PRELIMINARY SURVEY OF BREEDING BIRDS, AMPHIBIANS, REPTILES, AND RESIDENT MAMMALS AT LAKE LOWELL, IDAHO, SPRING/SUMMER 1998

Final Report
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INTRODUCTION

The U.S. Bureau of Reclamation has initiated a study to evaluate the water quality of Lake Lowell, a reservoir located within Deer Flat National Wildlife Refuge in southwest Idaho. Currently, the lake experiences bacterial contamination, high nutrient loading, algal blooms, and dissolved oxygen depletion. The Bureau is considering several options for improving water quality at Lake Lowell including:

-improving the quality of irrigation return flows into the lake
-diversion of irrigation return flows to the downstream distribution system
-in-lake chemical treatment
-segregation of agricultural and urban drainage in the New York Canal
-exclusion of livestock from the New York Canal

Lake Lowell, located in Canyon County, was formed near the turn of the century to provide off-stream storage for the Bureau of Reclamation's Boise Project. The Boise Project provides irrigation water to lands within the Boise and Payette River drainages, and the Boise Project Board of Control regulates delivery of water to irrigation districts. Lake Lowell receives inflow mainly from the New York Canal, which is diverted from the Boise River near Boise at Diversion Dam. Inflows to the reservoir are a mixture of irrigation return flows and water diverted from the Boise River. Irrigation return flows contribute significant quantities of nutrients and salts to the New York Canal and ultimately to Lake Lowell (USBR 1979). Nutrient-rich inflows combined with the lake's shallow depth and high water-exchange rates have resulted in dense blue-green algae blooms for over 50 years (USBR 1979).

The Boise and Snake River Valleys are major waterfowl wintering areas in the Pacific Flyway. Lake Lowell provides roosting and feeding habitat for large numbers of migrating and wintering waterfowl, primarily mallards (*Anas platyrhynchos*) and Canada geese (*Branta canadensis*). Waterfowl nesting at Lake Lowell is limited by habitat availability, but marsh habitats support breeding mallards, wood ducks (*Aix sponsa*), gadwalls (*Anas strepera*), cinnamon teal (*Anas cyanoptera*), northern pintails (*Anas acuta*), redheads (*Aythya americana*), and other ducks. Upland game birds are common to the refuge and include ring-necked pheasant (*Phasianus colchicus*) and California quail (*Calipepla californicus*). The majority of past study and monitoring on the refuge has focused on waterfowl and other game birds. A list of birds occurring on the refuge has been compiled by refuge personnel and local birders, and contains 215 species and includes seasonal and habitat association information. This list is likely incomplete, and has never been ground-truthed with formal surveys of different habitat types occurring on the refuge.

Fish and wildlife habitats have the potential to be affected by proposed actions designed to improve water quality associated with agricultural inflows at Lake Lowell. Changes in water quality could affect both aquatic and terrestrial organisms, and actions resulting in changing water levels could, in turn, affect many wetland-associated plants and animals. In order to

understand the effects from potential management actions on fish and wildlife resources, the U.S. Fish and Wildlife Service (Service) initiated this project to gather baseline data on current conditions at the reservoir. Given the nature of data available, the Service recommended that information be collected on habitats, breeding birds, amphibians, reptiles, and resident mammals at Lake Lowell. In addition, more detailed information is needed to describe the bald eagle nesting territory at Lake Lowell. Because of the history of failed nesting attempts at this territory, there is concern that failures may be contaminant-related. More information is needed about habitat use, foraging ecology, prey selection, and nesting chronology of this breeding pair.

The following report presents data collected about the refuge's wildlife resources. This information represents informal surveys conducted in each of the major habitat types at Lake Lowell for breeding birds, resident mammals, amphibians, and reptiles. Also contained in this report is a brief update of the Lake Lowell breeding bald eagles. Lastly, this report includes a section which makes recommendations for further study designed to evaluate the potential effects of contaminants on the refuge's wildlife resources.

STUDY AREA AND METHODS

Lake Lowell is approximately 14 km in length, has a maximum width of 2.5 km, and is relatively shallow. The lake has a surface area of approximately 3980 hectares, and a capacity of 208.5 x 10^6 m^3. The area surrounding the lake is generally flat with some rolling hills. Land use in the vicinity is mostly irrigated agriculture, and local farms produce sugar beets, grains, alfalfa, vegetables, and fruit. Many fruit orchards are located south and west of the lake.

Lake Lowell's fish and wildlife resources are managed as part of the U.S. Fish and Wildlife Service's National Wildlife Refuge system. Deer Flat National Wildlife Refuge was established in 1909, and includes Lake Lowell and its surrounding uplands (a total of 4688 ha) and 107 Snake River Islands located from the Ada/Canyon County line (in Idaho) downstream to Farewell Bend, Oregon, a distance of approximately 160 km.

