3.8 SPECIAL-STATUS SPECIES

3.8.1 INTRODUCTION

This section identifies potential effects of proposed interim surplus criteria to aquatic and terrestrial species of concern and their habitat, from Lake Powell to the SIB. Potential impacts to special-status species in Mexico are discussed in Section 3.16, Transboundary Impacts. As discussed in Section 1.4, a considerable amount of information pertinent to this analysis is available from various documents prepared by Reclamation and the Service under NEPA and/or the ESA, and is incorporated by reference.

Special-status species are species that are listed, or are proposed for listing, as "threatened" or "endangered" under the federal ESA that may be present in the area affected by the proposed action, and also include species of special concern to states or other entities responsible for management of resources within the area of analysis. This section contains a discussion of the life history requirements of each species, followed by an analysis of potential impacts to the species and its habitat.

Reclamation is consulting with the Service (and NMFS) to meet its responsibilities under Section 7 of the ESA on the effects of the proposed action to federally listed species. Reclamation prepared a biological assessment (BA) which evaluates the potential effects on listed species which may occur in the area from the headwaters of Lake Mead to the SIB (Reclamation, 2000). Preliminary evaluation of the effects to listed species which may be present in the Colorado River corridor from Glen Canyon Dam to the headwater of Lake Mead led to the conclusion that the interim surplus criteria would not affect any species. Therefore, this area was not addressed in the BA. Refinements to the model used to predict future operations of Glen Canyon Dam for this EIS indicated there would be a minor change in the frequency with which flows recommended by the 1994 biological opinion concerning operation of Glen Canyon Dam would be triggered. It was determined that this change may affect listed species. The results of this analysis were provided to the Service in a November 29, 2000 memorandum as supplemental information to the BA, which is included in Attachment S.

Potential impacts to special-status species occurring in Mexico are discussed separately in Section 3.16, Transboundary Impacts. Specifically, Section 3.16 considers the potential effects on the following species: desert pupfish, vaquita, totoaba, Southwestern willow flycatcher, Yuma clapper rail, yellow-billed cuckoo, California black rail, elf owl, Bell's vireo, and Clark's grebe. Although consultation on species occurring in Mexico may not, as a matter of law, be required by the ESA, Reclamation is also supplementing the BA to include information pertinent to federally listed species from this analysis.

3.8.2 METHODOLOGY

Information on the affected environment and special-status species that may occur in the analysis area was compiled based on review of the pertinent documents listed in Section 1.4, available published and unpublished literature, and through personal communication with agency resource specialists. Species' distribution, range and habitat requirements were reviewed. These requirements formed the basis for compiling an initial list of plant, wildlife and fish species to be considered.

This analysis first discusses vegetative communities that exist throughout the analysis area, from Lake Powell to the SIB. Potentially affected plant, wildlife and fish species are then determined by considering hydrologic requirements and other habitat elements important to the species, such as nesting or breeding habitat for birds and spawning and rearing areas for fish. Species that are not known to be present in the analysis area, do not depend on terrestrial or aquatic habitat associated with the area under consideration or have a hydrologic connection are addressed briefly and removed from further consideration. The analysis of effects to the remaining potentially affected plant, animal and fish species and their habitat follows the section on the affected environment.

3.8.3 AFFECTED ENVIRONMENT

Vegetative communities within the analysis area are discussed, based on if they are located alongside the reservoirs (lakeside habitat) or along the Colorado River (riverside habitat). The special-status species are then identified. The species are divided into three main categories: plants, wildlife and fish. Tables in this section list the species' common and scientific names and current status, and indicate if critical habitat has been federally designated. Following each table, the occurrence and requirements of the species is provided. Species that would not be affected by the interim surplus criteria are identified and removed from further analysis.

3.8.3.1 LAKE AND RIPARIAN HABITAT

A description of lakeside vegetation associated with Lake Powell and GCNRA is provided below, followed by a description of vegetation associated with Lake Mead and LMNRA (which includes Lake Mohave) and Lake Havasu. This section then describes riverside habitat along the Colorado River corridor from Separation Canyon to the Lake Mead delta and below Hoover Dam. Aquatic habitat is discussed in the previous section on Aquatic Resources (Section 3.7).

