Nesting and Productivity of Golden Eagles in Northwestern and West-Central, New Mexico
2002 Annual Report

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ABSTRACT:

During the spring of 2002, Hawks Aloft, Inc. conducted a study of the distribution and reproductive success of Golden Eagles in west-central and northwestern New Mexico. A total of 33 territories (23 in the northwest area and 10 in the west-central area) were occupied by Golden Eagles, and 13 active nests (11 in the northwest area and 2 in the west-central area) were located in the two survey areas combined. In the northwest area there were two active nest sites that were either new or previously undocumented. For both study areas combined reproductive success was determined at 13 active nests (11 in the northwest area and 2 in the west-central area), with 11 (85%) of these nests producing at least one fledgling. Productivity was 0.82 young/breeding pair (n=11) in the northwestern study area and 1.5 young/breeding pair (n=2) in the west-central study area. Overall productivity for the two study areas in 2002 was 0.92 young/breeding pair (n=13). Productivity was relatively consistent with that in 2001 (1.1 young/breeding pair) and 2000 (0.85 young/breeding pair).

In northwestern New Mexico, where oil and gas development may represent a source of disturbance, noise levels from compressors or air exchangers were measured and extrapolated to determine the noise impacts at active nests. Noise levels were determined at two nest sites located within 1 kilometer of a compressor or air exchanger associated with oil and gas extraction activities in northwestern New Mexico during 2002. Only one of these nest sites was active and it successfully fledged a single chick. The other nest site was a nearby alternate nest where noise levels were measured for comparative purposes. From the data available, there was no significant effect of noise disturbance on the reproductive success of Golden Eagles in 2002.

The study of the impact of noise disturbance on nest site selection and/or reproductive success is inconclusive due to the small sample size. Long-term data are needed to evaluate the effect of noise disturbance on reproductive success as well as rates of territory reoccupation and nest site selection. As oil and gas operations continue to expand, particularly in the northwest study area, the disturbance effects to nesting eagles may become significant.

INTRODUCTION:

Since 1998, Hawks Aloft, Inc. (HAI) has been gathering information on the distribution, density, and productivity of Golden Eagles (*Aquila chrysaetos)* nesting in northwestern, and west-central New Mexico. Golden Eagles commonly nest on the ledges of sandstone cliffs and volcanic rock outcrops adjacent to open areas in New Mexico (Hawks Aloft 1999). Although the Golden Eagle breeding population has remained relatively stable in New Mexico, and elsewhere in the western states, human-related activities and land use practices could impact Golden Eagle nesting and reproductive success (Spofford 1964, 1988, Benson 1981, Boeker and Nickerson 1975, Glinski 1988, Hawks Aloft 2000).

The work conducted this year is a continuation of surveys initiated in 1998. Noise monitoring efforts began during the 2000 breeding season, and continued as part of a long-term study to evaluate potential noise impacts on the nesting and productivity rates of this species. Gas compressors and air exchangers used for the extraction of oil and gas can often occur in close proximity to Golden Eagle nests in the northwestern study area near Farmington, New Mexico. Oil and gas extraction facilities create a noise disturbance, as well as the associated human activity, which could affect these birds at critical times during the breeding season.

STUDY AREAS:

We surveyed two study areas in New Mexico during 2002. The northwestern study area is roughly centered around the town of Farmington, New Mexico and includes those lands administered by the Farmington Bureau of Land Management. The study area is mainly composed of sandstone canyons, arroyos and sandstone cliffs. The mesas in the area are typically topped with pinyon-juniper woodland. At the base of the cliffs, the vegetation typically includes a narrow band of pinyon-juniper woodland bordered by desert scrubland or desert grassland with a strong shrub component. Land use is chiefly oil and gas extraction but also includes cattle grazing and agriculture. A large number of unpaved roads, many of which are associated with oil and gas operations, allow access into the canyons and mesas of the area.

The other survey area is located in west-central New Mexico and includes areas east of Socorro to the Sierra Larga and west of Quemado to the Arizona border, including those lands administered by the Socorro Bureau of Land Management. The area is characterized by sandstone and basalt cliffs, along with mesas having pinyon-juniper woodlands scattered among a mix of desert scrubland, juniper savanna and desert grasslands.

