Species Accounts - Fish

Sacramento River Winter-run Chinook salmon

Oncorhynchus tshawytscha

Chinook salmon. Courtesy of Hanford Reach National Monument.

State Endangered 1989
Federal Endangered 1994

General Habitat:

The Sacramento River winter-run Chinook salmon historically spawned in cold spring-fed tributaries of the upper Sacramento River Basin. The run is now restricted to the mainstem Sacramento River downstream of Keswick Dam.

Description:

Chinook salmon are easily distinguished from other *Oncorhynchus* species by their large size. Adults weighing over 120 pounds have been caught in North American waters. Chinook salmon are very similar to coho salmon (*O. kisutch*) in appearance while at sea (blue-green back with silver flanks), except for their large size, small black spots on both lobes of the tail, and black pigment along the base of the teeth.

Status:

The Sacramento River winter-run Chinook salmon is one of four runs of Chinook salmon occurring in the Sacramento River. Winter-run Chinook adults return to the mainstem Sacramento River downstream from Keswick Dam from December through July, peaking in March and April. Adults hold there until spawning in May through August. Juveniles spend five to nine months in the river and the Sacramento-San Joaquin Estuary before entering the ocean. Genetic studies have shown that the Sacramento River winter-run Chinook salmon is distinct from other Chinook salmon runs in the Central Valley. The population of winter-run Chinook salmon continues to be low, but has shown some recovery in recent years. Since 1967, run size estimates have been made based on counts at Red Bluff Diversion Dam. In 2000, 2001, and 2002, estimates based on dam counts were 1,352, 5,523, and 9,172 fish, respectively.

Beginning in 1996, the DFG and USFWS have conducted a mark-recapture carcass survey for winter-run Chinook in the upper Sacramento River. Since 2001, DFG has considered the population estimate from the carcass survey to be the best available estimate of winter-run instream spawner abundance. From the carcass survey data (Jolly-Seber model), the estimated number of spawning fish in 2001 and 2002 was 8,120 and 7,337 fish, respectively.

Population estimates in recent years are therefore higher than the average estimates from Red Bluff Diversion Dam counts in the early 1990's (fewer than 500 fish), but population levels remain well below observed population levels in the late 1960's and 1970's, and well below the proposed level defined for recovery of the run. Factors

contributing to the population increase in recent years include improved temperature control at Shasta Dam, habitat improvements, installation of fish ladders and screens at major water diversions, improved contaminant control at Iron Mountain Mine, more restrictive ocean harvest regulations, and relatively good conditions for ocean survival.

USFWS continues a propagation program for winter-run Chinook salmon at Livingston Stone National Fish Hatchery at the base of Shasta Dam. In January 2000, 2001, and 2002, approximately 166,000, 252,500, and 253,000 juvenile winter-run, respectively, were released into the upper Sacramento River. A captive rearing program for winter-run Chinook continues at the Livingston Stone National Fish Hatchery. The captive rearing program was established in 1991 when the run size was extremely small. The program was designed as a hedge against the possibility of extinction of the species by rearing fish in captivity until maturity. The program is currently being reevaluated in consideration of the increasing natural production of winter-run in recent years.

NMFS completed the *Proposed Recovery Plan for the Sacramento River Winter-run Chinook Salmon* in August 1997. In 2002, NMFS initiated comprehensive recovery planning for listed salmonid species in the Central Valley, including winter and spring-run Chinook salmon, and Central Valley steelhead.

The current status of the Sacramento River winter-run Chinook salmon is stable.

Sacramento River Spring-run Chinook Salmon

Oncorhynchus tshawytscha

State	Threatened	1999
Federal	Threatened*	1999

*Central Valley Spring-Run includes populations spawning in the Sacramento River and its tributaries

General Habitat:

The spring-run Chinook salmon is native to the San Joaquin and Sacramento River systems. Large pools with cold water are essential over-summering habitat for this species.

Description:

Chinook salmon are easily distinguished from other *Oncorhynchus* species by their large size. Adults weighing over 120 pounds have been caught in North American waters. Chinook salmon are very similar to coho salmon (*O. kisutch*) in appearance while at sea (blue-green back with silver flanks), except for their large size, small black spots on both lobes of the tail, and black pigment along the base of the teeth.

Status:

Sacramento River spring-run Chinook salmon now spawn and rear primarily in three Sacramento River tributaries (Deer, Mill and Butte creeks). Small populations also occur sporadically in Antelope, Beegum, and Big Chico Creeks. Although spring-run occur in the mainstem Sacramento, Yuba, and Feather rivers, these populations are probably hybridized with fall-run Chinook. Following significant restoration, spring-run are now also returning in increasing numbers to lower Clear Creek.

Spring-run Chinook salmon enter the Sacramento River between February and June. They move upstream and enter tributary streams from February through July, peaking in May-June. These fish migrate into the headwaters, and hold in pools through the summer. Spawning can start as early as mid-August and last until mid-October, with peak occurrence in September. Juvenile life history is more variable. Some fish emerge starting in early November, continuing through the following April. These juveniles emigrate from the tributaries as fry from mid-November through June. Some fish remain in the stream until the following October and emigrate as "yearlings", usually with the onset of storms starting in October through the following March. Peak emigration of yearlings is in November-December.

Adult spring-run spawning population estimates in Butte Creek in 2000, 2001, and 2002 were 4,118, 9,605, and 8,785 respectively. These estimates were higher than estimates from the late 1960's through 1994, indicating some continuing recovery since 1994. Spawning population counts in Deer and Mill creeks in 2000 through 2002 also indicate some recovery of these populations in recent years.

Monitoring and management actions continue to play key roles in minimizing the impacts of state and federal water project operations on juvenile spring-run migrating through the Sacramento-San Joaquin Delta. A decision process based on information from various fisheries monitoring activities is used by biologists to make real-time changes in water project operations for the protection of spring-run and other listed stocks.

Recent genetic research has provided evidence that supports the distinction of spring-run Chinook salmon from the other Central Valley Chinook runs. . This evidence indicates that there are two discrete subpopulations: one inhabiting Butte Creek and the other inhabiting Mill and Deer creeks. Low population abundance over many generations, relatively isolated subpopulations, and restricted range remain high risk factors to Sacramento River spring-run Chinook because of the potential for reduced genetic diversity and increased inbreeding. The potential for hybridization of spring-run and fall-run Chinook in some tributaries such as Clear Creek or the Yuba River may be a threat to the genetic integrity of remaining Sacramento River spring-run populations. These genetic risks can have significant impacts on the survival and reproduction of Sacramento River spring-run Chinook populations.

The DFG's Status Review Report was submitted to the Fish and Game Commission (FGC) in June 1998 with a recommendation that the species warranted threatened status under the California Endangered Species Act and was formally listed as a State-threatened species in February 1999. In November 1999, Central Valley spring-run Chinook salmon was listed as threatened under the federal Endangered Species Act.

Overall, low population sizes, high population variability, the potential of reduced genetic diversity and altered genetic integrity, and restricted habitat are still great risk factors for Sacramento River spring-run Chinook. Continued conservation efforts are essential for their protection.

The current status of the Sacramento River spring-run Chinook salmon: Stable.

Coho salmon *Oncorhynchus kisutch*

State	Endangered south of San Francisco Bay	1995
	Candidate Endangered north of San Francisco to Punta Gorda	2002
	Candidate Threatened north of Punta Gorda	2002
Federal	Threatened San Lorenzo River north to Punta Gorda (Central California Coast ESU)	1996
	Threatened Punta Gorda north to Cape Blanco, Oregon (Southern Oregon Northern California Coast ESU)	1997

General Habitat:

In California, coho salmon are found in many of the coastal drainages from the Oregon border south to Monterey Bay. In the larger coastal drainages coho migrate high into the drainages, such as in the Klamath River where they migrate to Iron Gate Dam (~190 miles from the river mouth), and to many of the nearby major tributaries.

Description:

Coho salmon are medium to large salmon, with spawning adults typically 16 to 28 inches and weighing 6-13 lbs. Spawning adults are generally dark and drab. The head and back are a dark, drab blue-green; the sides are a dull maroon to brown with a bright red lateral streak; and the belly is gray to black. Females are paler than males, usually lacking the red streak. Characteristics of spawning males also include hooked jaw, enlarged and more exposed teeth, slightly humped back and a more compressed head and body. The snout is less deformed than in other salmon species.

