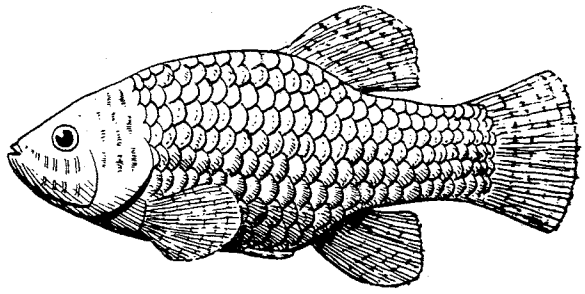
Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"

Proceedings of the Desert Fishes Council

VOLUME XI

Edited by
Edwin P. Pister

The Eleventh Annual Symposium

Held at
National Park Service Headquarters
Furnace Creek
Death Valley National Monument
November 15-17, 1979

Produced in cooperation with the University of Nevada, Las Vegas

Desert Fishes Council, 407 West Line Street, Bishop, California 93514
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FOREWORD

This document represents the second of the more recent proceedings summaries published by the Desert Fishes Council. Earlier summaries covered the first two symposia held in 1969-70. Work continues in preparing for publication a draft manuscript of summaries for the third through ninth symposia (1971 through 1977). We are hopeful that this material, which covers much of the early work and history relating to desert ecosystem preservation, will soon be available to interested workers.

During the past decade we have learned that eternal vigilance is the price of preservation, and that for every threat successfully encountered and resolved, seemingly a dozen more arise to take its place. However, we have also learned that there are ways within "the system" to preserve the priceless biological treasures that we have identified and learned to appreciate early enough to be able to preserve them. Hopefully, we can continue to hold the line until society embraces these same values and recognizes that their preservation comprises not a threat to sound economic development, but actually a logical and necessary precedent to the preservation of the same systems that support man.

Hopefully, the sound biological research and accompanying preservation programs fostered by the Council, and the successes engendered thereby, will serve as a beacon to those who might otherwise become discouraged as expanding populations in the southwest would appear destined to utilize every drop of desert water and every acre of level land. It is indeed paradoxical that man, although technologically capable of attaining virtually any goal he sets his mind to, somehow cannot achieve the degree of humility necessary to accept the profound truth expressed by the prophet Isaiah over 4,000 years ago:

> "Woe unto them that join house to house, that lay field to field, till there be no place, that they may be placed alone in the midst of the earth." (Isaiah 5:8).

Perhaps our efforts will help man to understand this concept before he finds himself adrift in a lifeboat with all of his supplies gone.

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THE PROCEEDINGS OF THE ELEVENTH ANNUAL SYMPOSIUM

Introduction

The Eleventh Annual Symposium was held on November 15-17 at National Park Service Headquarters, Furnace Creek, Death Valley National Monument, with 143 in attendance (list in appendix). Following a brief introduction to the Monument by Superintendent George Von der Lippe, the formally scheduled sessions began, as follows:

Reports from Area Coordinators, and Related Research -
Chairman: Chuck Minckley, Museum of Northern Arizona, Flagstaff.

DESERT FISHES COUNCIL

1979 Bonneville Basin Report

Don Duff
Bonneville Basin Coordinator
Salt Lake City, Utah

Many significant activities are taking place in the 34 million acre Bonneville Basin situated in the Great Basin, in Utah, eastern Nevada, southeastern Idaho, and southwestern Wyoming. Each activity will be reported briefly below.

Bonneville cutthroat, Salmo clarki utah

This cutthroat occurs in only 5 geographic areas within the Bonneville Basin and nearby adjacent transplant areas outside the basin. State and federal agencies in Nevada and Wyoming have made progress in developing and implementing management programs for the species. In Utah, while some positive action has been taken by the Utah Division of Wildlife Resources (DWR) and the Bureau of Land Management (BLM) there still exists no developed interagency management program to protect the species and its habitat. The DWR, BLM and the U.S. Forest Service (USFS) should independently and jointly develop management programs for this species on federal lands in Utah.

In October 1979 the Desert Fishes Council and the Bonneville Chapter, American Fisheries Society, both wrote letters to the Office of Endangered Species, U.S. Fish and Wildlife Service (FWS) requesting a status review for S.c. utah. This was precipitated by the apparent lack of state-federal concern and management for this species in Utah, and the precarious state of the species population levels and habitats now occupied by the species within the Bonneville Basin. A major habitat area for the species within Utah, the Deep Creek Mountains, harboring the rare Snake Valley strain of S. c. utah, is in danger of being despoiled by uranium mining activities. The BLM 1977 emergency land withdrawal of 27,000 acres is due to expire on May 3, 1980 unless BLM and the Secretary of the Interior recommend a permanent (20 year) protective land withdrawal for the area. To date the Utah BLM has not made a decision on this matter. It is swaying toward letting the current withdrawal lapse and then managing the area under interim wilderness guidelines. Wilderness guidelines will not suffice, in this case, for mineral entry will still be allowed until 1984, and it is not thought that BLM can protect the area from access road and mining damage. It is recommended the Council support a permanent withdrawal for the area as well as the development of a Utah interagency management plan for S. c. utah. Unless management agencies take more positive action for this species management, the Council should also support a nomination to FWS requesting official threatened status for S. c. utah.

Lahontan Cutthroat, Salmo clarki henshawi

This species exists in one stream in the Pilot Peak range, Utah and Nevada. It has been previously reported on in literature by Dr. Robert Behnke, Terry Hickman, and Don Duff. The BLM, Utah DWR, FWS, and Nevada Department of Wildlife are intensely interested in management for this threatened species. It is reported to be the original genotype from Pyramid Lake and its future survival and management has great scientific and recreational potential. The Utah BLM has completed and is implementing a joint habitat management plan (HMP) with Utah DWR for the Pilot Peak area. In October 1979 the Utah DWR rotenoned Bettridge Creek north of Donner Creek occupied by the Lahontan cutthroat and plan to reintroduce cutthroat into the creek in the spring 1980. BLM has initiated a land exchange proposal to obtain streamside land in Donner Creek to aid in future species management. Threats arise for species survival in Donner Creek, a part of Wendover, Utah's water supply, since the city would like to cap the headwater spring source and divert the entire flow. An interagency meeting between Utah and Nevada is being planned to discuss future management for the area and S. c. henshawi.

Least Chub, Iotichthys phlegethontis

A BLM sponsored inventory contract is being completed by Utah DWR (Gar Workman, Utah State University) to assess least chub habitats and populations in the Bonneville basin from highway I-80 at Wendover, Utah south throughout the basin to Beaver County near Cedar City, Utah. The final report is under preparation and should be released early in 1980. Only that portion of the basin in Box Elder County, north of I-80 remains now to be surveyed for the least chub. Hopefully, the BLM and Utah DWR can jointly provide for finalization of this inventory work.

Kent Miller, Utah DWR non-game fisheries biologist will present a paper at this meeting jointly with Marianne Lamarra (M.S. on least chub), to provide you with more detailed species data.

MX Missile

The Department of Defense and U.S. Air Force (USAF) are urging deployment of the MX missile system in the deserts of western Utah and eastern Nevada. I understand the USAF has been involved in pre-project planning and on-the-ground studies for quite some time now. However, no BLM biologists who I have contacted have a knowledge of this project or its impacts. I only recently became aware of the proposal when Salt Lake City newspapers reported recent USAF news releases. The project, I am told, will be more massive than the Alaska pipeline project. It will involve a circular racetrack type deployment system in desert valley basins. A total of 200 missiles are planned for 4,600 shelters. It is estimated that in Utah-Nevada a population increase of up to 150,000 people could occur. Massive amounts of water will be required for construction and operation for the system and people. Several test wells are being drilled now in Snake Valley and Hamlin Valley, Utah to obtain ground water data. Wells from 500' to 1000' deep, using 14" to 16" casings will be pumped at a rate of 750 gallons per minute for periods up to 30 days.

Impacts from this project on surface and ground waters and land will severely deplete native flora and fauna of the area. Only proper planning and consideration of natural resource values by the USAF, and hopefully echoed by the BLM, can provide some sort of protection and/or mitigation for the area involved. Certainly the Council should keep abreast of this project's activities and provide the USAF technical and scientific input for their planning.

The Inter-Basin Area Report - 1979

by

Thom Hardy[1]

The Inter-Basin Area of Nevada encompasses portions of the Central, Colorado and Death Valley Regions. The fish fauna is distributed within 21 valleys and is represented by three (3) families and eleven (11) genera containing fourteen (14) described species. This report is intended to provide quantitative and qualitative data on the distribution and abundance of each species and subspecies throughout the Inter-Basin Area as of November 24th, 1979 and was compiled with the cooperation of the United States Fish and Wildlife Service, Bureau of Land Management, National Park Service, Nevada Department of Wildlife and personnel of the University of Nevada at Las Vegas. Some portions of this report were funded by the U.S. Fish and Wildlife Service through Cooperative Agreement No. 14-16-001-6319-FS Amendment #4.

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Death Valley Region

The portion of this region within Nevada comprises some 2593 square miles along the extreme southwestern margin of the state. The principal drainage pattern is that of the Amargosa River which is an intermittent tributary to Pluvial Lake Manly in Death Valley, California. The native fish fauna is represented by Rhinichthys osculus nevadensis in the intermittent reaches near Springdale and Beatty. This species as well as Cyprinodon diabolis, C. nevadensis mionectes and C.n. pectoralis inhabit spring systems in the Ash Meadows area south of Beatty. Empetrichthys latos latos is the single surviving species of that genus in the adjacent area of Pahrump Valley but is extinct in its natural habitat. Specific species accounts are given in the order they appear in Table 1.

Cyprinodon diabolis: Devils Hole Pupfish

The Devils Hole pupfish continues to respond to increased water levels and is maintaining winter populations of over 200 individuals. Severe scouring from floods has reduced the total amount of algae on the shelf this fall (1979), and primary productivity estimates are below normal. Consideration is being given to turning on the artificial lights to increase the algae. The proposed transplants into the Amargosa pupfish station are progressing, and contingency plans are being drawn up to establish monthly monitoring at the site. Concern has been raised over the continued development of the Ash Meadows area for domestic use, as the water rights established by the Supreme Court do not appear to govern domestic wells.

Cyrpinodon nevadensis mionectes: Ash Meadows pupfish

Comprehensive surveys and population estimates were conducted over the entire range of this subspecies in May of 1979, and these data are presented for each spring as it occurs in Table 1.

Big Spring: The pupfish population in Big Spring is in very good shape with as many as 1000 fish utilizing the main pool. Reproduction is evident as many small fish were observed in the shallow waters. The Poecilia population in the spring pool is well above that of the pupfish and is easily the most common fish in the spring. Bullfrogs and tadpoles are present in high numbers and were evident throughout all levels of the habitat. The outflow areas contained fair numbers of pupfish in the quieter water and support a good population of dace. The dace in the pool habitat were observed mostly on the bottom of the pool and did not integrate with the other fish. The entire system has at least 2000 pupfish and several hundred dace.

Bradford 1,2,3: This spring system contains the highest concentration of mollies observed in the Ash Meadows area. The pupfish population is estimated at approximately 500 for this area, and only larger adults were obtained. The presence of dace in small numbers, and only adults, suggests that the molly population is restricting the reproductive effort of the native fishes in this system.

Crystal: The pupfish population in this spring is in fine shape, and reproduction is occurring. The exotic populations are not as high as in other places in Ash Meadows, and apparently the pupfish are maintaining good numbers. The total system, including the outflow, contain approximately 1500 pupfish; and this is a very conservative estimate as some difficulty in seining produced low numbers relative to those counted with a mask and snorkel. Many small pupfish were observed in the shallow waters of the pool as well as in the sides of the outflow.

Fairbanks: Within recent months a pump has been added to the spring head, and several people are living in a trailer adjacent to the immediate outflow. I did not observe or collect many fish from the spring pool, but the fish were doing well in the outflow below the trailer. Gambusia was present in large numbers lower down the outflow and became quite plentiful in the pool habitat that forms adjacent to the dike approximately one-half mile below the spring. The pupfish population in this spring system numbers about a thousand or less. This estimate as well as those that follow are very conservative in nature and are intended only as a rough guideline in the evaluation of the population. The actual population will be greater than the estimate given.

Jackrabbit: This spring system is a nursery ground for both dace and pupfish. Several thousand of each species were observed from a few mm in length to adult sizes. The spring pool itself contains about 20 dace/10 meters and comparable numbers of pupfish where slower water can be found. All along the entire outflow for over a mile pupfish and dace were abundant, and a conservative estimate of approximately 3000 for the entire system is given. This system also shows the highest concentrations of pupfish and dace fry as well as young of the year.

Longstreet: This spring contains the highest numbers of Gambusia observed during the census. The population easily exceeds several thousand. The pupfish population in the pool is doing well in spite of the exotics, and many fry and young of the year were obtained. The estimate for the pool population is approximately 750. During the course of measuring several hundred pupfish and Gambusia, I observed adult Gambusia consuming the smaller fish that were thrown back into the water.

Point of Rocks: This spring contains both P. mexicana and Gambusia in high numbers but the pupfish population is low for a spring this size. The fish appear only to inhabit the immediate outflow before it enters the cemented irrigation ditch that runs to the west. The inflow from the springs that lie approximately 1/8 mile east supports high numbers of exotics for less than half the distance. The total population in this inflow and the spring pool is approximately 500, and the exotic populations are at least three to four times that number. East of Point of Rocks are springs which contain only small numbers of fish, and outflow does not support good populations until nearly half of the 1/8 mile to Point of Rocks has been reached. Exotics are the most numerous fish in the outflows, but small population in these springs is approximately 150. The pupfish population in these springs is approximately 150. The possibilities of migration between the two connected springs is surely realistic, and this estimate may be biased.

Rogers: The spring pool itself contains under 150 fish (probably due to its size), but the outflow has several hundred pupfish in the area before the irrigation diversion. Gambusia is also very abundant in the outflow and is the most abundant fish in these waters. The whole system supports upward of 500 fish, and probably a much higher estimate can be expected if the adjacent marsh lands are considered.

Cyprinodon nevadensis pectoralis: Warm Springs pupfish

Population estimates were also carried out for this subspecies in May of 1979 except for School Springs. The fish population in this spring was censused on December 20, 1979. Each habitat is treated in order of occurrence in Table 1.

Indian: The pupfish population in this spring is rather small and reflects the small amount of available habitat. This system maintains a population of approximately 250 pupfish mostly confined to the outflow in and adjacent to the wooded area below the spring.

Marsh: The pool habitat below the spring has an excellent population of pupfish of all size classes. Both young of the year and fry were observed in this area as well as in the outflow below the dike. The total estimate for this system probably exceeds 3000.

School: The main pool system at this spring has over 300 fish at the present time, and the small observation pool in the lower enclosure has over 100. The emergent vegetation continues to proliferate through these springs, and control measures are scheduled for this April. This will include a coordinated study to assess various techniques of vegetation control and subsequent response of the pupfish population.

Scruggs 1,2: The large pool habitat below the outflow of the spring head contains several hundred pupfish, and reproduction has occurred as young-of-the-year and many fry were observed. The immediate outflow below the pool habitat also contained good numbers of pupfish, and the system collectively supports approximately 2000 fish.

Rhinichthys osculus nevadensis: Ash Meadows speckled dace

The dace population at Springdale and Beatty continues to survive in the intermittent portions of the Amargosa River, although they fluctuate widely. Current taxonomic studies on these and other Death Valley system dace are continuing to determine subspecific status. The populations present in Ash Meadows were treated under the springs listed for C.n. mionectes and C.n. pectoralis. The total population of dace in the Ash Meadows area cannot exceed 3000. The two highest populations are at Jackrabbit and Big Spring. Jackrabbit is the only system where the dace is not heavily impacted by exotic fishes. The intermittent nature of the Springdale and Beatty populations, in conjunction with the reduced numbers in the Ash Meadows area, warrant that this fish be listed as threatened or endangered. Continued development in the area will no doubt continue to impact this species.

Table 1. Specific localities of native species (ssp.) within the Death Valley Region of the Inter-Basin Area.

Species (ssp.)	Valley (Hydrologic #)	Body of Water	Locality	Quad #
Cyprinodon diabolis	Amargosa V. (230)	Devils Hole	T17S-R50E-S36	12-5
C. nevadensis mionectes	Amargosa V. (230)	Big sp.	T17S-R50E-S19	12-5
		Bradford 1,2,3	T18S-R50E-S11	12-5
		Crystal sp.	T17S-850E-S3	12-5
		Fairbanks sp.	T17S-850E-S9	12-5
		Forrest sp.	T18S-R51E-S7	12-5
		Jack Rabbit sp.	T18S-R51E-S18	12-5
		Longstreet sp.	T17S-R50E-S22	12-5
		Point of Rocks sp	T18S-R51E-S7	12-5
		Rogers sp.	T17S-R50E-S15	12-5
		Tubbs sp.	T18S-R50E-S12	12-5
C.n. pectoralis	Amargosa V. (230)	Indian 1,2 sps.	T17S-R50E-S35	12-5
		Marsh sp.	T17S-R50E-S35	12-5
		School sp.	T17S-R50E-S35	12-5
		Scruggs 1,2 sps.	T17S-R50E-S35	12-5
		Collins Ranch sp.	T18S-R50E-S1*	12-5
Rhinichthys osculus nevadensis	Amargosa V. (230)	Amargosa R.	T12S-R47E-S8	11-6
		Big sp.	T17S-R50E-S19	11-6
		Bradford 1,2,3,	T18S-R50E-S11	11-6
		Crystal sp.	T18S-R50E-S3	11-6
		Jack Rabbit sp.	T18S-R50E-S18	11-6
	Oasis V. (228)	Amargosa R.	T103-R47E-S32	10-6

Central Region

The central region of the Interbasin area contains twelve (12) valleys within which five (5) native species are currently distributed. Table 2 shows specific localities of these species and the following narrative follows the order in which they appear.

Crenichthys nevadae: Railroad Valley Springfish

This species has historically been confined to two thermal spring systems, Duckwater 1 and 2 and the system collectively known as Lockes Ranch Springs. The latter is composed of five individual springs. In 1978, personnel from the Bureau of Land Management and the Nevada Department of Wildlife transplanted several animals into Chimney Springs approximately 6 miles south of the Lockes Ranch complex. This population has now established itself and is maintaining good numbers in this habitat. The populations of C. nevadae at Lockes Ranch are currently in excellent condition, and this system supports over 3000 individuals. The presence of Gambusia affinis in the headwaters of Duckwater #1 Spring was confirmed on November 17, 1979. Springfish numbers were apparently reduced since my last visit in early October 1979. Close monitoring of this habitat should be initiated to document population fluctuations, as this is the first recorded exotic introduction into C. nevadae habitat. The population in Duckwater #2 is at this time in good condition. Systematic surveys of Railroad Valley in October of 1979 failed to produce any new locations for this species. The continued development of the existing oil field and the proposed MX missile development in this valley, as well as the recent exotic fish introduction, are the primary concerns for this species.

Empetrichthys latos latos: Pahrump killifish

This is the only surviving species of this genus, of which one other, E. merriami, has become extinct from the adjacent drainage in Ash Meadows, Nye County, Nevada. Two other described subspecies of E. latos known from Pahrump Valley, E.l. pahrump and E.l. concavus, were extirpated in the 1950's by destruction of their spring habitats. E.l. latos was transplanted into ponds at Corn Creek on the Desert Wildlife Refuge, Las Vegas Valley, Nevada, on August 12, 1971, when it became evident that ground water pumping would cause the springs on Manse Ranch to fail. The native population of killifish at Manse Ranch spring was extirpated due to spring failure in August of 1975. Several other transplants were attempted with this species, but only one other (on August 31, 1975, into Shoshone ponds in Spring Valley, Nevada) was successful. Current population estimates in October of 1979 show that the killifish population at Corn Creek is maintaining about 2500 individuals after peak reproduction. The population at Shoshone ponds as of October, 1979, also shows population estimates near 2500.

Proposed deployment of the MX missile in eastern Nevada could pose threats to the Shoshone ponds population, and an unusually high number of Rana catesbeiana at Corn Creek should be monitored to determine possible adverse effects. The listing of this species as endangered in 1967 has helped in preservation efforts; but the maintenance of the animal in totally artificial habitats is less than ideal, and efforts to reestablish it in its native waters should be a top priority in the management of this species.

Gila bicolor euchila: Fish Creek Springs Tui Chub

This subspecies has been restricted to a single cold water spring system in this valley, as recent surveys conducted in 1978 and 1979 found that no other springs in the valley contained native species. The single system is heavily impacted by the cattle ranching operations, and Salmo gairdneri were evident in all the springs except the one remaining locality where the chubs were found. The loss of this animal throughout most of its former distribution in this system, as well as the presence of the introduced trout, should warrant an endangered or threatened status. Rehabilitation and reintroduction of the chub should be considered.

Gila bicolor isolata: Independence Valley Tui Chub

The current status of this subspecies is unknown at this time and field reconnaissance of the habitat should be undertaken. No other collections from Independence Valley are known, and its recommended status is threatened or endangered. The continued alterations of habitat and the MX missile are of primary concern for this species.

Gila bicolor newarkensis: Newark Valley Tui Chub

The original three localities reported by Hubbs and Miller (1974) now contain chubs only at one location: on the Goecoechia Ranch. Surveys conducted by Gail Kobetich (USFWS) and myself in 1978 have produced nine new localities along the eastern escarpment of pluvial Lake Newark. These isolated spring systems are rather small and heavily choked with aquatic plants, and many of the outflows persist for only a few meters. The limited size of the habitats and potential threats of the MX missile deployment in this region of the state, and possible modifications for livestock, warrant that this subspecies be listed as special concern or threatened.

Gila bicolor obesa: Lahontan Creek Tui Chub

This species is known from only two localities in Diamond Valley: Thompson (Birch) Ranch and Sulphur Springs. The chub was reported extirpated from the latter location in 1976 by Jim Deacon (UNLV). He also documented the introduction of bass and carp into this system. The status of the remaining population and the increased pressures exerted on it warrants that the animal be listed as threatened or endangered. The proposed deployment of the MX missile project in this area and the continued development of the habitats for livestock and agricultural purposes are the primary concerns for this species.

Gila bicolor ssp.:

The several undescribed subspecies that inhabit both Hot Creek Valley and Railroad Valley are in need of taxonomic clarification. Those present in Railroad Valley upon examination in October of 1979 showed a wide variation in morphology. Because several of these populations have probably been separated over the last several thousand years, they are probably subspecifically differentiated. Surveys throughout Railroad Valley did not produce any new localities in October of 1979. Chubs at Bull Creek, however, have been extirpated since Deacon's collection in 1977. All the other localities still contained chubs, but habitat alterations and exotic fish introductions were widespread. The MX missile, oil field developments, and pressures from livestock and agricultural demands mandate that more life history information be gathered

on these subspecies to determine the need of listing for their protection.

Relictus solitarius: Relict (Steptoe) Dace

This animal is the only native fish species in the entire region composed of Butte, Goshute, Ruby and Steptoe Valleys. The species as a whole has experienced reduction in localities through most of its range over the past several years as a result of both exotic fish introductions and habitat alterations. The distribution of dace in Butte Valley was checked in the fall of 1979, with the apparent loss of two populations at Stratton Ranch and Wrights Springs. The springs at the former locality were modified into three large stock ponds, and the outflows were heavily utilized by cattle. Wrights Springs have lost most of their discharge, with many of the old channels now being dry. The remaining outflows were heavily polluted by cattle, and collections for many miles produced no speciments. The other locations within Butte Valley contained fair numbers of dace, although the habitats continue to be modified.

The Goshute Valley population at Twin Springs is in good condition, although heavily impacted by cattle. The springs on the Johnson Ranch in the northern extremities of the valley were not surveyed, as the owner would not permit sampling.

The Ruby Valley populations have been the most seriously impacted, with dramatic losses in both numbers and localities. Once the only species in all the expanse of the marsh and associated springs, they have been extirpated from all but a few isolated spring systems. Efforts should be made to protect these sites, as the Ruby Valley form of the dace is very different from those in the other valleys.

The Steptoe Valley populations have also been highly impacted by exotic species and habitat alterations. The Dairy Springs location is represented by a single specimen collected in the fall of 1979. Specimens were not found at four known locations in recent field collections. Local personnel of the Nevada Department of Wildlife examined the Grass Springs locality in 1977-78 and found only 5 springs out of 25 that still contained dace. I found none in the fall of 1979. The Spring Valley populations are considered to be introduced, and those localities collected all had healthy populations.

In summary, this species is experiencing widespread loss of both populations and habitat and stands to be heavily impacted by the proposed MX missile system. Life history studies should be undertaken as soon as possible to establish background information for this animal. In view of the current status of this animal and its habitat, it should be listed as threatened or of special concern.

Rhinichthys osculus lethoporus: Independence Valley Speckled Dace

The subspecies is confined to the single fish-inhabited system in Warm Springs in this Valley. This system, as indicated for Gila bicolor isolata, has been heavily impacted by exotic fish and habitat modifications. The current status of this species is unknown at this time, and habitat surveys as well as life history studies should be initiated.

R.o. oligoporus: Clover Valley Speckled Dace

This subspecies is confined to a single spring system on Wrights Ranch. The status of this animal is unknown, and habitat surveys should be initiated.

R.o. robusta: Lahontan Speckled Dace

This subspecies inhabits several springs within the Pluvial Lake Diamond drainage. It is currently known from only two locations in Diamond Valley, and these populations have been impacted by exotic fish species. The population at Birch Ranch Springs may be extirpated, as collections in 1978 failed to produce any specimens. The populations in Monitor Valley are in excellent condition, and all three localities supported high numbers as of fall, 1979. The three populations present in Ruby Valley are considered to be introduced from the Humboldt drainage. No recommendations are made at this time pending further field collections.

Table 2. Specific localities of native species (ssp.) within the Central Region of the Inter-Basin Area.

Species (ssp.)	Valley (Hydologic #)	Body of Water	Locality	Quad #
Crenichthys nevadae	Railroad V. (173)	Big sp.	T8N-R55E-S15	7-4
		Chimney Sp.	T7N-R55E-S16*	8-4
		Corral sp.	T7N-R55E-S15	7-4
		Duckwater 1,2 sps.	T13N-R56E-S19	7-4
		North sp.	T7N-R55E-S16	7-4
		Reynolds 1,2 sps.	T7N-R55E-S15	7-4
Empetrichthys latos latos	Spring V. (184)	Shoshone ponds	T12N-R67E-S15	7-1
Gila bicolor euchila	Fish Creek V. (155)	Fish Creek sps.	T16N-R63E-S8	6-4
G. b. isolata	Independence V. (188)	Warm Springs	T35-6-R66E-S27	3-2
G. b. newarkensis	Newark V. (154)	unnamed sp.	T22N-R56E	5-4
		unnamed sp.	T22N-R56E	5-4
		Gamma sp.	T23N-R55E-S25	5-4
		unnamed sp.	T23N-R55E-S35	5-4
		unnamed sp.	T22N-R55E-S2	5-4
		unnamed sp.	T22N-R55E-S2	5-4
		Minioletti sps.	T22N-R55E-S2	5-4
		unnamed sps.	T22N-R55E-S11	5-4
		unnamed sp.	T22N-R55E-S34	5-4
		unnamed sp.	T20N-R55E-S22	5-4
		unnamed sp.	T20N-R55E-S23	5-4
G. b. obesa	Diamond V. (153)	Birch Ranch sps.	T23N-R54E-S34[1]	5-4
		Sulphur Sp.	T23N-R52E-S36[1]	5-5
G. b. ssp.	Hot Creek V. (156)	Hot Creek	T4N-R51E	8-5
	Railroad V. (173)	Blue Eagle sps.	T8N-R57E-S1	7-4
		Bull Creek Sps.	T14N-R57E	6-4
		Butterfield Sps.	T8N-R57E-S27	7-4
		Duckwater Creek	T12N-R57E-S27	7-4
Relictus solitarius	Butte V. (178)	Atwood Ranch sps.	T29N-R62E	4-2
		Odgers Creek	T28N-R61E-S2	4-3
		Spring Creek	T26N-R62E-S17	4-2
		Stratton Ranch sps.	T26N-R62E-S15[1]	4-2
		Wrights sps.	T26N-R62E-S16[1]	4-2,3
		unnamed sps.	T28N-R61E-S2	4-3
	Goshute V. (187)	Johnson Ranch sps.	T36N-R66E-S29	3-2
		Twin sps.	T29N-R63E	4-2

Table 2. - continued

Species (ssp.)	Valley (Hydrologic #)	Body of Water	Locality	Quad #
	Ruby V. (176)	Franklin Lake	T29N-R58E	4-3
		Narcissus sps.	T25N-R57E-S2	4-4
		unnamed sp.	T27N-R58E	4-3
		unnamed sp.	T28N-R58E	4-3
	Spring V. (184)	Keegan Ranch sps.	T18N-R66E-S12	5-2
		Shoshone Ponds	T13N-R65E*	7-1
		Spring V. Creek	T23N-R66E-S31	5-2
		Stone House sps.	T22N-R66E-S17	5-2
	Steptoe V. (179)	Cardano Ranch sp.	T25N-R64E-S5	4-2
		Steptoe Ranch sp.	T19N-R63E-S5	5-2
		Grass sps.	T19N-R63E-S20	6-2
		Dairy Ranch sp.	T18N-R64E-S20	6-2
		Ruth Pond	T16N-R62E	6-2
Rhinichthys osculus lethoporus	Independence V. (188)	Warm sps.	T36N-R62E-S20	3-2
R. o. oligoporus	Clover V. (177)	Wright Ranch sps.	T36N-R62E-S20	3-3
R. o. robusta	Diamond V. (153)	Birch Ranch sps.	T23N-R54E	5-5
		Big Shipley sp.	T14N-R52E	5-5
	Moniter V. (140)	Potts Ranch sps.	T14N-R47E-S2	6-6
		Dianas Punch Bowl	T14N-R47E-S22	6-6
		Coils Creek sps.	T22N-R49E	5-5
	Ruby V. (176)	unnamed sp.	T25N-R58E-S7*	4-3
		unnamed sp.	T27N-R58E*	4-3
		unnamed sp.	T26N-R59E*	4-3

1 apparently extirpated
* introduced population

Colorado Region

This region in Nevada contains a diverse native fish fauna that inhabits both river and spring systems. Fishes are currently distributed throughout seven (7) valleys along the central and southeastern margin of the state. Specific commentaries follow the order given in Table 3.

Catostomus latipinnis: Flannelmouth Sucker

This species inhabits portions of the Virgin River along the extreme southeastern portions of the state. Its main distribution in the river occurs in Utah and the Arizona strip, but it is found in reduced numbers in the lower reaches near Mesquite, Nevada. This species has been impacted in recent years by agricultural diversions and habitat modifications. The Virgin River is only one of several systems that this animal is found in, so no recommendations are made at this time.

Crenichthys baileyi: White River Springfish

This species has just been recently designated into several subspecies by Williams and Wilde and will be treated accordingly in this text.

C. baileyi ssp.: Moapa White River Springfish

This subspecies is confined to the headwaters of the Moapa River approximately 9 miles west of Glendale, Nevada. It has experienced several population declines since the introduction of Gambusia affinis in the 1930's and Poecilia mexicana in the early 1960's. Field collections in 1978-79 indicate that they are stabilizing and have increased somewhat since these early periods. The habitats continue to be modified for agricultural purposes, and exotics are presently in high numbers. The continued withdrawal of ground water in this area for power plant usage and the MX missile system may lead to loss of habitat. It is recommended that this species be listed as of special concern.

C. baileyi ssp.: Hiko White River Springfish

This subspecies was known from two locations in Pahranagat Valley, Hiko and Crystal Springs. The former population was extirpated in the 1960's by bass. The remaining population at Crystal Springs has been severly reduced in numbers by the presence of Cichlasoma nigrofasciatum and other exotic species. This species should be listed as of special concern or threatened, and steps to eliminate or control exotics should be initiated.

C.b. baileyi: White River Springfish

This subspecies is confined to Ash Springs, Pahranagat Valley. It is currently being heavily impacted by the presence of exotic species such as Cichlasoma nigrofasciatum and Poecilia mexicana. C.b. baileyi is considered to be rare in this locality as of fall 1979. This subspecies should be considered as endangered and steps taken to rehabilitate the habitat.

C. baileyi ssp.: Preston White River Springfish

This subspecies inhabits those springs in the northern extremity of White River Valley adjacent to Preston and Lund. All of these habitats currently contain one or more exotic fish species and have reduced populations. The proposed deployment of the MX missile in this valley could seriously reduce numbers and/or cause the loss of habitat. It is recommended that this animal

be listed as of special concern or threatened.

C. baileyi ssp.: Mormon White River Springfish

This subspecies is confined to the Mormon Spring and Hot Creek Springs in the southern portion of the White River Valley. The Mormon Spring population is currently the only habitat without exotic fish and is in excellent condition. However, the system is currently being used by livestock and should be monitored to assess the impacts. The population at Hot Creek is in jeopardy as a bass was observed above the fish barriers in October of 1979. Personnel of the Nevada Department of Wildlife were contacted about this matter and steps are being taken to eliminate the exotic. State protection of this habitat has led to increased populations, so no further recommendations are made.

Cyrpinodon diabolis: Devils Hole pupfish

This species is currently being maintained in an artificial habitat below Hoover Dam. The population has experienced a steady decline over the past several years and is maintaining only about 60 individuals. Plans are currently underway to rehabilitate this habitat in an effort to stimulate population increases.

Empetrichthys latos latos: Pharump killifish

This is one of two populations of the killifish that is currently being maintained outside of its native drainage. This species as well as all other members of the genus have been exterminated in their natural habitats. Population estimates at Corn Creek in October, 1979, indicate that there are approximately 2500 fish present in the three ponds. There are an unusual number of Rana catesbeiana in this system, and measures should be taken to control them and assess their influence on the killifish. Attempts should be made to reintroduce this species back into its natural habitat.

Gila robusta jordani: Pahranagat Roundtail

This subspecies is currently confined to a small section of stream below the outflow of Crystal Springs. The animal is extremely rare, with less than 500 individuals still surviving. The habitat has been reduced in recent years, and there are a large number of exotics in the remaining habitat. Life history studies are currently underway at the University of Nevada at Las Vegas and by personnel in the Nevada Department of Wildlife. Establishment of a refuge and the purchase of the remaining habitat are top priorities. Failure to take appropriate action in the immediate future could lead to the extinction of this subspecies.

