

**Songbird Monitoring in the Lassen National Forest:
Results from the 2001 Field Season**

**Progress Report
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EXECUTIVE SUMMARY

Standardized bird monitoring conducted by the Point Reyes Bird Observatory in 2000 and 2001 within the Almanor Ranger District of the Lassen National Forest provided valuable baseline data and insight into the bird communities of the area. Important information regarding bird species diversity, species richness, abundance, productivity, and survivorship was gathered for numerous habitat and treatment types.

2001 marked the second year of an inventory and monitoring study of the breeding birds of the Almanor Ranger District (ARD) of the Lassen National Forest (LNF). The inventory has shown the ARD to have a high diversity of passerine and near-passerine bird species in numerous habitat types. A wide range of riparian, coniferous forest, oak woodland, and foothill chaparral species breed within the ARD. Among them are several sensitive species and species of management concern, including Willow Flycatcher, Hammond's Flycatcher, Olive-sided Flycatcher, and Yellow Warbler (CDFG 1992 & 2001).

High densities of songbirds detected during point count censuses, as well as high productivity indices, species richness, and capture rate recorded from mist-netting data continues to support the assumption that mountain meadows are critical habitat for numerous species of songbirds. The data suggests that higher elevation meadows harbor larger numbers and higher diversity of dispersing birds than lower elevation meadows in early August.

Results from mist-netting data, gathered at the Gurnsey Creek site, continues to support previous findings that productivity and survival is very high for most species at the site, especially MacGillivray's Warbler and Song Sparrow.

Several species that were reported as common or fairly common in the ARD in the early part of the 20th century are believed to have undergone serious declines including Lazuli Bunting, Green-tailed Towhee, Yellow Warbler, Mountain White-crowned Sparrow, and Willow Flycatcher (Grinnel et al. 1930). No Mountain White-crowned Sparrow were detected on any of the surveys in 2000 and 2001 but have been recorded in the past five years in very small numbers in the ARD and Lassen Volcanic National Park (Humble et al. 2001, King et al. 2001).

Swainson's Thrush and Ruby-crowned Kinglet once quite common and abundant breeders in the ARD (Grinnel et al. 1930) were not detected on any surveys during the two-year inventory nor were they detected in the three year study by King et al. (2001). It is our opinion that these species have undergone large declines and may now be extirpated from the ARD.

Future management effort should focus on reversing the recent declines in these species through restoring riparian and meadow systems, creating and preserving montane shrub habitat, and creating structurally diverse and open forest habitat.

INTRODUCTION

In recent years, concern has grown over the widespread decline of numerous songbird populations, particularly among Neotropical migrants, those species that breed in the U.S. and Canada and migrate to the Neotropics (for review see Finch and Stangel 1993, Askins 2000). The Lassen area supports populations of many of these declining and threatened species. The area is home to 9 of the 14 Riparian Focal Species and at least 12 of the 13 Coniferous Forest Focal Species listed by California Partners in Flight (RHJV, 2000, CPIF 2000), as well as all of the species of landbirds identified as declining or likely declining by the Sierra Nevada Ecosystem Project Report (Erman et al. 1996).

The composition and structure of northern Sierra Forests have been altered by fire suppression, timber harvest, grazing, and other forest management practices (see SNEP, 1996, Hejl et al, 1994). In recent years new management plans for the region have mandated changes to current practices. Both the Quincy Library Group and Sierra Nevada Forest Plan Amendment Act records of decision have mandated significant reductions in fuel loads while preserving old growth forest types in the Almanor Ranger District (ARD) of the Lassen National Forest (LNF) (HFQLG 1998, SNFPAA 2000). It is crucial to monitor both the treated and non-treated lands in the ARD, to provide an adaptive management feedback loop to assess the effects of these new management plans on songbirds.

From 1997 to 1999, PRBO, in cooperation with the ARD of the LNF, conducted a study of some of the bird communities within the ARD. The results from that study confirmed the belief that the Lassen National Forest supports diverse communities of avian species and contains vital habitat to numerous species of songbirds (King et al. 2001).

2001 marked the second year of a new bird monitoring study designed to gather baseline data in all habitat types within the ARD in order to inventory the breeding birds of the area and determine the effects of forest management practices on the breeding bird communities, as well as to monitor long-term trends in the local bird populations.

The **principle objectives** of this study are to:

- 1) Create an inventory of the breeding bird species of the ARD.
- 2) Assess the importance of different habitat types and treatment types by determining relative abundance, species richness, and diversity of breeding songbirds.
- 3) Gather baseline data on the composition and health of songbird communities using mountain meadows, as well as assess the importance of these meadows to those species.
- 4) Contribute to national and regional conservation efforts by using standardized methodologies and submitting data to national monitoring programs (e.g. National Point Count Database and MAPS).

METHODS

Point count censuses

Between ten and twenty random starting points were generated in a variety of different habitat types using a random point generator created for the Geographic Information System (GIS) software package ArcView (ESRI 1999). Points were selected for each of the most common vegetation types in the study area as determined from a GIS vegetation map provided by U.S. Forest Service Remote Sensing Lab (2000). Further distinctions were then made between ages of stands as predicted by the vegetation map. The actual points used were then determined based on logistical and habitat constraints. For example, some routes were established in suitable habitat adjacent to random starting point transects in order to allow for carpooling to sites. Random starting points were used for 7 of the 12 newly established transects. The five other newly established transects were selected in order to maximize the diversity of habitats censused or in order to cover habitats or age classes in which it was not logistically possible to use any of the random starting points (Table 1). Six out of seven of the sites established prior to 2001 were established in 2000 (Burnett et al., 2001), while the MNNB transect was originally established in 1997 (King et al., 2001). All points were located at least 50 meters from any roads. Each point was marked with flagging and GPS coordinates were recorded for each point.

Standardized five minute, fifty meter, fixed radius point count censuses (Ralph et al., 1993) were conducted at each of 213 stations along 19 transects in the ARD (Table 1 and Appendix 1 Map). 12 of these transects were established in 2001 while 7 were sites established by PRBO in previous years. Counts began around local sunrise and were completed within four hours. All birds detected at each station during the five-minute survey were recorded. These detections were placed within one of three categories: those detected within 50 meters, those detected outside of 50 meters, and those detected flying over the station but not detected having landed. The method of detection (song, visual, or call) was also recorded. Each transect was visited twice between mid May and 6 July.

Table 1. 2001 ARD point count transect habitat types, names, codes, number of points, and dates censused.

Transect	CODE	# OF POINTS	1ST VISIT	2ND VISIT
BURNED				
Black Rock	BLRO	15	5/23/2001	6/25/2001
Soda Creek (Mixed Conifer Fir)	SOCR	12	6/12/2001	6/24/2001
WHITE FIR				
Large White Fir	LGWF	12	5/30/2001	6/24/2001
Snag Lake	SNLA	12	6/6/2001	6/23/2001
RED FIR				
Humbug Summit	HUSU	12	6/6/2001	6/26/2001
Humboldt Summit Red Fir	HSRF	12	6/1/2001	6/29/2001
MIXED CONIFER PINE				
Upper Mill Creek Trail	UMCT	12	6/7/2001	6/16/2001
Rattlesnake	RASN	12	5/29/2001	6/17/2001
Philbrook Lake	PHLA	12	6/6/2001	6/23/2001
MIXED CONIFER FIR				
Mineral North B	MNNB	15	6/7/2001	6/15/2001
Morgan Summit	MOSU	12	6/11/2001	6/25/2001
JEFFREY PINE				
Jeffrey Pine	JEPI	12	6/1/2001	6/18/2001
ASPEN				
Aspen	ASPN	9	6/11/2001	6/28/2001
SHRUB				
Carter Meadow Road	CMRO	12	6/11/2001	6/26/2001
Humboldt Summit Shrub	HSSH	12	6/1/2001	7/6/2001
Ponderosa Pine				
Ponderosa Pine Small 1	PPS1	12	5/29/2001	6/20/2001
Ponderosa Pine Small 2	PPS2	11	5/29/2001	6/20/2001
OAK WOODLAND				
Blue Oak 01	BO01	15	5/22/2001	6/24/2001
Canyon Live Oak	CLOA	12	5/23/2001	6/25/2001
MEADOWS				
Big Springs Meadow	BSME	4	6/12/2001	
Cold Springs Meadow	CSME	6	6/12/2001	
Fanani Meadow	FAME	13	6/14/2001	
Henry's Flat Meadow	HFME	5	6/23/2001	
Jones Valley Meadow	JVME	4	6/13/2001	
Soldier Meadow	SOME	7	6/14/2001	
Willow Springs Meadow	WSME	7	6/13/2001	

Constant-effort Mist Netting

Constant-effort mist netting provides data on the productivity of locally breeding species and, if conducted for three or more years, can provide data on adult annual survival.

Mist netting was conducted for the fifth consecutive year, at the Gurnsey Creek riparian site established by PRBO and the ARD in 1997 (King et al., 2001, Burnett et al., 2001).

Ten nets were opened 15 minutes after local sunrise and operated for 5 hours. Each bird captured (except hummingbirds) was banded using a USFWS band enabling permanent identification. Prior to its release, species, age, sex, skull ossification, breeding condition, fat score, molt, flight feather wear and fade, wing length, weight, time captured and net captured in were recorded, for each bird captured, as described by Pyle (1997).

