

An Introduction to the  
Desert Pupfish,  
*Cyprinodon macularius*

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# Desert Pupfish

- The desert pupfish is a member of the Cyprinodontidae or Killifish family. This is a large group of small (2-8 cm), egg-laying fish species that are all similar in appearance.
- The desert pupfish is the only native fish species in the Salton Sea ecosystem.



# Desert pupfish male



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# Desert pupfish female



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# Desert pupfish have survived in the harsh desert thanks to a broad range of environmental tolerances:

- Have been found at temperatures up to 48.9°C (120°F)
- Can survive salinities up to 70 g/L, and in juveniles up to 90 g/L, with a tolerance for rapid salinity transitions
- Can tolerate dissolved oxygen levels down to 0.13 mg/L, at least for short periods



These tolerances, in combination with a high reproductive rate and short generation time, have made the pupfish well adapted to systems with cycles of flooding and drying such as those that historically occurred in the lower Colorado River system.



# Desert Pupfish Habitat

- Natural habitat occurred in the lower Colorado and Gila River systems in the United States and Rio Sonoyta in Mexico, but several populations currently occur in somewhat modified habitats.
- Pupfish generally prefer areas with slow flow, relatively shallow water, and some structure for use as spawning substrates.



# Desert Pupfish Diet

- The diet consists largely of detritus and algae.
- Pupfish will feed opportunistically taking invertebrates such as chironomid (midge) larvae and diptera pupae (including mosquitos).
- Pupfish have been observed to create a small depression in the substrate in which detritus will collect for easy foraging. Male pupfish will defend these pits.



# Desert Pupfish Habitat in the Salton Sea Basin

- Pupfish occur in San Felipe Creek on the west side of the Sea. This habitat has been designated as critical habitat under the Endangered Species Act.
- Pupfish have been found in Salt Creek on the east side of the Sea.
- Irrigation drains on the north and south ends of the Sea are also home to pupfish.
- Shoreline pools along the Salton Sea may also have desert pupfish.



Use of specific irrigation drains has varied over time, but all drains flowing directly into the Salton Sea are considered potential habitat.

Recently, pupfish have been found to be using some of the marinas and shallow, nearshore areas of the Salton Sea.



# Pupfish Drain Habitat



# Desert Pupfish Status

- The desert pupfish was reported as abundant in the Salton Sea in the first half of the 20<sup>th</sup> century.
- Since the 1960's the abundance of the desert pupfish has declined severely.
- Establishment of several exotic fish species that prey on desert pupfish, compete with pupfish or interfere with pupfish reproductive activities may, at least in part, be responsible for this decline.
- Survey results from the drains around the Salton Sea have been variable but have not changed greatly over the last 20 years.



As a result of the decline of the desert pupfish, the State of California listed the species as endangered in October of 1980.

The Service listed the desert pupfish as endangered in March of 1986. Critical habitat was designated at that time in San Felipe Creek in California and Quitobaquito Springs in Arizona.



# Desert Pupfish Genetics

- The desert pupfish (although listed throughout its range) falls into two groups: the Salton Sea/Colorado River Delta group (*C. m. macularius*) and the Rio Sonoyta/Quitobaquito Springs group (*C. m. eremus*).
- Recent genetic studies indicate that the two groups should be recognized as separate species. The Rio Sonoyta/Quitobaquito Springs group is now considered to be *Cyprinodon eremus*.
- Small but significant differences exist between the Salton Sea and Colorado River Delta populations suggesting separate management would be appropriate.



# Desert Pupfish Recovery

- The Service released a Recovery Plan for the desert pupfish in 1993.
- The Recovery Plan called for the re-establishment of pupfish in suitable natural habitats.
- The Plan also called for the creation of refugia populations to insure against the loss of genetic variation in the broader population.



# Desert Pupfish Recovery (cont.)

- Refugia populations have been set up in protected natural habitats and in constructed habitats.
- Refugia in the Salton Sea area are located in Salton Sea Recreation Area, Anza-Borrego State Park, the Living Desert, Thousand Palms Preserve, Dos Palmas Area of Critical Environmental Concern, and Oasis Springs Ecological Reserve.



# Desert Pupfish in the Salton Sea

- Desert pupfish have been found to move in the Salton Sea, at least between an irrigation drain and the shoreline pool at the mouth of the drain.
- Such movement is believed to be important to maintaining genetic diversity and providing for the repopulation of areas after changing conditions have temporarily extirpated pupfish from individual drains or shoreline pools.



# Water Transfer Desert Pupfish Requirements

Per the Biological Opinion provided to the Bureau of Reclamation:

- The necessary modifications will be made to maintain connectivity between drains in response to changes in elevation and/or salinity.
- Selenium toxicity studies will be conducted concurrent with selenium monitoring in the drains. Management actions will be taken as appropriate based on the results.
- Long-term population monitoring, including the development of a more effective protocol, will be carried out during the term of the water transfer.



# Additional Measures Anticipated as part of the HCP/NCCP

- No net loss of desert pupfish habitat;
- Increase (up to double) pupfish habitat over the term of the permit;
- Study the effects of routine drain maintenance and modify practices accordingly to minimize take; and
- Gradual dewatering and salvage/relocation of desert pupfish in construction areas to minimize take.



