ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM

Animal Abstract **Element Code:** AFCJB35020
Data Sensitivity: Yes

CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Ptychocheilus lucius*
COMMON NAME: Colorado Pikeminnow; Colorado Squawfish; Colorado Salmon; White Salmon
SYNONYMS:
FAMILY: Cyprinidae

AUTHOR, PLACE OF PUBLICATION: Girard, C. 1856, Proc. Acad. Nat. Science, Philadelphia 8:209

TYPE LOCALITY: Colorado River

TYPE SPECIMEN:

TAXONOMIC UNIQUENESS: One of three species in the genus; only species in the genus in the Colorado River basin; relatively unchanged since the Miocene.

DESCRIPTION: Reports of specimens from Arizona claim the fish reached lengths of 1.8 m (6.0 ft.) and weights of 45.0 kg (100 lbs.) (Minckley 1973, Sublette et al. 1990). Sublette et al. 1990 states that *Ptychocheilus lucius* in excess of 0.9 m (2.95 ft.) and 6.5 kg (14.3 lbs.) are now rare.

"Body somewhat compressed dorso-ventrally. Head flattened and elongated. Mouth large, nearly horizontal. Dorsal and anal fins almost always with nine rays. Dorsal fin far back, originating behind insertion of pelvic fins. Scales small, embedded (especially on breast, belly, and nape). Skin leathery in texture. Lateral line with 80 to 95 scales. Pharyngeal arches delicate, the lower ramus elongated and slender; teeth fragile and elongated, 2, 5-4, 2.

Color olivaceous, darker above. Lower sides yellowish and belly whitened, especially anteriorly. Young with a dark, wedge-shaped basicaudal spot, absent in adults" (Minckley 1973).

"Head: Long, flattened; HL/Sn L=2.7-3.6. SL/HL=3.5-4.3. Mouth large, terminal, the maxillary extending to or beyond the middle of eye. HL/Or L=5.5-11.2. Interior of jaws with acute skin-covered edge. Pharyngeal arch long and thin, dentition 2,5-4,2; teeth fragile. SN L/Or L=1.7-4.8. Mandible with 14-23 pores. Branchiostegal rays 3.

Body: Elongate, subterete, slightly compressed. Average total length 450-600 mm (17.7-23.6 in.); maximum total length 1.8m (6.0 ft.). SL/Pre Dor L=1.6-2.2; SL/BD=4.5-6.0. Body scales

small, sometimes missing or deeply embedded on the breast and abdomen. Lateral line strongly decurved, with 84-93 (80-95) scales. Scales above the lateral line 29 (27-30). Caudal peduncle thin; SL/Caud Ped D=12.5-12.9; BD/Caud Ped D=1.7-2.8 Vertebrae 48-49 (47-49).

Fins: Dorsal triangular, distal margin weakly falcate to almost straight; origin posterior to that of pelvics. Pectorals pointed. Pelvics ovate. Anal triangular. Caudal deeply forked, lobes pointed. Rays: Dorsal 9 (9-10); pectorals 16-17 (14-18); pelvics 9 (8-10); anal 9 (8-10); caudal 19" (Sublette et al. 1990).

AIDS TO IDENTIFICATION: Keys in Minckley (1973) and Sublette et al. (1990). Resembles species of genus *Gila* but can be distinguished by elongate body and snout; the maxilla extending to the orbit; and an acute skin-covered edge inside the jaws (Sublette et al. 1990).

ILLUSTRATIONS:

B&W photo (Minckley 1973:120)
Color drawing (Page and Burr 1991)
Color photo (Rinne & Minckley 1991:32)
Line drawing (Sublette et al. 1990:172)
B&W photos (Sublette et al. 1990:173)

TOTAL RANGE: Formerly widespread in the Colorado River basin from Wyoming to Arizona and California. Now, native populations are restricted to the upper basin in Wyoming, Colorado, Utah and New Mexico in the Green, Yampa, White, Gunnison and Colorado Rivers (Maddux et al. 1993). Critical habitat was designated for Colorado pikeminnow (called Colorado Squawfish at the time) in the upper basin (Federal Register 59(54), March 21, 1994) effective April 20, 1994. No critical habitat was designated in Arizona.

