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In Reply Refer To:

AESO/SE
2-21-93-F-167

February 16, 1996

MEMORANDUM

TO: Regional Director, Bureau of Reclamation, Salt Lake City, Utah

FROM: Field Supervisor

SUBJECT: Biological and Conference Opinions on Operation of Glen Canyon Dam - Controlled Release for Habitat and Beach Building (Your Reference UC-320, ENV-1.00)

The U.S. Fish and Wildlife Service has reviewed the Bureau of Reclamation's proposed test of beach/habitat-building flow (test flow) from Glen Canyon Dam, in spring 1996 in the Colorado River located in Coconino County, Arizona. Your November 20, 1995, request for formal consultation was received on November 21, 1995. This document represents the Service's biological and conference opinions on the effects of that action on the following endangered species: humpback chub (*Gila cypha*); Kanab ambersnail (*Oxyloma haydeni kanabensis*); and southwestern willow flycatcher (*Empidonax traillii extimus*); and on critical habitat for the humpback chub and proposed critical habitat for southwestern willow flycatcher, in accordance with section 7 of the Endangered Species Act of 1973 (Act), as amended, (16 U.S.C. 1531 et seq.).

These biological and conference opinions are based on information provided in the November 1995 biological assessment, the January 1996 draft environmental assessment and draft finding of no significant impact for the Glen Canyon Dam Beach/Beach Habitat-Building Flow (DEA/FONSI), the March 1995 final environmental impact statement on the operation of Glen Canyon Dam (FEIS), information provided at the Transitional Work Group and the Controlled Flood Scientific Coordination Group meetings, field investigations, and other sources of information. Literature cited in these biological and conference opinions is not a complete bibliography of all literature available on the species of concern, and its effects, or on other subjects considered in these opinions. A complete administrative record of this consultation is on file in this office.

BIOLOGICAL OPINION SUMMARY
Spring 1996 Beach/Habitat-Building Flow, Glen Canyon Dam

Date of opinion: February 16, 1996

Action agency: U.S. Bureau of Reclamation, Upper Colorado Region, Salt Lake City, UT

Project: Spring 1996 Beach/Habitat-Building Flow, Glen Canyon Dam

Location: Coconino County, Arizona

Listed species affected: endangered species: humpback chub (*Gila cypha*) with critical habitat; Kanab ambersnail (*Oxyloma haydeni kanabensis*) without critical habitat; and southwestern willow flycatcher (*Empidonax traillii extimus*) with proposed critical habitat.
Biological opinion: Nonjeopardy, nonadverse modification - page 2 and 22

Reasonable and prudent alternatives (RPAs): None required

Incidental take statement:

Anticipated take: *Exceeding this level may require reinitiation of formal consultation.* Humpback chub - No more than 25 humpback chub are found floating dead in the mainstem or if no humpback chub or native fish from 1995 year class are found in nearshore habitats in the mainstem above Unkar Rapid (RM 73) after the test flow. Kanab ambersnail - 17 % of the Kanab ambersnail habitat in Grand Canyon could be taken or about 129m^2 primary habitat. Southwestern willow flycatchers - Flow up to 1.5 m inundating historic nesting territories before nesting season.

Reasonable and prudent measures: *Implementation of these measures through the terms and conditions is mandatory.* Humpback chub - Conduct test during a period to avoids concentrations of young-of-year humpback chub; follow proposed pattern of stepped down-ramping rates; Use test flow studies to develop methods to detect take. Kanab ambersnail - Before another habitat-building flow, Reclamation will enter into informal consultation . Southwestern willow flycatcher - Conduct test flow before April 15, quantify flow depth and velocity at each of above four territories, measure habitat characteristics at four sites and compare with test flow, conduct surveys and monitoring in 1996, initiate formal consultation by February 1997 on preferred alternative.

Terms and conditions: *Terms and conditions implement reasonable and prudent measures and are mandatory requirements.* Humpback chub - Monitoring based on study proposal, report results of the monitoring; Kanab ambersnail - Monitoring based on study proposal, establish stage recorder, and relocate individuals to be inundated and monitor moved individuals for 1 year; Southwestern willow flycatcher - Monitoring of the project area and report of the results of the monitoring.

Conservation recommendations: *Implementation of conservation recommendations is discretionary.* Avoid using spillway during test flow; investigate comparable habitats for Kanab ambersnail; help establish refugium; continue with review of second population; and study success of moving vegetation.

Your November 1995 biological assessment determined that the test flow would have no effect on the endangered peregrine falcon (*Falco peregrinus anatum*), threatened bald eagle (*Haliaeetus leucocephalus*), and endangered razorback sucker (*Xyrauchen texanus*). Your determination removes these species from consideration because the action agency has the responsibility to determine "may effect;" consequently, the remainder of this biological opinion will not address those species. We do not concur with your determination that the test flow is not likely to adversely affect the humpback chub. While the long-term effect of the proposed test flow should be beneficial to the species, possible short-term adverse affects need to be evaluated. The consultation also analyzes new information made available regarding the Kanab ambersnail.

On December 14, 1995, the Service requested additional information on potential impacts to the southwestern willow flycatcher which Reclamation provided in a draft supplemental report dated January 8, 1996. On January 23, 1996, our staffs met to review the data and concluded that the test flow is likely to adversely affect habitat of the southwestern willow flycatcher. Your February 1, 1996, memorandum requested the Service to include the southwestern willow flycatcher in the ongoing formal consultation. Because your memorandum identified possible adverse modification of southwestern willow flycatcher habitat, we included a conference opinion on that species' proposed critical habitat.

SUMMARY BIOLOGICAL AND CONFERENCE OPINIONS

After reviewing the current status of the humpback chub, Kanab ambersnail, and southwestern willow flycatcher, the environmental baseline for the action area, the effects of the proposed spring 1996 beach/habitat-building flow from Glen Canyon Dam (test flow), and the cumulative effects, the Service's biological opinion is that the test flow, as proposed, is not likely to jeopardize the continued existence of the humpback chub, Kanab ambersnail, and southwestern willow flycatcher, and is not likely to destroy or adversely modify designated critical habitat for the humpback chub.

After reviewing the current status of the southwestern willow flycatcher, the environmental baseline for the action area, the effects of the proposed spring 1996 beach/habitat-building flow from Glen Canyon Dam (test flow), and the cumulative effects, the Service's conference opinion is that the test flow, as proposed, is not likely to destroy or adversely modify proposed critical habitat for the southwestern willow flycatcher. Critical habitat for the Kanab ambersnail has been proposed only in Utah; however, this action does not affect that area and no destruction or adverse modification of that critical habitat is anticipated.

CONSULTATION HISTORY

This reinitiates consultation on the preferred alternative for the FEIS that resulted in a final biological opinion dated December 21, 1994, transmitted to Reclamation January 7, 1995 (1995 biological opinion). Consultation is reinitiated because a new species was listed in February 1995 (southwestern willow flycatcher) with proposed critical habitat and new information from

the test flow revealed that incidental take for the Kanab ambersnail determined in the January 1995 biological opinion would be exceeded.

A 1978 biological opinion found that past, present, and future operations of Glen Canyon Dam jeopardized the continued existence of the humpback chub and limited recovery of the humpback chub and Colorado squawfish (*Ptychocheilus lucius*)(U.S. Fish and Wildlife Service 1978). Consultation accompanying the Glen Canyon Environmental Studies (GCES) program (Phase I) resulted in a draft jeopardy opinion in 1987 (2-21-87-23). The second phase of GCES began in 1988, and the Secretary of the Interior announced preparation of an EIS in July 1989. In September 1991, the Service agreed with Reclamation that a separate consultation would not be necessary for interim flows because consultation was continuing on operation of the dam and interim flows were designed to reduce impacts from the existing condition while the EIS was being prepared. With guidance from the cooperating agencies, Reclamation selected Modified Low Fluctuating Flow (MLFF) as the preferred alternative in January 1993. Common elements for FEIS alternatives included beach/habitat building flows and adaptive management. The January 1995 biological opinion identified a reasonable and prudent alternative with four elements for endangered fish and reasonable and prudent alternative for Kanab ambersnail. The Service agreed to a program of experimental flows that would include high steady flows in the spring, and specifically stated that "Studies of high steady flows in the spring may include studies of habitat building and habitat maintenance flows."

Because of the length of this biological opinion, we have included the following table of contents:

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BIOLOGICAL AND CONFERENCE OPINIONS

DESCRIPTION OF PROPOSED ACTION

The FEIS (page 40) identified that under any alternative, "Grand Canyon sandbars that exist above normal peak river stage would continue to erode, and backwater habitats within normal stage would tend to fill with sediment." To correct this, most FEIS alternatives included beach/habitat-building flows as "...scheduled high releases of short duration designed to rebuild high elevation sandbars, deposit nutrients, restore backwater channels, and provide some of the dynamics of a natural system." The FEIS also stated that "a test of the beach/habitat-building flow would be conducted prior to long-term implementation of this element...." Additionally, the beach/habitat-building flow would be conducted "...only in years when projected storage in Lake Powell on January 1 is less than 19 maf (low reservoir condition)."

