FISHES

Species Accounts

Sacramento River winter-run chinook salmon
(*Oncorhynchus tshawytscha*)

Sacramento River winter-run chinook salmon

CA - E (1989)
FED - T (1990) E (1994)

General Habitat: Permanent Streams with Fish of the Sacramento-San Joaquin Province

The Sacramento River winter-run chinook salmon is one of the four runs of chinook salmon found in the Sacramento River. Genetic research involving analysis of nuclear DNA has provided evidence that the Sacramento River winter-run chinook salmon is distinct from other chinook salmon in the Central Valley. They return to the upper Sacramento River in the winter but delay spawning until the spring and summer. Juveniles spend five to nine months in the river and Sacramento-San Joaquin Estuary before entering the ocean.

The population level for winter-run chinook salmon continues to be low but appears to have stabilized in recent years. Since 1967 run size estimates have been made at Red Bluff Diversion Dam by counting all or a portion of the run moving through the fish ladders and sampled in a fish trap. In 1998 and 1999 the run size estimates were 2,612 and 3,208 fish, respectively.

Beginning in 1996 the DFG has conducted a carcass survey for winter-run chinook salmon in the upper Sacramento River. This survey is part of a multi-year CVPIA supported investigation to identify salmon habitat requirements in the Sacramento River system. The information gained on the life history requirements of the species will be used to identify the relationship between management actions and salmon survival and ultimately identify management actions to optimize survival of anadromous resources. From the carcass survey a spawner population can be estimated. In 1998 the estimated number of spawners was 5,501. In 1999 the estimated number of spawners was 2,153. The methods used to estimate population size from this type of effort typically result in an overestimate. The true population size probably lies in between the Red Bluff Diversion Dam estimate and the estimate based on the carcass survey.

USFWS's propagation program for winter-run chinook salmon was reinitiated in 1998. The program was suspended in 1996 due to concerns about potential hybridization with spring-run salmon and imprinting problems with juvenile winter-run chinook salmon. After considerable advances in genetic analysis to assure genetic integrity of artificially propagated winter run, and the construction of the Livingston Stone National Fish Hatchery at the base of Shasta Dam, the program was re-authorized by NMFS and the DFG. In January 1999 and 2000 approximately 150,000 and 32,000 juvenile winter-run chinook salmon respectively were released into the upper Sacramento River.

An experimental captive rearing program continues at Bodega Marine Lab and Steinhart Aquarium. The captive rearing program was established in 1991 when the run size was estimated to be 191 fish. The program was designed as a hedge against the possibility of extinction of the species by rearing fish in captivity until maturity.

NMFS' "Proposed Recovery Plan for the Sacramento River Winter-run Chinook Salmon" was distributed in August of 1997, but has not yet been made final.

The Status in 1998 and 1999 of the Sacramento River winter-run chinook salmon: *Stable.*

Sacramento River spring-run chinook salmon

Sacramento River spring-run chinook salmon
(*Oncorhynchus tshawytscha*)

CA - T (1999)
FED - T (1999)

General Habitat: Permanent Streams with Fish of the Sacramento-San Joaquin Province

Spring-run chinook salmon are primarily found in Butte, Big Chico, Deer, and Mill creeks. There are other waters that contain spring-run salmon, but the bulk of the spring-run salmon are in these four tributaries to the Sacramento River.

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, hold in pools until they spawn, starting as early as mid-August and ending in mid-October, peaking in September. The 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, peaking in November-December.

The 1998 population estimate for spring-run chinook salmon on Butte Creek was between 18,742 and 20,259 salmon; in 1999 it was between 3,529 and 3,679. In 1998, an estimated 1,879 adult spring-run salmon were found in Deer Creek; in 1999 there were an estimated 1,591 spring-run salmon. Mill Creek had a population estimate of 424 salmon in 1998 and 560 in 1999. Big Chico Creek had a population estimate of 369 salmon in 1998 and 27 (preliminary estimate) in 1999.

The third year of a multi-agency effort to monitor the emigration of juvenile spring-run chinook salmon was instituted in the fall of 1999. The information is used by CALFED managers to recommend modified operations of the State and Federal water projects in the Sacramento-San Joaquin rivers and Delta to improve juvenile spring-run survival. Information on emigration timing, migration pathways, and juvenile abundance is being used to plan habitat restoration projects targeted at recovering this species.

