

restricted to the flowing portions of the main tributary streams and rivers that flow into the lake. These species are relatively less abundant and more restricted in distribution than the lake-associated fish species.

The creation of Lake Powell changed the riverine habitat formerly found on this stretch of the Colorado River to such an extent that native fish species have been virtually eliminated from the resulting lake environment. As a result of habitat modification and competition by introduced species, some native species are now classified as endangered or threatened.

The large seasonal and annual variations in water surface elevation resulting from reservoir operations and management impose substantial environmental constraints on the types of habitats that can develop and persist at near-shore locations. Wildlife species typically associated with the water fluctuation zone are highly adapted to using food, cover, and shelter conditions that may develop and disappear quickly. In many main lake locations, especially where the inundation frequency is high and prolonged, shoreline and near-shore areas consist primarily of unvegetated or sparsely vegetated rock, sand, cobbles, and boulders.

Wetlands and riparian areas are typically considered to be important wildlife concentration areas for several reasons. These include the availability of good foraging conditions resulting from the high degree of vegetation, water interfaces and interspersions (or edge), and structural diversity typically associated with vegetation conditions in such areas. General wildlife habitat values and uses generally increase as wetland and riparian area size increases. Because of the physical shoreline conditions and the operational characteristics of the reservoir, wetland sites are limited in number and small in size. Wetlands are typically associated with the upstream reaches of tributary or secondary side canyons where water levels fluctuate less.

Riparian areas are typically found along the shorelines of the four major rivers flowing into the reservoir. However, even in these locations, riparian corridors are generally scarce in number and small in size.

The perennial tributary rivers flowing into Lake Powell represent examples of the river systems and aquatic environments that existed prior to lake impoundment. These areas are of particular scientific and resource preservation values because of their general scarcity and because they preserve populations and community

relationships of previous riverine ecosystem conditions. Relict native fish species still survive within the rivers in limited numbers. Major examples include reaches of the Colorado, San Juan, Escalante, and Dirty Devil Rivers. Therefore, management actions should be consistent with the protection of these wildlife habitats.

Threatened and Endangered Species

In accordance with threatened or endangered species consultation and coordination activities, the U.S. Fish and Wildlife Service identified 13 listed, 1 proposed, and 1 candidate species for portions of Coconino County, Arizona and Kane and San Juan Counties, Utah (U.S. Fish and Wildlife Service letter dated May 9, 2002). Of these species identified, Glen Canyon NRA resource specialists confirm that habitat for 12 federally listed endangered, threatened and candidate species may occur in the lake or near its shoreline. The area addressed for this resource characterization includes Lake Powell up to the 3700-foot water surface elevation, the shoreline zone, and uplands within 500 feet of Lake Powell's 3700-foot water surface elevation.

Razorback sucker (*Xyrauchen texanus*) is native to the Colorado River and once occupied the entire range of the river basin. San Juan, Dirty Devil and Colorado River inflow areas continue to produce some razorback suckers. Eleven adult razorbacks were caught at the San Juan Inflow (USGS *et al.* open file report). Adult razorback suckers are considered to be the products of native fish recovery programs conducted further upstream of Glen Canyon National Recreation Area. Fish tracking studies conducted in Lake Powell from 1995 to 1997 indicated this species primarily used vegetated habitats less than 1.5 feet deep in side canyons and backwaters covering sandy or cobble bottoms and open waters in upper portions of the river inlets. These areas represent less than 1 percent of the habitat in Lake Powell (Karp and Mueller, 2002).

Colorado pikeminnow (*Ptychocheilus lucius*) is a native migratory species of the Colorado River that once was present basin wide. It is no longer present in the lower basin and is considered rare in the upper basin. It is only found upstream of Glen Canyon Dam. Juvenile pikeminnow have been found in off-channel and backwater habitats adjacent to lower reaches of the river inflows into Lake Powell (UDWR, M. Gustavson, pers. com. 2002). Some have been found in the San Juan River near Mexican Hat (National Park

Service, 1986). The Colorado pikeminnow has not been reported captured in the lake since 1977. Limiting factors include loss of habitat.

Humpback chub (*Gila cypha*) is a native migratory species that was once more abundant throughout the Colorado River. The species has been found to exist near the confluence of the Colorado and Little Colorado Rivers within Grand Canyon National Park. The humpback chub has not been captured in Lake Powell since the early 1970s. It is assumed to no longer be present in the lake. Habitat preferences include river channels with deep fast-moving water and large boulders that are often conditions created in river channels bounded by steep cliffs. Adults typically live in eddy currents of whitewater canyons. Threats to this species include habitat modification and fluctuating water discharges that eliminate preferred conditions.

Bonytail (*Gila elegans*) is a native species that has a historic range that includes the Colorado River and its main tributaries. The bonytail is no longer present in the upper basin and is believed to be the most endangered of the four fish species. Prior to 1996 less than 10 bonytails were captured in Lake Powell. No individual fish have been observed during annual gill-net surveys in the last 20 years. Some populations may be present in Utah but their relative abundance is unknown. The species prefers pools and eddies of warm, often heavily silted, swift moving rivers.

Mexican Spotted Owl (*Strix occidentalis lucida*) utilizes a variety of habitats including old growth forests, mixed conifer, Ponderosa pine, deciduous riparian, and steep canyons with rocky cliffs. Timber harvesting is the main threat to the Mexican spotted owl. Small populations roost in abandoned nests, tree cavities, or caves along canyon walls. Steep canyon habitats and drainages adjacent to Lake Powell and adjoining rivers may occasionally be utilized by this bird species. A juvenile was observed in Cataract Canyon several years ago but none have been sighted in Glen Canyon National Recreation Area since. There are no potential areas of concern located within the analysis area. Known occupied territories are located more than 4 miles from the Lake Powell shoreline (Glen Canyon NRA, Spence pers. com. 2002).

Southwestern Willow Flycatcher (*Empidonax traillii extimus*) is associated with low-elevation dense willow, cottonwood and saltcedar communities along streams and rivers. This species has been sighted about 30 miles from Lake Powell up the Escalante