All mist netting data will be submitted to the MAPS program of the Institute for Bird Populations (DeSante et al. 1998), and the Bird Banding Lab (BBL, Patuxent, MD).

Meadow Surveys

We surveyed seven new meadows during the 2001 breeding season. Along with the six censused in 2000, a total of thirteen meadows in the ARD have now been censused (see Appendix 2 Map for locations). New meadows were chosen using GIS vegetation maps of the ARD, and are generally the largest meadows within the ARD. Each meadow was visited twice using the methods outlined by Siegel (2000). The first visit was during the height of the breeding season (last week of June) and the second visit was conducted at the conclusion of the breeding season (first week of August). See table 5 for a summary of the 2001 mist-netting effort.

During the first visit, as many point count stations as could fit into the meadow were established, maintaining a minimum of 150 meters between points. These stations were then censused following the point count methods described above (Ralph et al. 1993), with an additional note made as to whether the bird was detected inside or outside of the meadow. Immediately following the point count census we conducted an area search, canvassing the entire meadow and adjacent edge and recording every species detected, noting its presence inside or outside of the meadow. The duration of each area search was based upon the number of point count stations established, using a formula of 10 minutes per point. For example, a meadow with 6 points would entail an area search of 60 minutes.

During the second visit, an array of 6 mist-nets were set up in and around each meadow. A general formula of placing three nets inside the meadow interior, two on the edge, and one 50 meters from the edge in the adjoining forest interior was used. In meadows in which there was no vegetation in the meadow interior, the three interior nets were moved to the meadow edge for a total of 5 edge nets and 1 interior net. The 6 nets were operated for 6 hours on one day only. The data collected was the same as described above.

Vegetation assessment

Vegetation at each point count station was assessed using the relevé method, following procedures outlined in Ralph et al. (1993). A 50-meter radius plot centered on each census station was used. General habitat characteristics of the site were recorded (canopy cover, slope, aspect, etc.) and the cover, abundance, and height of each vegetation

stratum (tree, shrub, herb, and ground) was estimated. Within each vegetation stratum, the species composition was determined and each species' relative cover recorded, as a percentage of total cover for that stratum (see Ralph et al. 1993 for complete description).

The same relevé method described above was employed at each meadow point count station. However, since many of the points were on the edge of the meadow and the habitat within these points was drastically different, the vegetation was assessed separately for each habitat type, as described in Ralph et al. (1993). A second more general vegetation assessment was also conducted following the method described by Siegel (2000). This method involved assessing an array of one-meter square census plots spread evenly throughout the meadow. The presence of water, total cover, and percent each species comprised of that total cover were recorded for each plot. In addition, a general description of hydrologic function, an assessment of grazing and browsing pressures, as well as the extent of human impact in each meadow was recorded.

Statistical Analysis

Species richness:

Species richness is defined as the total number of species detected within 50 meters. Richness can be presented as cumulative species richness (total number of species detected within a habitat or along a transect) or as mean species richness (average number of species detected per point within a habitat or transect). Presenting the mean species richness allows for comparisons between transects or habitats consisting of different numbers of point count stations. Although it is not appropriate to compare cumulative species richness between habitats or transects containing different numbers of point count stations, it can nevertheless be informative to know the cumulative number of species detected within a given habitat. The meadows point count censuses were conducted only once and therefore the richness might be artificially lower than if two visits had been conducted. This should be taken into account when comparing the meadow surveys to the other censuses.

Diversity:

Species diversity is defined as the number of species detected within 50 m (species richness) weighted by the number of individuals of each species. A high diversity score indicates high ecological (species) diversity, or a more equal representation of the species. Species diversity was measured using a modification of the Shannon-Wiener index (also called Shannon-Weaver index or Shannon index; Krebs 1989). We used a transformation of the usual Shannon-Weiner index (symbolized H'), which reflects species richness and equal distribution of the species. This transformed index, introduced by MacArthur (1965), is N_1 , where $N_1 = 2^{H'}$. The advantage of N_1 over the original Shannon-Wiener metric (H') is that N_1 is measured in terms of species instead of bits of information, and thus is more easily interpretable (Nur et al. 1999). Single visits instead of two visits to meadows surveys as with the species richness may result in slightly different diversity indices. As with richness, diversity can be presented for the entire transect or habitat; and it can also be presented as the mean diversity per point, to allow for comparisons. We chose to present only the mean diversity in this report due to the

inappropriateness of comparing total diversity between habitat types containing different numbers of points.

Abundance:

We define the index of abundance as the mean number of individuals detected per station per visit. This number is obtained by dividing the total number of detections within 50 meters by the number of stations and the number of visits.

The data in the 2000 report (Burnett et al, 2001) was presented as cumulative richness and diversity. All of the 2000 data used in this report is presented as by point means in order to allow for direct comparison between sites and year.

Assessing Sufficient Coverage of Each Habitat

Although it is not possible to directly determine the percentage of species breeding in the ARD that have been documented in our inventory, we needed to assess the likelihood that we have achieved a goal of documenting at least 80% of the bird species breeding within the ARD. We wrote a cumulative species function program to extrapolate the rate at which new species are encountered as points are added within a given habitat. This is averaged over 100 bootstraps (repetitions) of randomly selected orders of points. Mean and 95% confidence intervals were generated. We used this program to determine if a sufficient percentage of the species present were likely detected. We determined that at least 80 percent of the breeding birds in each habitat had been censused.

Regression Analysis and T-test

We used the computer program Stata to run linear regression (Statcorp 2000) to assess the effects of elevation and deciduous cover on the abundance (capture rate) and species richness of birds in mountain meadows. Meadows lacking any deciduous vegetation (Heckle and Wilson) were not used in this analysis due to the bias in capture probability in meadows lacking low lying vegetation to place nets within. Spenser meadow was also eliminated due to the likelihood that the sampling at this site was biased by high winds, extremely cold temperatures, and placement of nets on that day. Large numbers of birds were seen in the meadow on this day but capture rates and species richness data does not reflect this. Residuals for both models met the assumption of normality. We have presented the adjusted r^2 value as well as the p-value for each regression model. We tested for significance of between year variation in point count data using a paired t-test, with our data meeting the assumption of normality (Statacorp 2000).

Results and Discussion

Point Count Censuses

A total of 103 species were detected along 19 point count transects within the ARD during the 2001 field season (Appendix 1). Combined with counts conducted in 2000 a total of 107 species have been detected along point count transects during the inventory. We compared breeding bird diversity, richness, and abundance data from these standardized censuses among sites (Table 2).

Table 2. Species diversity, species richness, and number of individuals (<50m) detected at point count stations at each site during the 2001 breeding season.

Transect	Mean Species Diversity	Total # of Individuals	Mean Abundance/ Point	Mean Richness
Aspen	7.15	108	6	8.11
Black Rock	4.82	130	4.33	5.27
Blue Oak Woodland	5.68	182	6.07	6.53
Canyon Live Oak	4.36	77	3.21	4.67
Carter Meadow Road	6.47	188	7.83	8.08
Humboldt Summit Red Fir	5.56	106	4.42	6
Humboldt Summit Shrub	3.56	70	2.92	3.92
Humbug Summit	5.09	100	4.17	5.67
Jeffrey Pine	4.32	81	3.38	4.67
Large White Fir	5.52	95	3.96	5.92
Mineral North B CDZ	4.29	89	2.97	4.53
Morgan Summit	6.71	111	4.63	7.08
Philbrook Lake	4.19	67	2.79	4.42
Ponderosa Pine Small 1	4.14	83	3.46	4.58
Ponderosa Pine Small 2	2.8	42	2	2.91
Rattlesnake	5.16	105	4.38	5.67
Snag Lake	5.51	115	4.79	6.08
Soda Creek	4.19	79	3.29	4.5
Blue Oak Woodland	5.68	182	6.07	6.53
Upper Mill Creek Trail	5.12	92	3.83	5.5
LNF Average	5.02	2102	4.42	5.53

The transect with the highest diversity, and one the highest abundance per point, was recorded for the Aspen transect with a mean diversity of 7.15 and a mean of 6.00 birds per point. The Carter Meadow Road transect, originally censused in 2000, continued to show high diversity and abundance in 2001. The CMRO transect had a mean diversity of 6.47, and its abundance of 7.83 was the highest recorded for any transect. The Black Rock transect showed lower diversity and abundance per point in 2001 than it did in 2000. This site burned during the Gun Fire in the fall of 1999. Much of the vegetation that was still alive in 2000 had died by the spring of 2001, and the area was noticeably drier in 2001 than in 2000. The Shrub field located near Humboldt Summit had one of the lowest diversity and abundance figures of any transect but it had high densities of Yellow Warbler, a California Species of Special Concern (CDFG 2001) as well as several other shrub dependant species that may warrant concern under new management plans in the Sierra, including Green-tailed Towhee, Dusky Flycatcher, and Fox Sparrow.

