deposited in the Louisiana State University Museum of Zoology. The species are as follows:

Ruddy Duck (*Oxyura jamaicensis*).—Four of these ducks were observed on 18 June 1964, on Laguna de Chanmico, Dept. Libertad; a female was collected (LSUMZ 50481).

Least Tern (*Sterna albifrons*).—A pair of Least Terns was observed on 27 June 1964, at the small coastal fishing village of La Herradura, Dept. La Paz; a female was collected (LSUMZ 50503).

Melodious Blackbird (*Dives dives*).—This species was observed twice; a female (LSUMZ 50677) was collected on 13 June, 21 km W. of Libertad, Dept. Libertad, and a male (LSUMZ 50676) on 28 June 1964, at Laguna de Chanmico, Dept. Libertad.

I thank John P. O'Neill for providing information about these specimens.—ALAN FEDUCCIA, *Dept. of Zoology, Univ. of North Carolina, Chapel Hill, 27514.* *Accepted 13 Jan. 1975.*

The impact of an underground nuclear fracturing experiment on cliff-nesting raptors.—Almost any development and use of a natural resource has concomitant impacts on resident wildlife; stimulation of natural gas wells with nuclear fracturing techniques is no exception. On 17 May 1973, three 30-kiloton nuclear explosives were detonated 1900 m below the earth's surface in Rio Blanco County, Colorado in a U.S. Atomic Energy Commission-CER Geonuclear sponsored experiment called Project Rio Blanco. This note deals with the effects of ground motion resulting from that experiment on cliff-nesting hawks and eagles.

If nuclear stimulation of natural gas fields is to become a part of a national energy program, associated environmental costs must be carefully weighed. Two nuclear stimulation tests were conducted prior to Project Rio Blanco but environmental studies were not performed concurrently. The environment, including raptor populations, was studied before and after 2 underground nuclear tests on Amchitka Island, Alaska. Project Milrow damaged a cliff containing a Peregrine Falcon (*Falco peregrinus*) eyrie (White et al., Bioscience 21:623–627, 1971) and Project Cannikan destroyed or damaged 3 Peregrine Falcon and 6 Bald Eagle (*Haliaeetus leucocephalus*) nest sites (Kirkwood and Fuller, USAEC Report BMI-171-147, 1972). However, these tests differed from Project Rio Blanco in 3 important aspects. First, they were weapons tests and not nuclear fracturing experiments. They were 100 times more powerful and were closer to the surface; therefore, vertical displacement and damage were much greater. Finally, both tests were conducted in late fall, long after the raptor breeding season.

The nuclear devices of project Rio Blanco were detonated during the raptor nesting season. Red-tailed Hawk (*Buteo jamaicensis*) nests in the area contained eggs or newly hatched young; Golden Eagle (*Aquila chrysaetos*) young were 2–4 weeks old. In order to ascertain the impact of ground motion on active raptor nests, we searched for nests on cliffs within 16 km of the test site. On 15 May active nests found in an April 1973 survey conducted by Colorado Division of Wildlife were checked by helicopter. Additional cliffs were also visited and contents (eggs, young) of each active nest were noted. Portions of the study area not flown were searched from the ground on 16 May; nests located were examined and contents recorded. Nine Red-tailed Hawk and 3 Golden Eagle nests within the study area and 2 Red-tailed Hawk nests beyond the 16 km perimeter were documented prior to detonation (Table 1). All active nests were again examined by helicopter within 4 hours post-detonation; general condition

TABLE 1

RAPTOR NESTS OBSERVED NEAR PROJECT RIO BLANCO, 15–18 MAY 1973.

Nest no.	Species	Distance (km) and Direction from test site	Pre-detonation Survey	Post-detonation Survey
1	Red-tailed Hawk	1 SW	2 eggs	deserted
2	Red-tailed Hawk	2.5 SW	1 egg	destroyed
3	Red-tailed Hawk	5.5 W	2 eggs	minor rockfalls
4	Red-tailed Hawk	10 NE	2 young	no change
5	Red-tailed Hawk	11 E	1 young	no change
6	Red-tailed Hawk	13 W	1 young 1 egg	no change
7	Red-tailed Hawk	13 NE	3 young	minor rockfalls
8	Red-tailed Hawk	16 E-NE	1 young	no change
9	Red-tailed Hawk	16 NE	1 egg	deserted
10	Red-tailed Hawk	18 NE	fresh nest material	no change
11	Red-tailed Hawk	19 NE	recently deserted	destroyed
12	Golden Eagle	11 W	1 young 1 egg	no change
13	Golden Eagle	11 NE	2 eggs deserted	no change
14	Golden Eagle	16 E	1 young	no change

of the site, contents of the nest, and behavior of adult birds were recorded. Nests observed without adults on the aerial survey were examined from the ground on 17–18 May. While our documentation was the result of intensive air and ground searches, we do not imply that all cliff nests were located. Approximately 90% of the cliffs in the study area were searched and we feel at least an equal proportion of nests was found.

