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AESO/SE
2-21-98-F-288 January 25, 2001

Mr. George L. Beams
Chief, Construction - Operations Division
U.S. Army Corps of Engineers, Los Angeles District
P.O. Box 532711
Los Angeles, California 90053-2325

Dear Mr. Beams:

This biological opinion responds to your request for consultation with the U.S. Fish and Wildlife Service (Service) pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended (Act). Your request for consultation was dated August 23, 2000, and received in this office August 28, 2000. The U.S. Army Corps of Engineers (Corps) proposes issuance of a Section 404 permit to Arizona Department of Transportation (ADOT) for construction of a scour protection project on the Interstate (I)-19 and frontage road bridges over Peck Canyon near the confluence with the Santa Cruz River, Santa Cruz County, Arizona. The purpose of the scour protection project is to prevent bridge failure in the event of scouring flood flows in Peck Canyon. At issue are impacts that may affect the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) and endangered Gila topminnow (*Poeciliopsis occidentalis occidentalis*).

This biological opinion was prepared using information from the following sources: your August 23, 2000, request for consultation; ADOT's May 17, 1999, and June 23, 2000, requests for consultation; the April 19, 1999, biological assessment for the project (Entranco 1999); the supplemental information - biological assessment that accompanied ADOT's June 23, 2000, letter to this office; and our files. References cited in this biological opinion are not a complete bibliography of all literature available on the affected species, nor is it a complete review of the effects of bridge scour protection on these species. A complete administrative record of this consultation is on file in our office.

CONSULTATION HISTORY

Informal consultation on this project began in 1998 with discussions among ADOT, the Service, and Entranco; and included a site visit. An initial request for formal consultation, dated May 17, 1999, was transmitted from the Federal Highway Administration, Phoenix to this office. We responded in a letter dated June 23, 1999, in which we requested more information about the scope of the project and its effects to listed species. Specifically, we requested additional information about potential effects of the action to the southwestern willow flycatcher, cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*), and lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*); clarification of the location of proposed temporary access roads and material stockpiles; assessment of potential effects to species from hazardous materials; possible effects of flood flows in Peck Canyon during proposed construction; and other topics. ADOT responded in a letter dated June 23, 2000, with the additional information and requested formal consultation, this time on behalf of the Corps. According to the letter, the Corps, as a permitting agency (404 permit) had assumed the lead for the project. In a letter dated August 21, 2000, we informed ADOT that requests for formal consultation must come from a Federal agency. Federal agencies cannot delegate their responsibility to formally consult with the Service. A request for formal consultation, dated August 23, 2000, was subsequently received from the Corps. In a letter dated September 20, 2000, the Service acknowledged receipt of the request, found that the consultation package was complete, and that formal consultation had been initiated on August 28, 2000.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The project area includes the I-19 and frontage road crossings of Peck Canyon and adjacent areas, near the confluence of Peck Canyon and the Santa Cruz River, about 20 miles north of Nogales (Figure 1). Scour protection decks would be constructed under three bridges over Peck Canyon, including the bridges supporting the north and south bound lanes of I-19, and the frontage road bridge, located to the west of I-19. The purpose of the project is to prevent bridge failure in the event of scouring flood flows in Peck Canyon.

Scour protection consists of a steel-reinforced concrete decking constructed beneath the bridge that protects the bridge footings from erosion. The areas around the bridge piers are excavated to a depth of 10-15 feet. Excavated material would be stockpiled at five temporary spoil areas (Figure 1). The furthest west spoil area (towards the bottom of Figure 1) would be relocated from that shown on Figure 1 to an area devoid of sapling or mature cottonwood or willow trees. The small spoil area just west of I-19 that overlies the active stream channel is not needed (James Ridone, ADOT, pers. comm. 2000). After excavation, the stream bed would be temporarily dewatered to a depth of 15-20 feet below the surface via pumping groundwater from the

excavated area. Dewatering is necessary for further construction activities. Pumped water would be delivered to the Peck Canyon drainage downstream of the construction site where it would flow towards the Santa Cruz River. The completed scour decks would be approximately six inches thick and extend outward for14 feet from the bridge piers. Vertical cut-off walls would extend down from the edges of the deck for five feet into the streambed. The deck would be backfilled with the stockpiled streambed materials.

Figure 1: Project map

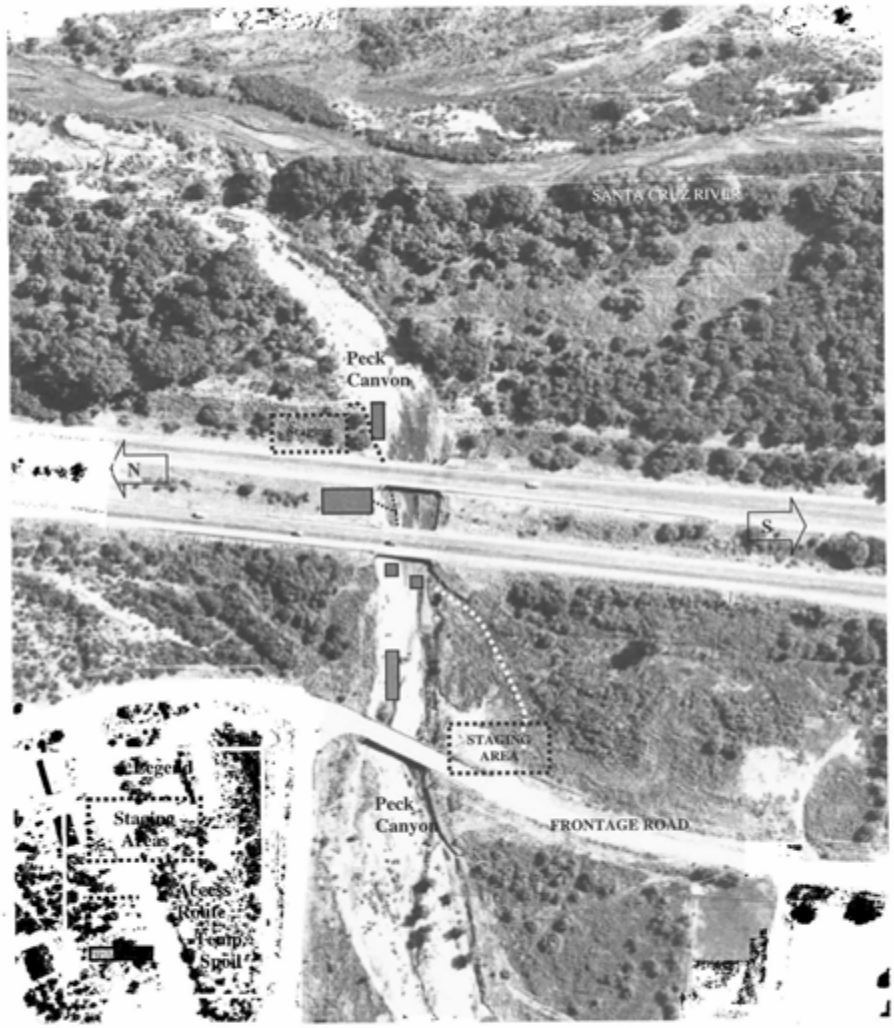

Figure 1: September 30, 1992, aerial photo of project area and project features. See text and Figures 2, 3, and 4 for current description of vegetation communities.

The total area excavated for the three bridges would be 2,560 feet^2, the area of the channel affected by excavation activities (area excavated plus stockpile areas) would be 0.5 acre, and 9,000 feet^3 of material would be excavated for the scour deck and cutoff walls. The project is expected to take 60 days to complete. Construction would occur from November 2001 to January 2002. The project would also include temporary placement of two equipment staging areas, one on the south side of the frontage road bridge, and another just northeast of the northbound I-19 bridge. A temporary access route would connect the two staging areas, material stockpile sites, and bridges (Figure 1). Additional information about the details of the project is included in the biological assessment for the project (Entranco 1999).

Proposed Measures to Minimize the Effects of the Action

1. Project construction will be planned for the winter months when Peck Canyon is typically dry. If the pools where Gila topminnow occur in Peck Canyon are dry, then effects of proposed dewatering and other project effects on the topminnow and its habitat will be minimized.

2. If Peck Canyon contains surface water prior to dewatering, then fishes and other aquatic organisms will be transferred downstream, or to a suitable holding facility. Riparian vegetation around the pools will be watered to maintain live trees, shrubs, and herbaceous vegetation. When pumping of groundwater ceases and water levels resume normal levels, any Gila topminnow held in off-site facilities will be returned to the stream or pond of origin. Replacement of topminnow will be conducted in stages, allowing time to observe the response of the fishes to the post-construction conditions. If mortality is observed, the reintroduction would be halted and the cause of mortality addressed.

3. Access roads will be placed in previously disturbed areas as much as possible. After construction is complete, the roads will be planted with erosion controlling vegetation, per standard ADOT practice. The ROW fence, which will need to be removed during construction, will be replaced after construction is complete, blocking vehicular access. The streambank will be recontoured where the road enters the channel to restore the bank.

4. Temporary spoil areas will be located outside of the channel or in unvegetated portions of the channel that are not wetted.

5. Scour pools downstream of the northbound I-19 bridge will not be physically disturbed by construction (although pumping may dewater them).

6. Areas to be avoided by construction activities will be marked by orange plastic mesh fencing (e.g. the scour pools).

7. Use of shoring will be employed to minimize the encroachment of excavation activities and sediment on downstream scour pools.

8. ADOT will use "good housekeeping specifications to prevent spills of hazardous materials, and containment provisions in the event of a spill. Construction equipment will not be stored, fueled, or maintained in or near the stream channel to avoid potential contamination.

9. If a storm flow event occurs in Peck Canyon during construction, construction activities will be temporarily halted until flows subside.

10. Effects to riparian vegetation will be minimized by placement of vehicle/equipment routes and spoil piles in open or previously-disturbed areas as much as possible.

11. Any cottonwood or willow trees that are removed will be cut into poles and planted in or adjacent to the channel downstream of the I-19 northbound lane (James Ridone, ADOT, pers. comm.).

