VERTEBRATE FAUNA OF A RADIOACTIVE LEACHING POND COMPLEX IN SOUTHEASTERN IDAHO

Douglas K. Halford[1] and Jere B. Millard[2]

ABSTRACT.— An inventory of the terrestrial vertebrate fauna and the seasonal occurrence of each species was determined for a man-made radioactive leaching pond complex in southeastern Idaho. Three reptile, 11 mammal, and 94 bird species were identified from February 1974 through January 1978. Fewest species were observed during the winter and most during the summer. Eight bird species nested at the pond complex, while 19 species of birds were common or seasonally abundant. It appears that the Test Reactor Area radioactive leaching pond complex is an important water source and provides habitat for some species of wildlife.

Since 1952, man-made leaching ponds at the Test Reactor Area (TRA) on the Idaho National Engineering Laboratory (INEL) Site in southeastern Idaho (Fig. 1) have been used to dispose of low-level liquid radioactive wastes generated from various test reactors and their support facilities. A variety of wildlife is attracted to the leaching pond complex which is one of the few sources of water available on or near the INEL Site. The Big Lost River flows intermittently and sometimes crosses as much as 50 km of the southwestern section of the site and then terminates in the Big Lost River Sinks. The Little Lost River terminates in the Little Lost River Sinks east of Howe (Fig. 1) before entering the site. The Big Lost and Little Lost rivers may dry up for a considerable portion of their length during the summer. During the winter they are often frozen. Mud Lake, which is 50 km northeast of the study area, is frozen during much of the winter, as are most other standing bodies of water in the area. However, since the TRA pond complex receives heated effluents, water is available throughout the year.

Since the pond complex contains radioactive isotopes, a potential exists for the movement of radionuclides from the area by indigenous animals. Therefore, it is important to document which species use the pond so estimations can be made on the export of radioactive materials and the potential for radionuclide uptake from species taken and consumed by hunters.

To determine which species of wildlife used the TRA pond complex, a species inventory was conducted. The purpose of this paper is to report species composition, abundance, and seasonal distribution of the vertebrate fauna which occur at the TRA radioactive leaching pond complex. The data from this study will provide information on wildlife attracted to a man-made radioactive leaching pond and also provide a data base for studies being conducted on the pond ecosystem and the environmental impacts if the pond were drained or otherwise altered.

STUDY AREA

The study was conducted at the TRA radioactive leaching pond on the INEL Site, Butte Co. in southeastern Idaho (Fig. 1). The INEL Site covers an area of 2315 km^2. The site is located on the cool desert shrub biome along the western edge of the upper Snake River Plain. The topography is flat to rolling, with an average elevation of 1470 m. The elevation of the study area is 1500 m. Annual precipitation averages 18–20 cm and temperatures range from –42 to 39 C, with an annual average of 6 C. Vegetation is dominated by desert shrubs, primarily big sagebrush (*Artemisia tridentata*), which covers about 80 percent of the site; the under-

[1]Environmental Sciences Branch, Idaho National Enginering Laboratory, U.S. Department of Energy, Idaho Falls, Idaho 83401.

[2]Department of Radiology and Radiation Biology, Colorado State University, Fort Collins, Colorado 80521.