Recent genetic research has provided evidence that supports the distinctiveness of spring-run chinook salmon and complements known spring-run chinook salmon life history.

The DFG's Status Review Report was submitted to the FGC in June 1998 with a recommendation that the species warranted a threatened status. In August 1998 the FGC found that the species warranted listing as a threatened species. The Sacramento River spring-run chinook salmon was formally listed as a threatened species on February 5, 1999.

NMFS published a final rule on September 16, 1999, listing Central Valley spring-run chinook salmon as threatened. The effective date of the regulation is November 15, 1999.

The Status in 1998 and 1999 of the Sacramento River spring-run chinook salmon: *Stable to Declining*.

Coho salmon

Coho salmon
(*Oncorhynchus kisutch*)

CA - E (1995; south of San Francisco Bay)
FED - T (1996; south of San Francisco Bay)
T- (1997; north of San Francisco Bay; not addressed in this account)

General Habitat: Sacramento-San Joaquin Province, Permanent Streams with Fishes
Klamath-North Coast Province, Permanent Streams with Fishes
Estuarine
Marine

The coho salmon is one of seven species of Pacific salmon belonging to the genus *Oncorhynchus* and one of five species found in California. In California, it is found in many of the short, coastal drainages from the Oregon border south to Monterey Bay. In the larger coastal drainages, it is found primarily in the lower sections. Coho salmon populations found in the drainages south of the San Francisco Bay are termed 'southern coho salmon'. However, studies thus far have not demonstrated that these populations are genetically distinct from other, more northerly coho salmon populations.

For the most part, coho salmon's life cycle takes three years. They normally spend their first year in fresh water and their next two years in salt water prior to returning to spawn in their natal streams. Some males, called "jacks", return to spawn after only one season in the ocean. Spawning migrations begin after heavy, late autumn or winter rains encourage the returning adult to leave the ocean and move upstream. In many of the coastal streams south of San Francisco Bay, heavy river flows are needed to breach sand bars that have formed at the mouths of coastal streams before fish can migrate up.

Nine coastal streams south of San Francisco Bay historically supported self-sustaining spawning runs of coho salmon. These streams 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-year lineages. A lineage is defined as the direct ancestor-descendent line. For the southern populations of coho salmon, there are three distinct and separate maternal brood-year lineages. The Scott Creek population has been supplemented in recent years by stocking of 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.

The size of the coho salmon populations in these coastal streams is not known; however, some limited sampling for juvenile coho salmon has been conducted on all the streams. 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 population sizes. The few existing southern coho salmon populations are small and in danger of extirpation.

The decline of southern coho is primarily due to unfavorable climate conditions in recent decades. Droughts during the 1970s and 1990, intense floods in the 1980s and late 1990s, and recent unfavorable ocean conditions have all contributed substantially to the continuing decline of southern coho salmon. Very poor (warm, nutrient-poor) ocean conditions in the fall of 1997 resulted in most adult coho returning to central coast streams having very poor fertility. In addition most of the limited production from this group of adults was probably destroyed by extraordinarily high rainfall amounts in February 1998, and associated high levels of streambed scour. More favorable ocean and precipitation conditions during the winter of 1998-99 produced a substantial 1999 year-class. Fall 1999 juvenile surveys have found evidence of successful reproduction in Pescadero, Gazos, Scott, Waddell, and San Vicente creeks. Approximately 4,000 juvenile coho are being reared at the Big Creek Hatchery for release in the spring of 2000.

The DFG is currently preparing its recovery plan for coho salmon in the nine southern streams. Individuals from National Marine Fisheries Service (NMFS), San Jose State University, Bodega Bay Marine Laboratory, and the California DFG of Conservation-Division of Mines and Geology are participating in the DFG's southern coho salmon recovery team. A peer and public reviewed draft restoration plan for southern coho salmon was completed in September 1998. The draft plan was circulated for another round of review in early 1999 and is expected to be finalized by the beginning of 2000.

