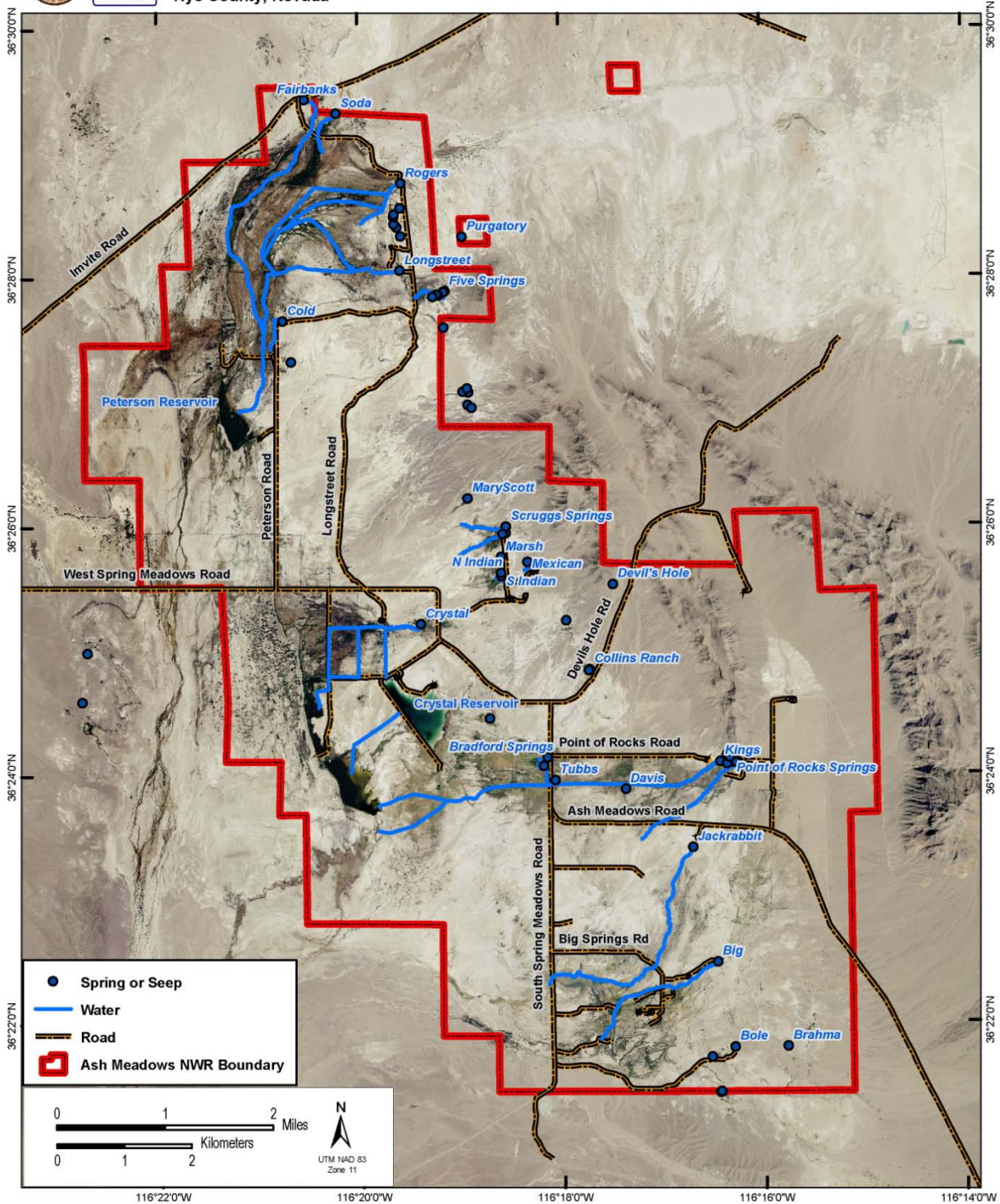


Ash Meadows National Wildlife Refuge



U.S. Fish & Wildlife Service
 Ash Meadows National Wildlife Refuge
 Nye County, Nevada



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The Significance of Ash Meadows National Wildlife Refuge

*To Americans who know natural history, and their numbers are certain to grow with each passing generation, Nevada's **Ash Meadows** and Florida's **Lake Wales** scrubland are sacred landmarks, the equivalent of Independence Hall and Gettysburg of original America.*

- **Edward O. Wilson**. Forward in Precious Heritage, The Status of Biodiversity in the United States, The Nature Conservancy and Association for Biodiversity Information, 2000.