METHODS:

An initial ground search was conducted from February 12-15, 2002 to establish occupied territories in the Farmington, Bloomfield, and Aztec areas.

Aerial surveys were conducted by HAI to locate occupied territories and active Golden Eagle nests in northwestern, and west-central New Mexico on April 18, and May 2-5, 2002. Cliffs that have suitable nesting habitat and historic nest sites in the study areas were aerially surveyed with

a crew of at least three observers, including the pilot, in a Cessna 205. The coordinates of the location of individual birds, nests, or signs of recent activity were recorded using a Garmin 92 Global Positioning System (GPS) unit especially designed for use in aircraft. Priority was given to historical nest sites that had nesting activity documented within the past three years.

Where access was possible, Golden Eagle territories and nest sites that appeared to be occupied during aerial surveys were ground checked within 10-14 days after the initial survey. Also, where access was possible, historic nest locations were checked from the ground at least once to determine nesting activity from April 1 through June 8, 2002. Active nests were revisited at least once when the young were within 7-10 days from fledging to determine reproductive success. All active nest sites were visited a total of two or three times during the survey period.

Raptor nests were considered to be "active" if at least one of the following was observed; 1) eggs were seen in nest, 2) nestlings or young were observed in or near nest or, 3) an adult was observed on the nest in an incubating posture (Postupalsky 1974). Nest sites were determined to be "inactive" if no raptor activity was observed at the nest. A nest site was considered an "occupied territory" if raptors were found in or around the nest, and/or exhibited territorial behavior.

In northwestern New Mexico, the occurrence of noise sources within the general area of an occupied nest was recorded. The distance between any active Golden Eagle nest and a nearby compressor or air exchanger was first determined using an electronic range finder (Bushnell Yardage Pro, model Laser 1000). Noise level was then recorded at a 20 m distance from the compressor or air exchanger using an impulse sound level meter (Quest, model 2700). To calculate the approximate noise level at a nest, the following formula was used:

$$\text{Change, dBA} = 20 \ (\log \ (\text{distance 1} / \text{distance 2}))$$

$$\text{Example: } 20 \ (\log \ (200/20) = 20 \ (\log \ (10) = 20 \ (1) = 20 \text{ Change, dBA}$$

$$70 \text{ dB} - 20 \text{ dB} = 50 \text{ dB}$$

Where Change, dBA is sound attenuation (reduction) with change in distance from a point source. By extrapolation, if noise level is 70 dB at a 20 m distance from a compressor and the distance between the compressor and a nest is 200 m, there would be a 20 dBA noise attenuation at the nest and an overall noise level of 50 dB (see example) (J. Brennen, pers. com. 12/2000).

The potential for human disturbance was evaluated at each active Golden Eagle nest site using criteria followed in 1999 (Table 1) with the addition of noise disturbance from compressors and air exchangers for the years thereafter.

Table 1. Criteria used to evaluate the potential for human-related disturbance at active

nest sites in northwestern New Mexico.

Disturbance Criteria	Disturbance Score		
	1	2	3
Noise level from compressor	No compressor near nest site	0-50 dBA	>50 dBA
Distance from road	>1 mile	1/4 mile – 1 mile	<1/4 mile
Road traffic level	Low (two-track)	Intermediate (un-paved road)	High (paved road)

Each active nest site received a score for each criterion depending on its location to noise sources. The total score provided an estimate of the potential for disturbance. A total score of three indicated minimum potential disturbance, while a total score of nine represented maximum potential for disturbance.

RESULTS:

Numbers and distribution of nesting Golden Eagles

In the Farmington area, approximately 44 historic Golden Eagle territories were checked. Of those 23 were occupied territories and 11 were active nest sites during 2002.

In central New Mexico, approximately 66 historic Golden Eagle territories were checked. Of those 10 were occupied territories and 2 were active nest sites.

Reproductive success of Golden Eagles

In the Farmington area, in 2002, the reproductive outcome was determined for all 11 of the active nests located. Nine of these nests were successful, producing a total of nine young, while two nests failed for reasons that were not determined (82% active nest success rate). The mean number of young fledged per active nest was 0.82. In 2001, the active nest success rate was 75%. In 2000, the active nest success rate was 78%. Table 2 summarizes the comparative results of the three survey years (2000-2002) for both study areas.

