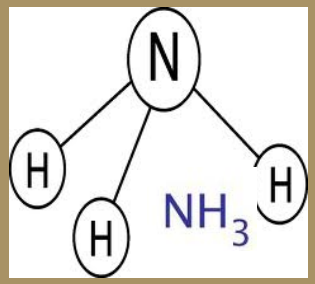
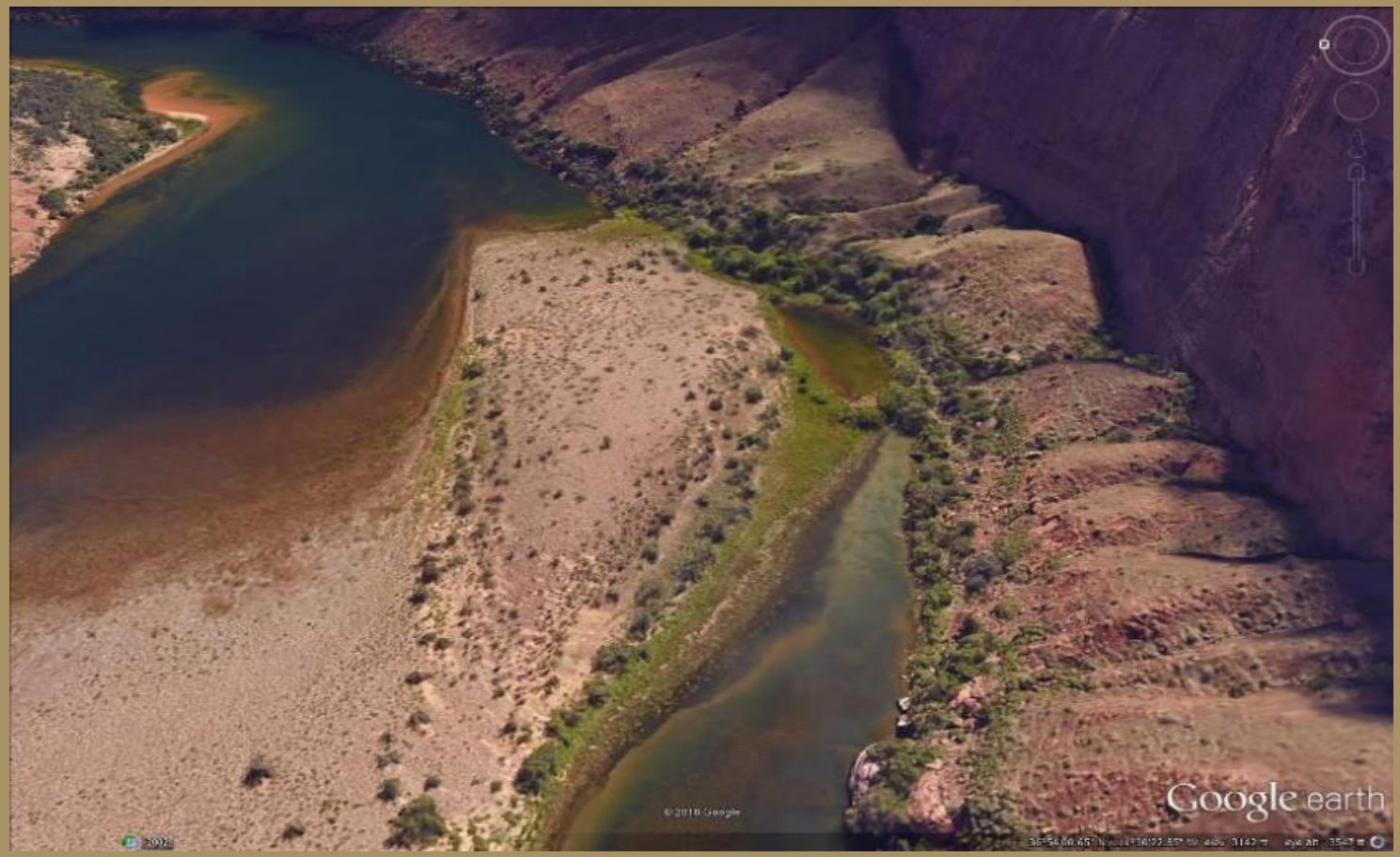
Eradication of Green Sunfish from the Lees Ferry Slough using Liquid Ammonia





Rapid Response: A Model of *Shared Vision, Cooperation, Hard Work*

IMR, GLCA, GRCA, NOCA

EXPERIENCE YOUR AMERICA

Google earth

“It is unlikely that the present arsenal of approved piscicides will be effective for controlling nonnative fishes in the southwestern United States”