Yellow Warbler is closely tied to shrubby riparian willow habitat, throughout most of its extensive range in North America, including the ARD (Lowther 1999, King and King 2001, Grinnell et al. 1930, Heath et al. 2001). Grinnell originally documented the unusual occurrence of Yellow Warbler away from riparian habitat in the Lassen region (Grinnell et al. 1930). Yellow Warbler have also been documented in Ceanothus and Manzanita

dominated shrub fields in several other locations in the Sierra and southern Cascades (Gaines 1992, prbo unpubl. data). The Humboldt Summit Shrub (HSSH) transect along with the shrub fields within the Ponderosa Pine Small (PPS1 and PPS2) transects are the only sites, in PRBO's five years of bird monitoring in the ARD, where we have documented Yellow Warblers away from riparian habitat. In these locations within the xeric montane shrub fields, we have found Yellow Warbler to be nearly as abundant as Fox Sparrow and Dusky Flycatcher, the most commonly encountered species in this habitat type. With the current management concerns surrounding the Yellow Warbler in California (RHJV 2000, CDFG 1991 & 2001), and the continuing loss of riparian habitat in the state, shrub populations of Yellow Warbler should be of considerable management interest. The possibility also exists that these shrub Yellow Warblers are of a distinct genetic population and therefore merit management consideration of their own.

Using the 6 transects that were surveyed in both years we found there to be significantly lower indices for species richness ($p < .03$) and abundance ($p < .05$) in 2001 compared to 2000. In fact, all sites except Snag Lake had lower species richness and abundance in 2001 than the previous year. Field observations and mist-netting data also suggest that there were fewer breeding birds in the ARD in 2001 than in 2000. 2001 was a much drier year than 2000 (USDA 2001), and may be an explanation for the decrease in species richness and abundance.

Table. 3 Comparison of Species Richness and Abundance by point (<50m) for six transects surveyed in 2000 and 2001.

Transect	Species Richness		Abundance	
	2000	2001	2000	2001
Black Rock	6.6	5.27	5.9	4.33
Carter Meadow Road	9.08	8.08	8.96	7.83
Humboldt Summit	8.08	5.67	6.46	4.17
Philbrook Lake	6.25	4.42	4.71	2.79
Snag Lake	5.42	6.08	3.67	4.79
Upper Mill Creek Trail	7.33	5.5	5.5	3.83
Total Averages	7.13	6.14	5.87	4.62

Vegetation Analysis

The relevé vegetation data collected in 2000 and 2001 has not been analyzed. We plan on analyzing this data in 2002, after a third year of data is gathered. Analysis of this data will provide information on the relationship between vegetation composition and structure and bird diversity, richness, and abundance of the birds of Lassen National Forest.

Meadow Surveys

Montane meadows are believed to be crucial habitat for numerous species of landbirds. However, aquatic systems are the most altered and impaired habitats in the Sierra, with many meadow systems threatened by management practices (SNEP, 1996). In a continued effort to determine the importance and health of individual meadows in the

ARD we surveyed seven meadows in 2001 and six in 2000. See Appendix 2 for a list of species and number of detections in each meadow for 2001.

Table 4. Species diversity, species richness, and number of individuals (<50m) detected at meadow count stations at each site during the 2001 breeding season.

Transect	Mean Species Diversity	Total # of Individuals	Mean Abundance/ Point	Mean Richness
Big Springs Meadow	3.08	18	4.5	3.25
Cold Springs Meadow	4.99	42	6	5.14
Fanani Meadow	3.99	59	4.54	3.69
Henry's Flat Meadow	3.98	28	5.6	4.6
Jones Valley Meadow	2.66	13	3.25	2.75
Soldier Meadow	2.4	19	2.71	2.43
Willow Spring's Meadow	2.29	25	3.57	2.43
2001 Total Average	3.33	204	4.31	3.47

The highest diversity and richness of all meadows surveyed was Cold Springs (4.99) (5.14) while the highest abundance was Henry's Flat (5.6). The lowest diversity and richness of all the meadows was Willow Springs. Although many of these meadows contained some deciduous vegetation it was often concentrated in one location of the meadow, with the majority of the total area of these meadows lacking willow or alder cover. The majority of the point counts in 4 out of the 7 meadows (Big Springs, Cold Springs, Henry's Flat, Jones Valley and Soldier) lacked willow cover. Personal observations suggest a higher abundance and diversity of bird species at point count stations based on the presence of deciduous cover. Vegetation analysis in coming years will allow for comparison of meadow points with and without deciduous cover and potentially highlight the apparent differences we have observed. The lowest abundance was Soldier Meadow, a site currently undergoing restoration. Already small numbers of Song Sparrow, MacGillivray's Warbler, and Wilson's Warbler have reinhabited the meadow, and a Willow Flycatcher was captured here during netting in August. As the flood plain continues to recover after being rewatered, and willows and alders mature, this site appears to have the potential to become high quality breeding as well as dispersal habitat for songbirds.

Mist netting in the meadows was conducted in order to determine the importance of meadows for breeding birds as well as for post-breeding dispersal. Capture rate from mist-netting can provide insight into the abundance of birds in an area. The capture rate for the 7 meadows combined was extremely high at 240.6 captures per 100 net hours (Table 7), compared to 206.67 captures per 100 net hours for the six meadows surveyed in 2000. All meadows surveyed in 2001 contained at least some deciduous vegetation. When the two meadows surveyed in 2000 that did not contain deciduous vegetation are eliminated the capture rate in 2000 was 293.13. 45 species were captured in the meadows in 2001 compared to 34 species captured in 2000.

An index of productivity can be obtained by looking at the ratio of young to adults captured (HY/AHY). An estimate of productivity can provide insight into the health and viability of a local breeding bird population. Indices may also suggest the importance of an area to different age classes of post breeding birds (i.e. high indices means more young birds). The total mean HY/AHY ratio for all meadows was 4.71 compared to 3.63 for the six meadows surveyed in 2000. The combined mean ratio for all meadows surveyed in both years was 4.18. The highest young to adult ratio was 20.8 at Big Springs Meadow and the lowest was 1.55 at Fanani Meadow. Among those species with the highest young to adult ratios were Golden-crowned Kinglet, Orange-crowned Warbler, Audubon's Warbler, Oregon Junco, Nashville Warbler and Hermit Warbler (Table 5).

Table 5. Species and age class for all birds captured in the meadows during 2001. (See appendix 3 for list of species names and corresponding 4-letter codes).

Species ¹	Big Spring		Cold Spring		Fanani		Henry's Flat		Jones Valley		Soldier		Willow Spring	
	HY	AHY	HY	AHY	HY	AHY	HY	AHY	HY	AHY	HY	AHY	HY	AHY
AMRO	1	1												
ANHU					1									
AUWA	23	1	9	1			11	2			1		1	
BHGR	1		8				1		2	1				
BRCR	1		1											
BTYW									2					
CAVI	1				1	1					1			
CHSP					2									
DUFL	3		2				1	1	4					2
FOSP								1						
GCKI	3		78								4	1		
GRJA	1													
HAFL	13	3	1	1			1				1	1		
HAWO												1		
HETH	1		1	1					1					
HEWA	4		10		1		2				4	4		
HOWR	1						2							
LAZB									1					
LISP				2			2	5						
MGWA	1		4		1	2	3		1		2	3	1	
MOCH	7	3	1								2		3	
NAWA	6	2	11				10	3			3		3	
OCWA	6		17	1			26	10		1	1		3	
ORJU	37		13	2	1	1	10	1	3	2	12	5		1
PSFL								1						
PUFI			3											
RBNU	2	1									1			
RBSA			2		3	1			2		1	1		
RSFL									1					
RUHU			1		5		1		2					
SOSP					1		1	1	5	2	3	3	2	2
WAVI	1						1			1			1	
WETA	5		2											
WEWP	0	1								1				1
WHWO									2					
WIFL												1		
WIWA			2		1		3	2	1				1	
YWAR			2		1	5								
TOTAL	118	12	167	8	17	11	74	28	26	10	35	21	15	6
Ratio		9.83		20.8		1.55		2.64		2.60		1.67		2.50

The most commonly captured species in the meadows in 2001 were Oregon Junco, Golden-crowned Kinglet, Orange-crowned Warbler, Audubon's Warbler, Nashville Warbler, and Hermit Warbler (Table 5). Oregon Junco and MacGillivray's Warbler were the only species captured in every meadow, while two species, Orange-crowned Warbler and Audubon's Warbler, were captured in six out of the seven. Four species were encountered in five out of the seven meadows: Dusky Flycatcher, Nashville Warbler, Wilson's Warbler, and Song Sparrow.

Many of the meadows, which showed low indices of species richness and abundance figures from the point count data, showed extremely high richness and abundance during the mist-netting visit in early August. To further explore this phenomenon, we investigated correlations between capture rates and species richness and 2 variables: deciduous vegetation cover and elevation. We found a highly positive correlation between meadow elevation and both capture rate ($r^2 = 0.55$, $p < 0.02$) (used here as an estimate of abundance), and species richness ($r^2 = 0.83$, $p < 0.001$). There was no correlation between capture rate and species richness and amount of deciduous (willow/alder) cover as long as some deciduous vegetation was present.