Reclamation proposes to conduct a test of the beach/habitat-building flow from Glen Canyon Dam. On or about March 22, 1996, 4 days of constant 226-cubic meters per second (cms) flow would begin. On or about March 26, flows would increase at a maximum rate of 113 cubic meters per second per hour (cms/hr) until a maximum flow of 1275 cms is reached and held essentially constant for 7 days. On or about April 2, flows will be decreased to 113 cms in the following manner: (1) Between the maximum release and 990 cms, releases would decrease at a maximum rate of 43 cms/hr. (2) Between 990 cms and 560 cms, releases would decrease at a maximum rate of 28 cms/hr. (3) Between 560 cms and 226 cms, releases would decrease at a maximum rate of 14 cms/hr. The staggered down-ramping is to mimic the reduction of flow after a natural flood. Discharge would be maintained at 226 cms for 4 days (through April 7). The constant 226 cms release proceeding the 1275 cms release would permit aerial photography and on-site evaluation of sedimentation patterns and effects on other downstream resources. Interim operations would resume at Glen Canyon Dam on or about April 8.

Annual release volume for water year 1996 would be the same as during interim flows. However, to conduct the test flow, release volumes for the period March and April would be increased 462.6 million cubic meters (cm), and 5 months would have from 61.7 million cm to 185.0 million cm reductions in release volumes. July volume would be increased 30.8 million cm.

An essential part of the test are the pre- post, and 6-month research and monitoring studies that will be conducted by various research groups coordinated by Reclamation's GCES Group. The proposed test flow will assess how flooding influences the river corridor's geomorphology, biological and cultural resources, and ecosystem process.

STATUS OF THE SPECIES

Humpback Chub

The species description, life history, population dynamics, status and distribution are presented in the January 1995 biological opinion and November 1995 biological assessment. Seven reaches of the Colorado River system were designated as critical habitat for humpback chub, for A total river length of 610 kilometers (km). This represents approximately 28 percent of the historical habitat for the species (U.S. Fish and Wildlife Service 1994a). Critical habitat primary constituent elements for the humpback chub were discussed in the 1995 biological opinion.

Kanab Ambersnail

The Kanab ambersnail is a terrestrial snail in the family Succineidae. The shell is dextral (right handed), thin-walled, and a light amber color sometimes with grayish mottling. Mature individuals are between 14 and 19 millimeters (mm) (Pilsbry 1948, Clarke 1991). The Kanab ambersnail is known from three locations of the Colorado Plateau, two areas near Kanab, Utah, and one in Grand Canyon National Park. One of the two Utah populations is believed extirpated after its habitat was dewatered within the past 10 years. The other Utah population has suffered losses due to flooding, wetland destruction, and livestock trampling (U.S. Fish and Wildlife Service 1995a). The Grand Canyon population is the only one known in a wilderness setting.

The Kanab ambersnail was listed under emergency rule in August 1991, and the final rule to list the species as endangered was published in April 1992 (U.S. Fish and Wildlife Service 1991. 1992). Critical habitat was proposed but not finalized for the larger population in Utah.

In Utah, the Kanab ambersnail is associated with cattail (*Typha* sp.) marshes and sedge meadows dominated by *Juncus* spp. (Clarke 1991, U.S. Fish and Wildlife Service 1995a). Cattails and dense sedge and grass meadows may provide crucial vegetative cover and food resources for the snails. The American robin (*Turdus migratorius*) has been observed to feed on the Kanab ambersnail in Utah and may be the largest natural predator in the area (Clarke 1991, U.S. Fish and Wildlife Service 1995a).

In Arizona, the Kanab ambersnail is found in a single spring-fed wetland habitat named Vaseys Paradise in the gorge of the Grand Canyon. Dominant vegetation includes the native cardinal monkey-flower (*Mimulus cardinalis*) (snapdragon family), and nonnative watercress (*Nasturtium officinale*). Other common plants in the area are *Polygonum* (knotweed or smartweed family), *Carex* (sedge family), and poison ivy (*Toxicodendron rydbergii*). The Kanab ambersnail is very rarely found on rock surfaces and even then within a short distance from primary vegetation (Stevens *et al.* 1995a). Wildlife other than the Kanab ambersnail is limited at this location Canyon wren (*Catherpes mexicanus*) and Says phoebe (*Sayornis saya*) have been documented at the Arizona location, but it is not known if they feed on the ambersnail. Ravens (*Corvus*

corax) have been noted displaying feeding behavior in Vaseys (J. Petterson, Grand Canyon National Park, personal communication). A more prevalent problem appears to be a trematode parasite, tentatively identified as *Leocochloridium* sp. During August 1995, approximately 9 percent of the adult snails expressed sporocysts indicating advanced signs of parasitism (Stevens *et al.* 1995a).

Population estimates of the Kanab ambersnail at Vaseys were approximately 18,500 in March; estimates for September ranged between 92,764 and 104,000 (Table 1). The wide range in population numbers follow the pattern of reproduction, overwintering, senescence, and mortality.

The annual life cycle and overwintering reduce numbers. In March, population numbers are low and the majority of individuals (94 percent) have lost their mucosal plugs and emerged from winter dormancy. In March 1995, individuals ranged from 2.0 to 11.0 mm, with a mean length of 7.1 mm. The individuals that successfully overwinter are large enough to reproduce by June, with individuals ranging from 3.5 to 16.0 mm with a mean length of 11.2 mm. Reproduction occurs primarily in July and August, with large numbers of individuals primarily dominating the 2 to 5 mm size class in September (Stevens *et al.* 1995a).

Southwestern Willow Flycatcher

The southwestern willow flycatcher is a small passerine bird (Order Passeriformes; Family Tyrannidae) approximately 15 centimeters long. It has a grayish-green back and wings, whitish throat, light grey-olive breast, and pale yellowish belly. Two whitish or buff wingbars are visible, the eye ring is faint or absent. The upper mandible is dark, the lower is light grading to dark at the tip. The southwestern willow flycatcher is a riparian obligate, nesting in riparian thickets associated with rivers, streams, and other wetlands where dense growth of willow (*Salix* sp.), *Baccharis* sp., buttonbush (*Cephalanthus* sp.), boxelder (*Acer negundo*), tamarisk (*Tamarix* sp.) or other plants are present, often with a scattered overstory of cottonwood (*Populus* sp.).

Surface water or saturated soils are usually present or nearby, especially early in the breeding season. During drier years surface water may be present early in the breeding season with only damp soil present or a total lack of soil moisture by late June or early July (Muiznieks *et al.* 1994, Sferra *et al.* 1995). The species composition and structure of nesting habitat varies across the range from homogeneous patches of only one or several shrub or tree species that form a single cover layer up to approximately 6 meters, to structurally heterogeneous patches of many tree and shrub species with distinct overstory, sub-canopy, and groundcover levels (Brown 1988, Whitfield 1990, Sedgewick and Knopf 1992, Muiznieks *et al.* 1994, Tibbitts *et al.* 1994, Sferra *et al.* 1995, Whitfield and Strong 1995).

The flycatcher is a neotropical migratory species that breeds in the southwestern U.S. and migrates to Mexico, Central America, and possibly northern South America during the non-breeding season. The historical range of the southwestern willow flycatcher included southern California, Arizona, New Mexico, western Texas, southwestern Colorado, southern Utah, extreme southern Nevada, and extreme northwestern Mexico (Sonora and Baja) (Unitt 1987).

The southwestern willow flycatcher was proposed for listing as endangered, with critical habitat, on July 23, 1993 (U.S. Fish and Wildlife Service 1993). A February 27, 1995, final rule listing the southwestern willow flycatcher as endangered became effective on March 29, 1995 (U.S. Fish and Wildlife Service 1995a). The States of Arizona, California, and New Mexico also list the southwestern willow flycatcher as endangered (Arizona Game and Fish Department 1988, California Department of Fish and Game 1992, New Mexico Department of Game and Fish 1988). Following the review of comments received during the public comment period, the Service deferred the designation of critical habitat, invoking an extension on this decision until July 23, 1995. A moratorium on listing actions under the Act passed by Congress in April 1995 required the Service to cease work on the designation of critical habitat until the moratorium is lifted.

Recent surveys have documented breeding populations of southwestern willow flycatchers in three states (California, Arizona, and New Mexico). Small numbers of probable breeders have been documented in Utah and Colorado, however breeding by known *E.t. extimus* has not been verified in those states. Statewide surveys in Arizona from 1993 to 1995 documented southwestern willow flycatchers at approximately 21 of over 400 sites surveyed (Muiznieks *et al.* 1994, Sferra *et al.* 1995, Spencer *et al.* in prep.). Sferra *et al.* (1995) estimated a total of 119 territorial males at the 21 extant locations.

Life History

The southwestern willow flycatcher is an insectivore, foraging within and above dense riparian vegetation, taking insects on the wing or gleaning them from foliage (Wheelock 1912, Bent 1963).

The flycatcher begins arriving on breeding grounds in late April and May (Sogge and Tibbitts 1992, Sogge *et al.* 1993, Sogge and Tibbitts 1994, Muiznieks *et al.* 1994, Maynard 1995, Sferra *et al.* 1995). Migration routes are not completely known. However, flycatchers, probably including sub-species *E.t. brewsteri* and *E.t. adastus*, have been documented migrating through drainages in Arizona that do not currently support breeding populations, including upper San Pedro River (Bureau of Land Management, unpublished data), Colorado River through Grand Canyon National Park (Sogge and Tibbitts 1992, Sogge *et al.* 1993, Sogge and Tibbitts 1994), lower Colorado River (Muiznieks *et al.* 1994, Spencer *et al.* in prep.), Verde River tributaries (Muiznieks *et al.* 1994), and Cienega Creek (Bureau of Land Management, written communication).