G.r. seminuda: Virgin River Roundtail

The subspecies is found throughout the Virgin River, although only sporadically abundant. Collections over the past several years indicate a need for deep pool habitats in this river system. Serious threats are being imposed by the development of the Allan-Warner Valley water project, desalinization plants, and agricultural diversions. This subspecies should be listed as threatened and further studies undertaken to determine its life history.

G.r. ssp.: Moapa River Roundtail

This undescribed subspecies in the Moapa River has received little attention from investigators other than noting its occurrence in this river. The

status at this time is unknown, and studies should be undertaken to determine its abundance and distribution.

Lepidomeda albivallis: White River Spinedace

The spinedace is confined to several springs in the vicinity of Preston and Lund. Their population status is unknown at this time, although collections made in October of 1979 produced very few individuals. It is considered rare in all habitats. Exotics are widespread in all springs and are undoubtedly responsible for their reduced numbers. The deployment of the MX missile in this valley poses a serious threat to this species. In view of the low numbers throughout its entire rante, it should be listed as threatened or endangered.

Lepidomeda mollispinis pratensis: Panaca Spinedace

This subspecies was thought to be extinct until personnel from the Nevada Department of Wildlife found a few individuals in Condor Canyon in late 1978. Efforts should be made to establish a refugium for this subspecies and have it listed as endangered. Little or nothing is known of the life history of this animal, and field observations should be undertaken to establish needed information.

Lepidomeda m. mollispinis: Virgin River Spinedace

The spinedace in the Virgin River is found mainly in those reaches of the river in Utah and Arizona. Lepidomeda (as does Gila robusta seminuda) prefers deeper water and apparently orients below clear water inflows of the tributaties. The animal is not considered too abundant although a few instances are known where large numbers of specimens were collected. The same general threats as those listed under G.r. seminuda apply here.

Moapa coriacea: Moapa dace

This species is confined to the first two miles of the headwaters of the Moapa River. It has experienced severe decline in numbers over the past several years as a result of exotic fish introductions and habitat alterations. Recently a refuge was established in the headwaters, and efforts to reintroduce the fish are underway. Life history studies are underway at the University of Nevada at Las Vegas and should be completed in the spring of 1980. Serious threats are posed by the MX missile project and the continued use of water for agricultural and industrial purposes.

Pantosteous clarki: Desert Sucker

This animal is currently very rare in all habitats in the White River Valley and is in serious danger of extinction in this area due to exotic fishes and loss of habitat. The populations in the Meadow Valley Wash area are of unknown status, and field work is needed in order to make any further determinations. The sucker is not extremely common in the Virgin River and is most abundant in those reaches in Utah and Arizona. Further studies are needed on this animal in view of the threats present to all of its habitats. Special concern or threatened status is recommended.

Plagopterus argentissimus: Woundfin

This species continues to hold out in the face of major habitat alterations

and water diversions. Field surveys conducted in 1979 indicate poor reproduction in the upper river reaches of Utah. In fact, collections made in December over several miles of river produced a total of only 13 specimens. Collection in October in the same area resulted in only 38 specimens. Other native species were common in October but rare in the December collections. Habitat partitioning studies for the Virgin River will be concluded in the spring of 1980, and food habits are currently being studied. It is recommended that intensive field surveys be conducted this spring to determine if the December collections were aberrant or indicative of the entire system. The river is currently facing major modifications from a desalinization plant, Allan-Warner Valley water project, and agricultural and domestic water diversions.

Rhinichthys osculus moapae: Moapa River Speckled Dace

This subspecies occurs along the mid-reaches of the Moapa River and has never been taken in any quantity. Little is known about the life history of this subspecies, and work should be undertaken as threats to the system could lead to serious decline or extirpation. It is further recommended that this subspecies be listed as threatened or of special concern. Field studies should be initiated to assess current distribution and population status.

R.o. velifer: White River Speckled Dace

The current status of the Pahranagat population is unknown at this time, and field work is needed to assess population abundance and distribution. The White River Valley populations are in reduced numbers from exotic fish interactions and/or loss and modification of habitats. The MX missile deployment in this valley poses serious threats to the continued existence of the subspecies, and it is recommended that it be listed as threatened or endangered.

R.o. yarrowi: Virgin River Speckled Dace

This subspecies is doing quite well in the Virgin River along its entire length. However, the current threats to the Virgin River system could lead to serious declines. No recommendations are made at this time.

R.o. ssp.: Meadow Valley Speckled Dace

There is very little known about the distribution or abundance of this subspecies, and field work should be undertaken in order to assess its status. No recommendations are made at this time.

Table 3. Specific localities of native species (ssp.) within the Colorado Region of the Inter-Basin Area

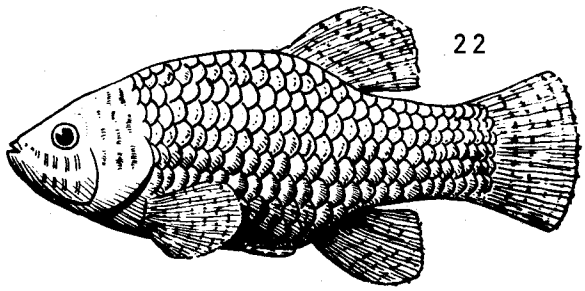
Species (ssp.)	Valley (Hydrologic #)	Body of Water	Locality	Quad #
Catostomus latipinnis	Virgin V. (222)	Virgin R.	T13S-R69-71E	11-1
Crenichthys baileyi	Moapa V. (219)	Apcar sp.	T14S-R65E-S16	11-2
		Big sp.	T14S-R65E-S16	11-2
		Cal-Neva sp.	T14S-R65E-S9	11-2
		Iversen sps.	T14S-R65E-S16	11-2
		Moapa R.	T14-16S-R65-68E	11-2
		MVWD sps.[1]	T14S-R65E-S16	11-2
		Oasis sps.	T14S-R65E-S16	11-2
		6 unnamed sps.	T14S-R65E-S16	11-2
	Pahranagat V. (209)	Ash sp.	T6S-R60E-S6	10-3
		Crystal sp.	T5S-R60E-S9	9-3
	White River V. (207)	Arnoldsen sp.	T12N-R61E-S2	7-3
		Cold sp.	T12N-R61E-S12	7-3
		Hot Creek sp.	T6N-R61E-S17	8-3
		Indian sp.	T12N-R61E-S2	7-3
		Lund Town sp.	T11N-R61E-S34	7-3,4
		Moon Ranch sp.	T6N-R60E-S25	8-3
		Mormon sp.	T9N-R61E-S31	7-3
		Nicholas sp.	T12N-R61E-S12	7-3
		Preston Big sp.	T12N-R61E-S2	7-3
		Preston Town sp.	T12N-R61E-S12	7-3
Cyprinodon diabolis	Colorado River V. (213)	Hoover Dam Refugium*	T22S-R65E	12-2
Empetrichthys latos latos	Las Vegas V. (212)	Corn Creek[2]*	T17S-R59E-S34	12-3
Gila robusta jordani	Pahranagat V. (209)	Ash sp.	T6S-R60E-S6	10-3
G.r. seminuda	Virgin V. (222)	Virgin R.	T13S-R69-71E	11-1
G.r. ssp.	Moapa V. (219)	Moapa R.	T14-16S-R65-68E	11-2,1
Lepidomeda albivallis	White River V. (207)	Arnoldsen sp.	T12N-61E-S2	7-3
		Cold sp.	T12N-R61E-S12	7-3
		Lund Town sp.	T11N-R61E-S34	7-3
		Nicholas sp.	T12N-61E-S12	7-3
L. mollispinis pratensis	Panaca V. (203)	Meadow Valley Wash[3]	T1S-R68E	9-1
L. m. mollispinis	Virgin V. (222)	Virgin R.	T13S-R69-71E	11-1
Moapa coriacea	Moapa V. (219)	Apcar sp.	T14S-R65E-S16	11-2
		Big sp.	T14S-R65E-S16	11-2
		Moapa R.	T14-16S-R65-68E	11-2

Table 3. - continued

Species (ssp.)	Valley (Hyrdologic #)	Body of Water	Locality	Quad No.
		MVWD sp.	T14S-R65E-S16	11-2
		unnamed sp.	T14S-R65E-S16	11-2
		unnamed sp.	T14S-R65E-S16	11-2
Pantosteus clarki delphinus	Panaca V. (203)	Meadow Valley Wash	T4-12S-R66-67E	9-1
	Meadow Valley Wash (205)	Meadow Valley Wash	T4-12S-R66-67E	9-1
	Virgin V. (222)	Virgin R.	T13S-R69-71E	11-1
P. c. intermedius	White River V. (207)	Arnoldsen sp.	T12N-R61E-S12	7-3
		Lund Town sp.	T11N-R61E-S34	7-3
		Preston Big sp.	T12N-R61E-S2	7-3
Plagopterus argentissimus	Virgin V. (222)	Virgin R.	T13S-R69E-71E	11-1
Rhinichthys osculus moapae	Moapa V. (219)	Moapa R.	T14-16S-R65-68E	11-2
R.o. velifer	Pahranagat V. (209)	Ash sp.	T6S-R60E-S6	10-3
		Crystal sp.	T5S-R60E-S9	9-3
		unnamed sp.	T8S-R62E-S32	10-3
	White River V. (207)	Lund Town sp.	T11N-R65E-S34	7-3
		Preston Big sp.	T12N-R61E-S2	7-3
R.o. yarrowi	Virgin V. (222)	Virgin R.	T13S-R69-71E	11-1
R.o. ssp.	Meadow Valley Wash (205)	Meadow Valley Wash	T4-12S-R66-67E	9-1

1 Moapa Valley Water District
2 Desert National Wildlife Refuge
* introduced
3 May be extinct

Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"

407 West Line Street
Bishop, California 93514

May 11, 1979

To: All Persons and Agencies Concerned

From: Chairman, Death Valley System Committee

Subject: Sixth Annual Meeting, Death Valley Area Committee

Subject meeting was held at the National Park Service Auditorium, Furnace Creek, on February 22, 1979 with 35 in attendance (list attached). The following agenda items were discussed:

1. Big Spring management and land acquisition. Bob Love reported that little has been done with the 80 acres currently owned by The Nature Conservancy. They have bought fence posts, but need fencing material and volunteer help to install it. Steve McCormick indicated that the Conservancy has an option to purchase 317 acres at $700 per acre, but they need $224,000 by May 31, plus $20,000 in endowment funds for stipends, etc. BLM and the Fish and Wildlife Service are interested in this land, too, but they are also experiencing funding problems. It is hoped that the land can either be bought or tied up even partially to preserve the essential Big Spring habitat. The Conservancy is currently engaged in an extensive fund raising project for Big Spring.

2. Resolutions enacted at 1978 symposium. Four resolutions were passed by the Council at the 1978 symposium: 78-1 relative to the Colorado squawfish (Ptychocheilus lucius), 78-2 relative to current administrative restrictions affecting the California Department of Fish and Game, 78-3 relative to the transplantation of animals and plants, and 78-4 relative to the restoration of San Simon Ciénaga. All resolutions have been completed and disseminated as directed by the assembled membership in Las Cruces,N.M.

3. Status of Gambusia affinis at Scotty's Castle. Phil Pister and Darrell Wong of California Fish and Game reported that two efforts in 1978 (June and August) using Antimycin and rotenone were unsuccessful in eradicating the Gambusia population. Another attempt is planned for June, 1979.

4. Proposed meeting at University of Nuevo León, Monterrey. Most recent thinking is that the proposed meeting of the Council in México would best be held in conjunction with the Chihuahuan Desert Symposium scheduled to be held in the fall of 1980. Dr. Salvador Contreras B. of the University of Nuevo León is considering this proposal and will notify the executive committee of his feelings at an early date. The idea of meeting during Easter week in 1979 has been abandoned.

5. Current status of the Railroad Valley springfish, Crenichthys nevadae. Kurt Ballantyne of BLM (recently transferred from Tonopah to Elko) provided the following report:

On October 25, 1978 personnel from the Nevada Department of Fish and Game and the Bureau of Land Management executed the final step in implementing the endemic fisheries recommendations and proposals, as identified under the existing cooperative habitat management plan for the Railroad Valley Wildlife Management Area.

The Railroad Valley springfish (Crenichthys nevadae), still classified as "rare" by the Nevada Department of Fish and Game, was transplanted from Big Springs at Lockes Ranch to the artificially created habitat at Chimney Springs just seven miles to the south.

With the use of a dip net and plastic bucket, approximately 100 Railroad Valley springfish of varying size and coloration were caught and immediately transported to Chimney Springs. Some minor ditch maintenance was performed prior to introduction in order to raise the temperature of the first three interconnecting ponds to more closely match that of the water obtained at Big Springs.

Upon introduction, all fish dispersed within the first pond, with no immediate mortality observed. Within two hours fish were observed in both the first and second ponds. Subsequent observations have indicated that the springfish are doing well but seem to utilize the first pond almost exclusively.

Under the proposed revision of the Railroad Valley Habitat Management Plan, still in draft form, continued monitoring of species and habitat conditions at Chimney Spring has been recommended. Also, as supported by this Council, the Bureau of Land Management through the Habitat Management Plan process has identified the opportunity for acquisition of the crucial habitat of the Railroad Valley springfish that exists on private land at Lockes Ranch.

6. Status of the Ash Meadows land acquisition. Tasker Edmiston reported that Senator Alan Cranston of California has introduced a new bill (S42), which is similar to another bill which will be introduced into the House. The problem is to get these bills to hearing, and concerted efforts to do so must be exerted by all concerned. This effort will, as usual, be spearheaded by the Edmistons. They need our help.

7. Status of the Death Valley System fishes:

Note: Meetings of the Pahrump killifish, Devils Hole pupfish, and Warm Springs pupfish recovery teams were held in Las Vegas on April 3. Material concerning these three fishes has been updated accordingly.

a. Pahrump killifish, Empetrichthys latos.

Gail Kobetich and Thom Hardy reported that the population in Corn Creek is in excellent condition, although the bullfrog population continues to pose a threat. Two days of trapping produced over 1,500 tadpoles in the main pond alone. Measures for their control should be implemented. The population at Shoshone Ponds is stable, and a census will be conducted in the spring. A Pahrump killifish recovery plan draft has been prepared by the recovery team and is currently being reviewed. The possible acquisition and restoration of Manse Spring was discussed at length during the meeting.

b. Devils Hole pupfish, Cyprinodon diabolis.

The water level at Devils Hole continues to rise since the cutback in ranching operations in Ash Meadows, and the pupfish population has responded with an overall increase in numbers. Presently, the winter counts are following the yearly cycle of decline, and the population at this time (February) is established at 263. The water level for Devils Hole established by the courts is 2.70. A draft Devils Hole pupfish recovery plan has been completed by the recovery team and is currently being reviewed.

c. Ash Meadows speckled dace, Rhinichthys osculus nevadensis; Owens dace, Rhinichthys osculus subsp; Rhinichthys osculus subsp., Amargosa River near Beatty, Nevada; and Rhinichthys osculus subsp., Amargosa Gorge, below Tecopa.

Thom Hardy is currently studying the Death Valley System dace populations to settle the question of subspecific status. Also, the proposed surveys of Ash Meadows will be helpful in determining the status of that population.

d. Ash Meadows pupfish, Cyprinodon nevadensis mionectes.

The current status of this subspecies is considered stable, and systematic surveys of the Ash Meadows area are scheduled to begin in March. A general status report of all Ash Meadows fishes will be forthcoming at its completion.

e. Warm Springs pupfish, Cyprinodon nevadensis pectoralis.

The status of this fish is considered to be stable at this time. The recovery plan, initially signed by the Fish and Wildlife Service in 1976, has been revised to correct a number of errors and to add a photograph on the frontispiece. Additional information concerning the recovery plan may best be obtained from Team Leader Jim Yoakum at the BLM Nevada State Office. Several springs containing the subspecies are scheduled for chemical treatment to eradicate Gambusia affinis, after which reinvasion barriers will be constructed.

f. Owens chub, Gila bicolor snyderi.

Habitat conditions remain unchanged for the Owens chub, but more life history information is needed to allow for its preservation. Plans to hire a graduate student to conduct a life history study beginning in 1978 were unsuccessful, but this avenue will be pursued further. A general population assessment is planned for late May, 1979.

g. Mohave chub, Gila bicolor mohavensis.

A Habitat Management Plan was completed for the Mohave chub at Fort Soda, the primary refugium. The proposed implementation schedule includes dredging and modification of the pond habitat, re-establishment of food chain and chubs, installation of water level markers, thermographs, recirculating and backup pumps, and posting. The lower portion of Piute Springs has silted in, and no fish were seen. However, they may be in the upper end. In addition, none were seen this year at Lark Seep Lagoon on the China Lake Naval Weapons Center. Sixteen Mohave chubs were introduced into a 100'x100'x30" refugium at the Desert Research Center near Hinckley. They are doing well, and more plants are planned. No other introductions in southern California are known to be successful.

h. Owens pupfish, Cyprinodon radiosus.

The Owens pupfish remains in real trouble, primarily as a result of a stalemate in our efforts to acquire the remaining privately held land (202 acres) in Fish Slough, which is located less than a mile from the Owens Valley Native Fish Sanctuary and the type locality of the species. BLM statewide work priorities have stalled the land exchange process which was implemented last summer, and efforts are being made to revive it. Appraisals of the land are now being made by both the landowner and the University of California's Natural Land and Water Reserves System, which is the lead agency in the acquisition process. Several options still exist here, but the landowner is becoming impatient with the inevitable bureaucratic delays and threatens to begin development, either alfalfa production or subdivision. To add to the gloom here, the Warm Springs population has been completely eradicated by a crayfish (Procambarus clarki) explosion. Plans are to eradicate the crayfish with Baytex in late May and to re-introduce C. radiosus from Fish Slough.

i. Tecopa pupfish, Cyprinodon nevadensis calidae.

A survey last fall by California Fish and Game personnel revealed small numbers of pupfish in two feeder springs previously identified as C. n. calidae habitat. This area had been surveyed in 1977 and found devoid of pupfish. Taxonomic analyses were inconclusive because of limited sample size; however, the characteristics of the fish were within the published limits for this subspecies. Future plans call for the collection of breeding stock for rearing sufficient numbers to allow taxonomic analysis.

j. Cottonball Marsh pupfish, Cyprinodon milleri.

This species remains in stable condition in its isolated location in Death Valley. This isolation may be increased if that portion of the Monument is classified as wilderness.

k. Saratoga Springs pupfish, Cyprinodon nevadensis nevadensis.

This subspecies remains in stable condition, with no change during the past year. Salt cedar removal continues in that area. Jerry Landye reported the presence of the snail Melanoides sp. in Saratoga Springs.

l. Amargosa pupfish, Cyprinodon nevadensis amargosae.

This subspecies remains in stable condition, with no change during the past year.

m. Salt Creek pupfish, Cyprinodon salinus.

This species remains in stable condition. The boardwalk interpretive facility continues to be very popular.

n. Owens sucker, Catostomus fumeiventris.

This species remains abundant and stable, especially in the northern portion of its range in the area of Long Valley Reservoir (Crowley Lake).

o. Desert pupfish, Cyprinodon macularius.

Glen Black, California's biologist for Imperial County, reported that 14 exotic species are now found throughout the former range of the species. Sailfin mollies were found to comprise between 70-99% within the populations sampled, with an overall mean of about 75%. Pupfish constituted between 1% and 7% of the various populations. Because of the dramatic decline in the overall status of desert pupfish, Dr. Dave Soltz of Cal. State Los Angeles proposed to the Fish and Wildlife Service in December, 1978 that it be listed as endangered. Two refugia in Anza-Borrego Desert State Park have been successful to date (although they are endangered by flash flooding). The best habitats and populations are found in the areas of San Felipe Creek and San Sebastian Marsh, and a resolution was sent to the California State Director of BLM requesting that a management plan for these key areas be drafted and implemented.

8. Other items discussed.

a. Proceedings of the 1978 symposium are largely completed, with a few Spanish abstracts yet to be sent in. Various publishing sources are being investigated, with the most promising being U.N. Las Vegas. Steve Prchal of the Arizona-Sonora Desert Museum has encountered some unforeseen problems in this respect, so this possibility now appears less likely.

b. A letter directed in 1978 to Assistant Interior Secretary Herbst requesting that funds be made available through the National Heritage Program to assist in maintaining the level of Mono Lake for some reason was never received by the Regional Assistant Director, James R. Mills. Mr. Mills suggested that the letter be resubmitted for his review and action. Mr. Mills pointed out that the budget of the National Heritage Program has been severely reduced, and funds are currently unavailable.

c. The Council's attorney has filed for tax exemption with both state and federal tax agencies. We should have a determination by the November symposium.

d. Jerry Landye reported that he has found 16 endemic snails within Death Valley National Monument.

e. The group was reminded that the Eleventh Annual Symposium will be held at National Park Service Headquarters, Furnace Creek, on November 15-16, 1979. Furnace Creek Ranch has set aside a block of rooms for our use. Further details on the meeting will be forthcoming during the early summer of 1979.

E. P. Pister, Chairman
Death Valley Area Committee

Death Valley Committee Meeting
Furnace Creek, February 22, 1979

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Cyprinodon radiosus update

The Warm Springs refugium was treated on May 17 and 18, 1979 to eradicate both *Gambusia affinis* and *Procambarus clarki* which probably had been responsible for extirpation of the existing pupfish population. The 255 *C. radiosus* reintroduced on June 7 had increased to several thousand by late fall, 1979. *Gambusia* have been completely eradicated, but crayfish are still present.

Explosives were used to reflood the original Owens pupfish "rediscovery" area in Fish Slough on September 5, 1979, resulting in the creation of approximately three acres of ideal pupfish habitat. A total of 561 *C. radiosus* were introduced in September and October. Inspections and further introductions of pupfish will be conducted in 1980.

Area Coordinator Report: Oregon Lakes

Neil B. Armantrout and Jack E. Williams

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Abstract--During 1979 extensive collecting was completed in the Alvord, Chewaucan, Goose Lake, Klamath, northern Lahontan and Warner Basins. Native fishes were found to be in generally good condition except for the Alvord cutthroat, Salmo clarki subsp., which appears to be extinct. New populations of Gila alvordensis, Gila bicolor, and Salmo sp. were located. Management plans are being developed for some of the sensitive species. Uranium development in the McDermitt area and geothermal development in the Alvord Basin are beginning and may pose future problems for the native fishes in those basins.

Abstracto--Durante 1979 colecciónes extensivas fueron hechas en los valles de Alvord, Chewaucan, Goose Lake, Klamath, norte Lahontan y Warner. Los peces indigenos fueron en general encontrados en buenas condiciónes menos por la garganta cortada Salmo clarki subespecie la cual parece estar extinta. Nuevas poblaciónes de Gila alvordensis, Gila bicolor y Salmo especie fueron localizadas. Planes de manejo estan siendo desarrollados para algunas de las especies mas sensitivas. El desarrollo de uranio en la región de McDermitt y desarrollo de energía de agua caliente en el valle de Alvord ha empezado y puede que dea problemas en el futuro para los peces indigenos en esos valles.

BASIN REPORT: OREGON LAKES

DESERT FISHES COUNCIL

1979

Neil B Armantrout
Jack Williams

1. RESEARCH/INVENTORIES

Jim Long completed a survey for the U.S. Forest Service in the Goose Lake, Klamath and Chewaucan Basins. Results:

A. Pit Sculpin, Cottus pitensis was found in Cottonwood Creek and Drews Creek. Drews Creek is a new location. A second historical location now lacks fish as a result of habitat deterioration from grazing.

B. Bull Trout, Salvelinus confluentus. Found in five locations, three being new. All were found together with redband and brown trout in water less than 11°C.

C. California Roach, Hesperoleucus symmetricus. Still extant in Goose Lake Basin, where it was found in Drews Creek.

D. Redband Trout, Salmo sp. Many pure populations found in Chewaucan drainage; a few fish found in Klamath drainage.

Investigations on the spawning and early life history of the Warner Sucker, Catostomus warnerensis, were conducted by Candia Coombs and Susan Drohan for the U.S. Fish and Wildlife Service during spring and summer, 1979. Three hundred adult, one and two year Warner suckers were captured and released in Honey, Snyder and Twelvemile Creek, and in a canal north of Hart Lake. Large numbers of postlarval suckers was also found in the creeks.

Jack Williams, OSU, has been conducting a two-year survey of fishes in the Sheldon Antelope Refuge of Northern Nevada and Oregon. The Refuge contains portions of the Alvord, Guano, Long Valley and Summit Basins. A new Tui chub, Gila bicolor subsp., was discovered in Guano Valley and is currently being described by Jack Williams and Carl Bond. Several new populations of the Alvord chub, Gila alvordensis, have been found, bringing the total populations to 11. All are doing well except those in One Thousand Creek Spring, where the Gila has been replaced by guppies; and in Griddlie Spring, where numbers are quite low. One new population of about fifty fish is restricted to a spring 2M x 3M x 50 cm.

The Borax Lake Chub is being named Gila boraxobius in a paper by Jack Williams and Carl Bond now in press. Jack Williams and Kevin Howe completed an environmental assessment of the Borax Lake area for the Boise office of the U.S. Fish and Wildlife Service.

All populations of the native Alvord cutthroat trout, Salmo Clarki sbsp., have become hybridized and the subspecies may be extinct. The subspecies in Willow and Whitehorse Creeks, considered by Dr. Robert Behnke to be a separate subspecies, continues to maintain itself.

Dave Hohlers, working for the Bureau of Land Management, completed an inventory of the Jenny Creek sucker. He found the sucker fairly widespread but in limited numbers. Conversations with Dr. Carl Bond indicate the sucker is a dwarf form of one of the Klamath Lake suckers and would be at most a new subspecies.

2. MANAGEMENT

Uranium has been discovered in the McDermitt Drainage in southeastern Oregon and Nevada. Considerable exploratory activity has taken place. At present the level of future activity is unclear, but it is probably that mining and perhaps milling will being within 1-3 years. Several organizations, including state agencies and BLM, conducted inventories in the area. Native cutthroat trout, once found in suitable habitat in the area, appear to have all become hybridized with rainbow trout. Inventories found hybrids in McDermitt, King, and Oregon Canyon among others.

BLM has been conducting extensive inventories through the area as part of the grazing ES effort. Habitat Management Plans (HMPs) will be prepared for public lands associated with the Warner Lakes and Borax Lake as part of the planning effort.

The Borax Lake area was earlier opened for geothermal leasing, but none of the bidders met the minimum bid and the offering was withdrawn. The bidding scale has since been revised, and the area will probably be opened to geothermal bidding again, as early as January. Permit requests have been processed for exploratory drilling within one mile of Borax Lake by companies wishing to assess the potential prior to the offering.

BLM is completing paper work on a proposed land exchange which would give BLM control over essentially all perennial fish habitat is the Willow and Whitehorse systems. Final disposition will probably be made in 3-4 months. An HMP was prepared for the drainages several years ago, but will be updated and completed during the current fiscal year.

During inventories by the Boise District, BLM, in the Owyhee drainage, many new populations of redband trout were found. Electrophoretic studies are being conducted by Pacific Fisheries Research in Seattle. Morphometric studies may also be done. A dace and a sculpin, both of which were sent to Dr. Carl Bond, may prove to be new forms.

3. PUBLICATIONS

Two publications appeared during 1979 which may be of interest:

A. "Managing Riparian Ecosystems (Zones) for Fish and Wildlife in Eastern Oregon and Eastern Washington" by the Riparian Habitat Subcommittee of the Oregon/Washington Interagency Wildlife Committee.

B. "Wildlife Habitats in Managed Rangelands: the Great Basin of Southeastern Oregon," published by the Bureau of Land Management and U.S. Forest Service. The publication is being issued as individual chapters which stand alone or which can be combined with the other chapters into a single volume.

Sonora Desert - Mexico

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The coordinator is only able to report on one major activity concerning the fishes in this area. A survey of the fish fauna of the Rio Yaqui basin was conducted in spring-summer 1978 under funding from the U.S. Fish & Wildlife Service, Office of Endangered Species, Albuquerque. Field work was performed by personnel from that office, the Department of Zoology, Arizona State University, and the Museum of Zoology, University of Michigan. A 151-page report (Hendrickson et al. 1979)[1] is complete and is now under revision and is intended for publication by the USFWS, Albuquerque as an Endangered Species Special Publication.

[1]Hendrickson, D. A., W. L. Minckley, R. R. Miller, D. J. Siebert, and P. L. Haddock. 1979. Fishes of the Rio Yaqui, Mexico and United States. 151 pp.

Desierto de Sonora - Mexico

El coordinador solo puede proveer informe sobre una actividad mayor que se trata de los peces de este area. Una investigación de la fauna ictica de la cuenca del Rio Yaqui se llevó a cabo durante primavera - verano de 1978 con fondos del servicio de Pesca y Fauna Silvestre de los Estados Unidos, Oficina de Especies Enpeligradas, Albuquerque, Neuvo Mexico. Personas de esa oficina, el Departamento de Zoología de la Universidad Estatal de Arizona y el Museo de Zoología de la Universidad de Michigan hicieron los trbajos del campo. Un informe de 151 paginas (Hendrickson et al. 1979)[1] se ha completado y está en revisión para publicación como Monografía de la Academía de Ciencia de Arizona y Nevada.

UPDATE ON SOME OF THE PROTECTED AND ENDANGERED FISHES OF TEXAS

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Although the last two fishes in this report do not actually occur in the desert, it was felt that their problems and the efforts to assure their survival would be of interest to this group.

Notropis simus (Bluntnose Shiner) still appears to be extinct. It has not been reported in its natural range, the Rio Grande drainage, for many years and the records for N. simus in New Mexico are from areas that now have reduced flow or are dry. Trevino Robinson (1959) did not find it in the lower Rio Grande drainage although this is the area of most previous records. Over the last two years our efforts to locate this species have been concentrated on the Rio Grande from near Fort Hancock, Texas to immediately downstream from Amistad Reservoir and we have been unsuccessful. The lower Rio Grande valley may warrant another look, but we are not very optimistic, as this area has been greatly impacted by human exploitation.

Cyprinodon eximius (Concho River Pupfish) was recently reported extinct at two locations in its range, the Devil's River and one of its tributaries, Dolan Creek (Harrell, 1978). Subsequently, J. Davis located a small number of the pupfish in the Devil's River location (Davis, 1980). In March of 1979 we surveyed the portion of the Devil's River where C. eximius had been reported and found low numbers in a few scattered locations. The population decline is probably linked to the filling of Amistad reservoir a few years ago which resulted in habitat alteration in this segment of the Devil's River, particularly by inundating many of the side pools and spring runs. The loss of the species at Dolan Creek, on the other hand, seems to have been complete. Floods and/or campground development (and alleged rotenone treatment) have been suggested causal factors. Observations during our May 1979 visit would tend to discount any impacts by campground development. The declining populations in the Devil's River along with the apparently normal habitat in Dolan Creek led to the decision to move several C. eximius from the river to the creek in the hopes of reestablishing that population. The relocation was accomplished in May, 1979 by moving approximately 200 individuals from the Poffard's Crossing area of the Devil's River to Dolan Creek. The Dolan Creek populations will be checked this spring (1980) in order to assure that the pupfish overwintered.

As Dr. Hubbs reported at last year's meeting (Hubbs, 1980) Cyprinodon bovinus (Leon Springs Pupfish) appears to be clear of its problem of hybridization with C. variegatus, that is, until someone throws some more C. variegatus into Leon Creek.

Gambusia gaigei (Big Bend Mosquitofish) seems to be doing well in its type locality. The National Park Service increased the water flow through the refugium pool and that population is thriving. The overflow ditch now also has a

healthy population that was recently spread to adjacent pools by a late 1979 flood. This past summer both "insurance" stocks were lost at almost the same time. We are not certain what caused the die-off of our stock at U.T., but Buddy Jensen reports that their stock at the Dexter National Fish Hatchery was apparently out competed by Cyprinodon elegans. (That's a switch!) The Dexter stock is now back in good shape after being replenished from the Big Bend population.

Anthony Echelle recently completed a survey for The Bureau of Reclamation of Gambusia nobilis (Pecos Mosquitofish) populations in Texas and New Mexico. He reports that the species is doing quite well at most locations.

Gambusia heterochir (Clear Creek Mosquitofish) recently had its survival odds improved a bit. This fish is endemic to Clear Creek, Menard County, Texas. its existence was first reported by Hubbs (1957). No doubt, it originally occurred throughout Clear Creek, but irrigation damming and the subsequent change from fast flowing, stenothermal to sluggish, eurythermal habitat allowed G. affinis to replace it throughout much of its range (Hubbs, 1957). G. heterochir is now restricted to the impounded headspring pool with G. affinis immediately below the dam. This earth and stone dam dates back at least as far as the 1880's and may go back as far as the time of the first Spanish settlers in the area. Consequently, the dam has fallen down in several places allowing movement of G. affinis into the headsprings. The resulting hybrid swarm was first reported by Hubbs (1957) and he felt that as the dam continued to deteriorate the increased hybridization might endanger the existence of G. heterochir. With the aid of a grant from the Fish and Wildlife Service, we were able to repair the dam in August, 1979. Ideally, the next step will be to acquire land along the creek, remove all the dams and restore the natural balance. I am happy to report that representatives from the Fish and Wildlife Service will soon be meeting with some of the owners to discuss this possibility.

Gambusia georgei (San Marcos Mosquitofish) is one of the many organisms endemic to the San Marcos River in Texas. For several years it has been feared extinct because of unsuccessful attempts to collect it. However, this summer Edie Marsh and Bob Edwards, with the aid of a Fish and Wildlife Service grant, were able to collect 19 specimens and they have retained six adults in the lab in order to establish a breeding population. They are also trying to find out the habitat requirements of the species and determine what happened to the San Marcos River that knocked the population to such a low level.

The Rio Grande Fishes Recovery Team plans to have a draft of the recovery plan for Gambusia heterochir out for technical review in two to three months with two other recovery plans to follow shortly thereafter.