The status in 1999 of the southern coho salmon: *Declining, near extirpation.*

Bull Trout
(*Salvelinus confluentus*)

CA - E (1980)
FED - T

General Habitat: Klamath-North Coast Province, Permanent Streams with Fishes.

The bull trout is a large (10-40 inches) nonanadromous 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. 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.

Extirpation of the bull trout from the McCloud River 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^{0} F), and has significantly reduced flushing flow and gravel recruitment. Other factors may have contributed to the demise of bull trout in the McCloud.

Introductions into the McCloud River of newly hatched bull trout from Oregon were attempted during the early 1990's, 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 species that was endemic to the McCloud. The DFG has determined that, due to dramatic changes in habitat which have occurred as a result of the McCloud Dam, bull trout probably cannot be successfully reestablished in this native water.

The status in 1999 of the bull trout: *Extirpated*

Delta smelt
(Hypomesus transpacificus)

CA - T (1993)
FED - T (1993)

General Habitat: Sacramento-San Joaquin Province, Permanent Streams with Fishes

The delta smelt is a small, slender-bodied fish with a typical adult size of two to three inches that is found only in the Sacramento-San Joaquin Estuary. Historically, it 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, have a low fecundity for a fish with planktonic larvae, are poor swimmers, are easily stressed and reside primarily in the interface between salt and freshwater. The reasons for the delta smelt decline are multiple and probably compounded by one another. In decreasing order of importance they include: 1) reductions in delta water outflow; 2) entrainment (movement of fish by currents caused by pumping) losses to water diversions; 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 1994 and 1996 and moderate levels observed in 1993 and 1995. The 1997 population appeared to be only slightly larger than in 1996. The abundance of delta smelt in 1998 was relatively low (summer tow net surveys) and slightly higher during fall midwater trawls (moderately low). The 1999 delta smelt population does not appear to be larger than we have seen in previous years. Total delta smelt catch was similar to previous years and average densities were similar to 1996 and 1997 and were lower than

in 1995 and 1998.

Since the early 1990s, mean fork length of adult delta smelt captured by the fall midwater trawl survey has declined significantly from 63.0 mm in 1975-1991 to 53.9 mm in 1992-1997. The DFG is investigating the potential causes of this apparent change in growth rate.

The DFG, in response to Fish and Game Commission directives, initiated an intensive, multi-disciplinary study program in 1992 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 the 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. The resulting standards from the Water Accord provided better rearing habitat conditions in the Estuary.

A five-year recovery review period established under USFWS's Recovery Plan had to be restarted in 1998 because abundance and distribution criteria were not achieved in 1997.

The status in 1999 of the delta smelt: ***Stable to Declining.***

Mohave tui chub
(*Gila bicolor mohavensis*)

CA - E (1971); Fully Protected
FED - E (1970)

General Habitat: Great Basin Province, Artificial Ponds

Mohave tui chub

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 March-April 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. 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.

The Mohave tui chub is the only representative of the minnow family (Cyprinidae) native to the Mojave River. However, during the 1930s, arroyo chub were illegally introduced into the headwater reservoirs of the Mojave River as a baitfish. The arroyo chub quickly spread throughout the drainage. Mohave tui chub population numbers began to decrease due to competition and hybridization with the arroyo chubs. By 1979, species replacement was complete in their natural habitat. Other threats include genetic contamination, introduction of other exotic species, habitat alteration, water diversion and pollution.

The existing Mohave tui chub populations occur at four sites: Soda Springs, the DFG's Camp Cady Wildlife Area, China Lake Naval Air Weapons Center, and the Barstow Desert Information Center. A 1997 survey of the Camp Cady ponds found that the population is thriving in one pond, but increasing numbers of bullfrogs threatens the

population in the other pond. The DFG has initiated a program to control the bullfrogs; however bullfrogs are difficult to eradicate. Regular monitoring and maintenance of the refuge populations have been difficult due to a shortage in available personnel and funds.

In 1997, a genetics study by UC Davis confirmed that the Mohave tui chub is a distinct subspecies and recommended that it should continue to receive protection as an endangered, unique subspecies. 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 1999 of the Mohave tui chub: *Stable to Declining*.

