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CRATERS OF THE MOON NATIONAL MONUMENT 1993 BIRD CENSUS

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INTRODUCTION

Bird censuses at Craters of the Moon NM (CRMO) began in 1988 as part of an ongoing effort to assess the biological value, richness, uniqueness and health of the area. The 1993 census is the fifth in the series of censuses conducted since 1988, excluding 1989 when a lack of qualified personnel prohibited any censusing.

Censuses are scheduled to begin in early May and run to the 15th of June. The 1993 census began May 8 and ended June 19. The censuses were conducted by Natalene Cummings - Biological Technician and Richard Schneider - Bird Census Volunteer.

In years past, it was difficult not to attribute some error in the data due to the varying skill levels of the individuals conducting the censusing from year to year. This season, a bird identification skills evaluation was implemented in an effort to eliminate the possible influence skill level may have on data. The evaluation consists of two parts; a visual section on bird identification and behavior patterns displayed by groups of birds and an audio section on bird call identification. Although the evaluation needs some perfecting, it appears, at this time, that a score of 75% (69 correct out of 93) or greater suggests the individual is knowledgeable enough to accurately identify most of the birds found within the monument.

METHODS

At the start of the season, before heading into the field, each field person was asked to take the Bird Identification Skills Evaluation. As mentioned earlier, this evaluation is new and will need some modification, however, it appears to be fair in its evaluation of the individuals identification skills.

Of 26 vegetation types (VT's) identified in the monument, 17 are included in the bird census (Appendix I). Census locations consist of two sites per vegetation type, totalling 34 sites. Since time and staffing are limited, it is probable that all sites will not be visited during the census season. To accommodate this constraint, four priority sites have been selected that are to be censused each year while visits to the remaining sites are rotated over a 5-10 year period (Appendix II).

During the 1993 season, 11 vegetation types were censused, meaning a total of 22 sites were visited (two sites/vegetation site). Those sites included the four priority VT's (marked with *) and the following:

- 26* - Riparian
- 25* - Upland Quaking Aspen
- 23* - Limber Pine/Antelope Bitterbrush - high overall cover
- 22* - Limber Pine/Antelope Bitterbrush - high limber pine
- 17 - Antelope Bitterbrush/Great Basin Wildrye
- 13 - Low Sagebrush/Sandberg Bluegrass
- 11 - Three-tip Sagebrush/Idaho Fescue
- 8 - Mountain Big Sagebrush/ Idaho Fescue
- 3 - Medium Density Lava Flows
- 2 - Low Density Lava Flows
- 1 - Cinder Gardens

Standard Operating Procedures (SOP's) for the bird census requires that censusing be conducted during the first two hours after sunrise. Observers are to wait ten minutes after arrival to the site before beginning the 30

minute censusing period. During the censusing period, observers identify all species by sight and by call/song and record each individual observed.

Data is compiled and species diversity is calculated through the application of the Shannon-Weaver Estimate of Diversity formula (Appendix III).

RESULTS

Both field staff completed the bird skills evaluation and achieved scores of 75% or greater.

Natalene Cummings	76%
Richard Schneider	96%

INDIVIDUALS

In all 22 sites visited in 1993, 566 individual birds were counted, totaling an average of 51.5 individuals per VT; the range consisting of 21 in VT 13 to 93 in VT 22. In the four priority VT's alone, the number of individuals per VT increased this season by 58 individuals compared to 1992 data, while down by 21 individuals compared to 1990 data (Table I).

Table I. Comparative total number of INDIVIDUALS in each of the four priority vegetation types for each of the bird census years, 1988, 1990-93, at Craters of the Moon National Monument.

VEGETATION TYPES					
YEAR	26	25	23	22	Total
1988	*	*	*	*	*
1990	60	71	86	11	327
1991	64	49	67	60	240
1992	70	42	69	67	248
1993	49	88	76	93	306

* = missing data

SPECIES RICHNESS

In all 22 sites visited, the species richness identified in the 1993 census was 56; the range consisting of 30 in VT 25 to 6 in VT 13 (Table II).

