Rehabilitation of School Spring
Ash Meadows National Wildlife Refuge

Robert Andress
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Ash Meadows NWR
Warm Springs Complex

[Image of a landscape]
Presentation Outline

School Spring Aquatic Habitat Rehabilitation

- Target species
- Habitat requirements/design parameters

- Design process
- Habitat construction
- Native species re-introduction
- Monitoring results to date
Primary Project Goals

- Replace existing pupfish refuge
- Improve hydraulic and thermal conditions
- Increase diversity, quality, and quantity of microhabitat
- Eradicate non-native aquatic species
  - Crayfish
  - Mosquitofish
  - Melanoides?
Aquatic Endemic Species

- Warm Springs pupfish (*Cyprinodon nevadensis pectoralis*)
- Warm Springs riffle beetle (*Stenelmis calida calida*)
- Warm Springs naucorid (*Ambrysus relictus*)
- Median-gland Nevada springsnail (*Pyrgulopsis pisteri*)
- Amargosa Tryonia (*Tryonia variegata*)
Habitat Requirements

Warm Springs Pupfish

- Spawning temperature 30-33 C
- Range of flow velocity, water depth, and microhabitat characteristics required for different age classes
- Velocity ~ 0-2 ft/s
- Riffles – food production areas
Habitat Requirements

Thermal Endemic Invertebrate Species

• Narrow temperature range ~30 C

• Inhabit travertine deposits and stream substrate ~0.5-2 cm

• Velocity ~ 1.5 to 2 ft/s
School Spring - 1970
Design

NCER Los Angeles, California
July 20-24, 2009
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Design

- Flat Caliche Cobbles, 4-12" Dia.
  - From BLM Pit on IMV Haul Road
- High Breaking Strength Mortar
- Bentonite
- Native Soil
- Bed of Gravel
- Impermeable Membrane
- Loose 1" minus gravels from commercial gravel pit in Amargosa Valley

Scale: 0 1 FT
Design

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Design

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Design
Invasive Species Eradication
Invasive Species Eradication
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Fish Salvage

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Habitat Construction

May 2008
Habitat Construction

May 2008
Habitat Construction

May 2008
Habitat Construction

May 2008
Habitat Construction

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July 2009
Habitat Construction

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Native Species Re-Introduction

Re-introduction of pupfish

- 761 Warm Springs pupfish (634 salvaged prior to construction)
Native Species Re-Introduction

Inoculation of invertebrate species

- ~900 Amphipods (*Hyalella spp.*)
- ~1,300 Warm Springs riffle beetle (*Stenelmis calida calida*)
- ~200 Riffle beetle (*Microcylloepus similis*)
- 14 Warm Springs naucorid (*Ambrysus relictus*)
- ~1,500 Median-gland Nevada springsnail (*Pyrgulopsis pisteri*)
- ~180 Amargosa Tryonia (*Tryonia variegata*)
Monitoring Results

- Crayfish eradicated
- *Gambusia* eradicated
- *Melanoides* not eradicated
- *Pyrgulopsis* and *Stenelmis* have persisted in upper 30m of constructed habitat since re-introduction
- *Ambrysus* and *Tryonia* have persisted in constructed habitat since re-introduction
- Multiple life stages of *Ambrysus* observed indicating recruitment
Monitoring Results

• *C. pectoralis* utilized 100% of constructed habitat following re-introduction, larval pupfish present

• Recruitment successful, large numbers of larval pupfish present

• *C. pectoralis* population presently estimated at approximately 1,500
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