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AREA COORDINATION REPORT ON UPPER COLORADO RIVER
BY BILL MILLER, FWS, SALT LAKE CITY, UTAH

Tom Lytle did not make the trip and Charlie Haynes from Colorado held a vote with the Upper Colorado River representatives to see who would fill in and I was voted in. I was out of the room at the time of the vote which I'm sure influenced my selection.

I have some good news and bad news to report on the endangered fishery work in the Upper Basin.

First the bad news - King energy and water development projects are going full steam ahead. With coal, oil shale, increased hydro power, we are looking at massive calls for Colorado River Water. There is a definite possibility of seeing a dry Green River if all developments proceed which are being planned.

Also, the FWS, or I should say the Department of Interior, and the States of Colorado and Utah are in a law suit concerning the Endangered Species Act where we, the FWS, are charged with carrying out programs contrary to the ESA.

The good news is that we have a number of people and agencies getting involved and looking at the endangered Colorado River fishes. Both Colorado and Utah are becoming involved with research on the endangered Colorado River fishes. We have Kent Miller (no relative) here from Utah who is the new Colorado River Fishes Recovery Team Leader. He is the non-game aquatic specialist in Utah's new non-game section. We also have Charlie Haynes, who I mentioned before here, who is in the Colorado DOW Research Division, and was just put on non-game fishery research this summer. So, you see the states are getting very active in Upper Basin work.

The Bureau of Reclamation, National Park Service, Fish and Wildlife Service, and Universities are also now getting more active in working with the endemic Colorado River fishes.

Things we are doing in the Upper Basin include:

1. Habitat requirement work - FWS and states
2. Instream Flow Requirements (FWS, BR)
3. Habitat trends (river monitoring-(States)
4. Hatchery-lab controlled experimental work (FWS, contracts)
5. Larvae fish work (State of Colorado, Colorado State U.)
6. Gila speciation work (FWS, and University people).
7. Flaming Gorge Penstock Modification analysis (BR contract with Bio/West)

We do not have the ability on the Colorado River endangered fish to acquire habitat such as Phil has described doing for some of the desert pup fish. With over 600 miles of river to be concerned with acquisition is out of the question. However, there are a couple of bright points on the horizon. The first is the present water rights filing that Dinosaur NPS

is working on. They are in court requesting the historic flows of the Yampa River. Well, if the Yampa River can maintain its integrity, then our work downstream in the Green and Colorado will be much easier. A second bright spot is the present negotiation with the Bureau of Reclamation concerning release flows from the Flaming Gorge Unit and Curecanti Unit for water for endangered Colorado River fish.

Finally, the woundfin minnow in the Virgin River. Warner Valley and LaVerkin Springs desalinization are still with us. The FWS has been working with Warner Valley representatives on water flow recommendations.

As many of you are probably aware, the FWS recently formed a Colorado River Fishery Project to work on the endangered Colorado River fishes. I am Project Leader of this team which has funds from various agencies including FWS, B.R. and BLM. I will go into more detail on what we are doing tommorrow in our agency report.

LOWER COLORADO RIVER AREA COORDINATOR REPORT

Herbert R. Guenther and William E. Rinne

Water and Power Resources Service
Lower Colorado Region
Boulder City, Nevada 89005

Proposed, ongoing and completed research on several species of native fishes highlight this year's activity in the lower Colorado River area. Most of the information concerning these species is addressed in eight individual papers at this symposium. Other information is available in two reports at the Water and Power Resources Service Environmental Office and in research proposals under review by the Fish and Wildlife Service, National Park Service and Water and Power Resources Service.

Four of the papers at this symposium concern the Desert Pupfish (Cyprinodon macularius). Recent planned agricultural development near San Felipe Creek by the Salton Sea, California, has created concern for the future of the desert pupfish in California. Steps have been initiated to consider this species for listing on the Federal list of Threatened and Endangered Wildlife.

Three other papers at this symposium provide information on ecological aspects of fishes in: Grand Canyon National Park, by C. O. Minckley, Museum of Northern Arizona, Flagstaff; the mainstream of the Virgin River, James E. Deacon et. al., University of Nevada, Las Vegas; and the Upper Bill Williams Drainage, Bill Kepner, Arizona State University, Tempe.

Interest continues to grow on the future of the razorback sucker (Xyrauchen texanus) in the lower Colorado River area. A paper by Terry McCall, Arizona Game and Fish Department covers recent observations and collections of razorbacks in Lake Mead.

A cooperative 1 year study on distribution and movement of razorbacks in Senator's Wash Reservoir, California beginning January 1980 is planned by California Department of Fish and Game, Bureau of Land Management and Water and Power Resources Service. Also, a proposal from University of Nevada, Las Vegas to study the biology of razorbacks in Lake Mohave is currently being reviewed by Water and Power Resources Service.

Two reports have been prepared on the Zuni mountain sucker in New Mexico and Arizona for the Water and Power Resources Services. It has been recommended by C. R. Smith and R. K. Koehn in one of these reports that the Zuni mountain sucker be classified as a subspecies of the bluehead mountain sucker (Catostomus discobolus).

Finally the Water and Power Resources Service along with the National Park Service and Fish and Wildlife Service are considering cosponsoring a study on the humpback chub (Gila cypha) by C. O. Minckley of the Museum of Northern Arizona, Flagstaff.

RÍO COLORADO SUREÑO
REPORTE DEL CORDINADOR DEL ÁREA

William E. Rinne y Herbert R. Guenther

Water and Power Resources Service
Región Del Río Colorado Sureño
Boulder City, Nevada 89005

Las investigaciones bajo consideración, en progreso y ya completas sobre varias especies de pez indígena al Río Colorado Sureño forman la mayor parte de la actividad en esta área. La mayoría de la información respecto a estas especies de pez está presentada en ocho discursos individuales para este coloquio. Más información se encuentra en dos reportes del Water and Power Resources Service Environmental Office y en investigaciones bajo la consideración del Fish and Wildlife Service, National Park Service y Water and Power Resources Service.

Cuatro de los discursos presentados en este coloquio se dirigen al "Desero Pupfish" (Cyprinodon macularis). El desarrollo agrícolo proyectado para la región cerca de San Felipe Creek al lado del Salton Sea en California ha despertado interés para el futuro del "Desert Pupfish" en California. Se ha iniciado al proceso de considerar esta especie para ser incluida en la lista federal de especies amenazadas.

Tres otros discursos presentados en este coloquio dan información respecto a aspectos ecológicos de los peces en: Grand Canyon National Park, autor C.O. Minckley, del Museum of Northern Arizona, Flagstaff; The Mainstream Of The Virgin River, autor James E. Deacon et. al., de la University of Nevada, Las Vegas; The Upper Bill Williams Drainage, autor Bill Kepner, Arizona State University, Tempe.

El interés en el futuro del "Razorback Sucker" (Xyrauchen texanus) en el área del Río Colorado sureño va creciendo. Un discurso del autor Terry McCall, Arizona Game and Fish Department, describe observaciones corrientes y acumulaciones de muestras de "Razorbacks" en Lake Mead.

Un estudio cooperativo que comenzará en enero de 1980 y durará 1 año respecto a la distribución y el movimiento de "Razorbacks" en Senator's Wash Reservoir está planeada por el California Department of Fish and Game, Bureau of Land Management y Water and Power Resources Service. Además, un propuesto de la University of Nevada, Las Vegas para estudiar la biología de "Razorbacks" en Lake Mohave está bajo la consideración del Water and Power Resources Service.

Dos reportes se han preparado con respecto al "Zuni Mountain Sucker" en Nuevo México y Arizona para Water and Power Resources Service. C.R. Smith y R.K. Koehn recomienden en uno de estos reportes que el "Zuni Mountain Sucker" sea clasificado como sub-especie del "bluehead Mountain Sucker" (Catostomus discobolus).

Por último el Water and Power Resources Service junto con el National Park Service y el Fish and Wildlife Service tienen bajo consideración el patrocinio cooperativo de un estudio del "humpback chub" (Gila cypha) dirigido por C.O. Minckley del Museum of Northern Arizona, Flagstaff.

Following the Lower Colorado River report, Bill Rinne chaired a "mini symposium" on the desert pupfish, Cyprinodon macularius. The papers follow in order of presentation.

RECENT CHANGES IN HABITAT CHARACTERISTICS OF THE SANTA CLARA SLOUGH, SONORA, MEXICO

William E. Rinne and Herbert R. Guenther

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Abstract--Periodic ground and aerial surveys of the Santa Clara Slough, Sonora, Mexico were conducted by Water and Power Resources Service (formerly Bureau of Reclamation) biologists from 1974-1979. These surveys were initiated to evaluate the effects of increased flows discharged from the Bypass Drain, U.S. - Mexico, on the aquatic ecosystem of the Slough.

The slough supports a thriving population of desert pupfish (Cyprinodon macularius), a fish being considered for the U.S. List of Endangered and Threatened Wildlife. Particular attention has been given to identifying the effects of these flows and increased water surface area on the pupfish population and associated habitat.

Results of these surveys show that aquatic habitat has changed greatly since June 1977 when the Bypass Drain become operational. Water surface expansion has occurred because of overtopping of existing braided channels. Subsequent formations of shallow pools have become lined with emergent vegetation. This new aquatic habitat presently provides excellent areas for pupfish. As a result it appears as if the pupfish population is experiencing continued growth.

A potential threat to this growth and the future of the pupfish population may exist because of the introduction of fish competitors and predators into the slough.

At least nine new species of fish have been introduced via the Bypass Drain. In addition, the "freshening" effect of this introduced water appears to be favoring the dispersal of these species throughout the slough.

It is difficult to predict the long-term outcome these changes in habitat characteristics will have on pupfish. If colonization by introduced species is restricted to deeper channels, the increase flows will probably continue to enhance the habitat of the pupfish. If not, increased predation and competition may significantly impact the pupfish population.

CAMBIOS EN LAS CARACTERÍSTICAS DE HABITACIÓN EN EL LODAZAL DE SANTA CLARA, SONORA, MÉXICO

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Introducción--examinaciones periódicas a nivel del terreno y utilizando métodos aéreos del lodazal de Santa Clara, Sonora, Mexico fueron ejecutados por biólogos de Water and Power Resources Service (anteriormente Bureau of Reclamation) desde 1974 a 1979. Estas examinaciones fueron iniciadas para evaluar los efectos de descargos acelerados del Bypass Drain (Estados Unidos (de América) a México) en el systema ecológica del lodazal.

El lodazal sostiene una poblicación próspera de "Desert Pupfish" (Cyprinodon macularis), una especie de pez considerada para la lista de "Threatened and Endangered Wildlife" del Gobierno Federal. Mucha importancia se ha dirigido a la identificación de los efectos de los descargos acelerados y el aumento de la superficie del agua en la población y habitación de los "Desert Pupfish".

Los resultos de estas examinaciones indican que la habitación acuática ha cambiado considerablemente desde junio de 1977 cuando comenzó la operación del Bypass Drain. El aumento de superficie de la agua ha resultado por causa del desbordamiento de canales entretejidos. Este aumento causa la formación de charcos superficiales con vegetación nueva. Esta habitación acuática nueva proporciona lo necesario para los "Desert Pupfish" resultando en el desarrollo de la población de los peces.

Una amenaza potencial a este desarrollo y al futuro de la población del "Desert Pupfish" puede existir por motivo de la introducion de especies de pez competidores y predatores al lodazal.

Aproximadamente nueve especies de pez se han introducido a la habitacion vía el "Bypass Drain". Por último el aumento de la superficie del agua favorece la dispersión de las especies nuevas por todo el sistema.

Es difícil predecir las consecuencias que estos cambios de habitación tendrán sobre los "Desert Pupfish". Si la colonización de especies nuevas por la mayor parte se encuentra en aguas profundas, los descargos acelerados probablemente seguirán mejorando la habitación del "Desert Pupfish". Si no, el aumento de especies nuevas tendra un impacto significante en la población del "Desert Pupfish".

SPAWN RECOGNITION BY MALE *Cyprinodon macularius californiensis*

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Sexually active male *C. m. californiensis* were found to behave differently toward eggs fertilized by themselves and those fertilized by other males, eating significantly more of the alien eggs than of their own. Ability to recognize their own spawn was not influenced by altering the spawning substratum within which they were presented or their position within the spawning substratum. Rendering a resident male anosmic by blocking his nares with an oral adhesive eliminated any differences in response to the two classes of eggs, indicating that recognition is effected by chemical cues. It is suggested that the ability to recognize his own eggs allows a male to selectively prey upon eggs deposited within his territory by non-territorial peripheral males, simultaneously reducing their fitness and enhancing his own by allowing him to exploit a high-quality food resource present within its boundaries. These observations also require that *C. m. californiensis* be regarded as a species that engages in deliberate rather than incidental parental behavior toward its spawn.

The Current Status and Future Management of the Desert Pupfish, *Cyprinodon macularius*, Within California

Glenn F. Black

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Abstract--The distribution of the desert pupfish has become severely limited within California during recent years. At present, populations exist only within various habitats at the Salton Sea and in San Felipe Creek, a perennial desert stream which is a tributary to the Sea only during times of flooding. Quarterly surveys of desert pupfish habitats at the Salton Sea indicate that pupfish numbers and distribution have become severely reduced due to the widespread establishment of numerous exotic species and also to severe habitat modifications. Despite the occurrence of several exotic species within San Felipe Creek, two separate surveys indicate that pupfish are by far the most abundant species and are distributed all along the 7.2 km permanent water portion. Proposed groundwater pumping for agricultural development on large sections of land adjacent to the creek seriously jeopardize this last natural viable population and habitat of the desert pupfish in California. In order to afford this species protection from extinction, it should be placed on both the state and federal endangered species lists. In addition, basic hydrological data for San Felipe Creek is also necessary before changes in zoning laws and land acquisitions can be proposed.

Evidence from various sources demonstrates that the distribution of the desert pupfish, *Cyprinodon macularius*, has become very limited within California. This species, once endemic to the Colorado River and numerous springs throughout the Salton Sink, is presently found only in the Salton Sea and several of its tributaries. Observations made by numerous individuals indicate that their distribution and numbers have become severely limited even within these areas, probably due to the establishment of exotic species.

Quarterly surveys were conducted at the Salton Sea to determine the distribution, relative abundance, and status of the desert pupfish. Minnow traps were used to sample fish species within irrigation drains, shoreline pools, natural tributaries and the Salton Sea proper between March 1978 and January 1979. In addition, San Felipe Creek, a tributary to the Salton Sea, was surveyed in November 1978 and March 1979.

Thirteen non-native species of fish and one invertebrate species were found in addition to the desert pupfish. Desert pupfish comprised 3% of the total catch from the four surveys of the irrigation drains, 5% of the catch from the shoreline pools, and less than 1% of the catch from the natural tributaries and the Salton Sea proper. On the other hand, the sailfin molly, *Poecilia latapinna*, accounted for 85% of the total catch in the quarterly surveys of the irrigation drains, 81% of the catch in the shoreline pools, 70% of the catch from the natural tributaries, and 98% of the catch in the Salton Sea proper.

In contrast to the findings at the Salton Sea, desert pupfish made up 70% of the total catch in San Felipe Creek. Although several non-native species were

present, including the sailfin molly, their numbers were quite low which is probably due to the habitat favoring desert pupfish over the other species and to limited access of exotic species to San Felipe Creek.

It is not known whether desert pupfish populations within the various habitats at the Salton Sea will decline to the point of extinction. However, due to the abundance and diversity of the exotic species, especially the sailfin molly and the Zill's cichlid, *Tilapia zillii*, and extreme habitat modification within the irrigation drains, there may be little that can be done to insure the continued existence of the desert pupfish in these areas.

Despite the fact that a good, viable population of desert pupfish exists within San Felipe Creek, an immediate threat to the habitat is posed by the planned agricultural development of 16 ½ sections of land adjacent to the creek. Proposed groundwater pumping in this area may completely dry up the surface flow in San Felipe Creek.

In order to provide protection for the desert pupfish and its habitats within the Salton Sea and San Felipe Creek, this species should be placed on both state and federal endangered species lists. Further management objectives should include: 1) initiation of hydrological studies in the area of San Felipe Creek to determine the location and nature of the aquifers supplying the surface flow as well as the impact of groundwater pumping in this area; 2) persuade Water Power and Resources Service and Imperial County to withdraw land in and adjacent to San Felipe Creek from zoning which allows for agricultural development; 3) acquire private land bordering and within San Felipe Creek to preserve integrity of the habitat and; 4) investigate the feasibility of installing a concrete spillway below the permanent water portion of San Felipe Creek to block the upstream movement of exotic species. Cooperation between county, state, and federal governments is necessary to protect this species and its few remaining habitats, because without this protection this native species could become extinct in California.

RESEARCH PAPERS AND ABSTRACTS (Alphabetically, by senior author)

Chairmen: Jim LaBounty, Water and Power Resources Service, Denver;

Dave Soltz, California State University, Los Angeles.

A Fishery Investigation of the Modoc Sucker *(Catostomus microps)* and the Rough Sculpin *(Cottus asperrimus)* in the Pit River Drainage between Turner Creek and Juniper Creek, Lassen and Modoc Counties, California

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David L. Koch[2]

The Water and Power Resources Services (formerly United States Bureau of Reclamation) has proposed development of the Allen Camp Unit in the Pit River Division of the Central Valley Project. The proposed reservoir would have a capacity of near 100,000 acre-feet for the primary purposes of irrigation and flood control. The general region of study was approximately 62.5 km (100 mi.) northeast of Redding and 30 km (48 mi.) southwest of Alturas, California in southwestern Modoc and northwestern Lassen Counties.

This project will alter native aquatic habitat and within this general area two rare species of fish potentially could occur as listed by the State of California: the Modoc sucker *(Catostomus microps)* and the rough sculpin *(Cottus asperrimus)*. The purpose of this fish survey was to determine the effects the proposed reservoir would have on either of the rare species, in addition to associated fish populations. Field sampling was conducted during the summer and fall of 1978.

Although the Modoc sucker is commonly found within the Turner Creek system at the northern project boundary, none were captured within the Pit River or tributaries to the river within the projected impact area. However, utilizing a stepwise discriminant analysis program to statistically determine hybridization, Modoc sucker-Sacramento sucker *(Catostomus occidentalis)* hybrids were collected within the inundation area of the proposed reservoir and in Willow Creek, a small tributary to Ash Creek. Hybridization is considered to be a major factor leading to the decline of the Modoc sucker population as outlined by the Klamath Basin Threatened Fishes Team.

Although not entirely surprising, the rough sculpin was not found during the survey and is generally considered to be an inhabitant of the lower Pit River, Fall River and lower Hat Creek.

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Based on the results of this investigation the proposed Allen Camp Dam will not have a significant impact on habitat occupied by either of the rare fishes if proper precautions are followed. The reservoir pool would create excellent habitat for the Sacramento sucker which would most likely thrive within the impoundment. Preferring stream habitat for their spawning purposes, the Sacramento sucker population would seek out suitable tributaries for this purpose. It was suggested that in order to prevent the reservoir Sacramento sucker population from entering and hybridizing with the Turner Creek System Modoc sucker population just upstream, a migratory barrier should be installed at the confluence of the Pit River with the impoundment. This structure would alleviate any potential increase in sucker integration problems which would be directly caused by the project.

Table 1 lists the species captured in tributaries and within the Pit River by percent composition. Juvenile Sacramento sucker and Sacramento squawfish *(Ptychocheilus grandis)* in addition to speckled dace *(Rhinichthys osculus)* and brown bullhead *(Ictalurus nebulosus)* comprised the majority of fishes captured in streams and reservoirs. Within the Pit River adult Sacramento sucker, Sacramento squawfish and hardhead dominated the catch.

The upper Pit River and lower Pit River stations within the survey area can be divided into two distinct habitat types. The upper reach between Turner Creek and Rose Canyon Creek is probably similar to the way it was hundreds of years ago. With the exception of cattle grazing and farming activity presently occurring along its course, man has not impounded or significantly disturbed the river in any way. This upper reach was characterized by a relatively steep gradient and subsequent high stream velocities with riffle, run and pool habitat present. Substrate type was primarily boulders and gravel with less prevalent sand and silt. The proposed Allen Camp Reservoir will inundate a large portion of this section of the Pit River. In contrast, the lower river stations between Rose Canyon Creek and Juniper Creek were generally characterized by sluggish flows created by only a slight gradient or impounded water behind irrigation diversions in Big Valley. Substrate was usually silty, water depth was greater than 1-2 m (3.3-6.5 ft.), turbidity was moderate (secchi disc reading .4 - .7 m), water temperature was relatively high when compared to flowing sections and the velocity of stream flow was negligible. To give an example of a typical diversion dam on the lower Pit River, the Gerig Diversion is approximately 4 m (13 ft.) high but backs up the river's water to Lookout, a small town 9.6 to 12.8 river km (6 to 8 mi) to the north. Within 0.4 km (0.25 mi) to the north of Lookout is the Lookout Diversion which again backs Pit River water to a distance of over 16 river km (10 mi.).

Fish capture data reflect the habitat conditions as the upper river population structure was significantly different than the lower. The upper Pit River habitat was highly preferred by the native species. The Sacramento sucker - Sacramento squawfish - hardhead association comprised 72.5% of the catch for this reach of stream. An arcsine transformation was used in order to compare percent composition data for the two habitat types. The results of this test revealed a significantly higher proportion of this native fish association in the upper river than all other species found in that habitat.

TABLE 1. List of fish species, total number and percent composition by species, and number of stations at which a specific species was captured for tributary and Pit River stations between Turner Creek and Juniper Creek, California.

		TRIBUTARIES			PIT RIVER		
Common Name	Scientific Name	Total No. Captured	Percent Comp.	No. of Stations at which Sp. was found	Total No. Captured	Percent Comp.	No. of Stations at which Sp. was found
Sacramento Sucker	*Catostomus occidentalis*	162	18.1	15	613	27.6	11
Sacramento Squawfish	*Ptychocheilus grandis*	165	18.4	14	281	12.7	12
Hardhead	*Mylopharondon conocephalus*	8	.9	2	461	20.8	8
Channel Catfish	*Ictalurus punctatus*				175	7.9	11
Largemouth Bass	*Micropterus salmoides*	41	4.6	1	190	8.6	11
Green Sunfish	*Lepomis cyanellus*	24	2.7	5	134	6.0	10
Golden Shiner	*Notemigonus crysoleucas*	51	5.7	2	218	9.8	5
Speckled Dace	*Rhinichthys osculus*	161	18.0	5	1	.04	1
Bluegill	*Lepomis macrochirus*	38	4.2	1	95	4.3	10
Brown Bullhead	*Ictalurus nebulosus*	162	18.1	7	40	1.8	11
Tui Chub	*Gila bicolor*	25	2.8	1	3	.1	1
Sunfish	*Lepomis* sp.	16	1.8	8	3	.1	2
Pit-Klamath Brook Lamprey	*Lampetra lethophaga*				1	.04	1
Hybrid Sucker	*Catostomus* sp.	3	.3	2	2	.09	1
Pit Sculpin	*Cottus pitensis*	26	2.9	6	4	.2	2
Rainbow Trout	*Salmo gairdneri*	13	1.5	3			

With the exception of channel catfish (*Ictalurus punctatus*), introduced species did not comprise a significant portion of the upper river's catch. Other species caught with the native association included Pit sculpin (*Cottus pitensis*), speckled dace (*Rhinichthys osculus*) Pit-Klamath brook lamprey (*Lampetra lethophaga*), the introduced green sunfish (*Lepomis cyanellus*), largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*) and brown bullhead. Sacramento sucker had the highest biomass with a mean of 64.2% of total fish weight on this river reach. Also of importance were channel catfish with a mean biomass of 23.6% per station, providing a significant and apparently underutilized sport fishery. Diversity averaged 8.2 species per upper river station being relatively evenly distributed momentarily, ranging from only 8 to 9 species per site. The species most infrequently captured were Pit sculpin, speckled dace and lamprey. Two hybrid Modoc-Sacramento suckers were collected on the upper river near the Miller Ranch. This may indicate that either Modoc suckers at one time inhabited this river section or they may have potentially migrated downstream from Turner Creek, a stream known to support the species, which enters the river only 8 km (5 mi.) upstream.

The lower river survey area which has been significantly influenced by human activities was preferred habitat for many of the introduced species. Golden shiner were the dominant fish captured at three lower river stations comprising 47.8%, 40.5% and 37.2% of the catch at these sites. Other introduced species which dominated a station's catch on this reach of river included bluegill (37.4%), largemouth bass (45.1%) and channel catfish (32.1%). The only native fish which made up the majority of the catch at a lower river station were Sacramento squawfish where they comprised 26.7% of the catch. Species present in lesser abundance included green sunfish, brown bullhead, Sacramento sucker, squawfish, tui chub (*Gila bicolor*) and hardhead. Although introduced species had higher populations than natives on the lower river they were generally smaller in size and had lesser amounts of total biomass. Sacramento sucker and Sacramento squawfish were responsible for 60.2% of the biomass at the average station within this reach. Species diversity was usually relatively high on the lower river ranging from 6 to 9 species per station ($\bar{x}$=8.1). However, the mean number of introduced species was 5.6 per station suggesting their importance and habitat preference for the disturbed environment which is ecologically similar to their native habitat.

The unique native fish associations of the Sacramento-San Joaquin River systems have in many instances been replaced by introduced exotics as evidenced by this investigation. With man's increasing population a greater demand will be placed upon water resources in the future and the native aquatic environment will undoubtedly be neglected. At the present time a great deal of emphasis is placed on endangered or threatened species when an impact to the environment is expected to occur. In the future, consideration should also be given to native fish assemblages during the analysis of environmental impact as their ecological and evolutionary values are irreparable following aquatic degradation.

Species Specificity in the Mating Systems of *Cyprinodon variegatus* and *Cyprinodon bovinus*

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Abstract--*Cyprinodon bovinus* is an endangered, west Texas pupfish occurring in Leon Creek, Pecos County, Texas, U.S.A. An accidental introduction of a small number of *C. variegatus* in 1974 resulted in hybridization of unexpected proportions. The possibility that this was a result of females choosing to mate with "odd" males in order to increase heterozygosity seemed to be a reasonable explanation. However, mate preference experiments show that *C. variegatus* females tend to mate conspecifically while *C. bovinus* females choose randomly.

Resumen--*Cyprinodon bovinus*, especie en vías de extinción, habita en el arroyo Leon Creek en el Condado de Pecos, Texas, EEUUU. En 1974, cuando se introdujeron accidentalmente varios ejemplares de *C. variegatus*, se produjo la hibridación entre ambas especies de proporciones inesperadas. Se pensó que dicha hibridación fue consecuencia de que las hembras copularon con machos "inusuales" para aumentar el número de heterozigotas. Sin embargo, en los experimentos de laboratorio se pudo determinar que las hembras de *C. variegatus* tienden a copular con machos de la misma especie, mientras que las hembras de *C. bovinus* lo hacen al azar.

Cyprinodon bovinus is an endangered pupfish endemic to a small stream in west Texas. Five years ago an accidental introduction of *C. variegatus* resulted in hybridization to a level that threatened to replace the pure *C. bovinus* genome. This behavioral study was initiated in order to determine the reason for the extreme amount of hybridization.

C. bovinus occurs today in Leon Creek, Pecos County, Texas. However, the type locality for the species is Leon Springs which is approximately 15 kilometers upstream from the present day location of the species. It was first collected at Leon Springs in 1851 (Girard, 1859). In 1918 the spring run was impounded for irrigation purposes. This environmental perturbation was probably responsible for the extinction of the species in the type locality (Hubbs, 1980). Subsequent overuse of the water dried up the connection with the downstream portion of Leon Creek which is now fed mainly by Diamond-Y Spring. The species was thought to be extinct until 1965 when W.L. Minckley and W.E. Barber rediscovered it in the downstream section (Minckley and Arnold, 1969).

Present day Leon Creek is divided into two sections with a total length of no more than eight to ten kilometers. The upper portion, which receives most of

its water from Diamond-Y Spring, flows almost two kilometers before sinking into the ground. Approximately one kilometer downstream it reappears as the lower section. The two sections are sometimes connected during floods.

In August of 1974 Dr. Royal Suttkus collected specimens of Cyprinodon variegatus from Leon Creek. This is a coastal pupfish found naturally in estuarine waters of the Atlantic and Gulf coasts. However, its popularity as a bait fish seems to have greatly enhanced its dispersal capabilities. A collection made the previous January in Leon Creek had yielded no C. variegatus, thus the time of release is fairly well known.

Collections made in November 1975 and January 1976 by Anthony and Alice Echelle indicated extensive hybridization throughout the lower section of the creek. This was unexpected since a "bait bucket" introduction would probably not have involved more than 100 fish and the C. bovinus population was estimated to have been at least two orders of magnitude larger. Some habitat segregation was noted with C. bovinus tending to be in the stenothermal, flowing water and hybrids in the more eurythermal, quiet water (A.A. Echelle, pers. comm.). As a precaution against completely losing the pure C. bovinus genome, a stock from the uncontaminated upper section of Leon Creek was moved to the Dexter National Fish Hatchery in New Mexico.

From February 1976 to August 1978, a combination of rotenone treatment and selective seining efforts seems to have thoroughly reduced the amount of C. variegatus genes in the population. The details of this effort were reported at the 1978 Desert Fishes Council meeting by Dr. C. Hubbs (Hubbs, 1980).

While the immediate problem now appears to be resolved, a question still remains as to why the hybridization was so extensive. The 1974 collection made by Dr. Suttkus was the only time pure C. variegatus were taken from Leon Creek, yet the hybrid swarm grew to a level that threatened the genetic purity of C. bovinus. Paul Loiselle's work with C. bovinus, C. nevadensis and C. macularius indicates that female C. bovinus may actually prefer male C. nevadensis and C. macularius over males of their own species. These experimental results led to the hypothesis that female pupfish may, in fact, choose to mate with novel males in order to increase heterozygosity (P.V. Loiselle, pers. comm.). In order to determine if this would explain the sequence of events at Leon Creek, I performed mate preference experiments between the two species in question, C. bovinus and C. variegatus.

The C. bovinus used in the experiments were obtained from the known pure stock at the Dexter National Fish Hatchery. C. variegatus were obtained from the Laguna Madre on the south Texas coast. The pupfish were maintained in the lab in two 500 liter troughs with approximately 150 fish in each trough. The light cycle was 14 hours light and 10 hours dark at a temperature of 25°C.

Experiments were conducted in 50 liter aquaria that had been divided into three compartments by two plates of glass. The middle compartment contained a bottomless nylon screen cage that could be raised by remote control. One male of either species was placed in each side compartment 24 hours before an experiment. In the basic pupfish breeding system a male defends a territory that the female enters only long enough to breed. The 24 hour acclimation period was designed to

allow each male to establish his compartment as his "territory". Female receptivity was insured by isolating them in three liter jars 24 hours prior to each experiment.

At the beginning of each test a female was placed inside the nylon cage and left to observe the males for at least 15 minutes. The cage was then slowly raised and the female usually went to one of the males within one minute. Often the pair would try to spawn through the glass.

Figure 1 represents data from experiments using pairs of equal sized males. The upper portion of each bar graph is derived from females of 29 millimeters or less. This is the size range at which females are first becoming reproductively mature and apparently they are not yet very good at differentiating species differences. Among the larger, more mature females, C. variegatus chose the conspecific males significantly more often than not. Mate preference of C. bovinus females on the other hand, does not appear to be species specific.

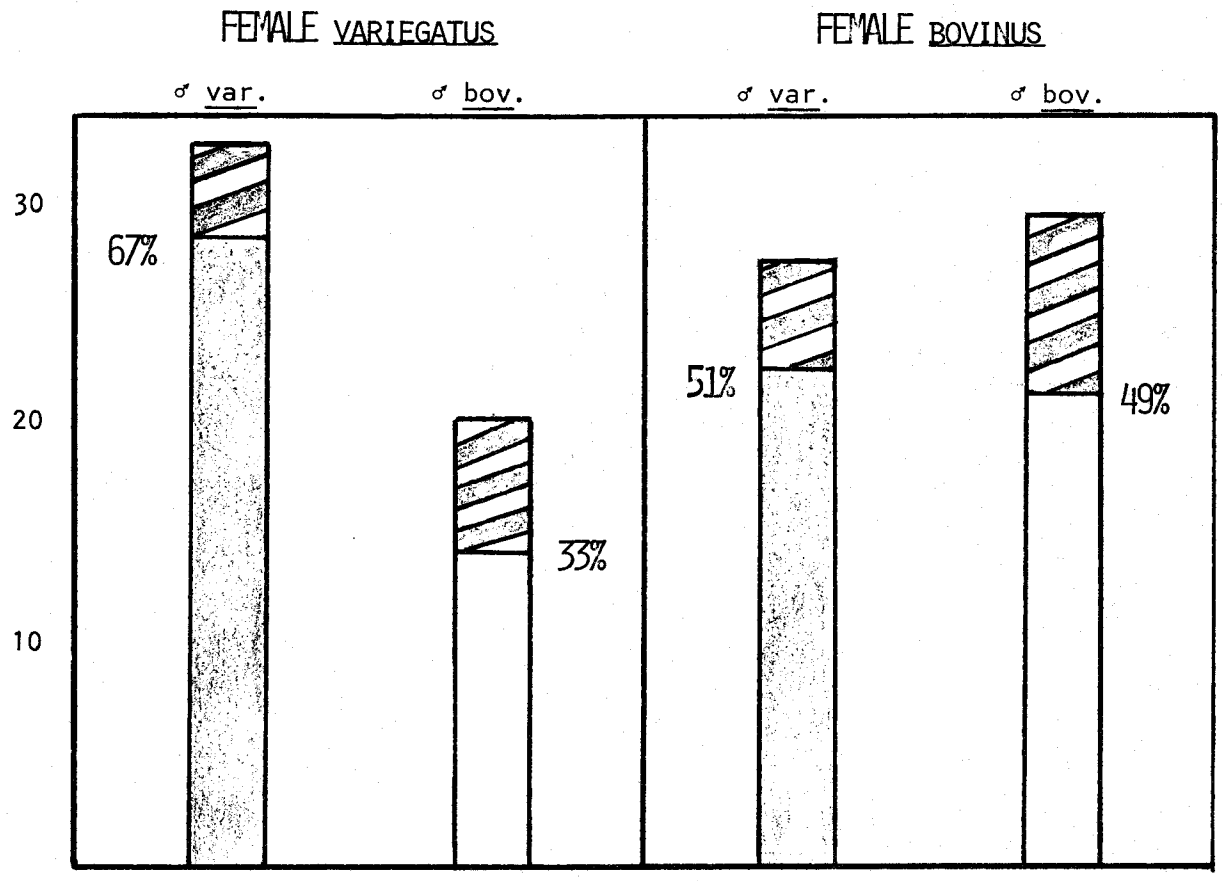

FIG. 1 The left side of the diagram represents mate choice of female C. variegatus and the right side is for that of C. bovinus.

