

THE DEVIL'S HOLE PUPFISH,
A CLASSIC STUDY OF MAN'S ROLE WITH AN ENDANGERED SPECIES

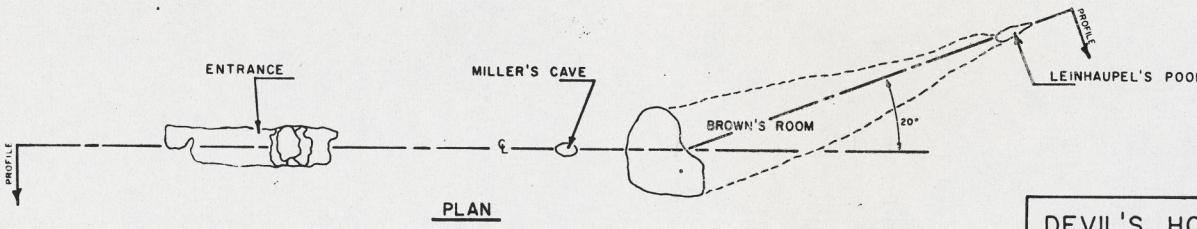
Presented by
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INTRODUCTION: For 30 thousand years the Devil's Hole Pupfish, Cyprinodon diabolis, lived undisturbed in its only habitat, a single limnocrene in Nevada called Devil's Hole. However, in the brief time since its discovery by man in 1930, the fish has been subjected to near extinction. Agricultural development and land speculation in Pahrump Valley, the home of Devil's Hole; has rendered the waters of Devil's Hole a valuable commodity. Pumping of underground waters significantly lowered the water level in the "Hole" itself, exposing the only shelf in the spring, a shelf essential for food production and spawning of the pupfish. The uniqueness of the fish, as well as these threats to its habitat, have prompted "endangered species" status for the fish, and the inclusion of Devil's Hole as a part of the Death Valley National Monument. Further attempts to save the fish have led to the establishment of a second population within an artificial refugium located below Hoover Dam, Nevada. However, the uniqueness of Devil's Hole itself as a habitat, has prompted court suits to prohibit or curtail pumping of the waters of Devil's Hole. Recently, these arguments were heard by the Supreme Court of the United States which in effect ruled in "favor of the pupfish" by restricting pumping in the area. Herein lies the plight of the Devil's Hole Pupfish, a fish brought to the verge of extinction by man, and now, for the moment, brought back.

Figure one shows the underwater cavern system associated with Devil's Hole. The fish are crepuscular by habit, migrating down to near 10 meters during midday and later returning to the shelf area where they spend a considerable period of the day. With such a behavior pattern, population estimates are a formidable task. However, with the recent aid of three scuba divers on each count, the task has been somewhat simplified. Pupfish have been seen at a depth of almost 30 meters.

Beyond the 70 meter depth (near the 200 feet mark on the map) the cavern is unchartered.