3.8.3.1.1 Lakeside Habitat

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, 1999d), and the continuously fluctuating lake levels that precludes

establishment of 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, 1987).

Small intermittent or seasonal streams occur in many of 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.) (NPS, undated b). The vegetation within these side canyons has been altered by the lake itself as a result of periodic inundation in association with fluctuating lake levels. In areas where there are 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, 1987).

The GCNRA also 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, 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. GCNRA 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, 1992). Other species typically associated with hanging gardens include maidenhair fern, golden columbine (*Aquilegia chrysantha*) and scarlet monkeyflower (*Mimulus cardinalis*).

The highest concentration of 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 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, tamarisk was the dominant tree species in the Lake Mead delta (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 five 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. As such, conditions for establishment of native vegetation at the Lake Mead delta have improved since 1963 allowing cottonwood and willow to become the dominant vegetation.

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, 1998c). The water surface elevations in 1996 and 1997 were 1192 feet and 1204 feet, respectively (Reclamation, 1998c). 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, 1998c).

Section VI of the BA (Reclamation, 2000) provides additional information on fluctuations in lake levels and development of riparian habitat at Lake Mead. It notes that determining exactly how many acres of riparian habitat that may be formed due to declining levels at Lake Mead under the proposed interim surplus criteria is problematic. It further states that the majority of the Lake Mead shoreline does not have the soil necessary to regenerate riparian habitat, and that riparian habitat created by declining lake levels would most likely occur in four areas: Lake Mead delta, Virgin River delta, Muddy River delta and the portion of the Lower Grand Canyon influenced by Lake Mead. However, future wet hydrologic cycles, would inundate the newly established riparian habitat.

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 and Muddy rivers above Lake Mead (Reclamation, 1998c). 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. Lower water levels in Lake Mead that expose sediments in the Lake Mead, Virgin River and Muddy River deltas have the potential to benefit establishment of riparian habitat in

these areas. However, lower water levels in Lake Mead do not benefit establishment of riparian and marsh habitat in the lower Grand Canyon. In order for riparian and marsh habitats to become established along the Colorado River in the lower Grand Canyon, higher water levels in Lake Mead are necessary.

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, 1996a). 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). 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 river flows during winter with lower flows during summer), these sites are more likely to support emergent marsh vegetation (Reclamation, 1995b). 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, 1996a). Marsh vegetation that develops during low lake levels is important habitat for many species, particularly breeding birds.

The interim surplus criteria BA (Reclamation, 2000) provides additional information on fluctuations in lake levels and development of riparian habitat at downstream reservoirs (Lake Mohave and Lake Havasu). The interim surplus criteria are not expected to affect levels of the downstream reservoirs as they would be continue to be regulated to meet downstream flood control, power generation and water delivery purposes.

3.8.3.1.2 Riverside Habitat

The riparian vegetation along the Colorado River is among the most important wildlife habitat in the region. 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, 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, 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 and extending downriver approximately two to three miles. In the lower canyon, arrowweed *(Pluchea sericea*) and horsetail are common. Below Havasu Creek, bermuda grass becomes the dominant ground cover at many sites (Reclamation, 1996a).

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 (Reclamation, 1996a). Catclaw acacia in the Grand Canyon 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).

Two types of marsh plant associations have been identified along the Colorado River (Stevens and Ayers, 1991). 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 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, the interim surplus criteria may affect backwater marshes 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. Section V of the BA (Reclamation, 2000) discusses historic and existing marsh, backwater and aquatic habitat on the lower Colorado River below Hoover, Davis and Parker dams.

3.8.3.2 SPECIAL-STATUS PLANT SPECIES

The list of special-status plants in Table 3.8-1 below is based on documented or potential occurrence within vegetation communities of the Glen Canyon National Recreation Area (GCNRA), Lake Mead National Recreation Area (LMNRA) and the Colorado River corridor in the lower Grand Canyon. No special-status plant species were identified for analysis below Hoover Dam. Nineteen plant species were removed from detailed consideration, as discussed in the next section. Four species could be affected by interim surplus criteria alternatives and are considered further.

