hell’s Canyon, Mountain Quail in north-central and central Oregon did not exhibit movement patterns favoring any particular direction. The difference in movement patterns between the 2 studies may be related to differences in the number and diversity of capture locations. Most translocated Mountain Quail from Pope’s (2002) study in Hell’s Canyon were captured near Myrtle Creek in the lower Cascades of southwest Oregon while translocated quail for MCCRA and Fly Creek were captured in the Coast Range, lower Cascades Mountains, and Siskyou Mountains of southwestern Oregon. Translocated birds in north-central and central Oregon in 2003 moved higher in elevation during breeding season, but not nearly as high as translocated birds in Hell’s Canyon and native birds in the lower Cascades of southwest Oregon.

Reproductive behaviors were similar for the translocated quail released in north-central and central Oregon in 2003 and Hell’s Canyon (1997-1998), and the native quail in Hell’s Canyon and the lower Cascades (1997-2000). Males actively incubated clutches and brooded their chicks without assistance from their mates. Mountain Quail from both studies demonstrated a reluctance to abandon nests even after partial nest depredation. Also, a number of nests from both studies had infertile or unhatched eggs, and most of the unhatched eggs were found in male-incubated nests.

Comparisons between nests found in MCCRA (2002-2003) near the south fork of the John Day (2002-2003), in the Deschutes National Forest (2003), Hell’s Canyon National Recreation Area (HCNRA) (1997-1999), and the southwestern Cascades (CR)
(1997-2000) suggested some differences in nests site characteristics between the areas (Table 4). Nests of resident quail in the southwestern Cascades were further from release or trapping sites than either MCCRA, DNF, or HCNRA. Canopy closure appeared to be higher for nests in CR and HCNRA than DNF or MCCRA. Slope was comparable for MCCRA, HCNRA, and CR, and generally greater than percent slope for nests in DNF. Nests in DNF were closer to roads than MCCRA and HCNRA but further from roads than CR. Nest plots in HCNRA and CR contained a greater proportion of shrubs and taller shrubs than either DNF or MCCRA. DNF, MCCRA, and HCNRA had greater quantities of grass in nest plots, but less woody debris than the southwestern Cascades. Nests in MCCRA and HCNRA were located in higher elevations than either DNF or CR.

Clutch sizes were similar for the 4 areas (DNF = 10.5 eggs, MCCRA = 10.8 eggs, HCNRA = 11.6 eggs, and CR = 10.9 eggs) but hatch size for successful nests was less in DNF and MCCRA (DNF = 7.4 chicks, MCCRA = 8.4 chicks, HCNRA = 10.3 chicks, and CR = 9.5 chicks). Mean hatch date for MCCRA (20 June) was similar to DNF (24 June) but considerably earlier than hatch dates for CR (6 July) and HCNRA (5 July).
Table 4. Mountain Quail nest site characteristics in 8-m radius plots for John Day area of north-central Oregon (MCCRA), the eastern Cascades of central Oregon in the Deschutes National Forest (DNF), the lower Cascades in southwest Oregon, and Hell's Canyon National Recreation (HCNRA) in northeast Oregon, spring and summer 1997-2003.

