3.8 SPECIAL-STATUS SPECIES

3.8.1 INTRODUCTION

This section identifies potential effects to special-status plant, wildlife and fish species that could result from implementation of interim surplus criteria alternatives under consideration. Specifically, the section addresses only special-status species associated with Lake Powell, Lake Mead, the lower Grand Canyon along the Colorado River corridor, and the lower Virgin River. Consultation on federally-listed threatened and endangered species under the Section 7 of the ESA is ongoing. For the purposes of NEPA compliance, other species of concern to states are included here. Should the ESA consultation identify other information or effects, they will be fully addressed in the FEIS. The FEIS will include the Service's determination on the interim surplus criteria.

Special-status species within the Colorado River corridor from Glen Canyon Dam to Separation Canyon are not included in this analysis as annual release patterns from Glen Canyon Dam are determined in accordance with the 1996 ROD and are monitored through the Glen Canyon Adaptive Management Program. (Analyses of potential changes in low steady summer flow and BHBF frequencies are included in Sections 3.6.2 and 3.6.3, respectively.) As long as the Adaptive Management Program continues to function successfully, the natural resources within the Colorado River corridor between Glen Canyon Dam and the headwaters of Lake Mead will be protected and conserved. However, special-status species that may occur in the lower Grand Canyon, from Separation Canyon to the Lake Mead delta, and the Virgin River immediately above Lake Mead, are also included in the analysis. These areas are included because fluctuations in lake levels could potentially result in effects on riparian and marsh habitat associated with special-status species. This analysis also includes potential effects of the interim surplus criteria on special-status fish species associated with the larger rivers that flow into Lake Powell (e.g., San Juan and Green rivers).

3.8.2 POTENTIAL EFFECTS ON SPECIAL-STATUS SPECIES

This special-status species analysis describes potential interim surplus criteria effects on special-status species (i.e., species listed as "threatened," "endangered," or of concern under the Federal ESA or species with special protection under individual state statutes or regulations), designated critical habitat, and other important special-status species habitat (aquatic and terrestrial). The analysis identifies special-status plant, wildlife, and fish species, as well as designated critical habitat and other ecologically significant areas, within or adjacent to Lake Powell and Lake Mead, the lower Colorado River corridor from Separation Canyon to the Lake Mead delta, and the lower Virgin River corridor. Although state candidate species and federal and

state species of concern are not currently protected under federal or state laws, these sensitive species are also included.

3.8.2.1 METHODOLOGY

Information on special-status species and their habitat was compiled after review of available published and unpublished sources, and through personal communication with agency resource specialists. Review of existing literature concerning Lake Powell, Lake Mead, the lower Colorado River corridor within the Grand Canyon, and the lower Virgin River above Lake Mead provided information on special-status plants, wildlife and fish. Species' distribution, range and habitat requirements were reviewed. These requirements formed the basis for compiling an initial list of special-status species to be considered.

Due to the large number of species with federal or state status that may occur, the following criteria were developed to establish a core list of special-status species for the analysis: 1) special-status species associated with Lake Powell and Lake Mead, the lower Grand Canyon Colorado River corridor, and lower Virgin River (includes resident and migratory species); 2) riparian-obligate special-status species (those that are dependent on riparian habitat for meeting and/or fulfilling breeding requirements); and 3) special-status species that utilize the existing habitat for fulfilling essential life history requirements.

Potential effects on special-status species were determined by considering hydrologic requirements and other habitat elements important to the species. Special-status species that do not have a hydrologic connection, or those that do not depend on terrestrial or aquatic habitat associated with the area under consideration, are addressed briefly and removed from further consideration. Species that are hydrologically-linked to, or dependent on, habitat associated with Lake Mead, Lake Powell, and/or the lower Grand Canyon River corridor, and lower Virgin River are identified and considered further. In addition, potential adverse effects to federally-designated critical habitat for wildlife and fish species are also assessed.

3.8.2.2 AFFECTED ENVIRONMENT

The special-status species in the area under consideration for this analysis are divided into three main categories: plants, wildlife and fish. Tables in this section list the species' common and scientific names and current status, including critical habitat designations. Following each table, the occurrence of the special-status species in the area under consideration is provided.

3.8.2.2.1 Special-Status Plant Species

The list of special-status plants in Table 3.8-1 below is based on occurrence of the species within the GCNRA or LMNRA, or plants with the potential to occur within

the Colorado River corridor in the lower Grand Canyon. Based on modeled Colorado River system changes, four plant species could be affected under the interim surplus criteria. These species are considered further. The remaining 19 special-status plant species were removed from further consideration.

Table 3.8-1
Special-Status Plant Species Potentially Occurring Within the Area of Analysis

Common Name	Scientific Name	Status
Alcove bog orchid	*Habenaria zothecina*	Federal Species of Concern
Alcove daisy	*Erigeron zothecinus*	Federal Species of Concern
Alcove deathcamas	*Zigadenus vaginatus*	Federal Species of Concern
Barrel cactus	*Ferrocactus acanthodes var. lecontei*	Northern Nevada Native Plant Society (NNNPS) Watch List species and Listed as Sensitive by the Service (Intermountain Region)
Brady's footcactus	*Pediocactus bradyi*	Federally Listed Endangered
Canyonlands sedge	*Carex scirpoidea var. curatorum*	Federal Species of Concern
Geyer's milkvetch[1]	*Astragalus geyeri var. triquetrus*	Federal Species of Concern; Nevada Critically Endangered
Grand Canyon evening-primrose[1]	*Camissonia specuicola ssp. hesperia*	Federal Species of Concern
Hole–in-the-Rock prairie clover	*Dalea flavescens*	Federal Species of Concern
Jones cycladenia	*Cycladenia humilis var. jonesii*	Federally Listed Threatened
Kachina daisy	*Erigeron kachinensis*	Federal Species of Concern
Las Vegas bear poppy[1]	*Arctomecon californica*	Nevada Listed Critical Endangered
Navajo sedge	*Carex specuicola*	Federally Listed Threatened
New Mexico raspberry	*Rubus neomexicana*	Federal Species of Concern
Rock Daisy	*Perityle specuicula*	Federal Species of Concern
Rosy bicolored beardtongue	*Penstemon bicolor ssp. roseus*	Federal Species of Concern
Satintail grass	*Imperata brevifolia*	Federal Species of Concern
Sawgrass	*Cladium californicum*	Federal Species of Concern
Sticky buckwheat[1]	*Eriogonum viscidulum*	Federal Species of Concern
Thompson's indigo-bush	*Psorothamnus thompsoniae var. whittingii*	Federal Species of Concern
Ute ladies' tresses	*Spiranthes diluvialis*	Federally Listed Threatened
Virgin River thistle	*Cirsium virgenense*	Federally Listed Species of Concern; Arizona Salvage-restricted, Protected Native Plant
Western hophornbeam	*Ostrya knowltonii*	Federal Species of Concern

[1] Species with the potential to be affected by the interim surplus criteria that are considered further in this analysis.

3.8.2.2.1.1 Special-Status Plant Species Removed from Further Consideration

This section discusses the reasons for eliminating certain special-status plant species from further consideration.

Special-status plant species that occur in hanging gardens at GCNRA include alcove bog orchid, alcove daisy, alcove deathcamas, canyonlands sedge, Kachina daisy, Navajo sedge, New Mexico raspberry, sawgrass, western hophornbeam and Virgin River thistle. The water source for these species comes from seepage from the Navajo sandstone that would not be affected by hydrologic changes associated with interim surplus criteria.

Barrel cactus, Brady's footcactus, rosy bicolored beardtongue, Jones cycladenia and Thompson's indigo-bush are desert species. This habitat type and associated plant species would not be affected by interim surplus criteria.

Hole-in-the-Rock prairie clover occurs in the Hall's Creek and Escalante drainages in the GCNRA, which would not be affected by hydrologic changes associated with the interim surplus criteria.

Rock daisy occurs at Cedar Mesa in GCNRA, growing in sandstone along the margins of an ephemeral stream channel at the canyon bottom that would not be affected by interim surplus criteria.

Satintail grass occurs within lower Wilson's Creek in the GCNRA, an area that would not be affected by interim surplus criteria.

Sawgrass has been found in the riparian zone of Alcove Canyon in Grand Canyon National Park, and in the riparian zone of "Garden Canyon" on the cliffs above Lake Powell. These riparian zones would not be affected by interim surplus criteria.

Ute lady's tresses occur in moist to wet meadows along perennial streams at elevations between 4300 and 7000 feet msl. These occurrences are above those elevations that occur within the area under consideration. As such, this species would not be affected by interim surplus criteria.