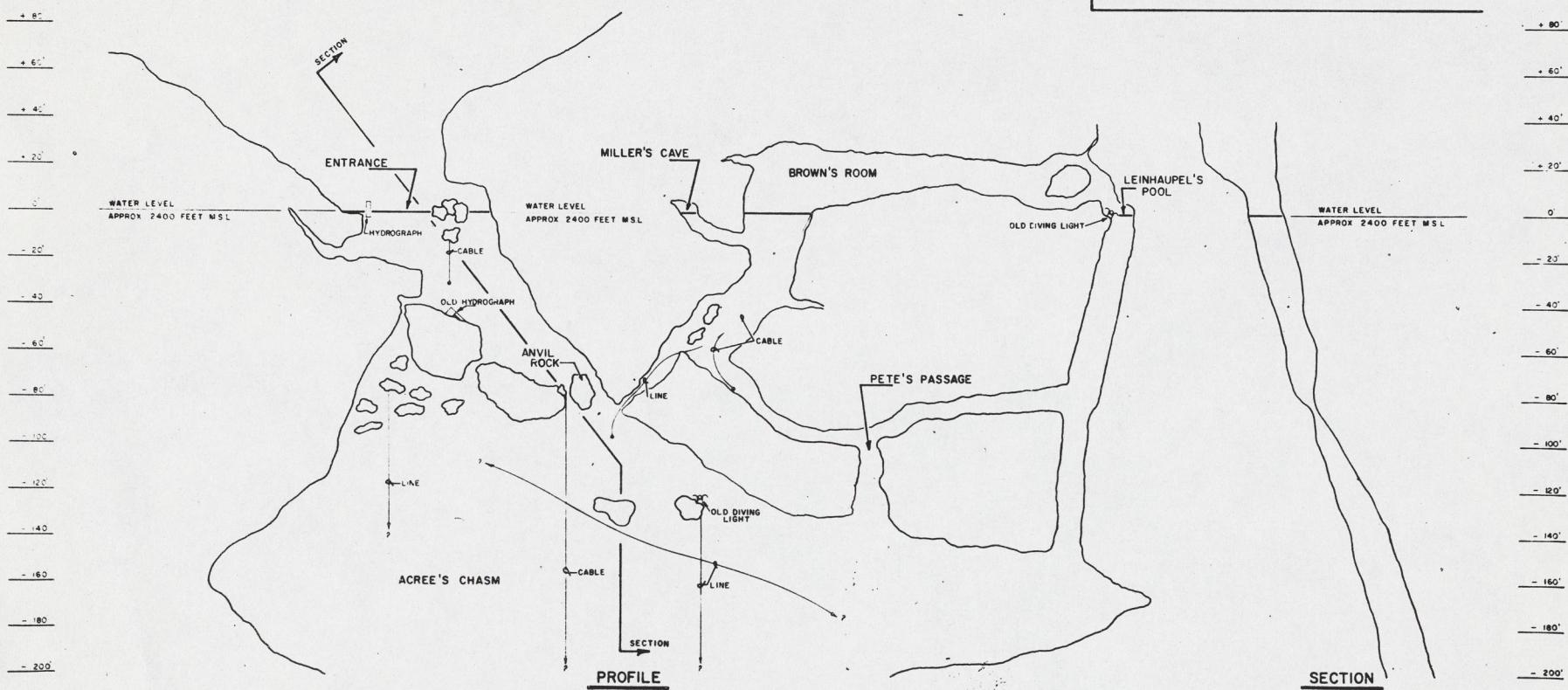


DEVIL'S HOLE

DEATH VALLEY NATIONAL MONUMENT
NATIONAL PARK SERVICE - U.S. DEPT. OF INTERIOR

MAP BY J. A. L. PARK RANGER - V. 1, 1972

SCALE - VERTICAL 1" = 20'
SCALE - HORIZONTAL 1" = 20'



Population estimates for Devil's Hole are given in table one. Prior to the start of agricultural development, i.e. pumping of groundwater, the usual winter population ranged between 200 and 300 fish, while the summer populations usually neared the 700 mark. Recent years however, have shown a lower population average. We speculate the population levels are closely correlated with water levels (reflected in percent of the shelf covered and therefore the abundance of food, cover, and spawning areas). However, bear in mind that seasonal population fluctuations normally exist due to the amount of sunlight reaching the shelf, peak reproductive periods, and other factors.

Values for the water level are given in distance from a water gauge; therefore, the lower numbers reflect a higher water level and therefore more of the shelf available for the fish. A prepumping water level resulted in summer pupfish numbers of near 700.

TABLE 1*

1975 DEVIL'S HOLE POPULATION ESTIMATES AND ASSOCIATED WATER LEVELS

DATE	POP. EST.	WATER LEVEL
22 January	208	3.04
20 February	159	2.79
18 March	148	2.83
10 April	158	2.92
19 May	201	3.10
16 June	262	3.14
30 July	278	3.30
20 August	294	3.36
30 September	260	3.24
21 October	279	3.19
25 November	261	3.12
16 December	246	2.97

* There exists a lag period between water level, algal growth, and population increase (or decrease) of about two months.