In central New Mexico, the 2002 reproductive outcome was determined for two of the active nests located. Both of these nests were successful (100% active nest success rate). A total of three young fledged from the active nests, yielding an average of 1.5 young fledged per active nest. Nest success rate was 89% in 2001, and 60% in 2000.

Table 2. Productivity (average number of young produced per nesting pair) of Golden Eagles for northwestern and west-central NM, from 2000 through 2002.

Study Area	Number of active nests			Number of nests with known outcome			Number of successful nests			Total number of young fledged			Productivity per breeding pair		
	'00	'01	'02	'00	'01	'02	'00	'01	'02	'00	'01	'02	'00	'01	'02
Northwestern	14	11	11	9	4	11	7 (78%)	3 (75%)	9 (82%)	6	4	9	0.66	1.0	0.82
West-central	8	10	2	6	9	2	4 (66%)	8 (89%)	2 (100%)	6	10	3	1.0	1.1	1.5
Study areas combined	22	21	13	15	13	13	10 (71%)	11 (85%)	11 (85%)	12	14	12	0.80	1.1	0.92

Distribution and productivity of nesting Golden Eagles as a function of noise disturbance

In 2002, compressors or air exchangers were observed in the proximity of one of the 11(~9%) active Golden Eagle nests in northwestern New Mexico. The observed distance from the active nest (#102b) to the nearest noise source was 535 meters. For comparative purposes a noise reading was taken at an inactive alternate nest nearby (#102a) that was active and successful in 2000. The observed distance from the noise source to nest #102a was 85 meters. It may be that this pair is selecting for the quieter nest site. Using the meter readings provided from the noise monitoring in the formula described in the methods, the calculated noise level at the active nest was 45.45 dB. The calculated noise level at the inactive alternate nest was 61.43 dB. The noise level at 20 meters from the compressor was 74 dB. Nest #102b was successful and fledged a single young.

In 2001, nest success of only one out of four active nests was determined. The successful nest also had the highest extrapolated noise level (65.3 dB) of the four nests monitored. Noise monitoring data was provided for four active Golden Eagle nests in 2000. Distance from the nest to the noise source ranged from 425 to 2,000 meters. Extrapolated noise at the nests ranged from 35.8 to 51.3dB. At least three of the nests were successful. The fourth nest was never re-checked to determine reproductive outcome.

Over the past three years of surveys and noise monitoring, the reproductive outcome was determined for five nests located within 2,000 meters of a noise source. All five of these nests successfully fledged at least one young. Although the sample size has remained small, the data seems to indicate that the current proximity of noise sources and the associated noise levels are not significantly impacting the reproductive outcome of breeding pairs of Golden Eagles. However, when the nesting option is available in a given territory, it is possible that the eagles are selecting the nest site that has the lower noise level, over an alternate one that has a higher noise level.

Estimated potential for human-related disturbance based on noise level and accessibility

For 2000 through 2002, the noise monitoring and disturbance data was used to evaluate the potential for human-related disturbance at all the active nest sites visited on the ground using the criteria mentioned above in Table 1. The 2000 survey data indicate that on average, successful nests had a lower disturbance score than unsuccessful nests. In 2001, the successful nests had a higher disturbance score than failed nests, and in 2002, successful nests had a slightly lower disturbance score than the failed nests. These disturbance scores are only a general guideline and it would require intensive monitoring at active nest sites to begin to understand the effects of disturbance on the nesting success of Golden Eagles.

Table 3. Average disturbance score of successful vs. unsuccessful nests for central and northwestern New Mexico combined, 2000-2002.

Reproductive outcome	Number of active nests			Average disturbance score		
	2000	2001	2002	2000	2001	2002
Nesting Success	6	10	11	4.83	5.4	5.5
Nesting Failure	3	2	2	5.33	4.5	6.0

Table 4. Summary of nest success and productivity by area from 1999-2002.