Compared to the data from previous years, species richness in 1993 is second with eight fewer species than the high of 64 that occurred in 1988. However, this year's figure falls within one species of the four year (1992 excluded since only the four priority sites were censused) species richness average of 55.

Comparatively, the four priority VT's by themselves contained 47 species. This again places the 1993 census totals second to the highest species count of 48 in 1988 and seven species greater than the combined average of 40 (Table III).

In addition, a total of 31 species were found in VT's where they had not previously been recorded. Thirteen species were found in only one VT compared to 12 in the 1992 census, 15 in 1991, 17 in 1990 and 17 in 1988. Five species were found in all four of the priority VT's censused compared to seven species in the 1992 census, 3 in 1990, 3 in 1991 and 5 in 1988. No species were found in all 11 VT's censused this season, however, the brown headed cowbird was found in all but one (VT 13) of the 11 VT's visited.

Table II. SPECIES RICHNESS at each of the stations within each of the eleven vegetation types surveyed in the 1993 census.

Vegetation Types	Station 1	Station 2	Average
26	10	15	19
25	20	15	30
23	15	20	27
22	24	17	27
TOTAL			46*
AVERAGE SPECIES RICHNESS/PRIORITY VEG. TYPE			11.5
17	12	17	23
13	5	4	6
11	8	6	10
8	5	9	11
3	7	6	10
2	5	8	10
1	6	8	14
TOTAL			56*
AVERAGE SPECIES RICHNESS/ALL VEG. TYPES			5.1

* = These figures are not the sum of the above numbers since there will be some overlap of species within the VT's, but instead are the total number of species found between the VT's (Table IV).

There were no new birds sighted for the monument, however, four species of birds were observed and recorded for the first time during a bird census. Those species include the evening grosbeak in VT 25, red crossbill in VT 22, canada goose (fly over) in VT 25 and song sparrow in VT 26 (Table IV).

SPECIES DIVERSITY

The Shannon-Weaver Species diversity estimate (H') for the 11 VT's censused in 1993 averaged 2.489. The greatest diversity was 3.142 occurring in VT 22 while the lowest was 1.662 in VT 13. This seasons average places second compared to 2.507 in 1990.

However, when comparing the four priority VT's alone, 1993's average of 2.973 was greater than any year previous, including the second highest average of 2.849 in 1992 (Table V).

Table III. Comparative SPECIES RICHNESS for all vegetation types for each of the bird census years (1988, 1990, 1991, 1992, 1993) at Craters of the Moon National Monument.

VEGETATION TYPES																			
YEAR	+26	+25	+23	+22	+TOT	24	21	17	16	13	11	8	6	5	4	3	2	1	TOTAL
1988	26	25	26	20	48	34	20	11	14	14	16	13	14	13	15	12	12	4	6
1990	17	20	18	19	38	24	16	-	12	-	-	-	9	11	13	-	-	-	51
1991	18	16	16	16	35	22	17	13	14	9	9	14	14	9	21	-	-	-	49
1992	20	17	20	21	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1993	19	30	27	27	47	-	-	23	-	6	10	11	-	-	-	10	10	14	56
AVERAGE SPECIES RICHNESS FOR PRIORITY VT's FOR ALL YEARS					40	AVERAGE SPECIES RICHNESS FOR ALL VT's FOR ALL YEARS													55

(+) = a top four priority site
(-) = not censused

NOTE: All figures taken from Craters of the Moon National Monument Annual Bird Census Reports.

Table IV. Birds detected during the 1993 census in the eleven priority vegetation types surveyed at Craters of the Moon National Monument.

