Unarmored Threespine Stickleback
(*Gasterosteus aculeatus williamsoni*)

5-Year Review:
Summary and Evaluation

Photo by Chris Dellith, U.S. Fish and Wildlife Service

U.S. Fish and Wildlife Service
Ventura Fish and Wildlife Office
Ventura, California

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5-YEAR REVIEW

Unarmored Threespine Stickleback (*Gasterosteus aculeatus williamsoni*)

I. GENERAL INFORMATION

Purpose of 5-Year Reviews:

The U.S. Fish and Wildlife Service (Service) is required by section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 *et seq*.), to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the species' status has changed since it was listed (or since the most recent 5-year review). Based on the 5-year review, we recommend whether the species should be removed from the list of endangered and threatened species, be changed in status from endangered to threatened, or be changed in status from threatened to endangered. Our original listing of a species as endangered or threatened is based on the existence of threats attributable to one or more of the five threat factors described in section 4(a)(1) of the Act, and we must consider these same five factors in any subsequent consideration of reclassification or delisting of a species. In the 5-year review, we consider the best available scientific and commercial data on the species, and focus on new information available since the species was listed or last reviewed. If we recommend a change in listing status based on the results of the 5-year review, we must propose to do so through a separate rule-making process defined in the Act that includes public review and comment.

Species Overview:

The unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*) (UTS) is a small, scaleless, freshwater fish of up to 5 centimeters (cm) (2 inches (in)) standard length (i.e., the distance from the tip of the snout or lower jaw to the end of the vertebral column) inhabiting slow-moving reaches or quiet-water microhabitats in streams and rivers. Favorable habitats are usually shaded by dense and abundant vegetation. In more open reaches, algal mats or barriers (e.g., sand bars, floating vegetation, low-flow road crossings) may provide refuge for the species. The UTS feed primarily on benthic insects, small crustaceans, and snails, and to a lesser degree on flatworms, nematodes, and terrestrial insects. The UTS reproduce throughout the year with less breeding activity occurring from October to January. Reproduction occurs in areas with adequate aquatic vegetation and slow-moving water where males can establish and vigorously defend territories. The male builds a nest of fine plant debris and algal strands and courts all females that enter his territory; a single nest may contain the eggs of several females. Following spawning, the male defends the nest including newly hatched fry. The UTS are believed to live for only 1 year.

The UTS is currently restricted to three areas: the upper Santa Clara River and its tributaries in Los Angeles County, San Antonio Creek on Vandenberg Air Force Base in Santa Barbara County, and the Shay Creek vicinity (which includes Shay Pond, Sugarloaf Pond, Juniper Springs, Motorcycle Pond, Shay Creek, Wiebe Pond, and Baldwin Lake), in San Bernardino County (Figure 1). San Felipe Creek in San Diego County is another area that may support the UTS; however, its current status is unknown.

Historically, the UTS were found throughout a much larger area including the Los Angeles, San Gabriel, and Santa Ana Rivers, but were extirpated from these areas as a result of the effects of urbanization (e.g., dewatering of streams, habitat alteration, introduction of exotic predators, and pollution).

Methodology Used to Complete This Review:

This species overview is based on information provided in the Unarmored Threespine Stickleback Recovery Plan (Service 1985), the Inland Fishes of California (Moyle 2002), and the Final Report on the Status of the Unarmored Threespine Stickleback *(Gasterosteus aculeatus williamsoni)* in the Upper Santa Clara River (Baskin 1974). This review was prepared by the Ventura Fish and Wildlife Office (VFWO), following the Region 8 guidance issued in March 2008. We used information from the recovery plan for the UTS (Service 1985), survey information from experts who have been monitoring populations of this subspecies, and the California Natural Diversity Database (CNDDB) maintained by the California Department of Fish and Game (CDFG). The recovery plan for the UTS and personal communications with experts were our primary sources of information used to update the species' status and threats. This 5-year review contains updated information on the species' biology and threats, and an assessment of that information compared to that known at the time of listing. We have not previously conducted a 5-year review for the UTS. We focus on current threats to the species that are attributable to the Act's five listing factors. The review synthesizes all this information to evaluate the listing status of the species and provide an indication of its progress towards recovery. Finally, based on this synthesis and the threats identified in the five-factor analysis, we recommend a prioritized list of conservation actions to be completed or initiated within the next 5 years.

Contact Information:

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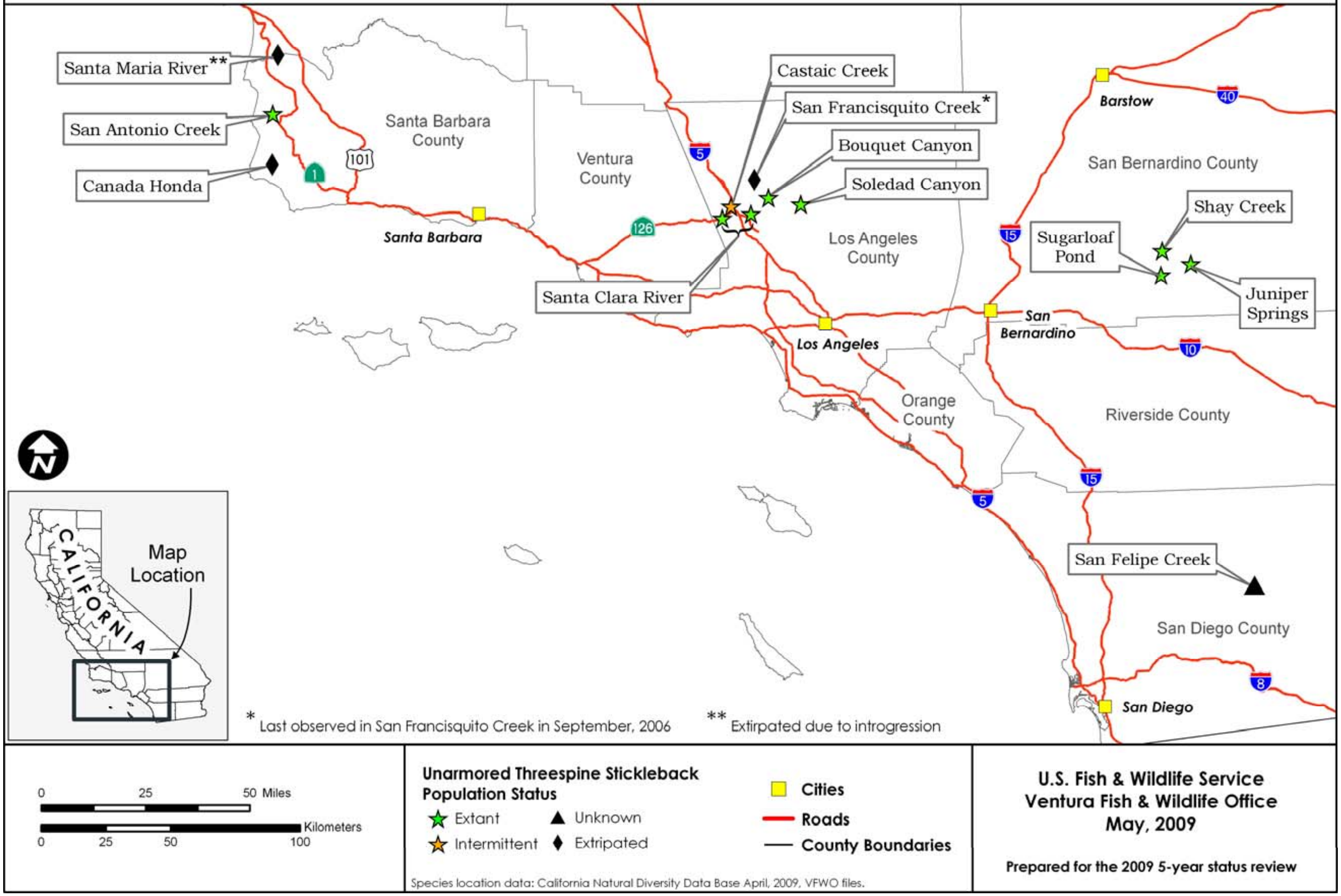
Federal Register (FR) Notice Citation Announcing Initiation of This Review: A notice announcing initiation of the 5-year review of this species and the opening of a 60-day period to receive information from the public was published in the FR on March 5, 2008 (73 FR 11945). The Service received one response collectively regarding all 58 species covered in the notice, which we have considered in preparing this 5-year review.

Figure 1. Distribution of Unarmored Threespine Sticklebacks Since Listing on October 13, 1970



Listing History:

Original Listing
FR Notice: 35 FR 16047
Date of Final Listing Rule: October 13, 1970
Entity Listed: (*Gasterosteus aculeatus williamsoni*), a fish subspecies
Classification: Endangered

State Listing
The UTS was listed by the State of California as endangered in 1971. The species is also State-listed as a California Fully Protected Species.

Review History: The general status of the UTS was reviewed in 1985 during the preparation of the "Unarmored Threespine Stickleback Recovery Plan" (Service 1985).

Species' Recovery Priority Number at Start of 5-Year Review: The recovery priority number for the UTS is 3 according to the Service's 2008 Recovery Data Call for the Ventura Fish and Wildlife Office, based on a 1-18 ranking system where 1 is the highest-ranked recovery priority and 18 is the lowest (Endangered and Threatened Species Listing and Recovery Priority Guidelines; 48 FR 43098; September 21, 1983). This number indicates a subspecies with a high degree of threat and a high potential for recovery.

Recovery Plan or Outline

Name of Plan or Outline: Unarmored Threespine Stickleback Recovery Plan.
Date Issued: December 27, 1977.
Dates of revisions: This recovery plan was revised on December 26, 1985.