Study Area	Breeding Pairs (outcome determined)				Nest Success (%)				Productivity (young/breeding pair)			
	1999	**2000**	**2001**	**2002**	**1999**	**2000**	**2001**	**2002**	**1999**	**2000**	**2001**	**2002**
Northwestern	14	9	4	11	78	77	75	82	1.1	0.77	1.0	0.82
West-Central	4	5	9	2	75	60	88	100	0.75	1.0	1.1	1.5
Both Areas	18	14	13	13	77	71	84	85	1.1	0.85	1.1	0.92

DISCUSSION:

Although the sample size of nests with confirmed outcome is relatively small, nest success in the northwestern study area has remained fairly constant (75-82%) during the past four survey years (Table 4.). The 2002 season had the highest recorded rate of nest success for the past four years. The west-central study area had a nest success rate of 100%, however, the sample size was only two active nests. In the last four years nest success has ranged from 60-100%. It is possible that more nests were actually active in the west-central area but failed very early on before field surveys had begun.

From 1999 to 2002, estimates of productivity levels in northwestern and west-central New Mexico have ranged from 0.75 to 1.5 young per breeding pair (Table 4). Productivity from these survey areas are comparable with other nearby areas; 0.82 in Utah (Bates and Moretti, 1994); 1.2 in Wyoming, Colorado and New Mexico (Boeker and Ray, 1971); 0.78 in Montana and Wyoming (Phillips et al.,1990); and 0.97 in New Mexico (HAI, 1998). The survey areas overall reproductive success is considered adequate for population recruitment (Newton 1979).
With the exception of 2001(when field time was greatly reduced), northwestern New Mexico has

consistently had the greatest number of active Golden Eagle nests of the regions surveyed from 1999-2002. Golden Eagle pairs frequently will breed in the same territory using alternate nest sites and it is not uncommon for a pair to use the same nest site as the previous year. The data indicates that at least 50% or more of the territories each year in the study area are re-occupied by Golden Eagles. The availability of suitable cliffs for nesting habitat and/or the availability of adequate prey may be factors in the re-use of historic sites.

Hawks Aloft and others have monitored the effects of noise disturbance on the nesting and reproductive success of Golden Eagles in northwestern New Mexico. Adverse effects (reproductive failure or nest abandonment) of noise disturbance on breeding Golden Eagles due to the presence of compressors and/or air exchangers has not been documented to date. However, the sample size continues to be small and reproductive outcomes have not always been determined for all of the nests that are in close proximity to noise sources. It is also possible that where alternate nest sites exist, eagles are selecting more frequently, those sites that have lower noise levels.

Noise monitoring and disturbance data was used to evaluate the potential for human-related disturbance at all the occupied nest sites. Evaluation of the reproductive success of nesting Golden Eagles near sources of noise and/or roads indicates that noise disturbances do not appear to significantly impact the nest success of the monitored eagle pairs. Some breeding pairs may become habituated to noise disturbances, which could be the situation with some of the eagle pairs that consistently breed near compressors or air exchangers (i.e. nests 102a,b and 105). Over the past three years of surveys and noise monitoring, the reproductive outcome was determined for five nests located within 2,000 meters of a noise source. Of the five monitored nest sites four of these nests successfully fledged at least one young, site #117 failed early in 2002 for reasons that were not determined. Although the sample size is small, the data seems to indicate that current noise sources and levels are not significantly impacting the reproductive outcome of these breeding pairs of Golden Eagles.

From 2000 through 2002, active nest sites were evaluated using the criteria described in Table 1. These criteria are, to varying degrees, subjective because they depend on observation efforts and descriptive accounts of the field technicians. Without intensive monitoring at all active nest sites that are exposed to disturbance, reasons for nest failure will likely remain inconclusive. In the northwestern area many of the nests are in regions where there is considerable oil and gas development. These areas create a unique paradox in that while they are largely uninhabited, there is substantial human activity involved in the maintenance and repair of oil and gas facilities. It also appears that the northwestern area will be undergoing a significant increase in oil and gas exploration in the future and issues regarding disturbance will only increase. Golden Eagles tend to be very shy and secretive birds and have been observed to be particularly sensitive to human disturbance (Fyfe and Olendorff, 1976; Watson and Dennis, 1992). In the long term, monitoring data may indicate that further protection measures may need to be developed to minimize disturbance to the populations of nesting Golden Eagles in the survey areas.

RECOMMENDATIONS FOR FUTURE RESEARCH:

1. Increase survey efforts to recheck active nests prior to the estimated fledge times (mid-June) to determine the reproductive outcome.