RANGE WITHIN ARIZONA: Considered extirpated in Arizona (Miller and Lowe 1964; Minckley and Deacon 1968; Minckley 1973), Colorado pikeminnow are restricted to two "experimental, non-essential" reintroduced populations in Arizona (Maddux et al. 1993). Adult and juvenile pikeminnow have been captured in Lake Powell (Minckley 1973; Minckley and Carothers 1979; Miller et al. 1984), but not in the Arizona portion of the lake.

Fish have been experimentally stocked in the Salt River drainage (Cherry Creek, Canyon Creek, Salt River at Horseshoe Bend and Gleason Flat) and the Verde River drainage (Verde River from below Sullivan Lake to Beasley Flat, East Verde River, West Clear Creek, Fossil Creek, and Sycamore Creek [Yavapai County]). A rule was proposed to designate an "experimental, non-essential" population on the Lower Colorado River between Imperial and Parker dams (Federal Register 52(165), August 1987). That rule was never finalized.

Pikeminnow have also been held or reared in Arizona at Page Springs/Bubbling Ponds State Fish Hatcheries, Willow Beach National Fish Hatchery, ASU Research Park, and Palm Lake (Hassayampa River Preserve operated by The Nature Conservancy).

SPECIES BIOLOGY AND POPULATION TRENDS

BIOLOGY: Early *Ptychocheilus* likely developed riverine adaptations by the mid Pliocene (about 6 million years ago). They were the top predator of the Colorado River basin in the early 1900s. They are largely solitary other than during spawning or when crowed together during low water conditions. The species is potamodromous (migratory in freshwater), with adults capable of long-distance migrations for spawning (Tyus 1986, 1991). There is some evidence of homing behavior in pikeminnow (Tyus 1985). May live 30 years or more. Mature fish are highly mobile while immatures are sedentary.

REPRODUCTION: Fish are sexually mature at 5-7 years of age and at least 40 cm (16 in) in length. Tyus (1990) reported that the onset of the reproductive cycle is marked by the beginning of migration to spawning areas. Cues for onset of migration may be high spring flows, increasing water temperature, and possible chemical cues from inundated terrestrial habitats. Movements of 200 miles have been reported, and fidelity to spawning grounds has been observed. Pikeminnow may not spawn annually. Pikeminnow migrations were initiated at water temperatures between 19.4-20.0°C (67-68°F). Baseline flow spikes may also serve as spawning cues (Negler et al. 1988).

Colorado pikeminnow spawn following the peak runoff when water temperatures reach 17.8-25.0°C (64-77°F), the peak between 22.2-25.0°C (72-77°F) (Tyus 1990). Spawning or egg deposition usually takes place during decreasing flows during which time sediment transport is decreasing and temperature is increasing (Tyus and Karp 1989). Spawning may be concentrated in relatively small areas where large, deep pools, eddies, and submerged cobble, gravel, boulder and sand substrates were associated with the main channel (Tyus 1990). Fish gather in the deep pools or eddies where they rest, feed, and prepare for spawning bouts. Females, followed by several males leave the pools for riffles or shallow runs where the spawning actually happens. They often return to the pool and the cycle is repeated. Hamman (1981) reported spawning behavior from raceways. Two or three males pursue a single female; as she slowly settles to the bottom with a male on each side, eggs are deposited followed by a release of sperm by the males (Sublette et al. 1990). The process may be repeated. Based on radiotelemetry data, fish may stage (rest) for hours to days in pools and eddies approximately 6.0 ft. (1.83 m) in depth, with water velocities of about 1 ft/sec (Tyus 1990). Spawning was noted in nearby cobble/boulder bars approximately 3.0 ft. (0.91 m) in depth, with water velocities of about 1.9 ft/sec. Fish returned to eddies/pools after 30 minutes to 3 hours and were presumably spent.