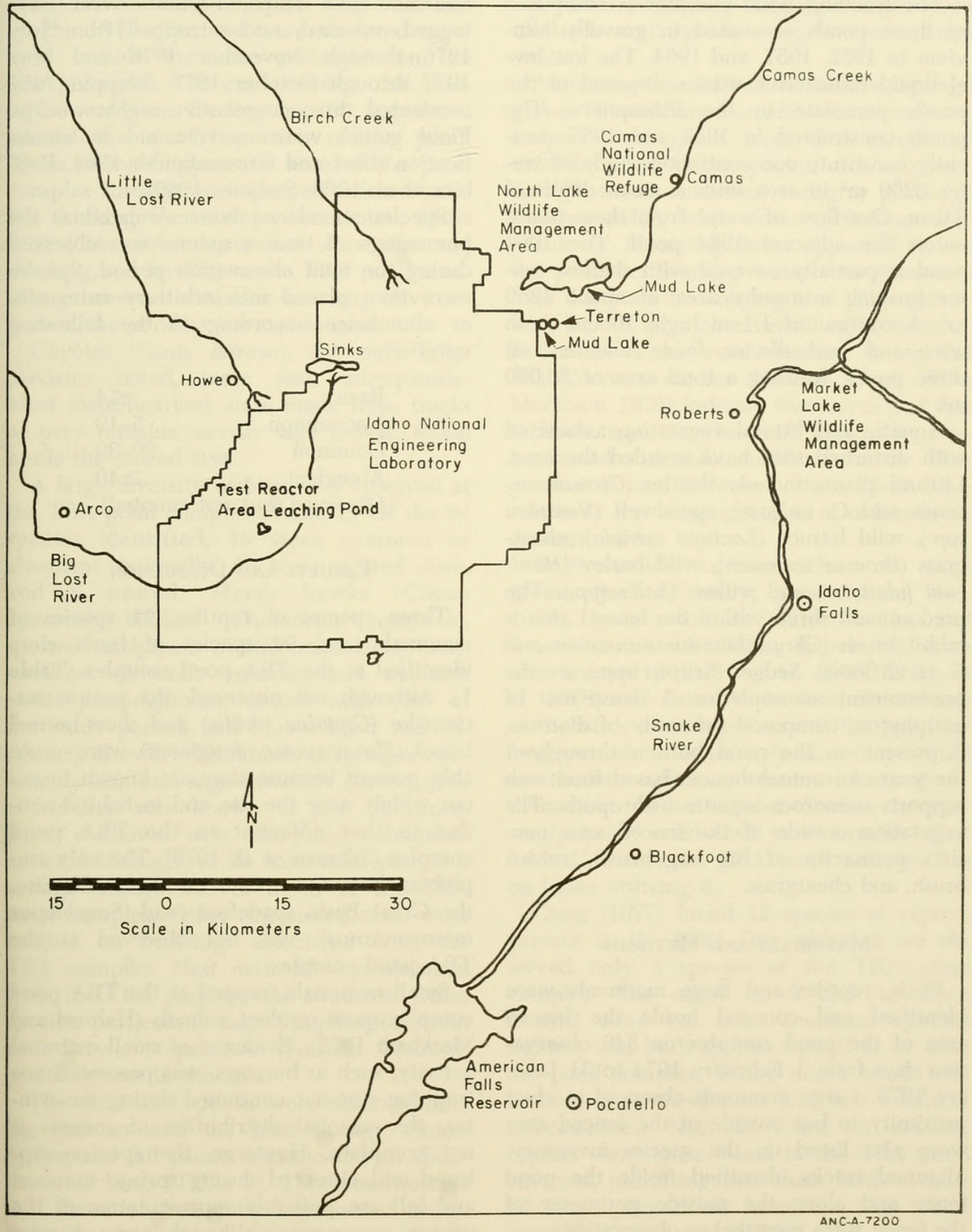

Fig. 1. Location of Test Reactor Area leaching pond complex on the Idaho National Engineering Laboratory Site in southeastern Idaho.

story is composed of grasses and forbs (Harniss and West 1973).

The leaching pond complex is composed of three ponds excavated in gravelly alluvium in 1952, 1957, and 1964. The low-level liquid radioactive wastes disposed in the ponds percolate in the lithosphere. The ponds constructed in 1952 and 1957 presently constitute one continuous body of water 8200 m^2 in area with a mean depth of 3.0 m. Overflow of water from these ponds enters the adjacent 1964 pond. The 1964 pond is partially covered with shallow water forming a marshy area of about 1250 m^2. A continuous 1.1 m high, 10 cm mesh wire and barbed-wire fence encloses all three ponds, forming a total area of 26,000 m^2.