II. REVIEW ANALYSIS

Application of the 1996 Distinct Population Segment (DPS) Policy

The Act defines "species" as including any subspecies of fish or wildlife or plants, and any distinct population segment (DPS) of any species of vertebrate wildlife. The 1996 Policy Regarding the Recognition of Distinct Vertebrate Population Segments under the Act (61 FR 4722; February 7, 1996) clarifies the interpretation of the phrase "distinct population segment" for the purposes of listing, delisting, and reclassifying species under the Act.

The UTS was listed as a subspecies with no mention of a distinct population segment. Genetic analysis of various populations of this subspecies suggests that the San Antonio Creek and Shay Creek vicinity populations could each potentially be classified as an individual DPS (or possibly as new subspecies or species) (see Genetics section below for details). However, we are not planning to conduct a formal DPS analysis of these populations until more definitive information is available.

Information on the Species and its Status

Species Biology and Life History

Threespine stickleback (*Gasterosteus aculeatus*) are mostly freshwater and anadromous fish found throughout much of the Northern Hemisphere (Moyle 2002). They are streamlined fish, usually not exceeding 6 cm (2.4 in) standard length. The dorsal fin consists of two isolated spines anteriorly (towards its head), with a third, smaller spine at the front edge of the more posterior (towards its rear or tail), soft-rayed portion of the fin. They are known for the brilliant red male nuptial coloration; breeding females tend to be pale-green-to-brown dorsally and silver ventrally. Miller and Hubbs (1969) recognized three subspecies of threespine stickleback on the Pacific Coast of North America: (1) fully plated threespine stickleback (*Gasterosteus aculeatus aculeatus*), (2) low or partially plated threespine stickleback (*Gasterosteus aculeatus microcephalus*), and (3) unplated or unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*). Moyle (2002) points out that threespine stickleback taxonomy can be problematic as a result of their wide distribution, anadromous nature, and ability to establish nonanadromous freshwater populations.

The UTS is distinguished from other sticklebacks by the number of lateral plates, provided that 10 to 15 morphologically mature specimens are available (Baskin 1974). The UTS generally have an average of 0.06 to 0.55 lateral plate per individual and partially armored threespine sticklebacks have an average of more than six lateral plates per individual (Bell 1976). Additional characters used to distinguish the UTS from other threespine sticklebacks include: short dorsal and pelvic spines, rounded pectoral and caudal fins, a less streamlined body, reduced denticulation of the spines, and reduced size of the ascending branch of the pelvic girdle (Baskin 1974).

The UTS was first described by Girard (1854) based on a collection from "Williamson's Pass," known today as Soledad Canyon, Los Angeles County, California. The subspecies is a small, scaleless freshwater fish inhabiting slow-moving reaches or quiet-water microhabitats of streams and rivers. The UTS feed primarily on benthic insects, small crustaceans, and snails, and to a lesser degree on flatworms, nematodes, and terrestrial insects (Moyle 2002).

The UTS reproduce throughout the year, with the least breeding activity occurring from October to January (Baskin 1974). Reproduction occurs in areas with adequate aquatic vegetation (e.g., watercress (*Rorippa* spp.) and filamentous algae (*Cladophora* spp.)) and slow-moving water, where males establish and vigorously defend territories. The male builds a nest of fine plant debris and algal strands and courts all females that enter his territory; a single nest may contain the eggs of several females. Following spawning, the males care for the eggs and newly hatched fry and guard the nest and surrounding territory from predators. Young UTS remain in the nest after hatching, although the length of time they remain in the nest is unknown. The smallest specimens of the UTS captured outside of a nest are approximately 10 millimeters (mm) (0.40 in) standard length. The UTS populations tend to decline due to natural mortality (e.g., predation, disease) and low recruitment during the winter, and individuals are believed to live for only 1 year (Moyle 2002).

Distribution and Abundance

At the time of listing, the was no abundance data for this subspecies and UTS were only known to occur in the upper reaches of the Santa Clara River, including Soledad Canyon (Baskin 1974). They were previously found in low-gradient portions of the Los Angeles, San Gabriel, and Santa Ana Rivers, and from a few localities in Santa Barbara County, but have been extirpated from these areas. In 1917, the UTS were reported to be abundant throughout the Los Angeles Basin (Miller and Hubbs 1969) but by 1942, the UTS were no longer found there and were believed to be extinct.

Currently, the UTS are restricted to the upper Santa Clara River and its tributaries in Los Angeles County, San Antonio Creek on Vandenberg Air Force Base (VAFB) in Santa Barbara County, and the Shay Creek vicinity in San Bernardino County (Moyle 2002) (Figure 1) (see below for a description of each location). In the Santa Maria River drainage in Santa Barbara County, populations regarded as the UTS were replaced by partially armored threespine sticklebacks and by intermediate types, through competition, hybridization, or both; the partially armored threespine stickleback was inadvertently introduced to this drainage with the introduction of trout for a recreational fishery (Moyle 2002).

A small, transplanted population of the UTS may exist outside the native range in upper San Felipe Creek, a tributary to the Salton Sea, San Diego County (Moyle 2002). The UTS were transplanted to San Felipe Creek from Soledad Canyon in 1972, 1973, and again in 1981(Swift et al. 1993, Service *in litt*. 2008a); however, the current status of this population or whether it still exists is unknown at this time (Service *in litt*. 2008a). The UTS from Soledad Canyon were also transplanted in 1972 into Piru Pond, Ventura County; in 1973 to the West Fork of the San Gabriel River just below Cogswell Reservoir; in1975 to Malibu Creek in the vicinity of Tapia park; and in 1982 to a small, artificial stream in the botanical garden on the campus of the University of California, Los Angeles. However, these transplant attempts all failed. Based on museum records, the UTS were transplanted to the Mojave River sometime before 1940; however, this population has since hybridized with partially armored threespine stickleback (Swift et al. 1993). The UTS were experimentally introduced into Cañada Honda Creek on VAFB in 1984. This transplanted population of the UTS appears to have been extirpated from Cañada Honda Creek. In fact, no individuals have been observed in Cañada Honda Creek in 13 years (Devenoge *in litt*. 2008).

No range-wide, long-term monitoring program is currently being conducted for the UTS, and data on population dynamics is limited. Despite the availability of survey methods that can estimate constant variability in local abundance (i.e., annual and seasonal changes in distribution and abundance hamper efforts to estimate population size for this short-lived species), estimates of population size are generally lacking due to minimal survey efforts. The UTS populations also vary with between-year changes in environmental conditions, such as drought. Nonetheless, assessments of presence and absence have been conducted at some locations. The locations where the UTS are currently found and any available information on the abundance of the UTS are summarized below.

<u>San Antonio Creek (Santa Barbara County)</u>: This location includes the reach of San Antonio Creek beginning upstream of VAFB from Barka Slough downstream to the lagoon at the Pacific

Ocean (Tetra Tech 1999). Baskin and Bell (1976) were the first to document the presence of UTS at this location. The following information was obtained from the "Special-Status Fish Species Survey Report for San Antonio Creek" (Tetra Tech 1999). The UTS was the most common fish observed in the creek above the lagoon during surveys conducted during the spring of 1999. The UTS were most abundant in the upper half of the creek due to the lower stream gradient, slower water velocity, broader channel, and lack of native or invasive aquatic predators in this area. The UTS comprised approximately 70 percent of the total number of fish observed (excluding the survey transects and lagoon surveys), which included arroyo chub (*Gila orcutti*), prickly sculpin (*Cottus asper*), mosquitofish (*Gambusia affinis*), and the federally endangered tidewater goby (*Eucyclogobius newberryi*) (Tetra Tech 1999). Approximately 48,000 UTS were estimated to inhabit the lower 8 kilometers (km) (4.97 miles (mi)) of the creek above the lagoon, with an average of 1.94 UTS per square meter (1.67 per square foot), assuming that the deeper, ponded areas that were not surveyed had about the same number of the UTS as the surveyed areas. The density of the UTS was the highest in the 2 km (1.24 mi) above and below the El Rancho Road crossing.

<u>Soledad Canyon (Los Angeles County)</u>: This location includes the upper-most reach of the Santa Clara River. Girard (1854) was the first to describe the UTS from this location. They are known to occur within the mainstem of the Santa Clara River in Soledad Canyon from the confluence of Arrastre Canyon downstream to the confluence of Bear Canyon Creek. The UTS also occur in Arrastre Canyon proper, which is the eastern limit of occupied habitat in this locality (Baskin 1974). A continuous flow of water in the upper canyon is maintained in dry seasons by several feeder springs, but the lower canyon is dry for much of the year. Most of the Santa Clara River in Soledad Canyon is privately owned with the exception of approximately 4.6 km (2.9 mi) administered by the U.S. Forest Service (Angeles National Forest). There are several ponded areas that are hydrologically connected with the Santa Clara River and located within Soledad Canyon. These ponds are artificially created by private land owners for various reasons, such as swimming pools, irrigation reservoirs, and fishing ponds. An artificially created pond located at Soledad Sands Park in Soledad Canyon is approximately 475 square meters (568 square yards) in size, and supports between 2.0 and 3.4 UTS per square meter (2.4 to 4.1 UTS per square yard) (Baskin 1974). Several hundred of the UTS were also observed in the Santa Clara River at Robin's Nest Campground within Soledad Canyon by a Service biologist during a site visit on March 27, 2006 (C. Dellith, pers. obs. 2006).

<u>Santa Clara River (Los Angeles County)</u>: This location includes a reach of the Santa Clara River below Soledad Canyon where the Los Angeles Aqueduct crosses the river and ending downstream near the Ventura-Los Angeles County line. The distribution of the UTS shifts in this portion of the Santa Clara River due to seasonal changes in water availability (portions of the river go dry during the summer months) and the availability of suitable habitat (adequate vegetation and low flow velocities). Two such areas have continuous flow provided by two different waste water treatment plants. The discharge point for one of the treatment plants is located at the Bouquet Canyon bridge and the other is located immediately downstream of the Interstate 5 freeway bridge. Portions of this reach of the Santa Clara River are both privately and publicly owned, with the majority being private. Impact Sciences (2003) found 1 or more UTS at 21 of the 48 locations within this reach of the Santa Clara River they surveyed from March through June 2002. Numerous individuals, including early-stage juveniles, were recorded in the

marshy area north of the main channel at Castaic Junction and the confluence of San Francisquito Creek. Their presence, combined with the occurrence of relatively ideal habitat, suggests these locations may be important breeding and nursery areas.