Data from experiments using different sized males are represented in Figure 2. The size difference between each pair of males was usually between two and ten millimeters. Judging from the pupfish mating system, one might assume that larger males would have the more desirable territories and be better at defending them. Whether the female is attracted more to the larger male or to the "better" territory that he occupies is not known. However, the present data indicates that relative size of the male is certainly not a dominant factor. In C. bovinus it does not appear to be a factor at all, with the females being random in their choice of males. Once again the C. variegatus preferred males of their own species, but this time not by a significant margin. It is possible that the relative size of the male in relation to the C. variegatus females may affect her decision, but the relationship is unclear. Future experiments will be concerned with this aspect in terms of intraspecific mate choice in order to determine what role, if any, size plays in a female's decision.

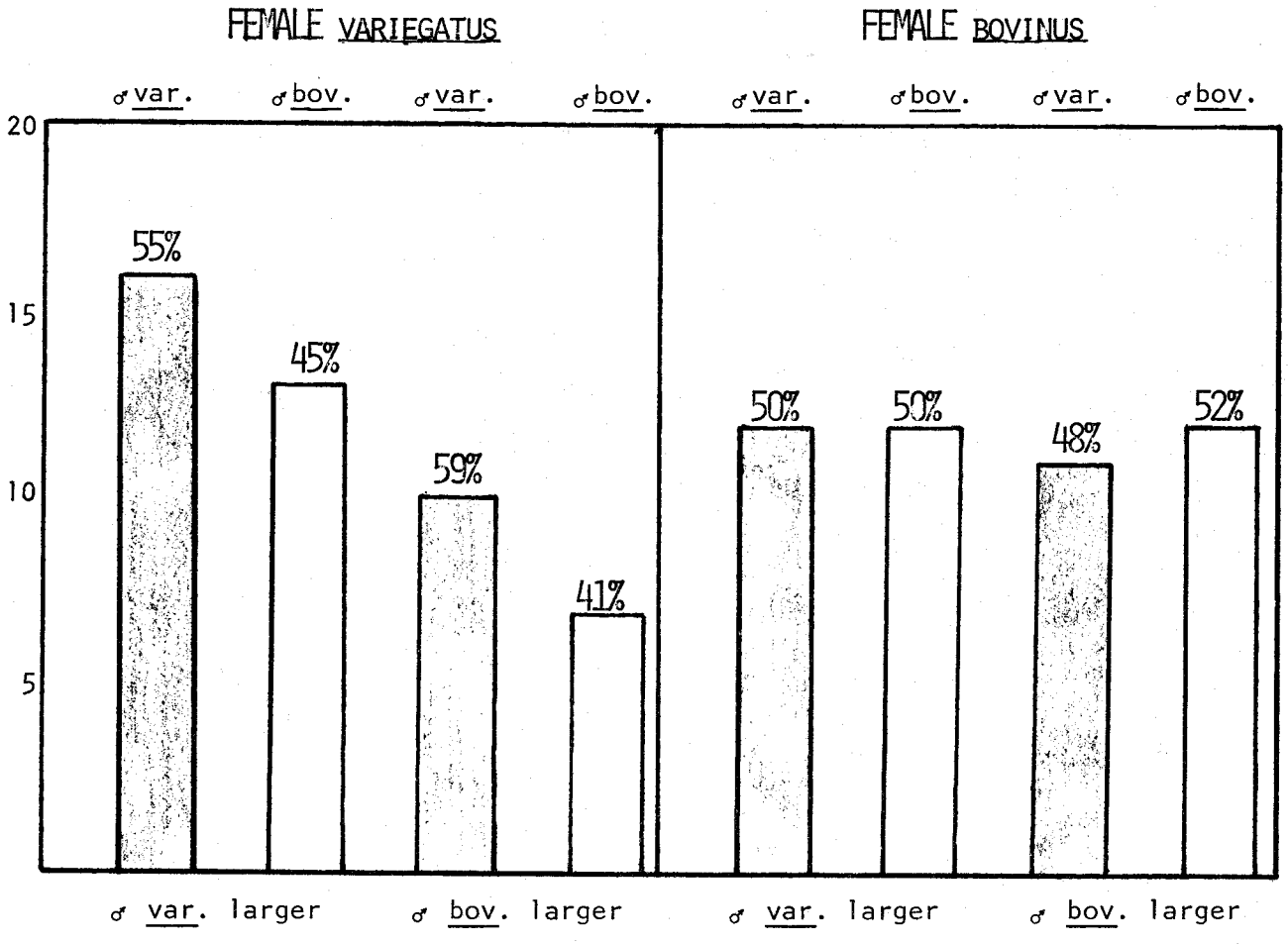

FIG. 2 Data paired according to the larger of the two males. All females ≥ 30mm

While male pupfish probably try to mate with as many females as possible, if put in a choice situation would they have a species specific mate preference? In order to test for this, the experiment was turned "inside out" with the male now in the nylon cage and a female of each species in each of the outer compartments. The results are shown in Figure 3. These experiments were only begun recently, thus, the data base is a bit low, but the trends are interesting. It appears that male C. bovinus lean toward species specificity in their mate choice while C. variegatus males seem to be random in their choice. If indeed this is the case, the majority of the hybridization at Leon Creek was probably the result of male C. variegatus x female C. bovinus combinations. More experiments are planned in order to rule out sampling error and to more precisely determine the role of the male's choice in the pupfish mating system.

In summary, female C. variegatus, while being far from perfect in their ability to discriminate species differences, have a significant preference for mating with conspecific males. On the other hand, C. bovinus females do not seem

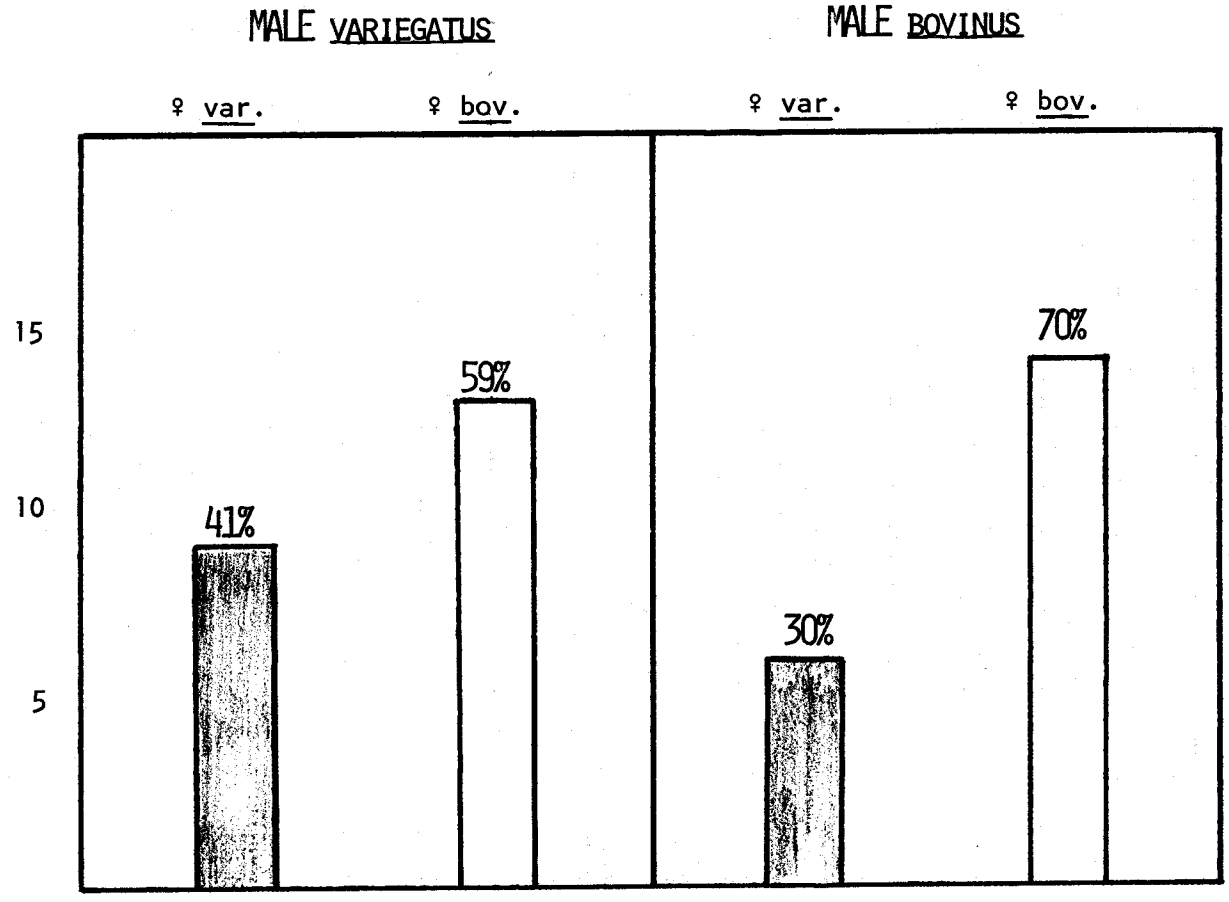

FIG. 3 Male mate preference.

to be very good at distinguishing species differences. This result is not so surprising when one considers that C. bovinus has probably been isolated since the mid-Pleistocene (Echelle and Echelle, 1978). Thus, there would have been little selection for reproductive isolating mechanisms.

It is of interest to note that in a study of hybridization between C. variegatus and another west Texas pupfish, C. elegans, Stevenson and Buchanan (1973) found a hybrid swarm between the two populations and little or no introgression into the C. variegatus population (any possible movement into the C. elegans population was precluded by a small waterfall). They concluded that there was some evidence of reinforcement towards the C. variegatus mode in the area adjacent to the hybrid zone. Perhaps the mate preference of the female C. variegatus was responsible for this reinforcement.

While this study does shed some light on what happened at Leon Creek, it still does not fully explain the extreme level of hybridization. Attempts are currently underway to produce hybrids in the lab in order to test for any indications of heterosis and to determine what sort of mating preference the hybrids might have.

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Aquatic Habitat Evaluation--A Possible Tool in Endangered Species Management

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Abstract--Federal legislation within the past decade has legally mandated the need for evaluation of fish and wildlife habitat in environmental planning and impact assessment. In response to this need the U.S. Fish and Wildlife Service Habitat Evaluation Group is developing standardized methods to evaluate aquatic habitats on a biological basis. In this paper we propose that the Habitat Evaluation approach could be a potentially useful tool for endangered species management in the following areas: Evaluating impacts, evaluating and comparing habitats for possible introductions, and identifying areas where habitat improvement practices will enhance the habitat. Examples of the contents and compilations of the species narratives and the development of habitat evaluation criteria and methods are given.

Federal legislation within the past decade, specifically the National Environmental Policy Act, 1973 Water Resources Council Standards, and the Endangered Species Act, has legally mandated the need for noneconomic evaluation of fish and wildlife habitat in environmental planning and impact assessment. In response to this need, efforts have been underway for the past several years at the U.S. Fish and Wildlife Service's Habitat Evaluation Project, Fort Collins, Colorado, to develop objective and quantitative methods that evaluate aquatic and terrestrial habitats on a biological basis. Other efforts underway to quantify and evaluate habitat in noneconomic terms include the work of Binns and Eiserman (1979), who have developed a standard method to quantify trout populations in Wyoming streams based on a "Habitat Quality Index", and the work of Platts (1974), who has related geomorphic and structural features of streams in Idaho to fish density and composition.

The Habitat Evaluation Project consists primarily of two components: the Habitat Evaluation Criteria Handbooks and a Habitat Evaluation Procedures (HEP) Manual (U.S. Fish and Wildlife Service 1979). Aquatic handbooks are proposed for each Water Resources Region (Seaber et al., 1974) in the U.S. and terrestrial handbooks for each ecoregion (Bailey 1978). The handbooks provide background species information and the criteria and methods necessary for rating habitat to assess its relative value in terms of satisfying the habitat requirements of species present. In turn, the HEP Manual details procedures to utilize this rating to quantify and analyze project impacts for use in impact evaluation, project planning, and requesting compensation for habitat losses.

The Habitat Evaluation rating system in the handbooks is based on a Habitat Suitability Index (HSI), a measure (on a scale of 0 to 1.0, with 1.0 optimum or most suitable) of the degree to which a habitat meets the cover, reproduction, water quality, food, and other special habitat requirements of a species or life stage. The total HSI for a species is a combination of the suitability index ratings for each of the species habitat requirements. Criteria used to determine the HSI rating are based on available information related to the growth, survival, and biomass of species in terms of important habitat parameters, e.g., temperature, oxygen, cover, and water velocity which may directly or indirectly influence the suitability of habitat for a species.

In this paper we propose that the Habitat Evaluation approach could be potentially a useful tool in endangered species management. The gathering of available species information into a handbook-type format with standardized guidelines for evaluating and rating endangered species habitats could be of use in several areas:

1) as a tool in evaluating impacts to endangered species;
2) a method for evaluating and comparing habitats for possible introduction of endangered species; and,
3) as a method to identify where habitat improvement practices will enhance an endangered species habitat.

We intend to further describe the contents and compilations of the

background species information and the development of habitat evaluation criteria and methods using cutthroat trout (Salmo clarki) as an example.

Species Narratives

Species narratives contain basic information on the known habitat requirements for a particular fish species. Narratives are comprised of habitat requirement information from the technical literature, unpublished reports, data files, and expert opinion; in short, they attempt to consolidate the often widely-scattered information on species habitat requirements. Narratives consist of six sections with the following information included under each section.

I. General

- --Distribution:native, introduced.
- --Subspecies.
- --Brief description of species ecological (e.g., forage species, predator), economic (commercial and-or game fish), and political-legal (endangered, threatened) importance, if applicable.
- --Abundance of species within range.

II. Physical Habitat-Cover Requirements

- --Common physical features of the habitat.
- --Niche occupied by the species (e.g., shallow riffles) and behavior patterns.
- --Types of cover species associated with; species dependence on cover.
- --Seasonal-life stage-subspecies variability of cover requirements.
- --Importance of specific parameters (e.g., velocity, cover, gradient, riparian vegetation); quantify parameters if information is available.

III. Reproduction

- --Type of spawner (e.g., builds nests in gravel and guards nests).
- --Characteristics of optimal spawning habitat (substrate, velocity); quantify ranges if data available.
- --Age at maturity; spawning migrations.
- --Period of spawning; temperature range for spawning.
- --Period of incubation.

--Factors or impacts affecting succeesful reproduction (e.g., flooding, siltation, temperature changes).

IV. Water Quality

--Species tolerance, lethal level, and optimum for water quality parameters of temperature, dissolved oxygen, turbidity, pH, salinity; quantify parameters where data is available.

V. Food

--Species food habits, by life stage.

--Degree of plasticity in feeding.

--Senses used in feeding.

--Habitat parameters influencing abundance or availability of food to species.

VI. Special Considerations

--Other special requirements of species.

--Environmental changes-impacts species most susceptible.

--Information needed on species to further understanding of habitat requirements.

Habitat Evaluation Criteria

Habitat evaluation criteria characterize the relationship between measurable habitat parameters and their relative value in terms of meeting species requirements. The ranges of these habitat parameters are rated according to a suitability index rating system and the rating is based on the background species information as outlined and referenced in the Species Narrative.

These criteria form the guidelines for evaluating and rating a habitat for the species. The guidelines for determining the habitat suitability for cutthroat trout serve as in illustration.

A. Physical Habitat-Cover Requirements:

1. % Pool Area--Pools are favored as resting areas and escape cover for all life stages of trout. Approximately 40-60% pool to riffle ratio is considered optimum. Pool quality is greatly influenced by their depths, lengths, and amount of instream structures suitable for cover.

   a. All life stages — Rating

      1) 40-60% pool-riffle ratio, depth twice the average depth of stream, abundant instream cover.....0.8-1.0

      2) 20-40 or 60-80% pool-riffle ratio, depth equal to average depth of stream, cover present.....0.4-0.7

      3) <20, >80% pool-riffle ratio, and-or depth average depth of stream, little or no cover present.....0.0-0.3

2. Stream Shade--Important for water temperature control. Stream velocity, depth, and elevation should be considered in rating stream shade. Shallow, low velocity, and-or low elevation streams tend to maintain higher water temperatures in the absence of shade. Increased depth, moderate to fast velocities, and-or higher elevations moderate the effect of reduced shade along the stream.

   a. All life stages — Rating

      1) 50-75% stream shaded at mid-day.....0.8-1.0

      2) 25-50% or 75-100% stream shaded at mid-day.....0.4-0.7

      3) <25% stream shaded at mid-day.....0.0-0.3

3. Cover--Cover for cutthroat trout is an important parameter with different requirements for different life stages and different seasons. Velocity, substrate, depth, undercut banks, and presence of instream structures are the main considerations in evaluating a stream in terms of meeting cover needs for cutthroat trout. The rating for substrate as cover would be reduced if fines are >25% and embededness is <50%.

   a. Adult — Rating

      1) ≥25% of total stream area consisting of one

or more of the following types of cover; depth (≥ twice the average depth of stream, and low velocity), boulders, undercut banks, and debris piles.....0.7-1.0

2) <25% of total stream area consisting of cover.....0.0-0.6

b. Juvenile--Winter cover

1) ≥25% of total stream area consisting of debris piles and-or large rubble-small boulders.....0.7-1.0

2) <25% of total stream area consisting of cover.....0.0-0.6

c. Juvenile--Summer cover

1) ≥25% of total stream area consisting of one or more of the following types of cover; depth (≥twice the average depth of stream, and low velocity), large rubble or boulders, undercut banks and debris piles.....0.7-1.0

2) <25% of total stream area consisting of cover.....0.0-0.6

d. Fry--Winter cover

1) ≥20% of total stream area consisting of substrate ranging from 5-4- cm (% fines 0-25), or aquatic vegetation.....0.7-1.0

2) <20% of total stream area consisting of cover.....0.0-0.6

e. Fry--Summer cover

1) ≥20% of total stream area consisting of shallow pools, substrate ranging from 5-40 cm (<15% fines in rocky areas) or aquatic vegetation.....0.7-1.0

2) <20% of total stream area consisting of cover.....0.0-0.6

4. Riparian Vegetation--Overhanging vegetation (dense brush and trees) is optimum for allochthonous food input of terrestrial organisms, shading cover, and bank stability.

As a result, stream banks with less than 60% bank vegetation should be given lower rating for cutthroat trout habitat.

a. All life stages — Rating

1) ≥60% riparian vegetation.....0.7-1.0

2) 25-60% riparian vegetation.....0.4-0.6

3) <25% riparian vegetation.....0.0-0.3

5. Gradient--Cutthroat trout are most abundant at moderate gradients of approximately 5-10% (average stream reach gradient), which is characteristic of 1st, 2nd, and 3rd, order streams. They are less abundant at higher and lower gradients.

a. All life stages — Rating

1) 5-10% gradient.....0.7-1.0

2) <5% or >10% gradient.....0.0-0.6

B. Water Quality

1. Temperature--Temperature is one of the most important parameters affecting cutthroat trout. It is related to almost every parameter considered in the cutthroat trout habitat evaluation criteria. Cutthroat trout usually do not persist in waters where maximum temperatures consistently exceed 22° C, although they may be able to withstand brief periods of daytime water temperature as high as 26° C if considerable cooling takes place at night. Temperature is not usually a limiting factor in the winter.

a. All Life Stages — Rating

Mean weekly summer growing season water temperature is:

1) between 9 and 12° C.....0.8-1.0

2) between 6 and 8° C or 13 and 15° C.....0.5-0.7

3) between 3 and 7° C or 16 and 19° C.....0.2-0.3

4) between 0 and 2° C or 20 and 22+° C.....0.0-0.1

5) If mean weekly summer water temperature is >22° C.....0.0

2. Dissolved Oxygen--Dissolved oxygen requirements vary with the species, life stage, temperature, water velocity, and concentration of substances in the water. Under natural stream situations, dissolved oxygen is not a limiting factor in the winter.

a. Adult, Juvenile, and Fry Life Stages — Rating

Mean weekly summer growing season dissolved oxygen (D.O.) content in mg/l is:

1) D.O.	>6	≥8	≥10	0.7-1.0
	— or —	— or —		
Temp. °C	≤10	≤16	≤22	
2) D.O.	≥3	≥5	≥7	0.3-0.6
	— or —	— or —		
Temp. °C	≤10	≤16	≤22	
3) D.O.	≥2	≥4	≥6	0.0-0.2
	— or —	— or —		
Temp. °C	≤10	≤16	≤22	

4) D.O. is below 2mg/l.....0.0

b. Embryo Life Stage — Rating

1) D.O.	≥6	≥8	≥10	0.7-1.0
	— or —	— or —		
Temp. °C	≤6	≤12	≤19	
2) D.O.	≥3	≥5	≥7	0.3-0.6
	— or —	— or —		
Temp. °C	≤6	≤12	≤19	

3) D.O.	≥2	≥4	≥6	
	— or —	— or —		0.0-0.2
Temp. °C	≤6	≤12	≤19	

4) D.O. below 2 mg/l.....0.0

3. Velocity--Velocity requirements vary for different life stages. Cutthroat fry prefer slower velocities than other life stages. Cutthroat trout generally prefer resting and feeding areas of low velocity where the least amount of energy is expended. The ratings for velocity are influenced by the presence or absence of instream structures and substrate.

a. Adult Life Stage — Rating

1) Velocity ≤ 20 cm/sec.....0.7-1.0

2) Velocity 21-70 cm/sec.....0.3-0.6

3) Velocity >70 cm/sec.....0.0-0.2

b. Juvenile Life Stage

1) Velocity ≤ 30 cm/sec.....0.7-1.0

2) Velocity 31-70 cm/sec.....0.3-0.6

3) Velocity >70 cm/sec.....0.0-0.2

c. Fry Life Stage

1) Velocity ≤ 10 cm/sec.....0.8-1.0

2) Velocity 11-25 cm/sec.....0.4-0.7

3) Velocity >25 cm/sec.....0.0-0.3

4. Turbidity--Bank stability, stream-level fluctuation, and soil characteristics of the watershed are factors affecting turbidity ratings.

a. All life stages — Rating

1) Turbidity < 10 JTU.....0.7-1.0

2) Turbidity 10-30 JTU.....0.3-0.6

3) Turbidity > 30 JTU.....0.0-0.2

5. pH--The optimal pH range for cutthroat trout is between 6.5 and 9.0. However, regional differences occur; cutthroat trout are found in waters with pH values above 9.0 in some areas of the western United States. The pH values are influenced by watershed characteristics and altitude.

a. All life stages	Rating
1) pH 6.5-9.0	0.7-1.0
2) pH 5.5-6.5 and 9.0-9.5	0.1-0.6
3) pH <5.5 and >9.5	0.0

C. Food

1. Cutthroat trout are opportunistic feeders. Aquatic insects, generally the most available food in streams, are the year-round dominant food item in the diets of most cutthroat trout. In headwater streams, as much as 40 to 50% of the food trout eat during the summer may be comprised of terrestrial insects, and aquatic invertebrate fauna is much more abundant and diverse in riffles than pools. The presence of submerged aquatic vegetation enhances the aquatic invertebrate abundance.

2. Substrate for Invertebrate Production

a. All life stages	Rating
1) Rubble dominant ($\geq$ 40%) with limited amounts of gravel. Boulders and fines not common	0.8-1.0
2) Rubble, gravel, boulders, and fines occur in approximately equal amounts	0.6-0.7
3) Rubble and gravel noticeable ($\leq$ 25%), but fines or boulders are dominant	0.3-0.5
4) Fines, bedrock, or boulders are the dominant bottom material. Rubble and gravel are insignificant, if present at all ($\leq$ 10%)	0.0-0.2

D. Reproduction

1. Cutthroat trout are stream spawners. Spawning begins as early as March and ends as late as August. The time of

spawning depends on water temperature, runoff, ice melt, elevation, and latitude.

2. Temperature — Rating

   a. 10-13° C.....0.8-1.0

   b. 7-9° C and 14° C.....0.5-0.7

   c. <7° C and 15-17° C.....0.1-0.4

   d. >17° C.....0.0

3. Substrate Diameter for Redds--Stream reach should contain >15% of the total area as suitable spawning habitat. Increasing percent fines decreases the suitability of substrate for redd construction.

   Rating

   a. Substrate size (in riffles) of 4-12 cm, with <10% fines.....0.8-1.0

   b. Substrate size 2-4 cm and 13-20 cm with <10% fines and 5-20 cm with 10-15% fines.....0.4-0.7

   c. Substrate size <2 cm or >20 cm regardless of % fines, or % fines >25% regardless of substrate size.....0.0-0.3

4. Velocity--measurements should be taken near the bottom in riffles.

   a. 20-30 cm/sec.....0.8-1.0

   b. 15-19 cm/sec or 31-60 cm/sec.....0.3-0.7

   c. <15 cm/sec or >60 cm/sec.....0.0-0.2

A field evaluation using Habitat Evaluation Criteria consists of measuring the parameters to determine the suitability index rating for each parameter. The methods and sampling procedures for a habitat evaluation are to be included in each handbook. The user has several options for evaluation after the various parameters have been measured and a rating determined for each parameter. The rating scores can be arranged into a matrix to display the degree to which each habitat parameter meets the habitat requirements of each life stage of the species. Other options include using the lowest mean or highest ratings or application of the geometric mean, to result in a total HSI score for the habitat. This source could then be compared with other suitability ratings to determine relative quality of habitats to the species.

Uses of Aquatic Habitat Evaluation in Endangered Species Management

An example of Aquatic Habitat Evaluation as a tool in evaluating impacts to endangered species would be the construction of a reservoir on the Yampa River, Colorado, and its impact to the endangered Colorado River squawfish (Ptychocheilus lucius). The impacts of the reservoir to the squawfish habitat could be determined by applying Aquatic Habitat Evaluation to rate the squawfish habitat prior to impoundment and comparing these ratings to those from predicted postimpoundment results (or results from studies on completed projects with similar habitats). In preimpoundment evaluations, temperature may be given a high habitat suitability rating; however, in postimpoundment studies temperature would receive a low rating. Thus, specific habitat parameters that would be impacted are identified, resulting in a possibility of compromise or modification of the project. Native species could also be considered, in the planning and operation of various projects, by the use of Aquatic Habitat Evaluation.

The selection of potential release sites for the threatened greenback cutthroat trout (S. clarki stomias) provides an example of the potential for use of Aquatic Habitat Evaluation in evaluating and comparing habitats for introduction of endangered species. The Colorado Division of Wildlife and the U.S. Forest Service compiled a list of possible stream release-sites but no definite set of guidelines were used to rate and compare these areas as potential habitat for the greenback cutthroat trout. A release was made in a tributary of the Poudre River, Colorado in 1966 when 54 greenback trout were introduced in the upper 3.2 km of Hourglass Creek (elevation near 3,000 M), a stream selected from the list of release sites. Subsequent sampling over several years failed to locate any greenback trout in Hourglass Creek, although a few were collected downstream in another tributary. Failure of this introduction was attributed to cold water temperature. Cutthroat trout prefer water temperatures between 9 and 12° C and the average summer water temperature in Hourglass Creek is below this optimum. Cutthroat trout have been known to migrate downstream when introduced into streams with low temperatures and data suggest that this may have occurred in this example. The use of Aquatic Habitat Evaluation would have resulted in a low temperature rating in Hourglass Creek. Based upon this rating, a decision may have been made to use another stream with a higher habitat suitability rating.

In addition, Aquatic Habitat Evaluation could be of use in selecting habitat improvement measures. Effective stream improvement efforts include two essential steps: 1) identification of the areas where habitat improvements are needed, and 2) the proper design and placement of these habitat improvements within the stream environment. Aquatic Habitat Evaluation can provide a quantifiable method for evaluating aquatic systems in order to identify habitat deficiencies. Raleigh and Duff (In press) discuss the identification of trout stream habitat improvements utilizing this methodology.

Considerations in the Use of Aquatic Habitat Evaluation

The main advantage of Habitat Evaluation is that it gathers information from several sources and attempts to utilize this information in a standardized way in evaluating a habitat for a species. However, the habitat evaluation criteria are only as good as the data base. If background species information is not available the usefulness and applicability of a habitat evaluation declines. In addition, the habitat evaluation criteria consists primarily of physical variables and the habitat ratings may be altered by knowledge of biological variables.

Habitat Evaluation is not a complete evaluation, but a standardized guideline and approach for evaluating habitat. It was not designed specifically for endangered species management, yet, the handbook information and procedures for evaluating and rating species habitats should be useful to those who have responsibility for endangered species management.

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Status of Populations of the Endangered Chihuahua Chub, Gila nigrescens, in New Mexico and México

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Abstract--The current (1979) population status and habitat requirements of Gila nigrescens were determined throughout the range in four separate river systems and one isolated basin in New Mexico and Chihuahua, México. The species occurred at eight of 16 localities where it was formerly common, but was abundant at only three stations. It is thus regarded to be an endangered species. Reasons for its decline are modification of the habitat due to depletion of ground water, channelization, water diversion, and pollution. Exotic, predatory fish species may also contribute to its reduction. Adult chubs require pools, shade, and undercut banks or protective cover for successful spawning; a constant flow of water may not be necessary for survival. A resolution has been sent to the U.S. Department of the Interior requesting that G. nigrescens be listed as an endangered species and that stock from the Mimbres River, New Mexico (now being cultured), be reintroduced into that river when a suitable refuge becomes available.

Abstracto--El estado actual (1979) y los requimientos ecológicos del ciprinido, Gila nigrescens, fueron determinados en las cuencas cerradas del Río Mimbres en Nuevo México, E.E.U.U., y en la Laguna de Bustillos, y los Ríos Casas Grandes, Santa María, y del Carmen en Chihuahua, México. Encontrámos poblaciones de esta especie en ocho de los dieciseís localidados estudiados, siendo abundante en solo tres. Es por esto que la consideramos una especie amenazada. Las poblaciones llegan a ser escases a causa de modificaciones ambientales, tales como el agotamiento de las aguas subterráneas y la canalización, diversión y contaminación de las aguas superficiales. Para reproducirse, los adultos requieren charcos (1 m o más de profundidad), sombra y lugares de abrigo. Parece ser que no requieren agua corriente para sobrevivir. Hemos enviado una resolución al Departamento del Interior, E.E.U.U., indicandoles que consideren Gila nigrescens como especie amenazada. También, recomendamos que reintroduzcan Gila nigrescens en el Río Mimbres, Nuevo México, después de la restuaración de la habitat natural.

Until recently, the representative of the genus Gila inhabiting the Rio Grande basin has been generally identified as Gila nigrescens (Girard), the Rio Grande chub (Bailey et al., 1970:20). In an unpublished study by Teruya Uyeno and R.R. Miller in 1960 that is now being updated and augmented, it was determined that this chub should be called Gila pandora (Cope). That conclusion received advance documentation by Miller (1961) and by Miller and Hubbs (1962), who described some of the characters by which G. pandora and G. nigrescens differ.

The fish we now call the Chihuahua chub was first described as Gila

pulchella (Baird and Girard,1854:29) on the basis of two specimens taken in 1851 from the Mimbres River north of Deming, New Mexico. Although the original description gave the type locality as "Rio Mimbres, tributary of the Gila", which was subsequently changed (Girard, 1859:63) to "Rio Mimbres, tributary of Lake Guzman, Mexico", careful study by William J. Koster of the route of the collector, John H. Clark, showed that the specimens actually came from New Mexico. There is no Río Mimbres in Chihuahua, México, despite Meek's (1904: map opp. xlvii) placement of it there.

The Chihuahua chub was next described (Girard, 1856:207) as Tigoma nigrescens from the Río Casas Grandes basin (Río Janos, Boca Grande) in Chihuahua, México. Although pulchella is the older name, it cannot be used because Günther (1868:207) united Gila with Leuciscus and thus brought into secondary homonymy Gila pulchella and Leuciscus pulchellus Storer, 1839 (a synonym of the eastern North American fallfish, Semotilus corporalis). Articles 57 and 59b-c of The International Code of Zoological Nomenclature make unavailable for use any secondary homonym rejected prior to 1960. Jordan and Evermann (1896:234) also rejected Gila pulchella and chose Tigoma nigrescens on the basis of secondary homonymy, although their concept of Leuciscus nigrescens included several currently recognized species of Gila and their description was based chiefly on Gila pandora.

The demise of the Chihuahua chub from the United States portion of its range was twice reported prematurely. Koster (1957:57) said it was gone from the Mimbres River, probably because of the introduction of the longfin dace, Agosa chrysogaster Girard. Miller (1961) "confirmed" its disappearance on the basis that Carl L. Hubbs and family collected in the Mimbres River in 1938, took no chubs, and were told by a Dr. Royal that in 1884, when the river had more water and many deep holes, he commonly caught 6-inch "Gila trout", the local name for Gila nigrescens. At the time of the Hubbs' visit no longfin dace were found but Notropis formosus (now extinct in the Mimbres) was taken. In May and June, 1975, 124 years after its last collection there, Gila nigrescens was "rediscovered" in the Mimbres River by Bill Rogers, a high-school science teacher and principal under contract for stream-survey work with the New Mexico Department of Game and Fish (Rogers, 1975, unpubl. rept. cited by Hubbard et al., 1978). Two specimens were obtained. In late March 1979, 10 adult chubs were removed from the river by Michael D. Hatch, employee of the same organization, for propagation at the Dexter National Fish Hatchery in Chaves County, New Mexico, a federally-supported endangered species facility. The transplanted stock has spawned successfully in a half-acre pond and it is planned to reintroduce the chub into the Mimbres after a suitable refuge is made available.

