Mountain Quail Translocation Project 2012

Gearhart Mountain

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Introduction

Mountain quail (*Oreortyx pictus*) populations have declined in the 20th century throughout the entirety of their historical ranges, but particularly in the eastern portions found in western Idaho, northwestern Nevada, and eastern Oregon. Habitat loss due to fire suppression, overgrazing, and water impoundment projects is thought to be the likely instigator of the population decline (Brennan 1991, 1994). Mountain quail can currently be found from Baja up the pacific coast to southern British Columbia and east to Nevada and Idaho. Fossil records indicate that they may have once been found in New Mexico as well (Johnsgard 1973, Crawford 2000, Gutierrez and Delahanty 1999). Unlike other New World Quail, during the breeding season, March to September, mountain quail will migrate to higher elevations singularly or with a mate and return to lower elevations as a covey in late fall/winter, timing dependant on snow levels and food and/or water resources. Ideal breeding range habitat consists of shrub dominated communities and early-successional mixed conifer forests, they will also utilize riparian habitat when available. In the winter mountain quail will seek out areas with thicker canopy cover to block falling snow (Gutierrez and Delahanty 1999).

In response to gradually dwindling mountain quail populations Oregon Department of Fish and Wildlife (ODFW), U.S. Forest Service (USFS), and the Game Bird Department at Oregon State University initiated the Mountain Quail Translocation Project in 2001. Mountain quail have been deemed strong candidates for translocation because they have abundant, easily accessed source populations, high productivity, and are capable of surviving the stresses of capture, handling, and transport (Stephenson et. al. 2011). The project captures mountain quail from more stable southwestern populations and translocates them to areas east of the Cascade Mountains where populations have been declining or thought to be extirpated. Since 2001, mountain quail have been released in 5 different locations in Oregon and 2012 marks the second year quail were released in the Gearhart Wilderness Area in south-central Oregon. Release locations for 2011 and 2012 were selected based on their similarity to habitat on the eastern slopes of the Cascade Range where mountain quail populations are still thriving (Tom Collom ODFW, personal contact in Cate 2011). Based on research that indicated that mountain quail form breeding pairs in late March a release date was selected that would allow the birds enough time to acclimate to their new surroundings and still find a mate (Pope 2002 in Nelson 2006, Jon Muir ODFW, personal contact 2012). On March 29, 2012 a total of 189 mountain quail were banded and released in the Gearhart Wilderness Area near the South Fork Sprague River. Stephenson et. al. (2011) recommends multiple year release efforts for restoration projects to accommodate the high mortality rates experienced by translocated quail due to increased movement when dispersing from the release site which causes an increase in predator exposure.

For the Mountain Quail Translocation Project, birds from Douglas County were baited with grain into traps from November through February. Trapped birds were then placed and cared for in a holding facility at the ODFW Roseburg office until the release date. Since mountain quail are
sexually monomorphic a blood sample was taken to determine sex. Along with the blood sample, weight and age (hatch year or after-hatch-year) were recorded. A bird aged at “hatch year” was recorded as a juvenile while an “after-hatch-year” was considered an adult. All 189 birds received a uniquely numbered metal leg band and 50 of those were fitted with a necklace-style radio transmitter (Table 1). Radio collared birds were monitored from May 14th to September 24th, 2012 to determine survival, movement, habitat use, and nesting success. The following report summarizes the information collected from observing the radio-collared quail during the previously mentioned time period.

Table 1: Translocated Mountain Quail to Gearhart Mountain Wilderness, 2012.

<table>
<thead>
<tr>
<th>Release Date</th>
<th>Release Total</th>
<th>Total Radio Collared</th>
<th>Total Leg # Band Only</th>
<th>Adult/Juvenile Collared</th>
<th>Male/Female Collared</th>
</tr>
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<tbody>
<tr>
<td>3/29/2012</td>
<td>189</td>
<td>50</td>
<td>139</td>
<td>21/29</td>
<td>29/21</td>
</tr>
</tbody>
</table>

**Study Area**

Since 1943 the Gearhart Mountain area had been called a Wild Area, but in 1964 the Wilderness Act officially designated it as a Wilderness. The Gearhart Mountain Wilderness now spans a total of 22,823 acres within the Bly Ranger District on the border of Klamath and Lake Counties. Many streams and creeks have their headwaters within the wilderness; this, paired with ancient glaciation, has made the area network of towering ridges and open meadows or chaparral shrub land with elevations ranging from 1798 meters to 2549 meters at the summit. A continuous dry pine forest on the desert/coastal transition zone, variations in vegetation are highly dependent on water availability. Dominant overstory composition in higher elevations consists of white fir (Abies concolor), ponderosa (Pinus ponderosa) and lodgepole pines (Pinus contorta). The understory is dominated by a wide variety of shrubs and bunchgrasses.