Bouquet Creek (Los Angeles County): This location is a tributary to the Santa Clara River. The UTS are known to occupy a reach of Bouquet Creek approximately 6.4 km (4 mi) upstream from its confluence with the Santa Clara River. Surface flow in Bouquet Creek is dependent on rainfall and releases from Bouquet Reservoir, which is managed by the Los Angeles Department of Water and Power. Most of Bouquet Creek is owned and managed by the U.S. Forest Service (Angeles National Forest); however, some of the lower portions of Bouquet Creek are owned by the County of Los Angeles, the City of Santa Clarita, or private entities.

Bouquet Creek is stocked with rainbow trout (*Oncorhynchus mykiss*) for recreational fishing purposes and is a popular destination for anglers, water play, and picnic use. The area experiences disturbance due to recreational activities (e.g., swimming, fishing, temporary dam building), the existence and use of summer recreation residences, and the use and maintenance of Bouquet Canyon Road and the side roads leading to summer recreation residences in the canyon.

Although no written record exists, the UTS is believed to have been first recorded in Bouquet Canyon Creek in the vicinity of Vasquez Canyon Road by Ken Sasaki of the CDFG in the 1970s (J. Baskin, San Marino Environmental Associates, pers. comm. 2008). Based on surveys conducted by San Marino Environmental Associates in 1998, 2000 through 2003, and 2005, during periods of adequate surface flow, UTS were abundant in Bouquet Creek and successfully reproduced in this stream reach. Even under the most adverse drought conditions, a refugium in the upper stream maintains a large population of UTS, which recolonize the downstream reach when conditions improve.

It should be noted that erosion caused by the severe winter storms of 2004-2005 formed significant drops in channel elevation (i.e., “headcutting” of the channel substrate) at the Esquerra Road crossing and the “Unnamed Road” crossing. Although these features should not pose a barrier to downstream dispersal of UTS, they are a barrier to upstream movement of stickleback, at least under low-flow conditions. However, in 2006 after these storms, 26 UTS were observed in various locations throughout Bouquet Creek on Angeles National Forest land (Hitchcock et al. 2006), and in 2007, 64 UTS were found in Bouquet Creek at Zuni Campground (San Marino Environmental Associates 2008).

The status of the Bouquet Creek population is in question at this time. The U.S. Geological Survey (USGS) conducted UTS surveys in Bouquet Creek in 2008 and noted the presence of both unarmored and partially armored threespine stickleback based on morphological characteristics in their samples (R. Fisher, USGS pers. comm. 2008). The partially armored threespine stickleback is not federally listed and is known to hybridize with the UTS (Haglund 1989). Over time, such hybridization can lead to increased plate counts for individuals within a population. In 2009, Robert Fisher (R. Fisher, pers. comm. 2009) was unable to detect any UTS during aquatic species surveys in Bouquet Creek; however, he did detect partially armored stickleback in the upper reaches. Although Dr. Fisher did not detect any UTS, we believe the

UTS may still be present in this reach. Additional, surveys in this reach of Bouquet Creek for UTS are warranted.

San Francisquito Canyon (Los Angeles County): This location is also a tributary to the Santa Clara River. The UTS are known to occur in San Francisquito Creek at its confluence with the Santa Clara River and, until recently, approximately 9.6 km (6 mi) upstream, where there are perennial flows from springs and legally mandated releases from the Drinkwater Reservoir. However, UTS were extirpated from this upstream area as a result of severe winter storms that occurred in 2004-2005. A wildfire (Copper Fire) burned through San Francisquito Canyon in June 2002 leaving the canyon in a very unstable condition. The subsequent storm events eroded the canyon hillsides and washed tremendous amounts of debris and sediment down the creek. Surveys of the upstream portion of the canyon in 2002 and 2003 determined that UTS declined after the fire (Hitchcock et al. 2004). The UTS were last observed in the upstream portion of San Francisquito Creek in September 2006 (Gallegos et al. 2007). Subsequent surveys have not detected any UTS in the upstream area (Backlin *in litt.* 2008, Gallegos et al. 2008). The upper reaches of San Francisquito Creek are on public lands and are administered by the U.S. Forest Service (Angeles National Forest). The lower reach of San Francisquito Creek is privately owned.

Castaic Creek (Los Angeles County): This location is also a tributary to the Santa Clara River. The UTS are known to occur in Castaic Creek at its confluence with the Santa Clara River and upstream to the Interstate 5 Freeway Bridge when water is present. The UTS were observed in Castaic Creek as a result of dewatering operations for the construction of the Commerce Center Drive Bridge (C. Dellith, pers. obs. 1999). In average rainfall years, parts of Castaic Creek are dry by mid-summer and remain dry until winter rains recharge the alluvium. Flows in Castaic Creek downstream of Castaic Reservoir are influenced by the water releases from the reservoir. When water is released from Castaic Reservoir, Castaic Creek supports one or two small channels that range from shallow and open to relatively deep and heavily shaded. Limited data exist regarding the number of individual UTS or their relative abundance within Castaic Creek, due to a lack of consistent or systematic surveys.

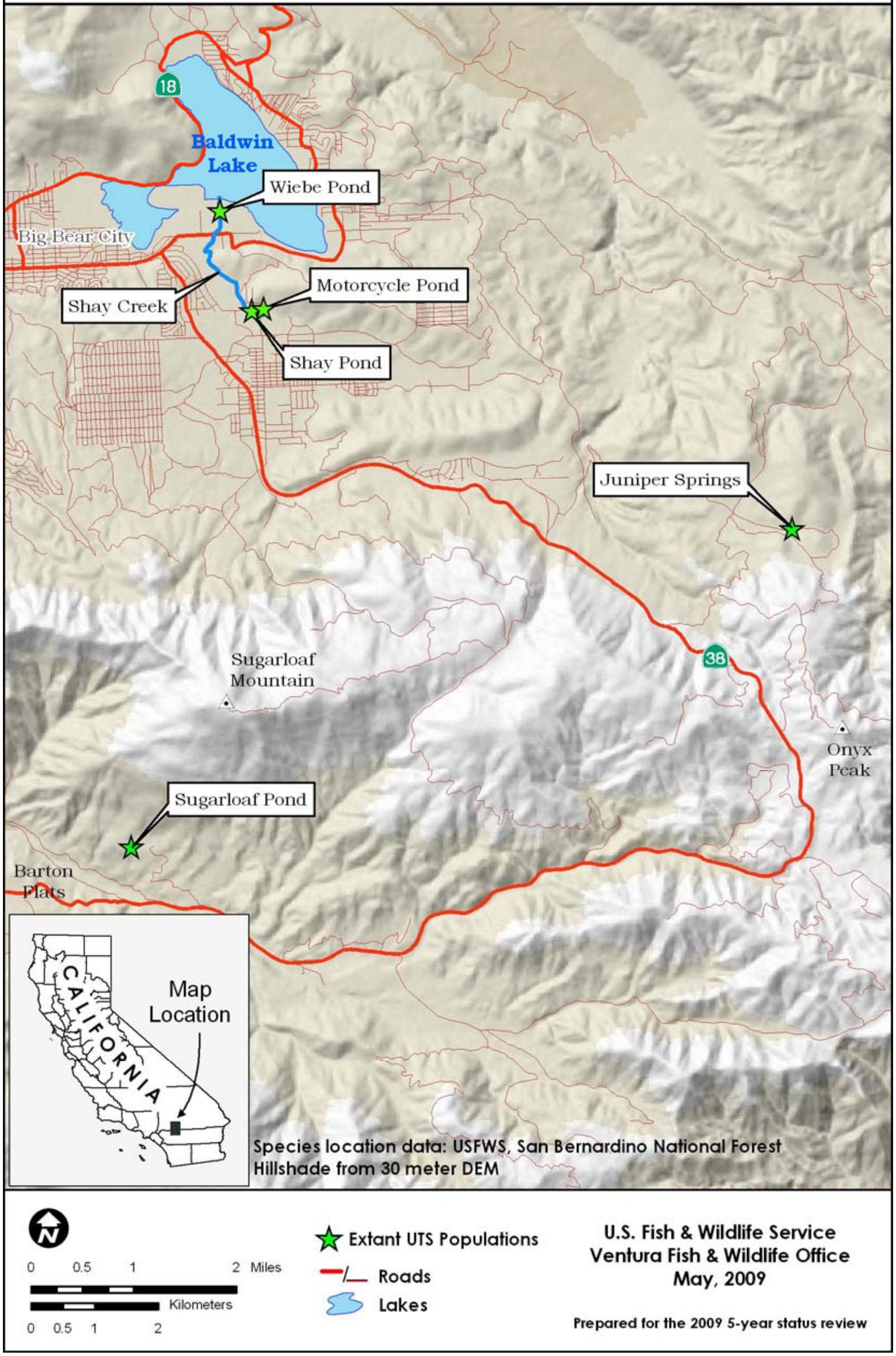
Shay Creek and Vicinity (San Bernardino County) (Figure 2): Shay Creek is generally a perennial stream, which is fed by several springs. The UTS were discovered in Shay Creek after the species was listed as endangered (U.S. Forest Service 2001). The Shay Creek vicinity includes Shay Pond, Sugarloaf Pond, Juniper Springs, Motorcycle Pond, Shay Creek, Wiebe Pond, and Baldwin Lake. Genetic studies on the Shay Creek vicinity population indicate that it may be a distinct subspecies (Haglund and Buth 1988, Buth and Haglund 1994); however, a peer-reviewed change in taxonomy has not been published, and we continue to consider the Shay Creek vicinity population as *Gasterosteus aculeatus williamsoni*. The Shay Creek vicinity population is unique in that it occurs at a high elevation, about 2,042 m (6,700 ft) above sea level, while all other UTS populations inhabit streams below 914 m (3,000 ft).