The present paper discusses the current population status and habitat requirements of the Chihuahua chub throughout its known range in four disjunct rivers and the endorheic basin of Laguna Bustillos in New Mexico and México (Fig. 1). All Mexican localities are in northern Chihuahua. A survey was made from 4 May to 4 June 1979, financed by the Albuquerque office of the U.S. Fish and Wildlife Service and the U.S. Army Corps of Engineers (Contract No. 14-16-0002-79-142). We found the species at 8 of 16 reported localities, but it was abundant at only 3 of these stations—essentially a single station (numbers 5 and 6) in the Río Casas Grandes and two (numbers 8 and 9) in the Río Santa María (Fig. 1). Abbreviations used below are: ASU (Arizona State

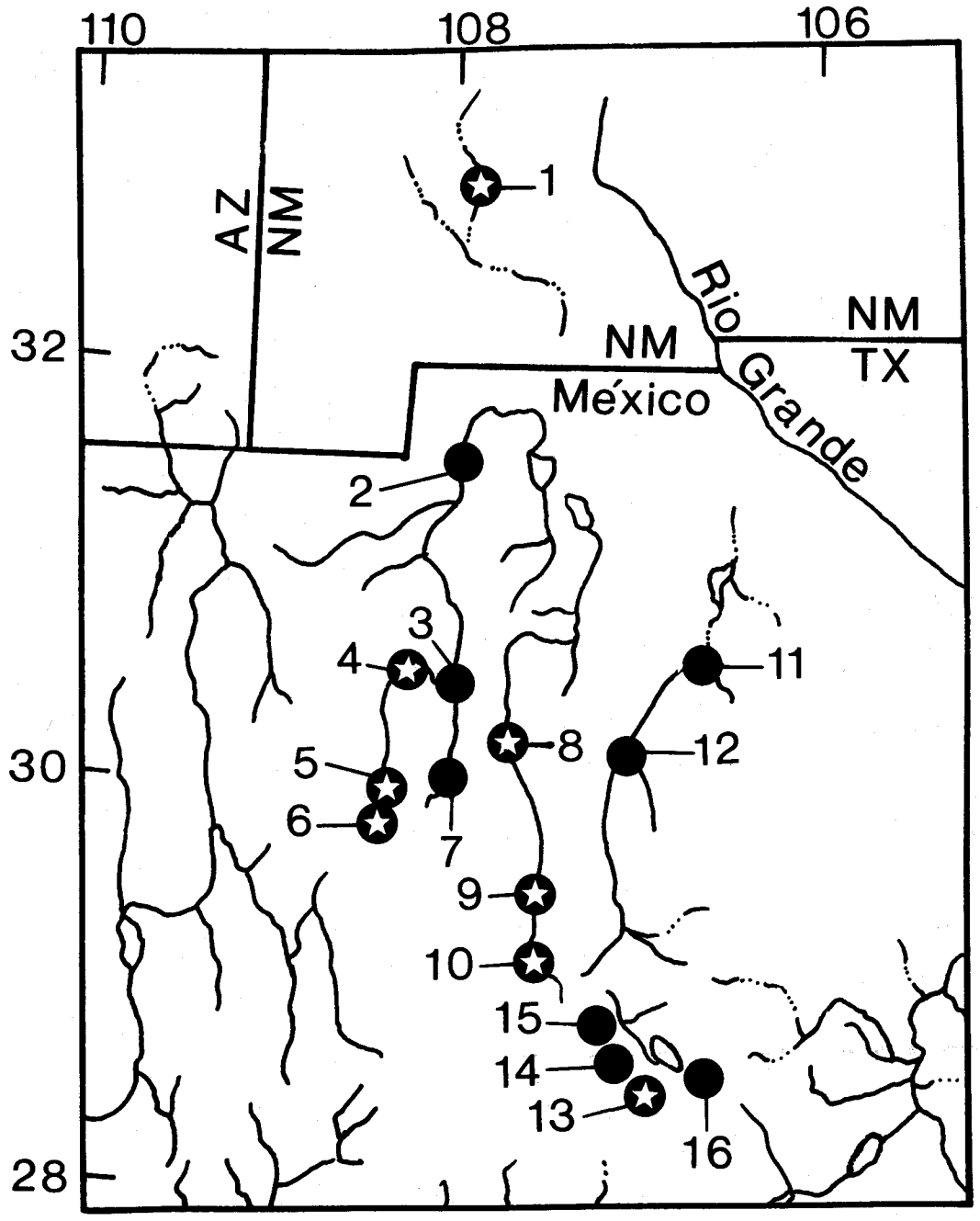

Fig. 1. Stations surveyed for Gila nigrescens in 1979. Those starred indicate presence, solid spots absence. Station 1 is on the Mimbres River, New Mexico (all others are in Chihuahua, Mexico). Stations 2 to 7 are on the Río Casas Grandes, 8 to 10 on the Río Santa María, 11 to 12 on the Río del Carmen, and 13 to 16 in the Laguna Bustillos Basin.

University), UANL (Universidad Autónoma de Nuevo León), and UMMZ (University of Michigan Museum of Zoology).

I. Mimbres River Drainage, New Mexico

(A) Tributary to Mimbres River, ca. 300 m N of confluence of Bear Canyon (Fig. 1, #1), Grant Co., T16S, R11W, Sec. 28, 1840 m, 4 May 1979.— This is the last known locality for Gila nigrescens in the Mimbres River, as stated above. Since we did not wish to disturb the adult population we confined our efforts to seining and dipnetting young-of-the-year fish in this spring-fed tributary. Study of this material revealed only Catostomus plebeius Baird and Girard and the exotic Agosia chrysogaster. There is no evidence that G. nigrescens is reproducing successfully in the Mimbres River.

II. Río Casas Grandes

(A) Río Casas Grandes, ca. 21 km SW of Ascensión (Fig. 1, #2), 108°09' N long., 30°53' W lat., 1325 m, 5 May 1979.—Gila nigrescens was not found; we did collect two exotics, Cyprinus carpio and Ictalurus melas, and eight adults of the native shiner, Notropis formosus. Gila nigrescens was last collected here in 1950 by R.R. Miller and party. Considerable change has taken place since then — the habitat is now badly polluted, the pools stagnant, with almost no flow on riffles, and choked by Spirogyra and other algae. About 10 years ago, Dr. W. L. Minckley, ASU, collected the Chihuahua chub ca. 4 km N of this station; however, the status of that population is presently unknown, although it seems unlikely that it still persists downstream from the present station.

(B) Río Casas Grandes just E of Casas Grandes (Fig. 1, #3), 107°56' N long., 30°23' W lat., 1470 m, 4 June 1979.—The Chihuahua chub was not present here. The habitat consisted of sluggish, murky water choked with Spirogyra, blue-green algae, and narrow-leaf Potamogeton, and strewn with trash. The only fishes collected were Cyprinus carpio, Ictalurus melas, Notropis formosus, and Campostoma ornatum. Gila nigrescens was last recorded here in 1964 (ASU 816 and UANL 588); the 425 specimens in the latter collections indicate the previous abundance of the chub.

(C) Río Piedras Verdes, 6.5-10 km above Colonia Juarez (Fig. 1, #4), ca 108°08' N long., 30°21' W lat., ca. 1550 m, 3 June 1979.—One juvenile Gila nigrescens, 77 mm SL, was taken at this station. This 5-10 m wide portion of the river had clear-flowing water (fast over riffles, slow in deeper portions), sand, gravel, rocks and boulders (only occasionally mud), often dense patches of narrow-leaf Potamogeton, Hydrocotle, and Spirogyra, undercut banks, good cover (downed willows and shrubs), and few pools. The banks were characterized by sod, shrubs, willows, sycamore, and ash trees. Other fishes collected were Catostomus plebeius, Campostoma ornatum, Notropis formosus, Pimephales promelas, Ictalurus melas, and Ambloplites rupestris (exotic). Previous collections made in the Río Piedras Verdes near Colonia Juarez indicate that G. nigrescens was formerly more abundant (e.g., UMMZ 182401, 85 specimens). In June 1978 the Río Yaqui survey team, from ASU, found the chub to be common here. The apparent change between June, 1978,and June, 1979, is inexplicable at this time.

(D) Río Piedras Verdes, near Colonia Hernandez (Fig. 1, #5), 108° 18' N. long., 30° 03' W lat., ca. 1975 m, 6 May 1979.—Gila nigrescens was very abundant at this locality, and a graded series of young to breeding adults was preserved. Many of the adults were in breeding color; 2 females (175 and 142 mm SL) had mature eggs but were not quite ready to spawn. The presence of many juveniles less than 30 mm SL (estimated to be 4-6 weeks old), and the condition of the females, indicate that spawning may occur over a protracted period or that bimodal spawning takes place (e.g., spring and fall). The habitat could be characterized as pristine — clear-flowing water, deep pools, sand and gravel bottom, large boulders, and crevices in the canyon walls. Many adult chubs were observed among the boulders in the deeper pools; juveniles were collected and observed in shallow water over gravel. Only indigenous species were taken with the chubs: Notropis formosus, Campostoma ornatum, and Catostomus plebeius. Gila nigrescens was last collected in 1953 3.2 km NE of Colonia García, ca. 7 airline km upstream (SW) of Colonia Hernandez.

(E) Arroyo del Aguila, ca. 5 airline km ESE of Colonia Hernandez (Fig. 1, #6), 108° 15' N long., 30° 03' W lat., ca. 2020 m, 6 May 1979.—This stream is a major tributary to the Río Piedras Verdes and joins that river at Colonia Hernandez. The collection was taken in the mountains ca. 50 m above the town. The upper reaches of the arroyo were intermittent and G. nigrescens was abundant in many of the pools and rheocrenes. The habitat comprised sand and gravel bottom with rocks and large boulders; little if any aquatic vegetation was present. Only three individuals were preserved for comparative purposes. Also taken with the Gila were the same three native species caught at Colonia Hernandez. This is the first known collection at this locality.

(F) Río San Miguel at Ignacio Zaragoza (Fig. 1, #7), 107° 46' N long., 29° 34' W lat., 2088 m, 30 May 1979.— Although the Chihuahua chub was known from this locality as of 1975 (UANL uncatalogued, ASU 6375, 6381), it was not present in 1979. The habitat has been drastically modified — the channel has been dredged and levees built (we estimate this was done within the last year because the levees were not vegetated and the gravel was still loose). The water was murky, without current, and not more than 5 cm deep anywhere. The bottom consisted of sand, gravel, and cobble, and some areas had dense stands of narrow-leaf Potamogeton, Hydrocotle, and Myriophyllum. Only Cyprinodon sp. was encountered.

III. Río Santa María Drainage

(A) Río Santa María, .3-1.5 km above Buenaventura (Fig. 1, #8), 107° 29' N long., 29° 47' W lat., ca. 1510 m, 30 May 1979.— The Chihuahua chub was common in some parts of the river. Notes on their microhabitat distribution are instructive. At the time of collection, the water was ca. 1 m deep, brown, turbid, and flowing swiftly. The bottom consisted of sand, gravel, boulders, and some mud closer to shore. Vegetation was not noted in the main channel, but was present in fords and small bays; the major species were narrow-leaf Potamogeton, Hydrocotle, Marsallia, and Nasturtium. Strong current made the main channel very difficult to work, and only some small shiners and a poeciliid were collected there. Gila nigrescens, including adults in breeding color, was collected only in flooded road crossings, bays, and eddies. Most chubs were taken in one small embayment with an undercut bank (the significance of

this will be discussed below). Other species collected were Notropis formosus, Pimephales promelas, Catostomus plebeius, and Gambusia affinis (exotic).

(B) Río Santa María at Santa Ana de Bavícora (Fig. 1, #9), 107° 28' N long., 29° 02' W lat., 1850 m, 29 May 1979. —Juvenile to adult Gila nigrescens were abundant at this locality. The only previous record of this species here is UANL 1850 (13 specimens). Although this is essentially a large-river habitat (10-15 m wide), the water present was due to a rheocrene; immediately upstream (above the hwy. bridge), for a distance of 8 km, the river bed was dry. The habitat did not comprise isolated pools; rather, the water was continuous, without visible current, deeper against the steeply-cut western bank, with a bottom of sand, fine gravel, and mud substrates. Aquatic vegetation consisted of narrow-leaf Potamogeton and green algae with willows and cottonwoods lining the shores. Small chubs were captured in the open water and shallow, vegetated habitats. The larger specimens were taken in deeper water (usually greater than 1 m), in shady areas, and against the steeply-cut bank. One adult Gila nigrescens was taken in a shady, shallow area among some fallen logs. Other species captured were: Notropis formosus, Pimephales promelas, Catostomus plebeius, Cyprinodon sp., and Cyprinus carpio.

(C) Río Santa María at Bachíniva (Fig. 1, #10), 107° 15' N long., 28° 45' W lat., ca. 2025 m, 29 May 1979. —This locality is the farthest upstream station that we collected in the Río Santa María basin. Only 2 small juveniles of the Chihuahua chub were taken; no previous records of this fish are known from Bachíniva. This is an arroyo with permanent water subject to much fluctuation; both shallow areas and deep pools were present. The substrate consisted of sand, gravel, rocks, and cobbles. A large area was choked with dense mats of filamentous green algae and fine-leaf Potamogeton; also present were Nasturtium and Hydrocotle. The shore adjacent to the arroyo was a garbage dump among the rooted Salix. Other species collected were: Notropis formosus, Pimephales promelas, Catostomus plebeius, and Cyprinodon sp.

IV. Río del Carmen Drainage

(A) Río del Carmen, near Ahumada (Fig. 1, #11) 106° 31' N long., 30° 37' W lat., ca. 1210 m, 31 May 1979. —Our search for water in the region surrounding Ahumada revealed that it had been diverted out of natural river channels for irrigation. Crossing the desert westward from Ahumada toward Ojo Carbonera across the Carmen basin, only dry stream beds and arroyos were encountered. Gila nigrescens was last collected in this region in 1975 (UANL 2223, 1 specimen).

(B) Río del Carmen, from Hwy 10 crossing W of Ricardo Flores Magón to 7 km S (Fig. 1, #12), 106° 59' N. long., 29° 57' W lat., ca. 1480 m, 30 May 1979. —At R. F Magón the entire river had been diverted into two concrete raceways and the former river bed (ca. 50 m wide) was completely dry. We drove upstream for 10 km to a large earthen dam (ca. 50 m high) with a hydro-electric power plant at the base. Behind the dam was a large reservoir (we estimate that we saw at least 32 km before the reservoir turned west between some mountains), with steep banks, containing brown, turbid water; the banks were too steep and soft and the water too deep for collecting in the reservoir. The Chihuahua chub was last taken near R. F. Magón in 1975 (UANL uncatalogued).

V. Laguna Bustillos Basin

(A) Arroyo de Nopabechic (Fig. 1, #13), 106° 58' N long., 28° 30' W lat., ca. 2140 m, 27 May 1979. —Several large isolated, stagnant pools, choked with algae and garbage, were seen in the arroyo west of the bridge. Another pool at the base of the bridge (ca. 7 m long, 1 m wide and up to 0.5 m deep) contained Gila nigrescens. The pool was supplied by a rheocrene with a very slight flow to the east. Sand, coarse gravel, rocks and cobbles formed the substrate, and filamentous green algae were present in the water. Five adult chubs were seen, two adults (ca. 200 mm and 150 mm SL) in breeding color were seined, photographed, and released. Thirty juveniles (less than 40 mm) were captured and five were preserved for study. The total population size in this pool was estimated to be 10 adults and 100 juveniles. The only other species present was Cyrpinodon sp. The Chihuahua chub was last collected here in 1975 (UANL uncatalogued).

(B) Arroyo Ojo Caliente (Fig. 1, #14), 106° 58' N long., 28° 34' W lat., ca. 1990 m, 27 May 1979. —Shallow, flowing water and some small standing pools (ca. 10 cm deep) were seen. Within this 30-m wide arroyo, the water was often restricted to 0.5 m or less. Upstream from the bridge the water was clear, without filamentous algae; however, at the bridge a thick surface scum was present. Only pupfish, Cyprinodon sp., and Bufo tadpoles were sighted within 200 m above the bridge; no collection was taken. The arroyo was dry below (east of) the bridge.

(C) Arroyo Miguel Chiquito (Fig. 1, #15), 106° 58' N long., 28° 32' W lat., ca. 2000 m, 27 May 1979.—This arroyo was totally dry. Gila nigrescens was previously collected here in 1975 (UANL 2493, 2 specimens).

(D) Arroyo San Antonio (Fig. 1, #16), 106° 47' N long., 28° 30' W lat., ca. 1990 m, 27 May 1979. —This large arroyo (ca. 30 m wide) had sufficient running water and pools to support fish. However, no fish or aquatic animals were sighted or encountered. The water was murky green, often with suds and scum floating on the surface. Bubbles were constantly rising from the bottom — probably the result of nutrient overload from the surrounding agricultural fields. Thirty-eight specimens of Gila nigrescens were collected here in 1964 (UANL 552).

Discussion

The summary of collection data (Table 1) shows that Gila nigrescens was present at only eight of the sixteen localities surveyed. Furthermore, the chub could be considered abundant at only four of these stations. Two places where the species was abundant (Río Piedras Verdes at Colonia Hernandez and Arroyo del Aguila) should perhaps be considered as one locality due to their proximity, thus reducing that number to three. These findings clearly support the listing of Gila nigrescens in New Mexico and Chihuahua as endangered (Hubbard et al., 1978:E-17; Deacon et al., 1979).

The latter authors cited (1) present or threatened destruction, modification, or curtailment of habitat or range and (2) hybridization, effect of exotics and

Table 1. Stations checked for Gila nigrescens in the Chihuahuan Desert, 4 May - 4 June, 1979.

Map #	Location	Date	Present	Abundant
Mimbres River Drainage				
1	Mimbres River, N of Bear Canyon Reservoir	4 May	+[1]	-
Río Casas Grandes Drainage				
2	Río Casas Grandes, SW of Ascención	5 May	-	-
3	Río Casas Grandes at Casas Grandes	4 June	-	-
4	Río Piedras Verdes above Colonia Juarez	3 June	+	-
5	Río Piedras Verdes, near Colonia Hernandez	6 May	+	+
6	Arroyo del Aguila	6 May	+	+
7	Río San Miguel at Ignacio Zaragoza	30 May	-	-
Río Santa María Drainage				
8	Río Santa María above Buenavantura	30 May	+	+
9	Río Santa María at Santa Ana de Bavícora	29 May	+	+
10	Río Santa María at Bachíniva	29 May	+	-
Río del Carmen Drainage				
11	Río del Carmen, near Ahumada	31 May	-	-
12	Río del Carmen, near R.F. Magón	30 May	-	-
Laguna Bustillos Basin				
13	Arroyo de Nopabechic	27 May	+	-
14	Arroyo Ojo Caliente	27 May	-	-
15	Arroyo Miguel Chiquito	27 May	-	-
16	Arroyo San Antonio	27 May	-	-

[1] 27 March 1979. No attempt to collect adults was made on 4 May 1979.

competition as the causative agents for the decline of this chub. Discussion of our observations on the ecology of Gila nigrescens are relevent here. Among the eight stations where taken, adult chubs were present only in those habitats that had some combination of pools at least 1 m deep, shade, and undercut banks or cover (e.g., downed logs, submerged shrubs). Juveniles were found in shallower habitats, with or without cover. This seems to suggest that the habitat requirements of the adults are the limiting factor for the survival of the species. That is, as the natural waterways are being continuously modified by hydrological projects, it is the adult habitats that are diminished. For example, it is obvious that habitats such as we observed in the Río San Miguel at Ignacio Zaragoza, with a maximum depth of 50 mm, could not support adult Chihuahua chubs, whose body depth is nearly as great as this. A constant flow of water is not necessarily important to adult survival and spawning. Rather it is the maintenance of those critical features listed above that is necessary. For example, the presence of adult and juvenile Gila nigrescens in the small, isolated pool at the base of a bridge in the Bustillos basin may indicate that this species can survive in intermittent environments as long as the pools persist throughout the dry seasons. This description also characterizes the situation at Arroyo de Aguila. Minckley (1973:108) reported this type of ecological adaptation for the Sonora chub, Gila ditaenia Miller.

It may be argued that large volumes of water would be best for the survival of the Chihuahua chub. Our observations support this contention as long as ample pools, etc., are maintained. For example, the population in the Río Santa María above Buenaventura is abundant, but further modification of the habitat that would increase currents and decrease the number of pools, undercut banks and embayments, would drive the population to extinction. Such a scenario may have occurred in the Mimbres River.

The marked reduction in abundance and distribution of Gila nigrescens thus may be attributed to habitat alteration or loss from groundwater mining, channelization, water diversion, deforestation, and pollution. We also noted the frequent occurrence of exotic species. However, what role they may play has not been determined and we can only assume that five introductions (carp, longfin dace, black bullhead, mosquitofish, and rock bass) into an area characterized by a depauperate fish fauna can scarcely enhance the survival of the native fishes. Gila nigrescens is not reproducing successfully in the Mimbres River (only 12 small to large adults have been taken since 1975), whereas longfin dace (Agosiachrysogaster) are excessively abundant; it is tempting to infer that this exotic not only eliminated the native Notropis formosus but also may be suppressing the survival of the Chihuahua chub. However, that hypothesis must be tested before competition is inferred.

We recommend that (1) the Chihuahua chub be officially designated an endangered species, for both the U.S. and México; (2) a rehabilitated refuge be selected for it, with adequate protection, in the Mimbres River basin; (3) a stock of the Mimbres population, now being developed at Dexter National Fish Hatchery, be reestablished in the Mimbres refuge when appropriate; (4) additional populations of the species be sought and monitored in the Río Casas Grandes, Chihuahua — the genetically closest stock to that of the Mimbres River; and (5) an attempt be made to designate a refuge for the species in México so as to assure perpetuation, should the Mimbres River population be extirpated.

At the eleventh Annual Symposium of the Desert Fishes Council in Death Valley, 15-16 November 1979, a resolution was unanimously passed asking the U.S. Department of the Interior to list Gila nigrescens as an endangered species and to reintroduce the Mimbres River stock when a suitable refuge becomes available.

Meristic data on hand strongly suggest that the populations of Gila nigrescens in the well isolated Laguna Bustillos basin are worthy of taxonomic recognition but at what level remains to be determined. The taxonomic status of all populations treated above will be presented in a paper now in preparation.

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PRELIMINARY FINDINGS ON THE REPRODUCTIVE BIOLOGY OF THE LOACH MINNOW, TIAROGA COBITIS.

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The loach minnow, Tiaroga cobitis, spawns in cavities under large flattened cobble. Spawning sites are located in the shallow margins of riffles. Mean depth of egg sites in this study was 9 cm. Fertilized ova were found attached to the underside of large flattened cobble. Number of ova per rock ranged from 9-160 with a mean of 58. Most ova were deposited in a single layer under the downstream half of the rock. Mean size of cobble used as an egg site was 13x17 cm.

Ova were first found in the East Fork of the Gila River in mid May with a mid day water temperature of 16.5 C. Ova were observed hatching in the East Fork on June 1, 1979, at a water temperature of 21 C. The main Gila River also had ova hatching on June 1,1979, at a temperature of 16 C. Prolarvae hatched in aquaria were 5 mm, T.L., at hatching. Only the caudal fin was well developed at hatching.

Analysis of oocyte diameter measurements revealed only one mode of ova matured and were spawned during the 1979 breeding season. Length frequency data for Tiaroga cobitis from the East Fork and the main Gila River indicated a life span of 16-18 months and 24-26 months respectively. Growth of young-of-year was slower in the main Gila than in the East Fork. Loach minnows from the 1978 year class were still common in collections from the main Gila during October but were absent in collections from the East Fork at the same time.

La pequena locha, Tiaroga cobitis, desova in cavidades bajo grandes guijarros aplanados. Los sitios de desove son localizados en las margenes de corrients someras. La profundidad media de sitios de desove en este estudio fue 9 cm. Los huevos fertilizados son encontrados adheridos al lado inferior de los grandes guijarros aplanadas. El numero de hileras de huevos por roca es de 9-160 con una media de 58. La mayoria de los ovulos fueron depositados en una simple capa bajo la corriente media de la roca. El tamano medio del guijarro usado como un sitio de desove fue de 13x17 cm.

Los ovulos fueron primero encontrados en el East Fork de Rio Gila a mediados de Mayo con una temperatura del agua a medio dia de 16.5 C. Los ovarios fueron observados incubando en el East Fork en Junio primero de 1979, con una temperatura del agua de 21 C. En el region principal de Rio Gila se han incubado ovulos en Junio primero a una temperatura de agua de 16 C. Prolarvas incubadas en acuarios midieron 5 mm (longitud total) al nacer. Solamente la aleta caudal estaba bien desarrollada al nacer.

El analisis de medidas del diametro de ovocitos revela solo una moda de ovulos maduros y que fueron desovados durante la epoca de cria en 1979. Datos de frecuencia de duracion para Tiaroga cobitis del East Fork y el Rio Gila indican una longevidad de 16-18 meses y 24-26 meses respectivamente. El crecimiento de juveniles de un ano fue mas lento en el Gila principal que en el East Fork. Las pequenas lochas de la clase del ano de 1978 fueron comunes en colectas del Gila principal durante Octubre pero fueron ausentes en colectas del East Fork en el mismo tiempo.

Translated by Pablo Dominguez

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ABSTRACT

Title: Distribution of introduced and native salamanders in east-central and southeastern Arizona.

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Abstract: Collections and museum records of A. tigrinum indicate that there are two taxa in southeast Arizona. A. t. nebulosum is the native form and it occurs in natural and artificial aquatic habitats principally in montane conifer forests or subalpine grasslands at elevations > 1500 m. A. t. mavortium is probably introduced and is restricted to artificial habitats principally in sonoran desertscrub and semi-desert grassland at elevations < 1600 m. Both forms occur in intermediate elevation communities. A. t. mavortium was presumably introduced in Arizona by commercial bait dealers and sportsmen.

Observations on Population Status and Reproduction of the Warner Sucker (Catostomus warnerensis)

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Abstract--The Warner sucker (Catostomus warnerensis) is endemic to the Warner Valley, an endorheic basin in southeastern Oregon. The status of the Warner sucker appears threatened because of apparently dwindling population sizes. Agricultural diversion of water in spawning streams seems to have been the main causative factor. During our study from 29 April to 27 July, 1979, 300 adult (3 yr) and 1-2 yr old suckers were captured in streams tributary to the Warner lakes. Populations of 1-3 yr old suckers were found in Twelvemile Creek, Snyder Creek and in the spillway canal north of Hart Lake. No spawning was observed but postlarval and young of year suckers were observed in Twentymile, Twelvemile, Snyder and Honey Creeks. Young of year do not appear to migrate to the lakes soon after hatching but may spend as long as 3 yrs in the creeks.

Abstracto--El Warner sucker es endémico del valle Warner, una cuenca cerrada en el sudeste de Oregon. La situacion del Warner sucker parece estar amenazada debido a la aparente reducción del tamano de la poblacion. La diversificación agricola del agua en paqueños riachuelos de regadío parece haber sido el principal factor causante de esta situación. Durante el estudio, del 29 de Abril al 27 de Julio, se encontraron poblaciones de 1-3 años de edad en Twelvemile Creek, Snyder Creek y in el canal norte del Lago Hart. No se observó desove pero se encontraron estadíos post larvales y juveniles de menos de un ano en Twentymile Creek, Twelvemile Creek, Snyder Creek y Honey Creek. Los juveniles de un año no parecen migrar a los lagos rápidamente y pueden pasar hasta 3 años en los riachuelos.

Ecological and Genetic Interaction Between The Pecos Gambusia (Gambusia nobilis) and Two Sympatric Congeners

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Abstract--The Pecos gambusia, Gambusia nobilis, occurs in a wide variety of habitats in four general areas: (1) Bitter Lakes National Wildlife Refuge, Chaves Co., New Mexico; (2) Blue Spring, Eddy Co., New Mexico; (3) a springfed irrigation system in the vicinity of Balmorhea, Reeves Co., Texas; and (4) Leon Creek, Pecos Co., Texas. The densest populations were in marshy waters directly influenced by springflow. Absence or low abundance of G. nobilis was associated with habitat instability, waters with conductivities in excess of 32,500 micromhos/cm, and lack of cover from predators. Competition with Gambusia geiseri and to some extent with G. affinis also seems important in limiting the abundance of G. nobilis. Electrophoretic and morphological analyses of populations in several areas suggest that hybridization between G. nobilis and G. geiseri is of negligable impact, while that between G. nobilis and G. affinis can be sufficiently frequent as to be detrimental in local situations, especially where G. nobilis is rare compared to G. affinis.

Abstracto--El Pecos gambusia, Gambusia nobilis, se encuentra en una gran variedad de lugares en cuatro areas generales: (1) Bitter Lakes National Wildlife Refuge, Chaves Co., New Mexico; (2) Blue Spring, Eddy Co., New Mexico; (3) un sistema de irrigación suplido por un manantial de agua en la vecindad de Balmorhea, Reeves Co., Texas; y (4) Leon Creek, Pecos Co., Texas. Las poblaciones mas densas estaban en aquas pantanosas directamente afectadas por la corriente de los manantiales. Ausencia o poca abundancia de G. nobilis está associada con instabilidad en el lugar de habitación, aguas con conductivilidad en exceso de 32,500 micromhos/cm y por carecer de protección en contra de predectores. Competencia con Gambusia geiseri y hasta cierto punto con G. affinis también parece importante en prevenie la abundancia de G. nobilis. Electroforesis y analisis morfológicos de la población en várias areas sugieren que hibridización entre G. nobilis, y G. geiseri es de poco impacto, mientras que entre G. nobilis y G. affinis puede ser frequentemente suficiente para ser dañoso en situaciones locales, especialmente donde G. nobilis ocure raramente comparado con G. affinis.

Genetic Differences in Physiological Tolerances of Amargosa Pupfish (*Cyprinodon nevadensis*)

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Abstract--Dissimilar physiological tolerances of two pupfish populations inhabiting differing environments indicate that the fish have differentiated genetically since their isolation ca. 2000 years ago. Fish from constant temperature Big Spring showed a narrower range of temperature and oxygen tolerances than fish from the much more variable Amargosa River. These results suggest that minor evolutionary changes in physiological tolerances can take place relatively rapidly and may not be as difficult as previously believed.

Abstracto--Las tendencias fisiologicas disimilares de dos poblaciones de "pupfish" viviendo en medio ambientes distintos indican que los peces han diferenciado geneticamente desde su dislamiento hace 2000 anos. Los peces de una temperatura constante en Big Spring demostraron una alcance mas estrecha de tolerancias de temperatura y oxigeno que los peces del Rio Amargosa que es mucho mas variable. Estos resultados indican que cambios evolucionarios pequeños en las tolerancias fisiologicos pueden ocurrir relativamente rapido y no tan dificilmente como creido anteriormente.

Some Aspects of the Natural History of *Agosia chrysogaster* and *Pantosteus clarki* in Sycamore Creek, Maricopa County, Arizona

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Monthly samples of *Agosia chrysogaster* females from Sycamore Creek indicate an association between flooding and various aspects of reproductive behavior. Egg maturation to yolked stage occurred between 5 and 15 days after flooding at all 5 sites sampled in August 1979. Nests appeared at three of five sites and remained active for 45 days. Fry appeared in the vicinity of nests within 5 days of nest construction. Estimates of the ratio of gravid females to nests suggest that either only a small percentage of females with yolked eggs spawn or that nests are not prerequisite to spawning or both.

Feeding relations in both *Agosia* and *Pantosteus clarki* were observed in autumn 1978. Both species fed upon algae almost exclusively at this place and time, however *Agosia* fed during the day on filamentous algae and associated epiphytes while *Pantosteus* fed continuously on epipelic diatoms. Neither species feeds upon bluegreen algae, which were abundant at this time. Diel feeding patterns disappear when food supply is limited, thus increasing apparent competitive interactions between these two species.

These observations suggest that desert fishes respond to successional changes in desert streams by keying their reproductive activity to food availability. Because they function as herbivores and can achieve quite high densities, these fishes through their selective feeding activity, may be extremely important in shaping desert stream ecosystem productivity and algal community composition.

HABITAT PARTITIONING OF THE FISHES OF THE VIRGIN RIVER

Thom Hardy, James E. Deacon and Angelo Yfantis

The Virgin River was divided into four areas based upon similarity of habitats. Areas I and III are characterized by armoured stream areas with sand and cobble substrates and each are located below a gorge in canyon topography with steep gradients. Areas II and IV occur below major water diversion structures at the end of Areas I and III respectively. They are characterized by more open stream beds with sand substrates. These areas may be intermittant during late summer. Fish were collected with 15' x 6' x 14" mesh nylon seines during 1977-79. Six native species were collected in the study area: Lepidomeda mollispinnis mollispinnis (L.m.), Plagopterus argentissimus (P.a.), Rhinichthys osculus (R.o.), Gila robusta seminuda (G.r.), Catostomus latipinnis (C.l.) and Pantosteus clarki (P.c.), as well as the introduced species Notropis lutrensis (N.l.). All six native species showed highest densities ($p=.05$) in Areas I and III. Area II had the lowest density ($p=.05$) of any area. Area IV has the highest density of fish but the population consisted primarily of the introduced red shiner (N.l.). The woundfin (P.a.) was the only native species consistently collected in this area. There was no significant preference ($p=.05$) for any of the species for a particular substrate. Pools were selected over runs or riffles in general and G.r., L.m. and C.l. showed the strongest response. Fish density showed a positive response ($r\simeq.88$) to increasing current speed up to $\simeq.64$ meters per second. At higher current speeds fish density showed a negative correlation to current speed ($r\simeq.75$) and a wide scatter in response patterns.

Reintroduction of Endangered Fish Species into Historic Habitats

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Abstract--Reintroduction of endangered species back into their historic habitats is a viable recovery method for those species that presently occupy greatly reduced ranges. Two theories of reintroduction exist: 1) determine the reason for the original extirpation and correct it before attempting reintroduction, and 2) produce many individuals and spread them abundantly through historic range (Johnny Applefish method). The Fish and Wildlife Service has been blocked from reintroductions of endangered species in Arizona and New Mexico by the game and fish agencies and partially discouraged by the Colorado State Legislature. Principal problems revolve around how federal regulations might impact present resource utilization in the reintroduction areas (fishing, grazing, dam building, etc.). Three solutions are suggested in order to resolve the present problems: 1) specific federal policy on reintroducing endangered species; 2) an EXPERIMENTAL classification within the Endangered Species Act to allow special management regulations for reintroduced populations, and 3) all involved agencies should give first consideration to the resource we are all trying to save.

