

- Extirpated Fishes of the Grand Canyon and Current Management Practices

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WHAT IS EXTIRPATION?

The situation in which a species or population no longer exists within a certain geographic location

- Why do we care?

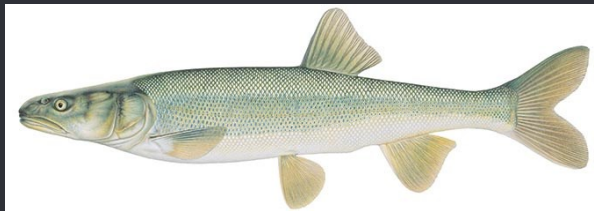
- Effects of Extirpation:

- Global extinctions are often preceded by local and regional extirpations
- Loss of biodiversity and ecosystem function/ services
- Changes in trophic interactions

● Who is extirpated?

Colorado pikeminnow

Ptychocheilus lucius



Lifespan: 30 yrs

Length: 180 cm

Feed: cladocerans, copepods, chironomid larvae, aquatic insect larvae, other fishes.

Endangered

Bonytail chub

Gila elegans



Lifespan: 30 yrs

Length: 60 cm

Feed: little known, probably insects, fishes, plant matter.

Endangered, possibly functionally extinct

Roundtail chub

Gila robusta



Lifespan: 7+ yrs

Length: 50 cm

Feed: aquatic insects, fishes, invertebrates.

Not Listed, near threatened

Historic vs. current range



Colorado pikeminnow



Bonytail Chub



Roundtail chub





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HOW DID THEY BECOME EXTIRPATED?

● LOTS of dams!

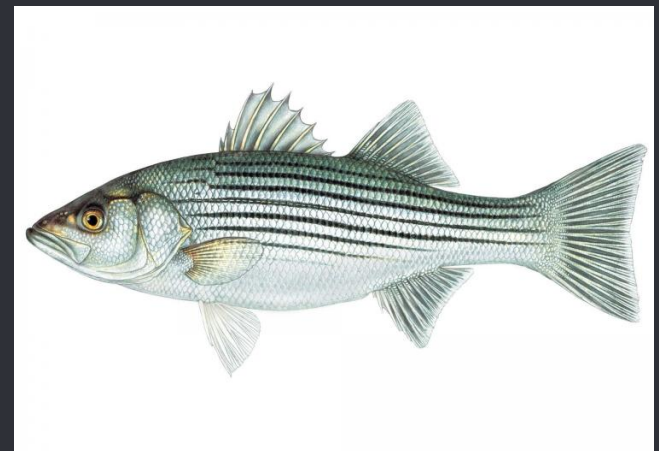
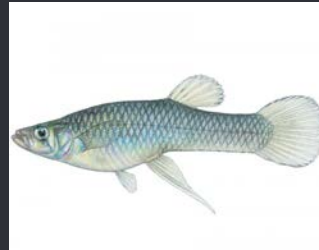


- LOTS of dams!