From Uplands...



To Springs...



A Land of Contrast...



A true oasis, this...refuge embraces the type of spring-fed wetlands and alkaline desert uplands that development has rendered rarer than usual in the arid Southwest.

- **Audubon**, June 2003

Ash Meadows NWR was established to *conserve and recover endangered and other sensitive plant and animal species in the area*. The refuge provides habitat for:

- ❖ 14 threatened and endangered species with designated Critical Habitat for 12 of them
- ❖ 26+ endemic species (found nowhere else in the world)
- ❖ > 100 species of plants and animals that are considered sensitive or are State protected or priority species.

Ash Meadows is distinguished as having a higher number of endemic species for its given area than any other place in the United States, and the second highest in all of North America.

The largest remaining oasis in the Mojave Desert, the defining feature of Ash Meadows is water. Around 50 seeps and springs produce almost 11,000 gallons of water per minute. Ash Meadows is the major discharge point in the Death Valley Regional Aquifer.



- ❖ One of the first four wetlands in the United States to be designated a Wetland of International Importance by the Ramsar Convention. [Ramsar Convention on Wetlands, designated on December 18, 1986]
- ❖ Designated a priority wetland in Nevada [Nevada Wetlands Priority Conservation Plan]
- ❖ Designated a Gastropod Focal Area [Nevada Comprehensive Wildlife Conservation Strategy, Nevada Wildlife Action Plan]
- ❖ Designated one of the highest priority conservation sites in the state of Nevada. [The Nevada Natural Heritage Program 2006 Scorecard of Highest Priority Conservation Sites.]
- ❖ Designated a Bird Habitat Conservation Area [American Bird Conservancy, Intermountain West Joint Venture, Bird Habitat Conservation Area Program. Coordinated Implementation Plan for Bird Conservation in Nevada, 2005]
- ❖ Designated a Nevada Important Bird Area [National Audubon Society and BirdLife International]

Past (ab)uses of Ash Meadows:

- Carson Slough drained and mined for peat
- Commercial fish farming
- Large-scale agriculture and cattle ranching
- Clay mining
- Brothel: the Ash Meadows El Rancho
- Residential development (planned community for 30,000-50,000 people)



Impacts:

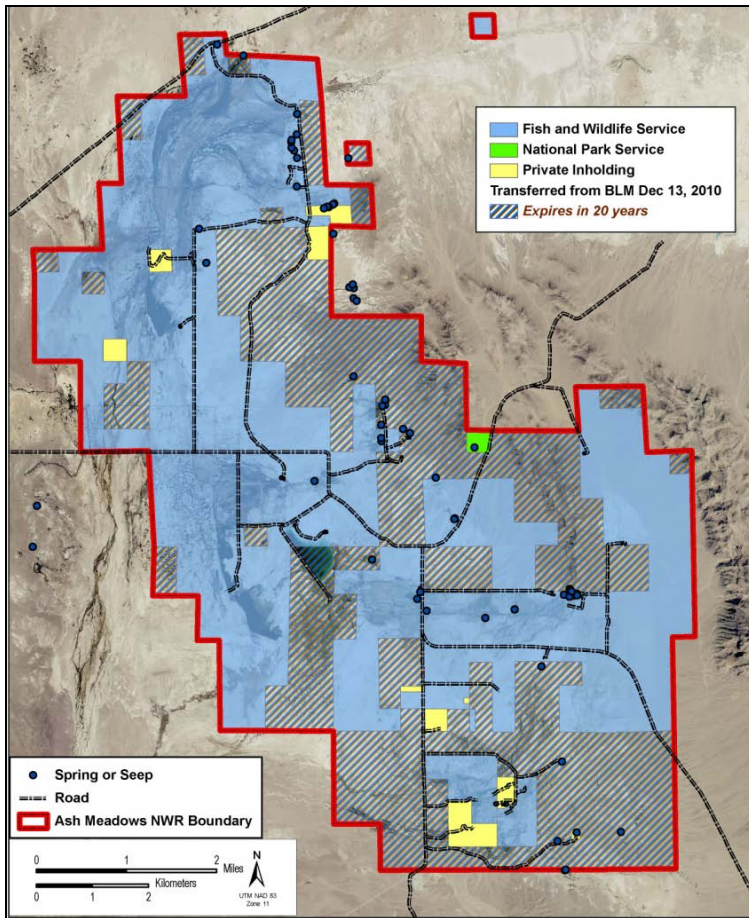
- altered hydrology (dams, irrigation ditches, berms, roads)
- groundwater extraction = lowered water table
- loss of wetland ecosystem function
- non-native species introductions
- altered fire regime
- extinction of endemic species (at least three?)