Adult coho salmon in the ocean are steel-blue to slightly greenish on the back, silvery on the sides, and white on the belly. They have numerous small, irregular black spots on the back, upper sides above the lateral line, and base of the dorsal fin and upper lobe of the caudal fin. The adults have black mouths with white gums at the base of the teeth in the lower jaw. This is the most reliable physical feature that distinguishes them from chinook salmon (*O. tshawytscha*).

Juvenile coho salmon in inland waters are blue-green on the back, with silvery sides. The large eye and the characteristic sickle-shape of the anal and dorsal fins are characteristic of coho salmon juveniles and distinguish them from juveniles of other Pacific salmon species.

Status:

The coho salmon is one of seven species of Pacific salmon belonging to the genus *Oncorhynchus* and one of two native salmon species regularly occurring in California. The coho salmon life cycle is generally three years, spending their first year in fresh water and the next two years in salt water prior to returning to spawn in their natal streams (anadromous). Some males, called "jacks", return to spawn after only one season in the ocean. Adult coho salmon usually enter fresh water to spawn from September through January, peaking mid-November through mid-January. In many California coastal streams, spawning migrations do not begin until heavy rains have opened the sand bars that form at the mouth of the stream. In the larger rivers where the mouth remains open all year, coho have access earlier in the season and these early runs generally move higher in the watershed.

California coho salmon have experienced a significant decline in the past 40 to 50 years. Many of these populations have been individually and cumulatively depleted or extirpated and the natural linkages between them have been fragmented or severed. The severity of the decline and number of extirpated populations increases as one moves closer to the historical southern limit of the coho salmon range, indicating that freshwater habitat in these marginal environments is less able to support coho salmon populations than in the past. Freshwater habitat loss and degradation have been identified as leading factors in the decline of anadromous salmonids in California, and coho salmon do not appear to be an exception to this trend.

Timber harvest activities, especially past and present road construction, have had deleterious effects on coho salmon habitat. Diversion of water for agricultural and municipal purposes and dams that block access to former habitat have resulted in further reduction of habitat. Water quality in historical coho salmon streams has degraded substantially, as evidenced by the number of north- and central-coast streams that have been placed on the list of impaired water bodies. Even though unfavorable climate conditions have contributed to the continued decline of remnant populations of coho, these factors alone would have little impact on a healthy robust population. A team of individuals from several governmental and private organizations is assisting the Department in its efforts to develop a statewide recovery plan for California coho salmon. The Department has completed the Recovery Strategy for California Coho Salmon. This document is an update to the report presented to the DFG Commission on August 2003.

South of San Francisco Bay (southern portion of Central California Coast Coho ESU)

Nine coastal streams south of San Francisco Bay historically supported self-sustaining spawning runs of coho salmon. These streams (listed from north to south) are San Gregorio, Pescadero, Gazos, Waddell, Scott and San Vincente Creeks, the San Lorenzo River, and Soquel and Aptos Creeks in San Mateo and Santa Cruz counties. Presently, only Scott Creek is known to support all three brood-years (a brood-year is a group of fish that hatched during a given spawning season). The Scott Creek population has been supplemented in recent years by stocking coho juveniles from a small hatchery on Big Creek, a tributary of Scott Creek. Waddell Creek, five miles north of Scott Creek, is known to support two of the three brood-year lineages, although one of the two appears to total less than 20 returning adults.

Limited sampling for juvenile coho salmon has been recently conducted in the streams south of San Francisco. Juveniles have been found in Pescadero, Gazos, Waddell, Scott, and San Vicente Creeks. However, due to the difficulties in sampling, it has not been possible to estimate juvenile abundance. The few existing southern coho salmon populations are small and in danger of extirpation.

The Department, with the assistance of individuals from several governmental and private organizations, has

developed a draft recovery plan for coho salmon in the nine streams south of San Francisco Bay. Concepts from the draft plan will be incorporated into the statewide coho salmon recovery plan currently in development. At this time, the DFG considers the status of the coho salmon south of San Francisco Bay to be declining and in danger of extinction.

North of San Francisco to Punta Gorda (northern portion of Central California Coast Coho ESU)

Presence surveys done in 2001 and 2002 in the northern portion of the Central California Coast (CCC) Coho ESU show a level of occupancy of historical streams that is similar to the Southern Oregon Northern California Coast (SONCC) Coho ESU. However, stream systems south of Mendocino County show a much greater proportion of streams in which coho salmon were not found. These surveys and other recent monitoring data indicate that widespread extirpation or near-extinction have already occurred within some larger stream systems (e.g. the Gualala and Russian rivers) or over broad geographical areas (e.g. Sonoma County coast, San Francisco Bay tributaries, and streams south of San Francisco). Most abundance trend indicators for streams in the CCC Coho ESU indicate a decline since the late 1980s. However, some streams of the Mendocino County coast show an upward trend in 2000 and 2001. Time-series analysis for these streams show a declining trend and predict that this trend will continue, despite the recent increases.

There is anecdotal evidence that relatively large numbers of coho salmon adults returned to some Marin County streams in 2001, and some of these streams, such as Lagunitas Creek, appear to have relatively stable populations. However, these populations are more vulnerable to extinction due to their small size, and the spatial isolation of this region due to extirpation of coho salmon populations to the north and south.

Coho populations in streams in the northern portion of this ESU seem to be relatively stable or are not declining as rapidly as those to the south. There is fragmentation in all but the Marin, Bodega, and Russian River watersheds. Both persistence and numbers of fish are problematic. However, the southern portion, where widespread extirpation and near-extinctions have occurred, is a significant portion of the range of coho salmon in this ESU. Data suggest that coho salmon are extirpated from all the streams and watersheds that flow into the San Francisco Bay. Data also indicate that metapopulation structure may be severely compromised and remaining populations may face greatly increased threats of extinction because of this. Hence, in both north and south of the Bay, conservation hatcheries are being operated and are considered vital for any chance to recovery the CCC. Small population size along with large-scale fragmentation and collapse of range observed in data for this area. For this reason, the Department concludes that CCC coho salmon are in serious danger of extinction throughout all or a significant portion of their range.

North of Punta Gorda to the Oregon/California Border (California Portion of SONCC Coho ESU)

The analysis of presence-by-brood-year data indicates that coho salmon now occupy only about 61% of the SONCC Coho ESU streams that were previously identified as historical coho salmon streams. However, these declines appear to have occurred prior to the late 1980s and data do not support a significant decline in distribution between the late 1980s and the present. This analysis and the 2001 presence surveys indicate that some streams in this ESU may have lost one or more brood-year lineages.

The 2001 presence survey data also show a decline in reported distribution in this ESU. These data show a substantial reduction in the number of historical streams occupied by coho salmon, especially for the Mattole, Eel, and Smith River systems, where coho salmon appeared to be absent from 77%, 75%, and 62% of the streams surveyed, respectively. These data should be interpreted with caution, however, because they represent only one year of surveys, and 2001 was a drought year on the north coast. Nevertheless, the inability to detect coho salmon in streams where they were historically documented, and that are considered by biologists to contain suitable coho salmon habitat is significant, especially since coho salmon were not found in 64% of all the streams surveyed. Adult coho salmon counts at Benbow Dam on the South Fork Eel River show a substantial decline in coho

salmon abundance in this system starting in the mid-1940s. Most other trend indicators for streams in the area show declining or stable trends.