Flycatchers of the genus *Empidonax* rarely sing during fall migration, so that a means of distinguishing subspecies without a specimen is not feasible (Blake 1953, Peterson and Chalif 1973). However, willow flycatchers have been reported to sing and defend winter territories in Mexico and Central America (Gorski 1969, McCabe 1991). Willow flycatchers winter in Mexico, Central America, and perhaps northern South America (Phillips 1948, Stiles and Skutch 1989, Peterson 1990, Ridgely and Tudor 1994, Howell and Webb 1995).

Southwestern willow flycatchers begin nesting in late May and early June and fledge young from late June through mid-August (Willard 1912, Ligon 1961, Brown 1988, Whitfield 1990, Sogge and Tibbitts 1992, Sogge *et al.* 1993, Muiznieks *et al.* 1994, Whitfield 1994, Maynard 1995). Southwestern willow flycatchers typically lay 3 to 4 eggs in a clutch (range = 2-5). The breeding cycle, from laying of the first egg to fledgling, is approximately 28 days. Eggs are laid at one-day intervals (Bent 1963, Walkinshaw 1966, McCabe 1991); they are incubated by the female for approximately 12 days; and young fledge approximately 12 to 13 days after hatching (King 1955, Harrison 1979). Southwestern willow flycatchers typically raise one brood per year but have been documented raising two broods during one season (Whitfield 1990). Southwestern willow flycatchers have also been documented renesting after nest failure (Whitfield 1990, Sogge and Tibbitts 1992, Sogge *et al.* 1993, Sogge and Tibbitts 1994, Muiznieks *et al.* 1994, Whitfield 1994, Whtifield and Strong 1995).

Whitfield, who has accumulated the largest dataset on *E.t. extimus*, reported the following data on survivorship of adults and young: of 58 nestlings banded since 1993, 21 (36 percent) returned to breed; of 57 birds banded as adults (after hatch year) since 1989, 18 (31 percent) returned to breed at least one year (10 males, 8 females), five (9 percent) returned to breed for two years (all males), and two (3.5 percent) returned to breed for three years (M. Whitfield, Kern River Preserve, personal communication) Whitfield (1995) also documented statistically significant variation in return rates of juveniles as a function of fledgling date; approximately 21.9 percent of juveniles fledged on or before July 20th returned to her study area the following year, whereas only 6.4 percent of juveniles fledged after July 20th returned the following year.

Walkinshaw (1966), who studied *E.t. traillii* in Michigan, estimated that 40.9 percent of the males at his study site returned to breed for two years, 22.7 percent returned for three years, 13.6 percent returned for four years, and 4.5 percent returned during their fifth year. Females return rates were substantially lower. Only 22.6 percent returned to breed for one year. These data are consistent with survival rates for other passerines (Gill 1990, chap. 21) and suggest that the lifespan of most *E.t. extimus* probably is two to three years.

The southwestern willow flycatcher is a frequent host of the brown-headed cowbird (*Molothrus ater*) (Muiznieks *et al.* 1994, Whitfield 1994, Sferra *et al.* 1995, Sogge 1995b). Cowbirds lay their eggs in the nests of other species directly affecting their hosts by reducing nest success. Cowbird parasitism reduces host nest success in several ways. Cowbirds may remove some of the host's eggs, reducing overall fecundity. Hosts may abandon parasitized nests and attempt to renest, which can result in reduced clutch sizes, delayed fledgling, and reduced overall nesting success and fledgling survivorship (Whitfield 1994). Cowbird eggs, which require a shorter incubation period than those of many passerine hosts, hatch earlier giving cowbird nestlings a competitive advantage over the host's young for parental care (Bent 1963, McGeen 1972, Mayfield 1977, Brittingham and Temple 1983). Where studied, high rates of cowbird parasitism have coincided with southwestern willow flycatcher population declines, or, at a minimum, resulted in reduced or complete elimination of nesting success (Muiznieks *et al.* 1994, Whitfield 1994, 1995, Sferra *et al.* 1995, Sogge 1995b). Whitfield (1995) found that flycatcher nestlings fledged after July 20th had a significantly lower rate of survival, and that cowbird parasitism was often the cause of delayed fledgling.

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Population Dynamics

Population size: Current estimates for total numbers of remaining southwestern willow flycatchers are 500 or fewer nesting pairs rangewide (Unitt 1987, U.S. Fish and Wildlife Service 1995b). Approximately 100 territorial males are estimated to occur in southern California, with most nesting groups occurring in four drainages (Whitfield 1993, Griffith and Griffith 1994, Holmgren, written communication). Approximately 119 territorial males were located at 19 sites spread over 11 drainages during statewide surveys in Arizona in 1994 (Sferra *et al.* 1995). Approximately 120 territorial males were located at 18 sites spread over 8 drainages in New Mexico during statewide surveys in 1994 (Parker and Hull 1994, Maynard 1995). A small number of territorial males ($\leq$ 5) has been documented in both southern Utah and southwestern Colorado during 1993, 1994, and 1995 surveys. However, breeding has not been confirmed in those states (Sogge 1995a, K. McDonald, Utah Division of Natural Resources, personal communication, T. Ireland, Service, Colorado, written communication). Rangewide, 77 percent of the locations with flycatchers are comprised of five or fewer territorial males.

Population stability: Southwestern willow flycatcher breeding populations are extremely small and unstable. The Service believes that at current population levels, and with continuing threats, extinction of this species is foreseeable. Southwestern willow flycatchers are absent from many areas previously occupied or are present in reduced numbers (Hubbard 1987, Unitt 1987, Sogge *et al.* 1993, Sogge and Tibbitts 1994, Muiznieks *et al.* 1994, Sferra *et al.* 1995). Former populations in Arizona on the lower Salt River, Santa Cruz River, and lower Colorado River near Yuma have been extirpated. Small groups of one to seven willow flycatcher territories have been detected on the Santa Maria River, lower San Pedro River, Verde River, upper Tonto Creek, upper Salt River, upper Gila River, Little Colorado River, and the Colorado River in Marble Canyon (Sogge *et al.* 1993, Sogge and Tibbitts 1994, Muiznieks *et al.* 1994, Sferra *et al.* 1995).

Nesting groups monitored on the Colorado River in the Grand Canyon have declined since monitoring began in 1984 (Sogge 1995c). A similar trend has been observed in the Verde Valley at Clarkdale where four territorial males were first observed in 1992. In 1993, two pairs were present, one nest was documented and contained a single cowbird nestling (Muiznieks *et al.* 1994). In 1994, two pairs and one unpaired male were present. Two nests were found, one of which successfully fledged two flycatchers, the other fledged a single cowbird (Sferra *et al.* 1995). Data from 1995 indicate that two unpaired males occupied the Clarkdale site (Sogge 1995a), however extensive monitoring efforts were not possible due to landowner restrictions on access to the site.

In California along the Kern River, Whitfield (1993) documented a precipitous decline in the total flycatcher population (44 to 27 pairs) from 1989 to 1993. During that same period cowbird parasitism rates between 50 and 80 percent were also documented (Whitfield 1993). A cowbird trapping program initiated in 1992 has reduced cowbird parasitism rates to $\leq$ 10 percent and appears to have stabilized population numbers at Kern River at 32 to 34 pairs (Whitfield 1994).

Status and Distribution

Reasons for listing: The southwestern willow flycatcher was listed as endangered in response to documented declines in population size and extent of historic range occupied as a result of loss, modification, and fragmentation of riparian habitat and parasitism by the brown-headed cowbird (U.S. Fish and Wildlife Service 1993, 1995b). Critical habitat was proposed to provide additional protection for areas (occupied and unoccupied) necessary for the survival and recovery of this species.

Rangewide trend: Southwestern willow flycatcher populations are extremely small and unstable; 77 percent of extant flycatcher locations are occupied by 5 or fewer territorial males. Rangewide monitoring continues to document declines in some locations. Some populations apparently have been stabilized as a result of cowbird trapping programs.

New threats: Additional habitat losses will likely include both small- and large-scale losses and be of the same types as known to date (i.e. habitat loss, fragmentation, and modification). The Service expects incidences of cowbird parasitism will vary spatially and temporally as a function of local cowbird population dynamics and local changes in the extent of riparian habitats.

Sensitivity to impacts: The southwestern willow flycatcher's sensitivity to changes in habitat is high as a result of the small sizes of nesting groups, the small sizes of riparian habitats occupied, and the highly fragmented distribution of habitats. The extent of riparian habitat, its distribution, continuity, and species composition have been substantially altered in the Southwest (Phillips *et al.* 1964, Carothers *et al.* 1974, Rea 1983, Johnson and Haight 1984, Katibah 1984, Johnson *et al.* 1987, Franzreb 1987, Unitt 1987, General Accounting Office 1988, Szaro 1989, Dahl 1990, State of Arizona 1990). Changes in the extent and composition of riparian habitat decreases suitability and carrying capacity, thereby depressing numbers of flycatchers that can occupy an area. These effects have resulted in a contraction of the range occupied by the southwestern willow flycatcher, a reduction in the number of flycatcher populations rangewide, and in isolation of flycatcher populations, potentially changing historical emigration/immigration patterns and severing genetic exchange among populations.