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.

3.8.3.2.1 Plant Species Removed from Further Consideration

This section discusses the reasons for eliminating certain special-status plant species from detailed 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 ladies' tresses occur in moist to wet meadows along perennial streams at elevations between 4,300 and 7,000 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.

3.8.3.2.2 Plant Species Considered Further

Geyer's Milkvetch - 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 (i.e., 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 (i.e., 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 Lake Mead (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 - 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 - 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 - 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 (i.e., tamarisk and arrowweed); and possibly three) 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 Lake Mead (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.

3.8.3.3 SPECIAL-STATUS WILDLIFE SPECIES

Special-status wildlife species with the potential to occur within the area under consideration in the United States are listed in Table 3.8-2. Two invertebrate, two amphibian, and one reptile species are of concern. Eleven bird species and two mammals are of concern. A number "1" after the species on the table indicates the species has the potential to be affected by the interim surplus criteria alternatives, and is therefore assessed in more detail.

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

Common Name	Scientific Name	Status
Invertebrates		
MacNeill's sootywing skipper	*Hesperopsis gracielae*	Federal Species of Concern
Kanab ambersnail	*Oxyloma haydeni kanabensis*	Federally Listed Endangered; Arizona Wildlife of Special Concern
Amphibians		
Northern leopard frog	*Rana pipiens*	Arizona Candidate for Listing
Relict leopard frog	*Rana onca*	Nevada State Protected; Arizona Wildlife of Special Concern
Reptiles		
Sonoran mud turtle	*Kinosternon sonoriense sonoriense*	California Species of Special Concern
Birds		
American peregrine falcon	*Falco peregrinus anatum*	California Endangered; Nevada State Protected and Endangered
Arizona Bell's vireo[1]	*Vireo bellii arizonae*	California Endangered
Bald eagle[1]	*Haliaeetus leucocephalus*	Federally Listed Threatened; California Endangered; Nevada State Protected and Endangered
California black rail[1]	*Laterallus jamaicensis coturniculus*	Federal Species of Concern; California Threatened
Clark's grebe[1]	*Aechmophorus clarkii*	Arizona Wildlife of Special Concern
Cooper's hawk[1]	*Accipiter cooperii*	California Species of Special Concern
Elf owl[1]	*Micrathene whitneyi*	California Endangered
Gilded flicker[1]	*Colaptes chrysoides*	California Endangered
Southwestern willow flycatcher[1]	*Empidonax traillii extimus*	Federally Listed Endangered (critical habitat designated); California Endangered; Nevada State Protected
Yuma clapper rail[1]	*Rallus longirositris yumaniensis*	Federally Listed Endangered; California Threatened
Western yellow-billed cuckoo[1]	*Coccyzus americanus*	Federally Proposed Endangered; California Endangered; Nevada State Protected
Mammals		
Colorado River cotton rat	*Sigmodon arizonae plenus*	Federal Species of Concern; California Species of Special Concern
Occult little brown bat	*Myotis lucifugus occultus*	Federal Species of Concern; California Species of Special Concern

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

3.8.3.3.1 Wildlife Species Removed from Further Consideration

The Kanab ambersnail occurs in semi-aquatic habitat associated with springs and seeps. In the Grand Canyon, Kanab amber snail were originally known to occur only at Vasey's Paradise, a large perennial spring. As part of an effort to recover the species, Kanab amber snails were translocated from Vasey's Paradise to three other locations. One of the criteria used to select these sites was that it be above the level of any potential future flood flows past Glen Canyon dam. These populations would not be affected by the adoption of interim surplus criteria. Reclamation has consulted with the Service on the effects to the Vasey's Paradise population from the operations of Glen Canyon Dam. The resulting biological opinion (USFWS, 1996) continues to be implemented and will not be affected by the proposed action. There will be no effect from the adoption of interim surplus criteria.