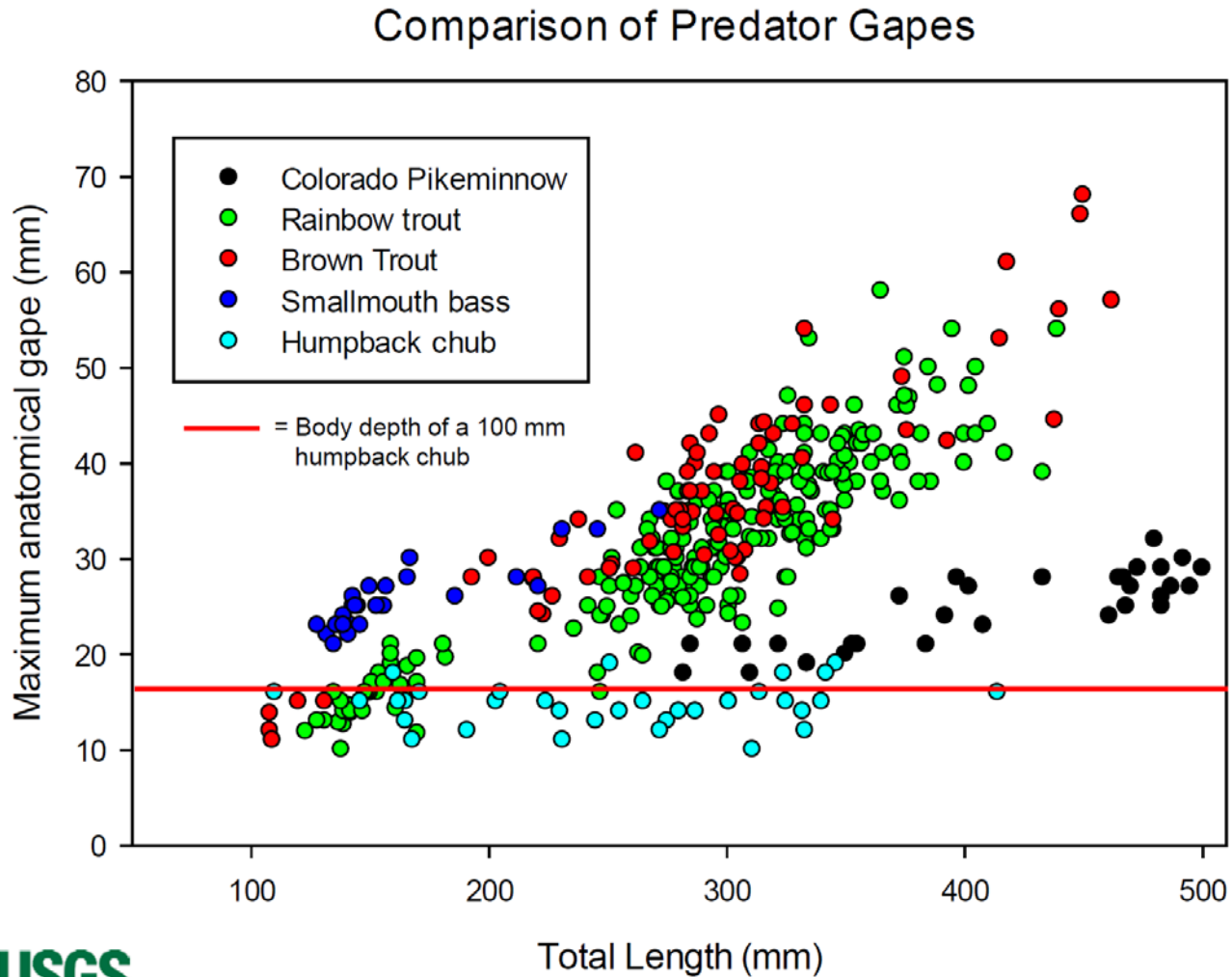
- Pre-dam water conditions:

- Flood-prone
- Virtually always turbid
- Highly variable sediment load, with a mean of 6×10^{10} kg/year
- Temperatures from freezing in the winter to 30 C in summer
- Little benthic algal cover

● and LOTS of non-native fishes



Many piscivorous fish are gape-limited



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SO HOW ARE THESE FISHES MANAGED?

It varies, but let's focus on Colorado Pikeminnow

● Grand Canyon National Park Native Fish Restoration Plan

○ Goals:

- Restore populations of native fish to a level that approximates natural conditions, and prevent adverse modification to their habitat.
- Restore self-sustaining populations of extirpated fish species.
- Minimize impacts of the recreational trout fishery in the Lees Ferry reach to downstream native fisheries in the GCNP.

- How does one restore fish populations that are critically low?

○ Captive broodstocks

- Colorado pikeminnow at the Southwestern Native Aquatic Resource and Recovery Center, Dexter, NM.
- Spawning and genetic management
- Life history studies using tag-and-release methods



● Southwestern Native Aquatic Resource and Recovery Center

○ Spawning

- Both natural and induced
March – mid-June
- Spawning matrices to maintain genetic diversity
- Sperm cryopreservation



		Female 1	Female 2
Least related	➔	Male 1	Male 6
		Male 7	Male 1
		Male 3	Male 2
Most related	➔	Male 8	Male 4

● Southwestern Native Aquatic Resource and Recovery Center

○ Tag-and-Release tag types

- Visible implant elastomer
- Passive Integrated Transponder (PIT)
- Calcein Marker
- Coded wire tag



So what can these studies tell us?...