Extracto--La re-introducción de especies apeligradas a sus hábitats hitóricos es un método viable de recuperación para aquellas especies que actualmente habitan extensiones severamente reducidas. Existen dos teorías acerca de la re-introducción: 1) determinar la razón por la cual ocurrió su excisión y corregir la condición previo al intento de re-introducción, y 2) producir seres individuales en gran abundancia y distribuirlos al través de su extensión histórica. El Fish and Wildlife Service ha vistro frustrados sus intentos de re-introducción de especies apeligradas en Arizona y en Nuevo México por acciones de las dependencias estatales de fauna y pesca, asimismo la legislatura del estado de Colorado a desanimado seriamente tales intentos. Los principales problemas se han centrado en el efecto que pudiera resultar de la reglamentación federal sobre el aprovechamiento de los recursos en las zonas afectadas por la re-introducción (pesca, pastoreo, construcción de presas, etc.). Por lo tanto se recomiendan tres soluciones para resolver los actuales problemas: 1) una política federal específica que reglamente tales re-introducciónes; 2) una clasificación EXPERIMENTAL dentro del decreto que afecta las especies apeligradas y que reglamente una administración especial para las poblaciones re-introducidas, y 3) las dependencias gubernamentales deben asignar una alta prioridad a los recursos que son objecto de intentos de rescate.

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October 10, 1979

FISHES OF THE UPPER BILL WILLIAMS DRAINAGE, MOHAVE AND YAVAPAI COUNTIES, ARIZONA

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ABSTRACT.- The upper Bill Williams drainage in Mohave and Yavapai counties, Arizona, supports a diversified fauna of both native and introduced fishes. Twenty species and two hybrids have been recorded from the upper drainage and Alamo Lake. Museum records have been combined with collections from an intensive aquatic survey of the area to outline an account of the fish species that occur there. Patterns of distribution and abundance appear to be realitively stabilized with native fishes (Agosia chrysogaster, Rhinichthys osculus, Gila robusta robusta, Catostomus insignis, and Pantosteus clarki) exclusively occupying the headwaters, and introduced forms inhabiting lower reaches.

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PECES DE LAS AGUAS DE LA PARTE ALTA DEL RIO BILL WILLIAMS, CONDADOS DE MOHAVE Y YAVAPAI, ARIZONA

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ABSTRACTO.- Las aguas de la zona alta del río Bill Williams mantienen una variada fauna piscícola nativa y no nativa. Se han registrado veinte especies y dos híbridos en el cauce superior del río y en el lago Alamo. Se han reunido los archivos del museo con las colecciones resultadas de un intensivo reconocimiento acuático del área, para bosquejar la cantidad de especies piscícolas que se encuentran allá. Los modelos de distribución y abundancia parecen estar relativamente estabilizados con los peces de especie nativa (Agosia chrysogaster, Rhinichthys osculus, Gila robusta, Catostomus insignis, y Pantosteus clarki) que ocupan exclusivamente las aguas calientes y las formas no nativas que viven en las extensiones inferiores.

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ABSTRACT

Least chub (Iotichthys phlegethontis - Cope) Biology, Habitat Protection and Reestablishment Efforts

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The reproductive biology of the least chub Iotichthys phlegethontis (Cope) was studied from June 1976 to March 1978. Fish from both field and laboratory populations of the Leland Harris Spring Complex, Juab Co., Utah were utilized in the study. Reproduction in 1977 occurred from April to July in the laboratory population.

Reproduction was determined from gross examination and weight measurements of testes and ovaries, breeding coloration in males and diameter measurements of ova.

Males and females matured at about the same size, 28 to 30 mm TL. The number of mature ova produced during spawning ranged from 283 to 2752 for females 31 to 46 mm TL. Mature ova range in size from 0.8 to 1.28 mm. Least chub are partial and intermittent spawners. This conclusion is supported by ova diameter measurements and calculations of the duration and peak of spawning.

Least chub are polyandrous broadcast spawners over vegetation. The eggs are demersal and adhesive. The egg incubation period was 2.1 days at 22.2 C. The eleutheroembryo are approximately 5 mm in length. They are not photophobic and appear to have cement glands. Specific characteristics of reproduction are discussed in relation to ecological conditions of the habitat.

Utah Division of Wildlife Resources biologists have attempted to reestablish least chub to locations within their native range. Habitat protection and improvement structures have been constructed at Leland Harris Spring where this healthy least chub population was threatened by cattle damage.

Stream use by Exotic and Native Fishes, Grand Canyon National Park, with Observations on their Food Habits and Reproductive Cycles in 1976-1977.

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Abstract--Investigations of the fishes of the Grand Canyon region have increased in recent years, however there is little information pertaining to the life histories of the fishes occurring in these studies. This presentation provides information collected during 1976-1977 on the food habits, reproductive cycles, and stream use of three common Grand Canyon fishes, the rainbow trout, speckled dace and bluehead mountain-sucker.

Rainbow trout were found to eat several types of organisms, however their main food sources were mayflies, midges and black flies. They also occasionally ingested fish, i.e., speckled dace, larval bluehead mountain-suckers and trout eggs. Spawning in this exotic species began in late fall when water temperatures dropped below 10^0 C, and continued until early spring in all of the systems investigated. After that time, all of the streams were nursery areas, until the next spawning season. Rainbow trout were always present in Bright Angel Creek and used Phantom and Pipe Creeks sporadically. General distribution was that of smaller rainbows occurring in these streams during the late spring through early fall, while adult fish were present through late fall to early spring.

The main food items of the speckled dace were mayflies, midges and black flies. Reproduction in this species occurred in April-May at water temperatures of 15-19^0 C, and was completed by June. Speckled dace were present in all of these streams also, but illustrated a distribution essentially the reverse of the larger rainbow trout, being present during the late spring through the early fall, after which they were unobtainable by the collector. It is thought that this disappearance was due to the presence of spawning rainbow trout and was observed in all of the streams investigated.

Bluehead mountain-suckers were found to utilize periphyton as their major food source, although midges, black flies and caddisflies did occur in diets. This species spawned in the various tributaries during April-May when water temperatures ranged from 15-19^o C. Distribution of this fish was similar to speckled dace, with more bluehead mountain-suckers occurring in the stream systems investigated when larger rainbow trout were absent.

Abstracto--Las investigaciones sobre peces de la region del Cañón del Colorado han aumentado en los últimos años, sin embargo, hay poca información en estos estudios sobre la historia de la vida de estos peces. Esta presentación contiene información recogida entre 1976 y 1977 sobre los hábitos alimenticios, ciclos reproductivos y el uso de las corrientes que realizan tres peces comunes al Gran Cañón del Colorado: la trucha arcoiris, el albur jaspeado y la rémora cabeza azul de las montañas.

Se observó que la trucha arcoiris comía varios tipos de organismos, sin embargo, su fuente principal de alimento eran chachipollas, mosquitos y moscas negras. A veces también ingirieron peces, por ejemplo larvas de rémora cabeza azul de las montañas y huevos de truchas. El desove en esta especie exotica comenzó a fines del otoño cuando la temperatura del agua bajó a 10° C bajo cero y en todos los sistemas que se investigaron, continuó hasta principios de la primavera. Después de esa época, todas las corrientes fueron viveros hasta la próxima estación de desove. Siempre se encontraron truchas arcoiris en el arroyo Bright Angel y también esporádicamente in los arroyos Phantom y Pipe. La distribución general fue de arcoiris menores que ocurrieron en estas aguas durante la ultima parte de la primavera hasta principios del otoño.

La comida principal del albur jaspedo fueron las cachipollas, mosquitos y moscas negras. La reproducción en estas especies ocurrió en abril y mayo en aguas a temperaturas de 15 a 19° C, y terminó en junio. También se encontraron albures jaspeados en todas estas corrientes pero mostraron una distribucion esencialmente contraria a la de las truchas arcoiris mayores, presentes durante la última parte de la primavera hasta principios del otoño después de lo cual no se pudieron recoger más. Se cree que esta desparición se dibió a la presencia de truchas arcoiris desovando y se observaron en todas las corrientes que se investigaron.

Se observó que la rémora cabeza azul de las montañas, utilizaba perifiton como fuente principal de alimento aunque también formaban parte de su dieta mosquitos, moscas negras y frigáneas. Estas especies desovaron en varios tributarios durante los meses de abril y mayo cuando la temperatura de las aguas osciló entre 15 a 19° C. La distribución de este pez fue similar a la del albur jaspeado con más rémoras de cabeza azul en los sistemas fluviales que se investigaron cuando no había truchas arcoiris más grandes.

Southwestern trouts: Why the differing colors and spotting patterns and morphometrics and meristics?

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Abstract--Systematic research on southwestern trouts has been ambiguous, in part, due to the loss of critical populations through the introduction of exotics and the apparent hybridization of populations. This situation has been further compounded by the conclusions of isolated, abbreviated studies of individual researchers normally using insufficient material and different systematic techniques and characters to define the status of populations.

This plastic group of fishes displays wide variability in color, body form, and meristics. Variations in color, spotting patterns, morphometrics, and meristics of a cross section of salmonid populations in Arizona and New Mexico are examined to determine the validity of a phenotypic approach when working with this group. Plausible reasons for the existence of and often times the ambiguity between these characters are offered. The unequivocable definition of these characters and their variability is vital for sound recovery efforts for these species.

Truchas del suroeste: Porque varian en respeto a los colores, manchas, morfometricos y meristicos?

Resumen--Investigaciones sobre taxonomía de las truchas del suroeste han dado resultados ambiguos, en parte, debido a la extinción de poblaciones criticas por la introducción de especies exoticas y la hibridización aparente de poblaciones. Esta situación se confunde mas por las conclusions de estudios aislados y abreviados de investigadores individuales usando normalmente materia insuficiente y diferentes técnicas y caracteres para definir el estado de poblaciones.

Este grupo plastico de peces exhibe variabilidad amplia en color, forma de duerpo y meristicos. Se examinan variaciones en color, pauta de manchar, morfomtricos y meristicos de una sección transversal de poblaciones de Salmonidae en Arizona y Nueyo México para determinar la validez de tomar un punto de vista fenotipico en trbajos con este grupo. Se ofrecen razones que parecen admisibles para la existencia, y a menudo, la ambiguedad entre estes carácteres. La definición inequivocable de estes carácteres y su variabilidad es esencial para los esfuerzos recuperativos para estas especies.

The Colorado Division of Wildlife's Colorado squawfish and humpback chub trend zone monitoring program.

Ed Wick and Darrel Snyder, Colorado State University Larval Fish Laboratory; Tom Lytle, Colorado Division of Wildlife, Grand Junction; and Charles Haynes, Colorado Division of Wildlife, Fort Collins.

Abstract--In July 1977 the Colorado Division of Wildlife began sampling five upper Colorado River trend zones to monitor the distribution and status of two endangered fish species. Study areas are: Yampa River from Maybell to Sunbeam plus special sites at Juniper Springs, Cross Mountain Canyon, and Lily Park; White River from Rio Blanco Lake to County Road 65 Bridge; Colorado River from Palisade to the old Clifton Bridge; Gunnison River from Whitewater to Redlands Diversion Dam and Colorado River from Loma to the Colorado Utah State Line. Generalized habitat types are identified, at each collection site and sampled as independently as possible. Fishes are collected primarily by seine, dipnet, and electrofishing. Hook and line has proven effective at times for squawfish and humpback chubs. Percent composition for each species is tabulated by size, habitat type, sampling site and entire trend zone for all fish collected. A major objective of the study is directed toward determining habitat preferences of the early life-history stages and documenting reproductive success of endangered fish species. On 24 August 1979, two 19mm (TL) Colorado squawfish (Ptychocheilus lucius) and one 79mm yearling were collected 2km above Black Rocks in Ruby Canyon, indicating limited reproductive success in the area for two successive years. Two yearling humpback chubs, (Gila cypha) 99 and 113mm were collected in Black Rocks in August, 1979, indicating recent reproductive success for that species also. Beginning in 1979 an endangered fish tagging program, coordinated by the USFWS, was incorporated into the study. On the Yampa River trend zone, 14 Colorado squawfish and one humpback sucker (Xyrauchen texanus) were tagged. On the lower Colorado River trend zone 29 squawfish and 66 humpback chubs were tagged. The majority of these fish were captured in the Black Rocks area in Ruby Canyon.

Prehistoric Weir Fishing on Recessional Shorelines of Lake Cahuilla, Salton Basin, Southeastern California

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Abstract--Abundant evidence of prehistoric weir fishing has been found on recessional shorelines of extinct Lake Cahuilla in the Salton Basin of southeastern California. This lake formed on occasion during Upper Pleistocene and Holocene times as a result of inflow of the Colorado River for extended periods of time. The resultant lake, over 175 km long, overflowed at an elevation of +12.7 m across the Colorado River delta into the Gulf of California. A stable freshwater lake, with a fish fauna like that of the Lower Colorado River, was thus maintained. Rerouting of the Colorado River at the head of its delta about A.D. 1500 brought to an end the most recent stand of Lake Cahuilla, which dried by evaporation apparently as a single progressive decline, in about 55-60 years.

At a large archaeological site along recessional shorelines on the west side of Lake Cahuilla, at elevations ranging from -7.8 m to -29.7 m, are some 650 stone fish weirs built in 15 levels representing separate construction episodes. The difference in elevation from one level of weirs to another is a little over 1.5 m, slightly less than the measured annual water loss by evaporation from the surface of nearby Salton Sea. The weirs are U- or V-shaped stone constructions one to several courses high, with openings about 0.6 m wide at the apexes, which point toward former deep water. The weirs are structurally similar to weirs of brush used in historic time by tribes of the Lower Colorado River. The historic weirs were baited with crushed watermelon seeds to attract fish, which were then taken with dip nets as they attempted to escape. The prehistoric weirs at Lake Cahuilla are thought to also have been used in conjunction with dip nets dropped at the openings in the apexes to take fish that had entered them while schooling along shore. However, the placement of the weirs in distinct levels, and the separation of levels by common elevational increments, indicates that they were built annually, at the same time each year, and during a very short period of each year. The weirs apparently were not baited, nor built annually in a tightly regimented cycle of hunting and gathering activities, but rather functioned synchronously with some seasonal environmental phenomenon.

Excavation of house ruins at the site yielded bones of *Xyrauchen texanus* (Abbott) and *Gila elegans* Baird and Girard, presumably the species taken in the weirs. Apparently the fish entered the quiet water within the weirs while spawning, and were taken with dip nets while attempting to escape. If this interpretation is correct, construction of the weirs occurred in March and April. The ecological conditions that attracted the fish to the rocky shore were of short seasonal duration, probably lasting about one to one and one-half

months each year.

The decline of the fishing industry, as indicated by the decline in weir construction, is believed linked to the demise of the native fish fauna as a result of increasing salinity or other unfavorable ecological conditions in the waters of receding Lake Cahuilla.

Abstracto--Se ha encontrado evidencia abundante acerca del uso prehistórico de la paradera en la pesca por las costas desistimientas del extinto Lago Cahuilla en la Hoya Salton del sureste de California. Este lago se formó ocasionalmente durante el Pleistoceno Superior y la epóca Post-Pleistocenica como resultado del influjo del Río Colorado por prolongados periodos. El lago resultante, más de 175 km de largo, se inundaba a la elevación de +12.7 m cruzando la delta del Río Colorado y entrando al Golfo de California. Así se conservaba estable un lago de agua dulce con una fauna de pes parecido al del Río Colorado Bajo. El reenrumbar del Río Colorado en la fuente de la delta cerca de A.D. 1500 llevó a termino la permanecencia más moderna del Lago Cahuilla, el cual se secó por evaporación aparentemente por una inclinación singular y progresiva en unos 55 a 60 años.

En un extenso sito arqueológico por las costas desistimientas del lado oeste del Lago Cahuilla, a las elevaciones que se extendienden de -7.8 m a -29.7 m, se encuentran unas 650 paraderas para pes hechas de piedra, las cuales se construyeron en 15 niveles representando epócas individuales de construción. La diferencia en la elevación de un nivel a otro es poco más de los 1.5 m, un poco menos que la pérdida de agua por evaporación de la superficie del cercano mar Salton. Las paraderas estan formadadas de piedra en forma de las letras U o V de una o más piedras de altura, con aberturas de 0.6 m de anchas por el ápice, el cual se dirije hacia donde hubo agua más profundo. Estructuralmente las paraderas se parecen a las paraderas construidas de maleza utilizadas en tiempos históricos por tribus del Río Colorado Bajo. Las paraderas se cebaban con semilla de sandía molida para atraer a los peces, los cuales se pescaban con redes sumergidas cuando atentaban escaparse. Es pensado que las paraderas prehistóricas del Lago Cahuilla se utilizaron en asociación con las redes sumergidas desprendidas en las aberturas en los ápices para tomar a los peces que habián entrado cuando se movián en masa por las costas. Sin embargo, la colocación de las paraderas en distinctos niveles, y la separación entre niveles por incrementos comunes de elevacion, indica que fueron construidas anualmente, durante el mismo tiempo cada año y durante un breve tiempo cada año. Las paraderas aparentemente no se cebaban, ni fueron construidas anualmente en un cíclo firmamente regulado con actividades de caza o recogimiento, pero más bien funcionaban sincrónicamente con algun fenómeno en el ambiente de una estación particular.

Excavación de las ruinas de casas produjó huesos del *Xyrauchen texanus* (Abbott) y del *Gila elegans* Baird y Girard, se supone que estos especies fueron tomados en las paraderas. Aparentemente los peees entraron el agua mansa dentro de las paraderas mientras el desove y fueron tomados con redes sumergidas cuando atentaban escaparse. Si esta interpretación es correcta, la construcción de las paraderas ocurrió en marzo y abril. Las condiciónes ecológicas que atrayeron a los peces a la costa peñascosa eran de corta duración estadial, probablemente

durando como un mes a un mes y medio cada año.

La declinación de la industria de pesca, indicada por la declinación en la construción de las paraderas, esta enlazada con la terminación de la fauna pesquera nativa como resultado del aumento en la calidad de salino u otras condiciones ecológicas adversas en los aguas rotrocedientes del Lago Cahuilla.

Food Habits of the Borax Lake Chub, Gila boraxobius, Endemic to a Thermal Lake in Southeastern Oregon

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Abstract--Food habits of the Borax Lake chub, Gila boraxobius, a cyprinid fish endemic to a thermal lake in southeastern Oregon, were analyzed from specimens collected March 1978 to June 1979. Exploitive and opportunistic feeding in response to seasonal availability of foods was observed. Terrestrial insects were a major food item from March through November. In winter, December through February, diatoms and microcrustaceans were primary food items. Chironomid larvae were a major food throughout the year. Seasonal changes in food habits of juvenile and adult G. boraxobius were similar except that juveniles ingested more copepods and terrestrial insects, whereas adults ingested more diatoms and gastropods. A comparison of summer foods of G. boraxobius with populations of a closely related species, G. alvordensis, showed that the former depended heavily on foods of terrestrial origin, whereas G. alvordensis consumed little or no terrestrial foods.

Abstracto--Los habitos alimenticios del Borax Lake chub, Gila boraxobius, una especie de pez que pretenece a la familia Cyprinidae y que es endémica en el lago termal del sudeste de Oregón, fueron analizados de espécimen recogido desde marzo de 1978 hasta junio de 1979. Gila boraxobius se alimenta de la mayoría de los alimentos, respondiendo a la disponibilidad de estacion, concentrando con frecuencia en los alimentos presentes en grandes cantidades. Insectos terrestres constituyeron la mayor fuente del alimento desde marzo hasta noviembre. En invierno desde diciembre hasta febrero, las diatomeas y los microcrustaceos fueron el alimento principal. Larvas chiromidas constituyeron el principal alimento durante todo el ano. Cambios estacionales en los hábitos alimenticios de los G. boraxobius juveniles y adultos fueron similares entre si, excepto que los juveniles ingirieron mas copépodos e insectos terrestres, a su vez los adultos ingirieron mas diatomeas y gastropodos. Una comparación del alimento veraniego del G. boraxobius con una especie cercanamente relacionada a el, tales como el G. alvordensis, mostró que el G. boraxobius depende substancialmente de alimentos de origen terrestre, in tanto que, el G. alvordensis consume pequeñas cantidades de alimentos terrestres o ninguna.

NOTE:

During the evening following the November 15 research session, David Gaines of the Mono Lake Committee presented a highly informative program describing the biopolitical dilemma faced by the entire Mono Basin because of water export for urban use and development in the Los Angeles area. This remains one of the foremost environmental issues in the western United States, and there currently appears to be no generally acceptable solution.

Reports by agency representatives.

Chairman: Phil Pister, California Department of Fish and Game.

Agency Report, Water and Power Resources Service

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Abstract--In early November the agency of the Bureau of Reclamation was officially changed to the Water and Power Resources Service. The missions of this agency seems to remain unchanged at the present time. Other than the areas reported elsewhere in this symposium there are only three areas I will report on here. The first area is a notice that development of water resources in the upper Colorado River Basin is continuing in response to water needs of energy development projects. Some of the projects are being developed by the WPRS while state and private entities are deeply involved in many others. It should be fully recognized that completion of many of these projects will directly or indirectly affect native fish habitats in the upper basin. The second area I wish to acknowledge is the potential effects of water resource development in the Yuma, Arizona region on populations of the desert pupfish (Cyprinodon macularius) in the Santa Clara Slough. Currently, effluent from Welton-Mohawk irrigation is diverted to the slough. This is changing the aquatic ecology of the slough. In the future, implementations of the Yuma Desalting Plant will further influence the ecology of the Santa Clara Slough. At the present time no plans exist to monitor population of the desert pupfish or its status in the Santa Clara Slough.

The third area I will mention is the planned research study on the possible use of sterile hybrids of grass carp and big mouth carp to control massive aquatic vegetation in waters of the Coachella and Imperial Water Districts. This research project is to be conducted by personnel from the Fish and Wildlife Service, Water and Power Resources Service, Science and Education Administration - U.S. Department of Agriculture, various state of California agencies including the California Department of Fish and Game, and Coachella and Imperial Water Districts. Hybrid fish (grass carp X big mouth carp) will be studied both in Denver and the Imperial Valley of California for substantiation of their sterility, effectiveness in control of aquatic weed species, salinity tolerances, and other things. Concern for the existing population of desert pupfish (Cyprinodon macularis) in and around the Salton Sea should be considered.

Abstracto--En el pasado noviembre, el nombre de la Agencia Oficina de Reclamaciones (Bureau of Reclamation) fue oficialmente cambiado por el de "Secretaria de Recursos y Fureza Hidraulica" (Water and Power Resources Service). Las funciones de esta Agencia aparentemente permaneceran sin cambios significativos, cuando menos hasta la presente fecha. Son tres las areas en las que este reporte esta basado, pues las demas ya han sido cubiertas durante el transcurso de este simposio. La primera es una noticia acerca de que el desarrollo de los recursos acuaticos se continuaran en respuesta a las necesidades de agua para el projecto de desarrollo de energeticos. Algunos de los projectos estan siendo desarrollados per la Secretaria de Recursos y Fuerza Hidraulica (WPRS) mientras que entidades estatales y

privadas estan incluidas en muchas otras areas. Deve ser claramente entendido que la realizacion de muchos de estos projectos afectaran directa o indirectamente los habitas de las especies nativas en las cabeceras de esta cuenca. Como segundo comentario yo quidiera remarcar de los efectos potenciales que el incremento en la toma de recursos del acuifero en la region de Yuma Arizona tendra sobre las poblaciones de los peces del desierto (Cyprinodon macularius) en el area de Santa Clara Slough. Actualmente los efluentes provinientes de el sistema de irrigacion Welton-Mohawk estan siendo desviados hacia el Slough produciendo un cambio ecologico en esta region. En el futuro la implementacion de la Planta Desalinadora de Yuma aumentara dicho impacto ecologico en Santa Clara Slough. Hasta el presente no existen planes para monitorear las poblaciones de peces del disierto en esta localidad. Como tercer comentario, yo quisiera mencionar hacera de los planes de investigacion y estidio de la posibiladad de usar hibridos esteriles de carpa herbivora X carpa hocicona como control masivo de la vegetacion acuatico de los distritos de Coachella y Imperial. Este projecto de la administacion sera conducido pro personal de el Servicio de Pesca y Vida Silvestre (Fish and Wildlife Service) de Recursos y Fuerza Hidraulica (WPRS) de la administracion de Ciencia y Educacion (Science and Eduction Administration) del Departmanto de Agricultura de los Estados Unidos (U.S. Department of Agriculture) varias agencias del estado de California incluyendo el departamento de Caza y Pesca (California Department of Fish and Game) y los distritos de Agua de Coachella e Imperial (Coachella and Imperial Water Districts). Dicho hibrido carpa hocicona X carpa herbivora sera estudiado en ambas localidades, el Valle Imperial en California y en Denver, Colorado para corroborar su esterilidad, efectividad como control de hiervas acuaticas, su tolerancia para salinidad, y otros topicos. Particular atencion y preocupacion, deve ser concedida para la problacion actual de (Cyprinodon macularius) dentro y en los alrededores del Mar de Salton (Salton Sea).

Agency Report - Forest Service

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Abstract--Forest Service (FS) activities dealing with the Great Basin and of interest to DFC members were briefly outlined as follows: (1) Livestock-fisheries problems are being recognized and receiving more attention; (2) Efforts are being made to include the FS in the Truckee River water allocation problems; (3) An ad hoc recovery team is being organized by the Fish and Wildlife Service for the Lahontan cutthroat trout; (4) Under the National Forest Management Act detailed plans will be completed for each Forest in the U.S. by 1983; (5) A system of Sensitive Species designation has been developed by the FS for protection of species on National Forest lands that have not been officially classified as threatened or endangered.

A brief dissertation was given on the fisheries biologist's approach to problems which involve both biological and socio-political input to solution.

Abstracto--Relacionado con las actividades del Servicio Forestal y la Great Basin y de interés para los miembros de EFC rapidamente son trazados como sigue: (1) Problemas de ganaderia y pesca, estan siendo reconocidos y recibiendo mas atencion; (2) Esfuerzos se estan haciendo para incluir el Servicio Forestal en los problemas de distribucion de agua en el Truckee River; (3) Un grupo de rescate para la trucha esta siendo organizado por el Servicio de pesca y animales silvestres; (4) Bajo el decreto de la administracion de los Bosques Nacionales, planes detallados estarán completos en 1983 para cada bosque en los Estado Unidos; (5) Un sistema de designar especies delicadas, a sido desarrollado por el Servicio Forestal para proteccion de las especies en los Bsoques Nacionales que no han siendo oficialmente clasificadas como amenazadas o en peligro.

Una rapida tésis fue dada a los problemas biologicos de las industrias pesqueres que pertenecen a soluciones biologicas y socio-politicas para encontrar una solucion.

It is indeed a pleasure to participate in this meeting of the Desert Fishes Council. I would like to outline briefly for you some of the Forest Service activities that may be of interest to you, with emphasis upon those relating to Great Basin ecology.

1. Livestock-fisheries problems. Increasingly more time is being

devoted to livestock-fisheries problems. Research is now adequate to define many of these relationships. From the standpoint of maintenance of fisheries resources the problems resulting from livestock impacts on riparian habitats are some of the most serious throughout the West and are just beginning to be recognized. An effort is being made to establish demonstration project areas in each Forest where such problems exist.

An outstanding project is currently being developed by the nearby Inyo National Forest involving the restoration of High Sierra meadows in the Golden Trout Wilderness that have deteriorated due to early day concentrated grazing use.

2. Truckee River Water Allocation. Most of you are acquainted I'm sure with the complex water problems of the Truckee River system resulting from increasing demands and limited supplies. At stake are the Pyramid Lake Lahontan cutthroat trout and cui-ui fisheries, as well as the fisheries and recreational use of Stampede Reservoir in the upper basin. We are taking an active role in the determination of stream flows and reservoir levels in the upper Truckee affecting National Forest lands.

3. Lahontan cutthroat trout. Recently the Fish and Wildlife Service took the positive step of forming an ad hoc Recovery Team for the Lahontan cutthroat trout. It pulls together representation by all state and federal agencies working on this species. Hopefully an overall mutually acceptable management plan, with common goals and objectives will result. The initial meeting was held at Lake Tahoe early this fall.

4. Forest planning. An activity with which you may or may not be familiar is the current Forest planning effort initiated by the National Forest Management Act. Each National Forest is responsible for preparation of an integrated plan for management of all resources within the Forest by 1983. If you have any special area of concern this is the time to make your thoughts known to the appropriate Forest personnel. They will welcome your participation in this effort.

5. Sensitive Species concept. In addition to the normal system of official designation of threatened and endangered species under the Endangered Species Act, the Forest Service has developed an effective system of streamlined action to designate troubled species needing prompt attention. They are called Sensitive Species and can be designated by the Regional Forester without any of the normal red tape. Under this designation, which applies only to National Forest lands, a species is given the same protection as those designated as threatened or endangered. It does not however, qualify for Fish and Wildlife Service funding or assistance.

PHILOSOPHICAL CONCEPT - IS THE FISHERIES BIOLOGIST MAKING THE MOST EFFECTIVE APPROACH TO HIS PROBLEMS?

For my remaining limited time I would like to pass on for your consideration a few thoughts that may be applicable to some of the current frustration with which all of us are confronted. We ask ourselves: Why don't things move more rapidly? How can I be more effective in getting

action when it is needed? How do I gain the necessary public support I need? These are common questions that confront us all. There have been ample examples of such frustrating issues already presented at this meeting.

Getting problems and their solutions in proper perspective is important and it would pay us to periodically examine our approach to such problems. Here is some of the steps we normally go through:

1. We recognize that a biological problem is arising. (Let's say for example that the habitat for a given species is noticeably deteriorating.)

2. We study the problem and make a biological assessment as to the effects, its seriousness and possible causes.

3. Next we search for possible solutions to the problem.

4. Once a feasible solution is identified we begin the task of implementing the action to bring about the solution of the problem.

It all sounds very logical, but is it? The key point is, are we drawing upon the best professional advice available in carrying out this process? Certainly in the definition of the biological aspects of problem determination we recognize the importance of utilizing the services of a professional trained biologist. We are the first to criticize an investigation by laymen that does not follow our prescribed methodology in the collection of biological facts and their proper assessment.

However, I contend that the solution of most problems with which we are faced in the management of natural resources are not biological in nature but rather are socio-political problems. Whether we are talking about Mono Lake water problems or the plight of the snail darter the same principle applies.

Do we recognize the fact that when we reach a certain point in the resolution of our resource management problems they shift from a biological nature to a socio-political nature? And what do we do at this point? Generally, using our biological training and background we endeavor to apply such knowledge to the solution of the problem. To be more realistic, at this juncture I believe we should shift gears and recognize the importance of obtaining socio-political professional guidance and assistance. A political science professor at Colorado State University recently convinced me that there are just as well defined general procedures for guiding socio-political problem solving as exist in the biological field. Oftentimes we are not utilizing this approach, even when we admit to ourselves that the key issues are social or political.

Next time we embark upon the solution of a difficult problem whose basic issues are social or political in nature lets pause a moment and recognize the basic methods and procedures developed by scientists in that field. Here are a few leading questions we might ask:

1. Do we understand the problem? Is it biological, social or political?

2. Are the key issues clearly in focus?

3. Who are the key elements that are being affected by the problem?

4. What are the interests and concerns of various factions?

5. Who are the controlling powers? Who will make the decisions?

6. Who are the key contacts of controlling interests?

7. Who supports me? Who opposes me?

8. What commonality, if any, do we all have? Is there an acceptable middle ground?

9. What should my approach or strategy be?

This general approach is used most effectively by some of you but not by many of us. I suggest we consider it seriously at least. If we decide to use it there are several positive actions that we can take:

1. Train our personnel or members in the principles of approaching and solving socio-political problems.

2. Look to the professionals in these fields for guidance. Use socio-political expertise.

Remember, if you have a problem which requires legislative action you will normally make faster progress by contact with legislative analysts and legislators, rather than organizing a group of fish biologists.

Thanks again for the opportunity to be here!

USDA Forest Service, Rocky Mountain Forest and Range Experiment Station

John N. Rinne
Forestry Sciences Laboratory
Arizona State University
Tempe, Arizona 85281

The Forest Service, Region 3, and the Rocky Mountain Station Scientists met in December 1978 to discuss the nature of research needs of the former and the direction and scope of the research of the latter. Of 10 priority needs listed by both groups over half were mutual interests and three (effects of grazing on fish and wildlife, effects of grazing on the riparian zone, and threatened and endangered species) were emphasized as high priority. For the period 1981-85, research in the Rocky Mountain Station will follow these priorities.

More specifically, two new Gila topminnow, Poeciliposis occidentalis, localities were discovered in southern Arizona. One is being reported in the form of a Station research note (Rinne et al. 1980).[1] The other locality presents an excellent opportunity for research on competition between topminnow and the mosquitofish, Gambusia affinis.

A survey of the type locality of the Arizona trout, Salmo apache Miller resulted in the documentation of brown trout, Salmo trutta Linn., above the falls (ca. 2 m) on this stream. Further surveys are needed to determine the extent of upstream movement of browns from this point.

A study of the influence of a 9-day fishing season on the Christmas Tree Lake S. apache population was conducted. Results suggest that more abbreviated seasons will be necessary in order to maintain a quality sport fishery in this small, man-made alpine lake (Rinne, et al. 1979).[2]

Because of the apparent loss of the Ord Creek stock of S. apache, streams have been sought to re-establish this population. Stock from Ord Creek was introduced into North Canyon Creek on the Kaibab National Forest in the early 1970's. In mid-October 1979, specimens were obtained from North Canyon Creek for taxonomic analyses. Eight specimens were examined phenotypically and found to be pure Arizona trout based on the agreement of morphometrics and meristics with 31 specimens taken from Ord Creek during 1977 renovation activities. The population of North Canyon Creek was estimated to comprise less than 150 fish.