Breeding Birds

Surveys for breeding birds were conducted in the 4 distinct habitat types described below during the week of 15-19 June 1998. We established informal walking transects within upland habitats. Walking transects were approximately 2 km in length, and we recorded all birds identified through direct observation, vocalization, presence of nests, or identification of feathers or other sign. We surveyed flooded habitats from a boat. We moved quietly through flooded habitats using an electric motor, and recorded all bird species observed as described above. Boat transects in flooded habitats were approximately 1 km in length. We also recorded incidental observations of unique birds found in open water habitats and agricultural or urban areas surrounding the refuge.

Russian Olive-fringed Marsh: We surveyed the small marsh located below the Upper

Embankment on 15 June. This cat-tail (*Typha latifolia*)/bulrush (*Scirpus* spp.) marsh contained some open water, and was surrounded by thick groves of Russian olive trees (*Elaeagnus angustifolia*). Purple loostrife (*Lythrum fruticosa*) also was present in the marsh. Cultivated fields abutted the marsh to the north, and uplands dominated by cheatgrass (*Bromus tectorum*) and other exotic annual grasses and forbes were present south of the marsh.

Shrub-steppe Uplands: We surveyed uncultivated uplands on the north side of Lake Lowell on 15 and 16 June. These uplands were mainly shrub-steppe grasslands dominated by sagebrush (*Artemesia tridentata*), rabbitbrush (*Crysothamnus nauseosis*), native bunchgrasses including great basin wildrye (*Elymus cinereus*), and exotic annual grasses. Shrub-steppe habitats were surveyed west of the refuge headquarters and visitor center, and from Gotts Point eastward to the Tio Lane access.

Cottonwood Forest: We surveyed cottonwood gallery forest on 16, 17, and 18 June. This habitat contained an overstory mainly of mature black cottonwood trees (*Populus trichocarpa*), but maples (*Acer* spp.), elms (*Ulmus* spp.), and other hardwoods also were present. Willows (*Salix* spp.), desert indigobush (*Amorpha fruiticosa*), and other shrubs were present in the understory. Width of the cottonwood habitat varied depending on water depth and incline, but was generally a narrow strip on the north side of the reservoir, and up to 0.5 km or more wide on the south side. A band of flooded willows were present to the main lake side of the cottonwood habitat. This willow band also varied in width according to water depth and incline. During the survey period, cottonwood habitats were completely flooded. We surveyed cottonwood habitats near the refuge office and visitor center from a road running west along the shoreline, from the main patrol road between Gotts Point and Tio Lane, near the New York Canal, and on the south side of the reservoir between Access Points 7 and 8, and 1 and 2. We surveyed cottonwood habitats near the New York Canal and between Access Points 7 and 8 from a boat.

Willow/Shrub Uplands: We surveyed willow uplands on the south side of the refuge on 17, 18, and 19 June. This habitat was located south of the cottonwood gallery forest and contained upland willows, sparsely scattered trees including cottonwoods, willows, ash (*Fraxinus* spp.), elm, maple, box elder (*Acer negungo*), and other hardwoods. The understory was a mixture of shrubs including wild rose (*Rosa woodsii*), golden current (*Ribes viscosissimum*), and other shrubs, native and exotic grasses including great basin wildrye and cheatgrass, and native and exotic forbes. This habitat was present along much of the south side of the reservoir between the cottonwood forest and refuge boundary. At higher lake levels, much of this habitat is partially flooded.

Breeding Bald Eagles

We searched for and made observations of the Lake Lowell bald eagle nest site during late May and early June. It was determined at this time that the 1998 breeding attempt was unsuccessful. No formal observations of the nest site or breeding adults were made after this determination. Throughout the remainder of the season, we recorded all incidental observations of bald eagles at Lake Lowell. It is unknown if egg laying occurred during the 1998 spring as the nesting attempt

had already failed before our surveys began.

Amphibians and Reptiles

We conducted field surveys for amphibians and reptiles at Lake Lowell during June and July 1998. Wetland surveys were conducted during June to determine the presence of pond-breeding amphibians. We sampled wetland areas in the Russian olive-fringed marsh below the upper embankment, in marsh habitat at the Shaffer's Access, in irrigation ditches flowing into the refuge between Dearborne Road and Access 1, at the Lower Embankment Recreation Area, and in Lake Lowell at Access Points 3, 4, and 7. We surveyed for evidence of breeding amphibians by walking the edges of flooded areas searching for adults and egg masses according to U.S. Fish and Wildlife Service protocol (Heyer et al. 1994). We used a dipnet to sample for amphibian larvae, and also turned cover objects adjacent to pond areas. If possible, we determined the maximum depth of pond areas by wading.

Road surveys were conducted for reptiles during June and July. One daytime road survey was conducted during mid-June between 1100 and 1400 hours along the main patrol road between Gotts Point and Tio Lane, and along Lake Shore Drive on the south side of the refuge. We conducted three evening road surveys during July. The driving route included roads near the refuge headquarters, the patrol road between Gotts Point and Tio Lane, and the entire length of Lake Shore Drive. Night road surveys began at dark, and continued until approximately 0200 hours. We made two complete surveys of the driving route during each survey night. We also included in results incidental observations of amphibians and reptiles made at other times during the 1998 spring and summer by refuge personnel and other biologists.