Ash Meadows is the birthplace of the movement to save desert fishes.

- Donald W. Sada.
Desert Research Institute

Ash Meadows was the site of one of the longest environmental battles in North America (1967-1984)

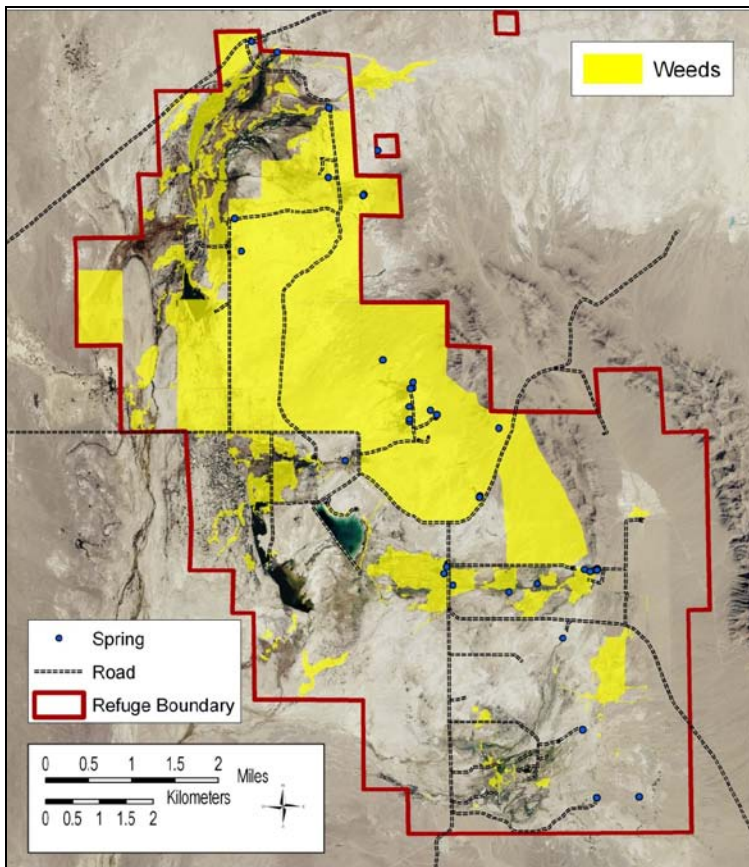


Issues and impediments to restoration:

Land ownership within Refuge administrative boundary:

December 13, 2010: ~ 9,460 acres of BLM land withdrawn from mineral entry and jurisdiction transferred to FWS [proviso: for a period of 20 years]

Private inholdings in areas critical for listed species or wetland restoration.