Family Species	Vegetation Types										
	26	25	23	22	17	13	11	8	3	2	1
Anserini											
Canada Goose**		25**									
Accipitridae											
Northern Harrier*			23*		17						
Red-tailed Hawk*			23	22							
Golden Eagle*	26						11*				
Falconidae											
American Kestrel*					17						1*
Columbidae											
Morning Dove*	26		23	22	17*			8	3	2	1*
Trochilidae											
Rufus Hummingbird							11				
Picidae											
Downy Woodpecker*		25*									
Hairy Woodpecker**		25**	23*								
Northern Flicker*	26	25	23	22*	17						
Tyrannidae											
Hammond's Flycatcher*		25*									
Dusky Flycatcher*	26	25	23	22*	17						
Say's Phoebe*					17*			8*	3		
Hiruninidae											
Violet-green Swallow*					17*			8			
Corvidae											
Clark's Nutcracker*		25	23	22	17*				3*	2	1*
Black-Billed Magpie		25									
American Crow	26			22							
Common Raven*				22	17*						1
Paridae											
Mountain Chickadee	26	25	23	22	17						
Sittidae											
Red-breasted Nuthatch		25	23	22							
Troglodytidae											
Rock Wren*				23*	22*	17	13	11	8	3	2
House Wren	26										
Musciapidae											
Blue-gray Gnatcatcher*			23*								
Ruby-crowned Kinglet		25		22							
Mountain Bluebird*			23	22	17	13*			3*	2	1*
Townsend's Solitaire*								8*			
American Robin*	26		23	22	17				3*		
Mimidae											
Sage Thrasher					17		11				
Vireonidae											
Solitary Vireo**			23**								
Warbling Vireo*	26	25	23*								
Emberizidae											
Orange-crwned Warbler		25									
Yellow Warbler	26										
Yellow-rumped Warbler*		25	23	22							1*
Townsend's Warbler**			23**								
MacGillivray's Warb.*	26			22*							
Wilson's Warbler*	26*	25*		22*							
Western Tanager*		25	23	22	17*						1*
Bl-headed Grosbeak**	26*		23**								
Lazuli Bunting	26	25		22							
Green-tailed Towhee*	26	25	23	22	17	13*			3*		
Rufus-sided Towhee*	26	25	23	22						2*	1*
Chipping Sparrow*		25	23	22	17*		11*	8*			

Table IV continued. Birds detected during the 1993 bird census in the eleven vegetation types surveyed at Craters of the Moon National Monument.

Family Species	Vegetation Types									
	26	25	23	22	17	13	11	8	3	2 1
Emberizidae cont.										
Brewer's Sparrow*					17	13	11	8		2* 1
Vesper Sparrow*			23*		17	13	11	8		
Lark Sparrow*										1*
Fox Sparrow	26									
Song Sparrow**	26**	25*								
White-crowned Sparrow*				22*						
Dark-eyed Junco		25	23	22						
Western Meadowlark							11	8		2
Brewer's Blackbird*	26				17		11	8		1*
Brown Headed Cowbird*	26	25	23	22	17		11	8	3	2* 1*
Fringillidae										
Cassin's Finch			23	22	17				3	2
Red Crossbill**				22**						
Pine Siskin*			23	22	17*	1*				
Evening Grosbeak**		25**								

* = first time noted in particular vegetation type

** = first time noted on Craters of the Moon National Monument bird census

= first time ever sighted at Craters of the Moon National Monument

Table V. Comparative species DIVERSITY (H)' for the all vegetation types for each of the bird census years, (1988, 1990, 1991, 1992, 1993) at Craters of the Moon National Monument.

VEGETATION TYPES																				
YEAR	+26	+25	+23	+22	+AVG.	24	21	17	16	13	11	8	6	5	4	3	2	1	AVERG	
1988	2.999	2.843	2.807	2.475	2.781	3.102	2.760	1.908	1.944	2.172	2.418	2.113	1.949	2.213	2.204	1.858	1.903	1.277	2.291	
1990	2.654	2.726	2.735	2.725	2.710	2.998	2.452	-	2.315	-	-	-	1.863	2.283	2.283	-	-	-	2.507	
1991	2.759	2.678	2.552	2.497	2.622	2.900	2.602	2.354	2.293	1.954	1.732	2.402	2.437	1.926	2.430	-	-	-	2.394	
1992	2.807	2.691	2.898	3.001	2.849	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1993	2.850	2.729	3.169	3.142	2.973	-	-	2.615	-	1.662	2.126	2.198	-	-	-	2.194	2.194	2.502	2.489	
AVERAGE DENSITY OF PRIORITY VT'S FOR ALL YEARS					2.787	AVERAGE DIVERSITY FOR ALL VT's FOR ALL YEARS														2.420

(+) = a top four priority site
 (-) = not censused

CONCLUSION

It is difficult to make fair comparisons between the census years when different vegetation types are censused each year. Some VT's naturally have lower species richness and diversity than others and, depending on which VT's are surveyed, the total average for the year will be influenced by this bias.