We compiled a list of amphibians and reptiles recorded during surveys. We also compiled a list of amphibians and reptiles likely occurring at Lake Lowell from researching species range maps (Stebbins 1985), state distribution maps (Nussbaum et al. 1983), and museum records at the Northern Intermountain Herpetological Database (Idaho Museum of Natural History).

Resident Mammals

No formal surveys for resident mammals were conducted during the 1998 spring or summer. A list of common mammals present on the refuge was compiled through incidental observations made during surveys for breeding birds, amphibians, and reptiles. We recorded all mammals identified through direct observation, tracks, or presence of other sign. We also recorded habitat associations of each mammal identified. No small mammal trapping was conducted.

RESULTS AND DISCUSSION

Breeding Birds

We recorded a total of 65 different bird species at Lake Lowell in all habitats combined during the 1998 spring and summer. This is likely not a complete list of bird species breeding at Lake Lowell, but contains common species present within each major habitat at the refuge.

Russian Olive-fringed Marsh: We identified a total of 19 bird species in this limited habitat located below the Lower Embankment (Table 1). Bird diversity was comparatively low in this habitat, likely due to the overwhelming presence of exotic vegetation (Russian olives, purple loostrife, and exotic annual grasses and forbes) and lack of native plant diversity. Birds identified in this habitat were generally common in other habitats within the refuge. Only marsh specialists such as Virginia rail (*Rallus limicola*), sora (*Porzana carolina*), and marsh wren (*Cistothorus palustris*) were recorded exclusively in this habitat, likely due to the lack of small, isolated marsh habitat within the refuge. The yellow-headed blackbird (*Xanthocephalus xanthocephalus*) is currently considered a Partners in Flight priority species. No other bird species identified in this habitat are federally listed as threatened or endangered, proposed for listing, candidates for listing, considered state species of special concern, or are Partners in Flight priority species.

It is unlikely that management actions proposed by the U.S. Bureau of Reclamation to improve water quality at Lake Lowell will affect breeding birds in this habitat unless actions result in the dewatering of the marsh. Habitat for breeding birds in this area could likely be improved by management of exotic vegetation and introduction of more native plant species.

Shrub-steppe Uplands: Only four bird species were recorded in shrub-steppe uplands at Lake Lowell during the 1998 spring and summer (Table 2). Only three of these species were breeding, as we observed northern flickers foraging only in this habitat. This habitat contained good mature shrub communities of sagebrush and rabbitbrush. Native bunch grasses were common, but cheatgrass and other exotic weedy annuals dominated the understory vegetation.

Surprisingly, many common shrub-steppe species were absent from this habitat, including burrowing owl (*Athene cunicularia*), horned lark (*Eremophila alpestris*), sage thrasher (*Oreoscoptes montanus*), lark sparrow (*Chondestes grammacus*), and Brewer's sparrow (*Spizella breweri*). Both vesper sparrow (*Pooecetes gramineus*) and Savannah sparrow (*Passerculus sandwichensis*) were recorded in willow uplands on the south side of the refuge, and thus, were likely also present in shrub-steppe uplands. The refuge bird list documents the following shrub-steppe/grassland birds as breeding on the refuge: burrowing owl, horned lark, sage thrasher, loggerhead shrike (*Lanius ludoviscianus*), vesper sparrow, lark sparrow, Savannah sparrow, and western meadowlark (*Sturnella neglecta*). It is unknown why the majority of these bird species were not detected during our 1998 surveys. It is possible that surveys were conducted too late in the spring to easily identify breeding shrub-steppe birds by their vocalizations. Thorough surveys conducted earlier in the breeding season would likely result in more breeding bird species identified within this habitat.

Of the shrub-steppe/grassland species identified in the refuge bird list, the burrowing owl and loggerhead shrike are considered state species of special concern, and are Bureau of Land Management (BLM) sensitive species. The Brewer's sparrow is a Partners in Flight priority species in Idaho, but is likely an uncommon breeding bird species on the refuge. It is unlikely

that management actions proposed by the U.S. Bureau of Reclamation to improve water quality at Lake Lowell will adversely affect breeding birds in shrub-steppe habitats. Shrub-steppe habitats could be improved on the refuge for breeding birds by management of exotic vegetation. However, shrub-steppe habitats may be too fragmented on the refuge to significantly benefit nesting birds over the long term.

Cottonwood Forest: A total of 36 bird species were recorded in flooded cottonwood gallery forest at Lake Lowell during the 1998 spring and summer (Table 3). Apart from open water, cottonwood forest was the most extensive habitat type on the refuge during our surveys. All cottonwood habitat was flooded during the time of our surveys, but much of this habitat is dry at lower lake levels.

House wrens (*Troglodytes aedon*) were the most common breeding bird in cottonwood habitat. Also common were mourning doves (*Zanaida macroura*), eastern kingbirds (*Tyrannus tyrannus*), black-billed magpies (*Pica pica*), American crows (*Corvus brachyrhynchos*), and colonial-nesting waterbirds including great blue herons (*Ardea herodias*), black-crowned night herons (*Nycticorax nycticorax*), double-crested cormorants (*Phalacrocorax phalacrocorax*), and western grebes (*Aechmophorus occidentalis*). Several colonies of breeding herons and cormorants were present on the south side of Lake Lowell between Access Points 5 and 7, 1 and 2, and near the New York Canal.