The northern leopard frog is known to occur in association with a spring at one site below Glen Canyon Dam. The population was monitored before and after the 1996 BHBF and found to persist under these flows. This species receives consideration under the Glen Canyon Dam AMP (see Section 3.2.2). The minor changes to operations of Glen Canyon due to adoption of the interim surplus criteria are not expected to affect the northern leopard frog.

Historically, the relict leopard frog (*Rana onca)* 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 three of 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 two 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 four 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 soils is required by the relict leopard frog. In addition, dense herbaceous cover and a canopy of cottonwoods or willows 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 five-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 fishes and bullfrogs may preclude occurrence of the leopard frogs in these areas. Reclamation concludes that the interim surplus criteria do not have the potential to affect the relict leopard frog.

MacNeill's sootywing skipper is a butterfly found along the Colorado River from southern Utah and Nevada to Arizona and southeastern California (Reclamation, 1996a). 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 also occurs along the Muddy River above Lake Mead (Austin & Austin, 1980).

The larval host plant for MacNeill's sootywing skipper is quailbrush (*Atriplex lentiformis*). Quailbrush is the largest salt bush found in Arizona and forms dense thickets along the drainage system of the Colorado River (Emmel and Emmel, 1973). Quailbrush is associated with floodplains 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 along the Muddy River 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, 1999). 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.

Lake Powell and Lake Mead provide breeding and wintering habitat for American peregrine falcons. The peregrine falcon breeds 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 above water of peregrine nests at GCNRA is approximately 460 feet (141 meters), with average cliff heights of 630 feet (193 meters) (Hetzler 1992a**,** Hetzler 1992b). These data include nest sites in Glen Canyon immediately below the Glen Canyon Dam as well as sites on Lake Powell. Glen Canyon Dam operations have resulted in increased riparian vegetation which supports a larger population of passerines and increased the food base for peregrine falcons.

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). Because their nesting sites are well above the water and their food base has increased, peregrine falcons would not be affected by hydrologic changes associated with the interim surplus criteria and have been eliminated from further analysis.

The Sonoran mud turtle, Colorado River cotton rat, and occult little brown bat were removed from further consideration because there are no known occurrences in the analysis area.

3.8.3.3.2 Special-Status Wildlife Species Considered Further

Arizona Bell's Vireo - The Arizona Bell's vireo (*Vireo bellii arizonae*) 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.

Bald Eagle - The bald eagle historically ranged throughout North America except extreme northern Alaska and Canada and central and southern Mexico. In 1978, in response to lowering population and reproductive success, the Service listed the bald eagle throughout the lower 48 states as endangered except in Michigan, Minnesota, Wisconsin, Washington and Oregon, where it was designated as threatened (43 FR 6233, February 14, 1978). In 1982, a recovery plan was developed specifically for the southwestern bald eagle; the geographic boundary includes southeast California within 10 miles of the Colorado River or its reservoirs. The bald eagle population has clearly increased in number and expanded its range since it was listed. This improvement is a direct result of the banning of DDT and other persistent organochlorines, habitat protection, and from other recovery efforts (60 FR 36001, July 12, 1995). On August 11, 1995, FWS reclassified the bald eagle from endangered to threatened in the lower 48 states. (60 FR 133, pg. 3600, August 12, 1995).

Reclamation's 1996 BA concluded that its Lower Colorado river operations and maintenance activities are not likely to adversely affect the food resources, foraging opportunities, or the nesting habitat of the bald eagle. Based on data from bald eagle winter counts conducted by the AGFD since 1992, eagles are not considered rare within

the project area. Wintering birds are expected to continue using the river and most likely will congregate where food resources are plentiful and excessive disturbance from recreation can be avoided. The 1996 BA also cites studies by Hunt et al., (1992) that conclude reservoirs and dams did not appear to have a negative effect on bald eagle reproduction. River operations and maintenance may affect establishment of newly regenerated cottonwood/willow stands that could provide future nesting and perching substrate for eagles. However, as documented in Hunt et al. (1992), bald eagles can successfully nest on other substrates (cliffs, pinnacles). Reclamation's ongoing native riparian plant restoration program has the potential to increase available tree nesting and perching habitat along the river. No evidence exists to suggest that the food resources available in the reservoirs and river are limiting nesting. Because of the minor changes to the operation of Glen Canyon Dam and the minor hydrologic changes in the reservoirs and along the river, Reclamation determined that adoption of the interim surplus criteria would not adversely affect the bald eagle.