A suitable release location (UTM Zone 10, easting 675731, northing 4696415) was selected near the South Fork Sprague River from recorded knowledge of mountain quail preferred habitat and accessibility. Mountain quail habitat includes brushy mountainsides, particularly those covered with chaparral vegetation such as manzanita, snowbrush, and similar broad-leaf hardwoods as well as coniferous forest edges, open forests, or forests recently disturbed by logging or fires (Johnsgard 1973). The immediate release area is on privately owned timber property that is open to public use; this is surrounded by a mosaic of closed private land and cattle ranches, national forest, and wilderness land. Plant association maps were obtained from the U.S. Forest Service and indicate that several different associations occur in the dispersal area around the release site, but the most common are ponderosa pine/western juniper/mountain mahogany, ponderosa pine/bitterbrush-manzanita/fescue, and white fir-ponderosa pine. A ponderosa pine and western
juniper (Juniperus occidentalis) overstory with a shrub understory of curl-leaf mountain mahogany (Cercocarpus ledifolius) is the dominant habitat at the release site. Slopes near the release location commonly support snowbrush (Ceanothus velutinus), greenleaf manzanita (Arctostaphylos patula), and wax currant (Ribes cereum) in conjunction with or in place of curl-leaf mountain mahogany. Common grasses and forbs in the area are fescue (Festucca spp.), bottlebrush squirreltail (Elymus elymoides), western needlegrass (Achnatherum occidentale), and mahala mat (Ceanothus prostratus).

**Methods**

Captured mountain quail were fitted with American Wildlife Enterprises’ necklace style radios with an expected battery life of 180 days. Radio-marked quail were monitored primarily via ground based telemetry. Advanced Telemetry System (ATS), Telonics, or Communications Specialist, Inc. scanning receivers were used in conjunction with a 3-element Yagi antenna to locate the collars in the field. Collaboration with ODFW district and research staff was also vital to schedule aerial telemetry flights which were utilized throughout the field season to locate birds that had moved out of range of the release site or from their last known location and could not be heard from the ground.

Visual confirmation of each radio-collared mountain quail was used to determine whether the birds were alive once located with telemetry equipment. Mortality was confirmed either by locating remains and scattered feathers of the bird or by bite marks and damage to the radio collar. The source of mortality was investigated by examining the location and condition of collar, remains, and feathers. Many collars were found on the ground under a tree with a scattering of feathers, indicating the likelihood of avian predation. Other collars were found under shrubs or near the entrances of holes in the ground which suggested the possibility of mammalian predation; however these could also be the result of scavenging. The latter situations and the few situations where only the collar was found with no remnants of the quail were difficult to identify an exact cause of death. These cases were documented as unknown causes of mortality. Each time that a collar or bird was located the time, Universal Transverse Mercator (UTM) coordinates, distance to nearest road, distance to nearest water, slope, aspect, elevation, and dominant overstory/understory vegetation was recorded. Any additional information about the observation was also recorded on the datasheet. When a nest was discovered the vegetation concealing the nest cup and material used to construct the nest cup were also documented. Once a clutch was laid in a nest the number of eggs was recorded and the nest was monitored weekly and any changes to the nest were documented. Attempts were made weekly to get visual confirmations for live birds and broods.

Terrain Navigator Pro version 8.71 was used to map all coordinates and determine distance from release site for all live bird and mortality locations. Microsoft Excel was used to calculate means and standard errors for all data. Survival of radio collared birds was calculated by the number of confirmed live individuals remaining at any particular moment in time divided by the total
number of confirmed observations at any particular time. A bird were considered to be alive until mortality had been documented; if a transmitter signal went unheard or unconfirmed for a given time period then the collar was deemed lost and not included in the pool of confirmed observations for a particular time period. Collars that were never heard through the entire season, post-release, were excluded from the total pool of collared birds.

**Results**

Survival

Following release on March 29, 2012 until mid-May, quail were only incidentally monitored by wildlife district staff. After mid-May, attempts were made to locate each radio-marked quail regularly, but location data was still irregular and only apparent survival could be calculated by month (Table 2). Three of 50 transmitters were never detected after release and therefore censored from the analysis. In addition, four transmitters emitting mortality signals were not recovered and assumed to accurately represent the fate of the birds (access to these radios was prohibited by landowner).