Included in the list of birds breeding in cottonwood habitat are bald eagles, a federally-listed threatened species, and willow flycatcher (*Empidonax traillii*), a Partners in Flight priority species. The Willow Flycatcher was identified by vocalization, and it is uncertain if it was associated with the cottonwoods or understory willows. This species is not included in the refuge bird list as breeding at Lake Lowell. Yellow-billed cuckoo (*Coccyzus americanus*) have been documented as breeding in this habitat at Lake Lowell during past years. The yellow-billed cuckoo is a state species of special concern, a BLM sensitive species, and a Partners in Flight priority species.

Cottonwood habitat at Lake Lowell could be greatly affected by management actions designed to improve water quality, especially manipulation of lake water levels. In general, this habitat is narrow on the north side of the refuge due to this shore's steep incline. Changes in lake operation would likely not affect cottonwood habitat on the north side of the refuge. However, cottonwood habitat is up to 0.5 km wide along much of the south side of the refuge due to its shallower incline. Changes in lake levels could directly affect these habitats, especially if cottonwoods were dry during the spring breeding season. This could allow for growth of understory willows and other upland vegetation, potentially improving habitat for breeding songbirds. It is unknown how other proposed actions could affect breeding birds in this habitat.

Willow/Shrub Uplands: A total of 35 bird species were recorded in willow/shrub uplands located on the south side of Lake Lowell during the 1998 spring and summer (Table 4). This habitat was present along much of the south side of the refuge between the cottonwood forest and

the refuge boundary. Some of this habitat was partially flooded during the time of our surveys due to spring high water, but this habitat is generally dry at lower lake levels.

House wrens and yellow warblers (*Dendroica petechia*) were the most common breeding bird in willow/upland habitats. Also common were ring-necked pheasant, California quail, mourning doves, eastern kingbirds, black-billed magpies, and American crows. Raptors were most common in this habitat type, as we recorded many red-tailed (*Buteo jamaicensis*) and Swainson's hawks (*B. Swainsoni*) territories along the south side of the refuge.

Included in the list of birds breeding in this habitat are Lewis' woodpecker (*Melanerpes lewis*), northern harrier (*Circus cyaneus*), and yellow warbler, all Partners in Flight priority species. Because we identified willow flycatcher in the flooded cottonwood/willow fringe, the species could also be present in this habitat. A more thorough survey effort would be necessary to determine the extent of this species on the refuge.

Willow/shrub upland habitat could be affected by management actions designed to improve water quality, especially manipulation of lake water levels. In general, this habitat is a relatively narrow band along the south side of the refuge. Changes in lake operation could directly affect these habitats, especially if lake levels were lower during the spring breeding season. It is unknown how proposed actions could affect breeding birds in this habitat.

Incidental Observations: Incidental observations of other bird species on the refuge included gulls and other waterbirds on main lake habitats. American white pelican (*Pelecanus erythrorhynchos*) were observed on the main lake, but it is unlikely that they are breeding on the refuge. Also recorded on main lake habitats were osprey (*Pandion halaetus*) breeding near the refuge headquarters on an artificial platform. Osprey bred successfully during 1998, fledging 2 young. We recorded ring-billed gull (*Larus delewarensis*), California gull (*Larus californicus*), caspian tern (*Sterna caspia*), and black tern (*Chlidonias niger*) flying over main lake habitats, but it is unlikely that these species breed on Lake Lowell. Ring-billed and California gull breeding colonies are present on the Snake River Island Sector of Deer Flat National Wildlife Refuge. We also observed a great-tailed grackle (*Quiscalus mexicanus*) feeding on private property at an urban residence near the intersection of Orchard St. and Riverside Drive.

American white pelican are a state species of special concern. Osprey are top-level predators like the bald eagle, and thus susceptible to bioaccumulation of contaminants in the food chain. Analysis of blood samples or eggshell fragments from osprey breeding at Lake Lowell may lend insight to the extent of contaminants within the system. Black tern also are a state species of special concern.

During some years in late summer and early fall, the lake is drawn down to supply irrigators, exposing mudflats near the New York Canal inflow. If timing of drawdown coincides with southward shorebird migrations, Lake Lowell can attract thousands of migrating shorebirds (USFWS 1986, Taylor and Bechard 1991). If lake sediments contain high levels of

contaminants, migrating shorebirds could be exposed to health hazards at this time. Detailed analysis of sediments is needed to thoroughly assess this risk.

Breeding Bald Eagles

It was determined that the 1998 breeding attempt was unsuccessful. No formal observations of the nest site or breeding adults were made after this determination. Throughout the remainder of the season, we recorded adult bald eagles on the east side of the refuge near the New York Canal, and flying over the small marsh east of the Shaffer's Access. It is unknown if egglaying occurred during the 1998 spring as the nesting attempt had already failed before our surveys began. Analysis of blood samples or eggshell fragments from bald eagles breeding at Lake Lowell may lend insight to the extent of contaminants within the system.