California Black Rail - California black rail (*Laterallus jamaicensis coturniculus*) have recently been documented in the Virgin River Canyon, including the corridor above Lake Mead (McKernan, 1999). 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 occurrence and potential impacts to species along the river corridor in Mexico are also discussed in Section 3.16.

Clark's Grebe – Clark's grebes (*Aechmophorus clarkii*) 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 – Cooper's hawks (*Accipiter cooperii*) 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 – The elf owl (*Micrathene whitneyi*) 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 – The gilded flicker (*Colaptes chrysoides*) 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). 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.

Southwestern Willow Flycatcher – The Southwestern willow flycatcher (*Empidonax traillii extimus*) 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 occurrence of this species and habitat below Lake Mead to the SIB is discussed in the BA for this proposed action (Reclamation, 2000).

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. From January 1978 until June 1990, Lake Mead elevations were above 1182 feet on a continuous basis. In June 1990, Lake Mead elevation declined to approximately 1182 feet and stayed below that elevation until the end of 1992 (Reclamation, 2000). If saturated soils are present in areas occupied by willow flycatcher, declines in lake levels during June have little to no effect on nesting. In contrast, when Lake Mead's elevation is high enough to inundate the delta, which typically occurs during June and July (Reclamation, 2000), willow flycatchers would not be affected because their territories and possibly nest sites would be established. Because suitable habitat utilized by Southwestern willow flycatcher may be affected by changes in Lake Mead water levels that would result from implementation of the interim surplus criteria, the species is considered in the environmental consequences section below. The interim surplus criteria are not expected to result in hydrologic changes below Hoover, Davis and Parker dams that would adversely affect the flycatcher.

Yuma Clapper Rail – The Yuma clapper rail (*Rallus longirostris yumanensis*), 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 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 Virgin and Muddy rivers including the Virgin River floodplain between Littlefield, AZ and the Virgin River Delta, NV (McKernan, 1999), and at sites within the lower Grand Canyon (McKernan, 1999). The occurrence of the Yuma Clapper below Lake Mead to

the SIB is discussed the BA for this proposed action (Reclamation, 2000). The marsh habitat utilized by Yuma clapper rail has the potential to be affected by the interim surplus criteria.

Western Yellow-billed Cuckoo – Historically, the western form of the yellow-billed cuckoo (*Coccyzus americanus*) 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) (Reclamation, 2000) as well as in habitat along the river corridor below Lake Mead and has the potential to be affected by the interim surplus criteria.

3.8.3.4 SPECIAL-STATUS FISH SPECIES

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

Critical habitat has been designated for each of the federally listed fish species (Federal Register: March 21, 1994), and portions of this habitat exist within the area of potential effect (Reclamation, 2000).

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 – Adult bonytail (*Gila elegans*) were once found throughout the big rivers and major tributaries of the Colorado River basin. Younger fish utilize the smaller streams and quiet areas. Bonytail prefer substrate which consists 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 eight and 17 inches in length and weigh just over one pound. The species can live for over 40 years. Spawning occurs in late spring to early summer usually over gravel bars with no nest being constructed. Gravid females can carryover 10,000 eggs each. Bonytail are carnivorous, feeding on insects, crustaceans, small fish, 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. At Lake Powell, 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, 1996a). 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, 1996a). 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, 1995).

