Great Gray Owl Project Report, 2016

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INTRODUCTION

In 2016 we continued a multi-year study on Great Gray Owls in northwestern Wyoming that began in 2013. Working from the vast dataset gathered on nest sites and movements of Great Gray Owls amassed over the past three years, our goal in 2016 was to continue the dataset on territory occupancy, nest initiation rates, productivity, and survival and movements of previously marked owls. In addition to long-term monitoring of these metrics, we also began three new aspects of this study in 2016. Our new objectives in 2016 were to investigate the use of automated recorders for monitoring Great Gray Owls, how snow and prey conditions relate to Great Gray Owl habitat use and nest success, and to better understand juvenile survivorship, movements, and dispersal. Snow characteristics likely have a strong influence on Great Gray demographics. Snow loads in the spring and crust hardness may affect timing of nesting, hunting success, and prey abundance. Juvenile dispersal, survivorship, movements and habitat use is not known in the Rocky Mountain regions. Great Gray Owls typically do not breed until their third year, and understanding the juvenile life stage is important to understanding the overall ecology of this species. We also began a study to investigate the efficacy of using automated recorders to monitor territory occupancy of Great Gray Owls. Details of this aspect of the study will be available in a future report because analysis of recordings will take some time.

METHODS

The primary study area in 2016 included the base of the Teton Range and the Snake River riparian corridor from the areas around Moose, WY in southern Grand Teton National Park south to the Snake River Canyon. The study area also included northern areas within Grand Teton National Park (e.g., Emma-Matilda/Two Oceans area) and Bridger-Teton National Forest (e.g., Rosie's Ridge and Blackrock areas). The typical forest habitats consisted of Douglas fir, lodgepole pine, sub-alpine fir (*Abies lasiocarpa*), and aspen (*Populus tremuloides*) surrounding the valley and mixed cottonwood (*Populus* spp.) spruce (*Picea* spp.) forests within riparian areas. Both mesic and sagebrush (*Artemesia* spp.) meadows occurred throughout the study area. Housing subdivisions are common throughout the study area but rarely extend beyond 1.5km from the valley floor.

We continued to track previously radio-tagged owls and monitor known Great Gray Owl territories through night surveys, nest-checks, and fledgling surveys. We also continued pocket gopher surveys at known territories, and we initiated snow surveys in a number of these territories as well as at locations of radio-tracked birds. We also continued to monitor nesting platforms to determine if nest sites may be limiting the number of nesting pairs.

Call-Back Surveys

During the courtship period of Great Gray Owls (mid-February – April), we conducted call-back surveys to record the presence of Great Gray Owls across the study area. In 2016, our main intent was simply to determine whether known territories were active or not, so we altered our methods from past survey years. We assigned three call-back locations per known territory in a triangular configuration, conducting the surveys at points 300m from 2015 nest sites. As soon as Great Gray Owls were detected within a territory, we ceased surveying that area for the night. We continued to follow the USFS/BLM protocol (Quitana et al. 2004) with slight modifications to better suit the study area. We played calls for both Great Gray Owls and Boreal Owls. Each calling period consisted of a two-minute listening period, Boreal Owl territorial call, one-minute listening period, Great Gray Owl territorial call, one-minute listening period, Great Gray Owl call, and a final two-minute listening period. We recorded all owl species detected, and we estimated distance to and direction of each owl. To help with distance estimates, we played owl calls at typical volumes for each species at known distances in training sessions. We conducted backcountry surveys in teams of two, typically on skis or snowshoes.

Nest Monitoring

We monitored all known Great Gray Owl territories. We considered a territory "active" only if we found direct evidence of breeding, such as an incubating female or fledglings. We considered a territory "occupied" if we documented multiple night detections or saw at least one adult owl multiple times but no active nest or fledglings were located. Once active nests were located, we checked on nesting status at least once every week to determine nest success and fledge dates. We considered fledged nests as successful. In some areas, 2015 nests were not re-used, so we conducted limited nest-searching and fledgling surveys to determine whether territories were active/successful. Fledgling surveys were conducted during August and used a mixture of contact and begging calls.

We also continued to check the 42 nesting platforms we installed in a portion of our study area in previous years to see if they are being utilized by Great Gray Owls. All platforms were checked at least once during the incubation period.

Gopher Surveys

We surveyed for pocket gopher abundance following van Ripper et al. (2013). We digitized all meadows within 500 m of known nests and randomly selected three (when available) for surveys. We started at the head of each meadow and walked 45-degree diagonal transects back and forth until reaching the end of the meadow, tallying fresh and old gopher mounds visible within 10 m of the transect. Because we are interested in relative abundance between years and among territories, we tallied total survey area (total transect length x 20 m) for each territory and divided by the total number of mounds to create an index of gopher abundance. Because we regularly observed owls hunting within forested areas, we also added a survey transect bisecting the territory through representative forest habitat. We tested for correlations between new, old, and total gopher mound abundance and between forest and meadow. We tested for relationships between years and between gopher abundance and productivity.