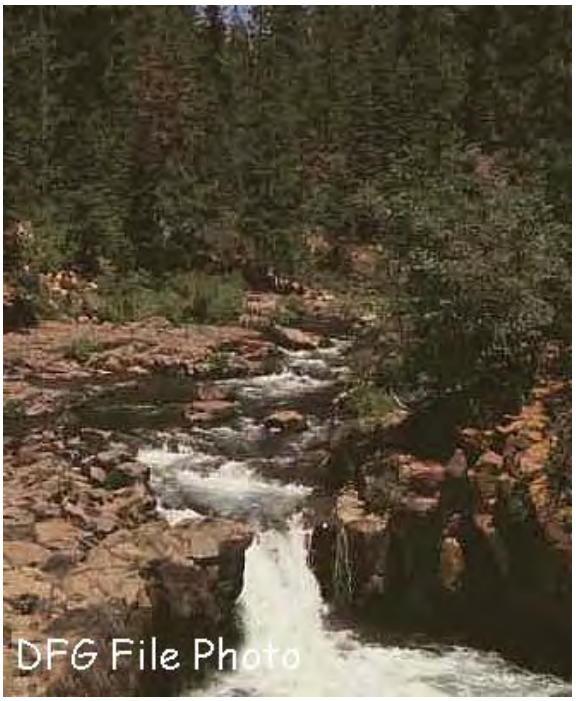
Although streams supporting coho salmon in the California portion of the SONCC Coho ESU now appear to be fewer in comparison to the 1985-1991 period, the available data suggest that population fragmentation within the larger river systems is not as severe as that within the CCC Coho ESU. The major stream systems within the California portion of the SONCC Coho ESU still contain coho salmon populations. Also, the presence-by-brood-year analysis indicates that the decline in the number of streams supporting coho salmon appears to have stabilized since the mid-1980s. For these reasons, the Department believes that the California portion of the SONCC Coho ESU is not presently threatened with extinction. However, because of the decline in distribution prior to the 1980s, the possibility of a severe reduction in distribution as indicated by the field surveys, and the downward trend of most abundance indicators, coho salmon populations in the California portion of this ESU will likely become endangered in the foreseeable future in the absence of the protection and management required by CESA. The Status in 2003 of the coho salmon from Punta Gorda north to the California-Oregon Border is declining, not presently in danger of extinction, but threatened.

Bull trout *Salvelinus confluentus*

State	Endangered	1980
Federal	Threatened	1999

General Habitat:

Bull trout prefer deep pools of cold rivers and larger tributaries. Spawning requires a large volume of cold water. Although bull trout are fairly common throughout much of their range, in California, they were native only to the lower McCloud River of northern Shasta and southern Siskiyou counties.



Description:

The bull trout is a large (10-40 inches) non-anadromous species of char. Bull trout have a long, broad head that is flat above and sharply tapered through the snout. The eye is positioned near the dorsal margin. The coloration of the bull trout is olive green with small yellow or light spots on the back and small but conspicuous red spots on the sides.

Status:

The bull trout has been extirpated from the McCloud River; extirpation has been attributed primarily to the construction of McCloud Dam in 1965. The dam blocked annual spawning migrations and inundated prime spawning and juvenile rearing habitat. McCloud Dam also reduced downstream flows and increased water temperature (by about 10° F), and has significantly reduced flushing flow and gravel recruitment.
Reintroductions into the McCloud River of newly hatched bull trout from Oregon were attempted during the early 1990s, without success. There is concern that Oregon bull trout are not of the same genetic stock as those that occurred historically in the McCloud River and its tributaries. Therefore, even if introductions had been successful, they may not have contributed to the recovery of the same stock that was endemic to the McCloud. The DFG has determined that, due to dramatic changes in habitat that occurred as a result of the McCloud Dam, any bull trout reintroductions (from any genetic strain) would not be successful.

The status in 2002 of the bull trout: Extirpated.

Delta smelt *Hypomesus transpacificus*

State	Threatened	1993
Federal	Threatened	1993

General Habitat:

Delta smelt are found only from the Suisun Bay upstream through the Sacramento-San Joaquin River Delta in Contra Costa, Sacramento, San Joaquin, Solano and Yolo counties. They are widely dispersed throughout the river channel and spawn in backwater sloughs and along channels with tidal influence.

Description:

Delta smelt are slender-bodied fish, about 2 to 3 inches long. They have a steely blue sheen on the sides and seem almost translucent. Delta smelt live together in schools and feed on small fishes and invertebrates. They are tolerant of a wide salinity range. For a large part of their one-year life span, delta smelt live along the freshwater edge of the mixing zone between the saltwater and freshwater interface.

Status:

Historically, the delta smelt was one of the most common species in the estuary. However, the population declined dramatically in the early 1980s. Delta smelt are considered environmentally sensitive because they live only one year, have a limited diet, produce low numbers of eggs, are poor swimmers, are easily stressed, and reside primarily in the interface between saltwater and freshwater. The reasons for the delta smelt decline are multiple and are probably compounded by one another. These reasons include: 1) reductions in delta water outflow; 2) capture by water diversions and pumping; 3) high delta water outflows; 4) reduction in prey food organisms; 5) toxic substances; 6) disease, competition, and predation; and 7) loss of genetic integrity.

The size of the delta smelt population varies from year to year, with extremely low levels observed in the Fall Midwater Trawl (FMWT) survey for the years 1994, 1996, and most recently 2002, with moderate levels observed in 1993, 1995, and most recently 1999. Based on the FMWT 2002 survey results, the 2002 population was substantially lower than in previous years.

The DFG, in response to Fish and Game Commission directives, initiated an intensive, multi-disciplinary study program in 1992. The study program was designed to monitor the population and investigate all aspects of delta smelt biology in order to protect sufficient numbers to ensure their long-term survival and make better informed water management decisions. The current research program is under the auspices of the Interagency Ecological Program and is funded by Department of Water Resources and Bureau of Reclamation. Recent findings indicate that the delta smelt population is affected by the amount of outflow from the estuary, which varies from year to year due to precipitation and water management. It appears that delta smelt populations do better when water outflow is allowed to flow downstream and create nursery habitat in Suisun Bay. Nearly continuous monitoring of delta smelt distribution and abundance throughout the estuary has been used to make informed water management

decisions and to reduce “take” of species at the State and federal water diversion projects in the south delta.

In December 1994, a three-year agreement was reached between representatives of the State and federal governments, water users, and the environmental community on how water is managed in the Estuary. This agreement, the Water Accord, provided for new water quality standards, predictable water management, endangered species protection, mitigation programs, and other Bay-Delta programs. Attainment of the standards proposed in the Water Accord will provide better rearing habitat conditions in the estuary.

A five-year recovery review period established under the USFWS Recovery Plan had to be restarted in 1998 because abundance and distribution criteria were not achieved in 1997. By 2003, all of these criteria were met by a slim margin. However, although delta smelt have fulfilled the criteria of the Federal Recovery Plan, FMWT data have shown a decreasing trend in the past three years with an extremely low index in 2002.

The status in 2003 of the delta smelt:Stable to Declining.

Mohave tui chub

Gila bicolor mohavensis

State	Endangered	1971
	Fully Protected	
Federal	Endangered	1970

General Habitat:

Formerly found in deep pools and slough-like areas of the Mojave River, this species now only occurs in highly modified refuge sites in San Bernardino County.

Description:

The Mohave tui chub is a chunky, large-scaled fish with a small, terminal, slightly oblique mouth. This subspecies has a bright brassy-brown to dark olive back with a bluish-white to silver belly. The average size for adults is four to six inches, while some fish may be as large as nine inches. Mohave tui chub typically spawn from February to October. Females lay approximately 4,000 to 50,000 adhesive eggs over aquatic vegetation. Once hatched, the fry will school in the shallows, while medium-sized tui chub (1 to 3 inches) school in water one to two inches deep. Large chub are typically solitary and found in deeper water. Mohave tui chub feed on insect larvae and detritus.

Status:

The Mohave tui chub is the only fish native to the Mojave River. They were historically restricted to the Mojave River, from the confluence of the east and west forks at the base of the San Bernardino Mountains to its terminus at Soda Dry Lake. Habitat modifications, including damming of the headwaters and withdrawals of the river's underflow, were major causes of the decline of the species. In the 1930's, non-native arroyo chub were illegally introduced into the headwater reservoirs of the Mojave River as a baitfish. Arroyo chub are better able to withstand warmer and shallower habitat conditions that prevail in the Mojave river today. As the new species quickly spread throughout the drainage, it replaced native Mohave tui chubs through competition and hybridization. By 1979, Mohave tui chubs no longer lived in the Mojave River. Other threats include genetic contamination, introduction of other exotic species, habitat alteration, water diversion and pollution.

In 1997, a genetics study by UC Davis confirmed that the Mohave tui chub is a distinct subspecies and recommended that it continue to receive protection as an endangered, unique subspecies. The existing, genetically-pure Mohave tui chub populations occur at three sites: Soda Springs (Zzyzx Springs), the Department's Camp Cady Wildlife Area, and China Lake Naval Air Weapons Station (NAWS). At Camp Cady, the population is thriving in two ponds, one of which is threatened by encroaching vegetation. Mosquito fish and Asian tapeworm were discovered at Soda Lake in 2001, with unknown consequences for the chubs. Perhaps the most secure population exists at China Lake, where the US Navy monitors and protects a population numbering in the thousands. China Lake was chosen as a refuge site and the Mohave tui chub were introduced into Lark Seep in 1971.