It also appears that the number of VT's surveyed has an effect on the total average; those years with fewer VT's surveyed have higher averages while the years with a greater number of VT's surveyed have lower averages. For this reason, it seems only logical, at this point in time, to compare the four priority VT's for data that is best representative of any trends. The same four priority VT's are visited each year and the number of sites is consistent.

When comparing the priority VT's over the past five census years, it appears that the number of individuals, species richness and diversity have all followed generally the same pattern. Figures were high in 1988 and gradually decreased in 1990 and 1991 before once again making a swing in the upward direction. However, species richness appears to have lagged behind the other factors by one year before it also began climbing upward.

While It is still too early to make any definitive conclusions about the differences in figures from year to year and while theories of possible explanations are be endless, there are some factors that deserve some consideration.

- 1 - It is hoped that with the addition of the Bird Identification Skills Evaluation, any differences between yearly figures will not be attributed to the varying skill level of the observer, however, it may also illustrate a link between the two factors. Although Roger Hoffman (1988 census) did not take the evaluation, his exceptional skills with bird identification is unquestionable; the 1988 census produced a high year for diversity and species richness. In 1990 and 1991 when numbers dropped, the skill level of the staff is questionable, both because no one presently at the monument could validate their skill levels and because they were both undergraduate interns, meaning that it is possible that they were fairly new to bird identification. In 1992, figures increased with myself as the observer with adequate skills and experience, scoring a 76 on the evaluation in 1993. In this years census, I was joined by Richard Schneider who scored a 96 on the evaluation and demonstrated excellent skill in the identification of bird songs. It is interesting that the 1993 increased again, this time nearly matching, or exceeding the previous census years highs that were achieved in 1988 when Roger Hoffman did the census. The evaluation may prove, in future years, that staff skill level is an important consideration which may require, as a result, the achievement of a specific score before one can be permitted to take part in the bird census.
- 2 - Since approximately 1986, the west has been in a drought with higher than "normal" temperatures during the summer and minimal amounts of annual precipitation. The winter of 1992/93 received ample amounts of precipitation in the form of snow followed by a spring and summer that received "normal" amounts of rainfall. Summer temperatures were cooler than average until about August (Appendix IV).

Many local people and long-time park staff commented on this years wildflower display, stating that it was the best they had seen in years. And, notably, the insect population appeared to have exploded as a result of all the standing water, as was evidenced by the very uncommon smear of countless bugs on the front grill and windshield of many long-time residents automobiles. These observations also help to support the fact that precipitation levels returned to normal.

It is very possible that the area may be coming out of the drought. The increase in precipitation apparently had an effect on both the vegetative and insect populations. It can be assumed that since the bird populations utilize both the vegetative and insect populations both for food and shelter, the decrease and subsequent increase in these populations may also influence the rise and fall of the bird populations.

It has also become evident that at this point there are no figures established to determine what degree of change in species diversity or richness is considered significant. As with the monuments mule deer census, 95% confidence intervals, or some other form of measurement, may need to be figured in to the bird census reports in the future.

Appendix I.

The eleven vegetation types and the 22 individual site locations surveyed in 1993.