Tracking

We continued to radio-track Great Gray Owls that are outfitted with VHF transmitters. We attempted to relocate each marked owl once per week throughout the study. Relocations were obtained via homing techniques and locations were recorded within 100 m of the owl without disturbing it.

Snow Measurements

In the winter of 2015-2016, we began conducting snow measurements near known Great Gray Owl territories across the study area, as well as at re-location sites of radio-tagged birds. We conducted measurements at least once biweekly. We measured snow depth by placing a measuring stick vertically down through the snow until it reached the ground. We measured snow crust strength by dropping a filled 1-liter Nalgene water bottle (ca. the same weight as an adult Great Gray Owl) one meter above the top of the snow (not the ground) and measuring how far the bottle penetrated the snow. We dropped the bottle both horizontally and vertically and averaged the depths. In each territory, we measured snow characteristics in a meadow and in a forest representative of the territory. The same meadow and forest sites were consistently measured. We made sure to conduct the measurements in areas representative of the area's average snow conditions (ie. not directly in a tree well, nor in an area disturbed by human activities).

Banding

We banded fledgling Great Gray Owls immediately after they branched with a USGS and custom-made blue and white plastic alphanumeric leg flag. Fledgling captures took place within one week of fledging using a net on an extendable pole. We took standard ornithological measurements of each individual and a blood sample for later genetic analysis. Gender was determined using a small portion of the blood sample (Zoogen DNA Services, Davis, CA). We also outfitted one fledgling per brood with tarsal

VHF transmitters attached to its leg flag. The tarsal mounts last approximately three months and will aid in the relocation of fledglings for autumn captures. In September, we will target all banded juveniles to outfit them with backpack VHF transmitters once they are fully grown. Tarsal mount transmitters will be removed before outfitting with the backpack transmitter.

RESULTS

Call-Back Surveys

We surveyed a total of 15 known territories four different times from 25 of February – 5 of April 2016. The overall survey period was divided into two periods, early and late (25 Feb - 16 Mar and 17 Mar – 5 Apr, respectively). Each territory was surveyed twice in the same week to correspond to the period when reorders were deployed in the same territory for direct comparison. Five territories were surveyed each week during the early period, then they were re-surveyed in the corresponding week in the late period (i.e., if territory A was visited in week one, then it was resurveyed in week four, and if territory B was surveyed in week three, it was re-surveyed in week 6). We also conducted surveys opportunistically at additional locations within suspected, unconfirmed territories.

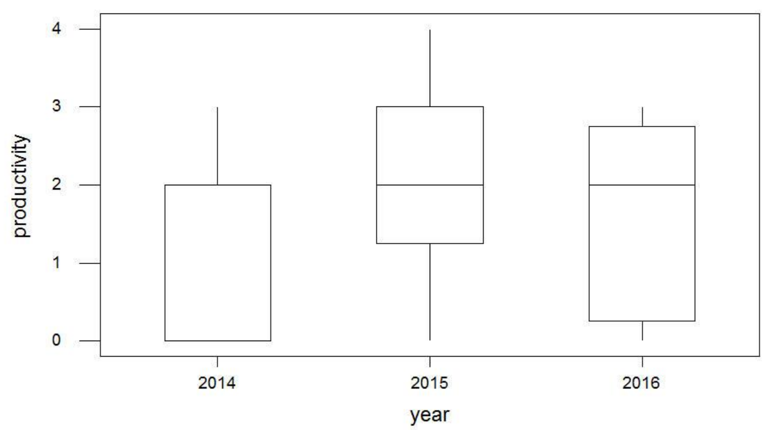
In 2016, we detected Great Gray Owls at 10 out of the 15 known territories we systematically surveyed. We detected Great Gray Owls as early as 25 February and as late as 1 April. During each round of surveys, we detected Great Gray Owls at six out of the fifteen known territories. We also detected Great Gray Owls in two new territories during spring call-back surveys. We visited 191 individual call locations total and recorded a total of 85 detections from six different owl species. We detected Boreal Owls (12), Great Gray Owls (25), Great Horned Owls (26), Long-eared Owls (2), Northern Pygmy Owls (14), and Northern Saw-Whet Owls (8).