- Southwestern Native Aquatic Resource and Recovery Center

- Tag-and-Release Uses

- Population size estimates
- Survivorship estimates
- Habitat usage
- Movement and migratory behavior
- Growth data
- Life history data

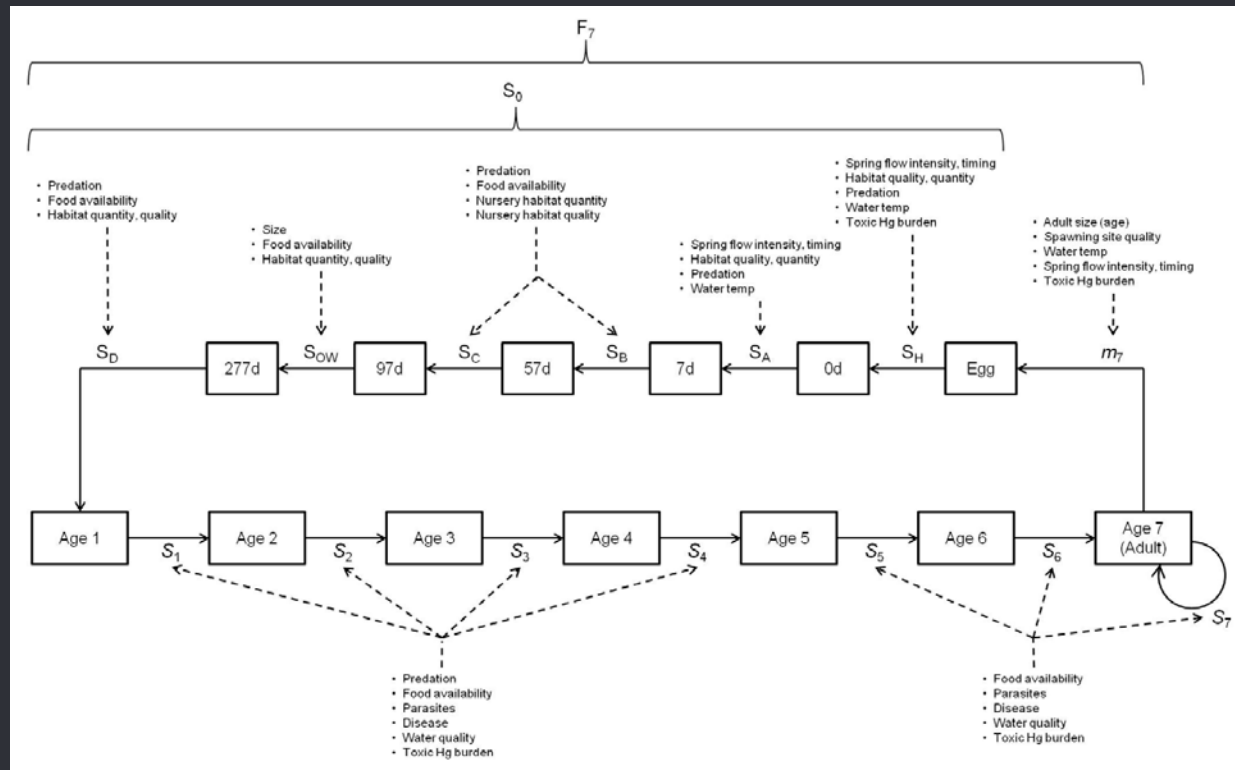
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WHAT CAN MANAGERS DO WITH THIS DATA?

Population viability analyses and adaptive management

Population Viability Analyses

Used for making models to estimate the probability a population will go extinct, and how it will respond to alternative future management scenarios



● Adaptive Management

○ Creation of conservation plans and stocking plans based on best available population demographic data

River Reaches	Fish age and Size (mm TL)	Season stocked ¹	Numbers of fish stocked per year	Number of years stocked
1: Colorado River: Rifle to Debeque Canyon	Age 3+ 150	1° Fall 2° Spring–Summer	1,125 ²	8
2: Gunnison River: Hartland to Redland dams	Age 3+ 150	1° Fall 2° Spring–Summer	1,125 ²	8

If only it were this easy!