Although Shay Creek is fed by several springs, water flows vary substantially from year to year. In the early 1980s, Shay Creek flowed year-round, and UTS were observed in a number of areas along it, particularly in association with natural pools and created ponds that exist along the stream course (Malcolm 1992). UTS have historically been observed from the top of Shay Creek in the spring area known as Motorcycle Pond (near the corner of Cascade Street and Hatchery

Road) down to the edge of Baldwin Lake, an ephemeral lake connected to Shay Pond via Shay Creek. Shay Creek UTS populations clearly undergo major fluctuations as their pond and creek habitat expands and contracts. According to the U.S. Forest Service (2001), catastrophic mortality of UTS in Shay Creek and Baldwin Lake occurred in 1985 and 1986 due to insufficient amounts of water. However, some of the UTS survived this period in the deeper pools of Shay and Wiebe Ponds. By the summer of 1990, it was thought that the UTS remained in only Shay Pond (Malcolm 1992), which is maintained by supplemental water provided through pipelines from the Big Bear City Community Services District (Big Bear CSD). However, several years of above-average precipitation in the mid-1990s resulted in the establishment of a pool of water in Baldwin Lake. The extent of year-round water in Shay Creek was briefly expanded as a result of this pool, which lasted for about 3 years. These observations suggest that the UTS re-occupy aquatic habitats that are connected to Shay Creek during periods when water is present.

Limited data are available on the abundance of the UTS at Shay Pond. The pond has been surveyed numerous times over the years, but not in a consistent or systematic fashion. The encroachment of emergent wetland vegetation has been gradually reducing open-water habitat in Shay Pond and may be limiting the UTS population. Shay Pond currently resembles a marsh with small pockets of deep water where the fish are concentrated. Over the years, people have sporadically manually removed emergent vegetation from Shay Pond to maintain areas of open water. During such a project conducted by CDFG in 1999, only 23 individual UTS were observed within a single deep pool. This contrasts with mark-recapture-derived population estimates of approximately 3,200 UTS in Shay Pond in the summer of 1990 (Stephenson 1990). However, the ability to survey for sticklebacks with minnow traps is greatly impaired in areas where the water column contains a substantial amount of aquatic vegetation. Thus, the 23 UTS detected in 1999 likely underestimated the total number present in the pond that year. In fact, during pond cleanout efforts in October 2000, over 200 UTS were captured in the pond. However, despite cleanout efforts, photo documentation shows that the aerial extent of open water habitat for the UTS was reduced significantly in Shay Pond between 1999 and 2007 by encroaching vegetation (Carlsbad Fish and Wildlife Office project files).

Figure 2. Populations of Unarmored Threespine Sticklebacks in the Vicinity of Shay Creek



Habitat or Ecosystem

The UTS spend all of their life in freshwater. Young UTS are typically found at the shallow edges of streams in areas with dense vegetation. The water temperature in these areas tends to be a few degrees higher than the surrounding stream, which may help speed development through the vulnerable early juvenile stages. The larger juveniles and sub-adults (less than 20 mm standard length (0.79 in)) also tend to be found in the protection of vegetation, in slow-moving or standing water. Adults (3 to 5 cm (1 to 2 in) standard length or more) are found in all areas of the stream; however, Baskin and Bell (1976) indicate that the ideal habitat for UTS is a small, clean pond in the stream with a constant flow of water through it. The UTS tend to gather in areas of slower-moving or standing water. In places where water is moving rapidly they tend to be found behind obstructions, or at the edge of the stream, especially under the edge of algal (*Cladophora* spp.) mats. Reproductive activity of the UTS generally occurs in pools and in sheltered areas of streams and may take place in weed-choked margins of streams. Pools up to 100 m (109 yd) in length and about 40 cm (15 in) or greater in depth are optimal habitat for reproduction, provided aquatic vegetation is present. Several studies on the biology of the UTS suggest that a slow, continuous flow of water in a headwater stream, isolated from the ocean except during rainy periods by stretches of dry streambed, is necessary for this particular subspecies to thrive (Baskin 1974). The intermittent lower watercourse evidently confers a necessary degree of isolation from other related sticklebacks found in lower stream segments. The UTS are not distributed uniformly throughout the rivers and streams in which they occur, and breeding habitat is patchily distributed. The nature of breeding habitat is dynamic and may shift in structure and specific location from year to year depending on seasonal rainfall and storm cycles.

Genetics

Based on electrophoretic analysis of allozymes, Buth (1984) concluded that unarmored threespine sticklebacks (*Gasterosteus aculeatus williamsoni*) are limited to Soledad Canyon. He also stated that the San Francisquito Canyon and Soledad Canyon populations may be genetically differentiated. Furthermore, Buth concluded that the San Antonio Creek population of threespine sticklebacks is an independent derivative of the neighboring partially plated threespine stickleback (*Gasterosteus aculeatus microcephalus*) and should not be assigned the unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*) (Buth and Haglund 1994, Ellis *in litt*. 1994). Buth and Haglund (1994) also determined through electrophoretic analysis of allozymes that the Shay Creek population of threespine sticklebacks are the most genetically distinct population in Southern California and warrant separate subspecies or perhaps species status. However, a taxonomic revision has not yet been published in the peer-reviewed literature. In the event that a revision is published we will consider modifying the taxonomy or nomenclature of the listed entity at that time.

Changes in Taxonomic Classification or Nomenclature

No changes in taxonomic classification or nomenclature are proposed at this time; however, unpublished references indicate that taxonomic reclassification may be warranted for the Shay Creek vicinity and San Antonio Creek populations (Haglund and Buth 1988, Buth and Haglund

1994). For the purposes of this 5-year review, we continue to use *Gasterosteus aculeatus williamsoni* for each of the populations (see below).

Species-specific Research and/or Grant-supported Activities

In 2005, the Santa Clara Trustee Council (comprised of representatives from the Service and California Department of Fish and Game) awarded Jonathan Baskin (San Marino Environmental Associates) a grant to collect data on two listed fishes–the UTS and the tidewater goby. Additional data are also being collected on the Santa Ana sucker (*Catostomus santaanae*) and arroyo chub, the distribution and relative abundance of non-native fishes and the African clawed frog (*Xenopus laevis*), and native aquatic reptiles and amphibians. Santa Ana suckers within the Santa Clara River have hybridized to a large extent with the Owens sucker (*Catostomus fumeiventris*), which we know was introduced into the Santa Clara River in the 1930s. Therefore, this entity is not is not federally listed.

Recommendations for control of non-native aquatic species and for restoring native species will be included in the final report, which is due to the Service by September 30, 2009, of activities conducted pursuant to this grant. This project will provide critical baseline information on distribution and abundance of biota, including the UTS, in the Santa Clara River, which will help resource managers select and prioritize upcoming land acquisitions and habitat conservation and restoration activities to protect and enhance populations of aquatic species.

In 2005, the Santa Clara Trustee Council also awarded a grant to The Nature Conservancy to identify important habitats in the upper Santa Clara River watershed. The Nature Conservancy is developing a plan focusing on important land acquisition targets, which are based on environmental and human stressors, parcel ownership, and long- and short-term conservation goals. This plan will provide critical information to aid resource managers in selecting and prioritizing land acquisitions and identifying restoration and monitoring requirements for such acquisitions. This plan includes habitat for the UTS as an acquisition target.

Five-Factor Analysis

Section 4 of the Act established a rulemaking procedure that requires a five-factor analysis for determining whether to list a species as endangered or threatened. However, the Service listed the UTS as endangered on October 13, 1970 (13 FR 16047) under the Endangered Species Preservation Act of 1966. This precursor to the current Act did not require a five-factor analysis; consequently, a five-factor analysis was not conducted for the UTS. In 1989, the American Fisheries Society (AFS) published its list of endangered, threatened, or species of concern fishes of North America (Williams et al. 1989). The AFS reported the UTS as endangered and identified two categories of threats: (1) present or threatened destruction, modification, or curtailment of habitat or range, and (2) other natural or manmade factors affecting its continued existence (e.g., hybridization, introduction of exotic or transplanted species, predation, or competition). The recovery plan for the UTS (Service 1985) identifies the following threats: (1) stream channelization, (2) urbanization, (3) introduction of predators and competitors, (4) introgression, (5) agricultural impacts, (6) oxygen reduction, (7) groundwater removal, (8) transpiration, (9) off-road vehicles, (10) water releases from Drinkwater Reservoir, (11) toxic spills and discharges, (12) addition of water, and (13) impoundment of water. The following analysis describes and evaluates the threats attributable to one or more of the five listing factors outlined in section 4(a)(1) of the Act.

FACTOR A: Present or Threatened Destruction, Modification, or Curtailment of Habitat or Range

Stream Channelization

Stream channelization can reduce or eliminate the side channels and back-water pool habitat used by UTS, and increase flow velocity, which may reduce or eliminate the substrate needed for nests (Baskin 1974). Although channelization and habitat removal is continuing throughout the State, the current degree of impact of these activities is less severe than prior to the listing of the species. In addition, improvements in technology (e.g., use of weirs and biostabilization techniques) have further reduced impacts of these activities.

Currently, stream channelization and bank stabilization projects that would remove the UTS habitat are under the jurisdiction of the U.S. Army Corps of Engineers (Corps). When such actions may affect species listed under the Act, the Corps is required to consult with the Service pursuant to section 7 of the Act. Review of pending Corps section 7 consultations indicates that some relatively minor habitat losses may occur within the Santa Clara River. As part of a residential development, the Newhall Land and Farming Company is proposing to construct approximately 9,096 m (29,843 ft) of bank stabilization along the north and south banks of the Santa Clara River. Approximately 8,928 m (29,293 ft) of buried bank stabilization (i.e., 98 percent of the project total) would be installed in upland areas adjacent to the river. By constructing the majority of the proposed buried bank stabilization in the upland areas, direct impacts to the UTS habitat should be minimized; however, the remaining 168 m (550 ft) of bank stabilization would occur in the UTS habitat.