Virgin River thistle occurs on sandy or gravelly alkaline slopes and washes and around saline seeps, alkaline springs or stream terraces. It occurs between elevations of 1968 and 6562 feet msl, and is associated with Mojave mixed scrub habitat. This habitat type would not be affected by interim surplus criteria. As such, this species would not be affected by interim surplus criteria.

3.8.2.2.1.2 Special-Status Plant Species Considered Further

Geyer's milkvetch is known to occur along the shoreline of Lake Mead and is associated with stabilized sand dunes and sandy soils. Population trends have not been well documented for Geyer's milkvetch. Germination may be tied to rainfall, and poor seed production and insect infestations may contribute to the limited distribution and/or small population sizes observed for this variety (Mozingo and Williams, 1980). Some populations have been directly affected by rising water levels at Lake Mead (e.g., Middle Point). Additional causes of decline for this taxon may include shoreline recreation, trampling and grazing by burros and livestock, off-road vehicle use, and utility corridors (Niles et al., 1995).

Threats to Geyer's milkvetch in the study area have not been well defined. This variety may be potentially threatened by: 1) loss of habitat from inundation and rising water levels at Lake Mead; 2) invasion of shoreline (beach) habitat by other plant species (e.g., tamarisk and arrowweed); and possibly 3) trampling and grazing by burros. Geyer's milkvetch occurs further back from the shoreline and may be less affected by these factors (E. Powell, 2000). Shoreline recreation does not currently appear to be a major threat to this species because the beaches where it occurs do not receive heavy recreational use. In addition, the species typically flowers and sets seed prior to the beginning of heavy use periods at the lake (Niles et al., 1995; E. Powell, 2000). However, rising lake levels may potentially affect this species directly by inundation of plants or indirectly through inundation of suitable habitat.

Grand Canyon evening primrose is a clustered herbaceous perennial plant with small flowers that are yellow or white at anthesis (flowering), but may turn to pink or lavender with aging. The Grand Canyon evening primrose occurs on beaches along or near the main stem Colorado River in the vicinity of Separation Canyon and downstream of Diamond Creek where available beach habitat is exposed (Brian, 2000 and Phillips, 2000). This species is likely adversely affected when beaches are disturbed through erosion or deposition of sediments during flood events. Some degree of flooding occurs seasonally as the result of increases in side-channel inflows during rainfall events. Additional flood flows result from periodic BHBF releases from Glen Canyon Dam. The degree to which flooding adversely affects this subspecies and which water levels are detrimental to the plants and its habitat is unknown. However, the amount of beach habitat in the Grand Canyon has decreased under post-dam conditions, and the remaining habitat is often invaded by riparian vegetation (Schmidt et al., 1998). Because this subspecies is found on good camping beaches, particularly in the lower portion of the Grand Canyon, it may also be adversely affected by disturbance associated with recreational beach use; however, this potential effect is not related to the interim surplus criteria.

Las Vegas bear poppy is a short-lived perennial species, occurring along the lower levels of the Lake Mead shoreline (E. Powell, 2000). This plant occurs on gypsum

soils below the high water line of Lake Mead (1225 feet msl) on sloping flats. Little is known about the life cycle of the Las Vegas bear poppy, and populations vary in a "boom or bust" pattern (E. Powell, 2000). This species would benefit from lower water levels at Lake Mead, and could be adversely affected by increases in water levels although timing of water fluctuations and associated effects to this species are unknown.

Sticky buckwheat is found primarily along the Overton Arm of Lake Mead (Reveal and Ertter 1980, Niles et al., 1995). Smaller, potentially significant populations occur in the vicinity of Overton Beach, along the Virgin River Valley, and along the Muddy River. Major threats to sticky buckwheat at Lake Mead include: 1) loss of habitat from inundation and rising water levels at Lake Mead; 2) invasion of shoreline (beach) habitat by other plant species (e.g., tamarisk and arrowweed); and possibly 3) trampling and grazing by burros. Shoreline recreation does not currently appear to be a major threat to this species because the beaches where it occurs do not receive heavy recreational use. In addition, the species typically flowers and sets seed prior to the beginning of heavy use periods at the lake (Niles et al., 1995). This species would benefit from lower water levels at Lake Mead, and could be adversely affected by increases in water levels although timing of water fluctuations and associated effects to this species are unknown.

3.8.2.2.2 Special-Status Wildlife Species

Described below are lake-associated vegetation and habitat types important to special-status wildlife species. Special-status wildlife species with the potential to occur within the area under consideration (as listed in Table 3.8-2) are then described. Special-status wildlife species include those associated with lakes Powell and Mead, and those species that may be found in the lower Grand Canyon from Separation Canyon to the headwaters of Lake Mead, and in the lower Virgin River. Species in the lower portion of the Colorado River immediately above the confluence with Lake Mead are considered lake-associated because fluctuations in Lake Mead levels influence riparian and marsh habitat along the river corridor from the Lake Mead delta up to about Separation Canyon. In addition, species in the lower portion of the Virgin River immediately above Lake Mead are also considered because fluctuations in lake levels influence establishment and development of riparian and marsh habitat that may be utilized by special-status birds. The species-specific discussions are largely the result of available information and literature for this analysis and may not reflect all habitat associations for all special-status wildlife species.

The 10 special-status wildlife species that have the potential to be affected by interim surplus criteria are indicated in Table 3.8-2. These species are considered further. The Colorado River cotton rat and Sonoran mud turtle were removed from further consideration because there are no known occurrences of these species in the area

covered under this analysis. In addition, the American peregrine falcon and MacNeill's sootywing skipper were removed from further consideration because these species and their habitat will not be affected by the interim surplus criteria. Five other special-status wildlife species are covered under the Glen Canyon Dam ROD (1996) and Adaptive Management Program (see Section 3.2.2) and are not discussed further.

Table 3.8-2
Special-Status Wildlife Species Potentially Occurring Within the Area of Analysis

Common Name ***Scientific Name***	**Habitat Association**	**Status**
American peregrine falcon *Falco peregrinus anatum*	Associated with Lake Powell and Lake Mead	California Endangered; Nevada State Protected and Endangered
Arizona Bell's vireo[1] *Vireo bellii arizonae*	Associated with the Colorado and Virgin rivers above Lake Mead, and the Lake Mead and Virgin River deltas	California Endangered
Bald eagle[2] *Haliaeetus leucocephalus*	Associated with the Colorado River during winter and migration	Federally Listed Threatened; California Endangered; Nevada State Protected and Endangered
California black rail[1] *Laterallus jamaicensis coturniculus*	Associated with the Colorado and Virgin rivers above Lake Mead, and the Lake Mead and Virgin River deltas	Federal Species of Concern; California Threatened
Clark's grebe[1] *Aechmophorus clarkii*	Associated with the Colorado and Virgin rivers above Lake Mead, and the Lake Mead and Virgin River deltas	Arizona Wildlife of Special Concern;
Colorado River cotton rat[3] *Sigmodon arizonae plenus*	Associated with the Colorado River	Federal Species of Concern; California Species of Special Concern
Cooper's hawk[1] *Accipiter cooperii*	Associated with the Colorado River including the Colorado and Virgin rivers above Lake Mead	California Species of Special Concern
Elf owl[1] *Micrathene whitneyi*	Associated with Colorado and Virgin rivers above Lake Mead	California Endangered
Gilded flicker[1] *Colaptes chrysoides*	Associated with the Colorado and Virgin rivers above Lake Mead	California Endangered
Kanab ambersnail[2] *Oxyloma haydeni kanabensis*	Associated with the Colorado River	Federally Listed Endangered; Arizona Wildlife of Special Concern
MacNeill's sootywing skipper *Hesperopsis gracielae*	Associated with the Colorado River	Federal Species of Concern

Table 3.8-2
Special-Status Wildlife Species Potentially Occurring Within the Area of Analysis

Common Name *Scientific Name*	Habitat Association	Status
Northern leopard frog[1] *Rana pipiens*	Associated with the Colorado River	Arizona Candidate for Listing
Occult little brown bat[3] *Myotis lucifugus occultus*	Associated with the Colorado River	Federal Species of Concern; California Species of Special Concern
Osprey[2] *Pandion haliaetus*	Associated with the Colorado River during migration	California Species of Special Concern
Relict leopard frog[1] *Rana onca*	Associated with the Colorado River	Nevada State Protected; Arizona Wildlife of Special Concern
Sonoran mud turtle[3] *Kinosternon sonoriense sonoriense*	Associated with the Colorado River	California Species of Special Concern
Southwestern willow flycatcher[1] *Empidonax traillii extimus*	Associated with the Colorado and Virgin rivers above Lake Mead, and the Lake Mead and Virgin River deltas	Federally Listed Endangered (critical habitat designated); California Endangered; Nevada State Protected
Yuma clapper rail[1] *Rallus longirositris yumaniensis*	Associated with the Colorado and Virgin rivers above Lake Mead, and the Lake Mead and Virgin River deltas	Federally Listed Endangered; California Threatened
Western yellow-billed cuckoo[1] *Coccyzus americanus*	Associated with the Colorado and Virgin rivers above Lake Mead	Federally Proposed Endangered; California Endangered; Nevada State Protected

[1] Species with the potential to be affected by the interim surplus criteria that are considered further in this analysis.