Critical habitat for bonytail includes the Colorado River from Hoover Dam to Davis Dam, including Lake Mohave. It also includes the Colorado River from the northern boundary of Havasu National Wildlife Refuge to Parker Dam, including Lake Havasu. 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, 1996a). Efforts are being undertaken to repatriate bonytail back to Lake Havasu from lakeside coves using young obtained from Dexter National Fish Hatchery (Reclamation, 1996a). The primary limiting factor for bonytail appears to be non-native fish predation of the early life stages (egg to subadult) (Reclamation, 1996a).

Colorado pikeminnow – The Colorado pikeminnow (*Ptychocheilus lucius*) is the largest member of the minnow family within North America and is endemic to the Colorado River system. It was, historically, the top predator fish in the Colorado River, but native populations are now restricted to the upper Colorado River Basin (Reclamation, 1996a). 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). Designated critical habitat within the area of effect for the analysis is limited to the normal pool elevation of Lake Powell. 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). Colorado pikeminnow were taken from Lake Havasu in the 1970s. Populations in the upper basin are thought to be stable or increasing, with documented natural recruitment.

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).

Flannelmouth sucker – The flannelmouth sucker (*Catostomus latipinnis*) 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 and Utah. In the Lower Basin, the flannelmouth sucker occurs only in localized areas of suitable habitat (Sublette et al., 1990). Populations in the Lower Basin occur in the Little Colorado River, Virgin River, Colorado River in Glen Canyon, Grand Canyon, and 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 – Endemic to the Colorado River, the humpback chub (*Gila cypha*) 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. Designated critical habitat includes the Colorado River from Nautiloid Canyon to Granite Park in the Grand Canyon, and the lower eight miles of the Little Colorado River, including its confluence with the Colorado River. 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). This population uses the Little Colorado River for spawning and rearing. The possibility exists that humpback chub found in the Middle Granite Gorge and lower Grand Canyon may represent a separate population (Reclamation, 1996a).

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).

Razorback sucker – The razorback sucker (*Xyrauchen texanus*) 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. 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. Reclamation's BA includes a detailed discussion of this species occurrence and requirements (Reclamation, 2000).

In Lake Mead, the fish were abundant for many years after the reservoir filled, but declined during the 1960s and 1970s. The current population in Lake Mead is estimated to be less than 300 fish. The capture of a small number of juvenile adults since 1997 along with recent capture of larval razorback sucker in the spring of 2000 (Holden, Personal communication) indicates some successful recruitment is taking place. There are two populations of razorback sucker in Lake Mead in Las Vegas Bay and Echo Bay. A five-year study is underway to determine population size and movements of this fish and to determine why there is a small number of fish able to recruit, thus enabling a small number of razorback sucker to persist in Lake Mead.

The razorback sucker is a large fish, reaching over two feet in length and eight 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 three to 20 feet in depth with the majority of fish in the five- 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 five 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, 1996a, 2000).

Most of the remnant populations of razorback sucker are found in Lake Mead and Lake Mohave (Reclamation, 2000). 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, and continued study of the persistent population in Lake Mead is planned (Reclamation, 2000).

3.8.4 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. This section is divided into three main special-status species categories: plants, wildlife and fish. For each category, the potential effects under baseline conditions are presented first, followed by a discussion of the alternatives as compared to baseline conditions.

3.8.4.1 EFFECTS ON SPECIAL-STATUS PLANT SPECIES

Only four plant species would potentially be affected by hydrological changes associated with the interim surplus criteria alternatives: Geyer's milkvetch, Grand Canyon evening primrose, Las Vegas bear poppy and sticky buckwheat.

3.8.4.1.1 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.

3.8.4.1.2 Effects of the Alternatives

Potential effects to special-status plant species under the each of the alternatives would be similar to baseline conditions. Each alternative would result in Lake Mead elevations that would vary from those under baseline conditions, with the Flood Control Alternative resulting in slightly higher reservoir elevations, and the Basin States, Six States, California and Shortage Protection alternatives having lower reservoir elevations as compared to baseline projections. (Section 3.3 discusses the modeling results concerning potential future reservoir elevation trends in detail.) The differences in

potential future Lake Mead elevations under the alternatives as compared with baseline conditions are not expected to adversely affect the special-status plant species discussed above, as lower Lake Mead elevation trends may benefit these species.