Owens tui chub

Owens tui chub
(*Gila bicolor snyderi*)

CA - E (1974)
FED - E (1985)

General Habitat: Great Basin Province, Permanent Streams with Fishes
Artificial Ponds

The Owens tui chub is very 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, you must microscopically examine the scale and gill rakers. The maximum body length is approximately eight inches. Owens tui chub spawn from spring through late fall. 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. The historic distribution was throughout the standing waters and low gradient reaches of the Owens River and its larger tributaries extending from the River's headspring to Owens Lake.

The major threats to the Owens tui chub are lack of sufficient habitat due to insufficient water supply, the introduction of Lahontan tui chubs that readily hybridize with Owens tui chub, and the introduction of predatory fish species.

There was long thought to be three existing natural Owens tui chub populations. These are at the Owens River Gorge, springs at the DFG's Hot Creek Hatchery, and a pond and ditches at the Cabin Bar Ranch near Owens Dry Lake. In 1997, a fourth population was found in the recently rewatered section of lower Owens River Gorge above Pleasant Valley Reservoir. Changes may have to be made to the species' recovery plan based on the verification of this rediscovered population. Natural volcanic activity that could change spring flow and water quality potentially threatens the springs at Hot Creek Hatchery. Groundwater thermal modification and withdrawal for geothermal development and domestic water supply for the town of Mammoth Lakes also threatens this site. There are three introduced populations of Owens tui chub. One is at BLM's Mule Spring, another is in Little Hot Creek on Inyo National Forest, and a third is being established at the University of California White Mountain Research Station owned by LADWP. In 1997, the DFG conducted field surveys to search for other populations. However, due to high turbidity and rainfall, the field surveys were abandoned.

In 1997, the DFG received federal Section Six grant funding to carry out portions of USFWS's *Recovery Plan for Owens Basin Wetland and Aquatic Species*. Activities being conducted using these funds are population monitoring, maintenance of existing refuge sites, control of harmful exotic species, identification of additional refuge sites, and reestablishment of rare species in restored habitats.

The status in 1999 of the Owens tui chub: *Stable*.

Bonytail
(*Gila elegans*)

CA - E (1974)
FED - E (1980)

Bonytail

General Habitat: Colorado River Province, Permanent Streams with Fishes
Colorado River Province, Standing Ephemeral Waters
Refuge Ponds

The bonytail is the rarest of the endemic big river fishes in the Colorado River Province. It is a large chub, commonly eight to 14 inches, with a gray or olivaceous back and white, silvery sides and belly. It has an extremely narrow caudal peduncle (the tail stalk, where the tail fin joins the body) with a deeply forked tail, fine, embedded scales and a short, flattened head with a broad snout and small elliptical eyes. There is a conspicuous hump behind the head. 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, the bonytail has not been seen in the Salton Sea since the first decade of this century.

Habitat alteration caused by flow depletion to irrigation and other water uses, construction of dams, hybridization with other *Gila* species, and the introduction of non-native and sport fish species has resulted in the bonytail's endangered status. This fish is virtually extirpated from its former California habitat. No bonytails have been found during monitoring efforts in recent years in California waters. In the Lower Colorado Basin, a few large, old adults are still found in Lake Mojave, but no successful reproduction has been documented. A few bonytail still occur in Lake Havasu. No bonytails have 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.

Like the endangered razorback sucker, the USFWS has determined that the bonytail chub is in jeopardy of becoming extinct in the near future if steps are not taken. 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, one of three State- and Federally-listed Colorado River fish species, initiated the development of the Lower Colorado River Multi Species Conservation Program (LCRMSCP). The LCRMSCP is a multi-species habitat conservation effort that will cover both aquatic and terrestrial species. The area covered by the LCRMSCP will include the 100-year flood plain of the Colorado River from Lee's Ferry, Arizona south to the southern international border with Mexico. It involves the planning efforts of the BOR, the BLM, the USFWS, the DFG, 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 by the Lake Havasu Fisheries Improvement Project (LHFIP). The only current effort to reintroduce bonytail into California waters is through the LHFIP. Like the razorback sucker, the partnership was to stock 30,000 bonytail, of ten inches or longer, into Lake Havasu over a five-year period. As of October 1999, three years into the project, only 1,751 Bonytail had been stocked. The LHFIP's effort is currently behind schedule. Isolated grow-out (received from another hatchery location and grown to a larger size) ponds on Lake Havasu were to be used, but they were largely unsuccessful. Achii Hanyo Hatchery, AZ, on Indian reservation land, has been used to grow the bonytail for the past two years or so. They have only seen a 15 percent survival rate for the bonytail.