[2] Species associated with the Colorado River from Glen Canyon Dam to the lower Grand Canyon that are not considered further because they are covered under the Glen Canyon Dam ROD (1996) and Adaptive Management Program (see Section 3.2.2).

[3] No known occurrences documented in the area considered in this analysis.

3.8.2.2.2.1 Lake Habitat and Habitat in the Lower Grand Canyon (Colorado River from Separation Canyon to Lake Mead)

A description of vegetation associated with Lake Powell and GCNRA is provided below, followed by a description of vegetation associated with Lake Mead and LMNRA. The discussion also includes a description of riparian habitat in the lower Grand Canyon along the Colorado River corridor from approximately Separation Canyon to the Lake Mead delta. Although riparian and marsh habitats at the Lake Mead and Virgin River deltas are presently inundated, they are also discussed.

Riparian and marsh vegetation around Lake Powell and Lake Mead is extremely restricted because of the desert terrain that extends directly to the water's edge (Reclamation, October 1999), and the continuously fluctuating lake levels that

precludes establishment of native vegetation. Tamarisk or salt cedar (*Tamarix ramosissima*), a non-native invasive shrub- to tree-like plant along the Lake Powell shoreline is still becoming established and has not yet formed stable ecosystems. These communities will probably attain some importance as insect and wildlife (particularly bird) habitat in the future, and already provide habitat for fish during high lake levels when the plants are inundated (NPS, April 1987).

Small intermittent or seasonal streams predominantly characterize the side canyons of Lake Powell. Fluctuations in lake levels may result in standing water in these side canyons where riparian vegetation has become established. Dominant plants found in these canyons include Fremont cottonwood (*Populus fremontii*), tamarisk, and cattail (*Typha* sp.) (USBR, no date). The vegetation within these side canyon streams has been altered by the lake itself as a result of periodic inundation in association with fluctuating lake levels. When the lake level drops, the side canyons may retain water in standing pools for part of the season and then dry out. In areas where there is standing water almost year round, such as in springs and seeps, cattail marshes may be found. The most serious adverse influence on canyon and spring riparian zones associated with intermittent or seasonal streams in the side canyons of Lake Powell is domestic and feral livestock use (NPS, April 1987).

The GCNRA has many springs, seeps that are common in alcoves along the canyon walls, and waterpockets located in canyons and uplands. These areas are recognized for their significance as wetland habitats and as unique ecosystems within the desert (NPS, April 1987).

The seeps that are common in alcoves along the walls of the canyon support hanging gardens. Hanging gardens are a specialized vegetation type and have a unique flora associated with them. The water sources that support hanging gardens originate from natural springs and seeps within the Navajo sandstone formation and are independent of Lake Powell. This plant community is found at various elevations around Lake Powell and is typically not affected by reservoir fluctuations. However, in 1983, high water levels at Lake Powell (3711 feet msl) caused considerable damage to some hanging gardens as the lake rose (Spence, 2000). With lower lake levels, there is likely to be little effect.

Glen Canyon hanging gardens are characterized by Eastwood monkeyflower (*Mimulus eastwoodiae*), alcove columbine (*Aquilegia micrantha*), Rydberg's thistle (*Cirsium rydbergii*), and alcove primrose (*Primula specuicola*). None of these are special-status species at this time, although all four are endemic to the Colorado Plateau. Maidenhair fern (*Adiantum* sp.) is the most typical species in hanging gardens throughout the Plateau (Spence, 2000). Species typically associated with hanging gardens in the Grand Canyon and Zion areas include maidenhair fern, golden columbine (*Aquilegia chrysantha*), and scarlet monkeyflower (*Mimulus cardinalis*).

Though not common, springs can be found within the GCNRA in intermittent drainages where they often support wetland plant communities. Between Glen Canyon Dam and Lees Ferry, springs are created by several spontaneous, copious flows from the lower canyon walls (NPS, April 1987). The *Water Resources Management Plan and Environmental Assessment for the GCNRA* speculates that this spring flow originates from Lake Powell bank storage in the Navajo Sandstone (NPS, April 1987), and thus this area could be affected by changes in Lake Powell surface levels. Overall, lower lake levels are not likely to have any impacts on gardens around Lake Powell, but may have some impacts on springs directly associated with Glen Canyon Dam extending downriver approximately two to three miles. However, there are no known special-status species associated with these small springs (Spence 2000).

The highest concentration of lake riparian and marsh habitat associated with Lake Mead in the LMNRA is found in the Lake Mead and Virgin River deltas. Linear riparian woodlands may be present along the shoreline of the Lake Mead delta following high water flows, and associated sediment deposition and exposure. The sediment deposition and the associated growth of riparian vegetation at the Lake Mead delta has occurred for decades (McKernan, 1997). When lake levels decline, vegetation in the Lake Mead and Virgin River deltas begins to establish on clay/silt deposits. The dynamic nature of how fluctuating lake levels and deposition of sediment in the Lake Mead delta is expressed as a change in plant species composition and relative abundance over time. In 1963, the Lake Mead Delta's dominant tree species was tamarisk (McKernan, 1997). In 1996, habitat descriptions for Southwestern willow flycatcher study sites at the Lake Mead delta reported 95 percent of the vegetation as willow or cottonwood with only 5 percent as tamarisk (McKernan, 1997). An increase in sediment deposition in the deltas followed by lower lake levels allows establishment of native riparian habitat if the lowering of the lake is timed to match native seed dispersal.

Germination of willows at the Lake Mead delta likely occurred in the spring of 1990 at the approximate water surface elevation of 1185 feet msl (McKernan, 1997 and Reclamation, March 1998). The water surface elevations in 1996 and 1997 were 1192 feet and 1204 feet, respectively (Reclamation, March 1998). These higher lake levels inundated willow habitat in the Lake Mead delta and the Lower Grand Canyon (McKernan, 1997). Until 1998, the Lake Mead delta contained an extensive growth of riparian vegetation principally composed of Goodding willow (*Salix gooddingii*) (McKernan, 1997). By 1999 the Lake Mead delta willow habitat was completely inundated. To a lesser degree, these same effects may also be seen at the Virgin River delta. A higher delta gradient at the Virgin River delta results in a shorter period of inundation at high (greater than 1192 feet msl) lake levels (Reclamation, March 1998).

Although higher lake levels may be detrimental to riparian vegetation at the Lake Mead and Virgin River deltas, it may be beneficial to the development of riparian habitat in the lower Grand Canyon downstream of Separation Canyon, and the Virgin River above Lake Mead (Reclamation, March 1998). Riparian habitat extends from the lake deltas upstream into the lower Grand Canyon and Virgin River Canyon. Development of riparian habitat in these canyons is directly dependent upon fluctuating lake levels and periods of inundation in the canyons. Data collected on riparian vegetation from 1998 Southwestern willow flycatcher surveys (McKernan, 1999) indicate a well-developed riparian corridor composed primarily of willow *(Salix* spp.) and tamarisk that forms extensive and continuous stands in some portions of the lower Grand Canyon.

A few literature sources briefly examine influences of fluctuating lake levels on marsh habitat at the Lake Mead and Virgin River deltas. In 1995, the Lake Mead delta supported hundreds of acres of cattail and bulrush marsh (Reclamation, March 1995, part 1). This vegetation type increased after a period of high flows from 1983 to 1986. Deposits containing clay/silt sediments are necessary for the development of emergent marsh vegetation (Stevens and Ayers 1993, and Reclamation, March 1995). Low water velocity sites, such as the Lake Mead and Virgin River deltas, permit clay/silt particles to settle from suspension. These deposits provide a higher quality substrate for seed germination and seedling establishment than underlying sand because of their greater nutrient levels and moisture-holding capacity. With the appropriate water regime (i.e., higher flows during winter with lower river flows during summer), these sites are more likely to support emergent marsh vegetation (Reclamation, March 1995). Marsh vegetation that develops during low lake periods would be lost during periods of high lake levels; however, this habitat is more likely than cottonwood/willow to reestablish as lake levels fluctuate (Reclamation, March 1995). Marsh vegetation that develops during low lake levels is important habitat for many species, particularly breeding birds.