It appears that the higher meadows, those above 6000 feet, are sites used by large numbers of songbirds, especially young ones, for molting and in preparation for migration (i.e. staging ground). Passerines generally store fat in preparation for migration (Moore, 1991, Moore and Kerlinger, 1987). We found nearly all of the birds captured were either molting, 77%, or had accumulated fat stores, 15%, suggesting they were using these meadows as a molting grounds and staging ground for migration. Higher elevation sites are still wet in August when lower elevation sites have dried up. These high elevation meadows mimic the conditions of lower elevation sites earlier in the year when the insects that songbirds prey on are abundant. High elevation meadows probably contain the important food resources for many species prior to migration.

Fanani Meadow was the only meadow where Yellow Warblers were detected in the two years of meadow surveys. Fanani Meadow, with its thick stands of shrubby willows, is very similar in vegetative composition and structure to Gurnsey Creek, and appears to support similar numbers of Yellow Warbler.

Lazuli Bunting, not recorded by King et al. (2001) in the Mineral area and believed to have undergone significant declines here and at nearby central valley sites (Grinnel 1930, King et al. 2001, Gardali et al. 1998), was found to be breeding in the Jones Valley meadow. This site was the only location other than the Black Rock area where we detected breeding Lazuli Buntings in the ARD.

Many of the meadows surveyed over the two years contain the vegetative structure and composition potentially suitable for the Willow Flycatcher. However, the Jones Valley Meadow was the only site at which we detected this species, a single singing individual.

Table 6. Total number of young and adult captures, and ratio of young to adults in ARD meadows mist-netting in 2001, all days combined.

Species	Hatch Year	After Hatch Year	Ratio
American Robin	1	1	1
Anna's Hummingbird	1	0	
Audubon's Warbler	45	4	11.25
Black-headed Grosbeak	12	1	12
Brown Creeper	2	0	
Black-throated Gray Warbler	0	2	0
Cassin's Vireo	2	2	1
Chipping Sparrow	2	0	
Dusky Flycatcher	10	3	3.33
Fox Sparrow	0	1	0
Golden-crowned Kinglet	85	1	85
Gray Jay	1	0	
Hammond's Flycatcher	15	6	2.5
Hairy Woodpecker	0	1	
Hermit Thrush	3	1	3
Hermit Warbler	21	4	5.25
House Wren	3	0	
Lazuli Bunting	1	0	
Lincoln's Sparrow	2	7	0.29
MacGillivray's Warbler	13	5	2.6
Mountain Chickadee	13	3	4.33
Nashville Warbler	33	5	6.6
Orange-crowned Warbler	53	12	4.42
Oregon Junco	76	12	6.33
Pacific-slope Flycatcher	0	1	0
Purple Finch	3	0	
Red-breasted Nuthatch	3	1	3
Red-breasted Sapsucker	8	2	4
Red-shafted Flicker	1	0	
Rufous Hummingbird	9	0	
Song Sparrow	12	8	1.5
Warbling Vireo	3	1	3
Western Tanager	7	0	
Western Wood-Pewee	0	3	0
White-headed Woodpecker	2	0	
Willow Flycatcher	0	1	
Wilson's Warbler	7	3	2.33
Yellow Warbler	3	5	0.6
TOTAL	452	96	4.71

Riparian habitat is the single most important habitat for songbirds in western North America (Johnson et al. 1977, Knopf et al. 1988). Mountain meadows, with their diversity and abundance of breeding species as well as the extraordinarily high numbers of post-breeding birds, may be the single most important habitat type in the Lassen area and should be given the highest priority for protection (see Siegel and Desante, 1999).

Most of the meadows we surveyed in the ARD were actively or recently being grazed by cattle. We documented the presence, or evidence of recent presence, of cattle in four of the seven meadows (Big Springs, Cold Springs, Henry's Flat, Jones Valley) in 2001. We documented grazing activity in four out of the six meadows surveyed in 2000 with Carter and Heckle being the only two without evidence. Cattle grazing in these meadows has likely altered their form and function. Cattle impact soils, cause stream bank erosion, and eat and trample the deciduous vegetation (Platts, 1991). Many of these meadows, even in an altered state, still harbor diverse assemblages of songbirds. However, the lack of Willow Flycatcher's from almost all of these meadows is disturbing. Willow Flycatchers have been shown to be very sensitive to cattle grazing pressure in riparian areas (Taylor 1986, Taylor and Littlefield 1986), and may be at least part of the explanation for their absence from ARD meadows. With continued grazing pressure, the health of these meadows may decline further, rendering them less valuable to songbirds and the other organisms that rely upon these sites.

Gurnsey Creek Mist Netting

A summary of the 2001 field season mist-netting efforts is presented in Table 7. The capture rate at Gurnsey Creek in 2001 was 72.91 captures per 100 net hours, which is still well above the 1997 MAPS national average of 37.2 (DeSante et al. 1998), but well below the mean for the previous 4 years at this site of 86.46 (King, et al., 2001, Burnett et al., 2001). The Gurnsey Creek capture rate of 72.91 was the lowest recorded of any of the five years the station has been monitored. A likely explanation for this drop in capture rate is the drier warmer conditions in May of 2001 compared to previous years (USDA 2001, University of California 2001).

Table 7. Summary of Gurnsey Creek and meadow mist-netting results in the ARD from Spring/Summer, 2001 (17 May – 8 August)

Location	Days of Operation		TotalNet Hrs.	No. Of Captures ¹			Birds/100 Net. Hrs.	# of Species
	Total	Range		B	R	U		
Gurnsey Creek, 2001	9	5/17 – 8/4	448.5	202	116	9	72.91	27
Gurnsey Creek, 2000	9	5/18 – 8/5	436.5	223	156	10	89.12	29
Gurnsey Creek, 1999	9	5/18 – 7/30	408	171	133	12	77.5	23
Gurnsey Creek, 1998	8	5/30 – 7/30	374	205	121	11	90.1	30
Gurnsey Creek, 1997	9	5/19 – 7/31	495	308	120	13	89.09	31
Meadows 2001	7	7/31 – 8/8	240.6	529	1	24	230.26	45
Meadows 2000	6	7/25 – 8/1	201	412	0	15	203.33	34

¹ B =Banded, R =Recapture U=Unbanded,

The Gurnsey Creek site has been shown to have both high productivity and adult survival estimates (King, et al., 2001, Burnett, et al., 2001). An index of productivity can be obtained by looking at the ratio of young to adults captured (Table 4). However, non-resident adult migrants that are caught when netting begins in mid-May can bias these data. Therefore, caution must be used when interpreting these data. The ratio of young to adults for all species captured at Gurnsey Creek was 0.51 in 2001 up from the 0.39 recorded in 2000, and slightly higher than the mean from 1997-2000 of 0.46. The hatch year to after hatch year ratio is intended to estimate the productivity of the local breeders

in the immediate vicinity of the netting station. In “early springs,” migration takes place earlier, and since netting commences each year on or around the same day, a good portion of migrants have already passed through the area when netting begins, resulting in the capture of a relatively small number of non-local breeders. Conversely, in “late springs”, when the main push of migrants through the site is in middle to late May, when netting has already commenced, more non-local breeders are captured, biasing the HY/AHY ratio low. 2001 was an exceptionally dry year in the Lassen area with very little snow pack and the onset of warm weather unseasonably early in May. Migration was most likely earlier in 2001 than 2000 and a possible explanation for the higher HY/AHY figure from 2001.

Table 8. Species, age class, and productivity indices for all birds captured at Gurnsey Creek during spring and summer 2001. (Figures in bold are those discussed in the Results section below).

Species	Hatch Year (HY)	After Hatch Year (AHY)	HY/AHY RATIO
American Robin	0	2	0
Audubon's Warbler	1	5	0.2
Calliope Hummingbird	1	1	1
Cassin's Vireo	1	2	0.5
Common Yellowthroat	0	1	0
Downy Woodpecker	0	1	0
Fox Sparrow	0	1	0
Golden-crowned Kinglet	0	4	0
Hammond's Flycatcher	0	3	0
Hairy Woodpecker	0	1	0
Hermit Warbler	1	7	0.14
House Wren	2	0	
MacGillivray's Warbler	11	33	0.33
Mountain Chickadee	3	1	3
Nashville Warbler	2	6	0.33
Orange-crowned Warbler	18	3	6
Oregon Junco	9	16	0.56
Pacific-slope Flycatcher	0	1	0
Purple Finch	0	2	0
Red-breasted Sapsucker	3	7	0.43
Song Sparrow	23	10	2.3
Townsend's Solitaire	0	1	0
Townsend's Warbler	0	1	0
Warbling Vireo	1	5	0.2
Willow Flycatcher	0	1	0
Wilson's Warbler	1	23	0.04
Yellow Warbler	6	26	0.23
Totals	83	164	.51

Due to this bias, it may be more useful to look at individual species capture rates of adults and young, across all five years, to get a clearer picture of the productivity at Gurnsey Creek over the past five years.

We obtained adequate sample sizes to look at productivity for five species breeding at the Gurnsey Creek netting site: MacGillivray's Warbler, Yellow Warbler, Wilson's Warbler, Oregon Junco, and Song Sparrow (see figures 1 and 2). In contrast to the overall productivity index, the individual indices were lower in 2001 than in 2000 for all species except Yellow Warbler. We present rate of capture for young and adults to control for the difference in net hours that may bias total number of young and adults captured, although we present total captures following the rates.

