Safe Harbor: A Tool to Help Recover Topminnow and Pupfish in Arizona

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Abstract—*The Arizona Game and Fish Department (Department) has developed a Safe Harbor Agreement (SHA) for four native fishes in Arizona. The SHA will allow Gila and Yaqui topminnow (*Poeciliopsis occidentalis *and* P. sonoriensis*) and desert and Quitobaquito pupfish (*Cyprinodon macularius *and* C. eremus*) to be released onto non-Federal lands while safeguarding landowner options for future property use. The SHA will assist recovery of these species by: creating replicate populations; creating partnerships between State, Federal, and other groups; minimizing stocking of mosquitofish and other nonindigenous species; providing for mosquito control; and educating those outside the native fish community about the plight of Arizona's native fishes.*

Introduction

Safe Harbor Agreements are a relatively new Endangered Species Act tool for non-Federal landowners. Only three have been completed in Arizona, and two of those were in the last year. The Arizona Game and Fish Department's Safe Harbor Agreement for topminnow and pupfish will be a proactive tool that will promote the conservation and recovery of these endangered species. The conservation status of Gila and Yaqui topminnow (*Poeciliopsis occidentalis* and *P. sonoriensis*) and desert and Quitobaquito pupfish (*Cyprinodon macularius* and *C. eremus*) is poor, recovery actions have been spotty, and a great deal of work is needed.

Safe Harbor

Much of the Nation's endangered species habitat is on non-Federal property. Conservation efforts on non-Federal lands are essential to the survival and recovery of many endangered and threatened species. Safe Harbor Agreements can provide the means to garner non-Federal property owners' support for species conservation on their lands. The assurances an SHA provides to non-Federal landowners ensure that voluntary conservation actions taken for listed species covered by an SHA on their property will not restrict uses of their property, except as provided in the SHA. SHAs can encourage landowners to manage their properties for the benefit of listed species, and they must be designed to achieve a net conservation benefit to these species. Many property owners are willing to voluntarily manage their properties to benefit listed fish, wildlife, and plants.

The Species

The Gila and Yaqui topminnow were listed as endangered in 1967, and the desert and Quitobaquito pupfish were listed as endangered in 1986 (USFWS 1967, 1986c). Since then, many conservation efforts have been attempted, but the status of all four species is only marginally better than when the species were listed (USFWS 1993; Minckley 1999; Weedman 1999). Basic life history information and recovery actions can be found in the species' recovery plans (USFWS 1993, 1994; Weedman 1999).

The Agreement

The SHA will assist recovery of topminnow and pupfish through five goals: creating replicate populations; creating partnerships between State, Federal, and other groups; minimizing stocking of mosquitofish and other nonindigenous species; providing for mosquito control; and educating those outside the native fish community about the plight of Arizona's native fishes.

Aldo Leopold (1953) once said: "To keep every cog and wheel is the first precaution of intelligent tinkering." The creation of refuge habitats for topminnow and pupfish has allowed us to intelligently tinker with recovery of these species. Refuge populations of topminnow and pupfish are currently held at museums, laboratories, universities, parks, and schools under various permits. The SHA will allow for the Arizona Game and Fish Department to hold a single Endangered Species Act permit at a range-wide level, thus allowing interested parties to "sign-on" to the permit through a Certificate of Inclusion.

Recovery of topminnow and pupfish will not occur solely due to the SHA, as most available natural habitat is on Federal lands. What will occur, however, is an increase in the number of fish refuges that will be available for wild site reestablishment. Use of the native topminnow and pupfish will also lead to a decrease in the perceived need for stocking of nonnative species to control mosquitoes and other insects, and education and outreach to educate the public about the value of our native natural resources. The SHA will facilitate the use of managed waters like effluent, stock ponds, and small public or private ponds that are increasingly major features of the Southwestern aquatic environment.

In recent years there have been an increased emphasis and interest in collaborative conservation. The SHA for topminnow

and pupfish will bring non-Federal land owners to the same table as the State and Federal agencies and will increase collaborative conservation for these four fishes in Arizona.

Nonnative aquatic species have had major detrimental impacts on native aquatic fauna and have been a major factor in the listing of topminnow and pupfish, as well as many other fishes native to the Gila basin (USFWS 1984, 1986a,b,c, 1991). Introduction of nonnative pathogens, parasites, plants, invertebrates, amphibians, and fish negatively affects the native fishes of the Southwest (Miller 1961; Robinson et al. 1996). The primary biological threat to the Gila topminnow is the nonnative western mosquitofish (*Gambusia affinis*), introduced to streams in the Southwest in the 1920s (Minckley 1999). Large scale reductions of Gila topminnow correspond strongly with the spread of mosquitofish.

Aquatic nonnative species are introduced and spread into new areas through a variety of mechanisms, intentional and accidental, and authorized and unauthorized (Fuller et al. 1999). These nonnative aquatic species include fishes, aquatic and semi-aquatic mammals, reptiles, amphibians, crustaceans, mollusks (snails and clams), insects, zoo- and phyto-plankton, parasites, disease organisms, algae, and aquatic and riparian vascular plants (Fuller et al. 1999). They affect native fish, including Gila topminnow, through predation (Courtenay and Meffe 1989; Marsh and Brooks 1989; Meffe 1985), competition (Baltz and Moyle 1993; Douglas et al. 1994; Schoenherr 1981), aggression (Meffe 1984), habitat alteration (Allen 1980), aquatic community disruption (Hurlbert et al. 1972; Ross 1991), introduction of diseases and parasites (Clarkson et al. 1997; Robinson et al. 1998), and hybridization (Dowling and Childs 1992; Echelle and Echelle 1997). Nonnative plants can reduce available habitat with abundant growth (e.g., water cress, giant salvinia), potentially cause loss of surface water (e.g., salt cedar), or alter ecosystem dynamics (Lovich and DeGouvenain 1998).