Eggs, varying in size from 1.5-2.0 mm (0.06-0.079 in.) hatch in 78-108 hours at 20.0°C (68.0°F) and 63 hours at 25.0°C (77.0°F) (Sublette et al 1990). Survival and percent hatch are highest at 20.0°C (68.0°C); no hatching occurred at 5.0, 10.0 and 30.0°C (41.0, 50.0, and 86.0°F) (Marsh 1985). There is no parental care.

Spawning pikeminnow are known or suspected from the Yampa River canyon; Gray Canyon of the Green River; and two sites on the Colorado River (Black Rocks to Loma, Grand Junction

to Clifton). Spawning is suspected from Labyrinth Canyon on the Green River and Cataract Canyon on the Colorado (Maddux et al. 1993). No spawning locations are known from Arizona.

Young may enter the drift as larvae and be transported long distances (perhaps 100 miles) before settling into nursery areas (Tyus and Haines 1991). Young-of-year, juveniles, and subadults have been noted in ephemeral backwater areas, with little or no current velocities, over silt and sand bottoms. Backwaters may be an important nursery area for young pikeminnow (Maddux et al. 1993). Young are highly mobile and may move among habitat types, but appear to seek out sites that provide the greatest warmth.

FOOD HABITS: Young pikeminnow may utilize crustaceans and aquatic diptera larvae. Aquatic and terrestrial insects make up the majority of the diet as fish exceed 50 mm (1.97 in.). Fishes predominate in the diets of squawfish larger than 100 mm (3.9 in.) (Minckley 1973). Condition of young fish entering winter periods may have a role in determining their overwinter survival. Low fat stores and poor condition may result in low overwinter survival of age-0 squawfish (Thompson 1989, Thompson et al. 1991).

HABITAT: Spawning, as described above, takes place over clean cobbles and rubble in relatively swift waters. Preferred temperatures for embryo development, juvenile growth, and adult spawning is from 20.0-26.0°C (68.0-78.8°F) (Berry 1988). Juveniles utilize slackwater, backwater, and side channel areas with low or no current velocity and silt/sand substrates. Larger individuals, greater than 200mm (7.9 in.) occur in turbid, deep, and strongly flowing waters (Sublette et al. 1990). Juveniles prefer total dissolved solid concentrations of 560-1,150 mg/l and avoid concentrations greater than 4,400 mg/l (Sublette et al. 1990). During floods, adults may move to flooded bottom lands where they may feed on terrestrial animals (Sublette et al. 1990).

Artificial habitats may have some utility for rearing young pikeminnow. Osmundson and Kaeding (1989) evaluated the use of gravel pits for grow-out of young pikeminnow. Growth in these gravel pits was related to density of fish and available forage. Survival was overall rather low. Habitat suitability curves have been developed for Colorado pikeminnow (Valdez et al. 1987). Clarkson et al. (1993) reported habitat preference for reintroduced pikeminnow in the Verde River, Arizona. Hendrickson (1993) discussed other aspects of Colorado pikeminnow reintroduction attempts in Arizona.

ELEVATION: Found below 4,000 ft (1,219 m).

PLANT COMMUNITY: Aquatic

POPULATION TRENDS: Extirpated in Arizona except for reintroduced stock.

SPECIES PROTECTION AND CONSERVATION

ENDANGERED SPECIES ACT STATUS:

LE (USDI, FWS 1967, 1970)
XN (USDI, FWS 1985a)
Experimental nonessential in the Gila River drainage (Salt River and Verde River)
Designated Critical Habitat (USDI, FWS 1994), none in Arizona
[Proposed Critical Habitat (USDI, FWS 1993)]
[PXN – Lower Colorado River (USDI, FWS 1987)]
[PXN (USDI, FWS 1984)]
Experimental nonessential in the Gila River drainage (Salt River and Verde River)
[Proposed Critical Habitat withdrawn (USDI, FWS 1979)]
[Proposed Critical Habitat (USDI, FWS 1978)]