Resilience: The resilience of the southwestern willow flycatcher and its habitat are both relevant aspects of a species' survival. The southwestern willow flycatcher has declined in extent of range occupied and population size as a result of habitat loss, modification, and fragmentation. Riparian habitats by nature are dynamic, with their distribution in time and space governed mostly by flood events and stream-flow patterns. Current conditions along southwestern rivers and streams are such that normal flow patterns have been greatly modified, catastrophic flood events occur with greater frequency as a result of degraded watershed conditions, stream channels are highly degraded, floodplains and riparian communities are reduced in extent, and the species composition of riparian communities modified with exotic species dominant. These conditions have significantly diminished the potential for southwestern rivers and streams to develop suitable habitat for the southwestern willow flycatcher. These factors, combined with the small size of flycatcher populations, indicate that this species' resilience to disturbance is low.

Recovery rate: The recovery rate of breeding populations will be a function of local population dynamics (i.e. total population size, annual reproductive success and mortality rates, rates of dispersal from other breeding locations) and habitat suitability. Because local populations are widely separated and small in size (Muiznieks *et al.* 1994, Sferra *et al.* 1995), recovery rates are anticipated to be slow.

Proposed Critical Habitat

The Service proposed a total of approximately 1038 km of riparian areas along streams and rivers as critical habitat for the southwestern willow flycatcher (U.S. Fish and Wildlife Service 1993) in Arizona, California, New Mexico, and Utah. Critical habitat areas provide, or with rehabilitation will provide, the following physical and biological features and primary constituent elements: Space for individual and population growth; food, water (seasonal wetland), air, light, minerals, and other nutritional or physiological requirements; cover, shelter, and roost sites, sites for breeding, reproduction, and rearing of offspring; habitats (vegetation type, feeding sites and nesting grounds) that are protected from disturbance or are representative of the historic geographic and ecological distributions of the species. Constituent elements include the riparian ecosystem system above the water's surface or within 100 meters (m) of the water's edge. This includes riparian thickets of shrubs or small trees or areas where such vegetation may become established.

ENVIRONMENTAL BASELINE

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

Humpback Chub

The 1995 biological opinion includes an environmental baseline focused primarily on the aquatic environment, and that section is incorporated by reference to this document. Recent final reports from three of the studies of endangered and native fishes for the GCES also provide detailed accounts of humpback chub ecology and habitat use in the Little Colorado River, the Colorado River from Lees Ferry to Lake Mead, and tributaries to the river (U.S. Fish and Wildlife Service 1994b, Valdez *et al.* 1995, Valdez and Ryel 1995).

Valdez and Ryel (1995) recounted that 535 km of potential historic habitat that was available to a population of humpback chub centered in the Grand Canyon in the late 1800s and identified factors reducing that range: Lake Mead inundation of lower Grand Canyon, 13 percent; Lake Powell inundation, 10 percent; and Glen Canyon Dam operations, 14 percent. Thus, 37 percent or 199 km of potential habitat was lost.

The population of humpback chub in the mainstem and Little Colorado River in Grand Canyon is thought to be the largest of six populations for the species range-wide (Marsh and Douglas 1992). The importance of the Grand Canyon mainstem to the species is exhibited by the nine aggregations identified by Valdez and Ryel (1995) throughout the mainstem Colorado River in the project area and are referenced as river miles from Lees Ferry: 30-Mile, Little Colorado River inflows (about RM 61), Lava Canyon to Hance Rapid (about RM 70), Bright Angel Creek mouth (RM 88), Shinimo Creek mouth (RM 108), Stephens Aisle (about RM 118), Middle Granite Gorge (about RM 128), Havasu Creek mouth (RM 157), and Pumpkin Spring (RM 212). Various life stages and age classes of humpback chub use the mainstem and are influenced by seasonal warming, food availability, and flow. Most humpback chub are spawned and successfully recruited into the population due to favorable habitat conditions in the Little Colorado River. Throughout the year, humpback chub of all sizes may leave the Little Colorado River and reside in the mainstem. During some of the winter season, temperatures in the mainstem are warmer than the more shallow, air-influenced tributaries.

Limited spawning of humpback chub occur in other tributaries or mainstem locations. In upper Marble Canyon, some success has been reported at warm springs entering the mainstem at RM 30 (Arizona Game and Fish Department 1993, Valdez and Ryel 1995). Larval humpback chub have been collected from Cardenas Marsh (RM 71) and several other locations throughout the river. Humpback chubs less than 1 calendar year of age have been captured in the mainstem in January and March (Valdez and Ryel 1995)

Humpback chub feed on a variety of aquatic and terrestrial organisms including the amphipod *Gammarus lacustris*, immature chironomids and simuliids, and other invertebrates, all which are influenced by nutrients, turbidity, velocity (Valdez and Ryel 1995), and other flow related conditions.

Critical habitat in Arizona includes most of the habitat now used by the Grand Canyon population of humpback chub. Designated reaches are the lower 13 km of the Little Colorado River and from Natuloid Canyon (about RM 34) to Granite Park (about RM 208) on the Colorado River (U.S. Fish and Wildlife Service 1994a).. This is a total of 291 km or 48 percent of humpback chub critical habitat. Known constituent elements include water, physical habitat, and biological environment as required for each life stage.

The dominant factor influencing critical habitat in the project area is Glen Canyon Dam. Effects of the dam on water quality and quantity attributes such as temperature, nutrients, turbidity, and hydrologic regime; on the physical habitat; and on the biologic environment such as food supply have been detailed in the FEIS, the 1995 biological opinion, and most of the various GCES research reports. Another important factor is the influence of nonnative fishes. Nonnative fishes have been introduced into altered habitats such as reservoirs and cold water rivers and have profoundly affected native fish populations through predation and competition.

Kanab Ambersnail

Information on the population size of the Kanab ambersnail in Arizona is limited. Anecdotal information on population size ranges from a couple dozen to over a hundred thousand individuals. During 1995, a cooperative interagency effort was made to estimate population size. Using a replicated, small-plot sampling technique, population estimates were made in March, June, and September 1995. Density estimates were made in patches that were not accessible due to sampling difficulties.

When Glen Canyon Dam closed in 1963, the high spring time floods of the pre-dam era ended. Typically, high spring time flows were in excess of 2260 cms and in some years exceeded 2800 cms (U.S. Bureau of Reclamation 1995b). Flows of this magnitude probably restricted habitat for the Kanab ambersnail at Vaseys Paradise. How much habitat existed before the closure of Glen Canyon Dam or whether the Kanab ambersnail even existed at Vaseys is not known.

During the interim flow period (1991 to present), maximum flows have been limited to 560 cms and have rarely exceeded that level. This change in dam releases has allowed the vegetation to expand down to the 560 cms level resulting in approximately 895 m^2 of primary habitat where most individuals are found in September 1995 (Stevens *et al.* 1995a). The primary habitat is dominated by the native *Mimulus* and non-native *Nasturtium*. This primary habitat is interspersed with other marginal or secondary habitat. The marginal habitat is dominated by poison ivy, grasses, maidenhair fern (*Adiantum capillus-veneris*), or other species. Only one individual was found in the marginal habitat during the 1995 field season (Larry Stevens. personal communication).

Data estimates suggest that only a small percent of the actual Kanab ambersnail individuals will be lost during a March flood, about 3.3 percent. However, information on population densities is limited and estimates are cursory. Many of the habitat areas were not measured. For example, population estimates were not performed on some 290 m^2 of the 851 m^2 total area of primary habitat calculated for March. If those 290 m^2 in fact did not contain snails, then the total primary habitat would not be 851 m^2, but rather 561 m^2. Mean densities likewise are not known for those unsampled areas, but as primary habitat, these areas are assumed to contain the same densities as the measured areas.

Southwestern Willow Flycatcher

The southwestern willow flycatcher is one of the most rare birds in the Grand Canyon corridor Historic records report the species near Lees Ferry and the Little Colorado River confluence (Phillips, personal communication, cited in Unitt 1987). Nesting southwestern willow flycatchers were reported to be common in the Glen Canyon area in the 1950s (later inundated by Lake Powell) and two pairs with nests were located in Grand Canyon (RM 50.7 and RM 71.1) (Behle and Higgins 1959). Carothers and Brown (1991) believe that nesting pairs in the Grand Canyon may have increased following closure of Glen Canyon Dam and attribute this

response to increases in riparian vegetation following reductions in major flood discharges. This species feeds on insects and nests in tamarisk in the new high water zone (Brown 1991).

In the 1980's, the population of southwestern willow flycatchers in Arizona was believed to have been no more than a few dozen pairs, with the largest number of individuals in the Grand Canyon (Unitt 1987). However, only two pairs were located in the Grand Canyon in 1991 (Brown 1991). In 1992, when comprehensive nest monitoring was initiated, two pairs were present, with only one establishing a nest. That nest successfully fledged three flycatchers (Sogge and Tibbitts 1992). In 1993, one breeding pair, one male with two females, and six unpaired males were detected. Three nests were found, all of which were parasitized by the brown-headed cowbird. None were successful in rearing flycatchers (Sogge *et al.* 1993). Four pairs and one unpaired male occupied the Grand Canyon in 1994. Nine nests were attempted, at least four of which were parasitized by cowbirds. All nesting attempts failed (Sogge and Tibbitts 1994). In summary, since 1992, 9 pairs of willow flycatchers have made 13 nesting attempts in the Grand Canyon, 1 of which successfully fledged 3 flycatchers.