Site Number	Vegetation Type	Location
26.1	Riparian	Below Martin mine
26.2	"	Above Martin mine
25.1	Upland Quaking Aspen	Big Cinders-E. side
25.2	"	Research Camp
23.1	Limber pine/Antelope bitterbrush	Silent Cone-E. side
23.2	"	Half Cone-E. side
22.1	Limber pine/Ant. bitterbrush-hi gr cover	Inferno cone-E. side
22.2	"	Big Cinders-W. side
17.1	Antelope Bitterbrush/Great Basin Wildrye	E. side of Sunset Cone
17.2	"	E. side of Silent Cone
13.1	Low Sagebrush/Sandberg Bluegrass	Top of ridge N. of Grassy Flow
13.2	"	Ridge top E. of Martin Mine
11.1	Three-tip Sagebrush/Idaho Fescue	E. side Carey Kipuka
11.2	"	W. headwall of Little Cottonwood Creek
8.1	Mtn Big Sagebrush/Idaho Fescue	Hillside W. of Sunset Cone, across from Carey Kipuka
8.2	"	S. side of Carey Kipuka
3.1	Medium Density Lava Flow	Between Half Cone and Crescent Cone
3.2	"	"
2.1	Low Density Lava Flow	Little Park Flow, S.E. of Carey Kipuka
2.2	"	Highway Flow
1.1	Cinder Gardens	Along loop rd., between Inferno and Paisley Cones
1.2	"	W. side of Hwy Flow

Appendix II.

Checklist of vegetation types, the years they were censused and the sites recommended for next season's bird census at Craters of the Moon National Monument.

Priority	Veg.Type	'88	'90	'91	'92	'93	Do in '94
1	26	x	x	x	x	x	1
2	25	x	x	x	x	x	1
3	23	x	x	x	x	x	1
4	22	x	x	x	x	x	1
5	21	x	x	x			2
6	24	x	x	x			2
7	5	x	x	x			2
8	4	x	x	x			2
9	16	x	x	x			2
10	6	x	x	x			2
11	13	x		x		x	3
12	8	x		x		x	3
13	17	x		x		x	3
14	11	x		x		x	3
15	3	x				x	3
16	2	x				x	3
17	1	x				x	3

1=priority, 2=second priority, 3=third priority

Appendix III

Shannon-Weaver estimate of diversity

$$H' = - \sum_{i=1}^S p_i \ln p_i$$

H' = Shannon-Weaver estimate of diversity

S = the number of species

i = individual

p_i = the proportion of the total number of individuals consisting of the i th species.

p_i is estimated by n_i/N

N = the total number of individuals detected

n_i = the number of individuals of species i

Appendix IV. The monthly temperature high's, low's and averages and precipitation averages for Craters of the Moon National Monument from 1988 to 1993.

	1988	1989	1990	1991	1992	1993
JANUARY						
Aver. Max	28.4	23.9	31.3	28.8	31.7	26.8
Aver. Min.	7.7	2.5	15.9	7.8	13.9	6.1
Average	36.1	13.2	23.6	18.3	22.8	16.45
Range	38./-7	38./-12	48./0	39./-22	43./4	37./-22
Precip/snow	1.33 snow	3.46 snow	1.87 snow	.08 snow	.26 snow	3.24 snow
% recovery	.70	.55	.94	.90	.71	.97
FEBRUARY						
Aver. Max	38.5	26.0	33.0	48.1	43.5	29.2
Aver. Min	13.8	5.9	8.7	22.9	22.9	11.6
Average	26.1	15.9	20.8	35.5	33.2	20.4
Range	51./-5	43./-17	46./-7	56./12	57./10	39./-16
Precip/snow	T. snow	2.12 snow	1.52 snow	T. snow	1.81 snow	3.58 snow
% recovery	.86	.93	.61	.96	.79	1.00
MARCH						
Aver. Max	44.9	42.1	48.0	43.3	55.3	40.0
Aver. Min.	17.9	22.9	23.6	23.3	29.8	21.3
Average	31.4	32.5	35.8	33.3	42.5	30.7
Range	62./-1	53./0	62./9	60./6	62./22	53./3
Precip/snow	.035 snow		2.65 snow	.78 snow	2.17 snow	.45 snow
1.83						
% recovery	.83	.90	.74	.97	.84	1.00
APRIL						
Aver. Max	59.8	63.6	60.9	53.4	66.0	50.6
Aver. Min.	32.0	32.2	35.5	30.2	36.1	28.0
Average	45.9	47.9	48.2	41.8	51.1	39.3
Range	73./20	75./16	75./19	63./18	81./21	62./18
Precip/snow	.59	.13 snow	1.64	2.14 snow	.29	1.14
% recovery	.66	.63	.70	.73	.70	1.00
MAY						
Aver. Max	71.8	66.0	61.7	60.1	74.3	69.4
Aver. Min.	35.0	34.5	34.0	35.4	43.9	40.7
Average	53.4	50.2	47.8	47.8	59.1	55.1
Range	85./21	80./24	70./22	45./26	83./34	81./25
Precip/snow	.38 snow	.83	3.14	2.21	.24	1.34
% recovery	.54	.35	.81	.87	.87	1.00
JUNE						
Aver. Max	85.8	79.3	75.5	73.9	77.9	68.7
Aver. Min.	51.7	44.2	44.3	43.6	48.7	41.6
Average	68.8	61.7	59.9	58.8	63.3	55.1
Range	98./38	85./33	92./26	81./33	93./36	85./28
Precip/snow	.06	.47	1.75	1.28	1.31	3.70
% recovery	.60	.36	.70	.80	1.00	1.00
JULY						
Aver. Max	89.3	89.7	82.8	87.1	82.6	74.1
Aver. Min.	50.3	57.6	57.5	54.2	51.3	45.7
Average	69.8	73.6	70.2	70.6	66.9	59.9
Range	94./38	95./47	98./40	93./43	94./37	86./37
Precip/snow	.21	.48	.14	1.15	.29	.92
% recovery	.77	.74	1.00	.71	1.00	.80