Yellow Warbler

The young to adult ratio for Yellow Warbler in 2001 was 0.23 (32 total captures), compared to 0.10 in 2000 (22 total captures). The mean from 1997-1999 was 0.26 (63 total captures). The rate of adults captured over the five year period has increased each year over the previous year except 1999, and has increased over the entire period from 3.03 adult captures per 100 net hours (15 total captures) in 1997 to 5.79 (26 total captures) in 2001. The mean rate of young captured over the period was 0.97 per 100 net hours (21 total captures), with a high of 1.34 per 100 net hours in 1998 and 2001 and a low of 0.46 in 2000. The number of adult Yellow Warblers in the area seems to be increasing yet the number of young produced seems to be remaining stable. Results from nest searching conducted at the site from 1997-1999 (King et al. 2001), suggests that the Yellow Warbler has a higher reproductive success at Gurnsey Creek than at any other site at which PRBO monitors the species (Heath et al. 2001, CALPIF 2000, Wood et al. 2001). Mist-netting data over the five years does not confirm this finding.

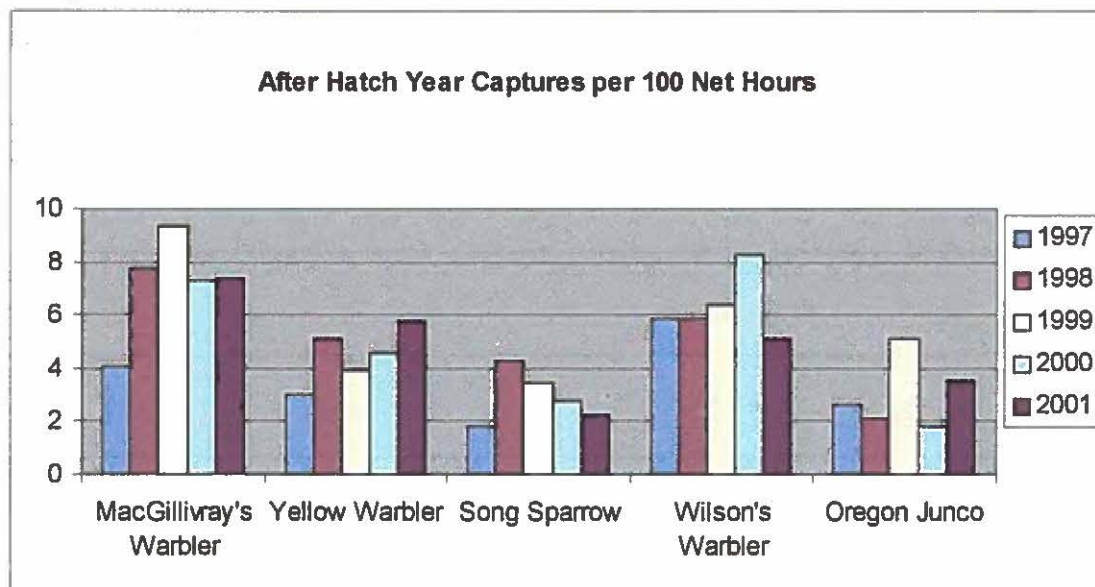
MacGillivray's Warbler

The young to adult ratio for MacGillivray's Warbler in 2001 was 0.33 (46 total captures) down from the 0.44 (44 total captures) recorded in 2000 but similar to the 1997-1999 mean of 0.29 (112 total captures). The mean adult capture rate per 100 net hours over the period was 7.15 (152 total captures) with a high of 9.31 (38 total captures) in 1999 and a low of 4.04 (20 total captures) in 1997. The capture rate in 2001 was 7.35 (33 total captures), similar to the five year mean of 7.15. The capture rate for young for the period was 2.32 (50 total captures) per 100 net hours. The rate of young captured over the period increased from a low of 1.82 per 100 net hours in 1997 (9 total captures) to a high of 3.20 in 2000 (14 total captures). The capture rate of young in 2001 was 2.45 (11 total captures), just above the five-year mean of 2.32. The number of young to adults captured is fairly high and seems to be rather stable assuming the poor year in 1997 was anomalous. The adult survival for MacGillivray's Warbler has been shown to be very high at Gurnsey Creek (King et al. 2001). Our data from 2001 has shown that there are very high annual return rates with many of the same birds captured at the site for most, if not all, of the five years we have conducted netting at the site.

Wilson's Warbler

The young to adult ratio for Wilson's Warbler in 2001 was 0.04 (24 total captures) down from 0.08 recorded in 2000 (39 total captures), and well below the 1997-1999 mean of 0.17 (90 total captures). The mean adult capture rate for the period was 6.29 (136 total captures) with a high of 8.24 (36 total captures) per 100 net hours in 2000 and a low of 5.12 (23 total captures) in 2001. The mean capture rate for young for the period was 0.73 (17 total captures) per 100 net hours with a high of 2.22 (11 total captures) in 1997 and a low of 0.22 (1 total capture) in 2001. Wilson's Warbler breeds in fairly small numbers at the Gurnsey Creek netting site (King et al., 2001, pers.obs.), and are one of the most common migrants through the area in May when the netting site is inundated with non-local breeding adults. The timing of spring migration can bias the index considerably, making Wilson's Warbler one of the most difficult species to obtain an accurate estimate of productivity. For example, the lowest adult capture rate for Wilson's Warbler was in 2001, the driest, warmest spring of the five year period. However, the number of young captured at the site is very low for the number of pairs of Wilson's Warbler breeding at the site (King et al., 2001, pers. obs.). Netting data suggest that, except for 1997, Wilson's Warbler have not had good productivity at the Gurnsey Creek site.

Figure 1. Adult capture rates for the five most commonly captured species breeding at Gurnsey Creek, 1997-2001.

*Oregon Junco*

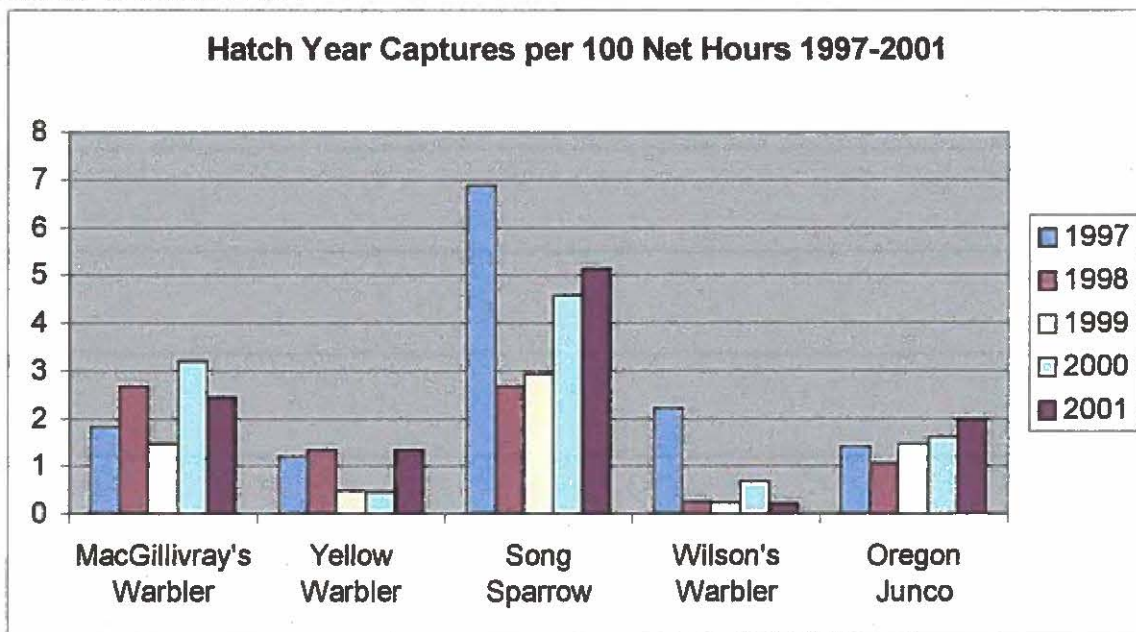
The young to adult ratio for Oregon Junco in 2001 was 0.56 (25 total captures), down from 0.88 (15 total captures) in 2000, but higher than the 1997-1999 mean of 0.40 (59 total captures). The mean adult capture rate for the period was 3.06 (66 total captures) with a high of 5.15 (21 total captures) in 1999 and a low of 1.83 (8 total captures) in 2000. The mean capture rate for young over the period was 1.51 per 100 net hours (33 total captures), with a high of 2.0 (9 total captures) in 2001 and a low of 1.07 (4 total captures) in 1998. The number of young captured each year does not appear to be

dependent on the number of adults captured. Young Oregon Junco's form large flocks after they disperse from their parents' territories, and capture rates of young may be a product of the chance capture of some of these flocks more than a true estimate of the productivity of the local birds.