ANALYSES BY SPECIES:

Southwestern Willow Flycatcher
STATUS OF THE SPECIES

The southwestern willow flycatcher is a small passerine bird (Order Passeriformes; Family Tyrannidae) measuring approximately 5.75 inches in length from the tip of the bill to the tip of the tail and weighing only 0.4 ounces. It has a grayish-green back and wings, whitish throat, light gray-olive breast, and pale yellowish belly. Two white wingbars are visible (juveniles have buffy wingbars). The eye ring is faint or absent. The upper mandible is dark, the lower is light yellow grading to black at the tip. The subspecies was listed as endangered under the Act on February 27, 1995 (US Fish and Wildlife Service 1995). Critical habitat was designated on July 22, 1997, and includes 18 critical habitat units totaling 599 river miles in Arizona, California, and New Mexico. In Arizona, critical habitat was designated along portions of the San Pedro River, Verde River, Wet Beaver Creek, West Clear Creek, Colorado River in the Grand Canyon, and Little Colorado River (US Fish and Wildlife Service 1997a&b). A recovery team has been convened for the flycatcher; a draft recovery plan is scheduled to be available for public review in early 2001.

One of four currently-recognized willow flycatcher subspecies (Phillips 1948, Unitt 1987, Browning 1993), the southwestern willow flycatcher is a neotropical migratory species that breeds in the southwestern U.S. from approximately May 15 to September 1 and migrates to Mexico, Central America, and possibly northern South America during the non-breeding season (Phillips 1948, Stiles and Skutch 1989, Peterson 1990, Ridgely and Tudor 1994, Howell and Webb 1995). 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 flycatcher is a riparian obligate, nesting along rivers, streams, and other wetlands where

dense growths of willow (*Salix* sp.), seepwillow (*Baccharis* sp.), buttonbush (*Cephalanthus* sp.), boxelder (*Acer negundo*), saltcedar (*Tamarix chinensis*), carrizo (*Phragmites australis*) or other plants are present, often with a scattered overstory of cottonwood and/or willow.

Unitt (1987) reviewed historical and contemporary records of *E.t. extimus* throughout its range, determining that it had "declined precipitously..." and that although the data reveal no trend in the past few years, the population is clearly much smaller now than 50 years ago, and no change in factors responsible for the decline seem likely. In 1999-2000, 12 sites contained 15 or more flycatcher territories. In 2000, an estimated 919-960 territories were known rangewide (in CA, NV, AZ, UT, NM, and CO) (Service files).

Declining numbers of flycatchers have been attributed to loss, modification, and fragmentation of riparian breeding habitat, loss of wintering habitat, and nest predation/brood parasitism by the brown-headed cowbird (*Molothrus ater*) (McCarthey *et al.* 1998, Sogge *et al.* 1997). Habitat loss and degradation is caused by a variety of factors, including urban, recreational, and agricultural development, water diversion and groundwater pumping, channelization, and livestock grazing. Fire is an increasing threat to willow flycatcher habitat (Paxton *et al.* 1996). Fire frequency in riparian vegetation increases with dominance by saltcedar (DeLoach 1991), and water diversions or groundwater pumping that results in dessication of riparian vegetation (Sogge *et al.* 1997). The presence of livestock, range improvements such as waters and corrals, and agriculture provide feeding areas for cowbirds. These feeding areas, if near riparian habitats, coupled with habitat fragmentation, facilitate cowbird parasitism of flycatcher nests (Tibbitts *et al.* 1994, Hanna 1928, Mayfield 1977a&b). After five years of cowbird trapping on the South Fork of the Kern River, California, nest parasitism rates dropped from 65 to 22 percent, nest success increased from 28 to 43 percent, and mean number of young fledged per female flycatcher increased from 1.04 to 1.72 (Whitfield *et al*. 1998).

The southwestern willow flycatcher breeds in dense riparian habitats from sea level in California to just over 7,000 feet in Arizona and southwestern Colorado. Historic egg/nest collections and species' descriptions throughout its range, describe the southwestern willow flycatcher's widespread use of willow (*Salix* spp.) for nesting (Phillips 1948, Phillips *et al.* 1964, Hubbard 1987, Unitt 1987, T. Huels *in litt.* 1993, San Diego Natural History Museum 1995). Currently, southwestern willow flycatchers primarily use Geyer willow (*Salix geyeriana*) , Goodding willow (*Salix gooddingii*), boxelder (*Acer negundo*), saltcedar, Russian olive (*Elaeagnus angustifolio*), and live oak (*Quercus agrifolia*) for nesting. Other plant species less commonly used for nesting include: buttonbush (*Cephalanthus* sp.), black twinberry (*Lonicera involucrata*), cottonwood (*Populus* spp.), white alder (*Alnus rhombifolia*), blackberry (*Rubus ursinus*), carrizo (*Phragmites australis*), and stinging nettle (*Urtica* spp.). Nesting southwestern willow flycatchers exhibit a strong preference for dense vegetation at the nest site, but high variation and density of vegetation at the patch scale (Hatten *et al.* 2000). Nesting sites are typically close to the edge of the vegetation patch and close to water (Allison *et al.* 2000). In Arizona in 1999, all nests found above 6,890 feet elevation were constructed in Geyer willow. Of the 222 nesting

attempts monitored below 4,070 feet, 210 were constructed in saltcedar, and 12 were in willows (Paradzick *et al.* 2000). Based on the diversity of plant species composition and complexity of habitat structure, four basic nesting habitat types can be described for the southwestern willow flycatcher: monotypic willow, monotypic exotic, native broadleaf dominated, and mixed native/exotic (Sogge *et al.*1997).

Open water, cienegas, marshy seeps, or saturated soil are typically in the vicinity of flycatcher territories and nests; flycatchers sometimes nest in areas where nesting substrates are in standing water (Maynard 1995, Sferra *et al.* 1995, 1997). However, hydrological conditions at a particular site can vary remarkably in the arid Southwest within a season and between years. At some locations, particularly during drier years, water or saturated soil is only present early in the breeding season (i.e., May and part of June). However, the total absence of water or visibly saturated soil has been documented at several sites where the river channel has been modified (e.g. creation of pilot channels), where modification of subsurface flows has occurred (e.g. agricultural runoff), or as a result of changes in river channel configuration after flood events (Spencer *et al.* 1996).

Throughout its range the southwestern willow flycatcher arrives 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, 1997). Nesting begins in late May and early June and young fledge from late June typically through mid August (Willard 1912, Ligon 1961, Brown 1988a&b, Whitfield 1990, Sogge and Tibbitts 1992, Sogge *et al.* 1993, Muiznieks *et al.* 1994, Maynard 1995), but as late as early September (Service files). Estimated territory sizes are 0.59 to 3.21 acres for monogamous males and 2.72 to 5.68 acres for polygynous males at the Kern River (Whitfield and Enos 1996), 0.15 to 0.49 acres for birds in a 1.48 to 2.22 acre patch on the Colorado River (Sogge 1995c), and 0.49 to 1.24 acres in a 3.71 acre patch on the Verde River (Sogge 1995a).

The southwestern willow flycatcher is an insectivore, foraging in dense shrub and tree vegetation along rivers, streams, and other wetlands. Flying insects are the most important prey of the southwestern willow flycatchers; however, they will also glean larvae of non-flying insects from vegetation (Drost *et al.* 1998). Drost *et al.* (1998) found that the major prey items of the southwestern willow flycatcher (in Arizona and Colorado), consisted of true flies (Diptera); ants, bees, and wasps (Hymenoptera); and true bugs (Hemiptera). Other insect prey taxa included leafhoppers (Homoptera: Cicadellidae); dragonflies and damselflies (Odonata); and caterpillars (Lepidoptera larvae). Non-insect prey included spiders (Araneae), sowbugs (Isopoda), and fragments of plant material.

In Arizona in 1999, 513 resident willow flycatchers were detected at 46 sites on 12 drainages. A total of 289 flycatcher territories, including a documented 256 paired flycatchers, were found at 41 sites. Major concentrations of birds were found near the confluence of the Gila and San Pedro rivers; Roosevelt Lake; the lower Grand Canyon; from Fort Thomas to Pima East on the middle

Gila River; Topock Marsh on the lower Colorado River, Verde River at Camp Verde, near Greer and Alpine; and Alamo Lake on the Bill Williams River (Paradzick *et al.* 2000). Documented willow flycatcher nesting attempts in Arizona in 1999 totaled 327, of which outcome of the nest was determined for 227 at monitoring sites. Of the 227 nests, 114 were successful; an estimated 259 flycatchers fledged from successful nests. Cowbird brood parasitism occurred at 10 nests, however, flycatchers fledged at two of these nests, despite parasitism. Twenty-three nests were either deserted or abandoned (Paradzick *et al.* 2000). In 2000, an estimated 289-330 territories were documented in Arizona. Five sites in Arizona in 2000 supported 15 or more territories (Service files).

For further information on the ecology, range, status, and threats to this subspecies, refer to Brown (1988a), Harris (1991), Harris *et al.* (1987a&b), Luff, *et al.* (2000), McCarthey *et al.* (1998), Paradzick *et al.* (1999, 2000), Paxton *et al.* (1996), Sferra *et al.* (1997), Sogge *et al.* (1997), Stoleson and Finch (1998), Tibbitts *et al.* (1994), Unitt (1987), and Uyehara et al. (1998).

ENVIRONMENTAL BASELINE

Environmental Setting

The project area includes Peck Canyon and adjacent areas near the confluence of Peck Canyon and the Santa Cruz River. Peck Canyon drains the northern end of the Atascosa Mountains and the southern end of the Tumacacori Mountains, west of I-19 and south of Tumacacori, Santa Cruz County, Arizona. Peck Canyon flows through mesquite and oak woodlands and semidesert grasslands to the Santa Cruz River. In the upper reaches of the canyon some perennial pools exist; however, flowing water is typically present only during or after precipitation events or during active monsoon seasons. Entranco (1999) indicates that permanent or nearly permanent scour pools exist between the I-19 northbound bridge and the Santa Cruz River. Cottonwoods and willows exist along Peck Canyon from upstream of the frontage road to the Santa Cruz River, indicating a dependable subsurface water source.

The Santa Cruz River is perennial from roughly the Potrero (or Nogales) Wash/Santa Cruz River confluence to Chavez Siding north of Tubac. This area includes the Santa Cruz River immediately east of the project area. Perennial flows in this area are sustained by flows from Potrero Creek and effluent discharged from the International Waste Water Treatment Plant at the Potrero Wash/Santa Cruz River confluence, which began discharging effluent to the river in 1972 (Coes, *et al.* 2000, Drost 1998). Historically, in the 1800s, the Santa Cruz River was perennial to Tubac and intermittent to Tucson (Brown *et al.* 1981, Hendrickson and Minckley 1984). Marshlands occurred as far downstream as San Xavier del Bac and near Tucson, but disappeared during arroyo cutting and extreme incisement of the channel in 1890-1892 (Cooke and Reeves 1976). The US Department of Agriculture (1977) found that in 1977 only two miles of the Santa Cruz River was classified as perennial. Increasing discharge of effluent from the International Wastewater Treatment Plant has bolstered flows considerably in recent years.