USGS
science for a changing world

Integrated Management Techniques to Control Nonnative Fishes

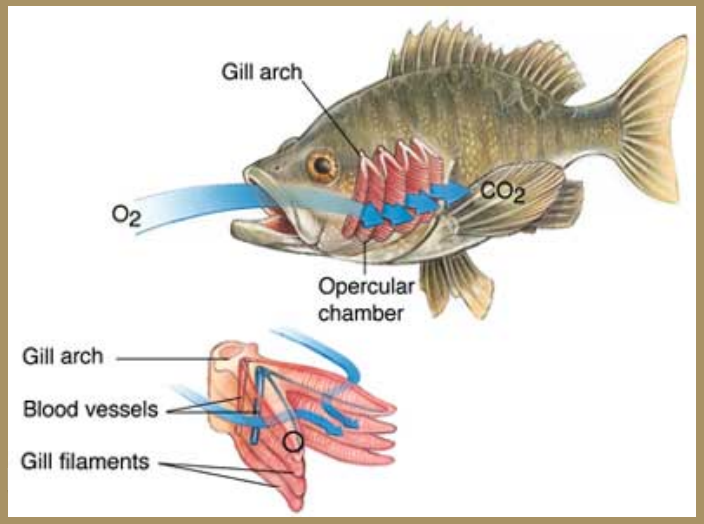
Completion Report
Interagency Agreement Number: 01-AA-32-0040

Dawson and Kolar 2003

New Piscicides?

Ammonia

- Waste product of aquatic organisms
- Naturally present in the environment
- Natural bacteria in the environment break it down



Nitrogen Cycle

Ammonia (NH3)
Caused by:
Fish waste,
invertebrate waste,
extra fish food, &
dead animals.

Nitrosomas bacteria convert the Ammonia to Nitrite

Nitrite (NO2)

Nitrobacter Bacteria convert the Nitrite to Nitrate

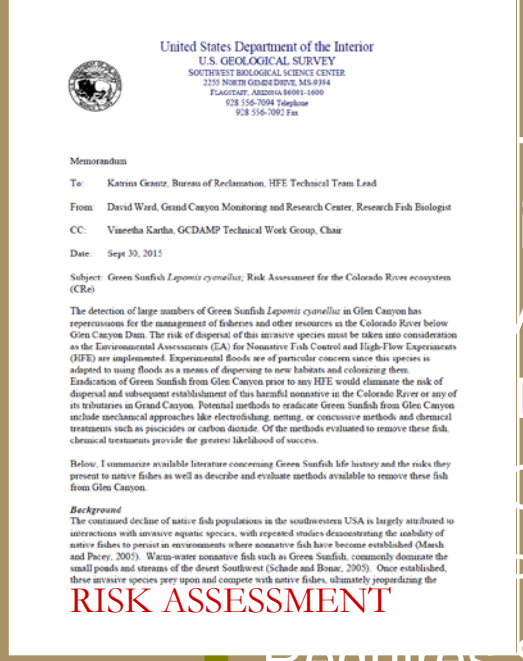
Nitrate
Nitrate is used by plants, such as algae

Green Sunfish - Background

- July 2015 - AGFD discovered large number of green sunfish in a backwater in the Lees Ferry Reach of GLCA below Glen Canyon Dam
- If the green sunfish dispersed downstream in large numbers, they are likely to have negative interactions with native fish like the humpback chub.
- As a result, partner agency biologists agreed that elimination of this invasive species from the backwater slough was necessary and urgent.

Joe Tomelleri

Lisa Winters AGFD


United States Department of the Interior
U.S. GEOLOGICAL SURVEY
SOUTHWEST BIOLOGICAL SCIENCE CENTER
2255 NORTH GEMINI DRIVE, MS-9394
FLAGSTAFF, ARIZONA 86001-1600
928 556-7094 Telephone
928 556-7092 Fax

Memorandum

To: Katrina Grantz, Bureau of Reclamation, HFE Technical Team Lead

From: David Ward, Grand Canyon Monitoring and Research Center, Research Fish Biologist

CC: Vineetha Kartha, GCDAMP Technical Work Group, Chair

Date: Sept 30, 2015

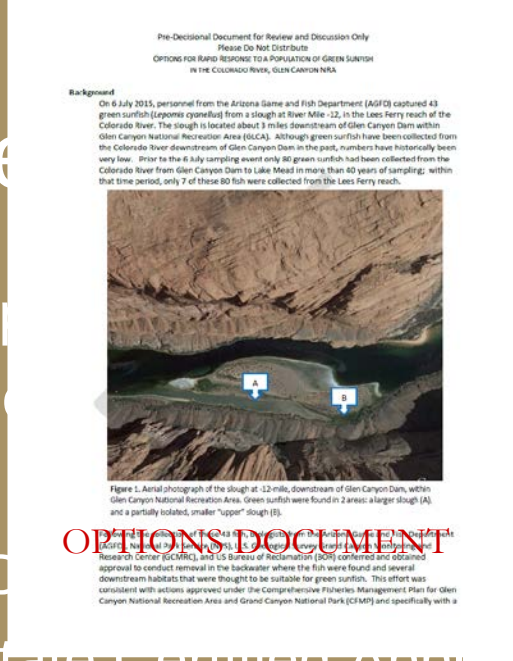
Subject: Green Sunfish *Lepomis cyanellus*; Risk Assessment for the Colorado River ecosystem (CRe)