A number of published reports and papers have documented the status, distribution, and nesting characteristics of southwestern willow flycatchers in Grand Canyon (U.S. Bureau of Reclamation 1996a). Nesting habitat was summarized as occurring in wide river reaches with broad stands of riparian vegetation, usually tamarisk about 4-7 m in height with occasional overstory and dense foliage 0-4 m from ground, and usually proximal to fluvial marshes or exposed sandbars (Brown and Trossett 1989, Tibbitts *et al.* 1994). Nests were usually over moist or wet soil and about 3.5 to 7 meters above ground.

Glen Canyon Dam closed in 1963, significantly changing the upstream and downstream ecosystem of Colorado River. Upstream, Glen Canyon and other reaches of the river that supported riparian vegetation for over 300 km were inundated by Lake Powell. Because of reservoir fluctuations and substrate types, the perimeter of Lake Powell only supports limited riparian vegetation, primarily at tributary confluences.

Downstream, woody riparian habitat existed above the zone that was regularly scoured by flows of 2800 cms. The mesquite (*Prosopis glandulosa*), catclaw (*Acacia greggii*), and hackberry (*Celtis reticulata*) riparian that existed above those floods continued after the dam but are perched above the river and only infrequently flooded (U.S. Bureau of Reclamation 1995b). This area, termed the "upper riparian zone" or "old high water zone," was approximated by Stevens (written communication in 1995 FEIS) to be 750 hectares.

The riparian vegetation that developed in the zone below the old scour line and the high water from the powerplant at Glen Canyon Dam has been termed the "lower riparian zone" or the "new high water zone." Stevens estimated that vegetation occupies about 530 hectares of that zone. Common woody species include tamarisk, seep-willow (*Baccharis salicifolia*), coyote willow (*Salix exigua*), and limited stands of Goodding willow (*Salix gooddingii*) (U.S. Bureau of Reclamation 1995b).

Shoreline habitats in the Grand Canyon with low water velocity, such as eddies and return current channels, collect fine, nutrient rich sediments, such as clays and silts, and may develop into emergent marsh habitats. Common species include cattail, bulrushes (*Scirpus* spp.), common reed (*Phragmites australis*), and, near the margins, horsetail (*Equisetum laevigatum*). Stevens (written communication in 1995 FEIS) estimated that a total of 25 hectares exist in the Grand Canyon.

Eight biologists who had observed the southwestern willow flycatcher foraging in the Grand Canyon reported the species primarily used the lower riparian zone (U.S. Bureau of Reclamation 1996a). They observed the species to "hawk" insects from perches near canopy height, over marsh vegetation, backwaters, river, and open areas riparian vegetation. Gleaning of insects was reported from foliage with some ground visits.

Diets of *Empidonax* flycatchers in Ontario, Canada, a 1912 study across the United States, and a Wisconsin study were summarized by the U.S. Bureau of Reclamation (1996a). In Grand Canyon, the southwestern willow flycatchers were observed feeding on Lepidoptera (moths and a butterfly), leafhoppers (possibly *Opsius stractogalus*) and hairless caterpillers (Geometridae) at the ends of tamarisk branches, and throughout the day on marsh insects (U.S. Bureau of Reclamation 1996a).

The southwestern willow flycatcher arrive in the Grand Canyon in mid-May, with males arriving before females to set up territories (Tibbitts *et al.* 1994, Sogge 1995c). The first date nests were reported by Grand Canyon researchers since active investigations began for this species in 1991 was May 22 and the latest date was July 18 (U.S. Bureau of Reclamation 1996b). In Grand Canyon, a clutch of 2-3 eggs are laid from late May through July (Sogge 1995c). Eggs or young in nest in the Grand Canyon may be found from early June to mid-July, but may extend into August (U.S. Bureau of Reclamation 1996b).

Much of the southwestern willow flycatcher nesting habitat in the Grand Canyon is isolated from man-caused habitat disturbance or use that has favored increases in populations of brown-headed cowbirds. However, the historic mule trails and correls at Phantom Ranch and the South Rim are used by brown-headed cowbirds, and brood parasitism by this species has been identified as a serious threat to some potential nesting sites in the Grand Canyon.

While the area of riparian habitat has increased since closure of Glen Canyon Dam, the canyon-bound reaches present a pattern of linear habitats, often disjunct, with limited opportunity for those habitats to appreciably increase. A minimum patch size for the species is difficult to define for a nesting pair, particularly when available observations are based on small sample sizes because of the species' rarity. Sizes of territory patches and associated marshes were measured by the U.S. Bureau of Reclamation (1996a) on four areas that have been consistently occupied by territorial southwestern willow flycatchers in Grand Canyon located from several km above Nankoweap Rapid (RM 50.4) to Cardenas Marsh (RM 71). Territory size, including marsh, ranged from 0.31 to 2.79 hectares. The four sites were described as wide, low gradient reaches with associated fluvial marshes.

Proposed critical habitat for the southwestern willow flycatcher area includes the Colorado River from RM 39 to RM 71.5 with the following description (U.S. Fish and Wildlife Service 1993):

The boundaries include areas with surface water (main river channel and all associated side channels, backwaters, pools and marshes) throughout the May-September breeding season, and areas where such surface water no longer exists owing to habitat degradation but may be recovered with habitat rehabilitation. The boundaries also include areas within 100 meters of the edge of the surface water described above. This includes area with thickets of riparian shrubs and trees, and areas where such riparian vegetation does not currently exist but may become established with natural regeneration or habitat rehabilitation.

This 52 kilometer reach represents 10 percent of the southwestern willow flycatcher habitat proposed in Arizona.

EFFECTS OF THE ACTION

Humpback Chub

The Service stated in the Reasonable and Prudent Alternative in the 1995 biological opinion that "Attainment of riverine conditions that support all life stages of endangered and native fish species is essential to the Colorado River ecosystem," and that "Studies of high steady flows in the spring may include studies of habitat building and habitat maintenance flows." As a common element in the FEIS, beach/habitat-building flows were to restore downstream habitat conditions that were the consequence of increase flood control. The Service identified that backwaters and other nearshore habitats were used by larval and young-of-year fishes as refuge and nursery areas. These areas are ephemeral in a riverine system, and maintenance of them by using flows that historically created these areas was incorporated into the preferred alternative of the FEIS.

Conducting the test flow in 1996, following a year of average humpback chub production in the Little Colorado River, supports previous recommendations from fishery biologists that transport of young-of-year fishes from preferred, productive habitats in the upper reaches of the Grand Canyon should be avoided in years following exceptional production in the Little Colorado River. This recognizes that some young-of-year or other small-sized humpback chub in the mainstem during flood flows might be transported downstream. The amount or extent of this transport is unknown and is the basis for some of the studies being conducted as part of, or in conjunction with, the test flow (Persons 1995).

Flood flows have the potential to displace nonnative fishes more than native, riverine fishes (Clarkson *et al.* 1994), and this would be beneficial to humpback chub and other native fishes in the Grand Canyon. Investigations of fishes before and after the test flow will provide needed data to address this potential benefit.

The maximum release of the test flow is not to exceed 1275 cms which is within the capacity of the Glen Canyon Dam powerplant and jet tubes. Releases greater than this would have required use of the spillways and create a potential for introduction of nonnative fishes from the Lake Powell. In addition to the obvious concerns for introduction of reservoir fishes into Grand Canyon, by not using the spillways, determining the affect of test flows on nonnative fishes in the Grand Canyon will be easier without the confounding influences that might occur if there another source of unknown nonnative fishes in the system.

The ramping of flows from 226 cms to 1275 cms will be accomplished at a rate of 113 cms/hour and down-ramping will decrease in a stepped pattern, beginning at 43 cms/hour and diminishing to 15 cms/hour. As down-ramping has more potential to degrade beach and sandbar faces, the pattern selected will assist in maintaining the newly deposited sediments. The extent that new return current channels and backwaters created by the 1275 cms flow will be available to fishes when operations return to normal (interim operations) is not known. While there has been considerable study of the Colorado River and the Grand Canyon ecosystem, the ability to accurately predict consequences of even a managed flood flow requires additional effort represented by the study component of the proposed action.

The critical habitat primary constituent elements of physical habitat and biological environment should be benefited by the test flow for the humpback chub. Particularly, nursery, feeding, and rearing areas should be restored for young-of-year and other sub-adult humpback chub in the mainstem by supplying an increase in sediment to the nearshore areas. Predation and competition from nonnative fishes might also decrease if those species are more disadvantaged by high flow.

Kanab Ambersnail

This is a re-consultation on the known population of the Kanab ambersnail in Grand Canyon which will be affected by the proposed project. The first consultation resulted from the December 1994 biological opinion issued by the Service on the operations of the dam that concluded that incidental take will assume to be exceeded if more than 10 percent of the occupied habitat were inundated. The proposed action anticipates that between 11.8 to 16.1 percent of the habitat will be destroyed (Table 1).

High flows will result in inundation, scouring and destruction of habitat. Habitat that is not destroyed may be flushed altering ambient soil moisture, litter, species composition or density, or other factors needed to maintain the Kanab ambersnail. The Kanab ambersnail distribution is strongly correlated with the presence of *Mimulus*, *Nasturtium*, and other species of vegetation associated with primary habitat. The loss of this habitat will adversely affect the population.