3.8.4.2 EFFECTS ON SPECIAL-STATUS WILDLIFE SPECIES

Special-status wildlife species with potential to occur in the area under consideration are Arizona Bell's vireo, bald eagle, California black rail, Clark's grebe, Cooper's hawk, elf owl, gilded flicker, Southwestern willow flycatcher, Yuma clapper rail and western yellow-billed cuckoo.

Under baseline conditions and each of the alternatives, the water surface elevation projected for Lake Powell indicates a potential for slightly declining water levels during the first 15 years of the period of analysis. Figure 3.3-6 in Section 3.3 shows modeled Lake Powell elevations. The differences between the alternatives and baseline conditions would not affect any special-status wildlife species identified for this analysis and as a result, Lake Powell is not discussed further.

3.8.4.2.1 Baseline Conditions

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, 1999). Woody riparian vegetation (i.e., cottonwood and willow) become abundant from below Separation Canyon to the Lake Mead delta as lake levels declined following high runoff years of 1983-1986 (Reclamation, 1995). As the probability for declining reservoir levels increases over time under baseline projections (as shown on Figure 3.3-13 in Section 3.3), an increase in the amount of sediment exposed in the Lake Mead and Virgin River deltas would again create favorable conditions for establishment of woody riparian habitat. An increase in riparian habitat along the deltas would potentially benefit Arizona Bell's vireo, Cooper's hawk, elf owl, gilded flicker, western yellow-billed cuckoo and Southwestern willow flycatcher. The interim surplus criteria alternatives are not expected to impact these species in the river corridor below Hoover Dam to the SIB (Reclamation, 2000).

The increase in the probability for Lake Mead water levels to decline under baseline projections would also increase 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 along the Colorado, Virgin and Muddy rivers above Lake Mead. This would in turn increase the amount of preferred habitat for California black rail, Clark's grebe and Yuma clapper rail.

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.

3.8.4.2.2 Effects of the Alternatives

Potential effects on special-status wildlife species would be similar to baseline conditions. Each alternative would result in Lake Mead elevations that would vary from those under baseline conditions, with the Flood Control Alternative resulting in slightly higher reservoir elevations, and the Basin States, Six States, California, and Shortage Protection alternatives having lower reservoir elevations as compared to baseline projections. (Section 3.3 discusses the modeling results concerning potential future reservoir elevation trends in detail.) Under each of the alternatives, vegetation associated with Lake Mead, including riparian and marsh habitat in the Virgin River and Lake Mead deltas, would experience changes similar to those described above under baseline conditions. Consequently, the potential for changes in special-status species' habitat associated with Lake Mead, and the Lake Mead and Virgin River deltas under the alternatives would be similar to those described for baseline conditions above.

3.8.4.3 EFFECTS ON 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 consultations under the ESA, the Glen Canyon Dam Operation AMP and ROD (1996), and the LCRMSCP. Reclamation is also a participant in the Upper Colorado and San Juan River Basin Recovery Implementation Programs for endangered fish in the upper Colorado River basin. Critical habitat for all four of the endangered fish species has been designated by the Service. Adverse modification of these habitats is prohibited under Section 7 of the ESA. These programs and protections will remain in effect under baseline conditions and each of the interim surplus criteria alternatives. As discussed, conditions are not favorable for 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 discuss effects of the alternatives on each of the special-status fish species.

3.8.4.3.1 Baseline Conditions

Bonytail - Under baseline conditions, it is anticipated that bonytail in the Colorado River Basin and their designated critical habitat would continue to be protected under the ESA. Reclamation has consulted with the Service under Section 7 of the ESA on the operation of Glen Canyon and Hoover dams. The resulting biological opinions will remain in effect. Reservoir operations remain within historical ranges, and efforts to protect, recover, and monitor the species status would continue.