The detection of large numbers of Green Sunfish *Lepomis cyanellus* in Glen Canyon has repercussions for the management of fisheries and other resources in the Colorado River below Glen Canyon Dam. The risk of dispersal of this invasive species must be taken into consideration as the Environmental Assessments (EA) for Nonnative Fish Control and High-Flow Experiments (HFE) are implemented. Experimental floods are of particular concern since this species is adapted to using floods as a means of dispersing to new habitats and colonizing them.
Eradication of Green Sunfish from Glen Canyon prior to any HFE would eliminate the risk of dispersal and subsequent establishment of this harmful nonnative in the Colorado River or any of its tributaries in Grand Canyon. Potential methods to eradicate Green Sunfish from Glen Canyon include mechanical approaches like electrofishing, netting, or concussive methods and chemical treatments such as piscicides or carbon dioxide. Of the methods evaluated to remove these fish, chemical treatments provide the greatest likelihood of success.

Below, I summarize available literature concerning Green Sunfish life history and the risks they present to native fishes as well as describe and evaluate methods available to remove these fish from Glen Canyon.

Background
The continued decline of native fish populations in the southwestern USA is largely attributed to interactions with invasive aquatic species, with repeated studies demonstrating the inability of native fishes to persist in environments where nonnative fish have become established (Marsh and Pacey, 2003). Warm-water nonnative fish such as Green Sunfish commonly dominate the small ponds and streams of the desert Southwest (Schade and Bonar, 2005). Once established, these invasive species prey upon and compete with native fishes, ultimately jeopardizing the

RISK ASSESSMENT


Pre-Decisional Document for Review and Discussion Only
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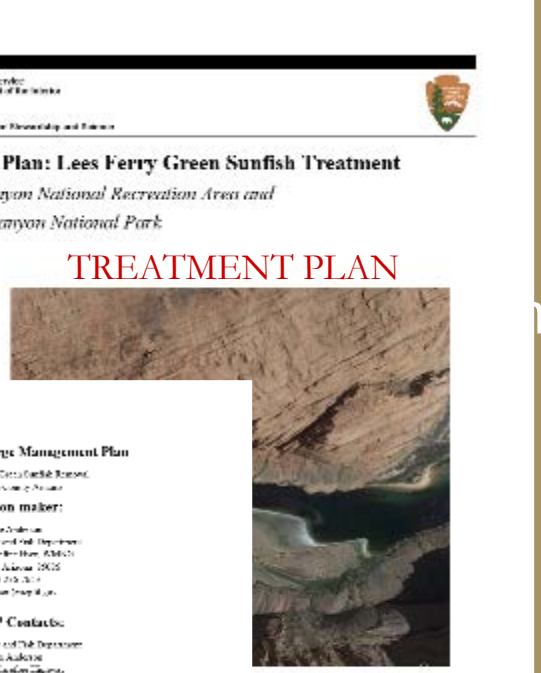
OPTIONS FOR RAPID RESPONSE TO A POPULATION OF GREEN SUNFISH
IN THE COLORADO RIVER, GLEN CANYON NRA

Background
On 6 July 2015, personnel from the Arizona Game and Fish Department (AGFD) captured 43 green sunfish (*Lepomis cyanellus*) from a slough at River Mile -12, in the Lees Ferry reach of the Colorado River. The slough is located about 3 miles downstream of Glen Canyon Dam within Glen Canyon National Recreation Area (GLCA). Although green sunfish have been collected from the Colorado River downstream of Glen Canyon Dam in the past, numbers have historically been very low. Prior to the 6 July sampling event only 80 green sunfish had been collected from the Colorado River from Glen Canyon Dam to Lake Mead in more than 40 years of sampling; within that time period, only 7 of these 80 fish were collected from the Lees Ferry reach.

Figure 1. Aerial photograph of the slough at -12-mile, downstream of Glen Canyon Dam, within Glen Canyon National Recreation Area. Green sunfish were found in 2 areas: a larger slough (A), and a partially isolated, smaller "upper" slough (B).