The analysis of habitat inundation is based on the Stars Model, a reach averaged standard step hydraulic model. This model has approximately 0.5 m of error at the 1275 cms line, indicating that the actual zone of inundation may be 21.6 m^2 less or 24.37 m^2 or more than anticipated

(Table 2). For example, figures in Table 1 indicate that approximately 105.5 m^2 of primary habitat would be lost if the 1275 cms flood had occurred during September 1995. The model may have overestimated the actual 1275 cms line. If the actual line is 0.5 m below the estimated line, only 83.9 m^2, or 9.4 percent of the habitat would have been lost. Similarly if the model is incorrect and has underestimated the 1275 cms line, instead of the loss of 105.5 m^2, approximately 128.9 m^2 or 14.4 percent of the habitat would have been lost. For March, the 1275 cms line will result in the loss of 125.1 m^2. If the model is incorrect and the actual 1275 cms line is 1.5 feet below the estimated line, only 108.1 m^2, or 12.7 percent of the habitat would have been lost. Similarly, if the model is incorrect and has underestimated the 1275 cms line, instead of the loss of 125.1 m^2, approximately 143.8 m^2 or 16.9 percent of the habitat would have been lost (Table 2).

Assuming the modeled 1275 cms line is correct and 105.5 m^2 of primary habitat will be lost, we estimate that an additional 1 foot of habitat (15.39 m2) will be impacted by the high flows. This 15.39 m^2 plus the 105.5 m^2 equals 120.89 m^2 of habitat or 13.5 percent of the total. This upper one foot of habitat is likely to be saturated, drenched, and or otherwise permeated but is not expected to be totally lost. Some of the individuals snails found in this area may find refuge and might be expected to survive. Similarly in March, 1 foot of habitat (12.34) above the estimated 1275 cms line means the total amount of habitat affected by the flood would be 117.8 m^2 or 15.31 percent.

In addition to the loss of habitat, the proposed project will result in the loss of individual Kanab ambersnails. Individual Kanab ambersnails are expected to be displaced from the habitat and drowned. Individual ambersnails that are in the zone of inundation that are not salvaged will be lost. If a test flow of 1275 cms had occurred in March of 1995, some 617 individuals, approximately 3.3 percent of the individual Kanab ambersnails at Vaseys would have been lost. However, the figure could be 11.4 in June or as high as 18.7 based on September figures. Information on population estimates are seasonally variable (Table 1).

The total population estimate during March 1995 was approximately 18,600 individuals. In June of that same year, the total estimated population had increased to 20,024 individuals with 2,275 or 11.4 percent of the individuals below the 1275 cms line. By September 17,370 or 16.7 percent of the estimated 104,004 individual Kanab ambersnails inhabited the area below 1275 cms. Alternative population estimates for September put the total population at 92,764 or 18.7 percent of the population below 1275 cms.

How long the Kanab ambersnail can be inundated is not known. Individuals may possibly withstand short periods of inundation or be able to emerge if refuge exists. Up-ramp rates toward the peak of 1275 cms are scheduled to raise at a rate of 113 cms per hour. Estimates for the maximum 20-minute stage change at Lees Ferry for the modified low fluctuating flow alternative is estimated at 0.03 m (U.S. Bureau of Reclamation 1995b). Nevertheless, whether the individuals will have the opportunity or ability to crawl out of harms way is not known. Individuals that merely climb up a piece of vegetation will be expected to perish since the high flows will last for 7 days.

Table 1. Summary of Kanab ambersnail total primary habitat (square meters), area and percent below 1275 cms, total number of individuals, number of individuals and percent of individuals below 1275, total density, and density of individuals below 1275 cms (snails m^2), in March, June, September, and November 1995.

Time	Primary Habitat Area (m^2)		Number of Snails		Density	
	Total	Below 1275 (%)	Total	Below 1275 (%)	(snails/m^2)	
					Total	Below 1275
March 1995	851.2	125.1 (14.6)	18,600	617 (3.3)	21.85	4.93
June 1995	905.8	146.2 (16.1)	20,024	2,275 (11.4)	22.11	15.56
September 1995a	895.1	105.5 (11.8)	92,764	17,370 (18.7)	103.60	164.6
September 1995b	895.1	105.5 (11.8)	104,004	17,370 (16.7)	116.19	164.6
November 1995c	unknown	unknown	unknown	unknown	unknown	77.3

a. Figure based on bootstrapped density
b. Figure based on grand mean for all low zone Mimulus patches
c. Estimate based on single low zone sample, n = 52

Table 2. The analysis of habitat inundation (area in square meters) based on the Stars Model indicating possible margins of error around the 1275 cms line during March and September 1995.

Area Estimates	Area (m^2)	Area (m^2)	Percent of Total	
	March	September	March	September
Area at 1275	125.1	105.5	14.6	11.8
0.5 m below 1275	125.1 - 16.9 = 108.1	105.5 - 21.6 = 83.9	12.7	9.4
0.3 m above 1275	125.1 + 12.3 = 137.44	105.5 + 15.4 = 120.89	16.1	13.5
0.5 m above 1275	125.1 + 18.7 = 143.8	105.5 + 24.4 = 128.87	16.9	14.4
Total Area	851.2	895.1		

The timing of the one-time test flow may occur at a sensitive periods of a the Kanab ambersnail's lifecycle. Although the one-time test flow is only scheduled for 7 days of high flows, impacts from the flow may be manifested throughout the growing season and into the fall. Substantial alterations to the lower habitat of the Kanab ambersnail habitat will occur as a result of the proposed action. High flows are likely to eliminate most, if not all, of the vegetation below the 1275 cms zone. In March, Kanab ambersnail numbers are at their lowest. The species is just recovering from high winter mortality and lowest annual densities (Table 1). The timing of the flood will likely occur during a period of dormant vegetation. The resumption of spring growth will follow as a result of increased photoperiod and temperature. Following completion of the project, the area will be allowed to naturally re-vegetate. The rate and pattern of rejuvenation is not known. Some rejuvenation is expected during the ensuing two to six month growing season. During the high flows of the 1983, *Mimulus* roots that were not eroded survived inundation (Larry Stevens, GCES, personal communication). *Nasturtium* is likely to re-colonize by seed. Individual ambersnails that successfully overwinter should be large enough to reproduce by June, with as mentioned earlier, the peak of reproduction occurring in July and August (Stevens *et al.* 1995a). In August and September 1995, Kanab ambersnail densities were higher on *Nasturtium* than *Mimulus*. Sand or other debris may be deposited at the lower elevation at Vaseys which may affect the rate of vegetation rejuvenation, species composition, or snail distribution.

Kanab ambersnails which fall or migrate down to the water's edge after the flood before vegetative rejuvenation, will not find habitat and may be lost to the river. During the 1995 field season, three individuals were found on bare rock but always in close proximity to vegetation. The likelihood of a higher percentage of individuals being impacted is increased if individuals have migrated or have been washed down to the river's edge after a natural disturbance. Conversely, if the habitat has undergone winter die-back or been scoured away from some natural event, the loss of habitat or individuals may actually be less than the anticipated level.

An unusually cold or later winter may find the Kanab ambersnail still in its winter state during the test flow. During March of 1995, three of 48 snails, or 6.3 percent of the individual examined retained the mucosal plug or seal indicative of the winter dormant state (Stevens *et al.* 1995a). It is possible that those individuals may be successfully transplanted. Researchers in New York State discovered that estivating *Cerion* sp. were able to survive several days of transport with broken epiphrams. It was hypothesized that the seal serves as a culture for fungi rather than a barrier to moisture (Paul Morris, University of Massachusetts, personal communication). The variability in natural conditions (springflows, floods, and climate) contributes to the large fluctuations in Kanab ambersnail population size and habitat.

Southwestern Willow Flycatcher

The test flow is designed to be a release over powerplant capacity to test the ability to use flow as beach and habitat-building tool to return processes of the Colorado River in the Grand Canyon similar to those provided under a natural hydrograph. As evaluated in this consultation, this is

a test to measure responses of the fluvial ecosystem and related resources. One of the critical observations will be to see if flow at the test level of 1275 cms for 7 days has the ability to move sediment from the channel and deposit it along the channel margins and banks. Rebuilding of channel margin deposits rejuvenates the system by providing substrate for woody riparian species. This should result in long-term benefit to the habitat of southwestern willow flycatcher in the Grand Canyon. The dates for conducting the test flow will also avoid enhancing regeneration of tamarisk, because tamarisk will not be in seed at this time. As discussed above, the ramping rates selected will help maintain, as possible, newly deposited sediments along the channel margins.

If the test is successful, some nesting and foraging habitats of southwestern willow flycatcher would be affected in varying degrees in the short-term. The degree and nature of that short-term loss concerns the Service due to the small size of the population range-wide and the downward trend of the Grand Canyon population. In response to the Service's request for more information regarding potential direct affects, Reclamation analyzed four sites in the Grand Canyon that have been occupied consistently by the southwestern willow flycatcher and provided the following information (U.S. Bureau of Reclamation 1996a):

1. Determine nest tree and nest height elevations in relation to local stage discharge elevations: Nests were reported to be $\geq$ 3.4 m up in tamarisk trees and $>$ 3 m above the 1275 cms stage. Root crowns at two sites might be inundated as much as 0.5 m, but erosion of those trees is not anticipated because they exist in densely vegetated sand bars. Observations of a similar release in 1980 when Glen Canyon Dam spilled for the first time are reflected in this conclusion.