A Red-tailed Hawk nest (Nest 8) 16 km east-northeast of the test site was under observation at detonation. Prior to detonation the female was brooding a week-old chick and the male was perched in a treetop 0.5 km away. As the shock wave passed the cliff, several large rocks were dislodged and the female leaped from the nest, screaming. The male joined her and they soared above the nest for several min, screaming periodically, before landing in piñon pines (*Pinus edulis*) above the cliff. They screamed intermittently and changed perches several times. The female's agitation gradually subsided, and 10 min after detonation she returned to the nest. Another Red-tailed Hawk nest (#2) 2.5 km from the test site was not observed during detonation but the female was seen hovering above the ruined nest by aerial observers 5 min after detonation. This female was still in the immediate vicinity on 18 May.

On post-detonation helicopter surveys, more raptors were observed in the air than were seen in comparable pre-detonation surveys. It is possible that all raptors remained in an excited state for some time after detonation. Another possibility is that birds began active hunting in direct response to increased small mammal activity associated

with ground motion and habitat alteration (Alldredge et al., 4th Symp. Radioecology, in press). We also realize that increased raptor activity could have been caused by stimuli unrelated to Project Rio Blanco.

On the post-detonation flight, no observable changes had occurred at the eagle nests; however, 6 of the Red-tailed Hawk nest sites were altered. Nest 1, containing 2 eggs, was 1 km from the test site. The female soared and screamed during documentation efforts at her nest. This nest was not destroyed by the shock wave although many sticks from it were scattered on the slope below and much of the cliff face was altered. Vertical displacement 1 km from the test site was expected to be between 8 and 16 cm according to the USAEC environmental impact report. The nest area was visited by helicopter and twice on foot after the detonation. No adults were observed and the nest was considered abandoned. Increased human activity, including that of the environmental analysis team, may have contributed to desertion.

The sandstone cliff on which Nest 2 was situated was also heavily damaged by the shock wave. A portion of the cliff above the nest fell, filling the nest with rocks and debris. The egg was probably crushed and was certainly inaccessible to the adults. Nest 11, 19 km from the test site, fell from the cliff and shattered on the ground below. Displacement was predicted to be 0.3 cm. It is quite possible, however, that the next severe wind would have had the same effect. The nest had contained 2 eggs on 27 April 1973, but the eggs had disappeared and the nest was abandoned on 16 May.

Cliffs on which 2 nests were located sustained observable damage but the nests and their contents were not harmed. At Nest 3, 5.5 km from the test site, portions of the cliff were dislodged by ground motion. Nest 7, 13 km from the test site, contained three 2–3 day old young. A slight overhang protected the back ⅔ of the nest. Several rocks 5–10 cm in diameter were in the front portion of the nest before detonation. Fragments, this size or larger, were dislodged from above the nest by the shock wave. The chicks would probably have been killed or injured by the falling debris had it not been diverted by the overhang.

An adult female was incubating one egg at Nest 9 prior to detonation. She was not seen during the post-detonation aerial survey, and the egg was cold on 18 May. It is difficult to ascertain whether the desertion of Nest 9 was due to ground motion, increased traffic on a road 50 m away, or our activities in documentation. Therefore, it was deleted from the affected nests in the following analysis.

Within 16 km of the test site, 3 eggs in 2 Red-tailed Hawk nests were lost, of 15 eggs and young in 9 nests, resulting in a 20% reduction in potential fledglings and a 22% loss of nests. However, nesting cliffs were not damaged so extensively that new nests could not be built on them in future breeding seasons. Unfortunately, we were unable to study this in 1974 or 1975. Since nesting was interrupted when eggs were near hatching, we doubt that renesting occurred in 1973.