Further information concerning the Devil's Hole Pupfish
may be obtained by writing me at the following address:

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THE PAHRUMP KILLIFISH

THE PAHRUMP KILLIFISH IS A MEMBER OF THE FAMILY CYPRINODONTIDAE AND A NOT TOO DISTANT RELATIVE OF THE MORE WELL KNOWN PUPFISHES OF THE SAME GEOGRAPHIC AREA OF NEVADA. IT IS A WARM WATER FISH (75 F) POSSESSING TWO DISTINGUISHING TRAITS OF CONICAL TEETH AND AN ABSENCE OF PELVIC FINS. IT ORIGINALLY SURVIVED IN THREE SPRINGS IN PAHRUMP VALLEY, NEVADA, EACH POPULATION AS AN ENDEMIC SUBSPECIES. TODAY TWO OF THE SUBSPECIES ARE EXTINCT AND THE THIRD IS OFFICIALLY CLASSIFIED AS ENDANGERED. THE EXTINCTION OF EMPETRICHTHYS MERRIMI IN AN ADJACENT VALLEY LEAVES E. LATOS LATOS ALONE TO REPRESENT AN ENTIRE GENUS.

DURING JULY OF 1975 THE ONLY NATIVE HABITAT OF E. LATOS LATOS DRIED UP DUE TO EXCESS PUMPING OF GROUND WATER FOR AGRICULTURAL DEVELOPMENT OF THIS DESERT VALLEY. THE SITE WAS MANSE RANCH AND TO THOSE FAMILIAR WITH DESERT SPRINGS AND WATER IN THIS AREA THIS OCCURENCE WAS NOT SURPRISING. IN FACT, THE DRYING OF MANSE SPRING HAD BEEN PREDICTED YEARS AHEAD AND IT IS MAINLY FOR THAT REASON THAT THE PAHRUMP KILLIFISH LIVES TODAY.

BECAUSE THE SPRING AND POOL OF E. LATOS LATOS ARE LOCATED ON PRIVATE PROPERTY, EFFORTS TO INSURE PRESERVATION OF THIS UNIQUE SPECIES WERE AIMED PRIMARILY AT TRANSPLANTATION TO OTHER WATERS. TODAY THE PAHRUMP KILLIFISH SURVIVES ONLY AT THESE TRANSPLANT SITES. TO DATE BREEDING SUCCESS HAS BEEN GOOD AT THE NEW AMARGOSA PUPFISH STATION, THE HOLDING PONDS ON THE UNIVERSITY OF NEVADA, LAS VEGAS CAMPUS AND YOUNG HAVE RECENTLY BEEN OBSERVED IN CORN CREEK POND WHERE COMPETITION WITH MOSQUITOFISH AND POSSIBLE INHIBITION OF REPRODUCTION BY LARGE NUMBERS OF BULLFROG TADPOLES HAD THREATENED THAT POPULATION UNTIL THE RECENT RENOVATION OF THE POND.

AN ADDITIONAL POPULATION OF PAHRUMP KILLIFISH WAS RECENTLY DISCOVERED IN A NATURAL SPRING POOL IN A WASH ALONG THE COLORADO RIVER. THE TRANSPLANT TO THIS POOL TOOK PLACE IN JUNE OF 1970 AND A SUBSEQUENT OBSERVATION OF THE POOL IN THE WINTER AND THE REALIZATION THAT THIS WAS NOT A CONSTANT TEMPERATURE WARM SPRING LED TO THE CONCLUSION THAT NONE OF THE KILLIFISH SURVIVED. RECENT STUDY SHOWS THAT PAHRUMP KILLIFISH ARE ABLE TO SURVIVE TEMPERATURES WELL BELOW THE 75 F OF MANSE SPRING, BUT HAVE A DEPRESSED DIURNAL ACTIVITY PATTERN SO VISUALLY OBSERVING THE POOL WOULD LEAD TO THE BELIEF FISH WERE ABSENT.