Because of the jeopardy status of the bonytail, a cooperative agreement has recently been made between DFG and Imperial Irrigation District (IID) to "grow out" bonytails at the DFG's Niland Warmwater Fish Hatchery. In October 1999, 1,500 fingerling bonytails were transferred from Dexter National Fish Hatchery in Dexter, NM to Niland. The fish will be grown out during 2000, and hopefully, they will reach a total length of ten inches or more by June, 2000. The DFG will then stock the ten-inch

bonytail in Lake Havasu. If funding is available, and if this pilot project proves successful, the Niland facility will be expanded. To coordinate these recovery efforts, the DFG has hired a new Fishery Biologist whose job will focus on the recovery of the Lower Colorado River native fishes.

The status in 1999 of the bonytail: ***Declining****. Bonytail is extremely close to extinction in California and nationwide.*

Colorado squawfish

Colorado pikeminnow (squawfish)
(*Ptychocheilus lucius*)

CA - E (1971); Fully Protected
FED - E (1967)

General Habitat: Colorado River Province, Permanent Streams with Fishes

The Colorado pikeminnow (newly renamed from squawfish) is one of the largest species of the minnow family (Cyprinidae) in the world and the top carnivore of the Colorado River system. It was historically 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. Although once abundant throughout the Colorado River and major tributaries in slow, deep water, it has not been seen below Arizona's Glen Canyon Dam since 1968. In California, the species was historically known from the U.S.-Mexico Border north to the Nevada State line and the Salton Sink. Extirpation in the lower basin was caused by habitat alteration.

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.

Even though the Colorado pikeminnow has been extirpated from California for some time now, and no plans have been made for reintroducing the fish into California waters, it is still 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 effort that will cover both aquatic and terrestrial species. The area covered by the LCRMSCP will include the 100-year flood plain of the Colorado River from Lee's Ferry, Arizona south to the southern international border with Mexico. The LCRMSCP involves the planning efforts of the BOR, the BLM, the USFWS, the DFG, Arizona Game and Fish, Nevada Division of Wildlife, various water, power and irrigation agencies, native American tribes, and environmental groups. Using Environmental License Plate Funds, the DFG has hired a new Fishery Biologist whose job will focus on the recovery of the Lower Colorado River native fishes and participating in various planning efforts.

The status in 1999 of the Colorado pikeminnow: ***Extirpated*** **in California.**

Lost River sucker

Lost River sucker
(*Deltistes luxatus*)

CA - E (1974); Fully Protected
FED - E (1988)

General Habitat: Klamath and North Coast Province, Standing Permanent Waters with Fishes
Klamath and North Coast Province, Permanent Streams with Fishes

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 a long, 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. The Lost River sucker inhabits lakes and typically migrates to spawn in springs or large rivers.

Lost River suckers 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 Project 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, BOR activities have resulted in reduction of much of the lakes' 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 by UCD, of Klamath River Basin suckers 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 BOR 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 goal of this plan is to downlist or delist the species. As of 1999, 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 it and BOR 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 BOR, 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 in 1999 of the Lost River sucker: *Declining*.

Modoc sucker
(*Catostomus microps*)

Modoc sucker

CA - E (1980); Fully Protected
FED - E (1985)

General Habitat: Sacramento-San Joaquin Province, Permanent Streams with Fishes

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. The species is found only in a small portion of the upper Pit River drainage in Modoc and Lassen counties.

Major threats include introduction of exotic predators, grazing and possible hybridization. Drought conditions also have a significant impact on this species.