Aquatic and littoral vegetation associated with disturbed sites have invaded the area. Littoral plants include thistles (*Cirsium arvenes* and *C. vulgare*), speedwell (*Veronica spp.*), wild lettuce (*Lactuca serriola*), cheatgrass (*Bromus tectorum*), wild barley (*Hordeum jubatum*), and willow (*Salix spp.*). The predominant shrub within the fenced area is rabbit brush (*Chrysothamnus nauseosus* and *C. vicidiflorus*). Sedges (*Scirpus spp.*) are the predominant macrophytes. A dense mat of periphyton, composed primarily of diatoms, is present on the pond bottom throughout the year. An autochthonous-based food web supports numerous aquatic arthropods. The vegetation outside of the fenced area consists primarily of big sagebrush, rabbit brush, and cheatgrass.

MATERIALS AND METHODS

Birds, reptiles and large mammals were identified and counted inside the fenced area of the pond complex on 849 observation days from 1 February 1974 to 31 January 1978. Large mammals observed in close proximity to but outside of the fenced area were also listed on the species inventory. Mammal tracks identified inside the pond fence and along the outside perimeter of the fence were recorded as observations.

Observations were made with 8 × 40 binoculars and a 20-power spotting scope between 0800 and 1300 from a vehicle driven around the entire perimeter of the pond area. Small mammals were inventoried by trapping inside the pond fence with 70 Sherman live traps. Rodents were eartagged, released, and retrapped from July 1976 through November 1976 and May 1977 through October 1977. Trapping was conducted three consecutive nights weekly. Field guides were used to aid in identification (Burt and Grossenheider 1964, Robbins et al. 1966, Stebbins 1966).

Species abundance was calculated as the percentage of time a species was observed during the total observation period. Species were then placed into arbitrary categories or abundance according to the following criteria:

Rare	≤ 4
Uncommon	5–19
Common	20–39
Abundant	≥ 40
Observed (but not counted)	

RESULTS AND DISCUSSION

Three species of reptiles, 11 species of mammals, and 94 species of birds were identified at the TRA pond complex (Table 1). Although not observed, the prairie rattlesnake (*Crotalus viridis*) and short-horned lizard (*Phrynosaoma douglassii*) were probably present because they are known to occur widely over the site and in habitat similar to that adjacent to the TRA pond complex (Sehman et al. 1976). The only amphibian known to occur on the INEL Site, the Great Basin spadefoot toad (*Scaphiopus intermontanus*), was not observed at the TRA pond complex.

Small mammals trapped at the TRA pond complex were resident animals (Halford and Markham 1978). Evidence of small mammal activity, such as burrows, was present. Since trapping was not continued during the winter, the seasonal distribution of rodents is not complete. However, the species captured and observed during spring, summer, and fall are probably representative of the winter occurrence, although some species hibernate. The most abundant small mammal at the TRA pond complex was the white-footed deer mouse (*Peromyscus maniculatus*) and the least abundant was

the meadow vole (*Microtus pennsylvanicus*).

Pronghorn antelope (*Antilocapra americana*) are the most abundant large mammal on the INEL Site and were observed regularly outside the wire perimeter on the TRA complex. On one occasion, 20 antelope were seen feeding on the vegetation around the marshy portion of the pond. These animals apparently entered the pond complex through an improperly closed gate. No drinking by antelope was noted. Mule deer (*Odocoileus hemionus*) were observed drinking and feeding in the TRA pond complex on several occasions and may have relied on the pond as a water source.

Coyotes (*Canis latrans*), the only large predator noted, were seen infrequently. Most identifications were made from tracks or prey remains, usually sage grouse, found inside the fenced area.