Allowing topminnow and pupfish to be used on non-Federal properties will reduce the public's use of nonnative fish. This will increase the number of topminnow and pupfish populations and minimize nonnative fish populations. Most movement of fish is not done legally by the Department, but illegally. Minimizing the number of populations of nonnative fish will help to reduce the spread of these problematic species.

The arrival of West Nile Virus in Arizona has created an additional, urgent need for this SHA. Since both topminnow and pupfish are known to prey on mosquito larvae as effectively as mosquitofish (Childs 2001; Walters and Legner 1980), having the SHA ready in 2004 will allow the use of topminnow and pupfish near the beginning of the mosquito season. This is a tremendous opportunity that will allow the Department and Service to market and publicize the SHA and native fishes. Making these fish available for release in suitable habitats to control mosquitoes will allow us to meet our goals for the SHA. This may create a substantial number of new populations, as well as encourage public institutions and private entities to think critically about ecosystem structure and management in terms of both mosquito control and native species recovery.

Education is always listed in species recovery plans as a task necessary to recover the species. However, since recovery plans are written and implemented by biologists with precious little time for anything but their core mission, effective and far-reaching education is rarely, if ever achieved. Because most threats impacting native fishes today are human caused or mitigated, education can go a long way to remove or reduce those threats. The two major causes of species endangerment in Arizona today are loss and modification of water from human causes and nonindigenous species such as mosquitofish and sunfishes. The propitious timing of the SHA and the arrival of West Nile Virus in Arizona is providing us with an incredible education opportunity that must be taken advantage of. Since both topminnow and pupfish are known to prey on mosquito larvae as effectively as mosquitofish (Childs 2001; Walters and Legner 1980), a tremendous marketing opportunity has presented itself that will provide us with a large audience and prodigious education opportunities. Making these fish available for release in suitable habitats to control mosquitoes will allow us to meet our five goals for the SHA, create partnerships essential to species conservation, and provide a positive public image of these fish as an environmentally beneficial biological control.

Plans and Implementation

Because of the amount of interest expressed previously by non-Federal landowners for having native fishes, and the increasing interest in mosquito control, we expect demand to initially outpace the supply of topminnow and pupfish. Therefore, the initial sites will be large sites and sites with the greatest education potential. Larger sites that receive fish early in the season can supply fish for stocking later efforts, increasing the supply of fish quickly. Utilizing other sites with high education potential will allow us to take advantage of the initial opportunity provided by the concern over mosquito control and mosquito borne diseases.

The SHA provides for two types of monitoring as required by Service policy and Federal regulation: (1) compliance monitoring to ensure that all commitments in the SHA are being met, and (2) biological monitoring to ensure that the biological goals of the SHA are being met and to help determine the effectiveness of its conservation program.

The SHA requires each landowner to comply with certain requirements. The Department will ascertain compliance to determine if each landowner is properly implementing those conservation commitments. The U.S. Fish and Wildlife Service is responsible for monitoring the Department's compliance with the ESA section 10(a)(1)(A) Permit.

The Department and the land owner will coordinate annual monitoring and reporting. Biological monitoring will address the status and distribution of fish populations established under the SHA. The biological monitoring may also address issues that require adjustment to the SHA's conservation program through adaptive management.

Biological monitoring will be funded and done primarily through the efforts of State and Federal agencies, academic institutions, conservation organizations, or other entities. Biological monitoring will be conducted uniquely by the Cooperator and agency, academic, and conservation personnel for each property as agreed upon by the Department and the Cooperator. Ultimately, the Department must ensure that required monitoring is completed for each property. The Department, as the

permittee under the Agreement, will submit an annual report to the Service describing biological monitoring activities.

There is no additional funding for the Service to assist with implementation of the Agreement. All Service work time is in addition to other duties. The Department may be eligible for ESA Section 6 funding to assist with implementation costs. Other external funding sources that the Department may use to implement the SHA are the continuing Section 6 topminnow/pupfish project and Heritage funds.

The draft agreement and Environmental assessment were released for a 30-day public comment period that was announced in the Federal Register. We addressed public comments and made changes as necessary to the SHA. When the SHA is signed and the permit issued, we will advertise it as widely as possible. In late 2003 and April 2004, a Tucson newspaper ran articles on the potential SHA. The first article was picked up nationally in newspapers and on CNN, with a West Nile Virus and human health focus.

Conclusion

The Department's topminnow and pupfish SHA will contribute significantly to the conservation and recovery of the species. Of the five benefits we hope to achieve with the SHA: replicate populations, partnerships, nonindigenous species reduction, mosquito control, and education; education may be the greatest benefit. However, the potentially extensive use of these native fishes in the ever increasing well of human-created and managed waters should not be underestimated. Effective education has been the weakest link in the conservation efforts for these species. The media coverage and other opportunities for outreach are likely to be the most significant education to occur regarding native fishes and their plight in Arizona.

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