AS RESEARCH FOR A MASTERS THESIS I AM WORKING ON THE THERMAL ECOLOGY OF THE PAHRUMP KILLIFISH, DETERMINING THERMAL TOLERANCE, DISTRIBUTIONS WITH RELATION TO TEMPERATURE AND TEMPERATURE PREFERENDUM AT VARIOUS ACCLIMATION TEMPERATURES. AT TWO TRANSPLANT SITES THE KILLIFISH HAVE SHOWN AN ABILITY TO SURVIVE NEAR FREEZING TEMPERATURES OF 39 F REPEATEDLY, AN AMAZING ACCOMPLISHMENT FOR A FISH WHOSE ANCESTORS FOR THOUSANDS OF YEARS HAVE ONLY KNOWN WATER OF 75 F. THE MAXIMUM TOLERANCE TEMPERATURE HAS YET TO BE DETERMINED.

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STATUS OF THE WHITE SANDS PUPFISH, CYRINODON TULAROSA, IN THE TULAROSA BASIN OF NEW MEXICO

by Paul R. Turner, Department of Fishery and Wildlife Sciences, New Mexico State University, Las Cruces, New Mexico 88003.

The White Sands pupfish is the only native fish species of the endorheic Tularosa Basin of south central New Mexico. Populations occur in Mound Springs (two adjacent limncrenes) and Malpais Spring and its outflow. Both spring-fed habitats derive their water from archaic sources. The species also is abundant in suitable habitats of about 40 km of Salt Creek, the primary drainage of the upper basin. These three waters are on the U.S. Army's White Sands Missile Range. A fourth population occurs in about 5 km of Lost River on Holloman Air Force Base and White Sands National Monument. No other fish species occurs in the habitats occupied by C. tularosa, but several introduced populations of Gambusia affinis were found in isolated ponds on the missile range and air base. Populations of C. tularosa are found in waters with total dissolved solids ranging from 4,000 mg/L in the spring-fed habitats to over 100,000 mg/L in Lost River. We found no imminent threats to the four populations of C. tularosa. However, unauthorized introductions of non-native fishes or unregulated habitat alterations related to expanding military activities could impact existing populations. These potential threats have been identified and are recognized by the civilian environmental personnel of the military installations. Completion of and compliance with a cooperative pupfish management plan should reduce the likelihood for future problems and negate the need for federal listing of C. tularosa. In summary, increased concern by the military and the extensive distribution of C. tularosa in the diverse aquatic habitats of the Tularosa Basin should favor its long-term survival.

ESTADO DEL PEZ PUPO CYPINODON TULAROSA EN LA CUENCA DE TULAROSA EN EL ESTADO DE NUEVO MEXICO.

Por Paul R. Turner, Departamento de Pesca y Vida Silvestre, Universidad del estado de Nuevo Mexico, Las Cruces, New Mexico 88003.

Pupo es la única especie nativa en la cuenca cerrada de Tularosa en la parte centro-sur del estado de Nuevo Mexico. Poblaciones de esta especie ocurren tanto en manantiales de la región conocida como Mound así como en manantiales de la región llamada Malpaís y sus derrames. Ambos manantiales son recargados por aguas intermitentes. Esta especie también es abundante en otras áreas similares a las anteriores abarcando 40 km de Salt Creek que es el principal drenaje de la parte alta de esta cuenca. Estos tres tipos de agua se localizan en la parte conocida como Arenas Blancas de la Armada de los Estados Unidos. Una cuarta población se encuentra en 5 km del río Perdido en la Base Aerea de Holloman y el Monumento Nacional de las Arenas Blancas. Ninguna otra especie de pez ocurre en el medio habitado por Cyprinodon tularosa, sin embargo, algunas especies introducidas de Gambusia affinis se encontraron en estanques aislados cerca del área de Arenas Blancas de la Armada de los Estados Unidos y la Base Aerea. Poblaciones de C. tularosa se encontraron en aguas con 4000 mg/L de sólidos totales en los manantiales así como en aguas con mas de 100,000 mg/L en el área de Rio Perdido. No se encontraron amenazas fuertes en éstas 4 áreas para C. tularosa. Es necesario mencionar que introducciones no autorizadas de peces no-nativos así como alteraciones del área debido a actividades militares podría impactar las poblaciones existentes. Estas amenazas potenciales han sido identificadas y son reconocidas por personal civil, expertos en problemas del ambiente, que se encuentran trabajando dentro de instalaciones militares. El establecimiento y cumplimiento de un plan de administración debe reducir la posibilidad de futuros problemas, además de evitar la extensión de C. tularosa. En resumen, preocupación de los militares y la gran distribución de C. tularosa en la cuenca de Tularosa favorecen la supervivencia de esta especie en el largo plazo.