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<tr>
<td></td>
<td>Mean (n)</td>
<td>Mean (n)</td>
<td>Mean (n)</td>
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<tr>
<td></td>
<td>23</td>
<td>23</td>
<td>34</td>
</tr>
<tr>
<td>Distance road (m)</td>
<td>262 ± 42</td>
<td>748 ± 284</td>
<td>2003 ± 153</td>
</tr>
<tr>
<td>Distance water (m)</td>
<td>319 ± 46</td>
<td>267 ± 59</td>
<td>1346 ± 91</td>
</tr>
<tr>
<td>Distance release area (km)</td>
<td>3.6 ± 74</td>
<td>728 ± 6.9</td>
<td>26 ± 6.1</td>
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<tr>
<td>Canopy closure (%)</td>
<td>1.9 ± 0.3</td>
<td>1.3 ± 0.8</td>
<td>2.5 ± 0.2</td>
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<tr>
<td>Slope (degrees)</td>
<td>10 ± 3</td>
<td>28 ± 2.5</td>
<td>26 ± 2.6</td>
</tr>
<tr>
<td>Elevation (m)</td>
<td>888 ± 16</td>
<td>1346 ± 91</td>
<td>1086 ± 66</td>
</tr>
<tr>
<td>Proportion of shrubs</td>
<td>0.12 ± 0.03</td>
<td>0.17 ± 0.03</td>
<td>0.28 ± 0.03</td>
</tr>
<tr>
<td>Proportion of grass</td>
<td>0.17 ± 0.03</td>
<td>0.09 ± 0.02</td>
<td>0.04 ± 0.03</td>
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<tr>
<td>Proportion of wood</td>
<td>0.08 ± 0.01</td>
<td>0.09 ± 0.02</td>
<td>0.29 ± 0.03</td>
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<tr>
<td>Proportion of litter</td>
<td>58.0 ± 3.5</td>
<td>8.3 ± 0.5</td>
<td>15.8 ± 0.5</td>
</tr>
<tr>
<td>Height perimeter (cm)</td>
<td>48 ± 7.6</td>
<td>40 ± 8</td>
<td>10 ± 6</td>
</tr>
<tr>
<td>Height shortest shrub (cm)</td>
<td>10 ± 0.15</td>
<td>7.6 ± 0.15</td>
<td>10 ± 0.15</td>
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<tr>
<td>Height tallest shrub (cm)</td>
<td>10 ± 0.15</td>
<td>7.6 ± 0.15</td>
<td>10 ± 0.15</td>
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MANAGEMENT IMPLICATIONS

Translocations of wildlife to supplement or re-establish populations of native species have become an important and broadly accepted conservation technique (Griffiths et al. 1996). A survey of translocation programs estimated that nearly 90% of approximately 700 translocations between 1973 and 1986 were game species, and gallinaceous birds accounted for a significant proportion (43%) of these translocation efforts (Griffiths et al. 1989). Few translocation efforts incorporated post-release monitoring that evaluated the effectiveness of the program or compared survival of translocated populations (Griffith et al. 1989). Game farm or pen-raised animals are usually less successful than wild birds as a source for translocations (Fellers and Drost 1995). A primary goal of this research was to coordinate management objectives with research to develop an effective and successful restoration program for Mountain Quail in eastern Oregon. Translocation programs will not succeed unless some measures of success are established and subject to evaluation. Post-release monitoring of radio-marked animals is one of the most effective methods of evaluating success.

Translocated Mountain Quail in north-central and central Oregon were successful in establishing nest sites, selecting mates, and producing chicks. Nest sites were characterized by a diversity in structure, topography, and habitat associations. Five nests were located in areas burned in 2002 and 1 of these nests was in an area that burned intensely leaving little canopy or understory vegetation. All radio-marked quail that produced nests in the Deschutes National Forest were paired with un-marked native quail. In 2003, movement patterns for quail were more diverse than reported for 2002 in north-central Oregon (Jackle et al. 2002) or for Hell’s Canyon and the southwestern Cascades (Pope 2002). This variation is likely related to the
diversity and increase in number of capture sites for Mountain Quail in 2002-3 in southwestern Oregon.

For 2004, we propose to release a minimum of 100 translocated Mountain Quail in Fly Creek in the Deschutes National Forest in March with 50 birds radio-marked for post-release monitoring. An additional 100 translocated Mountain Quail will be released at Wolf Creek northeast of Burns in the Malheur National Forest with 50 birds radio-marked for monitoring during the spring and summer. Translocations will continue through 2005 in Fly Creek and through 2006 for the Burns site. We are currently developing plans to begin restoration of Mountain Quail populations in historic ranges of the Steens Mountains in spring 2005. Comparisons of survival and reproductive success between the translocated sample populations at each site will allow for an effective evaluation of restoration strategies. Additionally, an ongoing review of release procedures will provide more effective methods for translocations and insure that the maximum numbers of birds survive until the breeding season.

ACKNOWLEDGEMENTS

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invaluable funding and assistance. We appreciated the financial support of the Oregon Department of Fish and Wildlife, Quail Unlimited, Oregon Hunter’s Association and the U. S. Forest Service.