Although discharge from the Treatment Plant has recreated a substantial perennial reach, degraded water quality downstream of the Plant has adversely affected aquatic organisms. Drost (1998) found that amphibians were absent for six miles downstream of the Plant. Drost attributed their absence to toxic levels of ammonia. Ground water samples from north of Nogales next to Nogales Wash exceeded State and/or Federal water quality standards for nitrite plus nitrate, manganese, and dissolved solids. These water quality problems were attributed to uncontrolled releases of untreated wastewater to Nogales Wash south of the international boundary (Coes *et al.* 2000). In 2000 a spill of diesel fuel occurred on the Santa Cruz River in Mexico that spread downstream to Tubac before it was contained. An analysis of effects to fish and wildlife has not been completed, but live Gila topminnow were found after the spill; no dead fish were reported.

Riparian vegetation has also increased with increasing flows from the Treatment Plant. Entranco (1999) describes the current riparian vegetation community along the Santa Cruz River and near its confluence with Peck Canyon in the vicinity of the project:

> "The Santa Cruz River floodplain has a riparian forest of Fremont cottonwood, Goodding willow, Mexican elderberry, and velvet mesquite. Canopy cover is varied, from about 70 percent to 95 percent. The tree canopy is tall, about 40-50 feet in places. There is a well-developed mid-story along the river channel and along the terminal reach of Peck Canyon within the floodplain. Except for the I-19 R/W (right-of-way), the Santa Cruz River floodplain riparian canopy is intact with the riparian canopy of Peck Canyon. The canopy gap left by I-19 is approximately 300 ft. wide.

Figure 1 shows patches of riparian woodland along the Santa Cruz River, particularly on the west bank, patches of trees both north and south of Peck Canyon from the confluence to the frontage road bridge, and scattered trees upstream of the frontage road. 1998 photos and descriptions in Entranco (1999) show the same pattern, with mostly young cottonwoods and willows in the Peck Canyon channel and more mature stands of trees north and south of the channel through the project area. Service personnel visited the site in early December 2000. At that time, considerable flow was occurring in Peck Canyon and the Santa Cruz River, and debris along the Peck Canyon channel suggested water had been probably several feet higher recently, no doubt in response to heavy rains in October and early November. These high flows did not; however, appear to have altered the channel or riparian vegetation substantially.

As of December 2000, higher riparian terraces in the project area support a velvet mesquite (*Prosopis velutina*) woodland with occasional netleaf hackberry (*Celtis laevigata*), Arizona ash (*Fraxinus veluntina*), Mexican elderberry (*Sambucus caerulea*), and other species. This community is well represented in the area between the frontage road and the southbound I-19 bridge, and north of the creek. It is also present immediately east of the northbound lane of I-19, north of the creek and west of the powerline road, seen as a scar through the vegetation, just east of and parallel to I-19 (Figure 1). East of the powerline road and north of the creek, is an

intermediate terrace with species characteristic of the higher terrace plus mature Fremont cottonwood (*Populus fremontii*) and Goodding willow (*Salix gooddingii*). This community is relatively open. Also on an intermediate terrace between the frontage road and southbound lane of I-19, and just south of the proposed access road, is a mature stand of Fremont cottonwood and Goodding willow. The proposed access road and the area between the access road and the creek is disturbed ground grown over with russian thistle (*Salsola iberica*), pigweed (*Amaranthus palmeri*), and desert broom (*Baccharis sarothroides*). A fenced facility, possibly a pumping station, exists in the open area adjacent to the frontage road and just south of Peck Creek. Fremont cottonwood and Goodding willow of varying age classes dominate in other locales in project area. In the channel, there is much open ground, but many young cottonwoods and a few willows are present from upstream of the frontage road bridge to the Santa Cruz River. Dense stands of medium age willows, 20-40 feet in height, occur on the south bank of Peck Creek from a short distance east of the powerline road to the Santa Cruz River. A large relatively open area south of Peck Creek between I-19 and the Santa Cruz River is an oxbow that apparently supports flows during high water on the Santa Cruz River. Some pools and flowing water were present in this area during early December 2000.

Uplands in the project area are characterized by mesquite-grassland communities. Low-density residential development occurs along Peck Canyon from the frontage road upstream for approximately 2.5 miles to the Coronado National Forest boundary. Calabasas School is located just southwest of the project area. The Peck Canyon Road Interchange of I-19 is located 0.3 mile south of Peck Canyon. Low density housing occurs east of the Santa Cruz River. Vegetation communities along this reach of the Santa Cruz River are dominated by velvet mesquite bosque on the higher terraces and cottonwood and willow forest near the river. Large portions of the bosque have been cleared for use as livestock pastures and farming.

Status of the Southwestern Willow Flycatcher in the Project Area

Surveys for southwestern willow flycatcher were conducted in the project during May-July 1999 by Entranco biologists in accordance with Service protocol (Sogge *et al.* 1997). Twelve stations were surveyed in total, although only 7-8 sites were surveyed during each of the three visits to the project area. Surveyed sites included seven in the Peck Canyon drainage, two adjacent to the channel and downstream of I-19, and three in riparian woodland on the west bank of the Santa Cruz River upstream of the Peck Canyon confluence. Sites were surveyed May 31, June 14, and July 10, 1999. No willow flycatchers were detected during these surveys.

Thetis Gamberg, Fish and Wildlife Service, Tucson (pers. comm.) located a calling willow flycatcher from the Peck Canyon frontage road bridge on May 19, 1998. Males are beginning to establish territories at this time and often sing reliably. However, migrants (including other subspecies) are also present in mid-May. No followup surveys were conducted in 1998 at the project site, thus we do not know if that bird was a migrant or breeding. The Santa Cruz River, coupled with the Rio Bambuto, Rio Magdalena, and Rio Miguel drainages south of Nogales,

could be an important migration corridor for flycatchers. The project area does not include critical habitat for the willow flycatcher. The nearest designated critical habitat is on the San Pedro River, approximately 50 miles to the east. No critical habitat has been designated on the Santa Cruz River drainage.

Entranco biologists described the habitat at the surveyed sites in the project area. They note that the riparian stand along the Peck Canyon channel "is not especially dense, a person can walk through most of the stand without difficulty. The riparian stand and stream channel is grazed by cattle east of I-19. The riparian stand may be poor habitat for the southwestern willow flycatcher due to lack of foliage density and absence of nearby surface water during the breeding season.

Based on a December 2000 visit by Service personnel, the best habitats for flycatchers in the project area are probably located on the south bank of Peck Creek east of the powerline road (Figure 2). This area supports dense stands of willow, 20-40 feet in height, characteristic of the species' habitat. However, lack of surface flows in Peck Canyon during late spring, when the birds are arriving and establishing territories, may reduce the suitability of this site. Another dense stand of willows on the east bank of the Santa Cruz River at the Peck Canyon confluence appears to be suitable habitat. Other riparian habitats in the project area are much less likely to support nesting flycatchers. Woodlands on the intermediate terrace, located north of Peck Creek and east of I-19, described above, are probably too open to support flycatchers. The cottonwood and willow woodland between the frontage road and I-19 and south of proposed access road, is also probably too open and far from perennial water.

Figure 2. Potential flycatcher habitat on the south bank of Peck Canyon, downstream of the northbound I-19 bridge. December 2000 photo.

The Santa Cruz River has not been surveyed regularly or thoroughly for southwestern willow flycatchers. These limited surveys have not confirmed presence of breeding southwestern willow flycatchers on the Santa Cruz River. No detections of willow flycatchers were noted during surveys in the early 1990s at Chavez Siding Road, Rio Rico, and Ruby Road Bridge (all south of the project area), or at Anza Trail near Tubac, north of the project area (Sferra *et al.* 1997). The river was not again surveyed until 1999, when, in addition to the Entranco surveys noted above, a migrant flycatcher was found at the Anza Trail, three migrants were found at Santa Gertrudis South (between Tubac and the project area), and one migrant was found at Rio Rico in June 1999 (McCarthey *et al.* 1998, Paradzick *et al.* 1999, Paradzick *et al.* 2000). No surveys for flycatchers were conducted on the Santa Cruz River in 2000. Most of the Santa Cruz River is privately owned and thus only a few localities have been surveyed by State or Federal agency biologists.

Effects of the Proposed Action

The effects of the proposed action on the southwestern willow flycatcher are not anticipated to include direct effects to individual flycatchers because construction is proposed for November-January, when flycatchers are not present. Flycatchers could be indirectly affected after completion of the project as a result of modifications to suitable habitat, or effects to potential habitat that might become suitable absent the project. Riparian habitat along Peck Canyon would be affected due to the following proposed construction activities: area excavated for the scour decks (0.06 acre), material stockpile areas (0.44 acre), staging areas (estimated 1.37 acre), and approximately 450 feet of temporary access route (estimated 0.1 acre). None of the areas proposed for disturbance support habitat likely to be used by nesting flycatchers. The two staging areas are disturbed ground dominated by russian thistle and pigweed. The temporary spoil area between the freeway lanes is also disturbed; vegetation includes russian thistle and a few scattered velvet mesquite, saltcedar, and desert broom. The temporary spoil areas in the channel are located in open areas largely devoid of vegetation.

In the areas to be excavated for scour decks, a few young cottonwoods (10-20 feet tall) will need to be removed (Figure 3). The access route will also result in removal of some young cottonwoods in the channel. Entranco (1999) estimated that 0.5 acre of young-aged cottonwood and willow habitat would be removed as a result of construction; however, inspection of the site in December 2000 suggested that less than that would be affected, primarily sapling cottonwoods in the vicinity of I-19. These cottonwoods, although they probably are not suitable nesting habitat and have little potential to develop into suitable nesting habitat, could provide foraging habitat for migrating flycatchers, or perhaps for foraging flycatchers nesting or dispersing from suitable habitats closer to the Santa Cruz River. With the exception of the area disturbed by the scour decks (0.06 acre), disturbance would be temporary. The proposed scour decks (0.06 acre) would preclude reestablishment of riparian trees; however, disturbance in other areas would be temporary. Riparian vegetation can quickly reestablish following disturbance, if flows and geomorphology have not been much altered. Cottonwoods and willows can grow several feet per

Figure 3. Northbound lane of I-19, east side, showing some of the sapling cottonwoods in Peck Canyon that would be removed during construction. The tops of trees that would be affected between the northbound and southbound lanes can be seen above the bridge. December 2000 photo.

year under adequate conditions; and herbaceous species can regrow within a season. The sapling cottonwoods that would be removed near the I-19 bridges would be replanted as poles in or near the channel downstream of I-19. Pole plantings are often quite successful if appropriate protocols are followed (Seery 1993, U.S. Soil Conservation Service 1983).