More than half (51%) of the transmitters were recovered by June 19th from quail with evidence of mortality or assumed to be dead. This initial mortality may have been even higher, as locations for 12 radio-marked quail mortalities were detected for the first time after June 19th. These birds may have perished prior to June 19th, but not detected.

<table>
<thead>
<tr>
<th>Date</th>
<th>June 19</th>
<th>July 17</th>
<th>August 17</th>
<th>September 24</th>
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<tbody>
<tr>
<td>Assumed Alive/ Total of Known Fate</td>
<td>23/47</td>
<td>14/47</td>
<td>10/47</td>
<td>7/47</td>
</tr>
<tr>
<td>Apparent Survival (%)</td>
<td>48.9</td>
<td>29.8</td>
<td>21.3</td>
<td>14.9</td>
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Seven radio-marked quail were assumed to survive (alive when last detected) to September 24th, the last date of monitoring and nearly 6 months post-release. One of these surviving quail was detected for the last time on August 15, but the remaining six quail were all last detected Sept. 14-24. Age and gender of surviving quail was 4 yearling males, 1 adult male, 1 yearling female, and 1 adult female, which resulted in an apparent survival of 17.9% for males and 10.5% for females through September 24.
If the apparent survival of the radio-collared birds was extrapolated to birds with only leg bands, about 21 additional birds survived to Sept. 24. This estimate does not include any surviving offspring.

Reproduction and Nest Site Characteristics

In 2012, 5 radio-collared quail were found incubating clutches; four were incubated by females and one by a male. The reproductive strategy of mountain quail includes simultaneous multi-clutching where the female may lay two clutches of eggs; one incubated exclusively by the female and one exclusively by the male. Three of five nests hatched successfully all incubated females. All hatching occurred between July 5th and July 16th; the first brood was observed on July 10th. Mean distance from a road for all nests, regardless of nest fate, was 57 ± 38 m and mean distance from water was 308 ± 384 m.

The following are descriptions of the five known nesting attempts:

A clutch of 6 eggs was discovered June 7 attended by a yearling female with leg band number 617. It was not known at the time of discovery if the clutch was complete. When visited on June 14, the bird was not at the nest which had been disturbed. There were 5 eggs total and 2 eggs were outside of the nest. This bird appeared to be paired with a radio-marked yearling male wearing leg band number 620. Bird 620 was not observed associated with a nest, but both birds were observed together on August 3 with four chicks. This was the first and only time chicks were observed associated with these two birds.

An adult radio-marked male with leg band number 1847 was first observed incubating a clutch of 10 eggs on June 25. On July 9 the bird’s mangled collar and feathers were located in snowbrush a short distance from the nest site. Predation was the suspected cause of mortality. Eggs were still present in the nest and cold to the touch.

Bird 1930, an adult female, constructed her nest from ponderosa pine (PIPO) needles on a 15°, SE facing slope. The cup was nestled into a crook between a medium sized boulder and a small Woods rose (Rosa woodsii) bush. The nesting area was near the riparian area of Brownsworth Creek, so the understory was filled with willow species, grasses, and a multitude of forbs. She was incubating 6 eggs when the nest was first discovered on June 14th and still incubating on July 5. Three chicks were first observed on July 10th, but during later observations in the same area there were 5 juveniles observed. The same day that the brood was first observed, a non-collared bird was flushed with an estimated 6 juveniles 360 m away from 1930s nest site. Approximately 4 weeks after hatching, 1930 began to move the brood in a northeastern direction. Initially she moved into an area of closely planted PIPO with little understory except sparse wax currant bushes. She stayed less than a week in this area before moving into the next draw to the northeast, which she began to follow away from the nesting area. On August 22 she was observed with a non-collared adult and six juveniles. After that observation her signal was lost for 3 weeks until it was picked up again during a flight. Via the Gearhart Mountain Trail a visual
confirmation of 1930 with seven other birds, which appeared to be an adult and six juveniles, was made in the Gearhart Wilderness 8.28 km northeast of the release site, 1300 m from a road, and 865 m from water.