Amphibians and Reptiles

We recorded five reptile and two amphibian species at Lake Lowell during the 1998 spring and summer (Table 5, Fig. 1). Both the bullfrog (*Rana catesbiana*) and painted turtle (*Chrysemys picta*) are introduced species not native to southwest Idaho. In addition to these species, we identified an additional four amphibian and ten reptile species that could potentially occur at the refuge based on species ranges and historic distributions (Table 6). On this list are the western toad (*Bufo boreas*) and northern leopard frog (*Rana pipiens*), both state species of special concern.

Amphibian breeding habitat is limited at Lake Lowell. Only 3 suitable areas were identified that could support significant amphibian breeding: the Russian-olive fringed marsh located below the Upper Embankment, isolated marsh habitat at the Shaffer's Access, and within irrigation inflows along the south side of the refuge (not the New York Canal). The lake margin appears to be good amphibian breeding habitat at high water, but receding water levels throughout spring and summer would subject eggs to desiccation, killing them. Bullfrogs were the only breeding amphibian species found at Lake Lowell, and were present in most areas surveyed. After introduction into a wetland system, bullfrogs usually outcompete native anuran species. These other species generally decline or disappear altogether after introduction of bullfrogs.

We found a Great Basin spadefoot toad (*Spea intermountana*) during a night road survey on the main patrol road between Middleton Road and Tio Lane. This specimen was a juvenile, and likely originated from a nearby irrigation ditch or temporary farm pond. It was likely dispersing from its natal site toward the refuge. Isolated and temporary wetland habitats could be important in providing a source of native anurans to the local area. This could prove to be important in re-establishing populations of native amphibians at Lake Lowell if bullfrogs could be eradicated in the future. More thorough surveys are needed to accurately determine if other amphibian species are present within the refuge. Isolated populations of native amphibians could be present at Lake Lowell where habitat is suitable. Monitoring of amphibian advertisement calling during the breeding season is an effective means of monitoring local anuran populations (Wells 1977, Karns 1986). More extensive evening listening surveys should be conducted to search for native amphibians at Lake Lowell and the nearby area.

Reptile habitat is not limited at Lake Lowell. Extensive shrub-steppe uplands and riparian areas are present on the refuge, and these habitats should support most of the species contained in Tables 5 and 6. Since many reptile species are nocturnal and secretive, more thorough surveys need to be performed to accurately access the extent of reptile abundance at Lake Lowell. Painted Turtles were recorded in marsh habitat near the Shaffer's Access. This species is native to north Idaho, but has been introduced into wetland systems throughout the state. Like the bullfrog, the Painted Turtle can adversely affect native amphibian populations by preying on both larvae and adults.

Amphibians could be directly affected by management actions designed to improve water quality, especially manipulation of lake water levels. Manipulation of lake water levels during the breeding season could result in stranding of amphibian eggs. Because amphibians respire through their moist skins, they could be directly affected by contaminants in lake water or sediments. Improving water quality within the refuge should benefit native amphibians in the long run. It is unlikely that proposed management actions would affect resident reptile species. Most reptiles live in upland habitats removed from the lake or its associated wetlands, and are thus not likely to be directly affected by high contaminant levels.

Resident Mammals

We identified a total of 22 species of resident mammals occurring or potentially occurring at Lake Lowell (Table 7). Mule deer (*Odocoileus hemionus*) and feral cats (*Felis domesticus*) were the most common mammals recorded during surveys. Elk (*Cervus elaphus*), mountain lion (*Felis concolor*), and bobcat (*Felix rufus*) were from unconfirmed reports, but presence of these species at Lake Lowell is not inconceivable. Most species recorded during surveys are common to southwest Idaho. Only the Pygmy Rabbit (*Brachylagus Idahoensis*) is considered a state species of special concern and a BLM sensitive species. No small mammal trapping or bat surveys were conducted during the 1998 spring or summer. More extensive mammal surveys including small mammal trapping and mist-netting for bats is necessary to fully describe all mammal species present within the refuge.

It is unknown how proposed management actions designed to improve water quality at Lake Lowell will affect resident mammal species.

RECOMMENDATIONS FOR FUTURE STUDY

Breeding Birds

1. To fully understand the extent of contamination in the food chain at Lake Lowell, a detailed study of top trophic level predatory birds is recommended. A study should be implemented that is designed to fully document breeding behavior, nesting success, and productivity of bald eagles, ospreys, and colonial-nesting birds at Lake Lowell. Emphasis should be placed on identifying prey items in the birds' diets. Prey items should be analyzed for presence of contaminants. Colonial nesting birds that should be studied include great blue herons, black-crowned night

herons, double-crested cormorants, and western and Clark's grebes. Breeding success and productivity of colonial nesting birds should be compared to uncontaminated systems. Blood, fat, feathers, and tissue samples should be collected from both adults and young of all species and analyzed for presence of contaminants. Additionally, eggs or egg fragments should be collected from nests and analyzed as described above.