Nest Monitoring

In 2016, we monitored 29 known Great Gray Owl territories in the study area. Of these, 27 were occupied in 2016 (we did not observe any Great Gray Owl activity at two of the territories, although access to these sites was limited until late in the breeding season). We documented 21 active nests, 17 of which successfully fledged young. The successful nests produced an average of 2.05 fledglings per nest. We calculated nest success rate based on 15 nests that we consistently monitored from the beginning of nest initiation. Of these, 11 were successful (73% apparent nest success rate). Average productivity was 1.67 fledged young/nest. We recorded accurate fledge dates for eight of the 17 nests that successfully produced young and calculated an average fledge date of 16 of June from those nests (range = 8 June - 28 of June). We documented an average initiation date of 13 of April.

Two of the occupied territories were new in 2016, located during fledgling surveys late in the breeding season. We are unsure whether eight occupied territories nested successfully because the 2015 nest sites were not reused and new nest sites were not located. Our nest-searching efforts to document alternate nest sites within these territories were inadequate to sufficiently know if these owls nested or not in 2016. We found no difference in productivity across years, from 2014-2016 (Figure 1). We also did not detect differences in nest success by year ($P = 0.524$).

Figure 1. Boxplots of Great Gray Owl productivity by year ($P = 0.308$).



Gopher Surveys

We conducted pocket gopher surveys at 16 territories between 21 of May and 17 of June. We found an average of 0.00051 fresh gopher mounds/sq m (SD = 0.00045) within meadows. Mean old and total mound abundance was 0.00352 and 0.000403 mounds/sq m, respectively. We first tested for correlations between the abundance of new, old, and total mound abundance within territories to investigate the appropriate measure. Not surprisingly, all measures were correlated (all $P < 0.001$), so we used the indices of fresh mounds to be consistent with van Ripper et al. 2013.

In 2016, mound abundance within forests (0.000145 mounds/sq. m, SD = 0.000161) was significantly lower to meadows ($P = 0.006$). Gopher abundance was also lower in 2016 compared to 2014 and 2015 ($P < 0.000$, Figure X). We did not find that productivity was related to gopher abundance across territories and years ($P > 0.01$). But we did find that failed nests had significantly fewer gophers than successful nests (Figure 2, 3).

Figure 2. ANOVA results of new gopher mound abundance by year. P < 0.000

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                   Individual 95% CIs For Mean
                   Based on Pooled StDev
Level    N    Mean     StDev  ---+---------+---------+---------+---
2014    10  9.61E-04  9.72E-04          (-----*-----)
2015    21  1.46E-03  5.96E-04                (---*----)
2016    16  1.45E-04  1.61E-04  (----*----)
                   ---+---------+---------+---------+---
Pooled StDev = 6.03E-04      0.00000   0.00060   0.00120   0.00180
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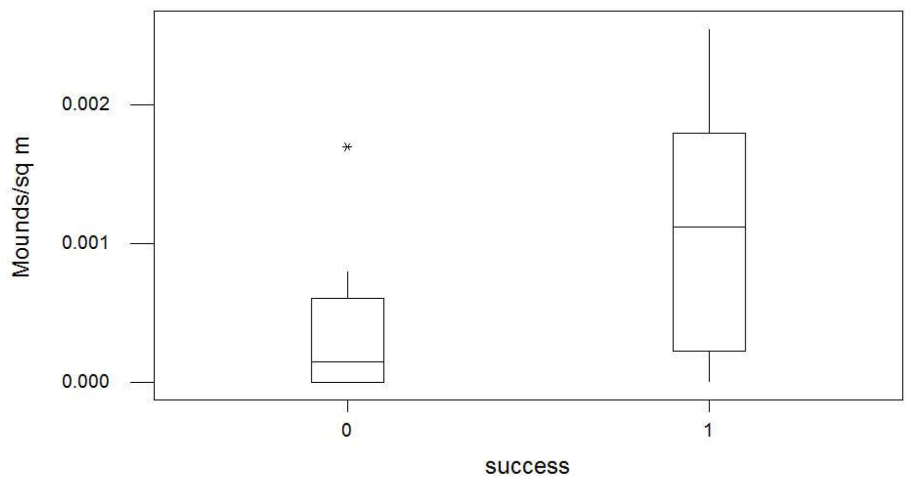
Figure 3. Boxplot of nest success by year (2014-2016, P = 0.0042). Success 0 = failed and 1 = successful nests.