Research Center (GCMRC), and US Bureau of Reclamation (BOR) conferred and obtained approval to conduct removal in the backwater where the fish were found and several downstream habitats that were thought to be suitable for green sunfish. This effort was consistent with actions approved under the Comprehensive Fisheries Management Plan for Glen Canyon National Recreation Area and Grand Canyon National Park (CFMP) and specifically with a

OPTIONS DOCUMENT


National Park Service
U.S. Department of the Interior

National Resource Stewardship and Science

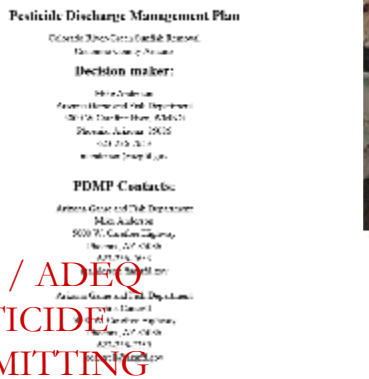
Project Plan: Lees Ferry Green Sunfish Treatment
Glen Canyon National Recreation Area and
Grand Canyon National Park

TREATMENT PLAN

PEPC
Planning, Environment and Public Comment

NEPA COMPLIANCE

CE 3.3(C)(2)

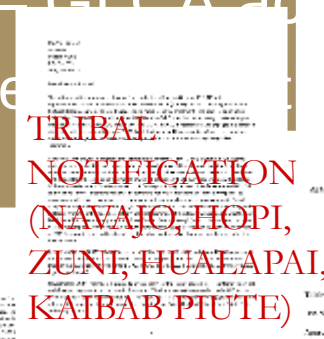

Pesticide Discharge Management Plan

Decision maker:

PDMP Contacts:

PDMP Preparation Date:

CWA / ADEQ PESTICIDE PERMITTING (NOI AND PDMP)



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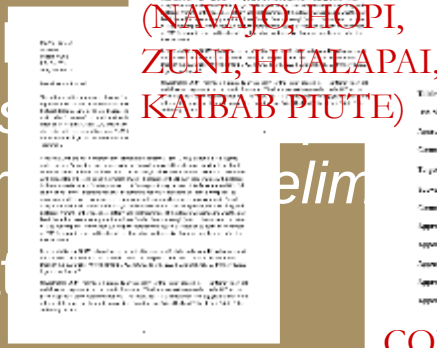
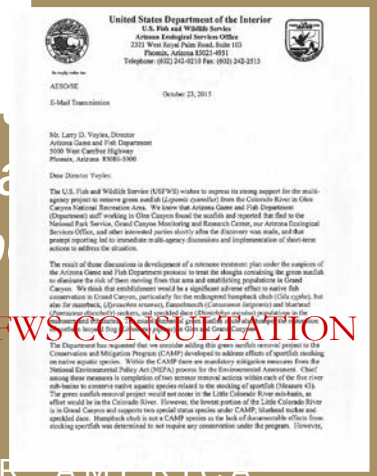


COMMUNICATION PLAN


United States Department of the Interior
U.S. Fish and Wildlife Service
Arizona Ecological Services Office
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
Telephone: (602) 242-0210 Fax: (602) 242-2513

AESOSE

October 23, 2015

E-Mail Transmission

Mr. Larry D. Voyles, Director
Arizona Game and Fish Department
5000 West Carefree Highway
Phoenix, Arizona 85086-5000

Dear Director Voyles:

The U.S. Fish and Wildlife Service (USFWS) wishes to express its strong support for the multi-agency project to remove green sunfish (*Lepomis cyanellus*) from the Colorado River in Glen Canyon National Recreation Area. We know that Arizona Game and Fish Department (Department) staff working in Glen Canyon found the sunfish and reported that fact to the National Park Service, Grand Canyon Monitoring and Research Center, our Arizona Ecological Services Office, and other interested parties shortly after the discovery was made, and that prompt reporting led to immediate multi-agency discussions and implementation of short-term actions to address the situation.