The main effort to protect and conserve bonytail in the Lower Basin is the reintroduction of fingerling bonytail from the Dexter National Fish Hatchery, New Mexico that have been reared in predator-free ponds into Lake Mohave by the NFWG. The primary limiting factor for bonytail under existing habitat conditions is predation of early life stages by non-native species. This program is designed to address predation and maintain genetic stocks of bonytail. The main efforts to protect and conserve bonytail in the Upper Basin are conducted through the Upper Colorado Recovery Implementation Program (UC-RIP). This program is designed to recover the bonytail in the Upper Basin by 2010.

Colorado pikeminnow - Under baseline conditions, it is anticipated that Colorado pikeminnow would continue to be restricted to the Upper Basin. Colorado pikeminnow and their designated critical habitat would continue to be protected under the ESA. The Colorado pikeminnow is extirpated from all areas considered in this analysis except for Lake Powell. The ability of the Colorado pikeminnow to successfully reproduce in Lake Powell has not been confirmed. Successful spawning occurs in riverine habitats above Lake Powell, and larvae then drift downstream to rear in sheltered environments. Survival of larvae that drift into Lake Powell is limited by predation by non-native fish. As development of water continues to occur in the upper basin, lower lake elevations are expected to occur. This will increase the amount of sheltered riverine habitat and indirectly benefit the survival of some larvae by preventing them from drifting into open water areas of the reservoir where the risk of predation is greater. The main efforts to protect and conserve Colorado pikeminnow in the Upper Basin are conducted through the UC-RIP, plus the San Juan River Basin Recovery Implementation Program (SJ-RIP). This program is designed to recover the pikeminnow in the Upper Basin by 2010.

Flannelmouth sucker - Under baseline 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 reservoir habitats and are seldom found there. The low survival of eggs and larvae in the reservoirs 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 reservoirs. 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. Lower lake

elevations may increase the amount of sheltered riverine habitat and indirectly benefit the survival of some larvae by preventing them from drifting into open water areas of the reservoir where the risk of predation is greater. Efforts to improve habitat conditions under the UC-RIP, SJ-RIP, Glen Canyon Dam AMP and the Lower Colorado MSCP will benefit the flannelmouth sucker.

Humpback chub - Under baseline conditions, it is anticipated that humpback chub populations would continue to be restricted to riverine and tributary habitats in the Colorado River in the Grand Canyon. The humpback chub and its designated critical habitat would continue to be protected under the ESA, the 1996 ROD, flow regimes and other activities as prescribed under the 1995 biological opinion and the Glen Canyon Dam AMP. In addition to the populations of the Grand Canyon, there are five stable populations in the Upper Basin. The UC-RIP and SJ-RIP are making progress toward recovery of the species. The humpback chub is considered extirpated from all other areas within the lower Colorado River Basin.

Razorback sucker - Under baseline conditions, it is anticipated that razorback sucker populations in the Lower Basin would continue to be limited primarily to Lake Mead and Lake Mohave and designated critical habitat would continue to be protected under the ESA. Spawning success has been limited by predation of eggs and larvae by non-native fish. Efforts are currently being made by the NFWG to supplement adult breeding populations of razorback suckers by stocking lakes and the river 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. A five-year study of the remnant razorback sucker population in Lake Mead is scheduled to be completed by 2002. These practices are expected to continue under baseline conditions and all the interim surplus criteria alternatives.

3.8.4.3.2 Effects of the Alternatives

Potential effects on the five special-status fish species discussed above would be similar to baseline conditions. Each alternative would result in Lake Powell and Lake Mead surface elevations that would vary from those under baseline conditions, with the Flood Control Alternative resulting in slightly higher reservoir elevations, and the Basin States, Six States, California and Shortage Protection alternatives having lower reservoir elevations as compared to baseline projections. (Section 3.3 discusses the modeling results concerning potential future reservoir elevation trends in detail.) Efforts toward protection and recovery of these species would continue under each of the alternatives in the same manner as describe above for baseline conditions. Potential changes in BHBF and low steady summer flow frequencies are discussed in Section 3.6 of this FEIS, and Reclamation has determined that these effects would not be likely to adversely affect special-status fish species.