2. More extensive surveys are needed to fully document the extent of breeding birds at Lake Lowell within the different habitat types present. A better understanding of the numbers and species of birds breeding at the refuge is needed to fully understand the effects of proposed management actions. We recommend that formal point counts be conducted in cottonwood and willow/shrub upland habitats on both the north and south side of the lake. Emphasis should be placed on gaining a better understanding of the occurrence of state species of special concern, federal sensitive species, and Partners in Flight priority species, which include the yellow-billed cuckoo, Lewis' woodpecker, willow flycatcher, yellow warbler, and yellow-headed blackbird. Surveys also should emphasize other riparian-associated neotropical migrants such as common yellowthroat and yellow-breasted chat.

3. A detailed evaluation of contaminants within Lake Lowell sediments should be made to determine the extent of contamination possible to migrating shorebirds. Evaluation of sediments should include study of contaminants in macro-invertebrates and other organisms eaten by migrant shorebirds. A full understanding of the effects of contaminants on living shorebirds is necessary. Levels of contaminants comparable to those found in Lake Lowell sediments should be fed to captive birds and the effects documented.

Amphibians and Reptiles

4. More extensive amphibian surveys should be conducted to fully determine the extent of breeding amphibians at Lake Lowell and within its surrounding habitats. More extensive searches of all habitats at Lake Lowell and surrounding isolated and temporary wetlands should be made. In addition, evening listening surveys should be conducted during May and early June to locate isolated populations of native anurans.

Habitats

5. A detailed survey of habitats should be made at Lake Lowell using GIS technology to determine the extent and exact amounts of specific habitats present at the refuge. This mapping should quantify available habitats at the refuge including wetlands, uplands, agricultural areas, open water, and cottonwood forest. This will provide managers a baseline of current conditions that can be used for long-term comparisons as management actions designed to improve water quality are implemented.

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Table 1. Bird species detected in the russian olive-fringed marsh located below the Upper Embankment at Lake Lowell, Idaho, spring 1998.

Common Name	Scientific Name
Pied-billed Grebe	*Podilymbus podiceps*
Mallard	*Anas platyrhynchos*
American Kestrel	*Falco sparverius*
Ring-necked Pheasant	*Phasianus colchicus*
California Quail	*Callipepla californica*
Virginia Rail	*Rallus limicola*
Sora	*Porzana carolina*
Mourning Dove	*Zanaida macroura*
Barn Owl	*Tyto alba*
Black-billed Magpie	*Pica pica*
American Crow	*Corvus brachyrynchos*
Marsh Wren	*Cistothorus palustris*
European Starling	*Sturnus vulgaris*
Common Yellowthroat	*Geothylypis trichas*
Song Sparrow	*Melospiza melodia*
Yellow-headed Blackbird[1]	*Xanthocephalus xanthocephalus*
Red-winged Blackbird	*Agelaius phoeniceus*
Western Meadowlark	*Sturnella neglecta*
Brown-headed Cowbird	*Molothrus ater*

[1] Partners in Flight priority species

Table 2. Bird species detected in shrub-steppe uplands at Lake Lowell, Idaho, spring 1998.

Common Name	Scientific Name
Northern Flicker[1]	*Colaptes auratus*
Black-billed Magpie	*Pica pica*
Rock Wren	*Salpinctes obsoletus*
Western Meadowlark	*Sturnella neglecta*

[1]Foraging in this habitat only

Table 3. Bird species detected in flooded cottonwood gallery forest at Lake Lowell, Idaho, spring 1998.

Common Name	Scientific Name	Common Name	Scientific Name
Western Grebe	*Aechmophorus occidentalis*	Belted Kingfisher	*Ceryle alcyon*
Clark's Grebe	*Aechmophorus clarkii*	Downy Woodpecker	*Picoides pubescens*
Double-crested Cormorant	*Phalacrocorax auritis*	Northern Flicker	*Colaptes auratus*
Great Egret	*Ardea alba*	Western Wood-Pewee	*Contopus sordidulus*
Snowy Egret	*Egretta thula*	Willow Flycatcher[2]	*Empidonax trailii*
Great Blue Heron	*Ardea herodias*	Eastern Kingbird	*Tyrannus tyrannus*
Black-crowned Night	*Nycticorax nycticorax*	Black-billed Magpie	*Pica pica*
Wood Duck	*Aix sponsa*	American Crow	*Corvus brachyrhynchos*
Bald Eagle[1]	*Haliaeetus leucocephalus*	Tree Swallow	*Tachycineta bicolor*
Swainson's Hawk	*Buteo swainsonii*	Black-capped Chickadee	*Poecile atricapillus*
Red-tailed Hawk	*Buteo jamaicensis*	House Wren	*Troglodytes aedon*
American Kestrel	*Falco sparverius*	American Robin	*Turdus migratorius*
California Quail	*Callipepla californica*	European Starling	*Sturnus vulgaris*
American Coot	*Fulica americana*	Yellow Warbler	*Dendroica petechia*
Mourning Dove	*Zenaida macroura*	Yellow-breasted Chat	*Icteria virens*
Barn Owl	*Tyto alba*	Black-headed Grosbeak	*Pheucticus melanocephalus*
Western Screech-Owl	*Otus kennicottii*	Brown-headed Cowbird	*Molothrus ater*
Great Horned Owl	*Bubo virginianus*	Bullock's Oriole	*Icterus bullockii*

[1] Federally listed-threatened species
[2] Parners in Flight priority species

Table 4. Bird species detected in willow/shrub upland habitats at Lake Lowell, Idaho, spring 1998.

