Bubbling Ponds Native Fish Propagation and Research Facility
Status Update - February 2008

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Abstract - Construction of a new propagation and grow-out facility at Bubbling Ponds Fish Hatchery for spikedace and loach minnow was completed in June 2007. The new facility contains 24, 6-foot diameter circular fiberglass tanks. Each tank is set up to mimic a natural environment with rock and sand substrates and submerged logs for structure. Overhead lights are controlled by a timer to manipulate photoperiod and induce spawning. This new facility utilizes an artesian well drilled in 2003 which produces approximately 2-3 gal/min per tank at 20° C. This water is pathogen-free, and ideal for rearing all life stages of Gila basin endangered fishes. The new building is located adjacent to the Game and Fish wet lab, and the two buildings are operated in tandem. The wet lab provides quarantine and disease treatment facilities and the open-air facility provides space for maintaining genetically distinct populations of endangered fish and their progeny. Successful reproduction of both species has already occurred in the new facility and methods for producing large numbers of offspring are currently being evaluated.

Introduction

Construction of a new building for propagation and research of Gila River endangered fishes was completed in June 2007 at Bubbling Ponds Fish Hatchery near Cornville AZ (Yavapai County). Funding for construction was provided by the Bureau of Reclamation through a cooperative agreement to support Reclamation's obligation to fund projects that benefit native fish. This agreement is pursuant to Fish and Wildlife Service's 2001 Biological Opinion regarding potential adverse impacts to native Gila River fishes from operation of the Central Arizona Project. The goal of this facility is to prevent catastrophic loss of rare populations of spikedace (*Meda fulgida*) and loach minnow (*Tiaroga cobitis*) by maintaining backup populations of these species and propagating fish for reintroduction and repatriation.

A well installed in 2003 (Figure 1) to supply water to the existing Arizona Game and Fish research wet laboratory produces 80 gpm of artesian water flow at a constant 20°C. Water from this well is neutral pH and does not have high nitrogen saturation making it ideal for aquaculture. This pathogen-free artesian water source provided the potential for rearing large numbers of endangered fishes and is the reason why the new open-air facility was built at this location. The new facility is located approximately 40 feet east of the existing Game and Fish wet laboratory for fish research.

Figure 1. Photo of artesian well producing 80 gpm at 20°C.

Overview of Facility

Research Wet lab

The Native Fish propagation and research facility now consist of two separate buildings; the research wet lab (constructed in 2000) and the newly completed production and grow-out facility, each with a specific purpose. The research wet lab functions as a quarantine facility where newly acquired fish can be held and treated for diseases and pathogens. This building is temperature controlled and contains 8, 500-gallon circular fiberglass tanks that function independently as isolated recirculating systems. Water from this building drains to a septic tank and has no connection to other water supplies, allowing it to act as an isolation and quarantine facility. Fish are treated for a wide range of diseases and parasites in the indoor building prior to movement to the outdoor facility.

Production and Grow-out Facility

The newly constructed production and grow-out building is an open-air structure 30' wide X 60 ' long which consists of an 11-foot high metal roof attached to a short 3-foot concrete wall. Chain link fencing is secured to the top of each wall and extends to the roof to provide security and prevent both avian and terrestrial predators from entering. Twenty four circular fiberglass tanks (6-foot in diameter, 1,900 L) are housed in the building (Figure 2) with artesian well water plumbed to each tank. Flow rates are 2-3 gpm at each tank when all tanks are in operation. Spawning is encouraged by manipulation of photoperiod and by addition of cobble and sand substrates as well as large boulders and woody debris to create environments that replicate natural pools and riffles. Pressurized well water is also installed at two corners of the facility. Overhead fluorescent lighting, controlled by automatic timer, provides flexibility to lengthen photoperiod and induce spawning.

Electrical conduit located in the ceiling provides ten drop-cords for power at each tank if needed. A regenerative blower connected to a centralized aeration system with two air stones in each tank provides additional aeration in the event that the water flow needs to be turned off during harvest of fish, or when fish densities are high and additional aeration is needed.

Details of Production and Grow out Facility

Tank Setup

Flow from the existing artesian well enters the building on the front right and left corners and is routed through a 4-inch supply line that forms an enclosed rectangle on the inside of the building. This allows water pressure to be equalized to each tank and prevents head loss as a result of flow through the pipes. Twelve, two-inch supply lines stem from this 4-inch line, providing flow to each set of two tanks with a gate valve on each tank. The floor is covered by 12 inches of pea gravel to provide drainage and cover supply and drain lines, which extend from each tank to the center drain trough. Each tank drains individually to the center trough (Figure 3) with a 6-inch drop as the water enters the trough to prevent backflow and potential contamination. The center trough drains out the front of the building into a pond connected to the main hatchery drainage system.