A wildfire burned throughout the Bouquet Canyon drainage in 2003. As a result of severe rainfall and flooding that occurred in 2004-2005, large amounts of sediment and debris were flushed into Bouquet Creek. Due to the subsequent channel aggradations (elevated substrate level), streamflows above a minimal discharge (approximately 0.06 cubic meter per second (2 cubic feet per second)) result in surface flows (and fish) leaving the stream channel and flooding the adjacent section of Bouquet Canyon Road. To address this situation, the Los Angeles County Department of Public Works is currently developing a proposal to elevate Bouquet Canyon Road approximately 2.3 m (7 ft) above the creek bed and armor the adjacent creek bank. The Service anticipates analyzing the potential effects of such a project on the UTS through section 7 consultation with either the Corps or the U.S. Forest Service (the project area is within the Angeles National Forest). However, until the proposal has been submitted and evaluated, we cannot determine the long-term impacts of the project on the Bouquet Canyon UTS population.

No channelization or bank stabilization is currently proposed for the areas where the UTS occur in San Francisquito Creek, Castaic Creek, Soledad Canyon, or Shay Creek. The Service recently completed a formal section 7 consultation with VAFB for restoration activities along San Antonio Creek, and bank stabilization activities are currently underway. Vandenberg Air Force

Base is implementing conservation measures to minimize adverse affects to the UTS. Additionally, VAFB prepared an Integrated Natural Resource Management Plan in 1997 and an updated draft in 2008 that provide some protection for the San Antonio Creek population of the UTS.

Urbanization

Urban and commercial development adjacent to or upstream of a water course can lead to the loss of freshwater fish and an increase in non-native species (Marchetti et al. 2006) as is the case for some of the UTS populations. Nonpoint-source pollution and habitat alteration often result from urbanization. One of these sources of pollutants is stormwater run-off, which is the byproduct of the construction of roadways or structures that reduce the permeability of urban watersheds. Stormwater run-off resulting from urbanization conveys large amounts of organic matter; pesticides; and fertilizers; heavy metals, such as hydrocarbons; and other debris into streams and wetlands. Skinner et al. (1999) found that developed watersheds had greater concentrations of toxic pollutants than less developed areas with more open space. The decrease in water quality can have profound impacts on native fish species (Moyle 2002). Furthermore, channelization and removal of riparian vegetation often results as urbanization occurs within a drainage basin.

The populations of the UTS in lower Soledad Canyon; the Santa Clara River; and lower San Francisquito, Castaic, and Shay Creeks are impacted by existing urbanization and additional development is expected to occur in Soledad Canyon, the Santa Clara River, and lower San Francisquito and Castaic Creeks. For example, the Newhall Land and Farming Company is proposing to develop approximately 4,856 hectares (ha) (12,000 acres (ac)) of upland habitat adjacent to UTS-occupied portions of the Santa Clara River.

To help reduce impacts in the Santa Clara River watershed, in 2005 the Santa Clara Trustee Council funded various non-governmental organizations and local governments to develop and implement public outreach and educational programs specifically covering sensitive resources including the UTS, and to restore habitat in the Santa Clara River watershed. Approximately $290,000 has been granted to the various non-governmental organizations and local governments through this program (Service *in litt*. 2008b).

Currently, the Big Bear CSD is in the process of acquiring property that includes Shay Pond as part of consultation between our agency and the U.S. Forest Service (draft Biological Opinion on Re-initiation of Formal Section 7 Consultation regarding the U. S. Forest Service Special Use Permits for Water Collection and Conveyance Facilities in the Baldwin Lake Watershed, San Bernardino National Forest, San Bernardino County, California). In addition, private property surrounding Shay Pond has been purchased with public funds to protect the wet meadow habitat surrounding the pond. As a result, 3.1 ha (7.8 ac) of UTS habitat including and surrounding Shay Pond in the San Bernardino Mountains will be conserved and managed for the species.

The populations of the UTS in Bouquet Canyon and upper San Francisquito Canyon are on public lands and are administered by the U.S. Forest Service, and although recreational residences were built in this area there are no plans for additional residences. This is also the case for the population in San Antonio Creek, which is administered by the U.S. Air Force at VAFB.

Agriculture Impacts

Possible impacts of agriculture are varied, depending on the type of agriculture and techniques used. Increased discharge of silt from agricultural activities can cause habitat destruction by covering the substrate of pools and backwater channels with fine sediment or completely filling them in. Increased siltation may be caused by overgrazing or by irrigation (Moyle 2002). Irrigation of farm crops is one likely source of silt in the Santa Clara River and San Antonio Creek drainages resulting in siltation of the UTS habitat.

Eutrophication is the excessive growth of aquatic vegetation resulting from the input of nutrients, particularly phosphate and nitrate (Ricklefs 1990). In recent times, the level of such nutrients in aquatic systems has increased as a result of water treatment outflows and runoff from heavily fertilized farms and cattle feed-lots. Furthermore, the addition of phosphates to laundry detergents has added a heavy phosphate burden to natural water systems. Discharge of these nutrients into the UTS habitat is increased by urbanization as well as agriculture (Moyle 2002). Water quality in the Santa Clara River drainage, including its tributaries; San Antonio Creek; and Shay Creek are compromised by excess nutrient loads in runoff from areas that support agricultural activities.

Oxygen Reduction

Oxygen reduction or depletion can cause major fish kills (Ricklefs 1990). Oxygen reduction occurs when the total demand for oxygen by biological and chemical processes exceeds the oxygen input from aeration to hold sufficient dissolved oxygen to maintain aquatic life. Oxygen reduction is usually associated with abundant growth of rooted vegetation, heavy algal blooms, or high concentration of organic matter (e.g., fertilizers, sewage, or livestock feces). The oxygen required during the decay of plants and breakdown of organic matter by bacterial flora, coupled with consumption by fish and other biota, may exceed the oxygen available in the water. Oxygen depletion occurs as a result of eutrophication such as that resulting from untreated or partly treated sewage.

Feldmeth and Baskin (1976) and Baskin (1975) showed that UTS have a moderate tolerance to oxygen reduction (down to 2.0 parts per million (ppm)). They pointed out that, as oxygen concentration approaches 2.0 ppm, the amount of energy the UTS use for respiration increases, thereby detracting from somatic growth, reproduction, and activity. Thus, sub-lethal reductions of dissolved oxygen may reduce growth and reproduction of the UTS, possibly placing them at a competitive disadvantage with sympatric fishes. Eutrophication thus could eliminate the UTS directly by reducing dissolved oxygen to lethal levels or indirectly by reducing dissolved oxygen to detrimental levels.

Two sewage treatment plants discharge treated effluent within the UTS habitat in the Santa Clara River. When burdened with heavy flows resulting from large storm events, these treatment plants may potentially discharge raw or partially treated sewage into the UTS habitat. San

Antonio and Shay Creeks are also vulnerable to activities that cause oxygen depletion due to cattle and horse manure on adjacent upland areas that is washed into the creeks.

Groundwater Removal

Groundwater removal for domestic and agricultural use is a major threat to the UTS in the Santa Clara River, upper San Antonio Creek drainage, Soledad Canyon, Bouquet Canyon, and Shay Creek. For example, according to the U.S. Forest Service (2001), catastrophic mortality of the UTS in Shay Creek and Baldwin Lake occurred in 1985 and 1986 due to insufficient amounts of water due to groundwater withdrawal. The UTS survived in the deeper pools of Shay and Wiebe Ponds. Excessive groundwater removal can, in some cases, result in the complete drying of a stream reach or pond, especially during drought conditions.

Groundwater removal can also result in increased water temperatures. As the volume and flow of water declines, pools become shallower and water temperature increases. Feldmeth and Baskin (1976) and Baskin (1975) found that UTS have a moderate tolerance (critical thermal maximum of 30.5 degrees Celsius (86.9 degrees Fahrenheit)) when acclimated at 8 degrees Celsius (46.4 degrees Fahrenheit) and a critical thermal maximum of 34.6 degrees Celsius (94.3 degrees Fahrenheit) when acclimated at 22.7 degrees Celsius (72.8 degrees Fahrenheit). High rates of mortality are likely to occur in situations where temperature is increasing rapidly or when temperatures exceed the critical thermal maximum.

Transpiration and Other Effects of Arundo donax (Giant Reed)

In plants, approximately 99 percent of the water taken in by the roots is released by the plant into the air as water vapor. The San Antonio Creek drainage and the Santa Clara River drainage, including Soledad Canyon, Bouquet Creek, and San Francisquito Creek, are severely infested with non-native *Arundo donax* (giant reed). Coffman (2007) notes that *Arundo donax* threatens river ecosystems by affecting natural river processes, such as lowering groundwater tables, decreasing surface water levels in streams, increasing the potential for wild fires, and reducing animal and plant diversity. *Arundo donax* may decrease surface-water levels by the transpiration process. This species of plant has been documented to transpire at a rate 6 to 110 times greater than native vegetation (Coffman 2007).

As stated previously, efforts are underway to help restore the Santa Clara River drainage, including its tributaries, with money provided by the Santa Clara Trustee Council in 2005. Restoration efforts include the management of *Arundo donax* infestations.

Off-Highway Vehicles

The use of off-highway vehicles (OHV) (motorcycles and four-wheel-drive vehicles) is a popular recreational activity in Southern California. Unmanaged, OHV use can damage riparian vegetation, increase siltation in pools, compact soils, disturb the water in stream channels, and crush UTS. In recent years, this activity has grown and pressure to find new locations for OHV recreation has increased. Off-highway vehicle activities continue to be a threat to the UTS in Soledad Canyon and the Santa Clara River despite efforts by law enforcement to stop OHVs from trespassing in the Santa Clara River. In Soledad Canyon, OHV use occurs on private property within the creek bed. The UTS habitat may be adversely impacted by OHV activities that destroy forage and breeding locations. Off-highway vehicles may also crush individual UTS or their nests.