AUGUST						
Aver. Max	82.2	81.7	86.3	86.7	86.3	78.7
Aver. Min.	50.9	51.5	56.4	53.7	54.2	47.5
Average	66.6	66.6	71.4	70.2	70.2	63.1
Range	93./35	93./36	98./42	93./44	97./32	86./36
Precip/snow	.81	.43	.59	1.14	.09	1.06
% recovery	.61	.87	.90	.58	1.00	1.00
SEPTEMBER						
Aver. Max	73.3	72.0	79.5	77.2	74.3	73.2
Aver. Min.	40.5	39.3	48.8	44.5	42.3	42.4
Average	56.9	55.7	64.2	60.8	58.3	57.8
Range	89./26	80./34	88./40	86./30	83./31	85./30
Precip/snow	.33	.54	.21	.63	.48	.78
% recovery	.90	.80	.77	.57	1.00	1.00
OCTOBER						
Aver. Max	72.4	60.3	61.5	59.7	64.4	59.6
Aver. Min.	38.1	34.5	30.1	30.2	35.6	32.8
Average	55.3	77.5	45.8	44.9	50.0	46.2
Range	82./28	70./17	78./18	80./3	85./20	79./12
Precip/snow	0.0	1.04	T	2.56	snow 1.07	1.18 snow
% recovery	.61	.61	.55	.81	1.00	1.00
NOVEMBER						
Aver. Max	34.3	44.5	44.7	36.8	34.9	38.3
Aver. Min.	18.4	18.9	23.3	18.3	18.0	14.4
Average	26.4	31.7	34.0	27.5	26.5	26.4
Range	66./4	60./4	55./8	52./-1	52./0	55./-9
Precip/snow	4.34 snow	.88 snow	.57 snow	1.09 snow	.78 snow	.18 snow
% recovery	.63	.66	.83	.97	1.00	.93
DECEMBER						
Aver. Max	27.2	34.7	24.0	33.9	25.7	29.9
Aver. Min.	15.1	13.6	3.0	12.8	8.1	12.2
Average	21.2	24.2	14.0	23.3	16.9	21.1
Range	40./-13	46./0	50./-29	43./0	35./-15	43./0
Precip/snow	2.2 snow	.15 snow	.56 snow	.37 snow	2.24 snow	.72 snow
% recovery	.77		.94	.45	1.00	1.00
ANNL PRECIP.						
	9.85	13.18	12.77	14.82	9.31	19.67
ANNL % RCVRY	.71	.68	.79	.77	.91	.96