The overall condition of Modoc sucker habitat has improved substantially. Protection of Modoc sucker streams and habitat improvement has been an interagency effort led by the USFS. Numerous restoration projects have been undertaken on Modoc

National Forest lands to reduce or eliminate the effects of grazing and to prevent stream bank erosion and sedimentation. Additional habitat was protected when the WCB purchased 160 acres on Dutch Flat Creek in 1991. That purchase brought into public ownership all of Dutch Flat Creek. In 1993, the DFG established this area as a State Wildlife Area. In 1995, USFS fenced this area to protect the stream habitat by restricting grazing. At that same time, the SWRCB took action to ensure sufficient flows from upstream to the Dutch Flat Creek Wildlife Area and to provide stability to dams within the Dutch Flat Creek drainage.

Habitat assessment in 1995 suggested that we protected adequate portions of Modoc sucker habitat from the major threat to the species, overgrazing. We can attribute habitat improvements on public lands to land acquisitions, fencing, and changes to US Forest Service grazing standards. Predatory exotic species have been essentially eliminated, and predation by native species is at an appropriate level.

In 1997, the DFG began considering downlisting the Modoc sucker to the threatened species status. Currently, the DFG and USFWS are evaluating new information concerning population status, distribution, habitat conditions and hybridization with the Sacramento sucker as it becomes available. As funding becomes available, the DFG 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 to plan future recovery projects intended to extend the range of the species.

The status in 1999 of the Modoc sucker: ***Stable to Increasing.***

Shortnose sucker

Shortnose sucker
(*Chasmistes brevirostris*)

CA - E (1974); Fully Protected
FED - E (1988)

General Habitat: Klamath and North Coast Province, Standing Permanent Waters with Fishes
Klamath and North Coast Province, Permanent Streams with Fishes

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. During most of the year, this species inhabits the open water of large, shallow lakes and river channels. Spawning occurs in tributary streams during April and May.

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 alterations associated with water diversions. A 1992 directive required BOR 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 shortnosed suckers in April 1993. The primary goal of this plan is to downlist or delist the species. As of 1999, 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 it and BOR 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

working in coordination with the BOR, 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 in 1999 of the shortnose sucker: *Declining*.

Razorback sucker
(*Xyrauchen texanus*)

Razorback sucker

CA - E (1974); Fully Protected
FED - E (1991)

General Habitat: Colorado River Province, Permanent Streams with Fishes
Colorado River Province, Standing Ephemeral Waters

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 olivaceous on the back and yellowish on the belly. 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 confirmed in the Salton Sea since the first decade of this century. 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. The decline of the razorback is due to habitat alteration and destruction, dam building, decline in water quality, and predation by non-native fishes.

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. There are few, if any, naturally spawned razorback suckers in California waters at present.

An electrofishing survey in 1995 confirmed the continued presence of a small, remnant population of adults in Senator Wash Reservoir, Imperial County. Other surveys conducted by USFWS in 1995 found populations at Cibola National Wildlife Refuge's High Levee Pond, Emerald Canyon Golf Course, and Imperial National Wildlife Refuge's Farmers Pond. 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. 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 effort that will cover both aquatic and terrestrial species. The area covered by the LCRMSCP will include the 100-year flood plain of the Colorado River from Lee's Ferry, Arizona south to the southern international border with Mexico. The LCRMSCP involves the planning efforts of the BOR, the BLM, the USFWS, the DFG, 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 the main reason that the LCRMSCP planning effort is taking place. The razorback sucker is a fully protected species in California, and its protection has been a major concern while drafting 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 of the efforts to reintroduce razorback suckers into the Colorado River is taking place in Lake Havasu. This effort is being conducted through the Lake Havasu Fisheries Improvement Partnership (LHFIP), a five-year partnership between DFG, Arizona Game and Fish, Metropolitan Water District, Anglers United, USFWS, BLM, and the BOR. Originally 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 becoming extinct. Through the LHFIP 20,431 razorbacks of 10 inches or longer have been stocked into Lake Havasu over the last three years. Most of them have been reared at Bubbling Ponds, Arizona. The goal is to stock a total of 30,000 razorback suckers into the lake over the life of the partnership. It appears that the LHFIP will reach this goal. On the most recent trammel net survey of Lake Havasu conducted by Arizona Game and Fish (July 1999), two razorback sucker were found.