Common Name	Scientific Name	Common Name	Scientific Name
Northern Harrier[1]	*Circus cyaneus*	Cliff Swallow	*Petrochelidon pyrrhonota*
Swainson's Hawk	*Buteo swainsonii*	Barn Swallow	*Hirundo rustica*
Red-tailed Hawk	*Buteo jamaicensis*	House Wren	*Troglodytes Aedon*
American Kestrel	*Falco sparverius*	American Robin	*Turdus migratorius*
Ring-necked	*Phasianus colchicus*	European Starling	*Sturnus vulgaris*
California Quail	*Callipepla californica*	Yellow Warbler[1]	*Dendroica petechia*
Killdeer[2]	*Charadrius vociferus*	Common Yellowthroat	*Geothlypis trichas*
Common Snipe	*Gallinago gallinago*	Yellow-breasted Chat	*Icteria virens*
Mourning Dove	*Zenaida macroura*	Vesper Sparrow	*Pooecetes gramineus*
Common Nighthawk	*Chordeiles minor*	Savannah Sparrow	*Passerculus sandwichensis*
Lewis' Woodpecker[1]	*Melanerpes lewis*	Song Sparrow	*Melospiza melodia*
Downy Woodpecker	*Picoides pubescens*	Lazuli Bunting	*Passerina amoena*
Northern Flicker	*Colaptes auratus*	Red-winged Blackbird	*Agelaius phoeniceus*
Western Kingbird	*Tyrannus verticalis*	Brewer's Blackbird	*Euphagus cyanocephalus*
Eastern Kingbird	*Tyrannus tyrannus*	Brown-headed	*Molothrus ater*
Black-billed Magpie	*Pica pica*	House Finch	*Carpodacus mexicanus*
American Crow	*Corvus*	American Goldfinch	*Carduelis tristis*
Bank Swallow	*Riparia riparia*		

[1] Partners in Flight priority species
[2] Killdeer recorded in gravel parking access

Table 5. Amphibians and reptiles detected at Lake Lowell, Idaho, spring 1998.

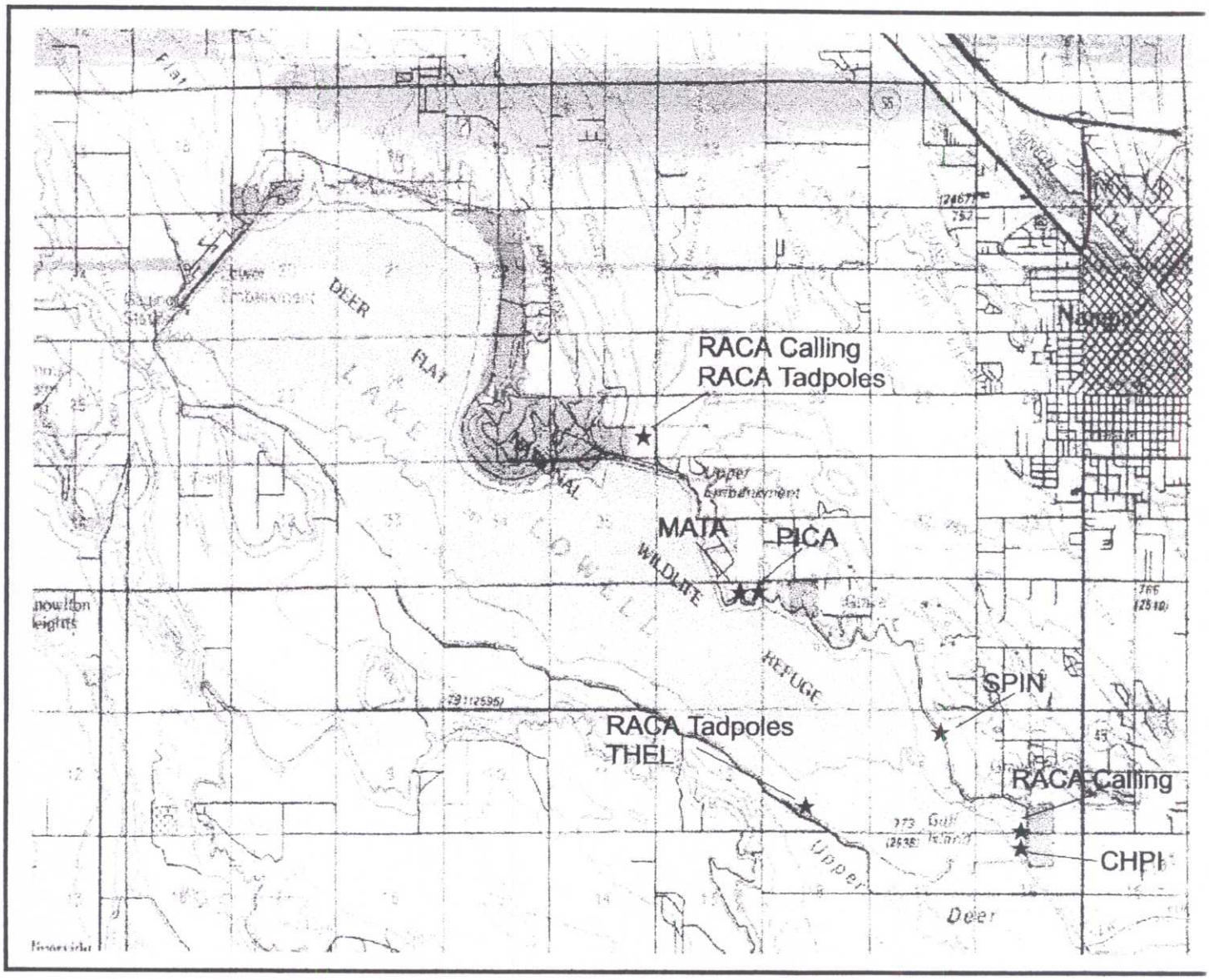
Common Name	Scientific Name	Location
Bullfrog	*Rana catesbeiana*	All areas surveyed
Great Basin Spadefoot Toad	*Spea intermountana*	Main Patrol Road
Western Terrestrial Garter Snake	*Thamnophis elegans*	Gotts Point
Gopher Snake	*Pituophis catenifer*	Gotts Point
Western Rattlesnake	*Crotalus viridis*	Main Patrol Road
Striped Whipsnake	*Masticophis taeniatus*	Gotts Point
Painted Turtle	*Chrysemys picta*	Shaffer's Access