Adult female with leg band 1968 located her nest hidden under the lower boughs of a white fir tree. The nest was discovered on June 22. The nest was lined with PIPO needles and completely obscured from view (unless the limbs were lifted). She incubated a total of 9 eggs, all of which appeared to hatch sometime between July 9 and July 16. The area this quail chose to nest and raise her brood was a moist meadow, watered by Buckboard creek, with minimal gradient and a variety of grasses and forbs in the understory. The nest was 4 meters from the road and 38 meters from Buckboard creek at 1907 m elevation. This location was 9.88 km east of the release site. The number of chicks observed began to diminish within a week of hatching. By August 28 only 2 juvenile quail were observed from the brood. No chicks were observed during each of the next 3 weekly locations. Bird 1968 never made any long distance movements with her brood and was often found on a hillside of tall, thick Snowbrush. On September 24th the collar of 1968 was found several hundred meters south from where she was normally found, but there was no sign of predation. The bird was still considered to be a mortality, but there is the possibility her collar was slipped.

Adult female with leg band 600 selected a medium sized rabbitbrush (Chrysothamnus nauseosus) bush at the base of a PIPO on a SW facing, 8° slope to build her nest of shed PIPO needles. The nest of 8 eggs was first discovered on June 18th. At the next check on June 25th, one additional egg had been laid for a clutch of 9 eggs. The nest location was 105.5 m from the nearest road and 98 m from a nearby intermittent stream that had water in it for most of the summer. The nearest consistent water was Brownsworth Creek 805 m away. A trail camera was deployed July 3 to monitor the nest. Pictures from the camera show chicks at the nest on July 14th. Promptly after hatch, bird 600 moved the brood to thicker cover; when observed on July 16th she had the chicks concealed under a stack of cut PIPO, which prevented an accurate chick count. Initial brood count was five juveniles, but two weeks later on August 2, six chicks were observed with bird 600 which had moved the brood NE of the nesting area. Contact with bird was lost for over 3 weeks until the collar was found by the South Fork Sprague River east of the nesting location. The fate of the brood is unknown.

A few broods were observed from unmonitored nests. The first observation was on July 10, when a non-collared bird was observed with at least 5 chicks. On August 3, eight chicks were observed with a non-collared bird that is thought to be associated with a radio-marked juvenile male (leg band 1996). Bird 1996 was not known to attend a nest. On September 24, bird with leg band 1961 was located with a non-collared bird and 3 other birds believed to be juveniles. On August 3, birds 617 and 620 were observed with a brood of 4 chicks which was the only time chicks were observed with either of these birds and it was weeks after 617 had been thought to have abandoned her nest. The following week a non-collared bird was observed with 617 and 620, but no juveniles were observed.
Once the chicks fledged, parents tended to seek areas of dense shrub cover, usually snowbrush and/or greenleaf manzanita. The average distance of brood observations from water was 286 ± 466 m. Maps 2, 6, and 10-12 show the movements and observations of the observed broods.

Movement

Intensive monitoring began May 14th, by this time the quail had likely reached their breeding range and most stayed in these areas during nesting season. Maps 1 though 8 depict all observations points for May 14 through September 24. Nests were located east, west, and north of the release site but only those east and west of the release site were successful. Nest sites averaged a distance of 4.45 ± 3.30 km from the release site, with the greatest distance 9.88 km. The mean elevation change for nesting locations was 125 ± 185 m. Generally, quail that successfully hatched a clutch began to move their brood after a couple weeks. Maps 2, 6, and 10-12 show the movements and observations of the observed broods.

The average distance from the release site to the last confirmed observation of live birds before July 10 was 6.28 ± 5.50 km. July 10 was selected to represent the end of nesting season. For the entire season the mean distance from the release site to last confirmed location of live birds was 7.66 ± 5.12 km. Collared birds gained average elevation of 119 ± 133 m from the release site elevation of 1563 m. Dispersal from the release site was observed in all directions but many of the birds travelled in a NE (1-90°) direction, as seen in Map 1.

In 2011, most of the mortality occurred <1 km the release sites (Cate, 2011). This year only 13 mortalities were found <1 km from the release location; one live bird was observed (once) <1 km from the release location. The farthest from the release site that a collar was recovered was 21.75 km. The collar belonged to bird 641, a juvenile male, and was located SW of the release site on a SW facing slope of Horsefly Mountain between Gerber Reservoir and Highway 140. It is unclear how much of the distance was travelled by 641, since it is possible the quail/collar was transported by a predator to this location. Two live quail and two mortality collars were located south of Highway 140, ranging in distances from 9.41 km to 21.75 km, and all were juvenile males. In September, after a month of being lost, birds 620 and 617 were found south of Highway 140, 10.4 km SE (91-180°) of the release. Both were juveniles. Map 13 shows the movements of 617 and 620 though out the season.