The result of those discussions is development of a rotenone treatment plan under the auspices of the Arizona Game and Fish Department protocol to treat the sloughs containing the green sunfish to eliminate the risk of them moving from that area and establishing populations in Grand Canyon. We think that establishment would be a significant adverse effect to native fish conservation in Grand Canyon, particularly for the endangered humpback chub (*Gila cypha*), but also for razorback, (*Xyrauchen texanus*), flannelmouth (*Catostomus latipinnis*) and bluehead (*Pantosteus discobolus*) suckers, and speckled dace (*Rhinichthys osculus*) populations in the

The Department has requested that we consider aiding this green sunfish removal project in the Conservation and Mitigation Program (CAMP) developed to address effects of sportfish stocking on native aquatic species. Within the CAMP there are mandatory mitigation measures from the National Environmental Policy Act (NEPA) process for the Environmental Assessment. Chief among these measures is completion of two summer removal actions within each of the five river sub-basins to conserve native aquatic species related to the stocking of sportfish (Measure 43). The green sunfish removal project would not occur in the Little Colorado River sub-basin, as effect would be in the Colorado River. However, the lowest portion of the Little Colorado River is in Grand Canyon and supports two special status species under CAMP; bluehead sucker and speckled dace. Humpback chub is not a CAMP species so the lack of documentable effects from stocking sportfish was determined to not require any consultation under the program. However,

FWS CONSULTATION

- Requires State Certified Appl
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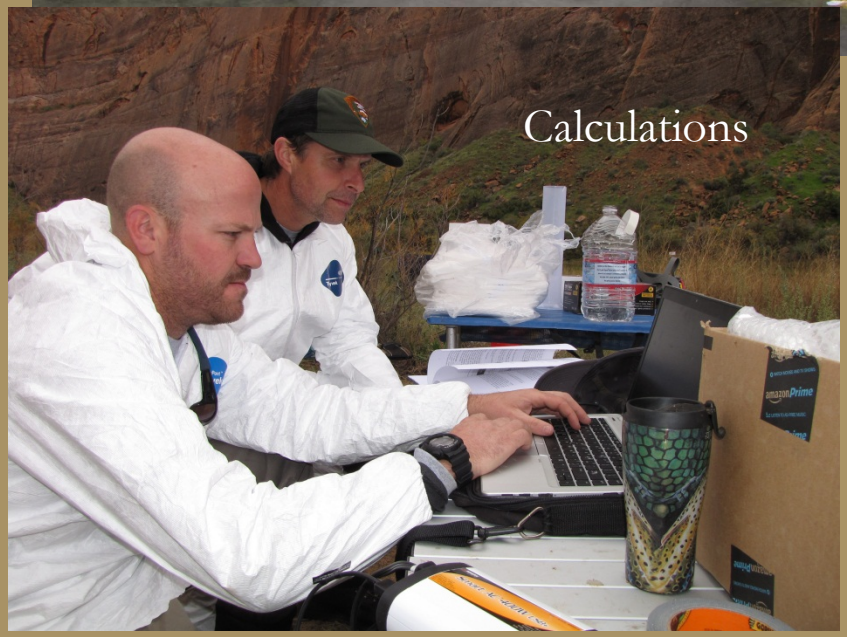
- FWS consultation
- Numerous other permits and

U R A M E R I C A



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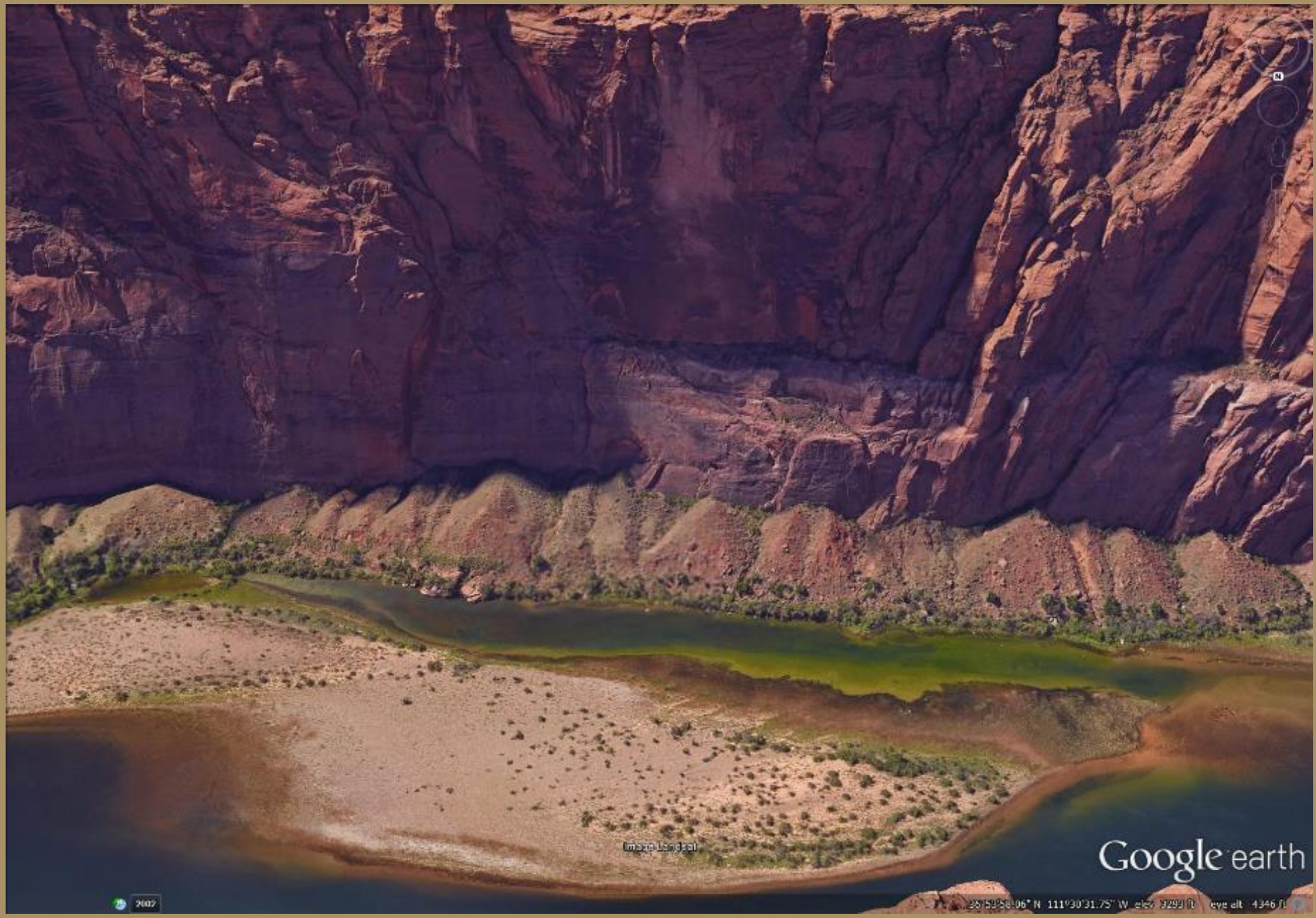