Since 1995, NAWS has conducted annual mark-recapture surveys to estimate the chub population at China Lake. From 1995 through 2000 the project was conducted in late May or early June, but encountered spawning fish. To reduce inadvertent capture of spawning fish or damage to their eggs, the survey date was changed to November in 2001. No spawning fish were encountered at that time.

In 2002, two 24-hour water quality meters were installed in the Lark Seep system. Both meters monitor pH, dissolved oxygen, temperature and conductivity. Cattail and tamarisk were also removed. To obtain more reliable population estimates, the Lark Seep System was divided into various habitat types. The defining features used for determination of habitat types were depth and width of the channels, as well as the existence of contiguous habitat. Channel banks support pickleweed, cattail, rush, saltgrass, and some tamarisk.

The 2002 survey captured 530 fish although few of those fish represented recapture of fish marked in previous sampling. Using statistical methods, NAWS estimated that population size to be about 6000 fish. A number of dead fish were found in the North Channel of the seep system. Mortality was attributed to low dissolved oxygen in the water. No spawning fish were noted during this mark-recapture survey. A study has been proposed for 2003 to characterize the dissolved oxygen levels at different depths within the water column along the North Channel. The results will also dictate where and when fish traps are placed into the channel for future mark-recapture surveys. No trapping would occur in 2003 until this study is completed and dissolved oxygen level changes are better understood and modifications to trapping locations are addressed as appropriate. These modifications may include changes such as suspension of traps in the upper part of the water column or relocation to shallower sites.

Recapture rates were low again for the 2002 census. NAWS concluded that the low number of recaptured fish indicated that additional trapping days should be added to future mark-recapture surveys. Additional trapping time within each habitat may increase the number of individuals captured and recaptured; data needed to gain a more precise population estimate. Recommendations for future projects include placement of additional 24-hour water meters the Lark Seep System; continuation of tamarisk removal; a complete dissolved oxygen study of the North Channel habitat; a complete topographical study of channel depths; and implementation of a bullfrog eradication program.

The Mohave Tui Chub Advisory Committee meets periodically, and will continue to investigate future refuge and reintroduction sites, provide recommendations to USFWS, and update USFWS's Recovery Plan.

The status in 2002 of the Mohave tui chub: *Declining*.

Owens tui chub *Gila bicolor snyderi*

State	Endangered	1974
	Fully Protected	
Federal	Endangered	1985

General Habitat:

The historic distribution of the Owens tui chub was throughout the standing waters and low gradient reaches of the Owens River and its larger tributaries extending from the River's source springs to its terminus at Owens Lake.

Description:

The Owens tui chub is similar in appearance to the closely related Mohave tui chub. Owens tui chub are large-scaled, small, chunky fish. They are olive-colored on the dorsal surface and bluish or creamy-white below. To distinguish the Owens tui chub from other tui chub requires microscopic examination of scales and cranial bones, although DNA techniques are under development. The maximum body length is approximately eight inches. Owens tui chub spawn from March through September. Females lay adhesive eggs on vegetation or other available substrates, such as rocks and gravel. Owens tui chub eat insect larvae and, to a lesser degree, algae and detritus.

Status:

There are three existing natural Owens tui chub populations. These are at the Owens River Gorge, source springs of the Department's Hot Creek Hatchery, and a pond and ditches at Cabin Bar Ranch near Owens Dry Lake. Additional populations of Owens tui chub have been established in cooperation with land owners at BLM's Mule Spring, Little Hot Creek in Inyo National Forest, and at the University of California White Mountain Research Station owned by LADWP.

The major threats to the Owens tui chub are the presence of numerous, introduced Lahontan tui chubs with which the natives readily hybridize, and the introduction of predatory fish species, and lack of suitable habitats for reestablishment. The New Zealand mud snail is a tiny, alien species that is invading some California waters and threatening wild trout populations. The snail has already been found in both the upper and lower portions of the Owens River. Its potential impacts on the Owens tui chub are not known. Competition with and predation by trout in the Owens Gorge, geothermal and water supply development in the Hot Creek watershed, and vegetation encroachment at Cabin Bar potentially threaten existing populations. The Department has contracted with UC Davis to verify the genetic purity of tui chub populations in the Owens Valley and make genetic management recommendations.

The Department is a signatory to the USFWS *Recovery Plan for Owens Basin Wetland and Aquatic Species*. The intent of the plan is to maximize benefits by preserving remnants of functioning ecosystems for many species

rather than just one. Restoration activities for tui chub called for in the plan include genetic assessment, vegetation management, fencing, water control structure maintenance, and removal of exotic fishes, identification of additional refuge sites, and reestablishment in restored habitats. Progress toward recovery has been hampered by limited funds and private lands issues.

The status in 2002 of the Owens tui chub: *Stable to Declining*.

Bonytail chub *Gila elegans*

State	Endangered	1974
Federal	Endangered	1980

General Habitat:

Historically, the bonytail chub occurred in the mainstream of the Colorado River and the lower-gradient portions of its major tributaries and in the Salton Sea Basin. However, bonytail chub have not been documented in the Salton Sea since the early 1900's. The natural habitat of the bonytail was characterized by highly fluctuating seasonal and annual flows, distinctly different habitat types (i.e., whitewater, lower gradient and meandering main channels, off-channel backwaters, and others) and varying water quality (i.e., sediment load, temperature, salinity, etc.). The bonytail chub is adapted to mainstream rivers, where it has been observed in pools and eddies. In reservoirs, the fish occupies a variety of habitat types. In Lake Mohave, the fish was observed in eddy habitats.

Description:

The bonytail chub is the rarest of the endemic big river fishes in the Colorado River Basin. It is a large chub, commonly eight to 14 inches, with a gray to olive back and white, silvery sides and belly. It has an extremely narrow caudal peduncle, where the tail fin joins the body, with a deeply forked caudal fin, fine, embedded scales and a short, flattened head with a broad snout and small elliptical eyes. There is a conspicuous hump behind the head. Bonytail are long lived fish. Individual fish have been aged up to 49 years. During breeding, males turn red-orange on the belly and paired fins.

Status:

Habitat alteration caused by flow depletion from irrigation and other water uses, construction of dams, hybridization with other *Gila* species, and the introduction of non-native species have resulted in the bonytail's endangered status. Bonytail are becoming increasingly rare in their California habitat and very few bonytail have been found during monitoring in recent years. In the Lower Colorado Basin, a few large, old adults are still found in Lake Mojave, but successful recruitment has not been documented. A few bonytail still occur in Lake Havasu. Bonytail have not been found or stocked south of the Parker Dam in recent years.

In 1994, USFWS designated critical habitat for four fish species found in the Colorado River, including the bonytail. This designation included seven reaches of the Colorado River system. These reaches total 312 miles with 50 miles on the California-Arizona border. As with the endangered razorback sucker, the USFWS has

determined that the bonytail chub is in jeopardy of becoming extinct in the near future if recovery activities are not implemented and successful. There are currently 15 species-specific management actions and 15 general habitat enhancement/restoration actions being carried out for the bonytail along the Lower Colorado River.

Concern over the status of the bonytail chub, one of four listed Lower Colorado River fish species, helped initiate the development of the Lower Colorado River Multi Species Conservation Program (LCRMSCP). The LCRMSCP is a multi-species habitat conservation plan that covers both aquatic and terrestrial species. The area covered by the LCRMSCP includes the 100-year flood plain of the Colorado River from Lee's Ferry, AZ south to the southern International Border with Mexico. It involves the planning efforts of the Department, USBR, BLM, USFWS, Arizona Game and Fish, Nevada Division of Wildlife, various water, power and irrigation agencies, Native American tribes, and environmental groups. The USFWS is directing stocking efforts in the Lower Colorado River Basin through the Lake Havasu Fisheries Improvement Project (LHFIP). The only current effort to reintroduce bonytail into California waters is through the LHFIP. One component of the partnership was to stock 30,000 bonytail, of ten inches or longer, into Lake Havasu over a five-year period. This goal was accomplished in November of 2004. Because bonytail chub proved to be more difficult to raise than razorback sucker, an additional three years was needed by the LHFIP to reach its goal.