An adult male quail, 1961, was located 3 weeks before the end of the season and had previously not been heard even via aerial telemetry. Originally located alone 5.35 km from the release site, a week later he was observed 11.79 km from the release location, depicted in Map 14, in a direction slightly NW of where he was first observed. This new location put him in the vicinity of Demming Creek, a 2011 release site. Further observations revealed 1961 was with another un-collared bird and 3 juveniles.

Bird 1908, a juvenile male, was originally found in the vicinity of birds 617, 620, and 1930 about 2.1 km west of the release site. For two months after 1908 was first observed, the bird was lost
until located approximately 400 m north of the Gearhart Mountain Wilderness Trail, approximately 5.63 km from the trailhead, as shown in Map 15. This location was 8.82 km NE of the release site. Between the first observation and the last, 1908 gained about 730 m in elevation, with a change from 1,524 m to 2,253 m. This bird was not located again; however the collars were near the end of their battery life so it is not known if the bird moved out of area, died, or if the collar simply stopped working.

Bird 1968 moved her brood 5 weeks after they hatched 393 m to a nearby hill slope covered in snowbrush. They were observed between the two areas but never outside of the area. A few weeks after the last juveniles were recorded, 1968’s collar was found 801 m west of the hill slope she frequented. Presumed to be a mortality, but the cause was unclear since there was no evidence of the bird.

Four weeks after hatching her clutch, 1930 moved her brood east 1.46 km to a grove of PIPO with very few shrubs in the understory. Five days later they were observed 4.68 km NE of that location heading up the Brownsworth Creek drainage. They lingered in this area for 2 weeks and associated with another adult and juvenile. After 3 weeks in the drainage the covey was located approximately 400 m south of the Gearhart Mountain Wilderness Trail 2.91 km NE of their last know whereabouts. This was the final observation of the covey. They were approximately 800 m south of the final observation of 1908, but were distinctly separate. Movements for this brood are depicted in Map 10.

Two weeks after hatching, bird 600 moved her brood 1532 m NE, as seen in Map 11. The group was lost for another 4 weeks before the mortality signal of 600's frequency was heard and the collar retrieved 2.63 km east of the previous location. The terrain in the area is very steep, with many ridges; if 600 was moving her brood often it is possible that they were in an area that blocked the signal.

**Discussion**

Mountain quail, and upland game birds in general, experience low survival rates. For translocated birds, survival can be even lower than for resident birds because of increased movement as the birds acclimate to their new surroundings. Courtship and nesting behavior can also cause increased activity. This movement increases their exposure to predators, especially avian predators (Stephenson et al. 2011). However, survival rates of translocated and resident mountain quail in the Hells Canyon National Recreation Areas were found to be similar (Pope and Crawford 2004). Survival rates for resident quail in the Gearhart Mountain Wilderness was not known because there were few, if any, resident mountain quail in the area prior to translocation efforts. Shrub component in the understories where the mortalities were discovered was sparse compared to the habitats that the live birds were utilizing, which may have contributed to their demise.
Most released birds traveled several hundred to several thousand meters from the release site before being recovered as a mortality. Mean distance from the release site to site of mortality was 3.57 ± 3.62 km. This mean distance did not include the two longest recoveries, which were 19.5 km and 22 km from the release site. These two recoveries were censored from analysis, since the movements were much longer than for the other quail and it was possible the birds/collars were transported by predators. However, through the course of the field season, at least 2 collared quail had moved greater than 10 km from the release site.

During the period 2001-2010, males incubated 47% of 142 nests of translocated mountain quail in Oregon (Budeau and Hiller, in press). During this field season, only 1 of 5 nests was incubated by a male. This year, nest success also favored females where 3 of 5 nests were successful and all were incubated by females. For mountain quail in Idaho, Beck, et al. (2005) observed that the odds for nesting success favored males 1.7% more than females. Given the relatively small number of nests, the low proportion of nests incubated exclusively by males, and the nesting success that favored females could have occurred by chance.