Two types of marsh plant associations have been identified along the Colorado River: wet marsh and dry marsh (Stevens and Ayers, 1991). Wet marshes were historically found along oxbow lakes and in backwater areas along the Colorado River. Cattails, bulrushes, common reed and some less common emergent plants occur in wet marsh areas that develop on sediment deposits containing about half clay/silt and half sand (Reclamation, 1995). In the lower Grand Canyon above Lake Mead, backwater marshes may be affected by seasonal lake fluctuations. As a result, the value of some backwater marshes may be reduced due to the changes in water levels. These changes in water levels could affect temperature and other water quality considerations, as well as the establishment of marsh vegetation.

Wildlife is both diverse and abundant along the river corridor through Glen and Grand canyons. (Reclamation, March 1995). The riparian vegetation in the lower Grand Canyon along the Colorado River is among the most important wildlife

habitat in the region. In the lower canyon, arrowweed *(Pluchea sericea*) and horsetail are more common. Below Havasu Creek, bermuda grass becomes the dominant ground cover at many sites (Reclamation, March 1995, part 1).

Mesquite (*Prosopis glandulosa*) historically occurred on the broad alluvial floodplains of the Colorado River on secondary and higher terraces above the main channel (LCRMSCP, undated). It still is a dominant species above the scour zone through the Grand Canyon (Ohmart et al., 1988; Turner and Karpiscak, 1980); however, tamarisk is replacing mesquite in many areas along the Colorado River.

Catclaw acacia occurs along watercourses and other areas where a summer water supply may be present (Barbour and Major, 1995; Brown, 1994; Holland, 1986; Sawyer and Keeler-Wolf, 1995). This species occurs in both upland and riparian vegetation associations (LCRMSCP, undated). Catclaw acacia occurs as a distinct mapping category only in the Grand Canyon, and can occur with Apache plume (*Fallugia paradoxa*), a typical constituent in the acacia-mesquite habitat. It may also be found with desert broom (*Baccharis* spp), which is an obligate riparian species that occurs in the cottonwood-willow habitat type (Turner and Karpiscak, 1980).

3.8.2.2.2.1.1 *Special-Status Wildlife Species Removed from Further Consideration*

American Peregrine Falcon (*Falco peregrinus anatum*) – Lake Powell and Lake Mead provide breeding and wintering habitat for American peregrine falcons. The peregrine falcon breeds within LMNRA at sites on Lake Mead, and the upper portion of Lake Mohave. Wintering and breeding peregrines are also found around Lake Powell, with an estimated 50 breeding areas (Interior, 1995), and 19 wintering territories (Hetzler, 1992a). Based on historical data, the average height of peregrine nests at GCNRA, is approximately 460 feet (141 meters) above the water with average cliff heights of 630 feet (193 meters) (Hetzler 1992a**,** Hetzler 1992b). These data include the Glen Canyon immediately below the Glen Canyon Dam.

Existing and potential American peregrine falcon breeding habitat also occurs in the Grand Canyon between Glen Canyon Dam and Lake Mead and in Black Canyon (south of Lake Mead). All breeding locations within the study area are considered regionally important. The American peregrine falcon would not be affected as the result of changes in lake levels because their nesting sites are well above the lake. Because peregrine falcons will not be affected by the interim surplus criteria, the species has been eliminated from further analysis.

MacNeill's Sootywing Skipper (*Hesperopis gracielae*) – The MacNeill's sootywing skipper is found along the Colorado River from southern Utah and Nevada to Arizona and southeastern California (Reclamation, 1996). Confirmed records of this species are reported for the Arizona counties of Mohave, La Paz, Yuma, Yavapai, Maricopa and Pinal. The MacNeill's sootywing skipper is also

present in San Bernardino, Riverside and Imperial counties in California. This species has recently been documented on the Virgin and Muddy rivers above Lake Mead (W. Wiesenborn, 2000).

The larval host plant for MacNeill's sootywing skipper is quailbush (*Atriplex lentiformis*). Quailbush is the largest salt bush found in Arizona and forms dense thickets along the drainage system of the Colorado River (Emmel and Emmel, 1973). Quailbush is associated with floodplains (W. Wiesenborn, 2000) located in alkaline soil areas with adequate water resources (Kearney and Peebles, 1951). Specific surveys for this species and larval host plants have not been conducted in the lower Grand Canyon; however, the documented occurrence of MacNeill's sootywing skipper in the Virgin and Muddy rivers above Lake Mead indicates there is a likelihood of occurrence in the lower Grand Canyon. Suitable habitat for this species likely requires stands of more than one host plant (W. Wiesenborn, 2000). Although this species occurs in the area of analysis, the host plant occurs on alluvial floodplains and has little potential to be affected by the alternatives considered for the interim surplus criteria.

3.8.2.2.2.1.2 *Special-Status Wildlife Species Considered Further*

The following section discusses special-status wildlife species associated with lakes Powell and Mead, the lower Grand Canyon along the Colorado River corridor, and the lower Virgin River. Only those species that have the potential to be affected by hydrologic changes that may occur as a result of the interim surplus criteria are included. These species are considered further in Section 3.8.2.3, Environmental Consequences.

Arizona Bell's Vireo (*Vireo bellii arizonae*) – The Arizona Bell's vireo is distributed throughout the river systems of the Southwest desert and have been documented in the Virgin and Muddy rivers, and the lower Colorado River. Since 1900, populations of this subspecies of Bell's vireo have declined along the lower reaches of the Colorado River, where it is now a rare, to locally uncommon, summer resident from Needles south to Blythe (Brown et al., 1983; Zeiner et al., 1990a; Rosenberg et al., 1991). Since the completion of Glen Canyon Dam in 1963, the Bell's vireo has expanded its range eastward into Grand Canyon National Park (Brown et al., 1983). An extensive riparian scrub, that has developed along the Colorado River in the Grand Canyon largely composed of tamarisk and willow, supports a significant population of Bell's vireo (Brown et al., 1983). The Grand Canyon population of Bell's vireo is regionally important due to the substantial decline of this subspecies at lower elevations. The riparian habitat utilized by Arizona Bell's vireo may potentially be affected by the interim surplus criteria.

California Black Rail (*Laterallus jamaicensis coturniculus*) – California black rail have recently been documented in the Virgin River Canyon. In general, Flores and

Eddleman (1995) found that black rails utilize marsh habitats with high stem densities and overhead coverage that were drier and closer to upland vegetation than randomly selected sites. Marsh edges with water less than 2.5 centimeters (1 inch) deep dominated by California bulrush and three-square bulrush (*Scirpus californicus* and *S. americanus*, respectively) are utilized most frequently. Areas dominated by cattail are also used regularly, but only in a small proportion to their availability and generally within 50 meters (164 feet) of upland vegetation where water depth is 3.0 centimeters (1.2 inch). The marsh habitat utilized by California black rail in the Virgin River corridor above Lake Mead (McKernan, 1999) may be affected by the interim surplus criteria.

Clark's Grebe (*Aechmophorus clarkii*) – Clark's grebes are typically less abundant than the western grebe at most locations throughout their range (Ratti, 1981; Zeiner et al., 1990a). A 1977 winter survey found Clark's grebes comprised less than 12 percent of *Aechmophorus* grebe sightings at locations within California and areas near Lake Mead (Ratti, 1981). At Lake Mead, a total of 321 western grebes were detected during the winter, while only three Clark's grebes were observed. At Lake Havasu, western grebes are also more abundant than Clark's grebes in the winter. However, Clark's grebes are more numerous in the breeding season, making up approximately 65 percent of the breeding colony (Rosenberg et al., 1991). Although the cattail and bulrush marsh habitat found at the Lake Mead delta exhibits characteristics preferred by Clark's grebe, it is not known whether this species currently occurs at the delta. The marsh habitat at the Lake Mead and Virgin River deltas, and in the Colorado and Virgin rivers above Lake Mead may potentially be utilized by Clark's grebe and may be affected by the interim surplus criteria.

Cooper's Hawk (*Accipiter cooperii*) – Cooper's hawks are associated with deciduous mixed forests and riparian woodlands and nests mainly in oak woodlands, but also use willow or eucalyptus woodlands. The Cooper's hawk nests near streams and prefers mature trees with a well-developed understory for nesting sites (Ziener et al., 1990a). Breeding activity has been documented in the lower Grand Canyon, below Separation Canyon, and in the lower Virgin River above Lake Mead (McKernan, 1999). The riparian habitat currently utilized by Cooper's hawk in the lower Grand Canyon and lower Virgin River may be affected by the interim surplus criteria.