Eight streams on the Gila National Forest; four presently considered as pure Gila trout, Salmo gilae Miller, and four to be hybrids with this native trout and rainbow and/or cutthroat trout, were sampled in June and August 1979. All specimens were analyzed biochemically to assist in verifying the validity of current classifications. Similarly, a half dozen streams in the White Mountains of Arizona were sampled and analyzed with electrophoresis to determine the validity of classification of 40+ streams as suggested by Rinne (1978).[3]

Activities for the coming year (FY '80) will include stream classification in Arizona, drafting and publishing manuscripts on trout taxonomy, movements, agressive behavior, temperature tolerances, and habitat. Work will commence on a General Technical Report on the natural history of native Arizona fishes.

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[1]Rinne, J. N., B. Rickel, and D. Hendrickson. 1980. A new Gila topminnow (Atheriniformes:Poeciliidae) locality in southern Arizona. USDA Forest Service Research Note RM-382, 4 p. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

[2]Rinne, J. N., B. Robertson, R. Major, and K. Harper. 1979. Sport fishing for the native Arizona trout, Salmo apache Miller in Christmas Tree Lake: A case study. Wild Trout II Symposium, Mammoth Hot Springs, Wyoming, 24-25 September, 1979.

[3]Rinne, J. N. 1978. Distribution of pure populations of the native Arizona trout, Salmo apache Miller--A report to aid in the management and recovery of a threatened species of fish. 60 pp.

El Servicio Forestal Región 3, y los Cientificos de la Estación de los Montes Rocosos se reunieron en Diciembre de 1978 para discutir la natura de las necesidades de las investigaciones del primer grupo y el alcance de investigaciones del segundo. Entre 10 necesidades de prioridad puesta en lista por ambos grupos, mas que la mitad fueron mutual y tres (efectos de ganaderia sobre pesquerías y fauna silvestre, sobre la zona ribereña y sobre especies amenazadas y enpeligradas) fueron destacadas de alta prioridad. Para el periodo 1981-85, investigaciones en la estación de los Montes Rocoscos seguirán estas prioridades.

Mas especificamente, fueron descubiertas en el sur de Arizona dos neuvas localidades para el Pipón de Superficie del Rio Gila, Poeciliopsis occidentalis. Una se reporta en forma de nota de investigación de la estación (Rinne et al. 1980).[1] La otra localidad ofrece una oportunidad para estudios investigativos sobre la competición entre el Pipon de Superfice y el pez mosquito, Gambusia affinis.

Una investigación de la localidad tipa de la trucha arizonense, Salmo apache Miller, resultó en la documentación de la existencia de la trucha morena, Salmo trutta Linn., arriba de la catarata (cerca dos millas) en esta quebrada. Se necesitan mas estudios para determinar la extención de movimientos hacía arriba por esta desde este punto.

Se llevó a cabo estudio de la influencia de un periodo de pesca deportiva de 9 dias sobre la población de Salmo apache en Laguna de Arbol de la Navidad. Los resultados sugeren que periodos de pesca mas breves serán necesarios para mantener una pesca deportiva de alta calidad en este pequeño represo alpino (Rinne et al. 1979).[2]

Debido a la perdida aparente de la población de Salmo apache en Ord Creek, se han buscado otras quebradas en que re-establecer esta población. Truchas de Ord Creek fueron introducidas a North Canyon Creek en Bosque Nacional Kaibab en la primera parte de los anos '70. En medio Octubre, 1979, se obtuvieron especimenes de North Canyon Creek para analises taxonomicas. Se examinaron 8 especimenes fenotipicamente y meristicamente y se concluyó que son pura trucha arizonense basada en la conformidad de los datos morfomentricos y meristicos con 31 ejemplares tomados de Ord Creek en 1977 durante actividades de renovación. La población de North Canyon Creek se estimó a menos de 150 individuos.

En Junio y Agosto de 1979 se colectaron truchas de 8 quebradas en el Bosque Nacional Gila; 4 del cual se consideran tener pura trucha Gila, Salmo gilae Miller, y 4 que tienen híbridos de esta nativa y trucha arco iris ó trucha garganta cortada. Se analizaron todos especimenes bioquimacamente para asistir en verificar la validéz de clasificaciones corrientes.

Semejantemente especimenes de truchas de docena de quebradas en las Montañas Blancas de Arizona fureron colectados y analizados con electroforesis para determinar la validéz de la clasificación de 40+ quebradas como sugerida per Rinne (1978).[3]

Actividades durante el año entrante (FY '80) incluirán clasificación de quebradas en Arizona, formulando y publicando manuscritos sobre taxonomia de truchas, movimientos, comportamiento agresivo, tolerancias termales y habitato. Trabajo comenzará en un Informe General técnica sobre la historica natural de peces nativos de Arizona.

Agency Reports - U.S. Fish & Wildlife Service (Albuquerque)

James E. Johnson

U.S. Fish and Wildlife Service (Albuquerque) - Seventeen species of cacti in Arizona, New Mexico and Texas have just been listed. San Bernardino Ranch (SE Arizona) has just been purchased for preservation of the Rio Yaqui fish fauna in the U.S. We have ongoing contract work (mainly status and distribution) on Gambusia georgei, G. heterochir, G. nobilis, Gila nigrescens, Ptychocheilus lucius (parasites), Plagopterus argentissimus, and molluscs of Texas and Oklahoma. Recovery plans have been completed for Plagopterusargentissimus, Salmo gilae and S. apache, and drafts are well along for Cyprinodon elegans, Gambusia nobilis and G. heterochir. Dexter National Fish Hatchery is presently rearing 12 fish species including the only population of Gambusia amistadensis and the only U.S. population of Gila nigrescens. Willow Beach NFH is rearing four native species:Ptychocheilus lucius spawned in 1979, producing about 1500 young; and two Gila elegans were brought in from Lake Mohave.

U.S. Fish and Wildlife Service (Albuquerque) - Diecisiete especies de cacto en Arizona, Nuevo México y Tejas han sido colocados en la lista. El Rancho San Bernardino (SE de Arizona) fué adquirido recientemente para la preservacion dentro de los Estados Unidos, de la fauna piscícola del Rio Yaqui. Actualmente hay estudios contratados (principalmente de condición y distribución) sobre Gambusia georgei, G. heterochir, G. nobilis, Gila nigrescens, Ptychocheilus lucius (parásitos), Plagopterus argentissimus, y moluscos de Tejas y Oklahoma. Se han establicide planes de recuperación para las especies Plagopterus argentissimus, Salmo gilae y S. apache; asimismo estan muy avanzados los borradores para Cyprinodon elegans, Gambusia nobilis y G. heterochir. El Dexter National Fish Hatchery actualmente cría 12 especies de peces que incluye la única población de Gambusia amistadensis y la única población estadounidense de Gila nigrescens. La Willow Beach National Fish Hatchery cultiva cuatro especies nativas: Ptychocheilus lucius desovado en 1979 con una producción de aproximadamente 1500 crías y dos Gila elegans traídos del Lago Mohave.

Sacramento Endangered Species Office Report To The Desert Fishes Council

Gail C. Kobetich

Sacramento Endangered Species Office (SESO) activities in regards to desert fishes have been continuing at a low but stable level. Staff members are heading up the Desert Pupfish Working Group and the Lahontan Cutthroat Trout Working Group. Both working groups were formed to evaluate the status of these fishes throughout their ranges and to assist in planning recovery efforts. Other agencies participating in the efforts are the U.S. Forest Service, U.S. Bureau of Land Management, U.S. National Park Service, California Department Fish and Game, Arizona Game and Fish, Nevada Department of Wildlife, U.S. Water and Power Resources Service.

Contract studies have been completed on the Warner sucker and the desert fishes monitoring program. Contracts have been let to do spawning studies on the Warner sucker and life history work on the Pahranagat roundtail chub. Money is available for the Warm Springs pupfish recovery effort which should get underway in August of 1980.

Recovery plans for the Devils Hole pupfish and the Pahrump killifish have been sent to the Washington Office for approval by the Director of the U.S. Fish and Wildlife Service.

Recovery plans for the Moapa dace and the Pahranagat roundtail chub will be completed during FY-80.

SESO is currently preparing listing packages for 14 desert fishes. As SESO prepares these packages they will be sent to the various State and Federal agencies for comment before they are processed through the U.S. Fish and Wildlife Service Regional Office. The fishes being considered for listing are the Warner sucker, Borax Lake chub, Hutton Spring tui chub, Foskett Springs tui chub, Foskett springs speckled dace, desert dace, Big Springs spine dace, Ash Meadows speckled dace, desert pupfish, three subspecies of the White River spring fish, Fish Creek spring tui chub, Railroad Valley spring fish, and White River desert sucker. Final listing for any of these species is at least a year to 18 months away.

AGENCY REPORT ON FISH AND WILDLIFE SERVICE, SALT LAKE CITY, UTAH
BILL MILLER, PROJECT LEADER, COLORADO RIVER FISH PROJECT

As I told you yesterday, I would take time today to explain what we are doing in the Colorado River Fishery Project which I head out of Salt Lake.

Our Project was formally initiated in March of this year. We organized the project into two separate phases. One phase to cover field work and one phase to cover controlled experimental work. We now have two field stations, one at Vernal, Utah and one at Grand Junction, Colorado. Our hatchery-lab controlled work is being done primarily by contracts with Universities, but we are using facilities such as Willow Beach NFH in Region 2 to assist in propagating test fish.

The Colorado River Endangered Fishery work has been rated as #11 in the FWS overall national-ranking system. This is a very high rating when you consider the competition of condors, whooping cranes, pacific salmon, etc. Because of the high importance FWS has given this work and the funding provided by B.R., we have been able to move rather quickly in setting this project up. I hired most of the field people in May and had them equipped and in the field in July. We had 3 field crews of 3 men each on the river most of the time since July.

The projects overall objectives are to find out the follow for Colorado squawfish and humpback chub.

1. Spawning requirements
2. Young and adult requirements
3. Migration and movement
4. Interspecific competition
5. Cultural technologies
6. Chemical bioassay
7. Speciation of Gila

We will find out 1-4 in the field data gathering. Part of 4, and 5-6 will be determined under controlled experimental conditions primarily with contracts to Universities. Number 7 will be done by our own Service Research people utilizing outside help such as R. R. Miller, Royal Sutkus, Glenn Clemmer and others.

Our field data gathering has been designed as a stratified random sample. River sections have been grouped into like reaches and randomly sampled on a pre-designed basis. We employ all types of gear to sample fish such as: electrofishing, floating gill nets, trammel nets, traps, rod and reel, seines, etc. The physical aspects of the river make it extremely difficult to get a good sample of the biological community. The access to the river is also restricted such that a lot of fore planning is involved. We now have 18 stations established in the upper basin for intensive sampling of the endemic fishes. We have sampled each station twice in the past year and have obtained some excellent field data. We found a large number of young-of-the-year Colorado squawfish this past field season. Hopefully, the water year in 1980 will be different than this past one and we can acquire some good comparative information on flow versus fish numbers.

Our hatchery lab controlled work is somewhat behind the field gathering phase. We are working with Region 2, FWS in propagating and rearing Colorado squawfish at Willow Beach. We now have 27 adult Colorado squawfish, 33 humpback chub, and 2 bonytail chub at Willow Beach NFH in Arizona. We have 1,500, 1974 year class squawfish there which may spawn in 1980. We believe this because some males from this lot were ripe this year. We also have about 90 from the 1974 year class at Hotchkiss NFH in Colorado. These are slightly larger in size than those at Willow Beach and stand a good chance of spawning in 1980.

Our contracts for bioassay work are not yet finalized with the University of Idaho. One part of this contract work will be done at the University of Utah and this work is about to be initiated.

We also plan to look and see what kind, if any, of stripped bass movement we are getting from Lake Powell upstream into the Colorado and Green River.

We are also planning to do some radio tagging work on spawning squawfish this next summer to see if we can further describe spawning requirements.

We are working with Paul Holden of Bio/West to mesh in present Penstock Modification Study he is doing with our work.

So as you can see, we are quite busy in the Upper Basin working on these endangered Colorado River fishes. If you are wondering why we are trying to do so much at once, it is because we believe we only have a couple of years to get answers so we can make recommendations to the water developers. If we don't get the information in a hurry, the Upper Basin will be developed without any input or consideration for flow needs of these endangered fish.

Agency Report - California Department of Fish and Game

Louis A. Courtois

California Department of Fish and Game
Endangered Species Project
1701 Nimbus Rd.
Rancho Cordova, CA 95670

The California Department of Fish and Game has developed sufficient biological information in the last year to propose several species for addition to the State's endangered species list. These include invertebrate species as well as a reptile and several fish species. The thicktail chub, Gila crassicauda, is proposed for delisting because of extinction. The status of the Modoc sucker will be changed to endangered from the present rare classification.

Status and project reports have been completed on: Desert pupfish; Modoc sucker(2); Colorado squawfish; Owens pupfish; and humpback sucker. These reports either are or will be available in the next several months. A draft report has been completed on status and management of the Cottonball Marsh pupfish.

Plans are being made to initiate a radio-telemetry study on the population of humpback sucker in Senator Wash Reservoir this coming January.

The sucker populations in northeastern California have been examined meristically and it appears the shortnose sucker is most likely extinct. This loss appears to be coupled with the discovery of a previously undescribed form of Chasmistes. Further collections need to be made to support this initial observation.

A long term internal tag, one lasting over ten years, has been developed under contract to our Department. This tag was designed for implanting Colorado squawfish. Further work will be carried out this year and hopefully implants can be made on Colorado squawfish. Internally tagged fish will also require an external mark to permit ease in identification so these fish can be x-rayed for deciphering the internal tag. Perhaps cold branding can be used or magnetic nose tags.

Session V-Reports by Agency Representatives

State fish and wildlife agencies (Colorado)

Charles Haynes, Aquatic Nongame Researcher

Abstract: Colorado squawfish (Ptytocheilus lucius) and humpback chub (Gila cypha) populations are being monitored relative to their distributions and status in the Colorado River and major tributaries by the Nongame section of the Colorado Division of Wildlife. These investigations and future research will be conducted in conjunction with the Colorado Rivers Fisheries Project (U.S. FWS) and in accordance with the research objectives of the respective recovery plans. As endangered fish concentration areas are identified, detailed habitat characterizations will be conducted, including analyses of hydrologic requirements, water quality, and ecological interrelationships.

A need to increase the general public's awareness of the uniqueness and plight of western endangered fishes has been recognized. It is conceivable that, without public support, the efforts of biologists to assure the perpetuation of native western fish species for the long-term may not be successful.

Agency Reports - Nevada Department of Wildlife

Cal Allan

On July 1, 1979 the Nevada Department of Fish and Game became officially the Nevada Department of Wildlife. Hopefully, this new designation by the State Legislature, and the appointment of a new Wildlife Commission, will enable us to expand our efforts in the protection and preservation of native fish species.

The status of Nevada's native fishes has been covered very well by Thom Hardy and other contributors during this symposium. Only one additional species comment is necessary.

The Big Spring spinedace, Lepidomeda mollispinis pratensis, that was rediscovered by personnel of our Department in 1977, appears to be establishing viable populations in the 1978 transplant site. The rediscovery site in Condor Canyon has not recovered from the 1978 flood.

BUSINESS MEETING

Chairman: Peter G. Sanchez, Chairman, Desert Fishes Council

a) The business session was dominated by a discussion relative to the location of the 1980 symposium. Primary choices were Mexico, Arizona-Sonora Desert Museum, and southern Utah. When put to a vote, sentiment strongly favored Mexico, with first choice votes being cast as follows: Monterrey, 12; Mexico (location unspecified) 11; Nuevo Laredo, 7; Juarez, 1, and Arizona, 1. Second choice votes were also strongly in favor of Mexico (15), with six votes being cast for Utah and seven for Arizona. Arrangements are currently underway for the 1980 symposium to be held on November 5-7 with Dr. Salvador Contreras-Balderas in charge of local arrangements.

b) Constitution and bylaws: no action.

c) Legal and tax status. The Council's attorney expressed an opinion that inasmuch as the structure and functioning to the Council are in accordance with a tax exempt organization, the Council may, for tax purposes, be considered tax exempt. Details of this judgment are available from the secretary upon request.

d) Resolutions. Reflecting increasing activity and concern of the Council, a record 17 resolutions were passed during 1979 (14 during the November 16th business meeting). The resolutions are presented in their entirety in the appendix.

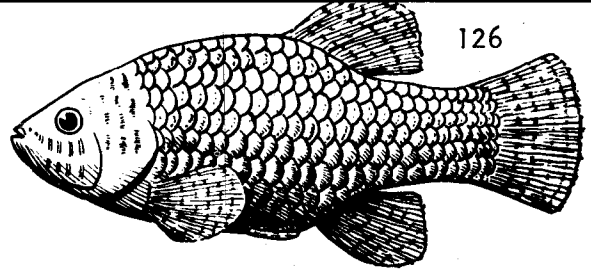
e) Treasurer's report. The treasurer reported a balance of $1,948.49 as of November 13, 1979, with significant dues payments yet to be deposited. Approximately $1,000.00 is being earmarked for payment for the 1978 symposium proceedings publication.

APPENDIX

Resolutions 79-1 through 79-17

Attendance list

Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"

407 West Line Street
Bishop, California 93514
February 28, 1979

RESOLUTION 79-1

RELATIVE TO THE EXCHANGE OF LAND WITHIN FISH SLOUGH,
INYO AND MONO COUNTIES, CALIFORNIA

WHEREAS the activities of Man have drastically and critically reduced the historic range of the Owens pupfish (Cyprinodon radiosus), and

WHEREAS the Owens pupfish is listed as an endangered species by appropriate agencies of both the state and federal governments, and

WHEREAS the only two remaining populations of the Owens pupfish in existence are found in an area known as Fish Slough in Inyo and Mono counties, California, and

WHEREAS the Fish Slough area will ultimately be managed as a natural area by means of a joint agreement between the Bureau of Land Management, Los Angeles Department of Water and Power, University of California, and California Department of Fish and Game, and

WHEREAS a portion of the Fish Slough area will become a part of the University's extensive and statewide Natural Land and Water Reserves System, and

WHEREAS Fish Slough represents the sole remaining portion of the lower Owens Valley which possesses a biota essentially unaffected by water diversion and thereby serves as a unique control area for related studies conducted elsewhere in the Owens Valley, and

WHEREAS the teaching value of Fish Slough is virtually unique and unlimited for a multitude of disciplines within the biological and physical sciences, and

WHEREAS the California Department of Fish and Game has already purchased 168 acres of privately-held land within Fish Slough as a means of assuring the integrity of the Owens Valley Native Fish Sanctuary and its associated flora and fauna, and

WHEREAS the recently acquired 168 acres within Fish Slough have been designated by the California Fish and Game Commission as units of the California Ecological Reserve System, and

WHEREAS there exists a privately owned 202 acre parcel of land in close proximity to the Owens Valley Native Fish Sanctuary and other ecological reserve units of the California Department of Fish and Game, and within the proposed boundaries of the Fish Slough Natural Area, and

WHEREAS the Owens pupfish populations and other natural values of Fish Slough are seriously jeopardized by the close proximity of such privately held land and the potential development of this land, and

WHEREAS the owners of the 202 acre inholding within Fish Slough have indicated a willingness to exchange their land for land of equal value lying outside of Fish Slough, and

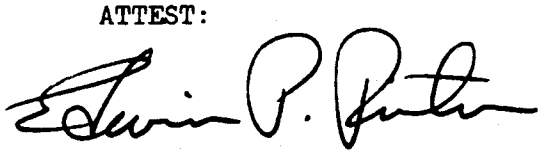
WHEREAS substantial data have already been acquired as part of the land exchange process by the Bureau of Land Management, now therefore be it

RESOLVED that the Death Valley Committee of the Desert Fishes Council, representing the entire Council, an organization numbering in excess of 300 persons and comprising a nationwide and international representation of federal, state, and university scientists and resource specialists, members of conservation organizations, and individuals concerned with long-term environmental values, assembled at the Committee's sixth annual meeting on February 22, 1979 at Death Valley National Monument, does hereby urge the Bureau of Land Management to proceed with diligence in the exchange of the land parcel referred to earlier in this resolution, and be it further

RESOLVED that copies of this resolution be forwarded to the California State Director of the Bureau of Land Management and to other interested parties as deemed appropriate.

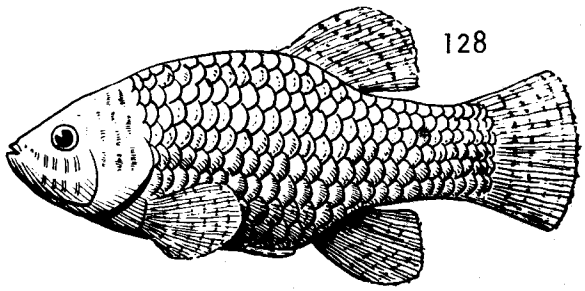
PASSED WITHOUT DISSENTING VOTE

ATTEST:



Edwin P. Pister
Chairman, Death Valley
System Committee

Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"

407 West Line Street
Bishop, California 93514
April 12, 1979

RESOLUTION 79-2

RELATIVE TO THE PRESERVATION
AND RECOVERY OF THE ENDANGERED
CUI-UI, *CHASMISTES CUJUS* COPE (CATOSTOMIDAE)

WHEREAS the cui-ui (*Chasmistes cujus*) is an endangered western sucker endemic to the lower Truckee River - Pyramid Lake system, and

WHEREAS the cui-ui is the only extant species of its genus which included only three species in widely disjunct locations, and

WHEREAS the other two species in the genus (*Chasmistes liorus* from Utah Lake and *Chasmistes brevirostris* from the Klamath Basin) are extinct, and

WHEREAS the influence of man upon the ecosystem that supports the cui-ui has caused the near extinction of the fish, and

WHEREAS the Truckee River - Pyramid Lake system continues to be abused, and

WHEREAS the cui-ui is important as a food source and a valued cultural symbol to the Pyramid Lake Indian Tribe, and

WHEREAS the scientific community considers the cui-ui of inestimable value because of light it sheds on evolutionary, geologic, and biogeographic processes, and

WHEREAS any organism on Earth has a right to live by and of itself, now therefore be it

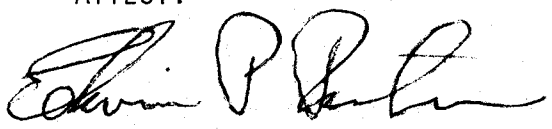
RESOLVED that the Death Valley System Committee of the Desert Fishes Council, representing the entire Council, an organization numbering in excess of 300 persons and comprising a nationwide and international representation of federal, state and university scientists and resource specialists, members of conservation organizations, and individuals concerned with long-term

environmental values, assembled at the Committee's sixth annual meeting on February 22, 1979 at Death Valley National Monument, does hereby importune the U.S. Fish and Wildlife Service not to lessen its efforts to restore the cui-ui population and its habitat and to exert every effort to provide a fishery biologist to oversee the cui-ui recovery effort. Specifically, the Death Valley Committee supports the efforts to artificially propagate cui-ui in large numbers for reintroduction into Pyramid Lake, to continue to evaluate this stocking program, and to maintain and modify the Marble Bluff Fishway so that it can be negotiated by cui-ui that will then spawn naturally in the lower Truckee River, and be it further

RESOLVED that copies of this resolution be forwarded to proper offices of the U.S. Fish and Wildlife Service, to the Chairman of the Pyramid Lake Paiute Tribal Council, to the Nevada Department of Fish and Game, and to other agencies and individuals as deemed appropriate.

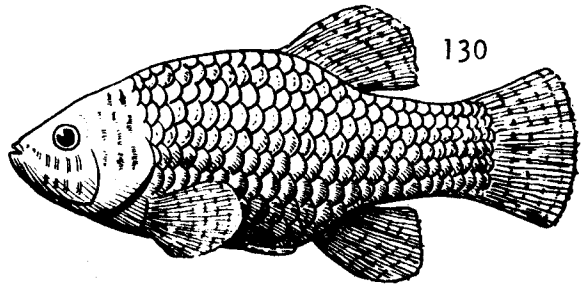
PASSED WITHOUT DISSENTING VOTE

ATTEST:



Edwin P. Pister
Chairman, Death Valley
System Committee

Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"

407 West Line Street
Bishop, California 93514

May 9, 1979

RESOLUTION 79-3

RELATIVE TO THE DESERT PUPFISH
(CYPRINODON MACULARIUS)

WHEREAS a petition by competent authority has been submitted to the U.S. Fish and Wildlife Service requesting that the desert pupfish be listed as endangered, and

WHEREAS the desert pupfish populations in and around the Salton Sea have diminished alarmingly in recent years, and

WHEREAS essential desert pupfish habitat exists on public land within San Felipe Creek and San Sebastian Marsh, and

WHEREAS the survival of this species is in large measure dependent upon the protection of these key areas, now therefore be it

RESOLVED that the Death Valley System Committee of the Desert Fishes Council, representing the entire Council, an organization numbering in excess of 300 persons and comprising a nationwide and international representation of federal, state, and university scientists and resource specialists, members of conservation organizations, and individuals concerned with long-term environmental values, assembled at the Committee's sixth annual meeting on February 22, 1979 at Death Valley National Monument, does hereby request that the Bureau of Land Management prepare and implement a habitat management plan for the San Felipe Creek - San Sebastian Marsh area to protect this essential habitat and assure the survival of the desert pupfish therein, and be it further

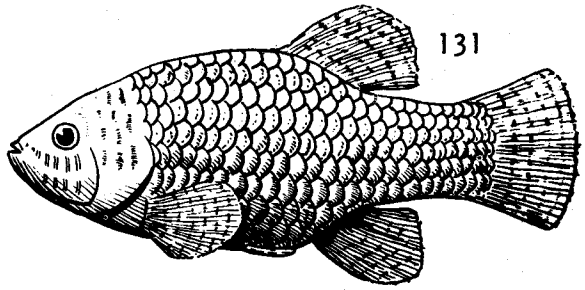
RESOLVED that copies of this resolution be forwarded to the State Director of the Bureau of Land Management and to other agencies and individuals as deemed appropriate.

PASSED WITHOUT DISSENTING VOTE

ATTEST:

Edwin P. Pister
Chairman, Death Valley
System Committee

Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"

P.O. Box 276
Death Valley, CA 92328
December 14, 1979

RESOLUTION 79-4

RELATIVE TO THE DEEP CREEK MOUNTAINS (UTAH) PROTECTIVE LAND WITHDRAWAL

WHEREAS on May 3, 1977 the Secretary of the Interior, acting on recommendations from the Bureau of Land Management to protect critical environmental values, withdrew from mineral entry about 27,000 acres in the Deep Creek Mountains, and

WHEREAS the Deep Creek Mountains comprise a unique desert "island" ecosystem and harbor many biological treasures, including the very rare Snake Valley strain of the Bonneville cutthroat trout (Salmo clarki utah) and the giant stonefly (Pteronarcys princeps), both of which were included in the original justification for emergency withdrawal, and

WHEREAS if the existing land withdrawal is allowed to expire on May 3, 1980 these unique biological resources will again be subject to severe impacts and possible demise as a result of surface disturbance from mineral exploration, and

WHEREAS geologic data contained in the recent U.S. Geological Survey mineral survey report on the Deep Creek Mountains have shown the uranium content of the area to be of low economic mining value, now therefore be it

RESOLVED that the Desert Fishes Council, an organization numbering in excess of 300 persons and comprising a nationwide and international representation of federal, state, and university scientists and resource specialists, members of conservation organizations, and individuals concerned with long-term environmental values, meeting at its Eleventh Annual Symposium in Death Valley, California on November 16, 1979 does hereby urge the Secretary of the Interior and the Utah State Director of the Bureau of Land Management to continue with a permanent protective withdrawal for the 27,000 acre area of critical environmental concern and does hereby request that this resolution be placed in the official record of testimony on this issue, and be it further

RESOLVED that copies of this resolution be forwarded to the Secretary of the Interior, to the Director of the Bureau of Land Management, to the Utah State Director of the Bureau of Land Management, to the Governor of Utah, to the Director of the Utah Division of Wildlife Resources, to the Executive Director of the American Fisheries Society, to the Executive Director of Trout Unlimited, to the Utah Wilderness Association, and to the Regional Director of the U.S. Fish and Wildlife Service.

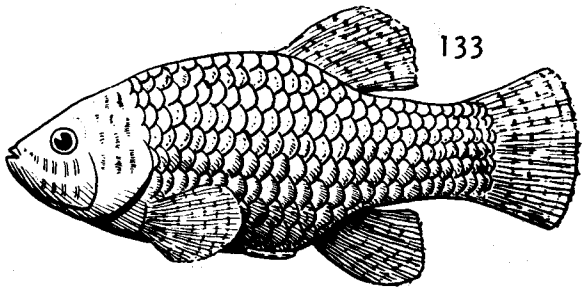
PASSED WITHOUT DISSENTING VOTE

ATTEST:

Peter G. Sanchez

Peter G. Sanchez
Chairman

Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"

P.O. Box 276
Death Valley, CA 92328
December 13, 1979

RESOLUTION 79-5

RELATIVE TO THE TRANSPLANTATION OF PLANTS AND ANIMALS

WHEREAS reintroduction of endangered species back into historic habitats is vital for the recovery of many species facing extinction in the United States, and

WHEREAS numerous recovery plans have already been approved by the U.S. Fish and Wildlife Service that identify reintroduction as a vital function in the conservation of endangered species, including the Colorado squawfish, humpback chub, woundfin, and Gila, Arizona and greenback trout, and

WHEREAS the U.S. Fish and Wildlife Service presently lacks policy on the reintroduction of endangered species, and this circumstance has already prevented several reintroductions from taking place, including the Colorado squawfish, woundfin, masked bobwhite, Houston toad and red wolf, and threatens to prevent other species from being reintroduced, which further jeopardizes their existence, and

WHEREAS this lack of Fish and Wildlife Service policy appears to have alienated at least three western states and caused them to ban the reintroduction of native endangered species or at least threaten to do so, and

WHEREAS it is the specific obligation of the Fish and Wildlife Service to conserve endangered species and their present lack of policy appears to be hindering the fulfillment of this obligation, and

WHEREAS the Desert Fishes Council recommended in a 1978 resolution that the Fish and Wildlife Service develop a policy for the reintroduction of endangered species that includes reclassifying reintroduced populations as "experimental" and no action relative to this resolution appears to have been taken, now therefore be it

RESOLVED that the Desert Fishes Council again requests the Fish and Wildlife Service to immediately develop a specific policy for the reintroduction of endangered species back into their historic habitats, and that this policy allow for the management of reintroduced endangered species and in addition allow for the management and harvest of other fish species in the same habitat, and be it further

RESOLVED that the Fish and Wildlife Service initiate the actions necessary to develop a new category of "experimental" for reintroduced populations of endangered species that will allow for the above activities, and be it further

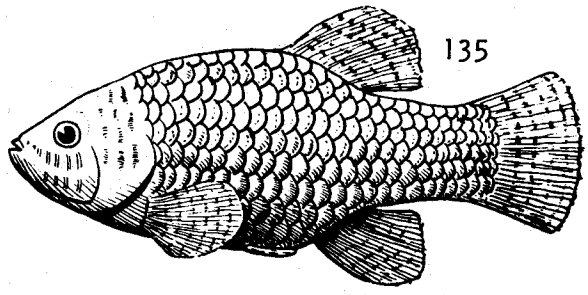
RESOLVED that copies of this resolution be forwarded to the Director of the Fish and Wildlife Service; to appropriate Regional Directors of the Fish and Wildlife Service; to the Secretary of the Interior; and to the Directors of the fish and wildlife agencies of Arizona, New Mexico, and Colorado.

PASSED WITHOUT DISSENTING VOTE

ATTEST:

Peter G. Sanchez
Chairman

Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"

P.O. Box 276
Death Valley, CA 92328
December 13, 1979

RESOLUTION 79-6

RELATIVE TO THE RECOVERY OF THE WOUNDFIN (PLAGOPTERUS ARGENTISSIMUS)

WHEREAS the woundfin has been listed as endangered by the Department of the Interior and is therefore accorded protection under the Endangered Species Act, and

WHEREAS the Woundfin Recovery Plan has been completed and accepted as the guide for private, state, and federal efforts to conserve the species, and said plan recommends the introduction of woundfin into the Gila River above Safford, Arizona as one of its principal objectives, and

WHEREAS portions of the selected reach of the Gila River are managed by the Bureau of Land Management, which recently completed management plans for the Gila River that also recommend the introduction of woundfin, and

WHEREAS past attempts to introduce woundfin into the Gila River have been delayed by the Bureau of Land Management until planning efforts and the recovery plan are completed, now therefore be it

RESOLVED that the Bureau of Land Management in the states of Utah, Nevada and Arizona be requested to participate actively in recovery efforts for the woundfin, and be it further

RESOLVED that the Bureau of Land Management in the State of Arizona assist the Arizona Department of Game and Fish and the U.S. Fish and Wildlife Service in introducing woundfin into the Gila River, and be it further

RESOLVED that the Bureau of Land Management assist in monitoring the introduced population to determine the success of the introduction, and be it further

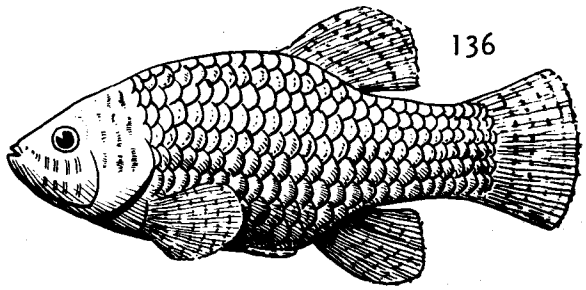
RESOLVED that copies of this resolution be forwarded to the Director of the Bureau of Land Management; to the Bureau of Land Management State Directors of Arizona, Nevada, and Utah; and to the Bureau of Land Management Safford District Manager in Safford, Arizona.