Small isolated grow out-ponds (ponds used to receive fish from another hatchery and grown to a larger size) on Lake Havasu were initially used but quickly discontinued due to lack of success. Achii Hanyo Hatchery, on Colorado River Indian Reservation land in Arizona was used as the primary grow-out location for bonytail. The survival rate for bonytail at Achii Hanyo increased with gained experience and at project completion was better than 80 percent.

USFWS recovery goals for the bonytail chub were released in 2002. Recovery of the Colorado bonytail is being considered in two recovery units: the upper Colorado River basin upstream of Glen Canyon Dam, Arizona and the lower basin.

The Status in 2005 of the bonytail chub: Declining. **Bonytail chub are significantly threatened with extinction in the wild in California and nationwide.**

Colorado pikeminnow (squawfish)

Ptychocheilus lucius

State	Endangered	1971
	Fully Protected	
Federal	Endangered	1967

General Habitat:

The natural habitat of the Colorado pikeminnow was characterized by slow, deep water in the Colorado River and its major tributaries.

Description:

The Colorado pikeminnow (renamed from squawfish) is one of the largest species of the minnow family (Cyprinidae) in the world and historically was the top carnivore of the Colorado River system. It was reported to reach lengths of more than 71 inches, and weights of 79 pounds. Specimens weighing over 15 pounds are now rare. The head, which may make up one-quarter of the total body length, is long, slender and depressed, with a large, toothless mouth and small eyes. The Colorado pikeminnow's coloration is dusky green above, silver on the sides, and yellow to white on the belly.

Status:

Although once abundant throughout the Colorado River and major tributaries in slow, deep water, the Colorado pikeminnow has not been seen below Arizona's Glen Canyon Dam since 1968. In California, the species was known from the U.S.-Mexico Border north to the Nevada State line and the Salton Sink. Extirpation in the lower Colorado River basin was caused by habitat alteration, including changes in water temperature and sediment regimes, following construction of dams.

In 1994, USFWS designated critical habitat for four Colorado River fish species, including the Colorado pikeminnow. This designation included a total of 1,148 miles of the Colorado River system as critical habitat for the Colorado pikeminnow. None of the proposed critical habitat is in California. USFWS recovery goals for the pikeminnow were released in 2002. Recovery of the Colorado pikeminnow is considered only in the upper basin recovery unit outside of California.

Colorado pikeminnow are considered extirpated from waters in California.

Lost River sucker *Deltistes luxatus*

State	Endangered	1974
	Fully Protected	
Federal	Endangered	1988

General Habitat:

The Lost River sucker is native to the upper Klamath River basin and Lost River basin. The Lost River sucker primarily inhabits lakes and typically migrates to spawn in springs or large rivers. Lost River suckers are present in Copco Lake, Iron Gate Reservoir, and other areas of the Klamath River Basin in California and in Clear Lake and its tributaries, the Lost River, and Boles and Willow creeks in Modoc County.

Description:

The Lost River sucker is a monotypic species, meaning it is the only species in the genus *Deltistes*. This fish reaches lengths more than three feet and is characterized by along, slender head with a subterminal mouth and a long, rounded snout. The coloring is dark on the back and sides, fading to white or yellow on the belly.

Status:

The Lost River sucker inhabits lakes and typically migrates to spawn in springs or large rivers. They are present in Clear Lake and its tributaries, the Lost River, and Boles and Willow creeks in Modoc County. Populations of Lost River suckers in Copco Lake, Iron Gate Reservoir, and other areas of the Klamath River Basin in California are small and habitat conditions are poor, resulting in limited reproductive success in these waters. Clear Lake is a comparatively pristine environment and probably has the greatest potential for maintaining viable populations of this species and the shortnose sucker. Water quality conditions in Clear Lake are generally good, and the surrounding watershed is relatively undeveloped compared with conditions elsewhere. Since 1992, however, USBR activities have resulted in reduction of much of the lake's habitat and the loss of many suckers. Water quality and supply problems seriously threaten populations in Oregon.

The predominant threats to the Lost River sucker are: 1) lack of spawning habitat, 2) water diversions, 3) predation by introduced fish species (largemouth bass and yellow perch), and 4) potential hybridization with other sucker species. Preliminary results of electrophoretic analysis of Klamath River Basin suckers by UCD suggest that phenotypic variation, rather than hybridization, may explain the differences in appearance between populations of suckers from different locations. Morphological analysis confirmed that Lost River suckers from California are similar to those from upper Klamath Lake, Oregon. A 1992 directive required USBR to construct a spawning channel below Anderson Rose Dam on the Lost River and provide spawning flows of 50 cubic feet per second from April 1 to June 15. In 1995, high flows destroyed part of the spawning channel. As of 1997, there were no documented significant increases in recruitment, and that restoration effort has been abandoned.

USFWS adopted a recovery plan for the Lost River and shortnose suckers in April 1993. The primary goals of this plan are to downlist or delist the species. USFWS have not developed detailed criteria for accomplishing downlisting or delisting, and the current objective is to establish at least one stable refuge population with a

minimum of 500 adults for each species.

Currently, the DFG is proposing that DFG and USBR develop a multiple species and basin-wide Klamath Project Operations Plan and MOU to address: 1) the listed suckers and listed downstream species (including listed salmonids), 2) the need for screening on many project diversions, and 3) the development of a water conservation plan. The DFG is working in coordination with the USBR, USFWS and other agencies on the development of a new Environmental Impact Statement for the Klamath Project Operations. A new Biological Opinion will be issued by the USFWS after the completion of the Environmental Impact Statement.

The status of the Lost River sucker is unknown.

Modoc sucker *Catostomus microps*

State	Endangered	1980
	Fully Protected	
Federal	Endangered	1985

General Habitat:

Preferred habitat of the Modoc sucker consists of small streams characterized by large shallow pools with cover, soft sediments, and clear water. The species is currently known from California only in two drainages of the upper Pit River drainage in Modoc and Lassen counties.

Description:

This fine-scaled sucker is small, rarely exceeding seven to eight inches. Body coloration varies from dark above and white below with no markings to black above with highly mottled sides and white below. Food of the Modoc sucker consists of benthic invertebrates, algae, and detritus.

Status:

Major threats to the Modoc sucker at the time of listing included degradation of its stream habitat by overgrazing, possible hybridization with the Sacramento sucker, limited population size, and introduced predatory fishes. Drought conditions also have had a significant impact on this species. The overall condition of Modoc sucker habitat has improved substantially since listing.

In 1991, the WCB bought 160 acres on Dutch Flat Creek, adding a significant reach of stream habitat. In 1993, the DFG established this area as a State Wildlife Area. In 1995, US Forest Service fenced the area to protect stream habitat by restricting grazing activities. In addition, SWRCB took action to ensure sufficient flows in Dutch Flat Creek upstream of the Wildlife Area and to provide stability to dams within the Dutch Flat Creek drainage. Habitat assessment in 1995 suggested that adequate portions of Modoc sucker habitat within designated critical habitat and other occupied streams have been protected. Habitat improvements on public lands can be attributed to land acquisitions, fencing, and changes in USFS grazing standards. Predatory exotic species have been essentially eliminated in the Turner Creek drainage, and only the non-native brown trout remain in occupied portions of the Ash Creek drainage. Predation by native species is at a natural level and does not impact the species. New populations of Modoc suckers were recently found by USFWS in Garden Gulch and in a tributary to Goose Lake in Oregon. The genetic character of several additional populations is under review.

Currently, the Department and USFWS are evaluating new information concerning population status, distribution, habitat conditions, and hybridization with the Sacramento sucker. As funding becomes available, the Department will conduct additional studies to evaluate the effectiveness of past recovery projects, including habitat restoration, chemical treatments, and exotic fish barriers, and will use this information for planning future recovery projects intended to extend the range of the species. The current status of the Modoc sucker is stable to increasing.

Shortnose sucker

Chasmistes brevirostris

State	Endangered	1974
	Fully Protected	
Federal	Endangered	1988

General Habitat:

The shortnose sucker is native to the upper Klamath River and Lost River basins in California and Oregon. During most of the year, this species inhabits the open water of large, shallow lakes and river channels.

Description:

The shortnose sucker is a heavy bodied, nearly cylindrical, lake species that grows to 20 inches in length. It has a large head with a blunt snout. The mouth is terminal, and the lips are thin with few papillae, which are small skin projections used for feeling. Coloration is dark above and white to cream colored below. Spawning occurs in tributary streams during April and May.