Elf Owl (*Micrathene whitneyi*) – The elf owl is a secondary cavity nester and, as a result, the population status of the elf owl is directly dependent on available nesting holes in trees made by woodpeckers. As an insectivore, the elf owl is also dependent on sufficient numbers of insects during the breeding season (Johnsgard, 1988). In California, at the extreme northwest edge of its range, the elf owl is likely declining in the few desert riparian habitats that it occupies (Johnsgard, 1988). There may also be a general decline in Arizona, although it may be increasing its range in north-central Arizona and western New Mexico. The species' overall status in the

Southwest has not been determined. The elf owl was never a common or widespread species along the lower Colorado River. Surveys of riparian habitats in the lower Colorado River Valley in 1987 reported between 17 and 24 owls at ten different sites (CDFG, 1991). Population estimates in California for the early 1990s were 17 to 25 breeding pairs (CDFG, 1991; Rosenberg et al., 1991). Riparian habitat in the Grand Canyon may provide suitable breeding habitat for the elf owl; however, based on the available information, it is unknown whether elf owls occur. The riparian habitat along the Colorado River above Lake Mead may be utilized by elf owl and has the potential to be affected by the interim surplus criteria.

Gilded Flicker (*Colaptes chrysoides*) – The gilded flicker occurs along the lower Colorado River Valley in southern Arizona and southeastern California (Rosenberg et al., 1991). In California, the gilded flicker is an uncommon resident along the Colorado River north of Blythe (Garrett and Dunn, 1981, CDFG, 1991). During the breeding season, the gilded flicker is found in saguaro habitats, mature cottonwood-willow riparian forests, and occasionally mesquite habitats with tall snags (CDFG, 1991; Rosenberg et al., 1991 from Reference R1 Appendix). This species was historically widespread in riparian habitat all along the Colorado River Valley. Based on available information, it is not known whether this species occurs in the lower Grand Canyon, although suitable habitat is present in both the riparian and mesquite habitats.

Relict Leopard Frog (*Rana onca)* – Historically, the relict leopard frog was known from several locations along the Virgin river, and from the Overton arm of Lake Mead to north of St. George, Utah. This species was also known from the Muddy River and Meadow Valley Wash in Nevada, northwest of the Overton Arm. This species was thought to be extinct, but was rediscovered at 3 or 51 potential habitat sites surveyed in 1991. Surveys conducted for relict leopard frog included potential habitat within the historical range of the species (Bradford and Jennings 1997). There are confirmed sightings of this species at springs about 2 miles (3.2 km) west of Stewarts Point on the Overton Arm of Lake Mead. A fourth population of leopard frog on the Virgin River near Littlefield, Arizona is within the range of the lowland leopard frog (*R. yavapaiensis)* and is still awaiting additional studies to confirm its taxonomic status. Other unconfirmed sightings are on the Virgin River near Littlefield, Arizona and about 4 km (2.5 miles) downstream from Hoover Dam.

In general, leopard frogs inhabit springs, marshes, and shallow ponds, where a year-round water supply is available. Emergent or submergent vegetation such as bulrushes or cattails provides the necessary cover and substrate for cover and oviposition (Jennings et al., 1994). Suitable aquatic habitat, as well as, adjacent moist upland or wetland sols is required by the relict leopard frog. In addition, dense herbaceous cover and a canopy of cottonwoods or wills characterize habitat for this species.

The relict leopard frog populations located near the Overton Arm of Lake Mead are associated exclusively with geothermally influenced and perennial desert spring communities. Because the known populations are currently confined within a 5-mile (8km) area (Bradford and Jennings 1997), they are susceptible to extirpation from localized impacts. Threats to this species include habitat destruction, lowering of the water table, and predation by introduced bullfrogs (AGFD, 1996; AGFD 1998).

The known occurrences of relict leopard frogs are in association with springs that will not be affected by the interim surplus criteria alternatives being considered. If additional emergent marsh vegetation develops at the Lake Mead and Virgin River deltas as the result of lower lake levels, it may provide potential habitat for the relict leopard frog. However, predation by introduced fished and bullfrogs may preclude occurrence of the leopard frogs in these areas.

If the relict leopard frog is confirmed as occurring below Glen Canyon Dam it would be covered under the Glen Canyon Dam ROD (1996) and Adaptive Management Program and would not be affected by the interim surplus criteria alternatives being considered.

Southwestern Willow Flycatcher (*Empidonax traillii extimus*) – The southwestern willow flycatcher is a riparian obligate, neotropical migratory insectivore that breeds along rivers, streams, and other wetlands where dense willow, cottonwood, tamarisk, or other similarly structured riparian vegetation occurs (Service, 1995a; McKernan 1999; AGFD, 1997e). Populations of breeding Southwestern willow flycatchers have been recorded at the upper Lake Mead delta, the Virgin River delta, Mormon Mesa North, and the Lower Grand Canyon (AGFD, 1997e; Sogge et al., 1997). However, due to high lake levels, as discussed previously, the Lake Mead and Virgin River delta willow flycatcher habitat has been inundated. This change in reservoir elevation has permitted suitable willow riparian habitat to develop in the Colorado River corridor from Lake Mead up to approximately Separation Canyon (McKernan, 1999).

The Grand Canyon population of Southwestern willow flycatcher is important from a scientific and management perspective because it is one of the longest continuously monitored populations in the southwest (Sogge et al., 1997). In support of this view, the USFWS designated river mile 39 downstream to river mile 71.5 as critical habitat for this species (USFWS, 1997a, 1997c). This habitat occurs in the upper Grand Canyon and will not be affected by the interim surplus criteria.

High lake levels (above 1192 feet) appear to be detrimental to Southwestern willow flycatcher nesting habitat at Lake Mead delta due to potential loss of suitable nest trees (Reclamation, March 1998). Lake levels below 1192 feet during the willow flycatcher breeding season (April through August) appear to allow for increased willow habitat establishment which would be beneficial to the species. Suitable

habitat at the Lake Mead and Virgin River deltas is affected by fluctuations in lake levels as discussed above. Because this habitat is utilized by Southwestern willow flycatcher and may be affected by the interim surplus criteria, the species is considered in the environmental consequences section below.

Yuma Clapper Rail (*Rallus longirostris yumanensis*) – The Yuma clapper rail, one of seven North American subspecies of clapper rails, occurs primarily in the lower Colorado River Valley in California, Arizona and Mexico. It is a fairly common summer resident from Topock Gorge on the lower Colorado River south to Yuma in the United States, and at the Colorado River delta in Mexico. In the area under consideration, the Yuma clapper rail is associated with freshwater marshes with the highest densities of the subspecies occurring in mature stands of cattails and bulrush (Reclamation, August 1999). In recent years, individual clapper rails have been heard at Laughlin Bay and Las Vegas Wash in southern Nevada (NDOW, 1998), and individuals have been documented at the Lake Mead delta (Fitzpatrick, 2000), Virgin and Muddy rivers, and at sites within the lower Grand Canyon (McKernan, 1999). The marsh habitat utilized by Yuma clapper rail has the potential to be affected by the interim surplus criteria.

Western Yellow-billed Cuckoo (***Coccyzus americanus)* –** Historically, the western form of the yellow-billed cuckoo was a fairly common breeding species throughout the river bottoms of the western United States and southern British Columbia (Gaines and Laymon, 1984). Due to the loss of riparian woodland habitat, the cuckoo has become an uncommon to rare summer resident in scattered locations throughout its former range. Western yellow-billed cuckoo have been documented in riparian habitat in the lower Grand Canyon and Virgin River above Lake Mead (McKernan, 1999) and has the potential to be affected by the interim surplus criteria.

3.8.2.2.3 Special-Status Fish Species

Described below are special-status fish species present within the area under consideration. Also identified are the locations of designated critical habitat. Table 3.8-3 lists special-status fish species including common name, scientific name, and status. Currently, the Service is updating the existing recovery plans for the four endangered fish species included in this analysis.