Song Sparrow

The young to adult ratio for Song Sparrow in 2001 was 2.3 (33 total captures), the highest of the five species, and higher than the 1.7 (32 total captures) recorded in 2000. The three-year mean from 1997-1999 was 1.44 (95 total captures). The mean adult capture rate for the period was 2.9 (61 total captures) with a high of 4.28 (16 total captures) in 1998 and a low of 1.82 (9 total captures) in 1997. The mean young capture rate was 4.44 (99 total captures) with a high of 6.87 (34 total captures) in 1997 and a low of 2.67 (10 total captures) in 1998. The highest adult capture rate was in 1998 following the extraordinarily high young capture rate of 6.87 in 1997. Excluding 1997, the capture rate of young has increased each year since 1998 while the capture rate of adults has decreased each year since 1998. It appears that fewer birds are producing more young at the Gurnsey Creek site. A potential explanation may be the fact that many of the same birds have been breeding at the site for most, if not all of the five years, and may be increasing their reproductive output, as they get older. Regardless of the explanation, it appears that the Gurnsey Creek site has become a more productive site for Song Sparrow.

Figure 2. Hatch Year Capture Rates for the five most commonly captured species breeding at Gurnsey Creek, 1997-2001.



CONCLUSIONS

The Almanor Ranger District of the Lassen National Forest supports diverse landbird communities and provides habitat for numerous species, both those thought to be stable and those believed to be threatened or declining in the Sierra Nevada. Mist netting data continues to show that riparian habitats in the ARD have good productivity, and high elevation meadows have extremely high bird abundance and diversity at the end of the breeding season. Our survey of different habitat types has identified crucial areas of high densities of species thought to have declined significantly in recent years. The inventory has documented at least 80% of the breeding songbirds in the ARD and along with vegetation data collected will enable us to provide habitat associations for those species. The inventory has highlighted several habitat types that contain high diversity and abundance or species of management concern. Aspen, burned, and clear cut shrub regeneration sites are found in small acreage within the ARD yet support high diversity and abundance of species and therefore warrant conservation activity. The ARD, contains numerous habitat types that support diverse bird communities. However, many habitat types have become less common, including old growth, diverse shrub fields, and pristine riparian. It appears as if both Swainson's Thrush and Ruby-crowned Kinglet have been extirpated from the ARD in the last 70 years (Grinnell et al. 1930). In addition many species documented in the ARD occur in fairly small numbers in habitats that continue to disappear or be altered. Species such as Green-tailed Towhee, Lazuli Bunting, Willow Flycatcher, Olive-sided Flycatcher, Yellow Warbler, Warbling Vireo, Mountain White-crowned Sparrow, and Black-backed Woodpecker may too soon be extirpated from the ARD if sufficient habitat is not managed for these species.

MANAGEMENT RECOMMENDATIONS

- Restrict all activities that may disturb bird breeding habitat (e.g. timber harvesting, grazing, burning) to the non-breeding season (August - April).
- Restore natural meadow and riparian systems by reducing the possible negative effects of grazing, adjacent timber harvest, and forest encroachment.
- Maintain and create diverse shrub habitat for the numerous songbirds dependent upon them.
- Maintain and create structurally complex forest habitats that include snags, a developed understory, and a diverse age structure.
- Manage for healthy Aspen stands and promote development of new stands where possible.

STUDY PLANS FOR 2002

- Conduct the fifth breeding season of banding at the Gurnsey Creek MAPS station to gain more data necessary to estimate adult survival, and to monitor productivity and populations dynamics of the local bird population.
- Continue to monitor bird populations within the ARD by censusing point count routes established in 2000 and 2001.
- Gather data on factors effecting breeding success of shrub-dependent species by establishing nest monitoring plots in shrub fields and clear cut regeneration sites.
- Expand the study of meadows to include work the height of the breeding season to determine the factors leading to high young to adult ratios in meadows with deciduous vegetation.

PERSONNEL

This project was supervised by PRBO staff biologist Ryan Burnett. Field work was conducted by Ryan Burnett, Nolan Zeide and Doug Zimmerman. LNF staff Terry Nelson and LVNP staff Mike Magnusson assisted in mist-netting. PRBO biologist Grant Ballard and Diana Stralberg assisted with study design and GIS maps. Computer programs used to manage and summarize data were created by PRBO staff biologists Grant Ballard, Dan Barton, and Mike Lynes. PRBO Staff biologists Diana Humple and Sacha Heath made helpful suggestions on earlier versions of this report. The study was carried out under the guidance of PRBO Terrestrial Program Director Geoffrey Geupel.

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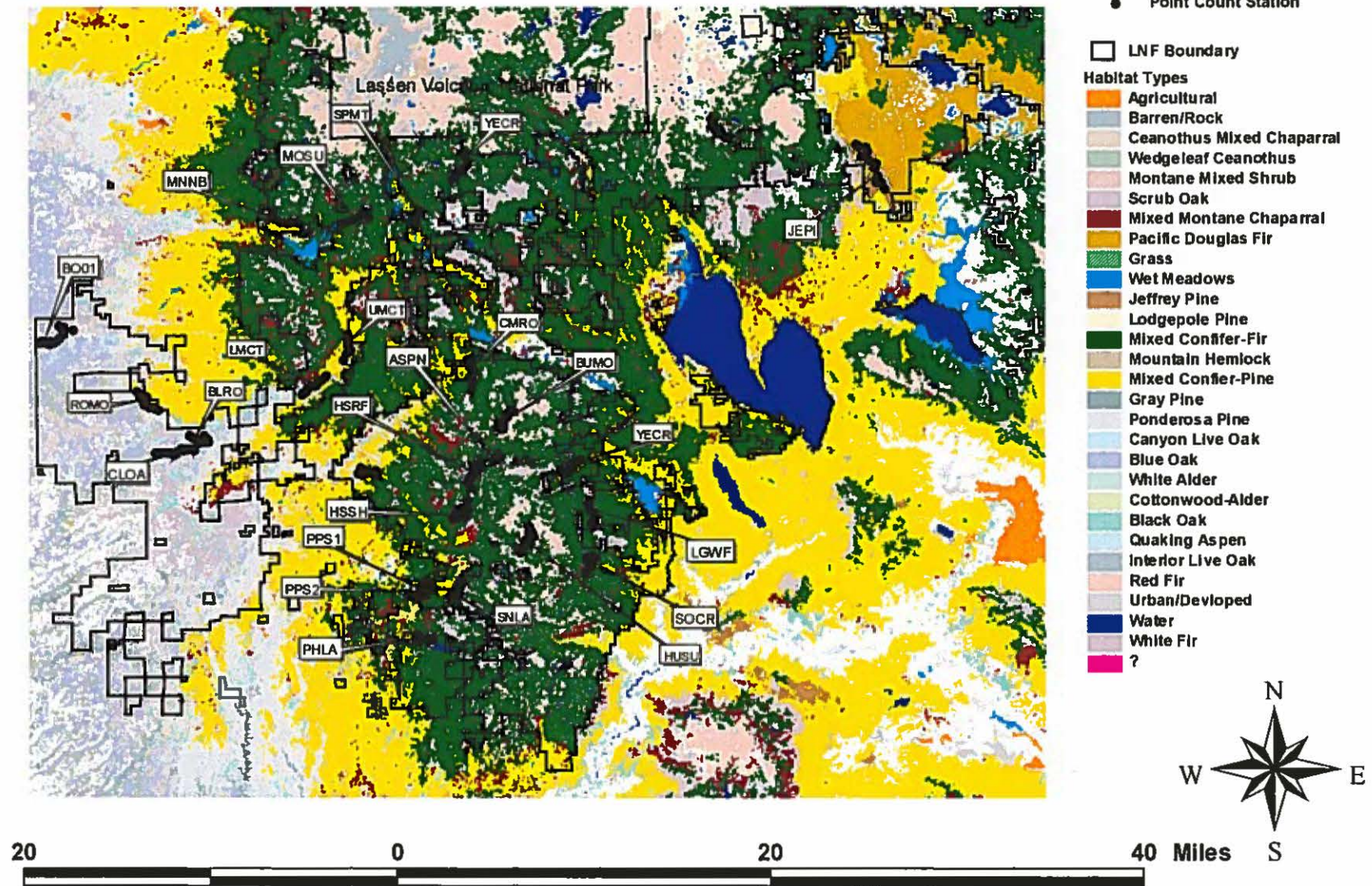
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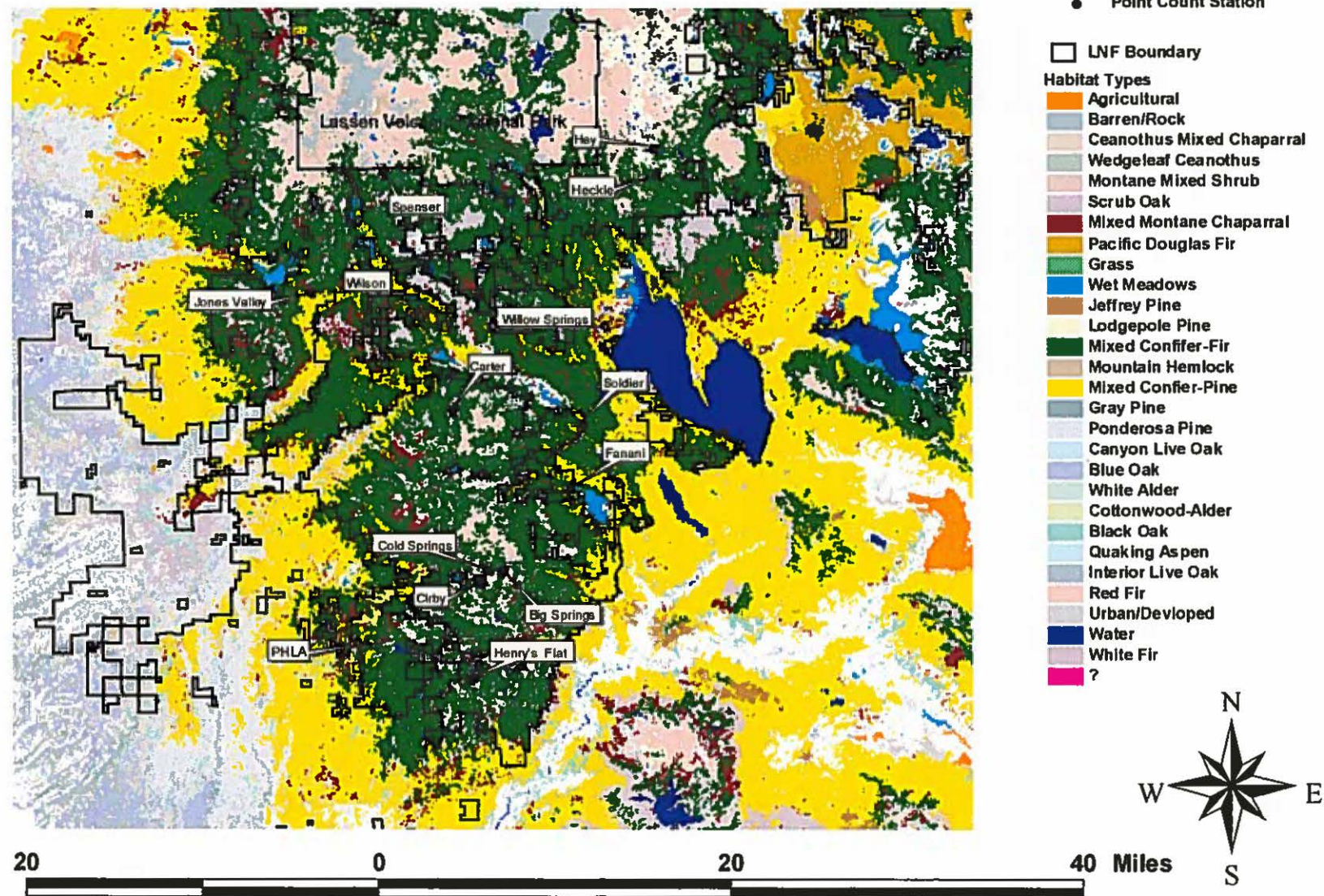
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Point Count Locations in the ARD, 2000 and 2001