Image Landsat
Google earth
2002
28°52'58.06" N 111°30'31.75" W elev 3292 ft eye alt 4346 ft

Rapid Response in 2015

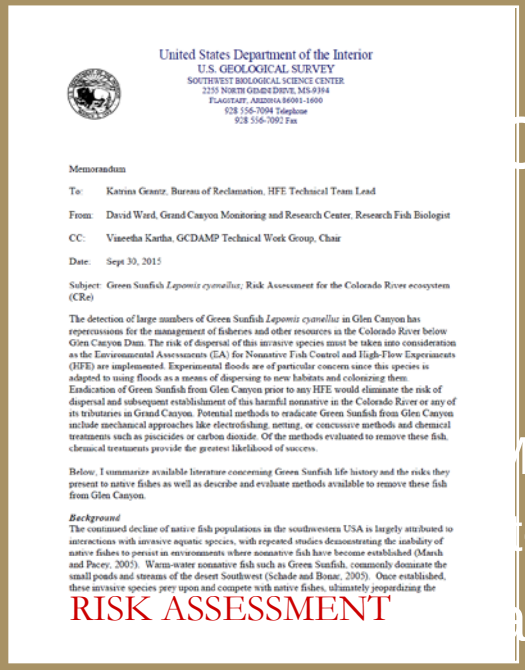
- July 2015 - GSF infestation discovered
- August 2015 - Two Mechanical Removals
- August-Sept 2015 - Risk assessment and review of Treatment Options, continued mechanical removal
- Oct 7 – Temporary net barrier installed
- October – permits, planning, compliance, approval
- Nov – No HFE
- Nov 2-6 – First Rotenone Treatment
- Monitoring Nov 12-13 - NO GSF found – no 2nd Treatment
- Future Prevention

GSF removed by electrofishing and netting in 2016

Date	Agency	GSF	passes - approx.= 45 min shock	minutes	CPE in fish per minute
6/16/2016	NPS	0	1		0
7/21/2016	AGFD	0	0		0
8/12/2016	NPS	26	1	9.5	2.7