Table 3.8-3
Special-Status Fish Species Potentially Occurring Within the Area of Analysis

Common Name	Scientific Name	Status
Bonytail	*Gila elegans*	Federally Listed Endangered (critical habitat designated); California Endangered; Nevada State Protected
Colorado pikeminnow	*Ptychocheilus lucius*	Federally Listed Endangered (critical habitat designated); California Endangered
Flannelmouth sucker	*Catostomus latipinnis*	Federal Species of Concern; Arizona Wildlife Species of Concern; Bureau of Land Management Nevada Special Status Species
Humpback chub	*Gila cypha*	Federally Listed Endangered (critical habitat designated)
Razorback sucker	*Xyrauchen texanus*	Federally Listed Endangered (critical habitat designated)

Bonytail (*Gila elegans*) – Adult bonytail were once found throughout the big rivers and major tributaries of the Colorado River basin. Younger fish utilize the smaller streams and quiet areas. Bottom habitat consists typically of clay, soft mud, or mud and sand, or occasionally rocks, gravel or rubble with little or no vegetation (Sigler and Miller, 1963; Wydoski, 1995). Adults range between 8 and 17 inches in length and weight just over one pound. The species can live to over 40 years of age. Spawning occurs in late spring to early summer usually over gravel bars with no nest being constructed. Gravid females can contain over 10,000 eggs each. Bonytail are carnivorous, feeding largely on insects, crustaceans, and snails; however, filamentous algae are often consumed (NPS, 1998).

The bonytail is now the rarest native fish within the Colorado River Basin (NPS, 1998). The decline in the number of bonytail are thought to be a result of changes in historical stream flow and water temperatures, blockage of migratory routes by dams, and introduction of non-native fish species. Present numbers are accounted for by fish older than 40 years of age; no recruitment has been demonstrated in recent years (NPS,1998).

Bonytail are believed to be extirpated in the Colorado River from Glen Canyon Dam to Hoover Dam (McCall, 1979 and Reclamation, August 1996). Small populations may still exist in the Upper Basin, but there is much confusion in fish identification due to the similarity in physical appearance with roundtail chubs (Reclamation, August 1996). Five suspected bonytail were captured in Cataract Canyon between 1985 and 1988, with one caught in Lake Powell near Wahweap Marina (Maddux et al., 1993 and Reclamation, March 1995). The largest remaining population of bonytail in the entire Colorado River Basin resides in Lake Mohave. There were at

least nine augmentation stockings of bonytail into Lake Mohave between 1981 and 1991 (Reclamation, August 1996). The historical population has most likely been extirpated. Efforts are being undertaken to reintroduce bonytail back to Lake Havasu from lakeside coves using young obtained from Dexter National Fish Hatchery (Reclamation, August 1996). The primary limiting factor for bonytail appears to be non-native fish predation of the early life stages (egg to subadult) (Reclamation, August 1996).

Designated critical habitat for the bonytail is the Colorado River from Brown Betty Rapid in T30S, R18E, sec. 34 (Salt Lake Meridian) to Imperial Canyon in T31S, R17E, sec. 28 (Salt Lake Meridian) (NPS, 1998).

Colorado pikeminnow (*Ptychocheilus lucius*) – The Colorado pikeminnow is the largest member of the minnow family within North America and is endemic to the Colorado River system. It has a large long head, somewhat pike-like, with a terminal mouth. It was, historically, the top predator fish in the Colorado River, but native populations are now restricted to the upper Colorado River Basin in Wyoming, Utah, Colorado, and New Mexico (Reclamation, August 1996). Colorado pikeminnow are now considered extirpated from the entire Lower Basin; where they were once extremely abundant. The last known wild adults from the lower Colorado River were captured in the 1960s, and the last known specimens from the Gila River basin were collected in 1958 (Minckley, 1973). Populations in the upper basin are thought to be stable or increasing, with documented natural recruitment. A portion of their current distribution includes the Colorado River from Palisades, Colorado downstream to Lake Powell (NPS, 1998). Colorado pikeminnow have been captured in Lake Powell as recently as 1999 (Reclamation, file data).

The species is adapted to large seasonal flow variations, high concentrations of silt, turbulence, periodically low food availability, and naturally variable riverine subsystems. It is typically a big river fish where the current is strong and the water heavily silt laden. Colorado pikeminnow are migratory and can utilize anywhere from 100 to 200 miles of river to complete their life cycle. Spawning takes place from spring to late summer depending on water temperatures. Larva and juvenile pikeminnow can drift 60 to 150 miles from spawning beds into nursery areas where they mature to a size that mostly prevents predation (Maddux et al., 1993; Sigler and Miller, 1963).

Designated critical habitat for the Colorado pikeminnow includes the Colorado River and its 100-year floodplain from the Colorado River bridge at exit 90 north of Interstate 70 in T6S, R93W, sec. 16 (6th Principal Meridian) to North Wash including the Dirty Devil arm of Lake Powell up to the full pool elevation in T33S, R14E, sec. 29 (Salt Lake Meridian), and the San Juan River and its 100-year floodplain from the State Route 371 Bridge in T29N, R13W, sec. 17 (New Mexico Meridian) to Neskahai Canyon in the San Juan arm of Lake Powell in T41S, R11E,

sec. 26 (Salt Lake Meridian) up to the full pool elevation (NPS, 1998). Additional designated critical habitat is located in the Green River, Utah, upstream of its confluence with the Colorado River.

Flannelmouth sucker (*Catostomus latipinnis)* – The flannelmouth sucker was historically found in medium to large rivers throughout the upper and lower Colorado River drainage (Joseph et al., 1977; AGFD, 1996a). Although the flannelmouth sucker is currently widely distributed in the upper Colorado River Basin (Holden and Stalnaker 1975a, b; McAda, et al., 1994), its occurrence in the lower Colorado River Basin has become more restricted. The species' range in the Upper Basin includes the main stem of the Colorado River, numerous tributaries that drain a large portion of Colorado and Utah, and the San Juan River drainage in New Mexico. In the Lower Basin, the flannelmouth sucker occurs only in localized areas of suitable habitat (Sublette et al., 1990). Populations in the lower Colorado River Basin occur in the Little Colorado River, Virgin River, Colorado River in Glen Canyon, Grand Canyon, lower Colorado River immediately below Davis Dam, and several small tributaries to the Colorado River above Lake Mead (AGFD, 1996a; Valdez and Carothers, 1998).

Flannelmouth suckers typically require medium to large flowing streams and react poorly to impounded habitats or habitats influenced by impoundments (Minckley, 1973), and the artificial thermal regime created by impoundments. Subadult flannelmouth suckers in the Grand Canyon use sheltered shoreline habitats, backwaters, and tributary inflows (Valdez and Ryel, 1995). Conversely, adults can be found in a variety of mainstem habitats, including: tributary mouths, vegetated shorelines, mid-channel cobble bars (Valdez and Ryel, 1995), eddies (Holden and Stalnaker,1975a; and Valdez and Ryel, 1995), and riffles (Holden and Stalnaker, 1975a). Spawning can take place from spring to early summer and is often preceded by an upstream migration.

Since 1986, the AGFD has conducted yearly monitoring of flannelmouth sucker populations in the Colorado River from Lees Ferry downstream to Lake Mead. The Glen Canyon Monitoring and Research Center (1998) has funded monitoring and research activities for this species. The objective of this program is to provide the knowledge base required to implement ecosystem management strategies within an adaptive management framework.

Humpback chub (*Gila cypha)* – Endemic to the Colorado River, the humpback chub inhabits the canyon-bound sections of the Colorado, Green, and Yampa rivers, with high fidelity for particular localized sites. Young are not known to widely disperse. The historical abundance and distribution of the fish is not well known. The largest population still extant is found in and near the Little Colorado River within the Grand Canyon (Maddux et al., 1993; Valdez and Ryel, 1995). The

possibility exists that humpback chub found in the Middle Granite Gorge and lower Grand Canyon may represent a separate population (Reclamation, August 1996).

Humpback chub becomes reproductively active between May and July depending on location and the hydrograph. Males become reproductively mature within three years. Spawning occurs during the highest spring flows when water temperatures approach 68°F (20°C) over cobble or gravel surfaces. Larvae tend to utilize silty bottom habitats. Later, humpback chub utilize a variety of habitats within a boulder strewn canyon environment (i.e., pools, riffles and eddies). They move between habitats dependent on life history needs and natural habitat change (NPS, 1998).

Young humpback chub feed mainly from the bottom eating small invertebrates and diatoms. Adults also feed mainly from the bottom but also feed on floating aquatic and terrestrial insects (SWCA, 1997; Valdez and Ryel, 1995; Wydoski, 1995).

The largest remaining population of humpback chub is found in the Colorado River in the Grand Canyon at the confluence with the Little Colorado River. This population uses the Little Colorado River for spawning and rearing.

Designated critical habitat for the humpback chub is the Colorado River from Brown Betty Rapid in T30S, R18E, sec. 34 (Salt Lake Meridian) to Imperial Canyon in T31S, R17E, sec. 28 (Salt Lake Meridian). (NPS, 1998.)