Non-native species

64 known non-native and pest plants

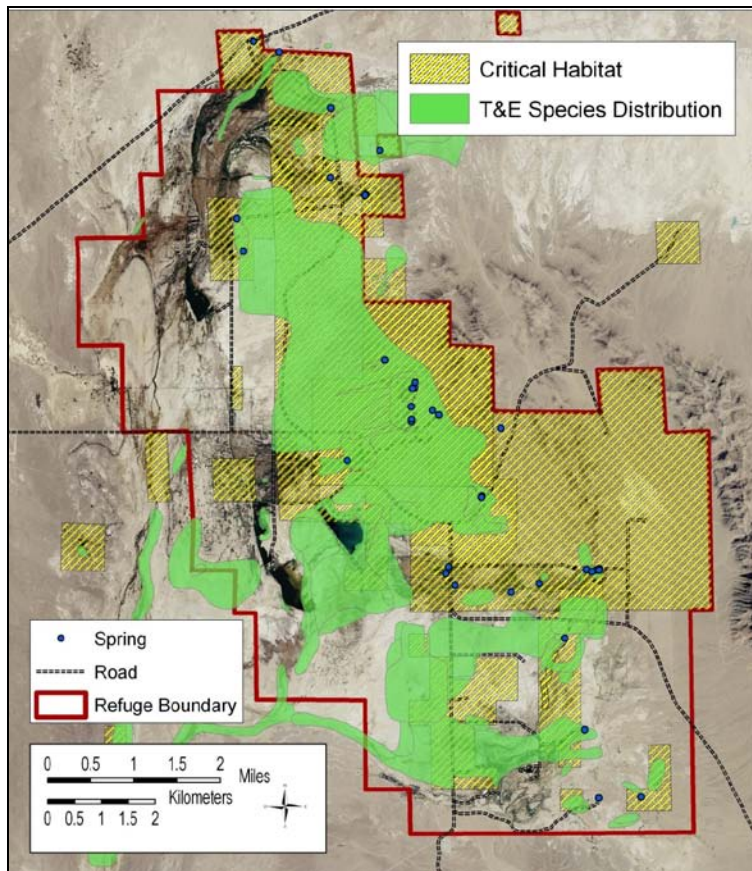
9+ non-native aquatic species (bullfrog, fishes & inverts)

IPM Plan completed in 2006

13 priority weed species mapped in 2007

Aggressive weed treatments began in 2008

Convict cichlids eradicated in 2008. Sailfin mollies eradicated (?) from Upper Carson Slough in 2011.

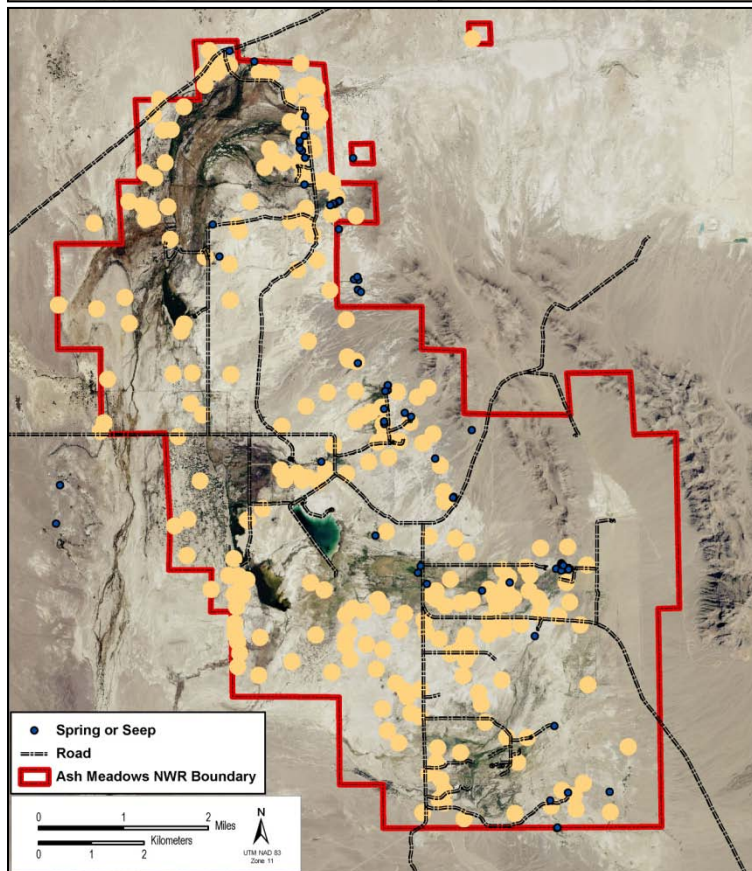


Consultation:

Section 7 of the Endangered Species Act

Recovery Plan addresses 32 species

NEPA



Section 106 of the National Historic Preservation Act

Restoration of a desert oasis

POINT of ROCKS area:

- 1960s - an illegal commercial aquarium fish rearing facility
- Late 1960s to 1970s - large-scale agriculture & ranching; well field development; major hydrological alteration refuge-wide
- Early 1980s - Calvada Lakes residential/agricultural/industrial development begins. POR springs excavated to create 5 small "lakes"; several containing largemouth bass.
- 1984 - Refuge established. No funding for restoration or recovery.
- 1990s- Irrigation ditches breaking down, creates cattail marshes at POR.

Kings Pool restored in 1997

1938⇓



1963⇔



↑2004

⇔1972

- ❖ Fish species composition shifted from 23% to 91% native species after restoration of Kings Pool and approximately 1 mile of stream channel.

"Calvada Lakes" (POR springs) restored to spring-fed channels in 2000

2001 ⇒



1982 ↑

Bighorn at POR 2006 ⇒

- ❖ Only known location of the Ash Meadows naucorid (*Ambrysus amargosus*) - an aquatic bug.



Jackrabbit Spring

Pumped dry in 1969



Jackrabbit Spring today



- Ash Meadows pupfish (*Cyprinodon nevadensis mionectes*), Ash Meadows speckled dace, (*Rhinichthys osculus nevadensis*) and springsnails were extirpated from this spring. The pupfish and dace were re-introduced - translocated from Big Spring.

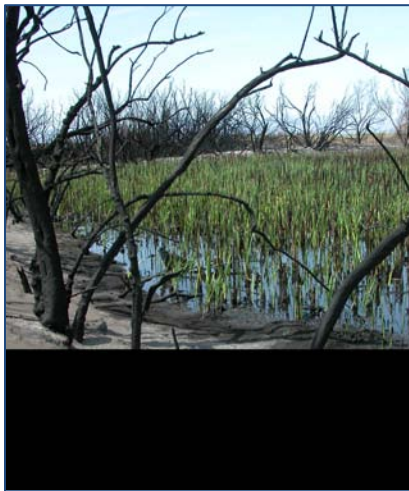
Jackrabbit Channel

- Saltcedar along Jackrabbit stream channel created an intense fire in 2005 that extirpated the native fish from sections of the stream.
- Impoundments that had been hidden by dense saltcedar and cattails were discovered after the fire. In 2006, the impoundments were filled in with 29,000 cubic yards of material from a breached dam. It took approximately 120 trucks per day, each carrying 15-20 yards per truck, for 12 days.
- Naturalized channel created. Speckled dace prefer faster flowing water of stream channel. Habitat of impoundments favored crayfish and non-native fish.
- Extraction of saltcedar and revegetation with native species began in 2006.

2000 - dense saltcedar



2005 post-fire impoundment



2006 - restored channel



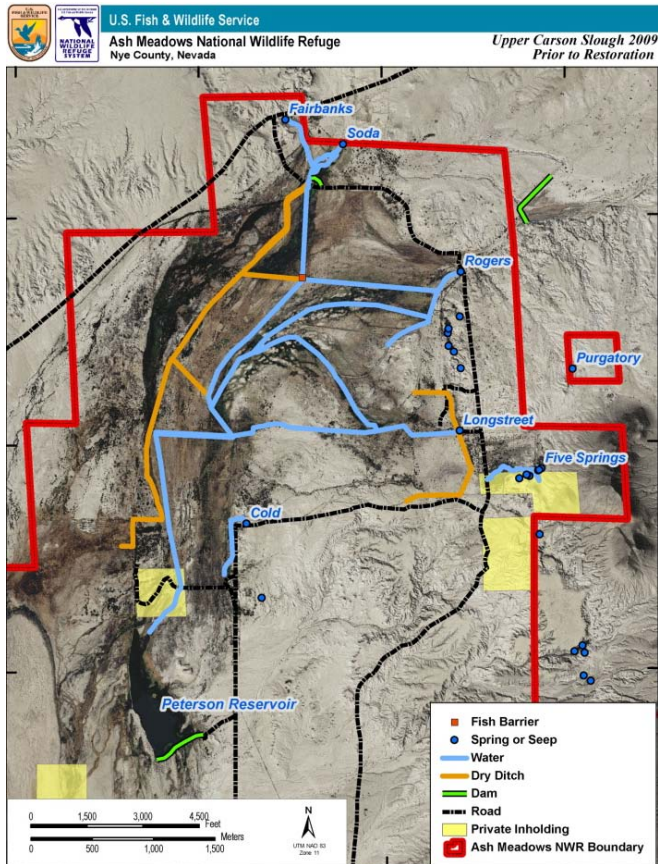
School Springs Naturalized Refuge restored in 2007