Drinkwater Reservoir

The population of UTS in San Francisquito Creek may be extirpated (Backlin *in litt*. 2008); however, a comprehensive survey is needed to determine their presence or absence. Habitat for the UTS exists in San Francisquito Creek at its confluence with Drinkwater Canyon in the Angeles National Forest. This habitat is approximately 100 m (328 ft) long during the summer but extends to a length of about 1.5 km (0.93 mi) in the winter. A reservoir in Drinkwater Canyon releases water that maintains the small amount of UTS habitat in San Francisquito Canyon. The Los Angeles Department of Water and Power releases 28 liters (1 cubic foot) per second of water throughout the year to satisfy the water rights of private property owners downstream of the reservoir; however, the flow is temporarily terminated when the discharge pipes at the reservoir are cleaned. Without careful management and timing of discharges, any remaining UTS in upper San Francisquito Canyon could be lost.

Toxic Spills and Discharges

The floodplain of the Santa Clara River within Soledad Canyon is crossed by the Southern Pacific Railroad tracks, Soledad Canyon Road, and the access roads for several commercial campgrounds. The possibility exists that a toxic chemical spill from private land or a railroad or highway accident could destroy the entire Soledad Canyon population of the UTS leaving only the San Antonio Creek population, the Santa Clara River population, and the small populations in Bouquet Canyon and Shay Creek.

The discharge of chlorine into the UTS habitat in Soledad Canyon is also a potential problem because of the large number of recreational lakes and pools in Soledad Canyon. The Los Angeles County Health Department requires property owners to chlorinate or otherwise treat these recreational water bodies. When they are drained, chlorine or other chemicals may be discharged into the creek. Thus, while the UTS may be seasonally abundant in most years, its restricted distribution renders it vulnerable to catastrophic extirpation from an accidental spill.

Addition of Water

The addition of water to drainages in southern California can be beneficial or harmful to the UTS depending on the timing, amount, and contents of the water. Both the increase in size and productivity of habitat that may occur as a result of additional water releases would tend to increase the population of the UTS; however, if too much water is released, increased flows could wash out pools and side channels or wash away the debris that help maintain flows at an appropriate velocity for the UTS. Also, addition of water in the Santa Clara River population could establish a permanent connection between the population of the UTS with the downstream populations of partially armored threespine stickleback resulting in introgression.

Although imported water may increase habitat for the UTS, importation of out-of-basin water has already resulted in the introduction of Owens sucker and prickly sculpin into the Santa Clara River drainage (Bell 1978). Imported water may also contain a variety of predators, competitors, and parasites that could injure or kill the UTS.

Lastly, a rapid increase in the amount of water released may flush the UTS and their nests from their habitats. The Metropolitan Water District (MWD) released 100s of acre feet of water into the Santa Clara River in January 2007 in order to inspect and repair its pipelines. Fishery biologists monitoring the discharge of the water observed stranded UTS in temporary pools of water on the upper terraces of the Santa Clara River banks, which were created by the high flows. The biologists attempted to rescue as many UTS as possible; however, any individuals not rescued were subject to desiccation or predation. MWD is required to inspect its lines every 5 years and must do so in short order (i.e., over an approximate 3-day period) or the City of Los Angeles will temporarily run out of water. Metropolitan Water District has indicated they may develop a habitat conservation plan (HCP) and an associated application for an incidental take permit pursuant to section 10 of the Act, as a mechanism for obtaining take authorization for their activities in the Santa Clara River.

Impoundment of Waters

Baskin (1974) found that impoundments may be beneficial or harmful to the UTS. Small impoundments with well-circulated water and abundant aquatic vegetation along the edges support the highest density of the UTS (Baskin 1974, 1975). However, large impoundments without aquatic vegetation are unsuitable for the UTS. Within Soledad Canyon there are many instream impoundments on private property that serve as swimming ponds during the summer months. These swimming ponds tend to be maintained free of aquatic vegetation and have higher temperatures than the naturally occurring back-water channel habitats with aquatic vegetation; however, these swimming ponds are abundant with filamentous algae. The UTS are known to favor relatively calm water with some plant cover, and the UTS are often absent from ponds with high water temperatures and very thick algal growth (Baskin 1974). During winter months these ponds are washed out and then recreated by the property owners sometimes with heavy equipment, which may crush the UTS and their nests.

Some of these ponds are created in violation of section 404 of the Clean Water Act of 1973, and would thereby be regulated by the Corps. For example, in the summer of 2005, the Robin's Nest Campground in Soledad Canyon tried to recreate one such pool after it was blown out by the storm event of 2004-2005. This part of Soledad Canyon is known to be occupied by the UTS (C. Dellith, pers. obs. 2007). The Corps cited the owner of the Robin's Nest Campground for violating the Clean Water Act of 1973. The Service also reached a settlement agreement with Robin's Nest Campground under a Law Enforcement action for take of UTS pursuant to section 9 of the Act. Subsequently, the owner of the campground agreed to restore this section of the Santa Clara River in Soledad Canyon to a natural condition, which should benefit UTS. The owner also posted signs educating campground users of the presence of UTS and their sensitivity. There are several other similar instances occurring within Soledad Canyon that are pending investigation. However, these ponds often go undetected because of the thick terrestrial vegetation that obstructs views from Soledad Canyon Road.

Threats Specific to Bouquet Canyon

In Bouquet Canyon, impacts to the UTS are most likely associated with road use and maintenance, recreation, streambed alteration, water diversions, water pollution, disease and invasive species. The Bouquet Canyon recreation residences are impacting the UTS through water extraction, streambed alteration, introduction of toxins, grey water and untreated sewage discharge, road use, stream crossings, recreational use, fuel reduction (i.e., vegetation clearing), and invasive species originating from the recreation residence lots. The U.S. Forest Service is currently conducting a section 7 formal consultation with the Service for proposed renewal of the special use permits associated with the recreational residences. Impacts associated with the recreation residences will be addressed during the formal consultation process.

Threats Specific to Shay Creek

The encroachment of emergent wetland vegetation has been gradually reducing open-water habitat in Shay Pond and may be limiting the UTS population. The pond has been cleaned out at irregular intervals by personnel from the Service, U.S. Forest Service, and California Department of Fish and Game, but these efforts have been hampered because property owners have often refused access to the pond. However, completion of real estate transactions to purchase Shay Pond and surrounding wet-meadow areas, which are expect to occur in the near future, will eliminate this threat.

Furthermore, Shay Creek and its pools, including Shay Pond, are located in close proximity to a developed area and approximately 6 m (19 ft) from an unpaved road. This location is potentially threatened by eutrophication or pollution from nuisance flow contamination by horse manure. Development of properties continues in areas adjacent to the creek and its pools. This activity would likely result in the loss of the creek, which is typically dry, and potentially the pools, without a sufficient input of water.

FACTOR B: Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Overutilization for commercial, recreational, scientific, or educational purposes was not considered a threat at the time of listing, and there is no information to suggest that it has become a current threat.

FACTOR C: Disease or Predation

Disease

Disease was not considered a threat at the time of listing; however, Warburton et al. (2001) examined 21 fish species, including the UTS, consisting of 1,933 individual specimens from 13 watersheds and detected 23 parasite species, 4 of which were confirmed to be exotic species of commercial significance. They determined that some individuals from the San Francisquito population of the UTS were infected with white spot (*Ichthiopterious* spp.) disease and anchor-worm (*Lernea* spp.). The degree to which parasites affect the UTS survival and productivity is unknown. Parasites can lead to direct mortality, create wounds that provide a route for pathogens to enter fish, and can make fish more susceptible to predation (Robinson et al. 1998). At least one die-off of UTS in San Francisquito Creek has been documented as a result of these diseases (Warburton et al. 2001).

Introduction of Predators

Non-native species have been a major factor in the decline of the UTS. Many non-native species were introduced into California in the late 1800s and early 1900s, and through range expansions and transplants have become established throughout most of the State (Moyle 2002). Introduced aquatic vertebrates and invertebrates are predators on one or more of the life stages of UTS. These include African clawed frogs, bullfrogs (*Rana catesbeiana*), red swamp crayfish (*Procambarus clarkii*), signal crayfish (*Pacifastacus leniusculus*), and various species of fishes, especially bass (*Micropterus* spp.), catfish (*Ictalurus* spp.), sunfish (*Lepomis* spp.), and mosquito fish.

Predators may adversely affect the UTS by removing individuals or restricting them to habitats that the predators cannot enter. Some predators randomly prey on the UTS, while others may select the UTS based on appearance. Bell (1976) found that predators remove sticklebacks with different plate counts at different rates. This can produce a shift in the frequency of individuals with different numbers of plates (Hagen and Gilbertson 1973, Moodie et al. 1973), which may result in the UTS more closely resembling the partially armored threespine stickleback. Random or selective removal may eventually result in the extirpation of a population.

Restriction to habitats that predators cannot enter will reduce population size. Larson (1976) found that predation by coho salmon (*Oncorhynchus kisutch*) caused lacustrine (i.e., lakes and reservoirs) sticklebacks to occupy a limnetic habitat (deepwater habitats within the lacustrine systems), to which they were poorly adapted.

Introductions of predators have come from a number of sources. African clawed frogs were introduced into Agua Dulce Canyon, a tributary of the Santa Clara River, sometime in the 1970s. African clawed frogs have voracious appetites and are regarded as a threat to native fishes (St. Amant et al. 1973) and a severe threat to the UTS (Baskin 1974). African clawed frogs are abundant throughout the Santa Clara River drainage, including Soledad Canyon, lower San Francisquito Canyon, Castaic Creek, and the mainstem of the Santa Clara River.