Status:

The distribution of the shortnose sucker and the Lost River sucker is very similar except that the shortnose sucker may be more widely distributed in the Lost River system. A large, viable population of shortnose suckers exists in Clear Lake and its tributaries in Modoc County. The Clear Lake population is reproductively isolated and is different from shortnose suckers elsewhere in the Klamath Basin.

The decline of this species is primarily due to habitat alteration associated with water diversions. A 1992 directive required USBR to construct a spawning channel below Anderson Rose Dam on the Lost River and provide spawning flows of 50 cubic feet per second from April 1 to June 15. In 1995, high flows destroyed part of the spawning channel. As of 1997, there were no documented significant increases in recruitment, and that restoration effort has been abandoned.

USFWS adopted a recovery plan for the Lost River and shortnose suckers in April 1993. The primary goals of this plan are to downlist or delist the species. As of 2002, the USFWS has not developed detailed criteria for accomplishing downlisting or delisting, and the current objective is to establish at least one stable refuge population with a minimum of 500 adults for each species. Currently, the DFG is proposing that DFG and USBR develop a multiple species and basin-wide Klamath Project Operations Plan and MOU to address: 1) the listed suckers and listed downstream species (including listed salmonids), 2) the need for screening on many project diversions, and 3) the development of a water conservation plan. The DFG is working in coordination with the USBR, USFWS and other agencies on the development of a new Environmental Impact Statement for the Klamath Project Operations. A new Biological Opinion will be issued by the USFWS after the completion of the Environmental Impact Statement. PacifiCorp is currently in the process of collecting environmental data pursuant to the relicensing of their Klamath Hydroelectric Project located on the Upper Klamath River between Iron Gate

Reservoir (CA) and Upper Klamath Lake (OR). A major component of the relicensing studies includes an Instream Flow Study using the Instream Flow Incremental Methodology (IFIM) to assess the effects of alternative flow releases on both the shortnose sucker and the Klamath large scale sucker (*Catostomus snyderi)*.

The species is considered *Stable.*

Razorback sucker *Xyrauchen texanus*

State Endangered 1974
Federal Endangered 1991

General Habitat:

In nonreproductive periods, adult razorback suckers, occupy a variety of habitat types, including impounded and riverine areas, eddies, backwaters, gravel pits, flooded bottoms, wash fans, runs, and riffles. Summer habitats include deeper eddies, backwaters, holes, and mid-channel sandbars. During winter, adult razorback suckers use main channel habitats that are similar to those used during other times of the year, including eddies, slow runs, riffles, and slackwaters.

Description:

The razorback sucker is easily distinguished by a sharp-edged hump on the back which elevates the dorsal region of the body above the head. Coloration of adults is dusky brown to olive on the back and yellowish on the belly. Razorback suckers are long lived fish. Individual fish have been aged up to 44 years.

Status:

The razorback sucker is on the verge of extinction in California as well as nationwide. The decline of the razorback sucker is due to habitat alteration and destruction, dam building, decline in water quality, and predation by non-native fishes. Researchers believe that the species was once widespread and common in both the upper and lower Colorado River basins, including the Salton Sea. However, the razorback sucker has not been documented in the Salton Sea since the early 1900's. In the lower basin, a population of large adults exists in Lake Mohave. Collections downstream of Lake Powell have yielded only a very few large adults and some juveniles. There are few, if any, naturally spawned razorback suckers in California waters at present. Their numbers are declining throughout the range of their original habitat, and the USFWS has declared the razorback sucker to be in jeopardy of becoming extinct in the near future if steps are not taken to ensure their continued existence.

Current surveys confirm the presence of approximately 200 adult fish in Senator Wash Reservoir, Imperial County. This is the only known remnant population of adult razorback suckers within California. Other surveys confirm the presence of razorback suckers in Cibola National Wildlife Refuge's High Levee Pond, Emerald Canyon

Golf Course Ponds, and Imperial National Wildlife Refuge's Duck Ponds. These populations resulted from stocking efforts and are not naturally recruited fish. In 1996, 30 large adult razorback suckers were captured, pit-tagged and released from Senator Wash Reservoir into the mainstem Colorado River.

In 1994, USFWS designated critical habitat for the razorback sucker in 15 reaches of the Colorado River system. These reaches total 1,724 miles, with 133 miles on the California-Arizona border. Limited stocking efforts are currently underway in the Lower Colorado River Basin by USFWS. USFWS is releasing razorback suckers that are 12 inches or greater in length in the federally designated "critical habitat" reaches of the Colorado River.

The razorback sucker is one of the "recommended priority and planning species" under the Lower Colorado River Multi Species Conservation Program (LCRMSCP). The LCRMSCP is a multi-species habitat conservation plan that covers both aquatic and terrestrial species. The area covered by the LCRMSCP includes the 100-year flood plain of the Colorado River from Lee's Ferry, AZ south to the southern International border with Mexico. The LCRMSCP involves the planning efforts of the Department, USBR, BLM, USFWS, Arizona Game and Fish, Nevada Division of Wildlife, various water, power and irrigation agencies, Native American tribes, and environmental groups. The current listed status of the razorback sucker, bonytail chub, and willow flycatcher is partially why the LCRMSCP was created. The razorback sucker is fully protected in California under Fish and Game Code Section 5515 and its protection is a major component of the LCRMSCP. Currently, there are 22 species-specific management actions and 13 general habitat enhancement/restoration actions being carried out along the Lower Colorado River which directly benefit the razorback sucker.

One effort to reintroduce razorback suckers into the Colorado River occurred in Lake Havasu. This effort was conducted through the Lake Havasu Fisheries Improvement Partnership (LHFIP). The LHFIP is a partnership between the Department, Arizona Game and Fish, Anglers United, USFWS, BLM, and the USBR. Originally, the LHFIP was set up as a partnership to improve sport fishing opportunities; it was later revised to include reintroduction of razorback sucker and bonytail chub into the lake. The USFWS determined that by increasing the number of sport fish in the lake, the natives would be put at a greater risk of extinction. One goal of the LHFIP was to stock a total of 30,000 razorback suckers into Lake Havasu over the life of the partnership. This goal was accomplished in July of 2001. Most of these fish were reared at Bubbling Ponds, AZ. Razorback suckers have been increasingly contacted during recent trammel net surveys on Lake Havasu.

Other significant augmentation has been conducted by the Arizona Department of Game and Fish (AZGF). Between November 20, 1997 and April 4,2005, AZGF has stocked 51,957 razorback suckers greater than 10 inches into the lower river below Parker Dam. Razorback suckers are also being stocked into Lake Mohave in Arizona and Nevada. Recruitment has not been documented and only larger adults are being found. Spawning has been observed, but the eggs and juveniles are quickly consumed by the non-native sport fish. In past decades, biologists stocked hundreds of thousands of fingerling razorbacks into the Colorado River annually. Due to predation, only larger fish are currently being stocked.

Desert pupfish *Cyprinodon macularis*

State	Endangered	1980
Federal	Endangered	1986

General Habitat:

In California, this species historically occurred in several springs, seeps and slow-moving streams in the Salton Sink Basin, as well as in backwaters and sloughs along the lower Colorado River. Desert pupfish are now relegated to remnants of their former habitats, which are too harsh for most introduced species to exist. Naturally-occurring populations of desert pupfish have been extirpated in Arizona.

Description:

The desert pupfish is a small, robust fish, usually less than three inches in length. During the breeding season, males turn bright blue with a lemon yellow tail. Females are tan to olive in coloration with irregular, darker vertical bars on their sides. The diet of the desert pupfish varies seasonally. They often eat insect larvae, detritus, aquatic vegetation, snails, and occasionally their own eggs and young.

The desert pupfish tolerates an extreme range of environmental conditions: salinities from freshwater to nearly twice that of seawater, water temperatures ranging from 36°F to 113°F, and oxygen levels down to 0.1 parts per million (ppm). Desert pupfish can also survive rapid changes in salinity and daily water temperature fluctuations of 72°F to 80°F.

Status:

Dams, channelization, water diversions, and groundwater pumping, combined with the introduction of exotic fish species have now reduced the wild populations of the desert pupfish to only a few saline pools along the edge of the Salton Sea, some irrigation drains flowing into the Salton Sea, and portions of two creeks (Salt and San Felipe Creeks) tributary to the Salton Sea. San Sebastian Marsh on San Felipe Creek also supports desert pupfish. Ten habitat refuges have been established for this species in various springs and artificial ponds. A refugium was established at Dos Palmas in the early 1990s with fish that came from the Thousand Palms refugium. Those fish

were originally from Salt Creek.