ARD Meadow Locations for 2000 and 2001



Appendix 3. Total number of detection's (within 50m) of each species by transect during 2001 point counts.

Species	Status ¹	ASPN	BLRO	BO01	CLOA	CMRO	HSRF	HSSH	HUSU	JEPI	LGWF	MNNB	MOSU	PHLA	PPS1	PPS2	RASN	SNLA	SOCR	UMCT
Acorn Woodpecker	2	0	8	20	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
American Robin	2	3	0	0	6	0	6	0	2	2	0	0	7	1	0	0	0	0	1	3
Anna's Hummingbird	2	0	15	3	4	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
Ash-throated Flycatcher	2	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Audubon's Warbler	2	6	0	0	0	8	19	1	22	18	9	12	12	11	11	3	5	27	11	8
Black-backed Woodpecker	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Bewick's Wren	2	0	19	7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blue-gray Gnatcatcher	2	0	2	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown-headed Cowbird	1	0	0	6	1	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0
Black-headed Grosbeak	2	1	1	0	2	0	0	0	0	0	0	0	2	0	0	0	12	0	0	1
Brewer's Blackbird	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brown Creeper	2	2	0	0	0	1	4	0	3	3	4	6	6	2	0	0	2	5	5	3
Brewer's Sparrow	1	0	0	0	0	1	0	3	1	0	0	0	0	0	0	0	0	0	0	0
Band-tailed Pigeon	1	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0
Black-throated Gray Warbler	2	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	5	0	0	2
Bullock's Oriole	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bush Tit	2	0	3	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassin's Finch	2	0	0	0	0	1	1	0	5	0	7	0	4	0	0	0	0	0	0	0
California Towhee	2	0	4	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
California Quail	2	0	7	6	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassin's Vireo	2	1	0	0	1	0	0	0	0	0	2	0	0	2	1	2	5	1	0	0
Chestnut-backed Chickadee	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Chipping Sparrow	2	3	0	0	0	5	1	0	13	6	0	1	1	1	0	0	1	0	0	0
Downy Woodpecker	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dusky Flycatcher	2	2	0	0	0	13	0	8	0	9	3	4	1	5	6	5	0	0	1	0
Evening Grosbeak	2	0	0	0	0	0	2	0	0	0	1	0	2	0	0	0	0	1	0	0
Fox Sparrow	2	1	0	0	0	63	2	20	0	0	0	1	2	9	26	12	0	7	0	0
Golden-crowned Kinglet	2	5	0	0	0	1	12	0	17	0	11	6	12	14	0	1	4	26	11	9

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Species	Status ¹	ASPN	BLRO	BO01	CLOA	GMRO	HSRF	HSSH	HUSU	JEP1	LGWF	MNNB	MOSU	PHLA	PPS1	PPS2	RASN	SNLA	SOCR	UMCT
Green-tailed Towhee	2	0	0	0	0	14	3	7	0	0	0	0	0	0	4	0	0	1	0	0
Hammond's Flycatcher	2	4	0	0	0	0	4	3	2	13	14	1	13	2	5	1	0	13	6	0
Hairy Woodpecker	2	0	2	0	0	2	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Hermit Thrush	1	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	1	2
Hermit Warbler	2	1	0	0	0	1	5	0	0	0	18	10	13	0	0	0	5	2	8	18
House Finch	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
House Wren	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hutton's Vireo	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Lawrence's Goldfinch	2	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lark Sparrow	2	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lazuli Bunting	2	3	11	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lesser Goldfinch	2	0	18	9	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lincoln's Sparrow	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MacGillivray's Warbler	2	4	0	0	0	21	0	2	0	0	0	0	1	0	5	0	5	0	1	2
Mountain Chickadee	2	15	0	0	0	14	12	3	12	4	0	4	6	3	6	2	2	10	4	0
Mourning Dove	2	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mountain Quail	2	0	0	0	0	1	2	0	0	0	0	0	0	1	1	0	1	0	0	0
Nashville Warbler	2	3	0	0	0	0	1	0	0	0	0	10	1	0	2	8	30	2	3	10
Nuttall's Woodpecker	2	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oak Titmouse	2	0	15	44	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orange-crowned Warbler	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
Oregon Junco	2	7	0	0	0	3	6	0	4	9	4	17	7	6	3	1	4	5	5	5
Olive-sided Flycatcher	2	0	0	0	0	12	1	1	0	0	1	0	0	0	0	0	0	0	0	0
Pine Siskin	2	0	0	0	0	1	2	0	1	0	0	2	3	0	0	0	0	0	0	0
Pileated Woodpecker	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Pacific-slope Flycatcher	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Purple Finch	2	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0
Red-breasted Nuthatch	2	0	0	0	0	3	5	0	6	3	2	2	3	0	0	0	2	8	10	0
Red-breasted Sapsucker	2	1	0	0	0	2	2	0	0	1	1	0	1	0	0	0	0	0	1	1
Rufous-crowned Sparrow	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Species	Status ¹	ASPN	BLRO	BO01	CLOA	CMRO	HSRF	HSSH	HUSU	JEPI	LGWF	MNNB	MOSU	PHLA	PPS1	PPS2	RASN	SNLA	SOCR	UMCT
Red Crossbill	2	0	0	0	0	0	2	0	0	4	0	0	0	0	0	0	0	0	0	0
Rock Wren	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Red-shafted Flicker	2	0	3	2	0	2	1	0	0	0	0	1	0	0	0	0	0	0	0	1
Song Sparrow	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spotted Towhee	2	0	3	0	1	0	0	0	0	0	0	0	0	0	1	2	7	0	0	0
Stellar's Jay	2	3	1	0	0	1	2	1	5	0	0	1	0	5	1	1	3	1	5	4
Townsend's Solitaire	2	0	0	0	0	0	1	0	0	1	2	2	0	1	0	0	0	0	0	0
Tree Swallow	1	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Violet-green Swallow	2	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Warbling Vireo	2	14	1	0	0	0	0	1	0	1	1	1	3	3	0	1	2	0	0	2
White-breasted Nuthatch	2	0	5	16	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Western Bluebird	2	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Western Scrub Jay	2	0	9	14	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Western Tanager	2	3	0	0	12	7	6	0	5	4	8	2	5	2	3	0	6	2	5	6
Western Wood-Pewee	2	6	0	1	0	3	0	0	0	0	0	0	1	1	0	0	0	0	1	0
White-headed Woodpecker	2	0	0	0	0	7	1	0	2	1	1	2	2	0	0	0	0	1	0	2
Williamson's Sapsucker	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Wilson's Warbler	2	7	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
Wrentit	2	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yellow Warbler	2	0	0	0	0	0	0	18	0	0	0	0	0	0	5	3	0	2	0	0

¹ Stat = Breeding Status, as determined by PRBO data and the expert opinion of the authors. 0 = non breeder, 1 = possible breeder, 2 = definite breeder.