Cumulative Effects

Cumulative effects are those adverse effects of future non-Federal (State, local government, and private) actions that are reasonably certain to occur in the project area. Future Federal actions would be subject to the consultation requirements established in section 7 of the Act and, therefore, are not considered cumulative to the proposed project. Effects of past Federal and private actions are considered in the Environmental Baseline.

Most of the Santa Cruz River corridor south of Tubac and between Atascosa-Pajarito and Patagonia mountains is privately owned. Some development on private lands will require Federal permits, such as 404 permits from the Corps, or Clean Water Act 402 permits from the Environmental Protection Agency. The effects of such activities are not considered cumulative effects; these activities would be addressed through the section 7 process.

Residential development is occurring at a rapid rate along some portions of the Santa Cruz River Valley. The communities of Green Valley, Tubac, Carmen, Rio Rico, and Nogales have all grown substantially in recent years. Industrial development is also occurring along the border in and near Nogales, Arizona along I-19 and in Nogales, Sonora. Increasing development and population in the area may not affect the riparian habitats of the river directly, but as populations increase, so will recreational use of the riparian corridor, including woodcutting, off-road vehicle use, and camping. Fires will probably become more frequent along the Santa Cruz River as more people use the area. In the upper riparian terraces that are less likely to flood, houses, corrals, barns, livestock pastures, and farming can be expected. Grazing by cattle and horses is expected to continue. Compliance with the Act for activities that may result in take of listed animals, but do not have a Federal nexus, could be addressed through section 10(a)(1)(B) of the Act.

CONCLUSION

After reviewing the current status of the southwestern willow flycatcher, the environmental baseline for the action area, and the anticipated effects of the proposed Peck Canyon scour protection project, and the cumulative effects, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of the southwestern willow flycatcher, nor is it likely to result in adverse modification or destruction of critical habitat. We make these findings for the following reasons:

1) No critical habitat occurs in or near the action area.

2) Surveys according to Service protocol in 1999 did not locate any migrant or nesting flycatchers in the action area.

3) Habitat in areas to be disturbed do not appear to be suitable for nesting flycatchers; although they may provide foraging habitat for migrants or flycatchers nesting or dispersing from habitats nearby on the Santa Cruz River.

4) Disturbance of riparian vegetation resulting from the proposed action is small (about 1.5 acre), of which 0.9 acre would be temporarily disturbed.

5) The Corp has proposed measures to minimize the effects of the proposed action on the flycatcher and its habitat.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act prohibits the take of listed species without special exemption. Taking is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed

species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR 17.3). 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 that include, but are not limited to, breeding, feeding, or sheltering. Incidental take is any take of a 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 sections 7(b)(4) and 7(o)(2) of the Act, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the Act provided that such taking is in compliance with 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. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to require any 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.

AMOUNT OR EXTENT OF TAKE

Based on the data before us at this time and a scenario in which construction occurs in November 2001-January 2002, we do not anticipate take of southwestern willow flycatcher for the following reasons: 1) construction activities would occur outside of the breeding season, 2) no flycatchers are known to breed on the Santa Cruz River or in Peck Canyon, 3) habitat in areas to be disturbed by the project is unsuitable for nesting flycatchers, and 4) disturbance of riparian habitat is small (less than 0.5 acre), of which 0.44 acre would be temporarily disturbed. Because no take is anticipated, no reasonable and prudent measures or terms and conditions are needed.

Because riparian habitat is dynamic and habitat suitability can change rapidly; if construction is delayed past November 2001-January 2002, the Corps should reevaluate the quality of the habitat in the action area and reinitiate consultation if cottonwood and willow habitats in areas to be disturbed have grown substantially since that described herein. In the case of a delayed project construction start date, the Corps should discuss informally with the Service the need for reinitiation pursuant to [50 CFR 402.16(b)].

CONSERVATION RECOMMENDATIONS

Sections 2(c) and 7(a)(1) of the Act direct Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of listed species. Conservation recommendations are discretionary agency activities to minimize or avoid effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to

develop information on listed species. The recommendations provided here do not necessarily represent complete fulfillment of the agency's section 2(c) or 7(a)(1) responsibilities for the southwestern willow flycatcher. In furtherance of the purposes of the Act, we recommend implementing the following actions:

1. The Corps should assist the Service in implementation the flycatcher recovery plan, when such plan is finalized, in regard to issuance of 404 permits.

2. The Corps should develop a riparian mitigation bank for projects in the Santa Cruz basin, to which projects such as this one could contribute. When sufficient funds are collected, meaningful riparian conservation projects could be enacted, such as purchase of conservation easements and restoration of riparian processes.

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

Gila topminnow
STATUS OF THE SPECIES

Gila topminnow was listed as endangered in 1967 without critical habitat (US Fish and Wildlife Service 1967). Only Gila topminnow populations in the United States, and not in Mexico, are listed under the Act. The reasons for decline of this fish include past dewatering of rivers, springs and marshlands, impoundment, channelization, diversion, regulation of flow, land management practices that promote erosion and arroyo formation, and the introduction of predacious and competing nonnative fishes (Miller 1961, Minckley 1985). Other listed fish suffer from the same impacts (Moyle and Williams 1990). Life history information can be found in the 1984 recovery plan (US Fish and Wildlife Service 1984), the draft revised Gila topminnow recovery plan (US Fish and Wildlife Service 1998a), and references cited in the plans.

Gila topminnow are highly vulnerable to adverse effects from nonnative aquatic species (Johnson and Hubbs 1989). Predation and competition from nonnative fishes have been a major factor in their decline and continue to be a major threat to the remaining populations (Meffe *et al.* 1983, Meffe 1985, Brooks 1986, Marsh and Minckley 1990, Stefferud and Stefferud 1994, Weedman and Young 1997). The native fish fauna of the Gila basin and of the Colorado basin overall, was naturally depauperate and contained few fish that were predatory on or competitive with Gila topminnow (Carlson and Muth 1989). In the riverine backwater and side-channel habitats that formed the bulk of Gila topminnow natural habitat, predation and competition from other fishes was essentially absent. Thus, Gila topminnow did not evolve mechanisms for protection against predation or competition and is predator- and competitor-naive. With the introduction of many predatory and competitive nonnative fish, frogs, crayfish, and other species, Gila topminnow could no longer survive in many of their former habitats, or the small pieces of those habitats that

had not been lost to human alteration. Both large (Bestgen and Propst 1989) and small (Meffe *et al.* 1983) nonnative fish cause problems for Gila topminnow, as can nonnative crayfish (Fernandez and Rosen 1996) and bullfrogs.

Gila topminnow was listed in 1967 as *Poeciliopsis occidentalis*. The species was later revised to include two subspecies, *P. o. occidentalis* and *P. o. sonoriensis* (Minckley 1969, 1973). *P. o. occidentalis* is known as the Gila topminnow, and *P. o. sonoriensis* is known as the Yaqui topminnow. *Poeciliopsis occidentalis*, including both subspecies, is collectively known as the Sonoran topminnow. Both subspecies are protected under the Act.

Historically, the Gila topminnow was abundant in the Gila River drainage and was one of the most common fishes of the Colorado River basin, particularly in the Santa Creek system (Hubbs and Miller 1941). Presently, only 12 of 15 recent natural Gila topminnow populations are considered extant (Weedman and Young 1997). Only three (Cienega Creek, Monkey Spring, Cottonwood Spring) have no nonnative fish present and therefore can be considered secure from nonnative fish threats. There have been at least 175 wild sites stocked with Gila topminnow; however, topminnow persist at only 18 of these localities. Of the 18, one site is outside topminnow historic range and four now contain nonnative fish (Weedman and Young 1997).

The Sonoran Topminnow Recovery Plan (US Fish and Wildlife Service 1984) established criteria for down- and de-listing. Criteria for down-listing were met for a short period. However, due to concerns regarding the status of several populations, down-listing was delayed. Subsequently, the number of reestablished populations dropped below that required for down-listing, where it has remained. The Yaqui topminnow is now included within the Yaqui Fishes Recovery Plan (US Fish and Wildlife Service 1995). A draft revised recovery plan for the Gila topminnow is available (US Fish and Wildlife Service 1998a). The plan's short-term goal is to prevent extirpation of the species from its natural range in the US and reintroduce it into suitable habitat within historic range. Downlisting criteria require a minimum of 82 reestablished populations, some of which have persisted at least 10 years.

The status of the species is poor and declining. Gila topminnow has gone from being one of the most common fishes of the Gila basin to one that exists at not more than 30 localities (12 natural and 18 stocked). Many of these localities are small and highly threatened. The theory of island biogeography can be applied to these isolated habitat remnants, as they function similarly (Meffe 1983, Laurenson and Hocutt 1985). Species on islands are more prone to extinctions than continental areas that are similar in size (MacArthur and Wilson 1967). Meffe (1983) considered extinction of Gila topminnow populations almost as critical as recognized species extinctions. Moyle and Williams (1990) noted that fish in California that are in trouble tend to be endemic, restricted to a small area, part of fish communities with fewer than five species, and found in isolated springs or streams. Gila topminnow exhibits most of these characteristics.

Federal actions have contributed to the degraded environmental baseline of the Gila topminnow. Federal actions requiring section 7 consultations in the Gila River basin have contributed to the lowered baseline. An indication of the poor environmental baseline of the Gila topminnow is that two previous formal consultations have resulted in jeopardy opinions. Although the reasonable and prudent alternatives remove jeopardy, not all adverse effects are removed by implementation of the reasonable and prudent alternatives. Other Federal actions, and non-federal actions that have not undergone section 7 consultation, also have unmitigated adverse effects that contribute to the degraded baseline.

ENVIRONMENTAL BASELINE

Environmental Setting

A description of the environmental setting in the action area, including vegetation communities, flow regimes, water quality, and other descriptors is provided in the environmental baseline for the southwestern willow flycatcher. Also included in that baseline are historical data and information for the Santa Cruz River drainage. That baseline is included here by reference.