**COOPERATORS**

Oregon Department of Fish and Wildlife  
Game Bird Research Program-Oregon State University  
U.S. Forest Service-Ochoco and Deschutes National Forest  
Quail Unlimited and Oregon Hunter’s Association  
National Fish and Wildlife Foundation

**LITERATURE CITED**


The annual report on Mountain Quail translocations in eastern Oregon for 2002 (Jackle et al. 2002) contained a summary of Mountain Quail observations from 1995-2002, methods for collecting Mountain Quail observations, mapping techniques, and a review of the historic literature on distributions in eastern Oregon. This Appendix will provide a summary of Mountain Quail locations submitted via email or as an observation form in 2003.

Gabrielson and Jewett (1940) reported that Mountain Quail were found throughout much of eastern Oregon, but were most common in Crook, Jefferson, Klamath, Lake, Wasco, and Wallowa Counties. Masson and Mace (1970) commented that Baker and Malheur Counties had large populations of Mountain Quail. However, in 1989, Humphreys (ODFW, personnel communication) remarked that Mountain Quail were rare or absent from Baker County, and that the last confirmed observation he recorded was in the late seventies near Balm Creek with unconfirmed locations in Oxbow and McClain Creek in 1987. In Umatilla County, the Oregon Department of Fish and Wildlife observed no birds along brood routes from 1974-1989 (Vic Coggins, Oregon Department of Fish and Wildlife, personnel communication). In the 1980s and 90s, Mountain Quail have become rare or absent from most of Malheur County. During the 1950s, Mountain Quail were observed along lower Calf Creek, the Owyhee Reservoir, Pole Creek, and Succor Creek (Coggins 1989 unpublished survey) in Malheur County. Cecil Langdon (Oregon Department of Fish and Wildlife, retired) reported >1500 Mountain Quail along Cow Creek north of Jordan Valley in Malheur County during the early 1950s but claimed they disappeared the next year. Also, in Malheur County, Mountain Quail were seen along Krumbo, Bridge, and Mud Creek canyons and west of Highway 205 north of Frenchglen in the
1970s, and in Malheur National Wildlife Refuge in the winter of 1970-1 (Marty St. Louis, Oregon Department of Fish and Wildlife, and Guy Sheeter, Bureau of Land Management, personnel communication). Mountain Quail have disappeared from most areas of Lake County. They were observed in the 1950’s on Hart Mountain National Wildlife Refuge in Lake County but have not been observed on the refuge since (Jenny Barnett, U.S. Fish and Wildlife Service, personnel communication). Mountain Quail were observed in 1990 in Crane Creek, 6 miles south of Lakeview and in the winter of 1993 feeding near a logging dock in Lakeview (Lake County), but have not been seen near Lakeview since that observation (Larry Conn and Craig Foster, Oregon Department of Fish and Wildlife, personnel communication).

Of 100 observations submitted in 2003, 27 (27%) were from Crook County, 21 (21%) from Jefferson County, 14 (14%) from Wallowa County, 7 (7%) from Grant County, 7 (7%) (7%) from Wheeler County, 4 from Umatilla County, 3 each from Deschutes, Hood, and Harney Counties, 2 from Sherman County, and 1 each from Baker and Malheur Counties. Of 325 observation forms returned between 1995-2003 for eastern Oregon, 189 (58%) were from 3 counties (Crook, Grant, and Jefferson). Thirty-one (10%) were from Wasco and 23 (7%) from Klamath Counties. Additionally, 21 (6%) were from Wallowa and 21 (6%) from Wheeler Counties.

The majority of the observations in Grant and Crook Counties were on the Umatilla, Malheur, and Ochoco National Forests. Most of the locations from the 3 counties (Crook, Grant, Jefferson) were associated with the John Day River and Crooked River or their tributaries. We had 3 new observations from Harney and 3 from Sherman Counties and 1 from Baker County, both areas with few observations from previous years. In Wallowa County, most of the
observations were associated with the Imnaha River in the eastern part of the county adjacent to Hell’s Canyon National Recreational Area.

Mountain Quail observations appear to be increasing (in frequency) in counties associated with the south and north forks of the John Day Rivers in northcentral Oregon and along some of the tributaries of the Imnaha River in northeastern Oregon. However, Mountain Quail observations are still rare from southeastern Oregon, particularly Lake, Harney, and Malheur Counties, and we had few locations from Morrow and Sherman Counties in northcentral Oregon, and Baker and Union Counties in northeastern Oregon.