2. Improve the data collection for disturbance scores. Surveys should record the location of compressors and air exchangers or other disturbance factors within 1/3 mile of the nest site. The distance from noise sources to nest sites needs to be collected. It is particularly important to recheck the outcome of any active Golden Eagle nest within the proximity of a noise source and specifically those nests where noise level data has been collected.

3. With adequate sample sizes, a spatial correlation analysis should be conducted using the distribution of nests, the location of historical nesting territories no longer used by Golden Eagles and compressors or air exchangers, main roads, and towns to determine the influence of noise disturbance and other human related disturbances on the distribution and reproductive success of active nests.

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APPENDIX 1: Status of Golden Eagle breeding territories in northwestern New Mexico, 2002.

HAI GE Nest Number (BLM Number)	2002 Territory /Nest Status (reproductive outcome)	Previous history of activity	Disturbance Score
AD-01 (78)	**Occupied territory**	99-active (s) 98-occupied territory	
AD-02 (107)	Inactive	01-occupied territory 99-active (s) 98-occupied territory	
AE-01 (35)		98-active (s)	
AR-01 (82)	Inactive	01-active (ND) 99-active (s) 98-active (ND)	3-compressor 58.9 dB
AR-02 (83)	Inactive	00-active (ND) 99-active (ND) 98-active (s)	6–compressor 28.7 dB
AR-03 (84)	**Occupied territory**	00-active (f) 99-active (s) 98-active (ND)	5--compressor (no noise data collected)
AR-04 (104)	**Occupied territory**		
AR-05 (120)	**Occupied territory**	99-active (ND)	
AR-06 (106)	**Occupied territory**		
AZ-01 (81)	Inactive		
BF-01 (109)	Inactive	98-active (s)	
BF-02 (99)	**Active - Successful**	00-active (s)	6
CC-10 (127)	Inactive	00-active (f)	6
CD-01 (135)	Inactive	01-active (s) 98-occupied territory	6-compressor 56.9dB
CD-02 (121)	**Occupied territory**	00-active (s) 99-active (s) 98-occupied territory	5-compressor* Compressor=57.4 dB Air exch. =54.4 dB
CR-01 (71)	Appeared Inactive	01-active (s) 00-active (s) 99-active (s) 98-active (ND)	5

HAI GE Nest Number (BLM Number)	2002 Territory /Nest Status (reproductive outcome)	Previous history of activity	Disturbance Score
FC-01 (112)	Inactive	01-active (ND) 99-active (f) 98-active (s)	
FC-10 (128)	Inactive	00-active (ND) 99-active (f) 98-active (s)	3-compressor 53.02 dB
FN-01 (103a,b,c)	(103b) **Active - Failed**	01-active (ND) 99-active (s) 98-active (s)	6 (103b)
FN-02 (77)	Inactive		
FS-01 (?)	Inactive	00-active (ND)	
GM-01 (113)	Inactive	99-active (f) 98-active (s)	
GP-01 (116)	Inactive	99-active (s) 98-active (ND)	
HC-01 (111)	**Active - Successful**	01-active (ND) 99-active (s)	6
HT-01 (122)	**Occupied territory**	01-occupied territory 99-active (f) 98-occupied territory	
JT-01 (13a)	**Occupied territory**	01-active (f) 00-active (s)	5
KE-01 (117)	**Active - Failed**	98-occupied territory	6-compressor 47.32 dB
MB-01 (80)	**Active - Successful**	98-active (ND)	5
OE-01 (123)	**Active - Successful**	01-active (ND) 99-active (ND)	5
RZ-01 (55a)	**Active- Successful**	01-active (ND)	5
RZ-02 (55b)	Inactive		
SM-01 (110)	**Active - Successful**	01-active (ND) 99-active (s) 98-active (s)	6
SM-02 (136) New	**Active - Successful**		5