A large diversity of birds was observed at the TRA pond complex (Table 1). Of the 94 species identified, 19 were common or abundant seasonally, 19 were sighted once, and 8 nested. Marsh hawks (*Circus cyaneus*), killdeer (*Charadrius vociferus*), spotted sandpipers (*Actitis macularia*), barn swallows (*Hirundo rustica*), and mallards (*Anas platyrhynchos*) nested each year of the study period, and blue-winged teal (*A. discors*), Brewer's blackbirds (*Euphagus cyanocephalus*), and sage thrashers (*Oreoscoptes montanus*) were known to nest but once. Barn swallows were the most abundant nester, building over 20 nests each year in a sewage facility 100 m north of the TRA pond complex. Other uncounted nests were located on buildings associated with the TRA complex. Nest material was obtained from the TRA pond by the swallows. Other species, particularly sage (*Amphisipiza belli*) and Brewer's sparrows (*Spizella breweri*), probably nest in the area.

The most bird species were observed during summer and the least during winter. Spring and fall counts also showed an abundance of birds (Table 2). The Passeriformes was the most frequently represented order, with the highest species counts occurring during spring and summer. Anseriformes was the next most frequently represented order, with most species observed during the spring and fall migration periods. Three of the 15 orders account for more than 75 percent of the species identified (Table 2). The most frequently observed birds were mallards and green-winged teal (*Anas crecca*).

Mourning doves (*Zenaida macroura*), sage grouse (*Centrocercus urophasianus*), and waterfowl were game birds that frequently used the pond. Other species, such as pheasant (*Phasianus colchicus*) and gray partridge (*Perdix perdix*), were observed infrequently (Table 1). Mourning doves appeared to use the pond for drinking water and waterfowl used the pond as a resting area. Sage grouse with broods were observed in early summer, and adult flocks were observed during the fall. Previous studies (Halford et al. 1976, Markham 1976) indicate that doves and waterfowl ingest or become externally contaminated with radionuclides from the TRA pond environs. However, these birds have relatively low concentrations of radionuclide contamination.

Radionuclide concentrations in sage grouse (Jack Connelly, pers. comm. Dec. 1977), barn swallows, marsh hawks, and American kestrels (*Falco sparverius*) were also assessed (Millard et al. 1976, Craig et al. 1978) and found to be low. Since none of the birds inventoried stay at the pond for long periods, it is unlikely that they would accumulate sufficient concentrations of radionuclides to be harmful. Studies are currently being conducted to determine what hazard, if any, the TRA pond complex has on fauna utilizing it.

Craig (1977) found 12 species of raptors present on the INEL Site, although we observed only 4 species at the TRA pond complex. The marsh hawk and American kestrel were the most common species sighted, and both species nested in or near the pond complex. Young marsh hawks and kestrels from these nests had low levels of radionuclides. Nuclides found in nestling raptors were those found in the TRA pond environs, indicating that these birds obtained some prey items from the TRA pond complex (Craig et al. 1978).

This species inventory indicated that the TRA radioactive leaching pond complex may provide a source of food, water, and other habitat requirements for several spe-

TABLE 1. Seasonal occurrence and abundance of reptiles, mammals and birds at the Test Reactor Area leaching ponds in southeastern Idaho.