Appendix 4. Total number of detection's from meadow point counts for each species detected (<50m) by transect during 2001 season.

<u>Species</u>	<u>Big Springs</u>	<u>Cold Springs</u>	<u>Fanani</u>	<u>Henry's Flat</u>	<u>Jones Valley</u>	<u>Soldier</u>	<u>Willow Springs</u>
American Robin	3	0	6	0	0	2	0
Anna's Humming bird	0	0	1	2	0	0	0
Audubon's Warbler	1	6	0	1	2	0	1
Brown-headed Cowbird	0	0	2	0	0	0	0
Black-headed Grosbeak	0	0	0	1	0	0	0
Brewer's Blackbird	0	0	1	3	0	0	0
Brown Creeper	0	0	0	1	1	2	0
Cassin's Finch	0	0	1	0	0	0	0
Cassin's Vireo	0	0	0	0	0	0	0
Chipping Sparrow	2	5	0	1	0	3	0
Evening Grosbeak	0	1	0	0	0	0	0
Fox Sparrow	0	0	2	1	0	0	1
Golden-crowned Kinglet	1	2	0	0	0	0	1
Green-tailed Towhee	0	0	0	0	0	1	0
Hammond's Flycatcher	0	4	0	0	0	3	0
Hairy Woodpecker	0	0	2	0	1	0	0
Hermit Thrush	1	0	0	0	0	0	0
Lazuli Bunting	0	0	0	0	2	0	0
Lincoln's Sparrow	1	1	0	6	2	0	0
MacGillivray's Warbler	0	0	3	0	1	0	0
Mountain Chickadee	4	2	1	1	1	2	1
Mountain Quail	0	1	2	0	0	0	0
Nashville Warbler	0	0	1	0	0	0	0
Oregon Junco	2	4	4	2	0	0	6
Pine Siskin	0	2	0	1	0	0	0
Red-breasted Nuthatch	0	4	0	1	0	0	2
Red-breasted Sapsucker	1	1	0	0	0	0	0
Red-shafted Flicker	0	0	1	0	0	0	0
Song Sparrow	0	0	6	2	0	4	11
Stellar's Jay	2	0	1	0	0	0	1
Warbling Vireo	0	5	9	0	1	1	0
Western Tanager	0	1	0	1	0	0	0
Western Wood-Pewee	0	0	2	0	0	0	0
White-headed Woodpecker	0	0	0	0	1	1	0
Willow Flycatcher	0	0	1	0	0	0	0
Wilson's Warbler	0	3	1	4	1	0	1
Yellow Warbler	0	0	12	0	0	0	0

Appendix 5. Common names, scientific names, and AOU four letter codes for all species mentioned detected in the ARD.

Common Name	AOU Code	Scientific Name
Acorn Woodpecker	ACWO	<i>Melanerpes formicivorus</i>
American Robin	AMRO	<i>Turdus migratorius</i>
Anna's Hummingbird	ANHU	<i>Calypte anna</i>
Audubon's Warbler	AUWA	<i>Dendroica coronata audobonii</i>
Bewicks Wren	BEWR	<i>Thryomanes bewickii</i>
Black-backed Woodpecker	BBWO	<i>Picoides arcticus</i>
Black-chinned Hummingbird	BCHU	<i>Archilochus alexandri</i>
Black-headed Grosbeak	BHGR	<i>Pheucticus melanocephalus</i>
Black-throated Gray Warbler	BTYW	<i>Dendroica nigrescens</i>
Blue-gray Gnatcatcher	BGGN	<i>Poliopitila caerulea</i>
Blue Grouse	BGSE	<i>Dendragapus obscurus</i>
Brewer's Blackbird	BRBL	<i>Euphagus cyanocephalus</i>
Brown-headed Cowbird	BHCO	<i>Molothrus ater</i>
Brown Creeper	BRCR	<i>Certhia americana</i>
Bufflehead	BUFF	<i>Bucephala albeola</i>
Bushtit	BUSH	<i>Psaltiriparus minimus</i>
Calliope Hummingbird	CAHU	<i>Stellula calliope</i>
California Towhee	CALT	<i>Pipilo crissalis</i>
California Quail	CAQU	<i>Callipepla californica</i>
Canyon Wren	CANW	<i>Catherpes mexicanus</i>
Cassin's Finch	CAFI	<i>Carpodacus cassinii</i>
Cassin's Vireo	CAVI	<i>Vireo casinii</i>
Chestnut-backed Chickadee	CBCH	<i>Poecile rufescens</i>
Chipping Sparrow	CHSP	<i>Spizella passerina</i>
Clark's Nutcracker	CLNU	<i>Nucifraga columbiana</i>
Common Snipe	COSN	<i>Gallinago gallinago</i>
Downy Woodpecker	DOWO	<i>Picoides pubescens</i>
Dusky Flycatcher	DUFL	<i>Empidonax oberholseri</i>
Evening Grosbeak	EVGR	<i>Coccothraustes vespertinus</i>
Fox Sparrow	FOSP	<i>Passerella iliaca</i>
Golden-crowned Kinglet	GCKI	<i>Regulus satrapa</i>
Gray Jay	GRJA	<i>Perisoreus canadensis</i>
Green-tailed Towhee	GTTO	<i>Pipilo chlorurus</i>
Hammond's Flycatcher	HAFL	<i>Empidonax hammondi</i>
Hairy Woodpecker	HAWO	<i>Picoides villosus</i>
Hermit Thrush	HETH	<i>Catharus guttatus</i>
Hermit Warbler	HEWA	<i>Dendroica occidentalis</i>
House Wren	HOWR	<i>Troglodytes aedon</i>
Huttons Vireo	HUVI	<i>Vireo huttoni</i>
Killdeer	KILL	<i>Charadrius vociferus</i>
Lark Sparrow	LASP	<i>Chondestes grammacus</i>
Lawrence's Goldfinch	LAGO	<i>Carduelis lawrencei</i>
Lazuli Bunting	LAZB	<i>Passerina amoena</i>
Lesser Goldfinch	LEGO	<i>Carduelis psaltria</i>
Lincoln Sparrow	LISP	<i>Melospiza lincolnii</i>
MacGillivray's Warbler	MGWA	<i>Oporornis tolmiei</i>
Mallard	MALL	<i>Anas platyrhynchos</i>
Mountain Chickadee	MOCH	<i>Poecile gambeli</i>

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Mountain Quail	MOQU	<i>Oreotyx pictus</i>
Mourning Dove	MODO	<i>Zenaida macroura</i>
Nashville Warbler	NAWA	<i>Vermivora ruficapilla</i>
Nuttall's Woodpecker	NUWO	<i>Picoides nuttallii</i>
Oak Titmouse	OATI	<i>Baeolophus inornatus</i>
Orange-crowned Warbler	OCWA	<i>Vermivora celata</i>
Oregon Junco	ORJU	<i>Junco hyemalis</i>
Olive-sided Flycatcher	OSFL	<i>Contopus cooperi</i>
Pine Siskin	PISI	<i>Carduelis pinus</i>
Pileated Woodpecker	PIWO	<i>Dryocopus pileatus</i>
Pacific-slope Flycatcher	PSFL	<i>Empidonax difficilis</i>
Purple Finch	PUFI	<i>Carpodacus purpureus</i>
Red-breasted Nuthatch	RBNU	<i>Sitta canadensis</i>
Red-breasted Sapsucker	RBSA	<i>Sphyrapicus ruber</i>
Rufous Hummingbird	RUHU	<i>Selasphorus rufus</i>
Rufous-crowned Sparrow	RCSP	<i>Aimophila ruficeps</i>
Red Crossbill	RECR	<i>Loxia curvirostra</i>
Red-shafted Flicker	RSFL	<i>Colaptes auratus</i>
Song Sparrow	SOSP	<i>Melospiza melodia</i>
Spotted Sandpiper	SPSA	<i>Actitis macularia</i>
Spotted Towhee	SPTO	<i>Pipilo maculatus</i>
Stellar's Jay	STJA	<i>Cyanocitta stelleri</i>
Townsend's Solitaire	TOSO	<i>Myadestes townsendi</i>
Vaux's Swift	VASW	<i>Chaetura vauxi</i>
Violet-green Swallow	VGSW	<i>Tachycineta thalassina</i>
Warbling Vireo	WAVI	<i>Vireo gilvus</i>
White-breasted Nuthatch	WBNU	<i>Sitta carolinensis</i>
White-headed Woodpecker	WHWO	<i>Picoides albolarvatus</i>
Western Bluebird	WEBL	<i>Sialia currucoides</i>
Western Scrub-Jay	WESJ	<i>Aphelocoma californica</i>
Western Tanager	WETA	<i>Piranga ludoviciana</i>
Western Wood-Pewee	WEWP	<i>Contopus sordidulus</i>
Willow Flycatcher	WIFL	<i>Empidonax traillii</i>
Wilson's Warbler	WIWA	<i>Wilsonia pusilla</i>
Winter Wren	WIWR	<i>Troglodytes troglodytes</i>
Yellow Warbler	YWAR	<i>Dendroica petechia</i>