Entranco (1999) described aquatic habitats in the project area:

> "Aquatic habitats in the project area include the intermittent stream in Peck Canyon, perennial riffles and pools in Peck Canyon downstream of the I-19 northbound bridge, and the nearby Santa Cruz River. Several relatively deep scour pools occur downstream of the northbound I-19 bridge.
>
> "Pools are relatively shaded, up to 3-4 feet deep, and are vegetated with willow, rooted emergents (e.g. speedwell, *Mimulus* sp., *Carex* sp., etc) and floating plants (e.g. duckweed, *Lemma* sp.). Filamentous algae is common. The water in Peck Canyon is relatively clear during low flow events. Water persists in the pools most of the time, except in extremely dry periods. The pools were observed to be dry in December 1998, however downstream pools contained water and fish (D. Weedman, AGFD pers. comm.). The period of November 1998 through March 1999 has been a very dry period.

A visit to the project area in December 2000 by Service personnel revealed similar conditions, except that the creek in Peck Canyon was flowing well and it was evident that flows had been much higher recently. Scour pools existed around the piers of all three bridges, and several large pools were found downstream of I-19 (Figure 4). Water was relatively clear with little cover by floating aquatic plants or filamentous algae, perhaps due to recent flooding. No seining or netting of fish was conducted; however, no fish of any species were observed in Peck Canyon.

Native fishes of the Santa Cruz River basin included longfin dace, speckled dace, Gila chub, Sonoran sucker, desert sucker, Gila topminnow, desert pupfish, and Monkey Springs pupfish.

Figure 4. Large pool downstream of the I-19 bridges in Peck Canyon that is likely habitat for Gila topminnow. December 2000 photo.

Big river fishes, such as razorback sucker and Colorado pikeminnow, as well as Gila River endemics are unknown from the Santa Cruz drainage, presumably due to a lack of perennial flow in historic times in a reach from approximately Tucson to the Gila River that probably acted as a barrier to fish movement (Minckley 1985). Monkey Springs pupfish is extinct in the basin. Within the Santa Cruz River drainage, Gila topminnow records exist from the headwaters above Lochiel, in the Sonora, Mexico, portion of the river, in the mainstem from the border downstream to Chavez Siding, at a formerly perennial reach of the river near San Xavier Mission, along Sonoita Creek between Patagonia and Patagonia Lake, and in Peck Canyon near the Santa Cruz River confluence. The species remains extant in all of these areas except the Santa Cruz River near San Xavier Mission (King *et al.* 1999, Weedman and Young 1997). Minckley (1985) reported that mosquitofish and fathead minnow were abundant in the mainstem of the Santa Cruz River through the project area.

In 1997 King *et al.* (1999) sampled water, sediment, fish, birds, and invertebrates at two sites upstream of the International Wastewater Treatment Plant and five sites downstream of the Plant, including on the Santa Cruz River at the Peck Canyon confluence. Five species of fish were found at the seven sites, including longfin dace, desert sucker, Sonora sucker, Gila topminnow, and mosquitofish. Numbers of Gila topminnow had declined substantially since previous surveys in 1993. Unionized ammonia originating at the Plant is highly toxic to fish and limited

fish distribution downstream of the Plant. In addition, almost one-half of all vertebrate samples contained chromium at concentrations that could be harmful to upper trophic level species.

Status of the Gila Topminnow in the Action Area

King *et al.* (1999) collected fish on the Santa Cruz River at the confluence with Peck Canyon in 1997. Four visits and 2,012 seconds of electroshocking yielded 14 longfin dace, 17 Gila topminnow, and one mosquitofish (*Gambusia affinis*). In their sampling along the Santa Cruz River, fish abundance increased with distance from the Wastewater Treatment Plant. Total numbers of fish collected per unit effort at Tubac and Chavez Siding were more than an order of magnitude greater than yields at the Peck Canyon confluence.

Entranco and Arizona Game and Fish Department biologists sampled fish in Peck Canyon on August 25, 1998. The stream and pools were seined with a 12-foot seine and aquarium nets. Gila topminnow, green sunfish (*Lepomis cyanellus*), mosquitofish, and longfin dace were captured. Green sunfish have also been found in permanent pools several miles upstream of the project area in Peck Canyon (Service files).

The population of Gila topminnow in Peck Canyon may be important as a source for colonizing the Santa Cruz River in case of a catastrophic event, such as fuel spills or unusually high releases of toxic materials from the Wastewater Treatment Plant. The recent accidental spill of diesel fuel that spread from south of border all the way through the perennial reach to Chavez Siding illustrates the possibility of such an event. Alternatively, during drought periods or a catastrophe in Peck Canyon, Gila topminnow could recolonize Peck Canyon from the Santa Cruz River. A refugial population of Peck Canyon Gila topminnow has been established at the International Wildlife Museum in Tucson.

Effects of the Proposed Action

If water is present in Peck Canyon through the project area during construction, Gila topminnow could be killed or injured by vehicles and equipment in the stream. Tom Newman (Coronado National Forest, pers. comm.) located a dead Sonora chub (*Gila ditaenia*) at the Ruby Road crossing of Sycamore Canyon west of Nogales that had apparently been splashed up onto the bank by a passing vehicle, where the fish died. Similar mortality of Gila topminnow could occur in the project area. Mortality of Gila topminnow could also occur by pumping the pools and stream dry under or near the bridges; by contamination of water via accidental hazardous materials spills or leachates from the concrete; if a flood event washed stockpiled spoil into the stream and caused increased turbidity or filling in of ponds used by Gila topminnow; or during proposed capture, holding of fish, and subsequent release back into Peck Canyon. The latter activity, even without injury or mortality of fish, is considered take under section 9 of the Act and is illegal without proper permits from the Fish and Wildlife Service and Arizona Game and Fish Department.

Entranco (1999) recognized the potential for take of Gila topminnow during construction, if the channel was wetted. The Corps proposed that prior to dewatering, fishes and other aquatic organisms would be transferred downstream or to a suitable holding facility. Fish and organisms would be returned to the pools as soon as pumping ceases and water quality is shown to be similar to previous conditions. Replacement of topminnow would be conducted in stages, allowing time to observe the response of fishes to the post-construction conditions. If mortality was observed, the reintroduction would halt and the cause of the mortality would be addressed. If topminnow were released downstream, they would be allowed to recolonize scour pools around the bridges naturally.

Problems with this mitigation scenario include: 1) toxic leachates from the concrete scour decks may make the aquatic habitats at the bridges and downstream of the bridges uninhabitable for Gila topminnow for a period of up to nine months, 2) scour pools around the bridges will take time to reform, unless purposely recreated, and 3) no holding facility has been identified and husbandry techniques have not been outlined. Also, the capture process will not remove all Gila topminnow from the Peck Canyon channel. Some fish will elude capture and be subject to construction-related effects.

In regard to 1) above, fresh concrete leaches salts, lime, catalysts, and potentially other toxic materials for a period of up to nine months that are toxic to fish. Gila topminnow and desert pupfish were killed by leachates from concrete fish ponds constructed at the Phoenix Zoo (M. Demlong, AGFD, Phoenix, pers. comm. 2000). Toxic conditions can remain for longer than nine months if petroleum sealers are used on the concrete to extend drying times (no such sealants are proposed). Two-part epoxy concrete sealants are available to prevent leaching of toxins into water; however, the sealant itself can be toxic unless approved for potable water use. Use of such sealants is not possible for the Peck Canyon project because the concrete would be poured in place, thus the underside of the scour protection deck can not be treated.

Perennial pools in the project where Gila topminnow could persist during dry periods are all under the bridges or downstream of the bridges, all of which could be affected by toxic leachates from the concrete. The degree to which the concrete scour protection decks will leach toxic materials into Peck Creek is unknown; however, we would expect such effects to be most extreme at the bridges and immediately downstream of the bridges. The distance from the bridges at which effects to fish attenuate and the length of time necessary for leachates to move through or disperse from the system, or be diluted to the point where they no longer cause adverse effects are unknown. The example from the Phoenix Zoo is probably an extreme example, because the ponds were closed systems in which the substrate was curing concrete. Nevertheless, some mortality of Gila topminnow is expected at and downstream of the frontage road and I10 bridges, possibly for periods up to nine months. The Corps has proposed that, if necessary, fishes and other aquatic organisms will be transferred downstream or to a suitable holding facility out of harm's way. If fish are removed from toxic conditions near the bridges and held long enough for toxins to abate, then mortality could be minimized.

Three of the four temporary spoil areas are located in the Peck Canyon channel. Flooding during the period proposed for construction (November-January) is less likely to occur than during the monsoon season, but some potential exists for floods that could mobilize spoil from these sites and transport them into the streambed. If this occurred, downstream pools used by Gila topminnow could be filled with sediment, and changes in channel geomorphology could occur. Filling of pools could displace topminnow and eliminate habitat, and changes in geomorphology could put in motion a variety of changes in aquatic habitats that are difficult to predict. If large storms or floods are forecasted, ADOT would remove their equipment from the channel, thus eliminating the possibility of equipment or vehicles becoming mired in the stream where they might alter stream hydrology and geomorphology, and perhaps release petroleum products or other contaminants. Construction equipment would not be stored, fueled, or maintained in or near the stream channel to avoid potential contamination. ADOT proposes use of "good housekeeping specifications to prevent spills of hazardous materials, and containment provisions in the event of a spill.

Reduction in riparian vegetation quantity and health, and shifts from deep rooted to shallow rooted vegetation contribute to bank destabilization and collapse and production of fine sediment (Meehan 1991). Loss of riparian shade results in increased fluctuation in water temperatures with higher summer and lower winter temperatures (Karr and Schlosser 1977, Platts and Nelson 1989). These effects are expected to occur along the stream at the bridges and where the access route is in or near the stream channel; however, the area affected is small (less than 0.5 acre of riparian vegetation removed). Effects of removing shade in the form of trees is also mitigated because the creek and associated pools are also shaded by the bridges.

Pools currently exist under the I-19 bridges, and Entranco (1999) found that the bridge piers are responsible for forming scour pools. These pools will be filled in during excavation and construction of the scour protection decks. However, we expect that with time flows will produce similar pools just downstream of the scour protection decks. Thus, there will be a temporary loss of pool habitat for Gila topminnow in the vicinity of the I-19 bridges. However, other pools are present between I-19 and the Santa Cruz River that provide permanent or near permanent pool habitat for Gila topminnow.