2. Determine changes in vegetation cover on southwestern willow flycatcher habitat patches from the 2622 cms flow in 1983: The peak of this flow was over twice that of the proposed test flow, and riparian vegetation persisted during subsequent flows from 940 to $\geq$ 1700 cms from 1984 through 1986, and 1993. Although regrowth of vegetation was minimal during the high, and often constant flood flows from 1983 to 1986, vegetation increased greatly following controlled water years with interim flows beginning in 1990. Limited observations and aerial photography of the 1275 cms flow in 1980 found that sand bars and wetland vegetation were not scoured by that event. Marshes were severely scoured by the 1983 flood flow but recovered with interim flows. As marshes that began as return current channels fill with sediment, they are colonized by woody species and are no longer available as habitats for larval native fishes or as feeding habitats for southwestern willow flycatcher. The objective, if possible, is to allow the river ecosystem to go through this dynamic process and not be fixed in just one point in time.

3. Determine test flow velocities at nest sites in comparison with velocities that occurred during the 1983 peak flow: Water velocities at several cross sections that represent the four primary southwestern willow flycatcher territories in Grand Canyon were reviewed using a flow model and water velocities measured by researchers as sites near territories. As anticipated, mainstem velocities will be less during the 1275 cms flow than those of 1983 flood flows that exceeded 2400 cms. Mainstem velocities were predicted to range from 1.30 to 3.34 m/second (m/s) at

a 1275 cms flow. More important are the velocity in the primary eddies close to the territories. Based on the prediction that debris fans will not be overtopped by a 1275 cms flow, velocities on the inundated surface of the reattachment bars (substrate for territory vegetation) are anticipated to range from 0.33 to 0.84 m/s. Velocities of this range may scour the face of the reattachment bar but are unlikely to scour the rear portions of the bar or the cohesive silt sediments. Predications are reinforced by observations of 6 return current channel marshes that agraded slightly but were not scoured after the 1980 spill.

4. Assess the relative proportions of terrestrial and aquatic invertebrates in the southwestern willow flycatcher diet: As no detailed diet study has been conducted on the southwestern willow flycatcher in Grand Canyon, examination of previous southwestern willow flycatcher food habits, Grand Canyon invertebrate studies, and interviews with biologists found the species feeds on a number of insects, other invertebrates and some plant matter. Aquatic invertebrates such as snails and Tabanidae larvae have reported elsewhere, and similar taxa may contribute to the food base of the species here. Because the test flow will be conducted in late March, invertebrate populations will have opportunity to repopulate or even increase because of renewed plant vigor and regrowth. Also, because most insects have not emerged at time of the test flow, while there may be some reduction in fossorial species, most terrestrial invertebrate groups are not anticipated to diminish.

Summarizing, the test flow will be conducted before territorial southwestern willow flycatchers have returned to Grand Canyon habitats so there will be no direct loss of nests or young. The timing of the flow approximates a hydrograph designed to restore a more natural dynamic process to the Grand Canyon ecosystem. Loss of woody riparian vegetation is not expected at nesting territories as the quantity and duration of flows do not exceed a level previously experienced that did not scour those habitats. Some loss of return current channel wetlands, marshes, and understory at nesting territories is anticipated if the test flow is successful; however, while not anticipated to reduce appreciable the breeding, nesting, and forage value of that habitat, this loss is unquantified. Some insect and other invertebrate populations that are a food resource for the southwestern willow flycatcher might be reduced immediately following the flow but might increase later in the season. Whether territories are more susceptible to brown-headed cowbird parasitism after the test flow is also not quantified.

If the test flow is successful, proposed critical habitat should be enhanced as the fluvial processes restore sediment from channel bottoms to the nearshore and areas above the mean high interim flow. The duration and magnitude of the test flow was devised in order to create enough velocity and force to move sand-sized sediment and deposit that sediment before it has traveled too far downstream or the flow has eroded return current attachment bars and other substrates of woody riparian in the upper portion of the Grand Canyon where sediment supply is limited. The physical and biological features and constituent elements of the proposed critical habitat would be benefited in the long-term (in this case, perhaps 1 or 2 years after the test flow) while there might be short-term adverse effects due to high flows to some of the constituent elements through temporary reduction in cover near or habitat for terrestrial insects. These short-term

effects would not appreciably lower the capacity of critical habitat to support the southwestern willow flycatcher, and no adverse modification of critical habitat would result.

One focus of critical habitat is to preserve areas for the future conservation of the species. In the proposal to list critical habitat (U.S. Fish and Wildlife Service 1993), activities that may adversely modify the southwestern willow flycatcher critical habitat included water diversion, or impoundment, or other activities that alter the quantity or quality of surface water flow that may affect riparian vegetation or food availability. In the FEIS, and many articles and reports on restoration of southwestern riparian habitat, the need for a more natural hydrograph, to include flood flows has been emphasized. In this instance, not to conduct the test flow might be considered adverse modification of proposed critical habitat.

CUMULATIVE EFFECTS

The project area occurs within the jurisdiction of the National Park Service. Therefore, it is not likely that actions that might affect listed species within the project area would not be considered a Federal action.

Actions by Indian Tribes whose land is adjacent to the Colorado River or its tributaries may or may not be considered a Federal action. We are unaware of any proposed non-Federal action these entities that affect habitats of species being considered in this consultation.

CONCLUSION

After reviewing the current status of the humpback chub, Kanab ambersnail, and southwestern willow flycatcher, the environmental baseline for the action area, the effects of the proposed spring 1996 beach/habitat-building flow from Glen Canyon Dam (test flow), and the cumulative effects, the Service's biological opinion is that the test flow, as proposed, is not likely to jeopardize the continued existence of the humpback chub, Kanab ambersnail, and southwestern willow flycatcher, and is not likely to destroy or adversely modify designated critical habitat.

After reviewing the current status of the southwestern willow flycatcher, the environmental baseline for the action area, the effects of the proposed spring 1996 beach/habitat-building flow from Glen Canyon Dam (test flow), and the cumulative effects, the Service's conference opinion is that the test flow, as proposed, is not likely to destroy or adversely modify proposed critical habitat for the southwestern willow flycatcher. Critical habitat for the Kanab ambersnail has been proposed only in Utah; however, this action does not affect that area and no destruction or adverse modification of that critical habitat is anticipated.

INCIDENTAL TAKE STATEMENT

Sections 4(d) and 9 of the Act, as amended, prohibit taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or the applicant. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary and must be implemented by the agency so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. Reclamation has a continuing duty to regulate the activity covered by this incidental take statement. If Reclamation (1) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

Humpback Chub

AMOUNT OR EXTENT OF TAKE

The Service anticipates incidental take of humpback chub will be difficult to detect for the following reason(s): Incidental take of actual species numbers may be difficult to detect because the species is be found throughout the mainstem; body size of humpback chub that might be transported will be small; and finding a dead or impaired specimen is unlikely because of the size and remoteness of the riverine system. Determination of incidental take in the January 1995 biological opinion identified that testing of habitat building flows would be conducted as a reasonable and prudent measure. Because the proposed action is a test of a flow of magnitude and duration experienced by the species in several recent events, and subsequent similar actions will require analysis and additional compliance as part of the adaptive management strategy being incorporated into Glen Canyon Dam operations, incidental take for the proposed action will limited and will be considered to be exceeded if more than 25 humpback chub are found floating dead in the mainstem or if no humpback chub or native fish from 1995 year class are found in nearshore habitats in the mainstem above Unkar Rapid (RM 73) after the test flow. The incidental take is expected to be in the form of harm, harass, and kill.

If, during the course of the action, the amount or extent of the incidental take anticipated is exceeded, Reclamation must reinitiate consultation with the Service immediately to avoid violation of section 9. Operations must be stopped in the interim period between the initiation and completion of the new consultation if it is determined that the impact of the additional taking will cause an irreversible and adverse impact on the species, as required by 50 CFR 402.14(i). An explanation of the causes of the taking should be provided to the Service.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take:

1. Conduct the test flow during a period that avoids concentrations of young-of-year humpback chub.

2. Follow the proposed pattern of stepped down-ramping rates designed to preserve created nearshore habitats, unless superseded by a system emergency.

3. Use studies associated with the proposed test flow that include determination of effects on physical habitat used by young fishes, food base, and direct effect on larval, juvenile, and adult native and nonnative fishes to develop methods to detect changes in numbers of humpback chub or their habitat.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of Act, Reclamation must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

1. Monitoring of the project area and other areas that could be affected by the proposed action shall be done to ascertain take of individuals of the species and/or of its habitat that causes harm or harassment to the species. This monitoring will be accomplished using the following protocol:

If, during the course of the controlled flood the amount or extent of the incidental take anticipated is exceeded, Reclamation must reinitiate consultation with the Service immediately to avoid violation of section 9. Operations must be stopped in the interim period between the initiation and completion of the new consultation if it is determined that the impact of the additional taking will cause an irreversible and adverse impact on the species, as required by 50 CFR 402.14(i). An explanation of the causes of the taking should be provided to the Service.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take:

1. Efforts to minimize the loss of individual Kanab ambersnails will be accomplished as set forth in the following terms and conditions.