Species	Seasonal Occurrence and Abundance			
	Spring	Summer	Fall	Winter
REPTILES				
Bull Snake (*Pituophis melanoleucus*)	–	c+	–	–
Western Terrestrial Garter Snake (*Thamnophis elegans*)	–	u	–	–
Sagebrush Lizard (*Sceloporus graciosus*)	–	o	–	–
MAMMALS				
Coyote (*Canis latrans*)	o	o	o	o
Long-tailed Weasel (*Mustela frenata*)	–	o	–	–
Least Chipmunk (*Eutamias minimus*)	c	c	c	–
Ords Kangaroo Rat (*Dipodomys ordii*)	c	c	c	–
Western Harvest Mouse (*Reithrodontomys megalotis*)	u	u	u	–
White-footed Deer Mouse (*Peromyscus maniculatus*)	a	a	a	–
Meadow Vole (*Microtus pennsylvanicus*)	–	r	–	–
Mountain Cottontail (*Sylvilagus nuttalli*)	o	o	o	o
Pygmy Rabbit (*Sylvilagus idahoensis*)	–	o	–	–
Mule Deer (Odocoileus hemionus)	–	u	u	–
Pronghorn (*Antilocapra americana*)	u	c	c	u
BIRDS				
Western Grebe (*Aechmophorus occidentalis*)	–	–	r	–
Eared Grebe (*Podiceps nigricollis*)	u	u	c	u
Pied-billed Grebe (*Podilymbus podiceps*)	u	–	u	–
White Pelican (*Pelecanus erythrorhynchos*)	–	–	r++	–
Whistling Swan (*Olor columbianus*)	r++	–	–	–
Snow goose (*Chen caerulescens*)	–	–	–	r++
Canada goose (*Branta canadensis*)	u	–	u	–
Mallard (*Anas platyrhynchos*)	c	a°	u	a
Pintail (*Anas acuta*)	u	–	r	–
Gadwall (*Anas strepera*)	r	r	r	–
American Wigeon (*Anas americana*)	r	r	u	–
Shoveler (*Anas clypeata*)	u	r	u	–
Blue-winged Teal (*Anas discors*)	u	c°	u	–
Cinnamon Teal (*Anas cyanoptera*)	u	u	–	–
Green-winged Teal (*Anas crecca*)	c	u	a	u
Wood Duck (*Aix sponsa*)	r++	–	–	–
Redhead (*Aythya americana*)	r	–	u	r
Canvasback (*Aythya valisineria*)	–	–	r++	–
Ring-necked Duck (*Aythya collaris*)	–	–	r++	–
Lesser Scaup (*Aythya affinis*)	r	–	c	u
Common Goldeneye (*Bucephala clangula*)	u	–	u	c
Barrow's Goldeneye (*Bucephala islandica*)	–	–	r	–
Bufflehead (*Bucephala albeola*)	u	–	c	–
Ruddy Duck (*Oxyura jamaicensis*)	u	–	u	–
Common Merganser (*Mergus merganser*)	–	u	–	–
American Kestrel (*Falco sparverius*)	–	u	–	–
Marsh Hawk (*Circus cyaneus*)	a°	c	u	–
Swainson's Hawk (*Buteo swainsoni*)	–	r++	–	–
Ferruginous Hawk (*Buteo regalis*)	–	r++	–	–
Sage Grouse (*Centrocercus urophasianus*)	r	u	u	–
Ringneck Pheasant (*Phasianus colchicus*)	–	–	r	–
Gray Partridge (*Perdix perdix*)	r	–	–	–
Great Blue Heron (*Ardea herodias*)	–	r	–	–
Green Heron (*Butorides virescens*)	–	r++	–	–
American Bittern (*Botaurus lentiginosus*)	–	r++	–	–
White-faced Ibis (*Plegadis chihi*)	–	r	–	–
American Coot (*Fulica americana*)	u	r	u	u
American Avocet (*Recurvirostra americana*)	r	u	–	–
Killdeer (*Charadrius vociferus*)	c	c°	u	–