The Corps has proposed a number of measures to minimize the effects of the proposed action. Some of these discussed above, include temporarily relocating Gila topminnow and other aquatic organisms during construction, if necessary; locating temporary spoil areas away from the stream and riparian vegetation, contingency plans in case of flooding in Peck Canyon, and measures to minimize the likelihood of a hazardous materials spill. The proposed action also includes replanting removed trees as pole plantings, scheduling construction for the winter months when Peck Canyon is typically dry, watering of riparian vegetation around the pools that would be dewatered by pumping; placement of the access route in previously disturbed areas as much as possible; after construction is complete, the access route would be planted with erosion controlling vegetation, per standard ADOT practice; the ROW fence, which will need to be

removed during construction, will be replaced after construction is complete, blocking vehicular access; the streambank will be recontoured where the road enters the channel to restore the bank; orange plastic mesh fencing will be used to mark areas to be avoided by construction crews; and shoring will be employed to minimize the encroachment of excavation activities and sediment on downstream scour pools. These measures greatly reduce the effects of the proposed action on the Gila topminnow and its habitat.

Cumulative Effects

Cumulative effects are those adverse effects of future non-Federal (State, local government, and private) actions that are reasonably certain to occur in the project area. Future Federal actions would be subject to the consultation requirements established in section 7 of the Act and, therefore, are not considered cumulative to the proposed project. Effects of past Federal and private actions are considered in the Environmental Baseline.

Non-federal actions most likely to affect Gila topminnow and its habitat in the project area are those that occur along or in Peck Canyon and the Santa Cruz River. Most of the Santa Cruz River corridor south of Tubac and between Atascosa-Pajarito and Patagonia mountains is privately owned. Development has occurred in Peck Canyon, but is low density and new development is not occurring at a rapid rate. More development is occurring east of the Santa Cruz River and in nearby Rio Rico, where areas of riparian vegetation, particularly in the mesquite bosque, have been cleared for homes, farming, or pastures. Grazing by cattle and horses in the floodplain is expected to continue. With increased population, recreation such as off-highway vehicle use, fishing, woodcutting, and camping can be expected to increase. Vehicle use in the river channel can destabilize banklines, destroy riparian vegetation, and fish could be run over or splashed from shallow ponds. Fishing and use of live bait could result in introduction of nonnative fishes that may compete with or prey upon Gila topminnow. Camping could result in fires that could destroy riparian vegetation. A recent diesel spill in Mexico that spread through the project area illustrates that actions occurring far upstream may also affect Gila topminnow.

Some non-federal actions, such as development on private lands, may require Federal permits, such as Clean Water Act 404 permits from the Corps or 402 permits from the Environmental Protection Agency. The effects of such activities are not considered cumulative effects; these activities would be addressed through the section 7 process. Compliance with the Act for activities that may result in take of listed animals, but do not have a Federal nexus, could be addressed through section 10(a)(1)(B) of the Act.

CONCLUSION

After reviewing the current status of the Gila topminnow, the environmental baseline for the action area, and the anticipated effects of the proposed Peck Canyon scour protection project, and the cumulative effects, it is the Service's biological opinion that the proposed action is not likely

to jeopardize the continued existence of the Gila topminnow. No critical habitat has been designated or proposed for the species, thus none will be affected. We make these findings for the following reasons:

1) If pools where Gila topminnow occur below the bridges are wetted, Gila topminnow would be moved downstream or temporarily relocated out of harm's way.

2) The Corps has included measures in the proposed action to minimize the likelihood of hazardous materials spills, to minimize the project footprint, to avoid sensitive areas as much as possible, and to restore areas degraded during construction.

3) If Gila topminnow are eliminated from some perennial pools in Peck Canyon, these habitats are expected to be recolonized by proposed translocation, or via immigration from other portions of Peck Canyon or the Santa Cruz River.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act prohibits the take of listed species without special exemption. Taking is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR 17.3). 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 that include, but are not limited to, breeding, feeding, or sheltering. Incidental take is any take of a 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 sections 7(b)(4) and 7(o)(2) of the Act, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited under the Act provided that such taking is in compliance with 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. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to require any 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.

AMOUNT OR EXTENT OF TAKE

The precise level of take will depend on conditions at the time of construction. If pools at the bridges and downstream of the bridges are dry, no take is anticipated during construction. However, if conditions during construction are similar to those in December 2000, in which the creek in Peck Canyon was flowing and pools were common from the bridges to the Santa Cruz River, direct take due to draining of pools, use of vehicles and equipment in the stream, and salvage of fish for temporary holding and re-release could number in the hundreds of fish. Some mortality of Gila topminnow as a result of toxic leachates from the curing concrete is also expected during a several month period after the concrete is poured. Again, the extent of take will depend in part on the conditions in Peck Canyon while the concrete is curing. It will also depend on resulting concentrations of leachates in stream and pond water and how Gila topminnow will respond physiologically to those leachates. We are unable to precisely estimate take associated with concrete leachates because we cannot precisely predict conditions in Peck Canyon during or after construction, or leachate concentrations in aquatic habitats and exactly how Gila topminnow will respond to those leachates physiologically. Incidental take will also be difficult to detect and quantify. Gila topminnow are small and many would probably go undetected or would be quickly scavaged by other organisms. Furthermore, if dead fish are found during construction, the cause of mortality may be unclear.

In cases where the extent of anticipated take cannot be quantified accurately in terms of number of individuals, the Service may anticipate take in terms of loss of a surrogate species, food, cover, or other essential habitat elements, such as water quality or quantity (US Fish and Wildlife Service 1998b). An approach whereby take is quantified both in terms of numbers of fish and degradation of habitat is warranted in this case. The Service anticipates the following forms of take:

1. All Gila topminnow in Peck Canyon from the frontage road bridge to the Santa Cruz River in the form of capture and harassment, as fish are captured, held, and re-released back into Peck Canyon.

2. Up to 20 Gila topminnow as a result of mortality due to stress during proposed capture and holding of fish.

3. Up to 20 Gila topminnow as a result of mortality or injury caused by toxic leachates from the concrete scour decks, vehicle or equipment use in Peck Canyon, and other proposed activities.

Because dead or injured Gila topminnow will be difficult to detect, the following will also indicate that take, as measured in items 2 and 3, has been exceeded:

More than 40 fish of any species are found dead in Peck Canyon from the frontage road to the Santa Cruz River during required monitoring in the first nine months following completion of construction.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If the incidental take anticipated in the preceding paragraphs is met, the Corps shall immediately notify the Service in writing. If, during the course of the action, the level of anticipated incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation. In the interim, the Corps must cease the activity resulting in the take if it is determined that the impact of additional taking will cause an irreversible and adverse impact on the species. The Corps 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. This biological opinion does not authorize any form of take not incidental to the Corps' proposed action as described herein.

EFFECT OF THE TAKE

In this biological opinion, the Service finds the anticipated level of take is not likely to jeopardize the continued existence of the Gila topminnow.

REASONABLE AND PRUDENT MEASURES

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

1. Personnel education programs, defined construction areas, and well-defined operational procedures shall be implemented during construction.

2. Proposed capture of Gila topminnow shall be designed to salvage and hold as many fish as is practicable that may be adversely affected by the proposed action. Holding of Gila topminnow shall occur until conditions in Peck Canyon are once again suitable for survival and reproduction of topminnow. Protocols shall be developed and implemented to minimize the effects on Gila topminnow of proposed capture, holding, and release.

3. The Corps shall monitor implementation of the proposed action and any resulting incidental take and report to the Service the findings of that monitoring.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions in regard to the proposed action. These terms and conditions

implement the reasonable and prudent measures described above. Terms and conditions are nondiscretionary. We assume implementation of "Proposed Measures to Minimize the Effects of the Action ; thus those measures, which are part of the Proposed Action, do not need to be restated here.

1. The following terms and conditions implement reasonable and prudent measure number one:

a. The Corps shall designate a field contact representative (FCR) who shall be responsible for overseeing compliance with these terms and conditions and proposed minimization measures, and shall also be responsible for coordination on compliance with the Service. The FCR shall have the authority and the responsibility to halt all project activities that are in violation of these terms and conditions. The FCR shall have a copy of the terms and conditions and proposed minimization measures of this biological opinion while on the work site.

b. Construction personnel shall be informed of terms and conditions and proposed minimization measures herein, and the need to comply with them.

c. No nonnative plants will be intentionally seeded or planted.

2. The following terms and conditions implement reasonable and prudent measure number two:

a. If any surface water exists in Peck Canyon from the frontage road to the Santa Cruz River within two weeks of the start of surface-disturbing construction activities, the following terms and conditions shall be implemented:

1. Proposed capture of Gila topminnow shall proceed within two weeks of the start of surface-disturbing construction activities. All aquatic habitats capable of supporting Gila topminnow from the frontage road to the confluence with the Santa Cruz River shall be seined or dip netted in an attempt to capture most Gila topminnow. Identity of Gila topminnow shall be confirmed by three fisheries biologists able to identify topminnow and mosquitofish.

2. Captured Gila topminnow shall be transported and held at a suitable holding facility for a period of up to nine months after completion of construction. Transport and holding/husbandry locations and protocols shall be agreed upon by the Service and Arizona Game and Fish Department.

3. Only qualified fisheries biologists permitted by the Service and Arizona Game and Fish Department shall capture and transport Gila topminnow. Holding facilities must also be permitted by the Service and Arizona Game and Fish Department.

4. Gila topminnow shall be returned and released in Peck Canyon nine months after construction is complete, or at a time agreed to by the Service and Arizona Game and Fish

Department. Release of Gila topminnow may occur sooner if it can be demonstrated toxic conditions have abated. Releases, including procedures and numbers released at each suitable pool or aquatic site, shall be agreed to by the Service and Arizona Game and Fish Department.

b. If no surface water exists in Peck Canyon from the frontage road to the Santa Cruz River within two weeks of construction, conditions will be monitored daily during construction and weekly after construction for a period of nine months after the concrete is poured. If surface water is found during monitoring, all surface waters from the frontage road bridge to the Santa Cruz River shall be inspected for fish kills. If more than 10 fish of any species are found dead during any one visit, or a total of 20 or more are found over all surveys, the salvage/holding/release procedures in parts a.1-4 above shall be implemented.