2016 Green Sunfish Rapid Response

- Two detection trips in July 2016 = no GSF
- August 2016 – GSF detected
- Phased approach
- 10 removal trips from August – October captured and removed over 4600 GSF
  - Trips conducted by GCMRC, AGFD, and NPS
- GSF numbers were reduced by mechanical removal but cannot eliminate GSF from the site
- Rotenone strongly discouraged by AGFD
- NPS applied for a permit from ADEQ to apply ammonia as an experimental piscicide
- NPS Research Permit and CE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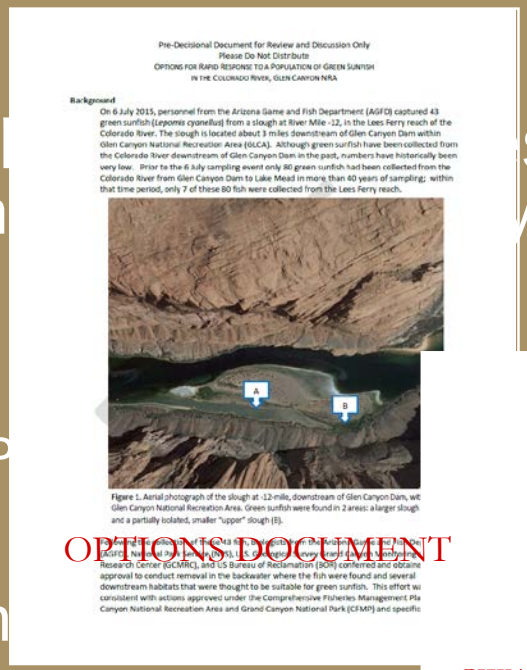
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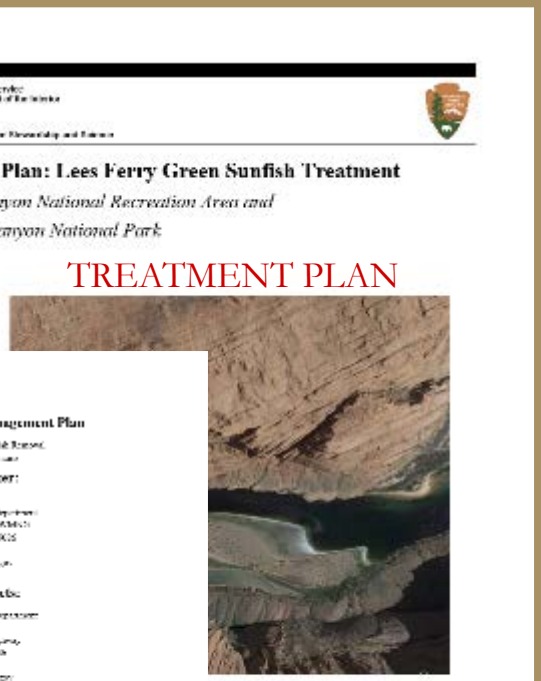
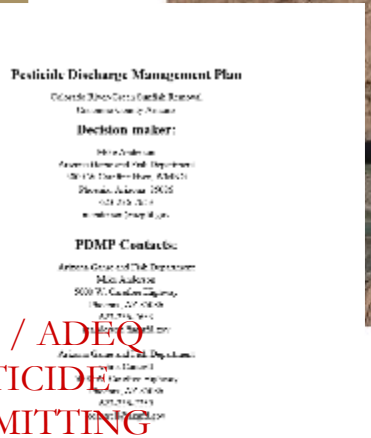

National Park Service
U.S. Department of the Interior

Project Plan: Lees Ferry Green Sunfish Treatment

Glen Canyon National Recreation Area and
Grand Canyon National Park

TREATMENT PLAN

- NPS leadership determined that Cat


Pesticide Discharge Management Plan

Decision maker:

PDMP Contacts:

PDMP Preparation Hale

CWA / ADEQ PESTICIDE PERMITTING (NOI AND PDMP)

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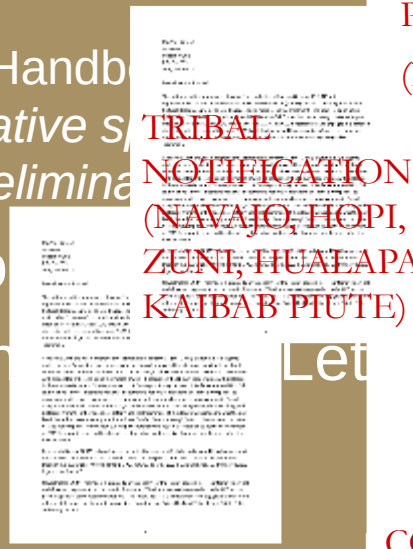

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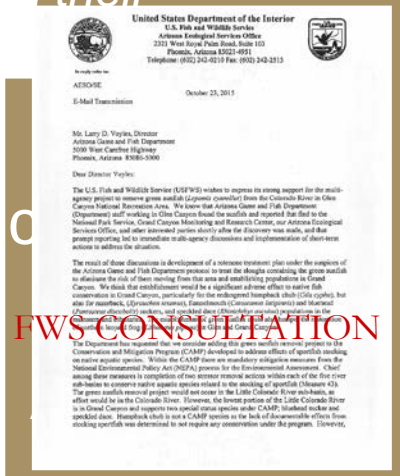
United States Department of the Interior
U.S. Fish and Wildlife Service
Arizona Ecological Service Office
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
Telephone: (602) 242-0210 Fax: (602) 242-2513