VARIATION IN AGE, GROWTH AND REPRODUCTION OF GILA TROUT, SALMO
GILAE IN HEADWATER STREAMS OF NEW MEXICO

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Transplants of Gila trout from the five original pure populations have been made into six additional streams. This increase in distribution has allowed the U.S. Fish and Wildlife Service to propose downlisting S. gilae from "endangered" to "threatened" status by 1988. Once this process is completed, the New Mexico Department of Game and Fish will be able to open suitable Gila trout streams to regulated sport fishing. Research indicates that the fishery potential of populations in headwater streams is highly variable. For example, S. gilae averaged only 113 mm (T.L.) at annulus 3 in a stunted population, but fish reached 242 mm at age 3 in an expanding introduced population at lower elevation. Female S. gilae first reach sexual maturity at age 4+ in the stunted population, but reach maturity at either age 2+ or 3+ in other streams. Spawning begins by March in a stream at 1900 m, but may not start until June in a stream at 2700 m. At higher elevations mean total length at annulus 1 is 35-60 mm, but S. gilae average 80-105 mm at age 1 in a lower elevation stream. Fecundity of S. gilae ranged from 68 mature ova in a 158-mm fish to 686 ova in a 274-mm fish. Standing crops of S. gilae were highly variable between and over time and ranged from 20-200 kg/hectare.

VARIACION EN EDAD, CRECIMIENTO Y REPRODUCCION DE LA TRUCHA SALMO
GILAE EN CORRIENTES DE LA PARTE ALTA DEL RIO GILA EN EL ESTADO DE
NUEVO MEXICO.

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Siembras de la trucha del Gila de 5 poblaciones puras han sido realizadas por agencias cooperativas dentro de 6 localidades adicionales. Este incremento en distribución ha permitido a el Departamento de Pesca y Servicio de Vida Silvestre salvar a la trucha del Gila de peligro de extinción y llevarla dentro de niveles normales para 1988. Una vez que el proceso este completo, el Departamento de Pesca y Cacería del estado de Nuevo Mexico podra abrir y regular la pesca de esta importante especie en el Rio Gila. Investigación indica que el potencial de pesca de poblaciones en altas montañas es muy variable. Por ejemplo, la trucha del Gila promedió únicamente 113 mm (largo total) a la edad 3 en una población con problemas de crecimiento, pero la misma especie alcanzo 242 mm a la edad 3 en una población de introducción en bajas elevaciones. Las truchas hembras alcanzaron madurez sexual a la edad de 4+ en una población con problemas de crecimiento pero la misma especie maduró a la edad 2+ o 3+ en otras localidades. Desove empieza en Marzo a los 1900 m de altura, pero posiblemente no empieza hasta junio a los 2700 m de altura. A mas altas elevaciones la media de el largo total a la edad 1 es 35-60 mm, sin embargo la trucha del Gila promedió 80-105 mm a la edad 1 en bajas altitudes. La fertilidad de Salmo gilae varió de 68 huevos maduros en truchas de 158 mm de largo, hasta 686 en truchas de 274 mm de largo. La cantidad total en peso de la trucha del Gila fue muy variable entre diversas localidades y diversas edades pero en general varió entre 20-200 kg/ha.