- ❖ Refugium for endemic Warm Springs pupfish (*Cyprinodon nevadensis pectoralis*) and a suite of endemic invertebrates

2006 - cement ponds at School Springs (built in early 80s)



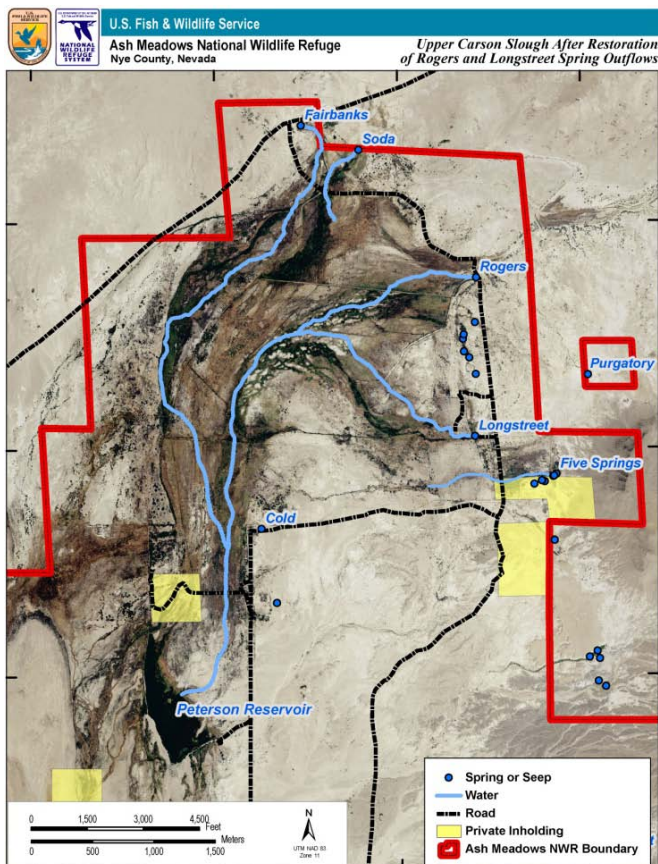
2007 - "hardened" naturalized channel



Upper Carson Slough starting with Fairbanks and Soda Springs

- The Carson Slough is the major artery of the Refuge and the receiving end of a 385-sq mile hydrologic basin.
 - Was drained and mined for peat in the 1960s; then leveled, tilled, and converted to farm fields.
 - Springs feeding into slough were diverted into irrigation ditches.

- Fairbanks and Soda spring outflows completed 2010-2011.
- Restoration of Rogers and Longstreet spring outflows will be next project.

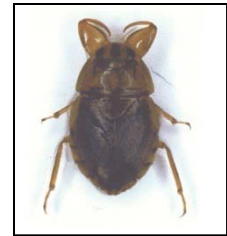


A Successful Reintroduction

Prior to restoration of Fairbanks, Ash Meadows speckled dace remained in only two springs in the southern part of Ash Meadows having been extirpated from all other springs due to habitat alteration.

118 Ash Meadows speckled dace were translocated to Fairbanks outflow in April and August 2010 - the first dace in the Upper Carson Slough since they were extirpated in the 1950s.

Recent surveys show that they are reproducing and expanding throughout the system.



Island Biogeography

- Each pupfish population occupies an island of suitable habitat surrounded by a sea of inhospitable habitat.
- Isolated populations of ancestral pupfish have evolved into ten unique taxa.
- One of the classic examples of divergent evolution in North America.