Spotted Sandpiper (*Actitis macularia*)	u	c°	u	—
Solitary Sandpiper (*Tringa solitaria*)	r	r	—	—
Lesser Yellowlegs (*Tringa flavipes*)	—	r++	—	—
Common Snipe (*Capella gallinago*)	—	r++	—	—
Willet (*Catoptrophorus semipalmatus*)	—	r	—	—
Marbled Godwit (*Limosa fedoa*)	—	—	r++	—
Wilson's Phalarope (*Steganopus tricolor*)	u	u	u	—
Herring Gull (*Larus argentatus*)	—	—	r++	—
Ring-billed Gull (*Larus delawarensis*)	—	—	r	—
Bonaparte's Gull (*Larus philadelphia*)	—	—	r	—
Black Tern (*Chlidonias niger*)	—	r++	—	—
Caspian Tern (*Hydroprogne caspia*)	—	—	r++	—
Mourning Dove (*Zenaida macroura*)	u	a	u	r
Great Horned Owl (*Bubo virginianus*)	r	—	—	r
Common Nighthawk (*Chordeiles minor*)	—	u	—	—
Rufous Hummingbird (*Selasphorus rufus*)	—	u	—	—
Belted Kingfisher (*Megaceryle alcyon*)	—	r	u	—
Common Flicker (*Colaptes auratus*)	—	r	r	—
Eastern Kingbird (*Tyrannus tyrannus*)	r	r	—	—
Western Kingbird (*Tyrannus verticalis*)	—	r	—	—
Say's Phoebe (*Sayornis saya*)	u	u	u	—
Horned Lark (*Eremophila alpestris*)	u	a	u	a
Barn Swallow (*Hirundo rustica*)	c	a°	c	—
Cliff Swallow (*Petrochelidon pyrrhonata*)	u	u	—	—
Violet-green Swallow (*Tachycineta thalassina*)	r	u	—	—
Tree Swallow (*Iridoprocne bicolor*)	u	u	—	—
Bank Swallow (*Riparia riparia*)	u	—	—	—
Rough-winged Swallow (*Stelgidopteryx ruficollis*)	c	u	—	—
Black-billed Magpie (*Pica pica*)	u	u	u	u
House Wren (*Troglodytes aedon*)	o	o	—	—
Sage Thrasher (*Oreoscoptes montanus*)	c	c°	—	—
American Robin (*Turdus migratorius*)	r	r	r	—
Ruby-crowned Kinglet (*Regulus calendula*)	r	—	u	—
Loggerhead Shrike (*Lanius ludovicianus*)	r	r	—	—
Starling (*Sturnus vulgaris*)	c	c	u	—
Yellow-rumped Warbler (*Dendroica coronata*)	o	—	o	—
Yellow Warbler (*Dendroica petechia*)	o	—	—	—
Townsend's Warbler (*Dendroica townsendi*)	r++	—	—	—
Western Tanager (*Piranga ludoviciana*)	—	r++	—	—
Western Meadowlark (*Sturnella neglecta*)	u	c	—	—
Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*)	u	u	u	—
Red-winged Blackbird (*Agelaius phoeniceus*)	c	c	c	—
Brewer's Blackbird (*Euphagus cyanocephalus*)	c	c°	c	r
Brown-headed Cowbird (*Molothrus ater*)	—	u	—	—
House Finch (*Carpodacus mexicanus*)	o	o	o	—
Dark-eyed Junco (*Junco hyemalis*)	—	o	o	—
Lapland Longspur (*Calcarius lapponicus*)	—	o	—	—
White-crowned Sparrow (*Zonotrichia leucophrys*)	—	o	o	—
Chipping Sparrow (*Spizella passerina*)	o	o	o	—
Sage Sparrow (*Amphispiza belli*)	c	c	—	—
Lark Sparrow (*Chondestes gammacus*)	—	o	—	—
Song Sparrow (*Melospiza melodia*)	o	o	—	—
Grasshopper Sparrow (*Ammodramus savannarum*)	—	o	o	—
Brewer's Sparrow (*Spizella breweri*)	u	c	—	—
Snow Bunting (*Plectrophenax nivalis*)	—	—	—	r++

+r = rare, c = common, u = uncommon, a = abundant, o = observed (numbers undetermined)
++ Single observation
° Known nester

TABLE 2. Numbers of bird species by order observed seasonally at the Test Reactor Area radioactive leaching pond complex.