Razorback sucker (*Xyrauchen texanus*) – The razorback sucker was formerly the most widespread and abundant of the big-river fishes in the Colorado River. In the lower basin, razorback sucker apparently began to decline shortly after impoundment of Lake Mead in 1935. Today the species occupies only a small portion of its historical range, and most occupied areas have very low numbers of fish. The largest extant population occurs in Lake Mohave where the population consists of 25,000 fish down from over 60,000 adults in 1988 (Wydoski, 1995; Maddux et al., 1993; NPS, 1998).

In the upper Colorado River Basin, most razorback suckers occur in the Gunnison River, Grand Valley, Colorado but numbers appear to be declining. Razorback suckers may also be present in the San Juan River upstream of Lake Powell, but few specimens have been confirmed. Fifteen adults have been captured and removed from Lake Powell and a few individuals presumably remain there (NPS, 1998).

The razorback sucker is a large fish, reaching over 2 feet in length and 8 pounds in weight. Reproduction in the lower basin has been studied in Lake Mead and Lake Mohave. Spawning in Lake Mohave typically begins in January or February, while in Lake Mead it begins slightly later (Jonez and Sumner, 1954). Spawning typically runs 30 to 90 days at water temperatures ranging from 55°F to 70°F (13°C to 21°C). Spawning areas tend to be wave-washed, gravelly shorelines and shoals. Fish spawn in water from 3 to 20 feet in depth with the majority of fish in the 5- to 10-foot

range. Razorback suckers apparently spawn continuously throughout the spawning season, with females releasing only a portion of their gametes at each event. Spawning occurs both day and night on Lake Mohave (Reclamation, file data). Eggs hatch in 5 to 10 days depending on water temperature. Optimal hatching success is around 68°F (20°C); hatching does not occur at extremes of cold or hot (50°F or 86°F; 10 C to 30 C) (Marsh and Minckley, 1985). Larvae swim up within several days and begin feeding on plankton. Juvenile razorback suckers in lakeside rearing ponds hide during the day in dense aquatic vegetation and under brush and debris and in rock cavities (Reclamation, August 1996).

Most of the remnant populations of razorback sucker are found in Lake Mead and Lake Mohave. They are considered rare in the Grand Canyon and have been documented in Lake Powell as recently as 1999 (Reclamation, file data). Spawning success has been limited by the predation of eggs and young by non-native species. Currently, efforts are being made to introduce razorback sucker that have been raised in areas free of predators into Lake Mohave to help establish a larger population of breeding adults.

Designated critical habitat for the razorback sucker includes Lake Mead and Lake Mohave and the river reach between them. It also includes the Colorado River and its 100-year floodplain from Parker Dam to Imperial Dam, including Imperial Reservoir, and the Colorado River and its 100-year floodplain from Westwater Canyon in T20S, R25E, sec. 12 (Salt Lake Meridian) to full pool elevation, upstream of North Wash and including the Dirty Devil arm of Lake Powell in T33S, R14E, sec. 29 (Salt Lake Meridian) (NPS, 1998 and Reclamation, August 1996).

3.8.2.3 ENVIRONMENTAL CONSEQUENCES

This section evaluates the potential effects on special-status species and their habitat that could occur as a result of implementation of the interim surplus criteria alternatives under consideration. These potential effects are presented as a comparison to baseline conditions. This section is divided into three main special-status species categories: plants, wildlife and fish.

3.8.2.3.1 Special-Status Plant Species

Although a number of special-status plant species occur within GCNRA and LMNRA, only four have been identified as occurring within the area potentially affected by hydrological changes associated with the interim surplus criteria alternatives. These four species are Geyer's milkvetch, Grand Canyon evening primrose, Las Vegas bear poppy, and sticky buckwheat. Other special-status plant species listed in Table 3.8-1 are not discussed further for reasons identified in Section 3.8.2.2.1.

3.8.2.3.1.1 Baseline Conditions

Geyer's milkvetch, which occurs along the shoreline of Lake Mead, is mainly threatened by loss of habitat from inundation as a result of rising water levels at Lake Mead, invasion of shoreline (beach) habitat by tamarisk and arrowweed, and possibly trampling and grazing by burros. Shoreline recreation does not currently appear to be a major threat to this species because the beaches where it occurs do not receive heavy recreational use. This species would be affected by variations in Lake Mead surface elevations if suitable habitat were inundated. Baseline conditions indicate a decreased potential over time for such inundation to occur. If lake levels decline, exposing sand dune habitat and sandy soils, the species could benefit. However, if these areas are colonized by tamarisk after being exposed, there would be no net benefit.

Grand Canyon evening primrose are found in beach habitat within the Grand Canyon. The beach habitat in the Grand Canyon is often invaded by riparian vegetation and is also utilized by recreationists, which results in adverse conditions for Grand Canyon evening primrose establishment. To the extent that beach habitat is altered by releases from Glen Canyon Dam, this species is covered under the Glen Canyon Dam ROD (1996) and Adaptive Management Program. Indirect effects to the habitat for this species may, however, result from fluctuations in Lake Mead pool elevations. Under baseline conditions, Lake Mead elevations are projected to decline over time. Reductions in Lake Mead elevations would likely result in an increase in exposed beach habitat in the lower Grand Canyon to Lake Mead that would potentially provide more suitable habitat for Grand Canyon evening primrose.

Las Vegas bear poppy occurs along the lower levels of the Lake Mead shoreline. As with the Geyer's milkvetch, this species would benefit from lower water levels at Lake Mead and would be adversely affected by any increases in water levels. Benefits of lower surface elevations would be negated if invasion of exposed areas by tamarisk or other weedy exotic plant species were to occur.

Sticky buckwheat is found primarily along the Overton Arm of Lake Mead with smaller, potentially significant populations occurring in the vicinity of Overton Beach, along the Virgin River Valley, and along the Muddy River. As with the other three special-status plant species discussed, the major threats to sticky buckwheat at Lake Mead are the loss of habitat from inundation as the result of rising water levels at Lake Mead, and the invasion of shoreline (beach) habitat by tamarisk and arrowweed. This species could potentially benefit from lower lake levels at Lake Mead provided the newly exposed habitat was not colonized by weedy exotic plant species.

3.8.2.3.1.2 Flood Control Alternative

Potential effects to special-status plant species under the Flood Control Alternative would be similar to those discussed under baseline conditions in Section 3.8.2.3.1.1. However, under the Flood Control Alternative, there would be a slightly lower potential for Lake Mead surface elevation reductions as compared to baseline projections.

3.8.2.3.1.3 Six States Alternative

Potential effects to special-status plant species under the Six States Alternative would be similar to those discussed under baseline conditions in Section 3.8.2.3.1.1. However, under the Six States Alternative, there would be an increased potential for Lake Mead surface elevation reductions as compared to baseline projections.

3.8.2.3.1.4 California Alternative

Potential effects to special-status plant species under the California Alternative would be similar to those discussed under baseline conditions in Section 3.8.2.3.1.1. However, under the California Alternative, there would be an increased potential for Lake Mead surface elevation reductions as compared to baseline conditions.

3.8.2.3.1.5 Shortage Protection Alternative

Potential effects to special-status plant species under the Shortage Protection Alternative would be similar to those discussed under baseline conditions in Section 3.8.2.3.1.1. However, under the Shortage Protection Alternative, there would be an increased potential (the greatest potential among the alternatives) for Lake Mead surface elevation reductions as compared to baseline conditions.

3.8.2.3.2 Special-Status Wildlife Species

Special-status wildlife species with potential to occur in the area under consideration are discussed in Section 3.8.2.2.2. Although a number of these species are known to occur in the area under consideration, only 10 species have been identified as having the potential to be affected by hydrological changes that may be associated with the interim surplus criteria. These species are Arizona Bell's vireo, California black rail, Clark's grebe, Cooper's hawk, elf owl, gilded flicker, relict leopard frog, Southwestern willow flycatcher, Yuma clapper rail, and western yellow-billed cuckoo. Additional special-status wildlife species that occur from Glen Canyon Dam to the lower Grand Canyon (at approximately Separation Canyon) would not be affected by interim surplus criteria, or are considered, managed and monitored under the Glen Canyon Dam ROD (1996) and the Adaptive Management Program (Section 3.2.2). In addition, threatened and endangered species are managed under the Glen Canyon Dam Operations Biological Opinion (Service, 1994).

3.8.2.3.2.1 Baseline Conditions

The water surface elevation projected for Lake Powell indicates a potential for slightly declining water levels through year 2015, when the median elevation is 3663 feet msl. This decrease in lake levels would not affect any special-status wildlife species identified for this analysis and as a result, Lake Powell is not discussed further.