The desert pupfish does not tolerate large numbers of introduced predatory or competing fishes. Numerous exotic fishes, particularly mosquito fish and tilapia, restrict desert pupfish numbers and distribution in Salt Creek, Riverside County. Periodic natural flooding in Salt Creek helps remove some of the exotic fishes there. In 1998, a series of events occurred in the upstream areas of Salt Creek that may have extirpated the species from those reaches. During late-winter flooding, largemouth bass were accidentally released into Salt Creek. A few days later, all upstream water was diverted from Salt Creek and some sections were dewatered. DFG surveys of these reaches in 1998 and 1999 did not yield any desert pupfish. However, desert pupfish were found in the lower reaches of Salt Creek in 1999. Desert pupfish in San Felipe Creek, Imperial County, remain strong despite periodic invasions of non-native tilapia and sailfin mollies. The proposed construction of a barrier to block continued migration of tilapia into San Felipe Creek has been postponed because such a barrier may impede any pupfish gene flow provided by the Salton Sea corridor. In addition, portions of the creek are intermittently dry, isolating tilapia from pupfish habitat, and periodic flooding and scouring of the stream channel washes tilapia back into the Salton Sea.

Additional threats to the desert pupfish are dense stands of tamarisk (salt cedar) in Salt Creek, lack of a reliable water supply at the refuge ponds, and off-highway vehicles (OHVs). Over the next two years, the DFG will be conducting a salt cedar removal program. In spring of 2002, the DFG with the assistance of CDF fire crews were able to clear tamarisk from approximately one half mile of pupfish habitat along Salt Creek. Construction on a new artesian well for the refuge ponds at Oasis Springs Ecological Reserve began in 1999 when water flows from the old well had decreased so dramatically that pupfish were being stranded in shallow water areas during summer. In August 1999, the flow situation was so dire that DFG hired a contractor to truck water from a nearby well to the ponds. Then, using Section 6 funding, DFG contracted the drilling of a new artesian well. The increased water flows from the new well have expanded the areas inhabited by desert pupfish and the population in the ponds is thriving. The DFG is considering expanding the refuge areas as funding and staff becomes available. The newest threat to the Salt Creek population is OHV activity, which has increased in the last two years.

The draft Coachella Valley Multiple Species Habitat Conservation Plan (MSHCP) conserves 100 percent of the 31 known localities for the desert pupfish. Specific conservation goals in the MSHCP are protection of occupied habitat and ecological processes essential to the conservation of the species and its habitat, and implementation of monitoring and adaptive management. The majority of known locations for the desert pupfish within the MSHCP boundaries are within agricultural drains (24 occurrences). The remaining seven occurrences are primarily east of the Salton Sea within the BLM's 20,000-acre Dos Palmas Area of Critical Environmental Concern (ACEC), which includes the existing BLM Dos Palmas Preserve, the existing DFG Oasis Springs Ecological Reserve, and a portion of the existing Salton Sea State Recreation Area. These existing refugia, in the proposed Dos Palmas and Thousand Palms Conservation Areas, are designated as Core Habitat. Under the MSHCP, approximately 25 acres of occupied habitat in the Whitewater River and agricultural drains as they enter the Salton Sea are also delineated as Core Habitat in the Coachella Valley Stormwater Channel and Delta Conservation Area.

When implemented, the MSHCP will protect and manage habitat for this species in Conservation Areas, refugia, and agricultural drains. In addition, the MSHCP calls for management and monitoring programs to ensure conservation of desert pupfish through conservation ownership and management. Management will include control of activities that degrade desert pupfish habitat, control of invasive species where necessary, and restoration and enhancement of degraded habitat as necessary according to monitoring results. The MSHCP also provides for a monitoring program that would assess the distribution, abundance, and habitat parameters of the desert pupfish throughout the MSHCP Reserve System. Implementation of the MSHCP is expected to maintain and enhance populations of the desert pupfish consistent with the 1993 Desert Pupfish Recovery Plan.

The status in 2002 of the desert pupfish: Declining (in the wild) to Stable (in refuge sites).

Cottonball Marsh pupfish

Cyprinodon salinus milleri

State Threatened 1974
Federal None

General Habitat:

The Cottonball Marsh pupfish is found only in the 640-acre Cottonball Marsh in the northwest portion of Death Valley National Park. The marsh is a component of the Salt Creek drainage lying within the saltpan on the floor of Death Valley. The marsh is an extreme habitat. Salinity ranges from 14 ppt (parts per thousand) to 160 ppt, about 4.6 times that of seawater. Water temperatures range from near freezing in winter to almost 104°F in summer. In shallower waters, the temperatures may fluctuate daily as much as 59°F. Cottonball Marsh also supports the endemic Badwater snail (*Assiminea infima*).

Description:

The Cottonball Marsh pupfish is a small (less than 1.5 inches), slender pupfish. Breeding males become deep blue on the sides with dark gray lateral bars and have an iridescent purple sheen on the back and silvery sheen on the sides. Females have a more elongate shape with an overall silvery brown coloration and lateral vertical bars. Little is known about either the reproductive biology or food habitats of Cottonball Marsh pupfish.

Status:

Cottonball Marsh is part of the Salt Creek system and located in a designated Wilderness Area. The limited habitat and restricted distribution of the pupfish makes it vulnerable to stochastic events such as droughts or earthquakes, which could disrupt the species' sources of groundwater. Threats to its survival include direct and indirect habitat alteration through regional water diversion, as well as from changes to water levels, water quality, and/or chemistry.

To assess possible effects of groundwater withdrawal on the wetland-dependent species, Death Valley National Park began a three-year study in 1998 to quantify the evapotranspiration rate for the Death Valley saltpan/playa. These data will greatly increase current understanding of the water budget for the Death Valley ground water system and allow the NPS to better represent the ground water interests of the park. Results of this study are not yet available.

In the fall of 1993, a GPS was used to accurately map the distribution of the Cottonball Marsh pupfish for the first time. Habitats occupied by the pupfish were found to occur along a linear line which measured approximately two miles in length. This distribution suggests that the spatial extent of pupfish habitat is probably a function of a geological structural control which results from the contact of permeable alluvial material and the denser playa mud. Although pupfish habitats were found to consist of a variety of pool and stream habitats, it is likely that pupfish occupy less than a hundred discrete water bodies during the summer and fall.

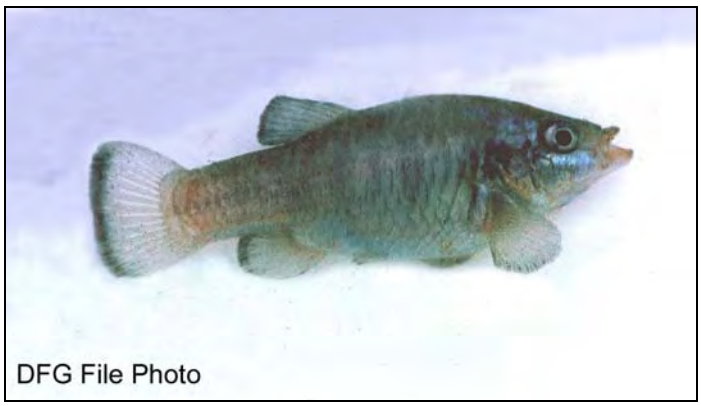
The genetic relationships among the Death Valley pupfish populations and their evolutionary histories have been inferred primarily from morphological similarities of the fishes and the hydrological relationships of their habitats. However, the underlying genetic and historical basis for morphological features had remained unknown. A recent study analyzed the genetic structure and divergence within and among populations using mitochondrial and nuclear DNA markers. The findings of these studies illustrated that the divergence of the small, fragmented pupfish populations from remnant aquatic systems in Death Valley was largely by genetic drift.

Genetic diversity within populations from the Salt Creek drainage (*Cyprinodon salinus salinus* at McLean Spring and in Salt Creek), and the Cottonball Marsh pupfish, was generally low, with most variation distributed among populations. This lack of genetic variation may point to one or more historical bottleneck events and indicate that the McLean Spring/Salt Creek and Cottonball Marsh populations were the same (monomorphic) prior to their separation about 2000 years ago. The findings also confirmed that many of the isolated populations of pupfish are demographically independent and should be managed as separate units to conserve the species.