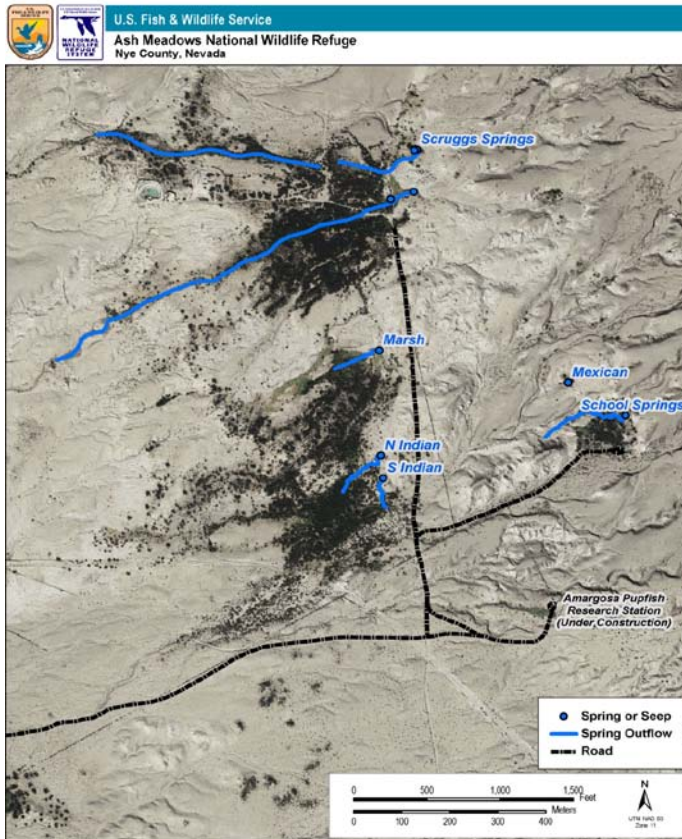
[Pupfish] ...represent one of the most striking examples of evolutionary change now to be found on our planet. Their research potential in genetics and evolutionary studies is enormous...

- Sterling Bunnell. *Pupfish of the Death Valley Region: The Desert Pupfish.* California Tomorrow, 1970.

The pupfish may seem merely a drop in the biological bucket, but we cannot afford to let them go. Rallying to their survival is as pure, clean, and moral a thing as we can do. It will show that as a people we are growing up, achieving reverence for life itself, and accepting guardianship of living things for which we have no material use whatsoever. Pupfish provide us no food or fertilizer or sport; they don't lend themselves to sentimental caricaturing in the Disney or Smokey Bear traditions, and certainly they don't know or care that as a life form they are endangered. That is for us to know, and to care.

- Martin Litton. *Pupfish of the Death Valley Region: Saving the Pupfish.* California Tomorrow, 1970.





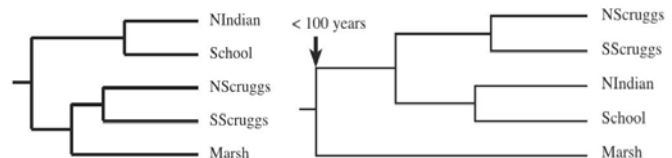
Warm Springs pupfish and restoration of North and South Indian springs

Warm Springs = 7 low flow springs within one square kilometer. Warm Springs pupfish were once found in all seven, but one spring dried up and the fish were extirpated from another, perhaps due to non-native crayfish.



Genetic Management Plan For the Warm Springs Pupfish, *Cyprinodon nevadensis pectoralis*

Concern over the declining, isolated populations resulted in development of a genetic management plan.



Molecular data shows that Warm Springs pupfish populations were isolated from each other relatively recently - probably within the last 100 years.

Preliminary results of a translocation experiment:

10 pupfish (5 males, 5 females) from North Indian Spring were translocated to South Scruggs Spring in 2009. This graph shows the proportion of NI genes in the South Scruggs population following the introduction and also the proportion of individuals that are from mixed descent (NI x SS) = P(Adm).

Note that the initial decline was followed by a gradual increase in NI genes. More interestingly, the number of mixed descent individuals appears to be increasing which **may** suggest the "hybrids" have higher fitness.