PASSED WITHOUT DISSENTING VOTE

ATTEST:

Peter G. Sanchez
Chairman

Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"

P.O. Box 276
Death Valley, CA 92328
December 13, 1979

RESOLUTION 79-7

RELATIVE TO THE ACQUISITION OF MANSE SPRING (NYE COUNTY, NEVADA)

WHEREAS the Desert Fishes Council retains a paramount interest in the welfare of all desert aquatic organisms and in particular the Pahrump killifish (Empetrichthys latos) because of the Council's early involvement in the transplantation from Manse Spring to Corn Creek, thus temporarily saving this sole remaining representative of the genus from extinction, and

WHEREAS the Council recognizes that all habitats currently containing Pahrump killifish are artificial, and

WHEREAS the Pahrump Killifish Recovery Team has recommended to the Fish and Wildlife Service and the Desert Fishes Council that the Pahrump killifish be returned to its ancestral home in Manse Spring, and

WHEREAS the desiccation of Manse Spring is a seasonal phenomenon evidently linked to pumping from a number of wells located immediately upslope from the spring, and

WHEREAS hydrologic research is needed to determine the relationships between Manse Spring and the upslope wells, and

WHEREAS the Pahrump illifish Recovery Team has recommended through the Recovery Plan that the Fish and Wildlife Service acquire Manse Spring, and

WHEREAS the Pahrump illifish Recovery Team has stated that the Pahrump killifish will be considered endangered until such time as it can be re-established in its natural habitat, now therefore be it

RESOLVED that the Desert Fishes Council does hereby urge the Fish and Wildlife Service to pursue immediately and vigorously a study to elucidate the hydrology of Manse Spring in order that a sound decision may be made at the earliest possible date concerning its acquisition, and be it further resolved

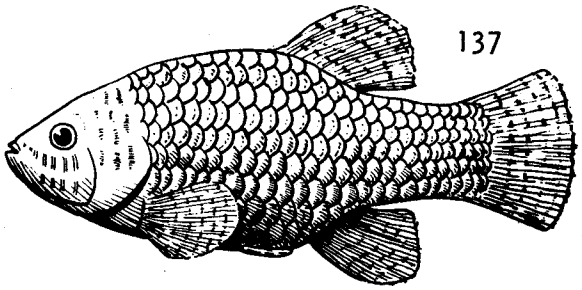
RESOLVED that copies of this resolution be forwarded to appropriate offices of the Fish and Wildlife Service.

PASSED WITHOUT DISSENTING VOTE

ATTEST:

Peter G. Sanchez
Chairman

Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"

P.O. Box 276
Death Valley, CA 92328
January 15, 1980

RESOLUTION 79-8

RELATIVE TO THE LISTING OF THE DESERT PUPFISH, CYPRINODON MACULARIUS BAIRD AND GIRARD (CYPRINODONTIDAE), AS AN ENDANGERED SPECIES WITHIN THE UNITED STATES AND MEXICO BY APPROPRIATE AGENCIES

WHEREAS information gathered by scientists from universities and state and federal agencies reveals that the desert pupfish (Cyprinodon macularius) has disappeared from the Gila and lower Colorado rivers and from numerous springs and seeps throughout the southwestern United States and northwestern Mexico, and

WHEREAS this represents the loss of the major portion of the desert pupfish's historical range, and

WHEREAS the aforementioned surveys demonstrate that the few remaining populations of this species exist in habitats that are seriously threatened with degradation and destruction due to competition and predation from exotic fish species and increased demands for water for agriculture, and

WHEREAS means of protection are necessary to prevent the extinction of the desert pupfish from the few remaining natural habitats in its historic range, now therefore be it

RESOLVED that the Desert Fishes Council, an organization numbering in excess of 300 persons and comprising a nationwide and international representation of federal, state, and university scientists and resource specialists, members of conservation organizations, and individuals concerned with long-term environmental values, assembled at the Council's eleventh annual meeting on November 15-16, 1979 at Death Valley National Monument, does hereby urge the United States Fish and Wildlife Service to proceed without delay in listing the desert pupfish as an endangered species throughout its range in the United States and Mexico, and be it further

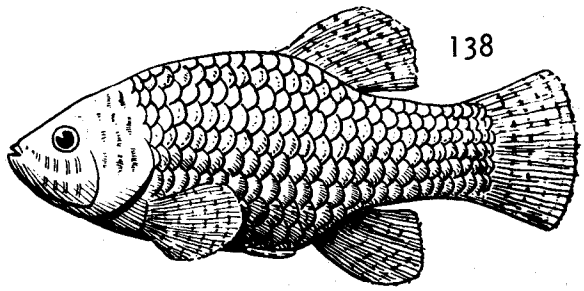
RESOLVED that copies of this resolution be forwarded to the Director of the United States Fish and Wildlife Service and to other individuals and agencies as deemed appropriate.

PASSED WITHOUT DISSENTING VOTE

ATTEST:

Peter G. Sanchez
Chairman

Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"

P.O. Box 276
Death Valley, CA 92328
January 15, 1980

RESOLUTION 79-9

RELATIVE TO THE LISTING OF THE DESERT PUPFISH, CYPRINODON MACULARIUS BAIRD AND GIRARD (CYPRINODONTIDAE), AS AN ENDANGERED SPECIES BY THE STATE OF CALIFORNIA

WHEREAS the activities of Man have severely reduced the historic range of the desert pupfish (Cyprinodon macularius) to the Salton Sea and several of its tributaries within California, and

WHEREAS surveys conducted by the California Department of Fish and Game within the vicinity of the Salton Sea reveal that habitat modification and the introduction and establishment of exotic species have critically reduced the amount of habitat available to the desert pupfish, and

WHEREAS additional surveys by the California Department of Fish and Game in San Felipe Creek, a perennial Colorado Desert stream tributary to the Salton Sea, demonstrate that the last viable population of desert pupfish exists within this creek, and

WHEREAS the population of desert pupfish within San Felipe Creek is currently threatened with a possible complete loss of habitat due to groundwater pumping for agriculture both on land within the creek and upon land contiguous thereto, and

WHEREAS no sure means of protection are currently being implemented to prevent the extinction of this species from natural habitats within its historic range, now therefore be it

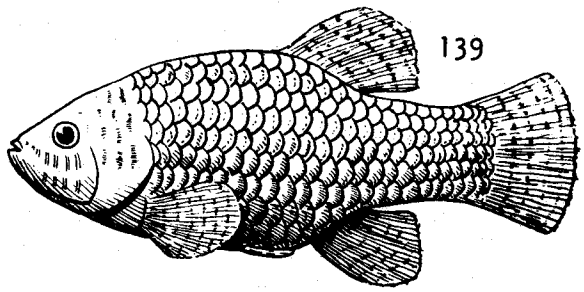
RESOLVED that the Desert Fishes Council, an organization numbering in excess of 300 persons and comprising a nationwide and international representation of federal, state, and university scientists and resource specialists, members of conservation organizations, and individuals concerned with long-term environmental values, assembled at the Council's Eleventh Annual Symposium on November 15-16 at Death Valley National Monument, does hereby urge the State of California to proceed without delay in listing the desert pupfish as an endangered species, and be it further

RESOLVED that copies of this resolution be forwarded to the Director of the California Department of Fish and Game, to the Citizens' Nongame Advisory Committee, and to other agencies and individuals as deemed appropriate.

PASSED WITHOUT DISSENTING VOTE

ATTEST:
Peter G. Sanchez
Chairman

Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"

P.O. Box 276
Death Valley, CA 92328
December 13, 1979

RESOLUTION 79-10

RELATIVE TO THE PRESERVATION OF THE DESERT PUPFISH, CYPRINODON MACULARIUS

WHEREAS Santa Clara Slough in northern Mexico currently supports one of the few remaining large populations of desert pupfish, and

WHEREAS the American Fisheries Society has recommended threatened status for this species, and

WHEREAS the Santa Clara Slough population could be adversely affected by saline and other deleterious effluents from a proposed desalinization plant on the lower Colorado River, now therefore be it

RESOLVED that the Desert Fishes Council, an organization numbering in excess of 300 persons and comprising a nationwide and international representation of federal, state, and university scientists and resource specialists, members of conservation organizations, and individuals concerned with long-term environmental values, meeting at its Eleventh Annual Symposium in Death Valley, California on November 16, 1979, does hereby urgently request the Water and Power Resources Service to include plans for the monitoring and preservation of this population in its construction and operational program for the desalinization plant on the lower Colorado River, and be it further

RESOLVED that the Regional Director of the lower Colorado River basin of the Water and Power Resources Service be requested to inform the Desert Fishes Council of his disposition of this matter, and be it further

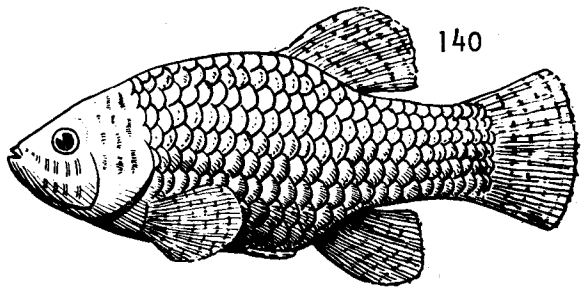
RESOLVED that copies of this resolution be forwarded to the Regional Director of the lower Colorado River basin of the Water and Power Resources Service, the Fish and Wildlife Service Regional Director in Albuquerque, and officials of appropriate Mexican agencies.

PASSED WITHOUT DISSENTING VOTE

ATTEST:

Peter G. Sanchez
Chairman

Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"

P.O. Box 276
Death Valley, CA 92328
December 14, 1979

RESOLUTION 79-11

RELATIVE TO THE ACQUISITION OF HABITAT FOR THE MOAPA DACE (MOAPA CORIACEA)

WHEREAS the United States Fish and Wildlife Service has established a refugium for the Moapa dace through land acquisition in the headwaters of the Moapa River, and

WHEREAS this action is considered a major accomplishment in the restoration efforts for this species, now therefore be it

RESOLVED that the Desert Fishes Council, meeting at its Eleventh Annual Symposium in Death Valley, California on November 16, 1979 does hereby support and commend the Fish and Wildlife Service for this land acquisition, and be it further

RESOLVED that the Council supports the concept of land acquisition for the protection and preservation of endangered or threatened wildlife anywhere within the jurisdiction of the Fish and Wildlife Service, and be it further

RESOLVED that copies of this resolution be forwarded to the Secretary of the Interior, to the Director of the U.S. Fish and Wildlife Service, to the Regional Director of the Fish and Wildlife Service in Portland, Oregon, and to the Manager of the Sacramento Area Office of the Fish and Wildlife Service.

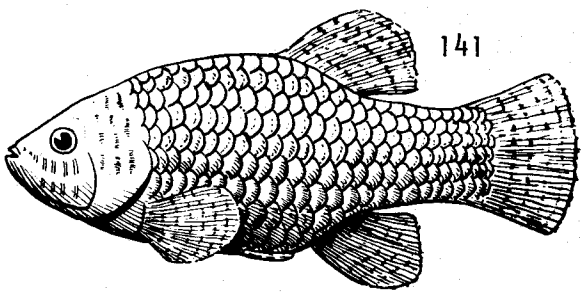
PASSED WITHOUT DISSENTING VOTE

ATTEST:

Peter G. Sanchez

Peter G. Sanchez
Chairman

Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"

P.O. Box 276
Death Valley, CA 92328
December 17, 1979

RESOLUTION 79-12

RELATIVE TO DEVILS HOLE AND ASH MEADOWS HABITAT PROTECTION

WHEREAS the Desert Fishes Council's formation was initially stimulated by preservation efforts for the Devils Hole pupfish (Cyprinodon diabolis), and

WHEREAS the need for such preservation efforts was a direct result of severe habitat degradation in and around the area of Devils Hole within Ash Meadows, and

WHEREAS the United States Supreme Court decision concerning Devils Hole limits irrigation pumping within certain portions of Ash Meadows but provides no such limitation for domestic uses, and

WHEREAS there are currently plans to subdivide for residential use much of the Ash Meadows area, and

WHEREAS extensive development of water supplies for domestic use could seriously deplete groundwater levels within Ash Meadows with disastrous effects upon spring ecosystems within that area, now therefore be it

RESOLVED that the Desert Fishes Council, meeting at its Eleventh Annual Symposium in Death Valley, California on November 16, 1979 does hereby urge the Bureau of Land Management to proceed with presently considered land exchanges, and be it further

RESOLVED that the Bureau of Land Management and Fish and Wildlife Service are urged to pursue with diligence further possible land acquisition, and be it further

RESOLVED that copies of this resolution be forwarded to the Secretary of the Interior, to the Director of the Fish and Wildlife Service, to the Director of the Bureau of Land Management, to the Nevada State Director of the Bureau of Land Management, and to the Regional Director of the Fish and Wildlife Service in Portland, Oregon.

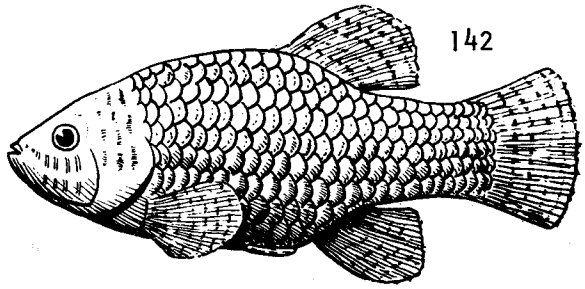
PASSED WITHOUT DISSENTING VOTE

ATTEST:

Peter G. Sanchez

Peter G. Sanchez
Chairman

Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"

P.O. Box 270
Death Valley, CA 92328
December 17, 1979

RESOLUTION 79-13

RELATIVE TO MOAPA DACE REFUGIUM PROTECTION

WHEREAS the U.S. Fish and Wildlife Service has established a refugium for the Moapa dace (Moapa coriacea) at Pederson's Warm Springs, Clark County, Nevada, and

WHEREAS several springs and their combined outflows from a commercial swimming resort constitute a common boundary with the refugium and contribute directly to its waters, and

WHEREAS these particular springs are planned for commercial development that would significantly jeopardize restoration efforts of the dace in waters of the refugium, and

WHEREAS the acquisition of these springs would not restrict the present operation of the swimming resort, now therefore be it

RESOLVED that the Desert Fishes Council, at its annual symposium held on November 16, 1979 in Death Valley, California, does hereby urge the U.S. Fish and Wildlife Service to continue land acquisition proceedings for these springs and requests that the Council be kept advised in this matter through proposals and progress reports, and be it further

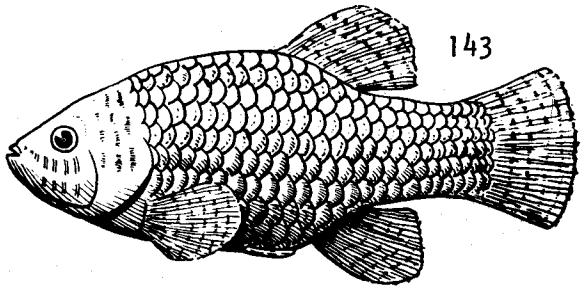
RESOLVED that copies of this resolution be forwarded to the Director of the U.S. Fish and Wildlife Service, to the Regional Director of the U.S. Fish and Wildlife Service in Portland, Oregon, and to the Area Manager of the U.S. Fish and Wildlife Service in Sacramento, California.

PASSED WITHOUT DISSENTING VOTE

ATTEST:

Peter G. Sanchez
Chairman

Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"
P.O. Box 276
Death Valley, CA 92328
December 17, 1979

RESOLUTION 79-14

RELATIVE TO STATE GENERAL FUND SUPPORT FOR
THE NEW MEXICO DEPARTMENT OF GAME AND FISH

WHEREAS the New Mexico Department of Game and Fish plans to submit a request to the New Mexico State Legislature for $1.4 million from state general funds in January 1980, and

WHEREAS the approval of this request for funds will permit the New Mexico Department of Game and Fish to maintain and enhance its management and educational programs, including a progressive program for nongame and endangered fish and wildlife, and

WHEREAS failure of the New Mexico State Legislature to approve requests for general fund revenues will severely restrict the ability of the New Mexico Department of Game and Fish to continue monitoring and management activities concerning the state's fish and wildlife resources, and

WHEREAS the absence of state-provided funds will impair the ability of the state to provide sufficient state matching funds required to continue Pittman-Robertson and Dingell-Johnson programs, as well as vital programs related to the preservation of endangered and threatened species, and

WHEREAS the reduction in conservation-oriented activities and programs, including land acquisition, will surely result in continued and increasingly rapid deterioration of natural habitats and fish and wildlife resources, now therefore be it

RESOLVED that the Desert Fishes Council, an organization numbering in excess of 300 persons and comprising a nationwide and international representation of federal, state, and university scientists and resource specialists, members of conservation organizations, and individuals concerned with long-term environmental values, meeting at its Eleventh Annual Symposium in Death Valley, California on November 16, 1979, does hereby urge the New Mexico State Legislature to give favorable consideration to the funding request by the New Mexico Department of Game and Fish, and be it further

RESOLVED that copies of this resolution be forwarded to the New Mexico Secretary of Natural Resources for his distribution to the Governor and other state legislators and public agencies as he sees fit, and be it further

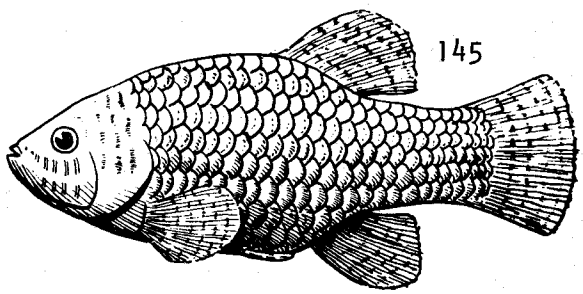
RESOLVED that this resolution be made available to all private conservation groups concerned, especially the New Mexico Wildlife Federation, and to concerned scientific societies within New Mexico for their consideration in providing similar support.

PASSED WITHOUT DISSENTING VOTE

ATTEST:

Peter G. Sanchez
Chairman

Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"

P.O. Box 276
Death Valley, CA 92328
January 15, 1980

RESOLUTION 79-15

REGARDING ENDANGERED STATUS FOR THE CHIHUAHUA CHUB,
GILA NIGRESCENS (GIRARD)(CYPRINIDAE),
AND REESTABLISHMENT IN MIMBRES RIVER, NEW MEXICO

WHEREAS the Chihuahua chub (Gila nigrescens) is almost extirpated from the Mimbres River, New Mexico, its only place of occurrence in the United States, and

WHEREAS a recent survey of populations in the Mexican portion of its range in Chihuahua reveals that it has become severely reduced there, and

WHEREAS stocks from the U.S. and Mexico are being propagaged successfully at the Dexter National Fish Hatchery, New Mexico, now therefore be it

RESOLVED that the Chihuahua chub be designated an endangered species by the U.S. Department of the Interior and further, that reintroduction of the species from stock reared at Dexter National Fish Hatchery be made when appropriate in a suitable refuge in the Mimbres River, and be it further

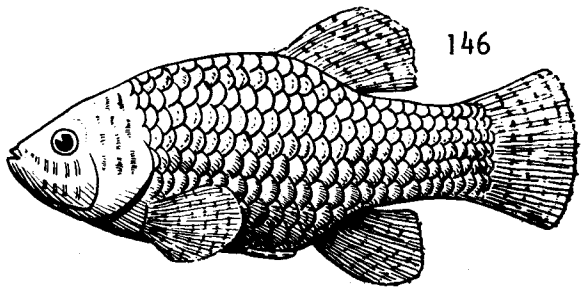
RESOLVED that copies of this resolution be forwarded to the Director of the U.S. Fish and Wildlife Service, to the Chief of the Office of Endangered Species of the same agency, to the Regional Director, Region 2, of the U.S. Fish and Wildlife Service, to the Director of the New Mexico Department of Game and Fish, and to the Director of the New Mexico Department of Game and Fish endangered species program.

PASSED WITHOUT DISSENTING VOTE

ATTEST:

Peter G. Sanchez
Chairman

Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"
P.O. Box 276
Death Valley, CA 92328
December 13, 1979

RESOLUTION 79-16

RELATIVE TO THE PROTECTION OF DESERT HABITATS DURING CONSTRUCTION OF THE MX MISSILE PROGRAM IN UTAH AND NEVADA

WHEREAS the Department of Defense has proposed construction of the MX missile deployment project in small interbasins within the Great Basin in western Utah and eastern Nevada, and

WHEREAS construction and operation of the MX missile system would involve vast surface disturbance and require massive quantities of ground and surface water, and

WHEREAS the use of pumped and diverted water would significantly degrade and decimate existing ground and surface water supplies supporting aquatic ecosystems, causing losses of habitat and dependent plant and animal species, now therefore be it

RESOLVED that the Desert Fishes Council, an organization numbering in excess of 300 persons and comprising a nationwide and international representation of federal, state, and university scientists and resource specialists, members of conservation organizations, and individuals concerned with long-term environmental values, meeting at its Eleventh Annual Symposium in Death Valley, California on November 16, 1979 does hereby urge the Department of Defense in its MX missile project planning to give adequate consideration and protection to desert aquatic ecosystems that occur within the proposed missile study sites and further urges that the Desert Fishes Council be kept advised of project planning through progress reports and proposals, and be it further

RESOLVED that the Desert Fishes Council urges the Bureau of Land Management in Utah and Nevada to actively involve its aquatic biologists in the evaluation of MX missile project impacts, and that the Bureau of Land Management actively inform and cooperate with the states of Utah and Nevada on the project in order that desert organisms and their habitats may be adequately protected, and be it further

RESOLVED that this resolution is in no way intended to constitute an endorsement, either expressed or implied, of the MX missile project, and be it further

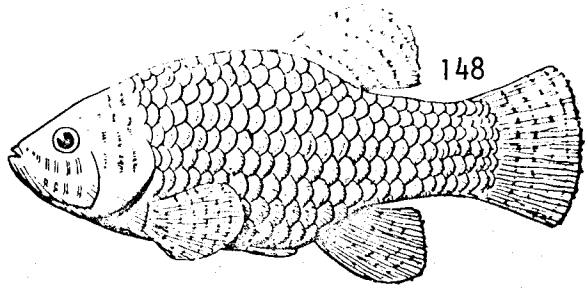
RESOLVED that copies of this resolution be forwarded to the President of the United States, to the Secretary of Defense, to the Secretary of the Air Force, to the Secretary of the Interior, to the Director of the Bureau of Land Management, to the Governors of Nevada and Utah, to the State Directors of the Bureau of Land Management in Nevada and Utah, to the Director of the Nevada Department of Wildlife, and to the Director of the Utah Division of Wildlife Resources.

PASSED WITHOUT DISSENTING VOTE

ATTEST:

Peter G. Sanchez
Chairman

Desert Fishes Council



"Dedicated to the Preservation of America's Desert Fishes"

P.O. Box 276
Death Valley, CA 92328
March 4, 1980

RESOLUTION 79-17

RELATIVE TO MAINTAINING THE INTEGRITY OF SPRING FLOW INTO BORAX LAKE

WHEREAS the Borax Lake chub, Gila sp., is currently being described as a unique endemic species differentiated from the Alvord chub, Gila alvordensis, in other waters of the Alvord Basin, and

WHEREAS the Borax Lake chub is restricted to Borax Lake and therefore dependent for its existence upon the maintenance of habitat integrity of Borax Lake, and

WHEREAS this habitat integrity is being maintained by the thermal spring flows issuing into the bottom of Borax Lake, and

WHEREAS the Unique Ecosystem Program of the U.S. Fish and Wildlife Service has designated Borax Lake as the second most important ecosystem in the State of Oregon, and

WHEREAS the American Fisheries Society has recommended threatened status for the Borax Lake chub, and

WHEREAS geothermal development may adversely affect spring flows into Borax Lake, now therefore be it

RESOLVED that the Desert Fishes Council, an organization numbering in excess of 300 persons and comprising a nationwide and international representation of federal, state, and university scientists and resource specialists, members of conservation organizations, and individuals concerned with long-term environmental values, meeting at its Eleventh Annual Symposium in Death Valley, California on November 16, 1979 does hereby urge the Bureau of Land Management to withdraw from geothermal leasing the three parcels of land under their administration located adjacent to the Borax Lake area, and other tracts as may be necessary to maintain the integrity of spring flow into Borax Lake, and be it further

RESOLVED that copies of this resolution be forwarded to the National Director of the Bureau of Land Management, the Oregon State Director of the Bureau of Land Management, the Burns District Manager of the Bureau of Land Management, the Portland Regional Director of the U.S. Fish and Wildlife Service, and the Director of the Oregon Department of Fish and Wildlife, and be it further

RESOLVED that the Oregon State Director of the Bureau of Land Management be requested to inform the Chairman of the Desert Fishes Council of his disposition of this matter.

PASSED WITHOUT DISSENTING VOTE

ATTEST:

Peter G. Sanches
Chairman

ELEVENTH ANNUAL SYMPOSIUM ATTENDANCE LIST

NAME	AFFILIATION	ADDRESS
Jeff Aardahl	BLM	1415 N. Norma, Ridgecrest CA
Cal Allan	Nevada Dept. of Wildlife	Las Vegas, NV
Jim Anderson	New Mexico State Univ.	Box 4901, Las Cruces, NM
Donald L. Archer	USFWS	2972 Scandia Way, Sandy UT
Neil Armantrout	BLM	Box 12052, Portland OR
Cary Atwood	Death Valley Natl. Monument	Box 231, Death Valley CA
Mary Bacon	USFS	2400 Washington St. Redding CA
Kurt Ballantyne	BLM	882 Hillside Dr., Elko NV
Tom Baugh		1020 Custier Ave., Ogden UT
Kraig Beckstrand	Nevada Dept. of Wildlife	4705 Greencreek Dr. Las Vegas
Glenn Black	Calif. Dept. Fish & Game	Chino, CA
Steve Bouffard	USFWS	Ruby Valley, NV
Peter Bowler	U.C. Irvine	Irvine, CA
Ken Britt	New Mexico State Univ.	Box 4901, Las Cruces, NM
Martin R. Brittan	Calif. State Univ.	Sacramento, CA
Jerry Burton	USFWS	Phoenix, AZ
M. Busdosh	Woodward-Clyde	3489 Kurtz St., San Diego CA
Osborne Casey	BLM	300 Booth St., Reno NV
Al Castro	Calif. Academy of Sciences	San Francisco, CA
Frances Clark		849 Coast Blvd., La Jolla CA
Jim Collins	Arizona State Univ.	Tempe, AZ
Candia Coombs	Oregon State Univ.	Corvallis, OR
Louis Courtois	Calif. Dept. Fish & Game	Rancho Cordova, CA
Bob Davies	HDR	Santa Barbara, CA
Kenny Detweiler	BLM	Box 5400, Las Vegas, NV
Don Duff	BLM	Salt Lake City, UT
Nick Dye	Arizona-Sonora Desert Museum	Rt. 9, Tucson AZ
Beula Edmiston		Monterey Park, CA
Tasker Edmiston		Monterey Park, CA
Larry Eng	Calif. Dept. Fish & Game	Sacramento, CA
Willis Evans	USFS	San Francisco, CA
Cathy Farrell	Bio-Resources	399 N500E, Logan UT
Robert Feldmeth	Claremont Colleges	Claremont, CA
S. G. Fisher	Arizona State Univ.	Tempe, AZ
Bill Foster	New Mexico State Univ.	Las Cruces, NM
David Gaines	Mono Lake Committee	Box 29, Lee Vining, CA
Bill Gallagher		173 Luella Dr., Pleasant Hill CA
Steve Gannon	BLM	331 Benton, Denver CO
Gary & Linda Garrett	Univ. of Texas	Austin, Texas
Dave Glenn	New Mexico State Univ.	Box 4901, Las Cruces, NM
Barbara Gorrell		1439 7th St., Riverside CA
Win Green	USFS	873 N. Main, Bishop CA
Paul Greger	UNLV	Las Vegas, NV
Phil Gruenberg	Calif. Reg. Water Qlty. Ctrl. Bd.	83-280 Rosa, Thermal, CA
Nancy Gumin	Arizona State Univ.	Tempe, AZ
Pat Haddock	Arizona State Univ.	Tempe, AZ
Dee Harper	Water & Power Resources Serv.	2800 Cottage Wy., Sacramento CA

Michael Havelka	Desert Research Station	511 H. Ave., Barstow, CA
Mike Hayes	New Mexico State Univ.	Box 4901, Las Cruces, NM
Charles Haynes	Colorado Div. Wildlife	317 W. Prospect, Ft. Collins CO
Dean Hendrickson	Arizona State Univ.	Tempe, AZ
Kevin Herbinson	So. Calif. Edison	Box 300, Rosemead, CA
Terry Hickman	USFWS	2625 Redwing Rd., Ft. Collins CO
Paul Holden	Bio/West, Inc.	Box 3226, Logan, UT
Frank Hoover	Calif. Dept. Fish & Game	Chino, CA
Laura S. Hubbs	Scripps Inst. Oceanography	La Jolla, CA
T. M. Jenkins, Jr.		Box 336, June Lake, CA
Jim Johnson	USFWS	Box 1306, Albuq. NM
Merritt S. Keasey	Arizona-Sonora Desert Museum	Rt. 9, Tucson, AZ
Don Keller	New Mexico State Univ.	Box 4901, Las Cruces NM
Jeff Kennedy	UC Natural Land & Water Reserve	2111 Bancroft Way, Berkeley CA
Bill Kepner	Arizona State Univ.	31 E. 6th St. Tempe, AZ
Gail Kobetich	USFWS	Citrus Heights, CA
David L. Koch	Desert Research Inst.	Box 60220, Reno NV
Jim LaBounty	Water & Power Resources Serv.	Box 25007, Denver CO
Jerry Landye	Landye Consulting	3465 N. Jamison, Flagstaff AZ
Raymond Lee	Arizona State Univ.	Tempe, AZ
Paul Loiselle	University of California	Berkeley, CA
Eric Loudenslager	Univ. of California	Davis, CA
Bill Loudermilk	Calif. Dept. Fish & Game	Box BD, Blyth, CA
Bob Love	Nature Conservancy	Box 1006, Yorba Linda CA
Tom Lugaski	University of Nevada	Reno, NV
Pat Mangan	USFWS	764 Horizm, Grand Junction CO
David Marshall	USFWS	Portland, OR
Margaret Matsui	Occidental College	Los Angeles, CA
Terry McCall	Arizona Game & Fish	Box 1891, Page AZ
Alan McCready		4529 Marble Way, Carmichael CA
Gary Meffe	Arizona State Univ.	Tempe, AZ
Bill Miller	USFWS	Salt Lake City, UT
Frances H. Miller	Univ. Michigan	Ann Arbor, MI
Kent D. Miller	Utah DWR	1596 W.N. Temple, SLC, UT
Robert R. Miller	Univ. of Michigan	Ann Arbor, MI
Elisabeth Milstead	Baylor Univ.	Waco, TX
C.O. Minckley	Museum of Northern Arizona	Box 720, Rt. 4, Flagstaff AZ
W.L. Minckley	Arizona State Univ.	Tempe, AZ
Sue Morgensen	Arizona Game & Fish	Box 3, Meadview, AZ
Dick Navarre	USFWS	4459 Plantation, Fair Oaks CA
Cindy Nelson	USFWS	Box 91, Vernal UT
Stephen Nicola	Calif. Dept. Fish & Game	Sacramento, CA
Larry Norris	Natl. Park Service	Box 434, Death Valley, CA
Butch Padilla	Nevada Dept. of Wildlife	6359 W. Woodbury, Las Vegas NV
Grey Pendleton		904 Dianne Dr., Boulder City NV
Phil Pister	Calif. Dept. Fish & Game	407 W. Line St., Bishop CA
Lauren Porzer	Arizona State Univ.	Tempe, AZ
Walter Reid	Calif. Dept. Fish & Game	407 W. Line St., Bishop CA
Carl Richards	Bio/West, Inc.	329 N500E, Logan UT
Bill Rinne	Water & Power Resources Serv.	Boulder City, NV
John N. Rinne	USFS-Arizona State Univ.	Tempe, AZ
Sdhari Russell		Citrus Heights, CA
Don Sada	USFWS	2800 Cottage Way, Sacramento CA
Jim & Evelyn St. Amant	Calif. Dept. Fish & Game	350 Golden Shore, Long Beach CA
Pete Sanchez	NPS, Death Valley	Death Valley, CA

Allan Schoenherr	Fullerton College	321 E. Chapman, Fullerton, CA
Gary Scoddettone	USFWS	4600 Kietzke, Reno NV
Mignon Shumway		735 Alturas del Sol, Santa Barba
Darrell Siebert	Arizona State Univ.	Tempe, AZ
Gary Smith	Calif. Dept. Fish & Game	Sacramento, CA
David Soltz	Calif. State Univ.	Los Angeles, CA
Gary Sonnevil	USFWS	4600 Kietzke, Reno NV
Jerry Stefferud	USFS	873 N. Main, Bishop CA
Bill Sweeney	USFWS	4456 Charleston, Carmichael CA
Jan Tarble	LA Audubon	Box 67193, Los Angeles, CA
Dean Wm. Taylor	Mono Lake Committee	Box 29, Lee Vining CA
Kathleen Teare	Mono Lake Committee	Box 29, Lee Vining CA
Rosie Thompson	HDR	Santa Barbara, CA
John L. Turner	Calif. Dept. Fish & Game	Carmichael, CA
Paul R. Turner	New Mexico State Univ.	Box 4901, Las Cruces NM
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Arcadio Valdes	Utah State Univ.	Logan, UT
Richard Valdez	USFWS	764 Horizon, Grand Junction CO
David Vanicek	Calif. State Univ.	Sacramento, CA
Gary Vinyard	Univ. of Nevada	Reno, NV
George Von der Lippe	NPS, Death Valley	Death Valley, CA
Johnson Wang	Ecological Analysts, Inc.	2150 John Glenn, Concord, CA
Wayne Wathen	USFWS	Box 25486, Denver, CO
Edmund J. Wick	Colorado State Univ.	Ft. Collins, CO
Gene Wilde	University of Oklahoma	Norman, OK
Philip J. Wilke	Univ. of California	Riverside, CA
Bob Williams	USFWS	125 So. State, SLC, UT
Dan Williams	Arizona State Univ.	Tempe, AZ
Jack, Cindy & Austin Williams	Oregon State Univ.	Corvallis, OR
Jim Williams	USFWS	Washington D.C.
Bill Winchester	CRWQCB	Morongo Valley, CA
Darrell Wong	Calif. Dept. Fish & Game	407 W. Line St., Bishop CA
Jonathan Wright	New Mexico State Univ.	Box 4901, Las Cruces NM
David Young	BLM	Richfield, UT
Jim Yoakum	BLM	1000 Valley, Reno NV

Late Registrants

Jim and Maxine Deacon	UNLV	Las Vegas, NV 89154
Thom and Tina Hardy	UNLV	Las Vegas, NV 89154