The status of the Cottonball Marsh pupfish is considered to be stable.

Owens pupfish *Cyprinodon radiosus*

State	Endangered	1971
	Fully Protected	
Federal	Endangered	1967


DFG File Photo

General Habitat:

Habitat for the Owens pupfish consists of spring pools, sloughs, irrigation ditches, swamps, and flooded pastures in the Owens Valley from Fish Slough in Mono County to Lone Pine in Inyo County. Currently, this fish is confined to five populations in the Owens Valley.

DFG File Photo

Description:

Less than 2.5 inches in length, the Owens pupfish is a small, deep-bodied, laterally compressed fish. Males are larger and deeper bodied than females. Breeding males are bright blue with broad vertical bars on the side. Females are generally brownish above and silvery below, with several irregular brownish vertical bars. Non-breeding males resemble females. Owens pupfish congregate in small schools and feed mostly on aquatic insects. Reproduction occurs from January through September. Spawning occurs in male-defended territories. Females may spawn daily, laying a few eggs at a time.

Betsy Bolster, DFG File Photo

Status:

Historically, Owens pupfish occurred in the Owens River and spring pools, sloughs, irrigation ditches, swamps, and flooded pastures in the Owens Valley from Fish Slough in Mono County to Lone Pine in Inyo County. Habitat alteration associated with the introduction of non-native trout and bass, along with historic water resources development reduced the distribution and abundance of this species. Currently, this fish is confined to five populations in the Owens Valley.

The Fish Slough ACEC is a system of springs and marshes cooperatively managed by the Department, BLM, Los Angeles Department of Water and Power (LADWP), University of California Natural Reserve System, and USFWS. Two sites within Fish Slough, “BLM Spring” and the Owens Valley Native Fishes Sanctuary, have lost pupfish populations following illegal introductions of largemouth bass. BLM Spring was restored in cooperation

with BLM in 2002, and reintroduction of pupfish occurred in 2003. This project included dam reconstruction, fabrication/installation of a new type of fish migration barrier, vegetation control, and exotic fish removal. Two additional populations tenuously persist in marshy areas of Fish Slough. Pupfish also occur in Inyo County at Mule Spring on BLM land, at Warm Springs and below an artesian well on LADWP land.

The Department is a signatory to the USFWS *Recovery Plan for Owens Basin Wetland and Aquatic Species*. The intent of the plan is to maximize benefits by preserving remnants of functioning ecosystems for many species rather than just one. Restoration activities for Owens pupfish called for in the plan include vegetation management, fencing, water control structure maintenance, and removal of exotic fishes, identification of additional refuge sites, and reestablishment in restored habitats. Progress toward recovery has been hampered by limited funds and private lands issues.

The status in 2002 of the Owens pupfish: *Stable*.

Unarmored threespine stickleback

Gasterosteus aculeatus williamsoni

State	Endangered	1971
	Fully Protected	
Federal	Endangered	1970

General Habitat:

The unarmored threespine stickleback (UTS) is currently restricted to the upper Santa Clara River drainage in Los Angeles and Ventura counties, San Antonio Creek on Vandenburg Air Force Base, San Luis Obispo County, and an isolated population in San Felipe Creek in San Diego County. The San Felipe Creek population is both introduced and outside the historic range of this species. A remnant population of stickleback exists in Shay Creek and Sugarloaf Pond, San Bernardino County. UTS are found in shallow pools and riffles with abundant cover including aquatic vegetation.

Description:

The unarmored threespine stickleback is a small (less than 2.4 inches), scaleless fish. These small fish are territorial. The males build and defend their nests and care for the eggs and young.

Status:

The unarmored threespine stickleback appears to be seasonally abundant where found, but is threatened by continuing habitat degradation and the introduction of other stickleback subspecies. Major threats include stream channelization, urbanization, agricultural development, water diversions, groundwater pumping, introduction of predators (e.g., bullhead, sunfish, bullfrogs, and African clawed frogs) and competitors (e.g., fathead minnows and mosquito fish), OHV use, and chemical/oil spills.

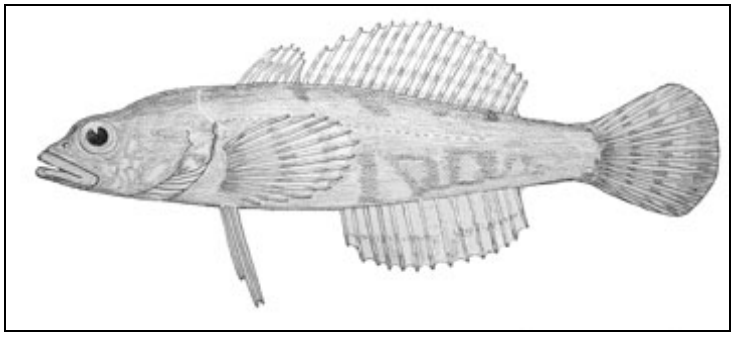
In 1993, a 40,000 barrel oil spill occurred on the Santa Clara River in Los Angeles County. The spill affected approximately 17 river miles of critical stickleback habitat. Cleanup took approximately six weeks and required bulldozing much of the river bed to free oil trapped in the sediments. In 1997, a settlement was reached with about $7 million to be used for restoration activities on the Santa Clara River. To date, no projects specifically directed toward the recovery of the UTS have been conducted.

Ongoing management activities include identifying appropriate reintroduction sites for sticklebacks from both the Soledad Canyon and Shay Creek populations and facilitating transplants to those sites. In 2001 a study was initiated by the United State Geological Survey for the Angeles National Forest to assess the status and distribution of UTS in the Forest. The primary study location was in San Francisquito Canyon. The report states that the status of the UTS throughout southern California to be highly imperiled, however the report also

concluded that the UTS population locally in San Francisquito Canyon appears to be maintaining a stable distribution, although population densities appear to fluctuating.

In September of 1994, the American Fisheries Society petitioned USFWS to list the Shay Creek population of UTS as a distinct subspecies based on morphological and genetic differences. USFWS declined to accept the petition, stating that the Shay Creek UTS remains a population of the federally endangered UTS. The DFG is very concerned about the long-term viability of the Shay Creek population of sticklebacks due to the limited habitat, possible genetic inbreeding, and the continuing threats to the species. A top priority for DFG is to establish refuge populations and to acquire/purchase the property at Shay Pond. In 2001, a Federal Section 6 grant was awarded to establish a refugia site near Baldwin Lake, San Bernardino County, CA. This work is currently ongoing and site assessment is being conducted. In 2002, non-traditional Federal Section 6 grant money was allocated to purchase a significant portion of Shay Meadow which would help secure the habitat surrounding Shay Pond. Genetic work conducted in 2002 proposed that the Shay Creek UTS is more closely related to British Columbia UTS when compared with other populations of UTS in southern California. This analysis is yet to be published and or peer reviewed; however, it may have significant implications for listing status and managing these populations in the future.

Rough sculpin *Cottus asperrimus*



State Threatened 1974
Fully Protected
Federal None

General Habitat:

The rough sculpin occurs only in Shasta County in the Pit River, in the Burney area, including Hat Creek and Fall River and its tributaries. Rough sculpin have also been found in the upper reaches of Lake Britton near Hat Creek and in Crystal Lake. This sculpin usually occurs in vegetated runs and riffles of creeks and small to medium rivers, usually over mud in clear, fairly deep water (3-6 feet).

Description:

The rough sculpin is the smallest member of the family Cottidae in California, approximately 3-4 inches in length. It is identified by its relatively narrow body shape and extremely rough skin.

Status:

Management of streams in which the sculpin occurs for wild trout and efforts to protect the Shasta crayfish probably benefit rough sculpin populations in lower Hat Creek and the Fall River. Due to the limited range of the rough sculpin, any impact to their habitat is significant. Siltation from dredging and bank erosion caused by livestock grazing are some of the primary threats to this species. Streambank restoration projects may ameliorate some of these impacts.

No management or recovery actions are planned at this time. Delisting of this species was considered during 1993 and 1994. However, complete status surveys must be completed before such action is proposed. In 2002, a Technical Advisory Committee was formed to assess impacts to aquatic species by small hydro projects on Hat Creek during the Hat Creek relicensing process. As part of the assessment, life history and habitat suitability of rough sculpin within the project area are scheduled to be studied.

The status in 2002 of the rough sculpin: Stable.