Other than the LHFIP stockings and the 40 tagged fish stocked above Imperial Dam each year, there are not any other razorback sucker stockings going on within California waters. Razorback suckers are being stocked into Lake Mohave in Arizona and Nevada. As far as we can tell, there is no recruitment taking place, 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. A decade ago, biologists stocked hundreds of thousands of fingerling razorbacks into the Colorado River annually. Due to predation, they would not find a single razorback sucker a year later. This is the reason that only larger fish are currently being stocked.

With annual funding from the sale of Environmental License Plates, the DFG has recently hired a Fishery Biologist whose job will focus on the recovery of the Lower Colorado River native fishes.

The status in 1999 of the razorback sucker: *Declining.* *The razorback sucker is verging on extinction in California as well as nationwide.*

Desert pupfish

Desert pupfish
(*Cyprinodon macularius*)

CA - E (1980)
FED - E (1986)

General Habitat: Colorado River Province Streams, Marshes and Springs
Artificial Ponds

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. This species 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 ppm. Desert pupfish can also survive rapid changes in salinity and daily water temperature fluctuations of 72˚F to 80˚F. This species, however, does not tolerate large numbers of introduced predatory or competing fishes. Desert pupfish are now relegated to remnants of their former habitats, which are too harsh for most introduced species to exist. 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.

Ten habitat refuges have been established for this species in various springs and artificial ponds. Dams, channelization, water diversions, and groundwater pumping, combined with the introduction of exotic fish species have now reduced the wild populations of this pupfish species to only a few saline pools along the Salton Sea's edge, some irrigation drains flowing into the Salton Sea and portions of two creeks (Salt and San Felipe creeks) tributary to the Salton Sea.

Desert pupfish in San Felipe Creek, Imperial County, are periodically threatened by invasions of the non-native tilapia, an African fish used for aquaculture, and sailfin mollies, an aquarium fish. Construction of a barrier to block continued migration of tilapia into San Felipe Creek pupfish habitat has been postponed indefinitely since: (1) tilapia populations in the sea are declining probably due to increasing salinity; (2) portions of the creek are intermittently dry thereby isolating tilapia from pupfish habitat; and (3) periodic flash floods wash tilapia back into the sea.

Numerous exotic fishes, particularly mosquito fish, 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 have not yielded any desert pupfish. However, desert pupfish were found in the lower reaches of Salt Creek in 1999. To compound matters, desert pupfish in Salt Creek are further restricted by an overabundance of vegetation, especially the introduced salt cedar (tamarisk). Over the next two years, the DFG will be conducting a salt cedar removal program. The newest threat to the Salt Creek population is OHV activity, which has increased in the last two years.

The most recently completed project to benefit desert pupfish has been the construction of a new artesian well for the refuge ponds at Oasis Springs Ecological Reserve. Water flows from the old well had decreased so dramatically that during summer of 1997 through 1999, pupfish were being stranded in shallow water areas. 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 become available.

The status in 1999 of the desert pupfish: ***Declining (in the wild) to Stable (in refuge sites).***

Cottonball Marsh pupfish
(*Cyprinodon milleri*)

Cottonball Marsh pupfish

CA - T (1971)
FED - None

General Habitat: Great Basin Province, Standing Permanent Waters

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. Currently, this species only occurs in the 640-acre Cottonball Marsh in the northwest portion of Death Valley National Park. Cottonball 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. Little is known about either the reproductive biology or food habitats of Cottonball Marsh pupfish.

Although this species is isolated in an NPS-designated Wilderness Area, the species' restricted distribution makes it vulnerable to stochastic events such as droughts or earthquakes, which could disrupt the species' sources of groundwater. Groundwater withdrawals recently proposed by the Las Vegas Valley Water District and other groundwater developments outside park boundaries may also pose a serious threat to the aquifer that supplies Cottonball Marsh plus several other rare desert fish species. In 1998, Death Valley National Park (DVNP) began a three-year study 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 DVNP.