Bird Orders	Number of Species Observed Seasonally				Total Species
	Spring	Summer	Fall	Winter	
Podicipediformes	2	1	3	1	3
Pelecaniformes	0	0	1	0	1
Anseriformes	16	8	16	6	21
Falconiformes	1	4	1	0	4
Galliformes	2	1	2	0	3
Ciconiiformes	0	4	0	0	4
Gruiformes	1	1	1	1	1
Charadriiformes	5	9	8	0	14
Columbiformes	1	1	1	1	1
Strigiformes	1	0	0	1	1
Caprimulgiformes	0	1	0	0	1
Apodiformes	0	1	0	0	1
Coraciiformes	0	1	1	0	1
Piciformes	0	1	1	0	1
Passeriformes	28	31	16	4	37
Totals	57	64	51	13	94

cies of wildlife which may otherwise not be available on the INEL Site. Because the area is protected from public interference, it may also act as a refuge for certain species. The TRA pond complex provides a unique opportunity to study the movement of radionuclides in an ecosystem and the effects of a radioactive environment on indigenous species.

ACKNOWLEDGMENTS

We thank B. W. Mortensen for his field assistance and O. D. Markham for critically reviewing the manuscript. Funds for this project were provided by the Division of Biomedical and Environmental Research, U.S. Department of Energy.

LITERATURE CITED

BURT, W. H., AND R. P. GROSSENHEIDER. 1964. A field guide to the mammals. Houghton Mifflin Co., Boston. 284 pp.

CRAIG, T. H. 1977. Raptors of the Idaho National Engineering Laboratory Site. Unpubl. master's thesis. Idaho State University, Pocatello.

CRAIG, T. H., D. K. HALFORD, AND O. D. MARKHAM. 1978. Radionuclide concentrations in nestling raptors near nuclear facilities. Wilson Bulletin (in press).

HALFORD, D. K., J. B. MILLARD, AND O. D. MARKHAM. 1976. Waterfowl study of the Test Reactor Area radioactive leaching pond, pp. 19–34. *In*: 1975 progress report, Idaho National Engineering Laboratory Site radioecology-ecology programs. IDO-12080. Nat. Tech. Information Service, Springfield, Virginia.

HALFORD, D. K., AND O. D. MARKHAM. 1978. Radiation dosimetry of small mammals inhabiting a liquid radioactive waste disposal area. Ecology (in press).

HARNISS, R. O., AND N. E. WEST. 1973. Vegetation patterns of the National Reactor Testing Station, southeastern Idaho. Northwest Sci. 47:30–43.

MARKHAM, O. D. 1976. Gamma emitting isotopes in mourning doves on the INEL site, pp. 58–64. *In*: 1975 progress report, Idaho National Engineering Laboratory Site radioecology-ecology Programs. IDO-12080. Nat. Tech. Information Service, Springfield, Virginia.

MILLARD, J. B., F. W. WHICKER, AND O. D. MARKHAM. 1976. An ecological study of the Test Reactor Area radioactive leaching ponds, pp. 17–18. *In*: 1975 progress report, Idaho National Engineering Laboratory Site radioecology-ecology programs. IDO-12080. Nat. Tech. Information Service, Springfield, Virginia.

ROBBINS, C. S., B. BRUUN, H. S. ZIM, AND A. SINGER. 1966. A guide to field identification—birds of North America. Racine, Wisconsin: Western Publ. Co. 340 pp.

SEHMAN, R. W., A. D. LINDER, D. WYCKOFF, AND W. E. CHRISTOPHER. 1976. A study of the amphibian and reptilian fauna of the INEL Site, pp. 121–131. *In*: 1975 progress report, Idaho National Engineering Laboratory Site radioecology-ecology programs. IDO-12080. Nat. Tech. Information Service, Springfield, Virginia.

STEBBINS, R. C. 1966. A field guide to western reptiles and amphibians. Boston: Houghton Mifflin Co. 279 pp.