Golden Eagle nests were not damaged, possibly because they were farther from the test site than Red-tailed Hawk nests that incurred the greatest damage. Also, they were located on large unbroken cliff faces whereas Red-tailed Hawk sites were smaller cliffs with numerous cracks and were more easily broken by ground motion. All eagle nests had an overhang above them that would have diverted any falling debris from the nest.

Project Rio Blanco had an observable impact on nests and behavior of Red-tailed Hawks. Damage was most severe within 2.5 km of the test site, where both documented Red-tailed Hawk nests were destroyed or deserted. However, an unstable nest site 19 km away (Nest 11) was also destroyed. The long-range impact of the test upon hawks

and eagles could not be ascertained from cursory short-term observations but it appeared to be minimal. Damage to raptor nests from natural erosion or strong winds undoubtedly occurs each year, but we have no baseline data to document such events. While damage to nests resulting from ground motion associated with Project Rio Blanco might have occurred, in time, from natural causes, the Project likely accelerated the frequency of occurrence. Although the overall impact of Project Rio Blanco on cliff nesting raptors appeared quite small, we recommend that future nuclear fracturing experiments not be conducted during the nesting season and that they be carefully monitored to ascertain all possible environmental impacts.

The field work reported herein was funded in part by CER Geonuclear Corporation, Las Vegas, Nevada. Colorado Division of Wildlife Raptor Project W-124-R funded Stahlecker's participation. Several other Division employees also assisted with field work as did personnel from Colorado State University's Department of Radiology and Radiation Biology. E. D. Campbell, Las Vegas Operations Office, ERDA is gratefully acknowledged for assistance in logistical matters. The pertinent pages of Kirkwood and Fuller 1972 (cited herein), have been deposited in the Josselyn Van Tyne Memorial Library.—DALE W. STAHLECKER, *Dept. of Fishery and Wildlife Biology, Colorado State Univ., Fort Collins 80523;* and A. WILLIAM ALLDREDGE, *Dept. of Radiology and Radiation Biology, Colorado State Univ., Fort Collins 80523.* *Accepted 22 Sept. 1975. Page costs paid.*

Natal pterylosis of *Sporophila* finches.—Finches of the genus *Sporophila* (Emberizidae) are a familiar part of the avifauna of many parts of the Neotropics. The only information on the natal pterylosis of these finches is confined to unquantified statements for the Variable Seedeater (*S. americana*) which is reported as having "sparse gray down" (Skutch, Pac. Coast. Avif. 83:1–448, 1951) or "Dark Neutral Gray (down) blending to Lighter Neutral Gray at the tips" (Gross, Auk 69:433–446, 1952) present in 6 tracts. This paper presents data on the natal pterylosis of 4 of the approximately 30 species presently included in this genus: the Ruddy-breasted Seedeater (*S. minuta*), Yellow-bellied Seedeater (*S. nigricollis*), Gray Seedeater (*S. intermedia*), and Dull-colored Seedeater (*S. obscura*). Hopefully it will stimulate similar studies of additional species. As noted earlier (Collins, Bird-Banding 34:36–38, 1963; Bull. Br. Ornithol. Club 93: 155–157, 1973) absence of the details of the natal down distribution patterns unfortunately is typical for most Neotropical species.

We examined the following fluid-preserved specimens: 2 *S. minuta* and 1 each of *S. nigricollis* and *S. obscura*. The specimens of *S. minuta* were collected (by CTC) on 17 August 1964 near Cacandee Village, Caroni Co., Trinidad. The specimens of *S. nigricollis* and *S. obscura* were collected respectively on 8 and 13 October 1966 near Estación Biológica de Rancho Grande, Est. Aragua, Venezuela by Paul Schwartz. All 4 individuals were newly hatched (Stage A, Wetherbee, Bull. Am. Mus. Nat. Hist. 113:339–436, 1957) and presumably had not lost any neossoptiles through abrasion. The nestling of *S. obscura* unfortunately was badly damaged when its container leaked and the specimen desiccated. We could see that it had a sparse complement of neossoptiles involving only 2 tracts, although the exact arrangement of these downs in the spinal tract could not be determined. In 1974 Paul Schwartz made observations on an additional 8 nestlings of *S. nigricollis* near Rancho Grande, 2 nestlings of *S. intermedia* near Guanare, Est. Portuguesa, and 9 nestlings of *S. obscura* at El Limon, near Maracay, Est. Aragua.

The downs of *S. minuta* and *S. nigricollis* ranged in total number from 80 to 134. Their