Water fluctuations of Lake Mead generally preclude development of shoreline riparian vegetation, with the exception of tributary inflow areas such as the Virgin River and Lake Mead deltas (Reclamation, August 1999). Woody riparian vegetation (i.e., cottonwood and willow) has become abundant below Separation Canyon into Lake Mead as lake levels have declined after high floodflows of 1983-1986 (Reclamation, 1995). As the probability for declining reservoir levels increases over time under baseline projections (as shown on Figure 3.3-16), an increase in the amount of sediment exposed in the Lake Mead delta and Virgin River delta would create more favorable conditions for establishment of woody riparian habitat. An increase in riparian habitat in the Colorado and Virgin rivers immediately above Lake Mead, and the Lake Mead and Virgin deltas would potentially benefit Arizona Bell's vireo, Cooper's hawk, elf owl, gilded flicker, western yellow-billed cuckoo and Southwestern willow flycatcher as additional nesting habitat.

With an increase in the probability for Lake Mead water levels to decline under baseline projections, there is an increased potential for sediment exposure that may create suitable conditions for marsh vegetation to develop and/or expand at the Lake Mead and Virgin River deltas, as well as the Colorado and Virgin Rivers above Lake Mead. This would in turn increase the amount of habitat preferred for nesting by California black rail, Clark's grebe and Yuma clapper rail. In addition, an increase in emergent marsh vegetation would provide potential habitat for the relict leopard frog. However, marsh vegetation may only develop as suitable wildlife habitat if the water table does not fall below what is requisite for marsh plant species to establish.

Riparian and marsh vegetation is typically located within the shallow water table zone near the lake shoreline. Although lowering lake levels has the potential to increase the amount of riparian and marsh vegetation because of increased sediment exposure, these habitat types would only become established if lake levels do not drop excessively. If the exposed sediment is too far above the water table, riparian and marsh habitat is not likely to become established.

3.8.2.3.2.2 Flood Control Alternative

As shown in Figures 3.3-6 and 3.3-13, median water levels at Lake Powell and Lake Mead under the Flood Control Alternative are slightly higher than baseline conditions throughout the period of analysis. Beyond 2015, surface elevation

reduction potential becomes equivalent to the potential under baseline conditions. As such, there would be a slightly lower potential for riparian and marsh habitat to develop at the Lake Mead or Virgin River deltas. However, there wold be a slightly increased potential for development of riparian and marsh habitat in the lower Grand Canyon and Virgin River above Lake Mead. Establishment of riparian and marsh vegetation in these areas may provide potential habitat for the 10 special-status wildlife species considered in this analysis.

3.8.2.3.2.3 Six States Alternative

As shown in Figures 3.3-6 and 3.3-13, there would be an increased potential for reductions in water levels at Lake Powell and Lake Mead under the Six States Alternative as compared to baseline conditions through year 2015. Beyond 2015, surface elevation reduction potential becomes equivalent to the potential under baseline conditions. Vegetation associated with Lake Powell and Lake Mead, including riparian and marsh habitat in the Virgin River delta and Lake Mead delta, would experience changes similar to those described above under baseline conditions. Consequently, the potential for changes in special-status species' habitat associated with Lake Powell, Lake Mead, the lower Grand Canyon, and the Lake Mead and Virgin River deltas would be similar to those expected under baseline conditions.

3.8.2.3.2.4 California Alternative

As shown in Figures 3.3-6 and 3.3-13, there would be an increased potential for reductions in water levels at Lake Powell and Lake Mead under the California Alternative as compared to baseline conditions through year 2015. Beyond 2015, surface elevation reduction potential becomes equivalent to the potential under baseline conditions. Vegetation associated with Lake Powell and Lake Mead, including riparian and marsh habitat in the Virgin River delta and Lake Mead delta, will experience changes similar to those described above under baseline conditions. Consequently, the potential for changes in special-status species' habitat associated with Lake Powell, Lake Mead, the lower Grand Canyon, and the Virgin River and Lake Mead deltas for the California Alternative would be similar to those expected under baseline conditions.

3.8.2.3.2.5 Shortage Protection Alternative

As shown in Figures 3.3-6 and 3.3-13, there would be an increased potential for reductions in water levels at Lake Powell and Lake Mead under the Shortage Protection Alternative as compared to baseline conditions through year 2015. Beyond 2015, surface elevation reduction potential becomes equivalent to the potential under baseline conditions. Vegetation associated with Lake Powell and Lake Mead, including riparian and marsh habitat in the Virgin River delta and Lake Mead delta, will experience changes similar to those described above under baseline

conditions. Consequently, the potential for changes in special-status species' habitat associated with Lake Powell, Lake Mead, the lower Grand Canyon, and the Lake Mead and Virgin River deltas would be similar to those expected under baseline conditions.

3.8.2.3.3 Special-Status Fish Species

Operations at Glen Canyon Dam and Hoover Dam include various programs designed to aid in the conservation and recovery of endangered native species in the lower Colorado River basin. These programs include Section 7 consultation under the ESA, the AMP and ROD (1996), the LCRMSCP and the Upper Colorado and San Juan River Basin Recovery Implementation Programs for endangered fish. Designated critical habitat for all four of the native endangered fish species has been identified. Protection of these habitats is required by the ESA. These programs and protections would remain in effect under baseline conditions and each of the interim surplus criteria alternatives. As discussed in Section 3.8.2.2.3, current lake conditions are not favorable for recovery of endangered fish. Future baseline conditions and each of the interim surplus criteria are expected to increase, to varying degrees, the potential for reduced reservoir surface elevations.

The following sections discuss potential future conditions for each of the special-status fish species. These effects may occur under baseline conditions and each of the alternatives.

3.8.2.3.3.1 Bonytail

Under future conditions, it is anticipated that bonytail populations would continue to be rare in the Colorado River Basin and designated critical habitat would continue to be protected under the ESA. As such this species would not be affected by the interim surplus criteria.

The main effort to protect and conserve bonytail is the reintroduction of fingerling bonytail from the Dexter National Fish Hatchery that have been reared in predator-free ponds into Lake Mohave by the NFWG. The primary limiting factor for bonytail is predation of early life stages by non-native species.

3.8.2.3.3.2 Colorado Pikeminnow

Under future conditions, it is anticipated that Colorado pikeminnow populations would continue to be restricted to the Upper Basin and designated critical habitat would continue to be protected under the ESA. The Colorado pikeminnow is extirpated from all areas within the project except for Lake Powell. The ability of the Colorado pikeminnow to successfully reproduce in Lake Powell has not been confirmed. Successful spawning is thought to occur in riverine habitats and larvae then drift downstream to rear in sheltered environments. For Colorado pikeminnow

that spawn in the Colorado River upstream of Lake Powell or other inflow areas, survival of larvae that drift into the reservoir is limited by predation of non-native fish. Higher lake elevations may reduce the amount of sheltered riverine habitat and indirectly impact the survival of some larvae.

3.8.2.3.3.3 Flannelmouth Sucker

Under future conditions, it is anticipated that flannelmouth sucker populations in the project area would continue to be found in riverine habitats and tributaries. The species is not well adapted to lake habitats and are seldom found there. The low survival of eggs and larvae may be attributed to impacts from cold water temperatures or predation by non-native species. These conditions would continue to limit the reproductive success of flannelmouth sucker in the project area. For flannelmouth sucker that spawn in rivers upstream of Lake Mead and Lake Powell or other inflow areas, survival of larvae that drift into the reservoirs is limited by cold water temperatures and predation of non-native fish. Higher lake elevations may reduce the amount of sheltered riverine habitat and indirectly impact the survival of some larvae.

3.8.2.3.3.4 Humpback Chub

Under future conditions, it is anticipated that humpback chub populations would continue to be restricted to riverine and tributary habitats in the Colorado River through Glen and Grand Canyons and designated critical habitat would continue to be protected under the ESA and the Glen Canyon Adaptive Management Program. As such, this species would not be affected by the interim surplus criteria. The humpback chub is considered extirpated from all other areas within the lower Colorado River Basin.

3.8.2.3.3.5 Razorback Sucker

Under future conditions, it is anticipated that razorback sucker populations would continue to be limited in the Lower Basin to primarily Lake Mead and Lake Mohave and designated critical habitat would continue to be protected under the ESA. Efforts are currently being made to supplement adult breeding populations of razorback suckers by stocking lakes with young reared in predator free ponds. Operations at Lake Mohave are conducted in an effort to conserve and protect razorback sucker by controlling the amount of lake fluctuation during the spawning season. Spawning success has been limited by predation of eggs and larvae by non-native fish. These practices are expected to continue under baseline conditions and the alternatives considered. As such, this species would not be affected by the interim surplus criteria.