Average eggs per nest in this study was 8.0, which is less than the 10-12 average for mountain quail (Gutierrez and Delahanty, 1999), and less than averages previously reported for Oregon. In a study of 55 Oregon nests which included both resident and translocated quail, male clutches averaged 11.9 ± 0.4 and females averaged 10.9 ± 0.4 (Pope and Crawford 2001) and in another study of 142 Oregon nests of translocated mountain quail the mean clutch size for all age and gender classes was 10.2 ± 0.2 (n=142). Males incubated larger clutches (n = 67, \( \bar{x} = 11.0 \pm 0.3, 95\% \text{ CL} = 10.4–11.7 \)) than females (n = 75, \( \bar{x} = 9.5 \pm 0.3, 95\% \text{ CL} = 9.0–10.1 \)) when the data were pooled adult males not only incubated larger clutches than other age and sex classes, but males hatched slightly more eggs on average than females of pooled age classes.

**Conclusion**

The survival of mountain quail translocated in 2012 was similar to the survival reported by Stephenson et al. (2011) in western Idaho and eastern Washington. Survival this season was a marked improvement to last year's translocations in N. Fork Sprague River and Demming Creek, which was only 2.2% by the end of the season (Cate, 2011). Last season it was believed that unseasonably cool and wet weather (wet snow) soon after release was the main reason for low survival of the released quail. Most of the mortality in 2011 occurred during the first few weeks post release. Quail this year did not encounter the same inclement weather, which probably aided their survival. The 2012 release on the S. Fork Sprague River was a little more than 6 km SE from the nearest of 2 releases in 2011. This year's release location appeared to provide suitable habitat options in close proximity and ample shrub cover for those birds who travelled far beyond the release location. Considering the improvement in survival and breeding success of the birds in 2012, and observations of non-collared birds, some of which were with broods, it is hoped the final planned release in this area in 2013 will result in a sustainable population of
mountain quail in the Gearhart Wilderness and surrounding areas.
Maps

Map 1: Dispersal of birds from the release site was in a northwestern direction. Nests locations are for birds 1930 and 617. Brood locations are for bird 1930.
Map 2: Northeast of the release site. The mortalities in the upper left and lower right are in the same drainage as one of last year's release locations.
Map 3: North of the release site. This map covers the late season movements of 1930's brood, the nesting and mortality location of 1847, and the observation points of two other birds.
Map 4: East of the release site.

- Mortality
- Live Observation
- Brood Observation
- Nest Location
- Release Site
Map 5: East of Map 4, even further east of the release site. Nesting and brood locations of bird1968.
Map 6: Southwest of the Map 5 location and southeast of the release site. Observations of bird 1996 and brood.
Map 7: 10,401m southeast of release site.

- Live Observation
- Mortality
Map 8: Far southwest of the release site. Live locations are of 666. An additional mortality to the one shown is west of these points and was the furthest point taken from the release location at 21,747 m away.
Map 10: Movement of 1930's brood over the season. The nest location was 2,042m from the release site, while the final location in the northeast corner was 8,281m from the release site.
Map 11: Nesting site and brood observations of bird 600. Nest site 2,743m from release. Mortality was 6,223m from release.
Map 12: Nesting site and brood locations for 1968. Nesting location was 9,881.37 m from release site. The NW corner of the map shows the mortality location of bird 600 as seen on Map 11.

1968 Nest
1968 Brood Observation
600 Mortality
Map 13: Movements of 617 and 620 throughout the season. They started near the release site and moved SE across the highway. The live observations to the west are of bird 1839, who was never observed with another quail.
Map 14: Movements of 1961 head in a NW direction.
Map 15: 1908 was first observer near the nesting site of 1930. He moved out of the area many weeks before she began moving NE as well. They were last observed within 800 m of each other, but 1908 was alone while 1930 was with a different covey. Map 10 shows the movements of 1930.
Acknowledgements

There are several people to whom I owe great thanks to for a successful field season, most notably the individuals of the Oregon Department of Fish and Wildlife field office in Klamath Falls, OR. I thank Tom Collom and Jon Muir for providing me with the opportunity for a variety of useful wildlife management experience and for all of their telemetry insight. Lanny Fujishin and Jim House for assistance with accommodation woes, lots of fun stories, and plentiful playful ribbing. Bill Tinniswood for letting me invade his office space to use the computer. A massive thank you to Susan Moody for all her help around the office and just being a great friend outside of work. Dave Budeau for all his helpful information about mountain quail and for assisting with the collection of some of the reference articles for this paper. Jackie Cupples and Andrew Menlow for instructing me during aerial telemetry flights and for listening for birds when I couldn't fly. I also thank Lora Vialpando from the U.S. Forest Service for sending me the plant association maps on short notice.

Literature Cited


Oregon Department of Fish and Wildlife.