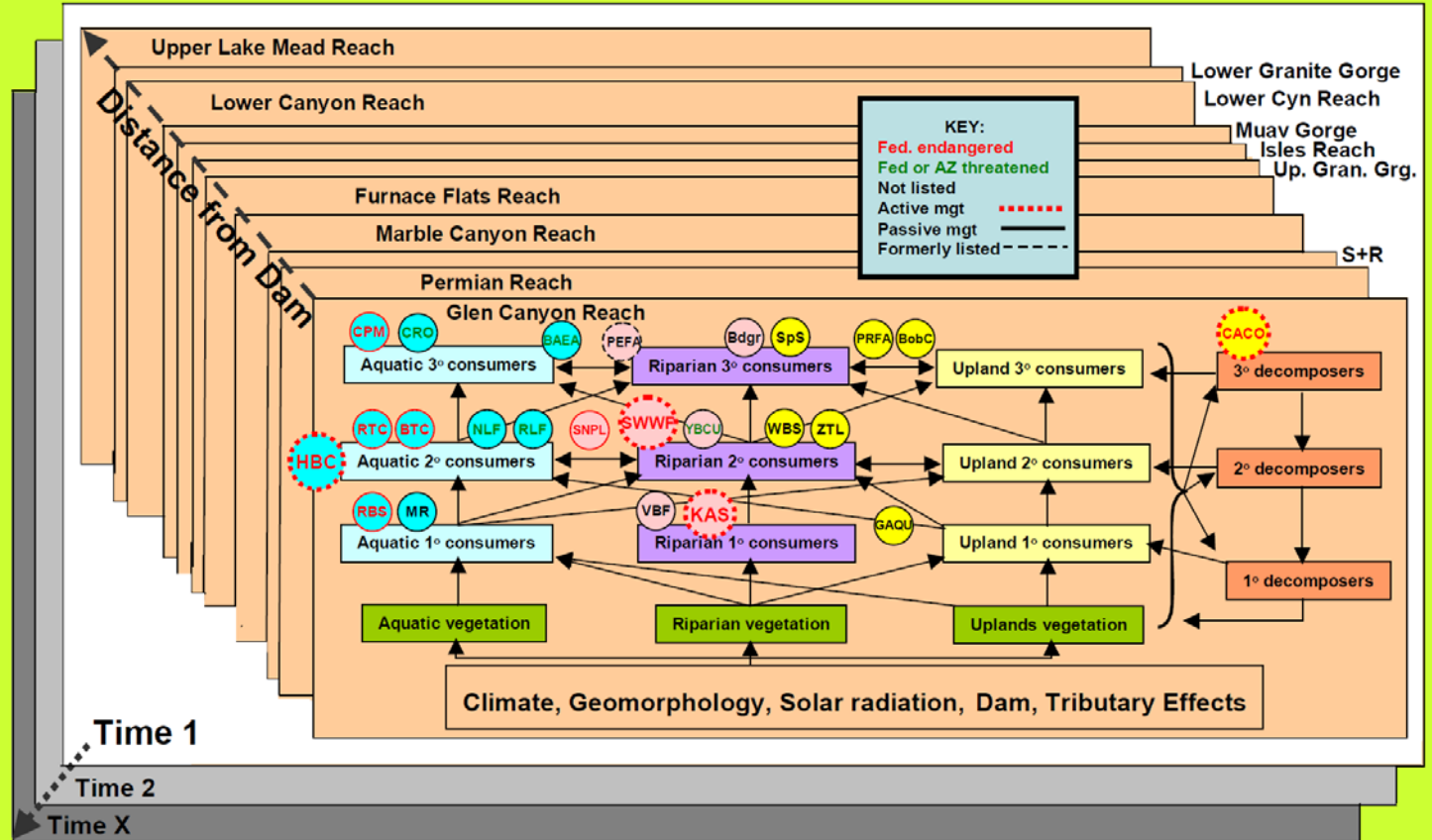
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STEPS FOR REINTRODUCTION OF EXTIRPATED SPECIES

● Reintroduction planning, compliance, and implementation

Administrative context	Oversight is complex! NPS, USFWS, Native American Indian tribes, Bureau of Reclamation, USGS, State of AZ, AZ Game and Fish
Compile relevant information	Ecology, life history, disease and parasites, trophic role, etc.
Stock assessment, and prioritization	Status of remaining population, fitness and genetics.
Compliance	Compliance requirements for species translocation, augmentation, reintroduction, NEPA, ESA.
Implementation	Feasibility and advisability of restoration
Monitoring and feedback	Does it work? What can be improved?

SIMPLIFIED CONCEPTUAL MODEL OF THE COLORADO RIVER ECOSYSTEM, SHOWING THE TROPHIC POSITION OF EXTIRPATED AND LISTED FAUNA



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● Questions?

○ What did the Colorado pikeminnow say to the other Colorado pikeminnow when he ran into a wall?

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