In July 2007, CDFG fishery biologists detected a large population of convict cichlids (*Archocentrus nigrofasciatus*) in a reach of the Santa Clara River at the outfall of the Saugus Sewage Treatment Plant. Convict cichlids are considered aggressive predators (Hovey *in litt*. 2007). Fortunately, this reach of the Santa Clara River is isolated from downstream reaches where the UTS are known to occur; however, during rain events this reach would connect with downstream and upstream reaches. In an effort to eradicate the convict cichlids from the Santa Clara River, biologists from CDFG, Los Angeles County Flood Control Department, and the Service attempted to capture all the convict cichlids while the Saugus Sewage Treatment Plant shut off flows for several days. At first, the effort appeared to be successful; however, by the summer of 2008, the convict cichlid population had re-established at the site. It should be noted that during the eradication effort, no native fish species to the Santa Clara River, including the UTS, were detected.

The only location currently occupied by UTS that is not compromised by non-native predators is the Shay Creek population. Currently, there is no coordinated attempt to manage vertebrate or invertebrate populations of non-native species within occupied locations for the UTS.

FACTOR D: Inadequacy of Existing Regulatory Mechanisms

The inadequacy of existing regulatory mechanisms was not identified as a threat to the UTS at the time of listing in 1970. The recovery plan for the UTS (Service 1985) also did not identify inadequacy of existing regulatory mechanisms as a threat to the subspecies, nor did it identify any recovery tasks that would mitigate this factor. With the protections afforded by the Act and the State of California (see below) we continue to believe, that this factor is a threat to the UTS.

The Act is the primary Federal law providing protection for this species. Since its listing, the Service has analyzed the potential effects of Federal projects under section 7(a)(2) of the Act, which requires Federal agencies to consult with the Service prior to authorizing, funding, or carrying out activities that may affect listed species. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild by reducing its reproduction, numbers, or distribution (50 C.F.R. § 402.02). A non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of listed species associated with a project. Incidental take refers to taking of listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity by a Federal agency or applicant (50 C.F.R. § 402.02). Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. In cases where some incidental take is unavoidable, the Service works with the agency to include additional conservation measures to minimize negative impacts. For projects without a Federal nexus that may negatively impact listed species, the Service may issue incidental take permits pursuant to section 10(a)(1)(B). To qualify for an incidental take permit, applicants must develop, fund, and implement a Service-approved Habitat Conservation Plan (HCP) that details measures to minimize and mitigate the project's adverse impacts to listed species. Regional HCPs in some areas now provide an additional layer of regulatory protection for covered species, and these HCPs are coordinated with the related Natural Community Conservation Plan State program.

The UTS was listed as endangered under the California Endangered Species Act (CESA) in 1971. Under CESA, the UTS cannot be "taken" without first obtaining a permit. "Take" is defined in section 86 of the California Fish and Game Code as to "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." If the take is incidental, CDFG requires that the permit applicant fully mitigate for it. If the take is intentional or purposeful (e.g., for research purposes), the researcher must first obtain a Memorandum of Understanding (MOU) with the CDFG.

In the 1960s, the CDFG classified the UTS as a fully protected species. A fully protected species may not be taken or possessed at any time, and no licenses or permits may be issued for their take except for collecting for necessary scientific research. Hence, incidental take and purposeful take are not authorized for a fully protected fish species except for collecting for necessary scientific research.

The use of existing regulatory mechanisms to conserve and help recover the UTS is ongoing. We are aware of six projects, which are proposed or are in progress and are likely to result in incidental take of UTS. These projects are: (1) Newhall Ranch–a proposed 28,000-unit residential development located along the Santa Clara River; (2) Bouquet Canyon Road re-alignment; (3) Bouquet Canyon Recreation Residential Re-authorization; (4) San Antonio Creek Bank stabilization (currently in progress on VAFB); (5) Department of Water and Power routine inspection of water lines; and (6) the proposed re-initiation of formal section 7 consultation regarding the U.S. Forest Service special use permits for water collection and conveyance facilities in the Baldwin Lake Watershed, San Bernardino National Forest. The CDFG has not recently issued any research permits/MOUs for UTS to individuals.

FACTOR E: Other Natural or Manmade Factors Affecting Its Continued Existence

In 1989 the AFS identified other natural or manmade factors as threats to the UTS (Williams et al. 1989). The recovery plan also recognizes that other natural or manmade factors threaten the UTS (Service 1985).

Introgression

Introgression results from hybridization between groups (species, subspecies, or populations) of organisms (i.e., the flow of genes from members of one of these groups into members of another group through cross-breeding). The result of introgression is that the group receiving intensive gene flow will come to resemble the source group. Increased gene flow to UTS may be caused by stream channelization, releases of water containing partially or fully armored threespine sticklebacks, or the introduction of partially or fully plated threespine sticklebacks into the habitat of UTS. The latter may occur when partially or fully plated threespine sticklebacks are inadvertently introduced into the UTS habitat along with game fishes. Introductions such as this by private parties for recreation (e.g., trout and bass fishing) becomes increasingly likely as urbanization occurs in the upper Santa Clara River Basin. Introgression can be a cause for concern for an imperiled species, even leading to extinction (e.g., Rhymer and Simberloff 1996). The Shay Creek population does not appear to be at risk of introgression at this time because it is isolated from other populations of stickleback. As stated earlier, the population of the UTS in the Santa Maria River drainage and the transplanted population in the Mohave River appear to have been lost due to introgression.

Competition

Competitors may also cause extirpation or morphological change of the UTS populations. Sticklebacks are rare in eastern North American streams because fish species diversity is high and there are many potential competitors. Ross (1973) believed that low gill raker counts (i.e., the bony processes on the inside of the branchial arches of fishes which prevents the passage of solid substances through the branchial clefts) of sticklebacks in Arroyo Trabuco Creek, a tributary of San Juan Creek, Orange County, was caused by the unusual presence of California killifish (*Fundulus parvipinnis*); therefore, introductions of competitors are likely impacting the UTS.

Introductions of competitors have come from a number of sources. Channelization may have provided a route for invasion by fathead minnows (*Pimephales promelas*) and prickly sculpin, which were introduced into the Santa Clara River drainage (Bell 1978). Urbanization also increases the probability that competitors will be introduced. For example, following urbanization, mosquito abatement typically occurs by stocking water bodies with mosquitofish. Mosquitofish are native to the eastern United States and have been introduced to wetlands worldwide as biological control agents for mosquito larvae. Mosquitofish are considered opportunistic feeders foraging on over 50 types of plant and animal life, including micro- and macro-invertebrates species that the UTS prey upon (Graf 1993). Baskin (1974) found that UTS are sympatric with mosquitofish in parts of the upper Santa Clara River. Stomach content analysis indicated that mosquitofish may be competing with the UTS for some food items; therefore the introduction of mosquitofish may have contributed to the disappearance of UTS in the Los Angeles basin. However, this basin has become thoroughly urbanized since 1917, and most of the streams have been channelized, thereby destroying suitable habitat required by the UTS.

Stochastic Extinction

The UTS remain at only five small, disjunct populations. Species consisting of small populations, such as the UTS, are recognized as being vulnerable to extinction as a result of stochastic (i.e., random) threats (Shaffer 1981). Such threats to the UTS are demographic, genetic, and environmental stochasticity and catastrophic events (Shaffer 1981). The conservation biology literature commonly notes the vulnerability of taxa only occurring at one or a few locations (Shaffer 1981, 1987; Primack 2006, Groom et al. 2006). Such populations may be highly susceptible to extirpation due to chance events or additional environmental disturbance (Goodman 1987, Gilpin and Soule 1988), such as adverse effects from changes in hydrology or temperatures due to climate change, introduction of non-native species, and failure to maintain habitat requirements at man-made locations. If an extirpation event occurs in an isolated population, the opportunities for natural recolonization are reduced or nonexistent due to physical isolation from other populations.

Demographic stochasticity refers to random variability in survival and/or reproduction among individuals within a population (Shaffer 1981). Random variability in survival or reproduction can have a significant impact on population viability for populations that are small, have low fecundity, and are short lived. In small populations reduced reproduction or die-offs of a certain age-class will have a significant effect on the whole population. Individuals vary naturally in their ability to produce viable offspring; for example, a particular male may be sterile or a female may produce fewer eggs than average. Although of only minor consequence to large populations, this randomly-occurring variation in individuals becomes an important issue for small populations.

Currently, some of the UTS populations are small (between 35 and 200 individuals), and therefore random events that may cause high mortality or decrease reproduction will have a significant effect on the viability of a population. Furthermore, because UTS live for approximately 1 year (Baskin 1974), a single bad year in reproduction, coupled with or followed by high mortality, could threaten a population with extinction. The risk of extinction is exacerbated because the number of populations is small (five) and each is vulnerable to this threat.

Genetic stochasticity results from the changes in gene frequencies caused by the founder effect, random fixation, or inbreeding bottlenecks (Shaffer 1981). Founder effect is the loss of genetic variation when a new population is established by a very small number of individuals. Random fixation refers to when some portion of gene loci is fixed at a selectively unfavorable allele (a different form of a gene) because the intensity of selection is insufficient to overcome random genetic drift. Random genetic drift (the occurrence of random changes in the gene frequencies of small isolated populations) happens when alleles are transmitted from one generation to the next, because only a fraction of all possible zygotes become breeding adults. A bottleneck is an evolutionary event in which a significant percentage of a population is killed or prevented from breeding.

In small populations such as the UTS, these factors may reduce the amount of genetic diversity retained within populations and may increase the chance that deleterious recessive genes may be expressed. Loss of diversity could limit the species' ability to adapt to environmental changes, and deleterious recessive genes could reduce the viability and reproductive success of individuals. Isolation of the five remaining UTS populations preventing any natural genetic exchange will lead to a decrease in genetic diversity. Lack of genetic diversity impairs the species' ability to adapt to changes in its environment and contributes to inbreeding depression (i.e., loss of reproductive fitness and vigor).