STATE STATUS:

1 (AZGFD, AWCS 2022)
[1A (AGFD SWAP 2012)]
[WSC (AGFD, WSCA 1996 in prep)]
[Endangered (AGFD, TNW 1988a)]

OTHER STATUS:

Not Forest Service Sensitive (USDA, FS Region 3 1999, 2013)
[Forest Service Sensitive, USDA, FS Region 3 1988]
State Endangered, Group I (State of New Mexico 1975)
Endangered, American Fisheries Society
E, IUCN
E, probably Extinct in the wild of Mexico (NORMA Oficial Mexicana NOM-059-SEMARNAT-2010)
[Listed Endangered, Secretaría de Medio Ambiente 2000]
[Listed Endangered Secretaría de Desarrollo Social 1994]
Group 2 (NNDFW, NESL 2001, 2008)
[Group 2 NNDFW, NESL 1994]

MANAGEMENT FACTORS: Interactions with nonnative fishes may be an important factor in the continued survival or success of reintroduced populations of Colorado pikeminnow. Creef et al. (1992), Hendrickson (1993), Brooks (1986), and AGFD (1988b) all pointed to predatory interactions as an impediment to successful pikeminnow reintroduction. Channel catfish, smallmouth bass, and flathead catfish were identified as major predators in Arizona. Overlap and interactions with nonnative fishes such as red shiner, fathead minnow and green sunfish may result in reduced growth and survival of age-0 pikeminnow (Karp and Tyus 1990). Dams have blocked migration routes (Tyus 1991). Water temperature changes can be significant, as cold temperatures can inhibit embryonic development (Marsh 1985) and increase early life mortality (Kaeding and Osmundson 1988).

Threats: stream diversion; impoundment; reservoir operations; predation by and competition with nonnative fishes.

Management needs: re-establish large pikeminnow in historical habitats; ameliorate impacts from nonnative predatory and competitory fish species; evaluate possibility of recreational use; maintain and restore select habitats within historical range.

PROTECTIVE MEASURES TAKEN: In Arizona, no critical habitat is designated. From 1981-1990 over 623,000 pikeminnow of various sizes were introduced into historical habitat in the Salt and Gila Rivers. Stocking continues in the Verde River, but a reproducing population has not become established (Robinson 2007, AZGFD 2019). Reintroduction efforts are experimental nonessential. Populations maintained at Dexter National Fish Hatchery by the US Fish and Wildlife Service and at Bubbling Springs State Fish Hatchery by the Arizona Game and Fish Department. Outside Arizona, six reaches in the upper Colorado basin totaling 1848 km (1148 miles)], have been designated as critical habitat.

SUGGESTED PROJECTS: Research into the viability of stocked populations and the efficacy of continued stocking is suggested.

LAND MANAGEMENT/OWNERSHIP: U.S. Forest Service (Tonto, Prescott, and Coconino National Forests), Tribal, State, and Private lands. Experimental nonessential populations have been introduced into Forest Service lands.

SOURCES OF FURTHER INFORMATION

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MAJOR KNOWLEDGEABLE INDIVIDUALS:

Robert W. Clarkson - U.S. Bureau of Reclamation, E-mail: rclarkson@lc.usbr.gov.
James E. Deacon - University of Nevada at Las Vegas
Dean A. Hendrickson - University of Texas, Austin
Paul Holden - BIO/WEST, INC
Charles O. Minckley - USDI. Fish and Wildlife Service, Parker, Arizona
Harold M. Tyus

Richard Valdez – SWCA, Flagstaff, Arizona

ADDITIONAL INFORMATION:

Common name was officially changed (per American Fisheries Society standards) from Colorado Squawfish to Colorado Pikeminnow in 1999.

Revised: 1994-07-29 (LMR)
1994-08-17 (MHH)
1994-09-29 (RWC)
1995-01-29 (KLY)
2001-10-18 (SMS)
2002-12-11 (RHB)
2021-02-04 (KSL)
2023-01-09 (MBL)