HAI GE Nest Number (BLM Number)	2002 Territory /Nest Status (reproductive outcome)	Previous history of activity	Disturbance Score
TN-01 (23a,b)	Inactive		
TN-02 (137) New	**Active - Successful**		5
TU-01a (102a)	Inactive	00-active (s) 99-active (s) 98-active (s)	6-compressor 61.43 dB
TU-01b (102b)	**Active - Successful**	01-occupied territory	7-compressor 45.45 dB
TU-02 (105)	**Occupied territory**	01-active (ND) 00-active (s) 99-active (s) 98 active (s)	7-compressor 56.6 dB
WR-01 (124)	**Occupied territory**	99-active (ND)	
WR-10 (?)	Inactive	00-active (s)	
YL-01 (28a,b,c)	**Occupied territory**	01-occupied territory 00-active (s) 98-active (ND)	
YL-02 (114)	Inactive	99-active (s) 98-active (f)	

*Distance from noise source to nest was not provided in 2002, therefore, distance from 2000 and 2001 data was used. (s)=successful nest, (f)=failed nest, (ND)=outcome not determined.

Summary of Golden Eagle activity in northwestern New Mexico, 2002.

Nests/territories checked by ground or air	44
Occupied Territories	23
Active Nests	11
Active Nests- outcome confirmed	11 (9 successful, 2 failed)
Sites re-occupied	9 nests, 20 territories, 2 nests were new or previously undocumented

APPENDIX 2: Status of Golden Eagle breeding territories in west-central New Mexico, 2002.

HAI GE Nest Number (BLM Number)	2002 Territory /Nest Status (reproductive outcome)	Previous history of activity	Disturbance Score
AH-01	Not checked	01-occupied territory	
BE-01 (525,530)	Inactive	98-active (ND)	2
BL-01 (?)	Inactive		1
BL-02 (54)	Inactive	98-active (ND)	2
BL-03 (48)	Inactive	01-occupied territory 99-active (s) 98-active (ND)	1
BL-04 (54)	Inactive	01-active (f) 98-active (ND)	4
BL-05 (54a-d)	Inactive		1
BL-06 (79)	Inactive	01-occupied territory 99-active (s) 98-active (ND)	1
BS-01	Inactive		2
BS-02	Inactive		
BS-03 (329)	Inactive		
BS-04	Inactive		
BS-05	Inactive		
BS-06	Inactive	01-occupied territory	
BS-07	Inactive		
BS-08	Inactive		
CA-10	Not checked	00-active (ND)	1
CS-01	Inactive	98-active (ND)	1
CP-04 (35)	**Occupied territory**	01-active (s) 00-active (s)	5
DS-01 (375,376)	Inactive		
GN-01	Inactive	01-active (s) 98-active (ND)	5

HAI GE Nest Number (BLM Number)	2002 Territory /Nest Status (reproductive outcome)	Previous history of activity	Disturbance Score
HE-01	Inactive		
HE-02	Inactive		
HW-01 (522A)	Inactive	98-active (ND)	1
Indian Peak	Not checked	01-active (s)	4
KW-20a,b	Not checked		2
LD-11/LD-01 (337)	Inactive		1
LD- (?) (209)	Inactive		1
LD-05 (208)	Inactive		
LD-06 (208A)	Inactive		
LD-07 (210)	Inactive		
LD-08 (211, 211a)	Inactive		
LD-16 (333)	Inactive		
LD-09 (335)	Inactive		
LD-10 (336)	Inactive	01-active (ND)	
LD-12 (394)	**Occupied territory**		
LD-15 (397)	**Occupied territory**		
LL-01 (131)	Inactive	01-active (s)	6
LL-03 (562)	Inactive		
LP-01/LP-02 (539,540)	Not Determined	01-active (s) 99-active (ND) 98-active (ND)	4
MC-01	Not checked		1
MS-01 (81a)	**Occupied territory**	01-occupied territory 99-active (ND) 98-occupied territory	2
MS-02 (82a)	**Active - Successful**		
MY-01	Inactive		
MY-02	Inactive		
MY-03	Inactive		