# Current Selenium Toxicity Studies

The Service sponsored a study by the U.S. Geological Survey to evaluate acute, waterborne selenium toxicity to desert pupfish. These studies indicate that desert pupfish are less sensitive than fathead minnows (a standard toxicity test species) which are among the fish most sensitive to selenium effects. However, dietary exposures are believed to be more important, and this exposure route will be evaluated in upcoming phases of study funded by the mitigation fund for the Quantification Settlement Agreement.



# Desert Pupfish Captive Rearing Set-up

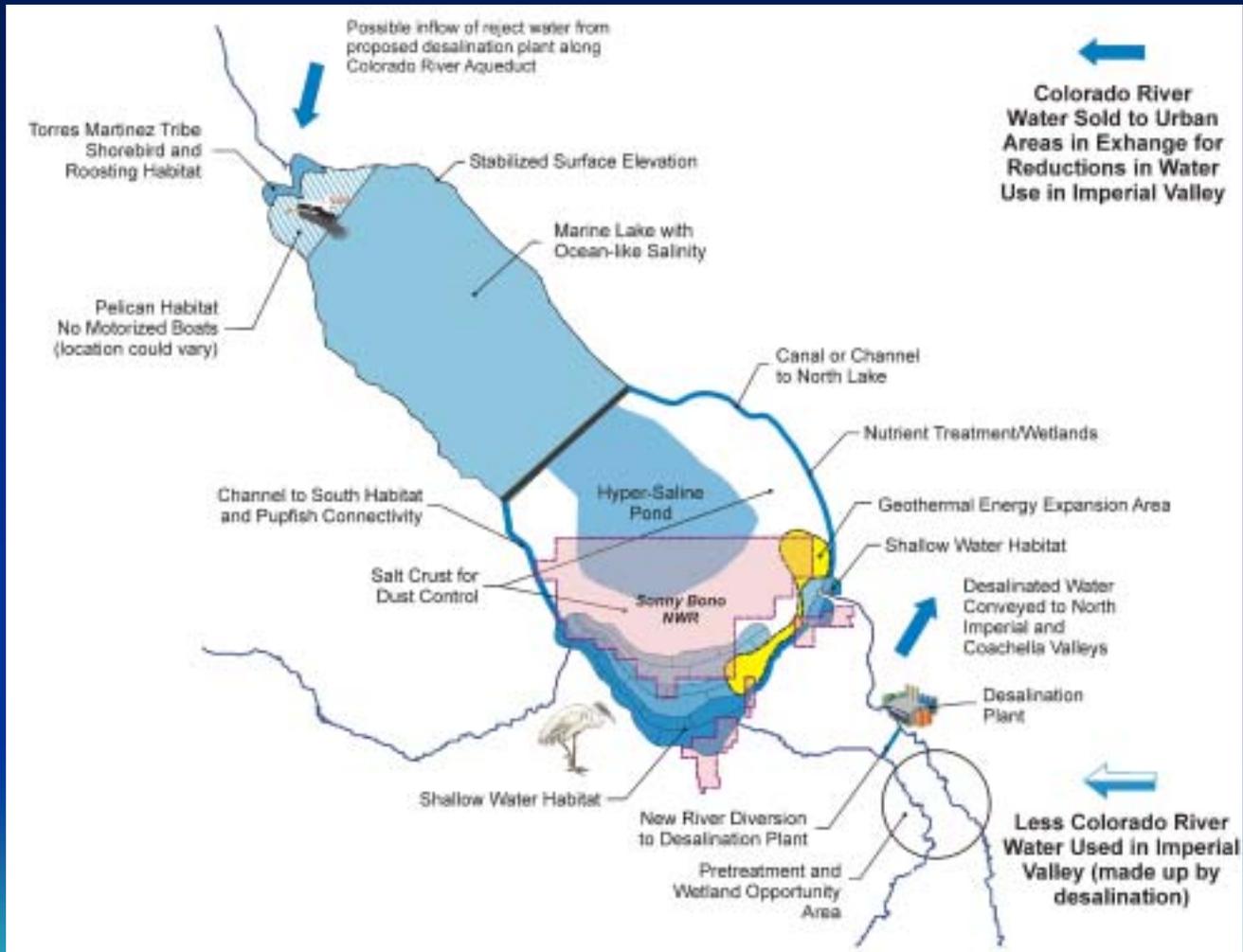


# Desert Pupfish and Salton Sea Restoration

Some of the current restoration proposals raise concerns for the desert pupfish. The required infrastructure for a “North Lake” approach could impact the ability of pupfish to move between drains at the south end of the Sea. Alternative movement corridors would need to be considered as a part of such an approach to restoration.



# The North Lake Alternative



# Status of the Desert Pupfish in Mexico

- Recent studies indicate similar temporal variations in populations as occur in the United States.
- Habitat loss and exotic fish species (particularly red-belly tilapia, sailfin molly and western mosquitofish) are the primary threats in Mexico as well.
- The highest abundance found in recent surveys was in discharge ponds from a geothermal plant where the salinity was elevated (potentially controlling competitors).
- The Cienaga de Santa Clara population may be at risk from proposed reclamation of water from the Wellton-Mohawk bypass drain that currently supplies water to the Cienaga. This reclamation would reduce flows and increase selenium concentrations.



# In Conclusion

Given the desert pupfish's unique role as the only native fish in the system and its endangered status, this species should be given careful consideration in the restoration planning process.



Thank you for your attention.

Are there any questions?