2. Before another habitat-building flow, Reclamation will enter into informal consultation with the Service to evaluate test flow studies, the establishment or discovery of a second population of Kanab ambersnail in Arizona, and reinitiate formal consultation with the Service if incidental take will exceed the 10 percent as established in the 1995 biological opinion.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, Reclamation must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

1. Monitoring of the project area and other areas that could be affected by the proposed action shall be done to ascertain take of individuals of the species and/or of its habitat that causes harm, harassment, or death to the species. This monitoring will be accomplished using the following protocol:

    a. "A Draft Proposal to Assess, Mitigate and Monitor the Impacts of an Experimental High Flow from Glen Canyon Dam on the Endangered Kanab Ambersnail at Vaseys Paradise, Grand Canyon, Arizona" (Stevens *et al.* 1995b).

a. "A Proposal to Determine Effects of Controlled Flood on the Aquatic Ecosystem if the Colorado River Downstream from Glen Canyon Dam, Arizona" provides a pre -, during, and post-test flow plan for aquatic resources (Persons 1995).

b. Additional plans have been developed for the physical and biological resources affected by the test flow under the coordination the GCES.

c. SALVAGE PROTOCOL. Humpback chub specimens found dead, or taken as part of research activities, will be turned over to Arizona Game and Fish Department (AGFD) for investigation of food habitats or parasites, and then deposited in the collection of fishes at Arizona State University.

2. A report of the results of the monitoring, including complete and accurate records of all incidental take that occurred during the course of the project, will be submitted to the Service the same date that a draft and final is submitted to Reclamation. Progress reports provided to Reclamation will also be provided to the Service. This report will also describe how the terms and conditions of all reasonable and prudent measures in this incidental take statement were implemented, including any deviations from the test flow and explanation for need to change.

3. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. With implementation of these measures the Service believes that take will be minimized and will not exceed 25 humpback chub found floating dead in mainstem or no native fish from the 1995 year class will be found in nearshore habitats above RM 73. If, during the course of the action, this minimized level of incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

Kanab Ambersnail

AMOUNT OR EXTENT OF TAKE

The Service anticipates that as much as 17 percent of the Kanab ambersnail habitat in Grand Canyon could be taken as a result of this one time proposed action. The 10 percent incidental take level remains with the return to normal operations. This translates to approximately 129m^2 of the population's primary habitat. Based on impacted area and anticipated snail densities, approximately 640 individuals are expected to be directly affected by this project. The incidental take is expected to be in the form of harm, harass, mortality during salvage, and death.

b. In order to more accurately determine elevation of river stage at the range of flow that will be experienced during the test flow, and for use in developing a stage-discharge relationship for future flow, the placement of a stage recorder, such as a pressure transducer coupled to a recorder should be deployed, if possible, in the mainstem at an appropriate site near the Kanab ambersnail population. The U.S. Geologic Survey should be contacted regarding the possibility of changing the location of a stage recorder to be used in test flow studies to the Kanab ambersnail site.

c. SALVAGE PROTOCOL. Kanab ambersnail specimens found dead, or taken as part of research activities, shall be collected and held as specified in the AGFD permit, with final deposition in a suitable museum collection such as at Northern Arizona University.

2. Relocate or collect approximately 90 percent of the Kanab ambersnail individuals from the lower zone of inundation to higher stage levels within Vaseys Paradise as described in the above 1.a. proposal. Control polygons must not receive moved snails.

3. Determine the fate of the moved ambersnails, observe temperature, light level, and local snail density; compare the survivorship of marked and moved versus resident Kanab ambersnail; and facilitate the one time collection of 100 individuals to AGFD for future studies.

4. Determine the Kanab ambersnail population recovery and habitat recolonization for one full year after the test flow and evaluate changes in the Kanab ambersnail population, its parasites, potential competitors, or predators, after the flood.

5. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. With implementation of these measures, the Service believes that no more than 17 percent of the total available primary habitat will be incidentally taken. If, during the course of the action, this minimized level of incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. Reclamation must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

Southwestern Willow Flycatcher

AMOUNT OF EXTENT OF TAKE

The Service anticipates incidental take of southwestern willow flycatcher will be difficult to detect for the following reasons: Incidental take of actual species numbers may be difficult to detect when the species is rare and wide-ranging and losses may be masked by seasonal fluctuations in numbers or other causes. However, the following level of take of this species

can be anticipated by loss of habitat as a result of the proposed action due to elevation of test flows before the nesting season that might inundate historic nest trees up to 1.5 m from ground level and degrade nesting territories. The incidental take is expected to be in the form of harm through loss of vegetative understory that provides cover and forage species habitat for both adults and young.

If, during the course of the action, the amount or extent of the incidental take anticipated is exceeded, Reclamation must reinitiate consultation with the Service immediately to avoid violation of section 9. Operations must be stopped in the interim period between the initiation and completion of the new consultation if it is determined that the impact of the additional taking will cause an irreversible and adverse impact on the species, as required by 50 CFR 402.14(i). An explanation of the causes of the taking should be provided to the Service.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take:

1. Conduct test flow to avoid adverse interactions with territorial southwestern willow flycatchers by concluding the maximum flow portion (1275 cms) of the test flow no later than April 15, and preferably before April 1.

2. To verify the stage-discharge relationships and flow models used to predict elevation and flow at nest sites and to monitor level of incidental take, quantify flow depth and velocity at each of above four territories.

3. To assess how flow regimes affect understory structure, conduct on-site visits of the four historic territories detailed in the draft Supplemental Report (U.S. Bureau of Reclamation 1996a) visiting sites during the post-breeding season (late summer 1996). Measure habitat characteristics important to southwestern willow flycatcher such as vertical structure, foliage height diversity, distribution of flood deposited debris, and habitat patch size and configuration. Evaluate these habitat characteristics as they relate to flood flow levels and the monitoring completed in the above reasonable and prudent measure 2. Compare with an aerial canopy evaluation to determine if habitat characteristics important to the southwestern willow flycatcher can be measured from aerial photographs or video media.

4. Conduct surveys and monitoring of southwestern willow flycatcher distribution and nesting success for the 1996 nesting season in accordance with the National Park Service monitoring plan.

5. Initiate formal consultation for the southwestern willow flycatcher on the preferred alternative to the FEIS before January 31, 1997, including in the biological assessment data from the test flow final reports due December 31, 1996.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, Reclamation must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

1. Monitoring of the project area and other areas that could be affected by the proposed action shall be done to ascertain take of individuals of the species and/or of its habitat that causes harm or harassment to the species. Monitoring for reasonable and prudent measures 2 and 3 will be accomplished by Reclamation and for measure 4 will be with the National Park Service which has lead for this task.

2. A report of the results of the monitoring, including complete and accurate records of all incidental take that occurred during the course of the project, will be submitted to the Service with a draft report by September 30 and a final report by December 31, 1996. This report will also describe how the terms and conditions of all reasonable and prudent measures in this incidental take statement were implemented.

3. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. With implementation of these measures, the Service believes that no more than 1.5 m of flow will inundate any of the four historic nest sites. If, during the course of the action, this minimized level of incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

Notice: While the incidental take statement provided in this consultation satisfies the requirements of the Act, as amended, it does not constitute an exemption from the prohibitions of take of listed migratory birds under the more restrictive provisions of the Migratory Bird Treaty Act.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Introductions of nonnative fishes has been identified as a major cause in the decline of native and, particularly, endangered fishes. Fishes from Lake Powell, passing through the turbines or jet tubes at Glen Canyon Dam, usually are injured or killed before entering the Colorado River downstream. Avoiding use of the spillways decreases the risk that some fish might survive and be transported downstream in to the Grand Canyon aquatic environment.

2. Investigate comparable habitats of Kanab ambersnail in Grand Canyon to determine the feasibility of secondary population introductions.

3. Participate in efforts aimed at the establishment of temporary refugium for Kanab ambersnail.

4. Continue to participate in the review process for establishment of second population of Kanab ambersnail in Grand Canyon, Navajo Nation, or elsewhere in Arizona.

5. Investigate the transplant success of vegetation important to the Kanab ambersnail:
   a. Investigate success of temporarily removing *Mimulus*, *Nastertium*, or other appropriate vegetation into a temporary holding facility, and replanting.
   b. Investigate success of permanently removing *Mimulus*, *Nastertium*, or other appropriate vegetation

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation and conference on the action outlined in the reinitiation request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or

critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

You may ask the Service to adopt the conference opinion incorporated in this consultation as a biological opinion issued through formal consultation if the proposed critical habitat is designated. The request must be in writing. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, the Service will adopt the conference opinion as the biological opinion on the project and no further section 7 consultation will be necessary.

After designation of critical habitat for the southwestern willow flycatcher and any subsequent adoption of this conference opinion, Reclamation shall request reinitiation of consultation if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this conference opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this conference opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

The incidental take statement provided with this conference opinion does not become effective until the designation of critical habitat and the conference opinion is adopted as the biological opinion issued through formal consultation. At that time, the project will be reviewed through formal to determine whether any take if the southwestern willow flycatcher has occurred. Modifications of the opinion and incidental take statement may be appropriate to reflect that take. No take of the southwestern willow flycatcher may occur between the designation of critical habitat and the adaption of the conference opinion through formal consultation, or the completion of a subsequent formal consultation.

We appreciate the extraordinary effort the Bureau of Reclamation has contributed to implementing the test flow. The final environmental impact statement and biological opinion for the preferred alternative both emphasized the importance of such a flow to endangered species and the Grand Canyon ecosystem. The Service has strived to assist during this period of furloughs and short deadlines. This opinion has been coordinated with Christine Karas and Gordy Lind of your Regional staff. For further information please contact Frank Baucom or Tom Gatz. Please refer to the consultation number 2-21-93-F-167 in future correspondence concerning this project.

Sam F. Spiller

cc: Director, Fish and Wildlife Service, Washington, D.C. (DDS)
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