HAI GE Nest Number (BLM Number)	2002 Territory /Nest Status (reproductive outcome)	Previous history of activity	Disturbance Score
MY-04	Inactive		
MY-10 (?)	Inactive	01-occupied territory 00-active (ND)	
MH 03	Inactive	99-active (f) 98-occupied territory	1
PO-01	**Occupied territory**		1
QM-01 (442)	**Occupied territory**	01-occupied territory	1
SV-01a (343,316)	Inactive	98-active (ND)	
SV-01b	Inactive		
SG-01 (464,465)	Inactive	98-active (ND) 99-active (f)	2
SS-20 (?)	Not checked	01-occupied territory	1
SZ-01 (283)	**Active - Successful**	01-active (s) 00-active (s)	6
SZ-02 (67)	Inactive	01- active (ND) 99-active (s) 98-occupied territory	1
SZ-03 (284b)	Inactive		
SZ-04 (?)	Inactive		
TM-01 (15)	Inactive	01-active (s) 00-active (s) 98-active (ND)	6
TM-02 (60)	**Occupied territory**	01-occupied territory 00-active (f) 98-active (ND)	2
TM-03 (?)	Inactive		
TM-05 (73a,b)	**Occupied territory**	01-occupied territory	2
ZL-01a,b (2)	Inactive	01-active (s) 00-active (s) 99-active (s)	6

(s)=successful nest, (f)=failed nest, (ND)=outcome not determined.

Appendix 2: continued

Summary of Golden Eagle activity in west-central New Mexico, 2002.

Nests/territories checked by ground or air	66
Occupied territories	10
Active nests	2
Active nests – outcome confirmed	2 (2 successful)
Sites re-occupied	2 nests, 10 territories

APPENDIX 3: Golden Eagle nest status and corresponding noise levels in northwestern New Mexico, 2002.

HAI Nest Number (BLM #)	Nest Status in 2002	Nest distance from nearest noise source (m)	Noise level at 20 meters from compressor/ air exchanger (dB)	Extrapolated noise level at the nest* (dB)
AR-01 (82)	Inactive	405**	85**	85-26.13= **58.87**
AR-02 (83)	Inactive	464**	56**	56-27.31= **28.7**
CD-01 (135)	Inactive	322**	81**	81-24.14= **56.16**
CD-02 (121)	**Occupied territory**	480**	85**@compressor 82**@air exchanger	85-27.6= **57.4** 82-27.6= **54.4**
KE-01 (117)	**Active - Failed**	966**	81**	81-33.68= **47.32**
FC-10 (128)	Inactive	563**	82**	82-28.98= **53.02**
TU-01 (102a,b)	102a - Inactive **102b – Active - Successful**	85 535	74 74	74-12.57= **61.43** 74-28.55= **45.45**
TU-02 (105)	**Occupied territory**	236**	78**	78-21.44= **56.56**

* Equation for changes in noise levels dBA= 20 (10 log (distance 1/distance 2)).
(Reference distance 2 = 20 meters, distance 1 = nest distance from noise source).

** Since the nest distance from compressor and air exchanger was not provided for 2002, it was assumed the locations and noise levels were the same as in 2000 and/or 2001, and this data was used in the equations.

APPENDIX 4: Comparison of nest status and noise levels for Golden Eagle nests in northwestern New Mexico, 2000 - 2002.

HAI Nest Number (BLM #)	Nest Status			Extrapolated noise level at the nest (dB)		
	2000	2001	2002	2000	2001	2002
AR-01 (82)	Inactive	Active - Outcome Unknown	Inactive	No data	58.87	58.87**
AR-02 (83)	Active – Outcome Unknown	Not Determined	Inactive	37.7and 40.9	28.7	28.7**
CD-01 (135)	Inactive	Active – Successful	Inactive	No data	56.2	56.2**
CD-02 (121)	Active-Successful	Inactive	**Occupied territory**	Air ex = 47.9 Compressor = 46.5	57.5 54.4	57.5** 54.4**
FC-10 (128)	Not Determined	Not Determined	Inactive	0	53.0	53.0**
KE-01 (117)	Inactive	Inactive	**Active-Failed**	No data	47.3	47.3**
TU-01 (102a,b)	102a-Active-Successful	Occupied Territory	**102b-Active-Successful**	35.8 46.6	65.32	102a-61.43 102b-45.45
TU-02 (105)	Active - Outcome Unknown	Active - Outcome Unknown	**Occupied territory**	51.3	56.56	56.56**

** Since the nest distance from compressor and air exchanger was not provided for 2002, it was assumed the locations and noise levels were the same as in 2000 and/or 2001, and this data was used in the table for 2002.