The status in 1999 of the Cottonball Marsh pupfish: ***Stable.***

Owens pupfish

Owens pupfish
(*Cyprinodon radiosus*)

CA - E (1971); Fully Protected
FED - E (1967)

General Habitat: Great Basin Province, Standing Permanent Waters and Small Streams
Artificial Ponds

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 generally resemble females. Owens pupfish congregate in small schools and feed mostly on aquatic insects. Reproduction occurs from January through September. Females may spawn daily, laying dozens of eggs per day. Spawning occurs in male-defended territories chosen for its rocks, vegetation, or silt.

Historically, Owens pupfish occurred in the clear, warm waters of spring pools, sloughs, irrigation ditches, swamps, and flooded pastures along the Owens River 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 has greatly 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 DFG, 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. These sites are to be restored and repopulated in 1998 to 2000. Two additional populations tenuously persist in marshy areas of Fish Slough. Additional pupfish populations occur in Inyo County at Mule Spring on BLM land, at Warm Springs and below an artesian well on LADWP land.

In 1996, USFWS completed its multiple species recovery plan of the Owens Valley. The intent of the plan is to maximize benefits by preserving remnants of functioning ecosystems for many species rather than just one.

In 1997, the DFG secured federal Section Six grant funding to conduct habitat restoration activities at Fish Slough ACEC. The restoration projects will include vegetation removal, fencing, water control structure maintenance, and control of exotic fishes.

The status in 1999 of the Owens pupfish: ***Declining***

Unarmored threespine stickleback

Unarmored threespine stickleback
(*Gasterosteus aculeatus williamsoni*)

CA - E (1971); Fully Protected
FED - E (1970)

General Habitat: South Coastal Drainage, Permanent Streams with Fishes

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. This fish 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, San Bernardino County.

The fish 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.

A Stickleback Advisory Committee, facilitated by DFG, meets periodically to coordinate actions presented in USFWS's Recovery Plan for the stickleback. The agencies cooperating in the recovery effort have undertaken several actions to conserve the fish. These activities include: (1) surveys to discover additional populations, (2) transplants to establish this subspecies in other waters, (3) surveys to discover exotic organisms, (4) eradication programs to remove or control exotic species, (5) a contingency plan to establish response procedures in case of oil or toxic chemical spills, (6) genetic studies to ascertain taxonomic relationships, and (7) surveys to find transplant sites to establish self-sustaining populations within the species' historical range.

These conservation efforts resulted in the discovery of a remnant population of sticklebacks in Shay Creek, establishment of additional stickleback populations, and a potential change in the taxonomic status of one or more of the recognized extant populations of the fish. 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 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 unarmored threespine stickleback have been conducted.

In September of 1994, the American Fisheries Society petitioned USFWS to list the Shay Creek population of the unarmored threespine stickleback as a distinct subspecies based on morphological and genetic differences. USFWS declined to accept the petition stating that the Shay Creek unarmored threespine stickleback remains a population of the federally endangered unarmored threespine stickleback. The DFG is very concerned about the long-term viability of the Shay Creek population of sticklebacks due to the restricted nature of the habitat, possible genetic inbreeding and the continuing threats to the species. A top priority is to establish at least one refuge population during 2000.

In 1999, the DFG received Section 6 funds to complete the genetic comparison of the Santa Clara River and the Shay Creek unarmored threespine sticklebacks. The results of the study will clarify the taxonomic status of the sticklebacks and allow the DFG and USFWS to better manage the remaining populations of the species.

The status in 1999 of the unarmored threespine stickleback: *Unknown for the Santa Clara River populations, declining for the Shay Creek population.*

Rough sculpin
(*Cottus asperrimus*)

Rough sculpin

CA - T (1974); Fully Protected
FED - None

General Habitat: Sacramento-San Joaquin Province, Permanent Streams with Fishes

The rough sculpin is the smallest member of the family Cottidae in California. It is identified by its relatively narrow body shape and extremely rough skin. It occurs only in Shasta County in the Pit River, in the Burney area, including Hat Creek and the 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.

Management of those streams as wild trout streams and efforts to protect the Shasta crayfish probably benefits populations in lower Hat Creek and the Fall River.

Rough sculpins are threatened by the nature of their restricted range. Siltation from dredging and bank erosion caused by livestock grazing also pose threats to this

species. 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.

The status in 1999 of the rough sculpin: ***Stable.***