Table 6. Amphibians and reptiles potentially occurring at Lake Lowell, Idaho, based on species range and state distribution maps (Stebbins 1985, Nussbaum et al. 1983), and historic records in the Idaho Museum of Natural History, Intermountain Herpetological Database (IHD) for Canyon County, Idaho. Source Codes are as follows: R=species range overlaps refuge, M=species record in IHD for canyon County, Idaho.

Common Name	**Scientific Name**	**Source**
Northern Leopard Frog	*Rana pipiens*	R
Long-toed Salamander	*Ambystoma macrodactylum*	R
Pacific Treefrog	*Pseudacris regila*	R
Western Toad	*Bufo boreas*	R
Common Garter Snake	*Thamnophis sirtalis*	R, M
Desert Horned Lizard	*Phrinosoma platyrhinos*	R
Leopard Lizard	*Gambelia wislizenii*	R
Night Snake	*Hypsiglena torquata*	R
Racer	*Coluber constrictor*	R
Sagebrush Lizard	*Sceloporus graciosus*	R
Western Fence Lizard	*Sceloporus occidentalis*	R
Side-blotched Lizard	*Uta stansburiana*	R
Western Longnose Snake	*Rhinicheilus lecontei*	R, M
Western Whiptail	*Cnemidophorus tigris*	R

Table 7. Common mammals observed, and mammals potentially occurring at Lake Lowell, Idaho, spring/summer 1998. Habitats mammals were associated with are as follows: S=shrub-steppe, C=cottonwood, W=willow/shrub, A=agriculture, L=main lake, R=dam riprap, *=unconfirmed or past reports only.

Common Name	Scientific Name	Habitat Association
Elk	*Cervus elaphus*	*
Mule Deer	*Odocoileus hemionus*	S, C, W, A
Coyote	*Canis latrans*	S, C, W, A
Red Fox	*Vulpes vulpes*	S, C, W, A
Feral Dog	*Canis familiaris*	S, C, W, A
Raccoon	*Procyon lotor*	C, W, A
Mink	*Mustela vison*	C
Badger	*Taxidea taxus*	S
Striped Skunk	*Mephitis mephitis*	S, C, W, A
River Otter	*Lutra canadensis*	C, L
Bobcat	*Felix rufus*	*
Mountain Lion	*Felis concolor*	*
Feral Cat	*Felis domesticus*	S, C, W, A
Least Chipmunk	*Tamias minimus*	S
Yellow-bellied Marmot	*Marmota flaviventris*	R
Fox Squirrel	*Sciurus niger*	C
Beaver	*Castor canadensis*	C, W
Muskrat	*Ondontra zibethicus*	C, W
Porcupine	*Erethizon dorsatum*	C
Nuttal's Cottontail	*Sylvilagus nuttalii*	S, A
Pigmy Rabbit	*Brachylagus idahoensis*	S
Black-tailed Jackrabbit	*Lepus californicus*	S



Reptiles

CHPI = Painted Turtle

MATA = Striped Whipsnake

PICA = Gopher Snake

THEL = Western Terrestrial Garter Snake

Amphibians

RACA = Bullfrog

SPIN = Great Basin Spadefoot

Figure 1. Distribution of reptile and amphibian species found during the summer 1998 surveys.