3. The following term and condition implements reasonable and prudent measure number three:

The Corps shall monitor implementation of the proposed action and these terms and conditions. A qualified biological monitor shall monitor aquatic sites in the project area from the frontage road bridge to the Santa Cruz River each day construction crews are on-site until construction is completed. The same reach of Peck Canyon shall be monitored, at a minimum (or in compliance with 2.b. above) one week, one month, six months, and nine months after construction is complete. During these monitoring efforts, the monitor shall document and record any take of Gila topminnow, dead fish of any species, and take notes on the condition of the habitat and reformation of scour pools under the bridges. The Service encourages development of a standard form to record these data. A brief written report shall be prepared by the biological monitor summarizing the results of such monitoring/documentation; the report shall also describe any deviations from the proposed action, and procedures and results of fish captures, transport, holding, and release. This report shall be submitted to the Service within one year of completion of construction. The report shall also make recommendations, as needed, for modifying or refining these terms and conditions to enhance protection of the Gila topminnow or reduce needless hardship on the Corps and its applicant.

CONSERVATION RECOMMENDATIONS

Sections 2(c) and 7(a)(1) of the Act direct Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of listed species. Conservation recommendations are discretionary agency activities to minimize or avoid effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information on listed species. The recommendations provided here do not necessarily represent complete fulfillment of the agency's section 2(c) or 7(a)(1) responsibilities for the Gila topminnow. In furtherance of the purposes of the Act, we recommend implementing the following actions:

1. The Corps should assist the Service in implementation of the revised Gila topminnow recovery plan, when finalized, in regard to issuance of 404 permits.

2. The Corps should develop a riparian mitigation bank for projects in the Santa Cruz basin, to which projects such as this one could contribute. When sufficient funds are collected, meaningful aquatic habitat conservation projects could be enacted, such as purchase of conservation easements and restoration of hydrologic processes.

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

REINITIATION NOTICE

This concludes formal consultation on the Corps proposed scour protection project on the I-19 and frontage road bridges over Peck Canyon near the confluence with the Santa Cruz River, Santa Cruz County, Arizona. 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 adversely 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 a 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 this action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation, if it is determined that the impact of such taking will cause an irreversible and adverse impact to the species.

If we may be of further assistance in this matter, please contact Jim Rorabaugh (x238) or Sherry Barrett (520/670-4617) of my staff.

Sincerely,

/s/ David L. Harlow
Field Supervisor

cc: Regional Director, Fish and Wildlife Service, Albuquerque, NM (ARD-ES)
Assistant Field Supervisor, Fish and Wildlife Service, Tucson, AZ
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References Cited

Allison, L.J., J. Rourke, and T. McCarthey. 2000. Characterizing vegetation in nesting and non-nesting plots for southwestern willow flycatchers within the same patch of continuous riparian vegetation. Page 15 in Abstracts of the Ecology and Conservation of the Willow Flycatcher Conference, 24-26 October 2000, Arizona State University, Tempe, AZ.

Bestgen, K.R. and D.L. Propst. 1989. Red shiner vs. native fishes: Replacement or displacement? Proc. of the Desert Fishes Council 18:209.

Brown, B.T. 1988a. Breeding Ecology of a Willow Flycatcher Population in Grand Canyon, Arizona. Western Birds 19:25-33.

Brown, B.T. 1988b. Monitoring bird population densities along the Colorado River in Grand Canyon: 1987 breeding season. Final Report to the Glen Canyon Environmental Studies. Bureau of Reclamation, Salt Lake City, Utah. 26 pp.

Brown, D.E., N.B. Carmony, and R.M. Turner. 1981. Drainage map of Arizona showing perennial streams and some important wetlands. Arizona Game and Fish Department, Phoenix, AZ.

Browning, M.R. 1993. Comments on the taxonomy of *Empidonax traillii* (willow flycatcher). Western Birds 24:241-257.

Brooks, J.E. 1986. Status of natural and introduced Sonoran topminnow (*Poeciliopsis o. occidentalis*) populations in Arizona through 1985. US Fish and Wildlife Service, Albuquerque, New Mexico. 19+pp.

Carlson, C. A., and R. Muth. 1989. The Colorado River: Lifeline of the American southwest. Pages 220-239 *in* Dodge, D.P. ed., Proc. of the International Large River Symposium, Canadian Special Publication of Fisheries and Aquatic Sciences 106.

Coes, A.L., D.J. Gellenbeck, D.C. Towne, and M.C. Freark. 2000. Ground-water quality in the Upper Santa Cruz Basin, Arizona, 1998. USDI, US Geological Survey, Water-Resources Investigations Report 00-4117.

Cooke, R.U., and R.W. Reeves. 1976. Arroyos and environmental change in the American Southwest. Oxford University Press, London.

DeLoach, C.J. 1991. Saltcedar, an exotic weed of western North American riparian areas: a review of its taxonomy, biology, harmful and beneficial values, and its potential for

biological control. Report to the Bureau of Reclamation, Boulder City, NV, Contract No. 7-AG-30-04930.

Drost, C.A. 1998. Survey of amphibians and amphibian habitat on the upper Santa Cruz River, Arizona. USGS, Biological Resources Division, Colorado Plateau Research Station, Flagstaff, AZ

Drost, C.A., M.K. Sogge, and E. Paxton. 1998. Preliminary Diet Study of the Endangered Southwestern Willow Flycatcher. Report to U.S. Bureau of Reclamation. U.S.G.S. Biological Resources Division/Colorado Plateau Res. Station/N. Arizona University. 26 pp.

Entranco. 1999. Biological assessment for Arizona Department of Transportation project, Peck Canyon bridges, TRACS No: 019 SC14 H4817 01 C. Report to Arizona Department of Transportation, Phoenix, AZ

Fernandez, P. J., and P. C. Rosen. 1996. Effects of the introduced crayfish *Orconectes virilis* on native aquatic herpetofauna in Arizona. Rep. to Ariz. Game and Fish Dept., Heritage Prog., IIPAM Proj. No. I94054, Phoenix. 57+pp.

Hanna, W.C. 1928. Notes on the dwarf cowbird in southern California. Condor 30:161-162.

Harris, J.H. 1991. Effects of brood parasitism by brown-headed cowbirds on willow flycatcher nesting success along the Kern River, California. Western Birds 22:13-26.

Harris, J.H., S.D. Sanders, and M.A. Flett. 1987. Willow flycatcher surveys in the Sierra Nevada. Western Birds 18:27-36.

Hatten, J., C. Paradzick, and M. Sumner. 2000. Constructing a nest-site suitability model for the southwestern willow flycatcher of Arizona. Page 20 *in* Abstracts of Presented Papers and Posters, The Ecology and Conservation of the Willow Flycatcher, 24-26 October 2000, Arizona State University, Tempe.

Hendrickson, D.A., and W.L. Minckley. 1984. Cienegas - vanishing climax communities of the American Southwest. Desert Plamts 6(3):131-176.

Howell, S.N.G. and S. Webb. 1995. A guide to the birds of Mexico and northern Central America. Oxford University Press, New York, New York. 851 pp.

Hubbard, J.P. 1987. The Status of the Willow Flycatcher in New Mexico. Endangered Species Program, New Mexico Department of Game and Fish, Sante Fe, New Mexico. 29 pp.

Hubbs, C.L., and R.R. Miller. 1941. Studies of the fishes of the order Cyprinodontes. XVII: Genera and species of the Colorado River system. Occas. Papers Mus. Zool., Univ. Mich. 433:1-9.

Johnson, J.E., and C. Hubbs. 1989. Status and conservation of poeciliid fishes. Pages 301-331 *in* Meffe, G.K., and F.F. Snelson, eds., Ecology and Evolution of Livebearing Fishes (Poeciliidae), Prentice Hall, Englewood Cliffs, New Jersey. 453pp.

Karr, J.R. and I.J. Schlosser. 1977. Impact of nearstream vegetation and stream morphology on water quality and stream biota. U.S. Environmental Protection Agency, Ecological Research Series 600/3-77-097. Athens, GA. 90 pp.

Laurenson, L.B.J., and C.H. Hocutt. 1985. Colonization theory and invasive biota: The Great Fish River, a case history. Environmental Monitoring and Assessment 6(1985):71-90.

Ligon, J.S. 1961. New Mexico Birds and where to find them. The University of New Mexico Press, Albuquerque, New Mexico. 360 pp.

Luff, J.A., E.H. Paxton, K.E. Kenwood, and M.K. Sogge. 2000. Survivorship and movements of southwestern willow flycatchers in Arizona - 2000. USGS Forest and Rangeland Ecosystem Science Center, Colorado Plateau Field Station, report to the Bureau of Reclamation, Phoenix. 46 pp.

MacArthur, R.H., and E.O. Wilson. 1967. The theory of island biogeography. Princeton University Press, Princeton, New Jersey.

Marsh, P.E., and W.L. Minckley. 1990. Management of endangered Sonoran topminnow at Bylas Springs, Arizona: Description, critique, and recommendations. Great Basin Naturalist 50(3):265-272.

Mayfield, H.F. 1977a. Brown-headed cowbird: agent of extermination? American Birds 31:107-113.

Mayfield, H.F. 1977b. Brood parasitism: reducing interactions between Kirtland's warblers and brown-headed cowbirds. Chapter 11 *in* Endangered birds: management techniques for preserving threatened species (S.A. Temple, ed.). University of Wisconsin Press, Madison Wisconsin.

Maynard, W.R. 1995. Summary of 1994 survey efforts in New Mexico for southwestern willow flycatcher (*Empidonax traillii extimus*). Contract # 94-516-69. New Mexico Department of Game and Fish, Sante Fe, New Mexico. 48 pp.

McCarthey, T.D., C.E. Paradzick, J.W. Rourke, M.W. Sumner, and R.F. Davidson. 1998. Arizona partners in flight southwestern willow flycatcher 1997 survey and nest monitoring report. Report to the Bureau of Reclamation, Phoenix, AZ.

Meffe, G.K. 1983. Attempted chemical renovation of an Arizona springbrook for management of the endangered Sonoran topminnow. N. American J. Fisheries Manage. 3:315-321.

Meffe, G.K.. 1985. Predation and species replacement in American southwestern fishes: A case study. Southwestern Naturalist 30:173-187.

Meffe, G.K., D.A. Hendrickson, W.L. Minckley, and J.N. Rinne. 1983. Factors resulting in decline of the endangered Sonoran topminnow *Poeciliopsis occidentalis* (Atheriniformes: Poeciliidae) in the United States. Biological Conservation 25:135-159.