Environmental stochasticity is the variation in birth and death rates from one season to the next in response to weather, disease, competition, predation, or other factors external to the population (Shaffer 1981). Drought or predation in combination with a low- population year could result in extinction. Catastrophes are an extreme form of environmental stochasticity. Although they generally occur infrequently, catastrophes, such as severe floods or prolonged drought, can have disastrous effects on small populations and can directly result in extinction. Climate change over the next century may increase the occurrence of prolonged drought. Current climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field et al. 1999, Cayan et al. 2005, IPCC 2007). However, predictions of climatic conditions for smaller sub-regions, such as California, remain uncertain. It is unknown at this time if climate change in California will result in a warmer trend with localized drying, higher precipitation events, or other effects. While we recognize that climate change is an important issue with potential effects to listed species and their habitats, we lack adequate information to make accurate predictions regarding its effects to particular species at this time.

All three of these stochastic factors may also act in combination. One possible scenario of how these factors in combination could increase the risk of extinction for the UTS would be the loss of one or two populations during a drought period at the same time a predator is introduced to one of the remaining populations. Although one or two of the populations may survive and be used for reintroductions, the resulting loss of genetic diversity would likely further increase the risk of extinction.

Summary of Five-Factor Analysis

All of the threats identified in the UTS recovery plan (Service 1985), remain matters of concern. Of the three applicable factors, we believe that the threats discussed under Factor A pose the greatest risk to the UTS. The ongoing effects of urbanization, eutrophication, stream channelization, addition of water, groundwater removal, and water quality, are the most critical threats to the habitat of the UTS; substantial reduction or elimination of these threats is not expected in the near future. Based on the record of urban growth during the past several decades, it is reasonable to conclude that within the foreseeable future, there is a high probability of habitat loss and alteration that would greatly reduce the UTS population sizes. However, the rate of habitat loss has slowed from historical levels. Restoration efforts are beginning to reverse the trend, but are unlikely to produce a substantially increased and stable habitat base for the UTS in the foreseeable future.

III. RECOVERY CRITERIA

Recovery plans provide guidance to the Service, states, and other partners and interested parties on ways to minimize threats to listed species, and on criteria that may be used to determine when recovery goals are achieved. There are many paths to accomplishing the recovery of a species and recovery may be achieved without fully meeting all recovery plan criteria. For example, one or more criteria may have been exceeded while other criteria may not have been accomplished. In that instance, we may determine that, over all, the threats have been minimized sufficiently, and the status of the species is robust enough, to downlist or delist the species. In other cases, new recovery approaches and/or opportunities unknown at the time the recovery plan was approved may be more appropriate ways to achieve recovery. Likewise, new information may change the extent that criteria need to be met for recognizing recovery of the species. Overall, recovery is a dynamic process requiring adaptive management, and assessing a species' degree of recovery is likewise an adaptive process that may, or may not, fully follow the guidance provided in a recovery plan. We focus our evaluation of species status in this 5-year review on progress that has been made toward recovery since the species was listed (or since the most recent 5-year review) by eliminating or reducing the threats discussed in the five-factor analysis. In that context, progress towards fulfilling recovery criteria serves to indicate the extent to which threat factors have been reduced or eliminated.

The recovery criteria and tasks are listed in the recovery plan for the UTS (Service 1985). The criteria are out of date because they do not reflect the best available information on the biology of the subspecies. Since the development of the recovery plan, much research has been conducted and additional threats have been identified. Furthermore, since the development of the recovery plan, a new population (Bouquet Creek) of the UTS has been discovered and two populations (Canada Honda and San Francisquito Creek) have been extirpated. Although the five factors are not mentioned specifically, the recovery plan addresses factors A, C, and E.

Listing factors B and D are not considered to be threats to the species and are not discussed in the recovery plan.

The recovery plan includes the following criteria specifically for the UTS:

The UTS will be considered for downlisting to threatened status when the following objectives have been achieved:

(1) Identify the factors responsible for threatening the integrity of the known remaining habitats and take actions to stabilize habitat conditions.

This objective addresses Factor A, C, and E.

Factors responsible for threatening the integrity of the known remaining habitats have been identified; however, the appropriate actions necessary to stabilize habitat conditions have not been achieved yet.

(2) Address other known threats to extant populations in a manner that assures the continued existence of these populations.

This objective addresses Factor A, C, and E.

Other threats, including introgression and predation, have not been addressed or eliminated and therefore Objective 2 has not been achieved.

(3) Maintain at least three self-sustaining populations within the historical range of the UTS for a period of 5 consecutive years without significant threats to their continued existence.

This criterion addresses Factors A, C, and E.

There are no self-sustaining populations without significant threats, and therefore, Objective 3 has not been achieved yet.

The UTS can be considered for delisting when downlisting objectives have been achieved and:

(1) At least five self-sustaining populations within the historical range of the UTS for a period of 5 consecutive years without significant threats to their continued existence.

This objective addresses Factor A, C and E.

Objectives 1, 2, and 3 for downlisting have not been achieved yet (see downlisting above).

IV. SYNTHESIS

In 1917, the UTS were reported to be abundant in the Los Angeles, San Gabriel, and Santa Ana River systems of the Los Angeles Basin. These rivers and streams have either been reduced to concrete-lined drains or severely altered, and by the time the UTS were listed, the species' range had been reduced to three populations (i.e., Soledad Canyon, San Francisquito Canyon, and Santa Clara River at Del Valle). Additional UTS populations were discovered after listing in Bouquet Canyon, Los Angeles County; San Antonio Creek and Santa Maria River, Santa Barbara County; and the Shay Creek vicinity, San Bernardino County. However, the taxonomic status of these additional populations is problematic and warrants further research. Currently, the UTS are limited to Soledad Canyon, Bouquet Canyon, Santa Clara River, San Antonio Creek, and the Shay Creek vicinity.

Factors that threaten the ecological stability of the river system where it occurs threatens the continued existence of this particular subspecies. The UTS continue to be threatened by: agricultural, industrial, and municipal water pollution; channelization and other habitat modifications associated with urbanization; stream flow alterations caused by water diversion; groundwater pumping; introduction of competing and predatory species; hybridization with partially armored threespine stickleback; drought; and stochastic extinction. Although some efforts have been and are being made to acquire habitat for the species, little has been done so far, and none of the recovery criteria in the recovery plan for the UTS (Service 1985) have been fully met. Furthermore, with the new information available on the genetics of some populations, the loss of one of the few remaining populations would not only move the subspecies further toward extinction but could also result in the extinction of an entirely different, although as yet undescribed, subspecies or species. Based on these ongoing threats and the small number and isolation of existing populations, we believe the UTS continues to be threatened with extinction throughout all or a significant portion of its range and thereby meets the definition of endangered under the Act. As a result, we recommend that the endangered status of the UTS remain unchanged.

V. RESULTS

Recommended Listing Action:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (indicate reason for delisting according to 50 CFR 424.11):
    ____ *Extinction*
    ____ *Recovery*
    ____ *Original data for classification in error*
__✓__ No Change

New Recovery Priority Number and Brief Rationale: We recommend that the recovery priority number be changed to 6C. This number indicates that the taxon is a subspecies that faces a high degree of threat and has a low potential for recovery. The threats that were present when the UTS was listed are still present with new threats identified. The status of this species may be in conflict with development projects and water rights issues. Although the number of populations of UTS has increased from one (i.e., Soledad Canyon) at the time of listing to five (i.e., Soledad Canyon, Santa Clara River, Bouquet Canyon, San Antonio Creek, and Shay Creek) there are now potentially four distinct genetic lineages to consider. Remaining Populations of UTS in the Santa Clarita Watershed for which the subspecies was originally described occur on private lands without any management plans in place. A population in San Francisquito Canyon in the Santa Clarita River watershed has been extirpated and a second population in Bouquet may be extirpated.

Listing and Reclassification Priority Number and Brief Rationale: No change needed.

VI. RECOMMENDATIONS FOR ACTIONS OVER THE NEXT 5 YEARS

- A nuclear DNA study of each population should be conducted to further support the taxonomic status of each population and determine from which populations UTS should be collected for re-establishing extirpated locations (e.g., San Francisquito and Bouquet Canyons).

- Evaluate and implement translocation of the UTS where appropriate (e.g., San Francisquito and Bouquet Canyons).

- Establish a program for routine monitoring of the UTS populations. The goals of the program would be to establish current status, detect declines, identify threats, and determine appropriate remediation.

- Develop and implement management plans for extant UTS populations, which address specific threats at each population location.

- Acquire, or otherwise secure for the conservation of the UTS, property within areas that have suitable habitat for the UTS (e.g., Soledad Canyon, Santa Clara River, Shay Creek vicinity).

- Consider describing the taxonomy of the Shay and San Antonio Creek populations of the UTS in a peer reviewed journal. Currently, unpublished literature (Haglund and Buth 1988, Buth and Haglund 1994) indicates that these populations are different subspecies from *Gasterosteus aculeatus williamsoni*. Until the taxonomy and distribution of the subspecies is clarified and adopted, jeopardy determinations will be based upon the current distribution of *G.a. williamsoni*, which may result in underestimating the impacts of projects on less widely distributed subspecies. By recognizing the different subspecies, the Service could conduct more effective conservation for the UTS.

- Revise the 1985 recovery plan for the UTS.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW

Unarmored Threespine Stickleback (*Gasterosteus aculeatus williamsoni*)

Current Classification: Endangered

Recommendation Resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__✓__ No change needed

Review Conducted By: Chris Dellith

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U.S. Fish and Wildlife Service

Approve ______________________ Date 6/15/09

Carlsbad Fish and Wildlife Field Supervisor, U.S. Fish and Wildlife Service

Approve ______________________ Date 6-9-09