Figure 2. Tank layout

Figure 3. Center drain trough with individual tank drain lines.

External standpipes (Figure 4) permit easy control of water level and allow internal standpipes to stay in place and retain fish when tanks are harvested. Supplemental aeration is not needed during normal operation but the blower is used when water flow is turned off to treat or to capture and harvest fish. Two layers of slotted well pipe, with a layer of sand in between them permits water to drain from the tank but retains larval fish. Artemia nauplii hatched directly over each tank provide a continuous supply of live fed for newly hatched fish.

Figure 4. External Standpipes

Tank Operation

Spikedace tanks are operated at high water levels (20 inches) and loach minnow tanks are operated at reduced (8-10 inches) water depth. The shallow water in the loach minnow tanks allows easier viewing of the fish to verify their health. Fish densities are maintained at less than 300 fish per tank. These low densities encourage spawning and decreases incidence of bacterial problems.

Feeding

Adult spikedace and loach minnow are fed a combination of Tetramin® flake and freeze-dried bloodworms. Larval fish are fed live brine shrimp nauplii for the first two weeks after hatching and then microencapsulated larval fish diets. Powdered razorback sucker diet developed at the Bozeman Technology Center and sold through Nelson and Sons, Inc., also appears to be an effective feed for larval spikedace and loachminnow. Fish are fed *ad libitum* twice daily using Sweeny vibratory auto feeders that are connected to a timer set to feed at 7:00 am and at 5:00 pm. Adjusting the gap size on the auto feeders allows precise feeding of different feed types.

Propagation

When possible, captive stocks are supplemented annually with adult fish from original source populations. Fish are permitted to spawn naturally within each holding tank. When propagation is the goal, a subset of individuals from a population are typically placed at low densities into a separate tank and allowed to spawn. Reduced densities appear to promote spawning and survival of larvae. Adults and larvae are later separated to prevent cannibalism. Two tanks are required to hold each spikedace or loach minnow metapopulation for refuge purposes, and three to four tanks are required for each metapopulation that needs to be propagated. The more offspring that are desired, the

more tank space is needed. Juvenile fish may be able to be maintained at higher densities (>300 per tank) but impacts on growth and survival are not currently known.

Capacity

The number of separate populations that the facility can accommodate depends on whether populations are merely being maintained to secure against loss in the wild (capacity = 12) or whether those populations are being held for propagation and repatriation purposes (capacity = 6). A minimum of two tanks per population are needed to secure against loss in the wild and three to four tanks are needed to maintain populations for propagation. Tanks can easily be manipulated to hold either species as needed. It may be possible to culture both spikedace and loach minnow together in the same tank from a given population to increase the number of populations that can be held on station, but this has not yet been tried and requires further evaluation. Other options to increase facility capacity are to install a larger holding tank on the outside of the facility that can be used for grow-out of small fish when large numbers of fish from a given population are needed. Table 1 outlines all fish currently on station.

Conclusion

The new propagation and research facility at Bubbling Ponds Hatchery provides much needed space and pathogen-free water for maintaining refuge populations of threatened and endangered Gila Basin fishes. The new facility allows for mitigation of catastrophic losses to wild populations, and production of fish for future repatriation efforts. Simultaneous efforts stop and or reverse causes for declines in wild native fish populations are needed in addition to the propagation efforts currently underway at this new facility.

Table 1. Current fish on station

Bubbling Ponds - Loach minnow and Spikedace as of Feb, 2008

	Loach Minnow	
Origin	Number	Size
Aravaipa 2007	254	Mixed
Aravaipa 2005	27	Adult
Aravaipa F1's	97	Adult
Aravaipa F1's	approx 100	small Juveniles
Aravaipa F2's	867	small and large juveniles
Blue River	71	Adult

*Total available to stock next spring/summer = 967

	Spikedace	
Origin	Number	Size
Aravaipa 2007	258	Mixed
Aravaipa 2005	35	Adult
Aravaipa F1's	194	Adult
Gila River	550	Adult

*Total available to stock next spring/summer = 194

* All Aravaipa offspring