Miller, R.R. 1961. Man and the changing fish fauna of the American Southwest. Pap. Michigan Acad. Sci., Arts, Lett. 46:365-404.

Minckley, W.L. 1969. Native Arizona fishes, part I livebearers. Ariz. Wildl. Views 16:6-8.

Minckley, W.L. 1973. Fishes of Arizona. Arizona Game and Fish Dept., Phoenix. 293pp.

Minckley, W.L. 1985. Native fishes and natural aquatic habitats in US Fish and Wildlife Region II west of the Continental Divide. Rep. to US Fish and Wildlife Service, Albuquerque, New Mexico, Arizona State University, Dept. of Zoology, Tempe. 158pp.

Moyle, P. B., and J. E. Williams. 1990. Biodiversity loss in the temperate zone: Decline of the native fish fauna of California. Conservation Biology 4(3):275-284.

Muiznieks, B.D., S.J. Sferra, T.E. Corman, M.K. Sogge, and T.J. Tibbitts. 1994. Arizona Partners In Flight southwestern willow flycatcher survey, 1993. Draft report: Nongame and Endangered Wildlife Program, Arizona Game and Fish Department, Phoenix, Arizona. Draft of April 1994. 28 pp.

Paradzick, C.E., R.F. Davidson, J.W. Rourke, M.W. Sumner, and T.D. McCarthey. 1999. Southwestern willow flycatcher 1998 survey and nest monitoring report. Nongame and Endangered Wildlife Program, Arizona Game and Fish Department, Phoenix, AZ, Technical Report 141.

Paxton, E., J. Owen, and M.K. Sogge. 1996. Southwestern willow flycatcher response to catastrophic habitat loss. Colorado Plateau Research Station. U.S. Geological Survey Biological Resources Division. Northern Arizona University, Flagstaff, AZ. 12 pp.

Peterson, R.T. 1990. A field guide to western birds. Third edition. Houghton Mifflin Company, Boston, Massachusetts. 432 pp.

Phillips, A.R. 1948. Geographic variation in *Empidonax traillii.* The Auk 65:507-514.

Phillips, A.R., J. Marshall, and G. Monson. 1964. The birds of Arizona. University of Arizona Press, Tucson, Arizona. 212 pp.

Platts, W.S. and R.L. Nelson. 1989. Stream canopy and its relationship to salmonid biomass in the intermountain west. North American Journal of Fisheries Management 9:446-457.

Ridgely, R.S. and G. Tudor. 1994. The Birds of South America: Suboscine Passerines. University of Texas Press, Austin, Texas.

San Diego Natural History Museum. 1995. *Empidonax traillii extimus* in California. The willow flycatcher workshop. 17 November 1995. 66 pp.

Seery, D. 1993. Riparian restoration projects in Arizona, Soil Conservation Service. Page 193 *in* B. Tellman *et al.* (tech. coords.), Riparian Management: Common Threads abd Shared Interests. USDA Forest Service, General Technical Report RM-226.

Sferra, S.J., Corman, T.E., C.E. Paradzick, J.W. Rourke, J.A. Spencer, and MW. Sumner. 1997. Arizona Partners In Flight southwestern willow flycatcher survey 1993-1996 summary report. Technical Report. Nongame and Endangered Wildlife Program. Arizona Game and Fish Department, Phoenix, AZ. 97 pp.

Sferra, S.J., R.A. Meyer, and T.E. Corman. 1995. Arizona Partners In Flight 1994 southwestern willow flycatcher survey. Final Technical Report 69. Arizona Game and Fish Department, Nongame and Endangered Wildlife Program, Phoenix, Arizona. 46 pp.

Sogge, M. K. 1995*a*. Southwestern willow flycatcher (*Empidonax traillii extimus*) monitoring at Tuzigoot National Monument. 1995 progress report to the Natl. Park Serv. Natl. Biol. Serv., Colorado Plateau Res. Stn./Northern Arizona University, Flagstaff, Arizona. 20 pp.

Sogge, M. K. 1995*b*. Southwestern willow flycatcher surveys along the San Juan River, 1994 - 1995. Final report to Bureau of Land Management, San Juan Resource Area. Natl. Biol. Serv., Colorado Plateau Res. Stn./Northern Arizona University, Flagstaff, Arizona. 27 pp.

Sogge, M. K. 1995*c*. Southwestern willow flycatchers in the Grand Canyon. Pages 89-91 *in* E. T. LaRoe, G. S. Farris, C. E. Puckett, P. D. Doran, and M. J. Mac eds., Our Living Resources: a Report to the Nation on the Distribution, Abundance, and Health of U.S. Plants, Animals, and Ecosystems. USDI, National Biological Service, Washington, DC.

Sogge, M. K., and T. J. Tibbitts. 1992. Southwestern willow flycatcher (*Empidonax traillii extimus*) surveys along the Colorado River in Grand Canyon National Park and Glen Canyon National Recreation Area. NPS CPSU/N. Arizona University, Flagstaff, Arizona. 43 pp.

Sogge, M. K., and T. J. Tibbitts. 1994. Distribution and status of the southwestern willow flycatcher along the Colorado river in the Grand Canyon - 1994. Summary Report. Natl. Biol. Serv., Colorado Plateau Res. Stn./N. Arizona Univ., Flagstaff, Arizona. 37 pp.

Sogge, M. K., T. J. Tibbitts, and S. J. Sferra. 1993. Status of the southwestern willow flycatcher along the Colorado River between Glen Canyon Dam and Lake Mead - 1993. Summary Report. Natl. Park Serv. Coo. Park Studies Unit/N. Ariz. University, U.S. Fish and Wildlife Service, and Arizona Game and Fish Department., Flagstaff, Arizona. 69 pp.

Sogge, M. K., R. M. Marshall, S. J. Sferra, and T. J. Tibbitts. 1997. A southwestern willow flycatcher survey protocol and breeding ecology summary. National Park Service/Colorado Plateau Res. Station/N. Arizona University, Tech. Rept. NRTR-97/12. 37 pp.

Spencer, J. A., S. J. Sferra, T. E. Corman, J. W. Rourke, and M. W. Sumner. 1996. Arizona Partners In Flight 1995 southwestern willow flycatcher survey. Technical Report 97, March 1996. Arizona Game and Fish Department, Phoenix. 69 pp.

Stefferud, J.A., and S.E. Stefferud. 1994. Status of Gila topminnow and results of monitoring the fish community in Redrock Canyon, Tonto National Forest, 1979-1993. Pages 361-369 *in* DeBano, L.F., P.F. Ffolliott, A. Ortega-Rubio, G.J. Gottfried, R.H. Hamre, and C.B. Edminster, eds., Biodiversity and Manage. of the Madrean Archipelago: The Sky Islands of the Southwestern US and Northwestern Mexico, USDA Forest Service, Gen. Tech. Rep. RM-GTR-264, Rocky Mtn. For. & Range Exp. Stn., Ft. Collins, Colorado.

Stiles, F. G., and A. F. Skutch. 1989. A guide to the birds of Costa Rica. Comstock, Ithaca, New York. 364 pp.

Stoleson, S.H., and D.M. Finch. 1998. Reproductive success of the southwestern willow flycatcher in the Cliff-Gila Valley, summary report for the 1997 field season. USDA, Rocky Mountain Research Station, Albuquerque, NM. 14 pp.

Tibbitts, T.J., M.K. Sogge, and S.J. Sferra. 1994. A survey protocol for the southwestern willow flycatcher (*Empidonax traillii extimus*). Technical Report NPS/NAUCPRS/NRTR-94-04. National Park Service, Colorado Plateau Research Station at Northern Arizona University, Flagstaff. 24 pp.

Unitt, P. 1987. *Empidonax traillii extimus*: An endangered subspecies. Western Birds 18:137-162.

US Department of Agriculture. 1977. Santa Cruz - San Pedro River basin, Arizona. Resource inventory. USDA, Soil Conservation Service, Economic Research Service, and Forest Service.

US Fish and Wildlife Service. 1998a. Gila topminnow, *Poeciliopsis occidentalis occidentalis*, revised recovery plan. Draft. December 1998. US Fish and Wildlife Service, Phoenix.

US Fish and Wildlife Service. 1998b. Endangered species consultation handbook. US Fish and Wildlife Service and National Marine Fisheries Service. Washington DC.

US Fish and Wildlife Service. 1997a. Final determination of critical habitat for the southwestern willow flycatcher. Federal Register 62(140):39129-39146.

US Fish and Wildlife Service. 1997b. Correction; final determination of critical habitat for the southwestern willow flycatcher. Federal Register 62 (161): 44228.

US Fish and Wildlife Service. 1995. Final rule determining endangered status for the southwestern willow flycatcher. Federal Register 60:10694-10715.

US Fish and Wildlife Service. 1984. Sonoran topminnow recovery plan. Albuquerque, New Mexico. 56pp.

US Fish and Wildlife Service. 1967. Native fish and wildlife. Endangered species. Federal Register 32(48):4001.

US Soil Conservation Service. 1983. Dormant stock planting for channel stabilization. USDA, SCS, Technical Note, Biology Note No 22 - Arizona.

Uyehara, J.C., M.J. Whitfield, and L. Goldwasser. 1998. The ecology of brown-headed cowbirds and their effects on southwestern willow flycatchers. Draft report, Santa Barbara, CA. 23 pp.

Weedman, D.A, and K.L.Young. 1997. Status of the Gila topminnow and desert pupfish in Arizona. Arizona Game and Fish Department, Phoenix. 141pp.

Whitfield, M.J. 1990. Willow flycatcher reproductive response to brown-headed cowbird parasitism. Masters Thesis, California State University, Chico, California. 25 pp.

Whitfield, M.J. and Enos, K.M. 1996. A Brown-headed Cowbird control program and monitoring for the Southwestern Willow Flycatcher, South Fork Kern River, California, 1996. Final report to the U.S. Army Corps of Engineers, Contract DACW05-96-P-0900. Weldon, California: Kern River Research Center; 1996. 16 pp.

Whitfield, M.J., K.M. Enos, and S.P. Rowe. 1998. Reproductive response of the southwestern willow flycatcher (*Empidonax traillii extimus*) to removal of brown-headed cowbirds in 1997. Final report to the U.S. Army Corps of Engineers and State of California Resources Agency. Kern River Research Center, Weldon, CA.

Willard, F.C. 1912. A week afield in southern Arizona. The Condor 14:53-63.