Snow Measurements

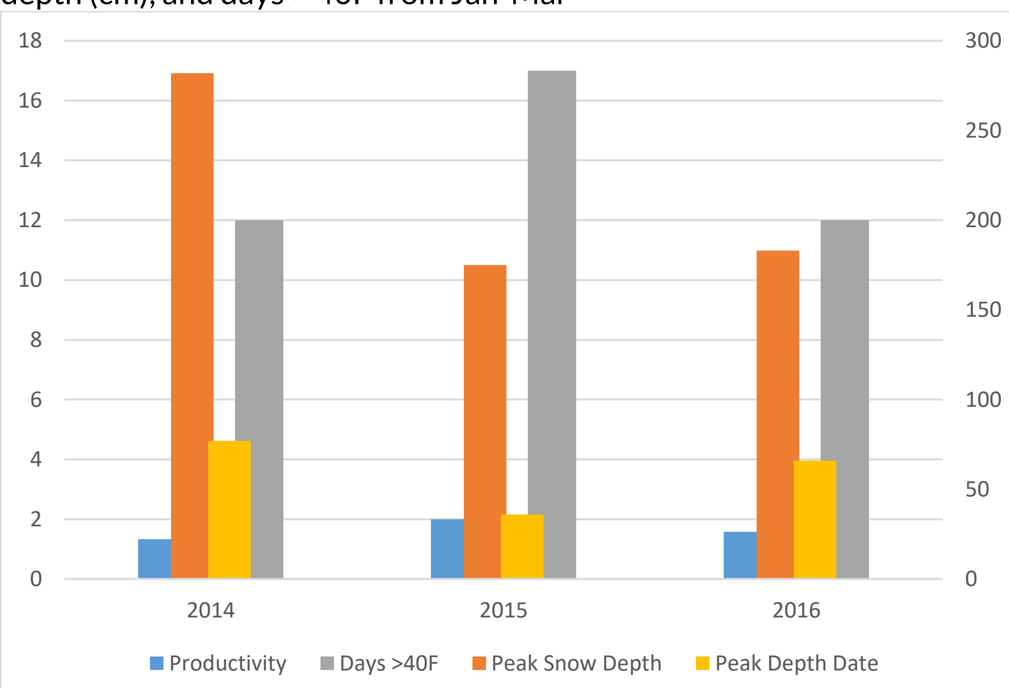
We conducted snow measurements at eighteen known Great Gray Owl territories across the study area. Measurements were taken as early as 1 of January through 20 of April. Some sites were visited more often than others due to accessibility, but we took measurements at the sites an average of 7.6 times throughout the winter. We ceased gathering snow data when there was <50% estimated snow cover within the territory.

We tested for correlations within territories between forest and meadow sites. We found that a minimum of 10 measurements over the winter were needed to detect a correlation between forests and meadows within a territory at the alpha = 0.05 level. Using the four territories where we measured at least 12 days (Murie, Munger, Granite, Death Canyon), we found that meadows had an average of 21.14 cm more snow than forest sites.

To standardize the relative amount of snow within a territory, we compared the snow depth measured at nests between February 10-12 to the snow depth at the Snowtel site on Phillips Ridge. We used this date range because we had data for almost all nests during this period and there were no snow events to influence estimates. This also generally corresponds to peak snow depths on the valley floor. We used the measure at meadow sites for comparisons. For nests which we had nest initiation rates or productivity rates, we tested to see if relative snow depth was correlated to nest success, nest initiation date, productivity, or gopher abundance. We found no evidence to suggest snow depth was related to anything tested (all $P > 0.1$). More years of data are needed to adequately test these relationships.

We also began exploring annual variation by looking at mean productivity with peak snow depth (at Phillips Ridge Snowtel site), peak depth date, and days >40 F from January – March. The only metric we looked at that exhibited a similar pattern to productivity was the number of days above 40F from January through March (Figure 4).

Figure 4. Mean annual productivity, Julian date for peak snow depth, maximum snow depth (cm), and days > 40F from Jan-Mar



Banding

We banded 17 fledglings from 11 territories immediately after they left the nest. Nine fledglings (one from each of nine different broods) were outfitted with <5g tarsal mounted VHF transmitters temporarily attached to their colored leg flags. The purpose of these transmitters was to help us relocate fledglings in the fall in order to target juveniles to outfit with VHF backpack transmitters. Range on the tarsal transmitters was weak and many of the juveniles could not be relocated via radio-tracking. However, we were able to relocate five of the banded juveniles as well as five unbanded juvenile owls, so we deployed ten VHF backpack transmitters this fall. If anymore banded juveniles from the 2016 cohort are relocated, we will target them for VHF transmitters.

CONCLUSION

Long-term monitoring of Great Gray Owls is essential in order to assess overall population health. We intend to continue nest-monitoring and prey-sampling in order to evaluate the health of Great Gray Owls in the Greater Yellowstone Ecosystem in the face of anthropogenic and natural changes over time. Snow conditions likely have an influence on Great Gray Owl winter habitat selection, seasonal movements, timing of breeding, and nest success, but these data need to be collected across years in order to adequately assess how climate affects this species. Furthermore, as Great Gray Owls are a denizen of boreal forests that will likely be effected by climate change, it is important to study how this species responds in light of rising temperatures and a changing environment.