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Arizona Game and Fish Department
5000 West Carefree Highway
Phoenix, Arizona 85085-5000

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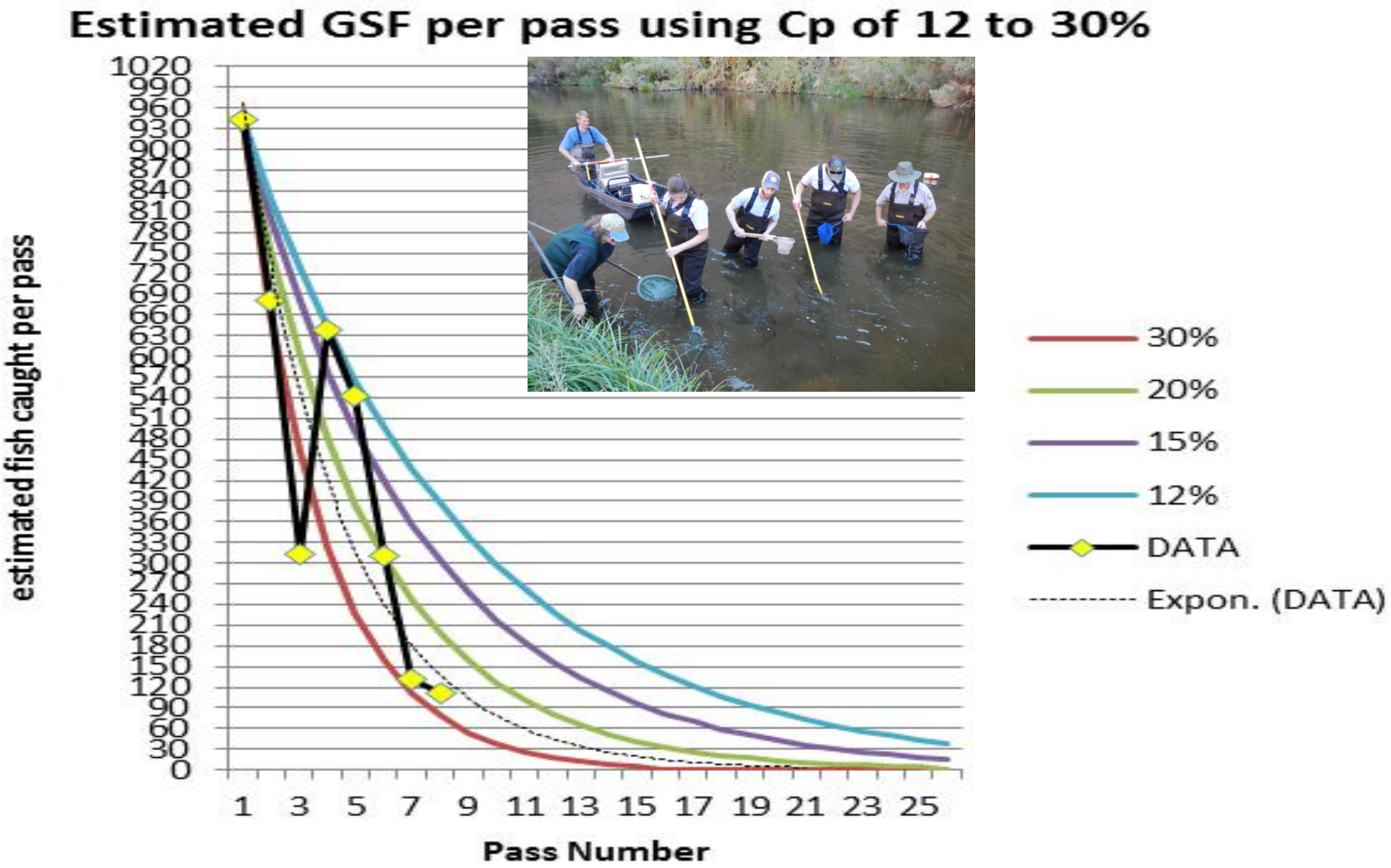
FWS CONSULTATION

Estimated #of passes to significantly reduce risk



Experimental Ammonia Treatm

- Noon Oct 20, 20 gal ammonium hydroxide 2
- Dying fish 90 min
- Ammonia 8+ ppm
- Sentinel fish all dead next morning
- A few live fish along bank where some inflow
- Treated with one more gallon
- Next week barge electrofishing, no fish
- Slight levels of ammonia in first 3 yards of lower slough, no dead fish
- HFE Nov 7 to 12 (96 hours at 38,000 cfs)
- Success

Ammonia as piscicide

- Secondary containment
- Spill kit
- Personal protective gear

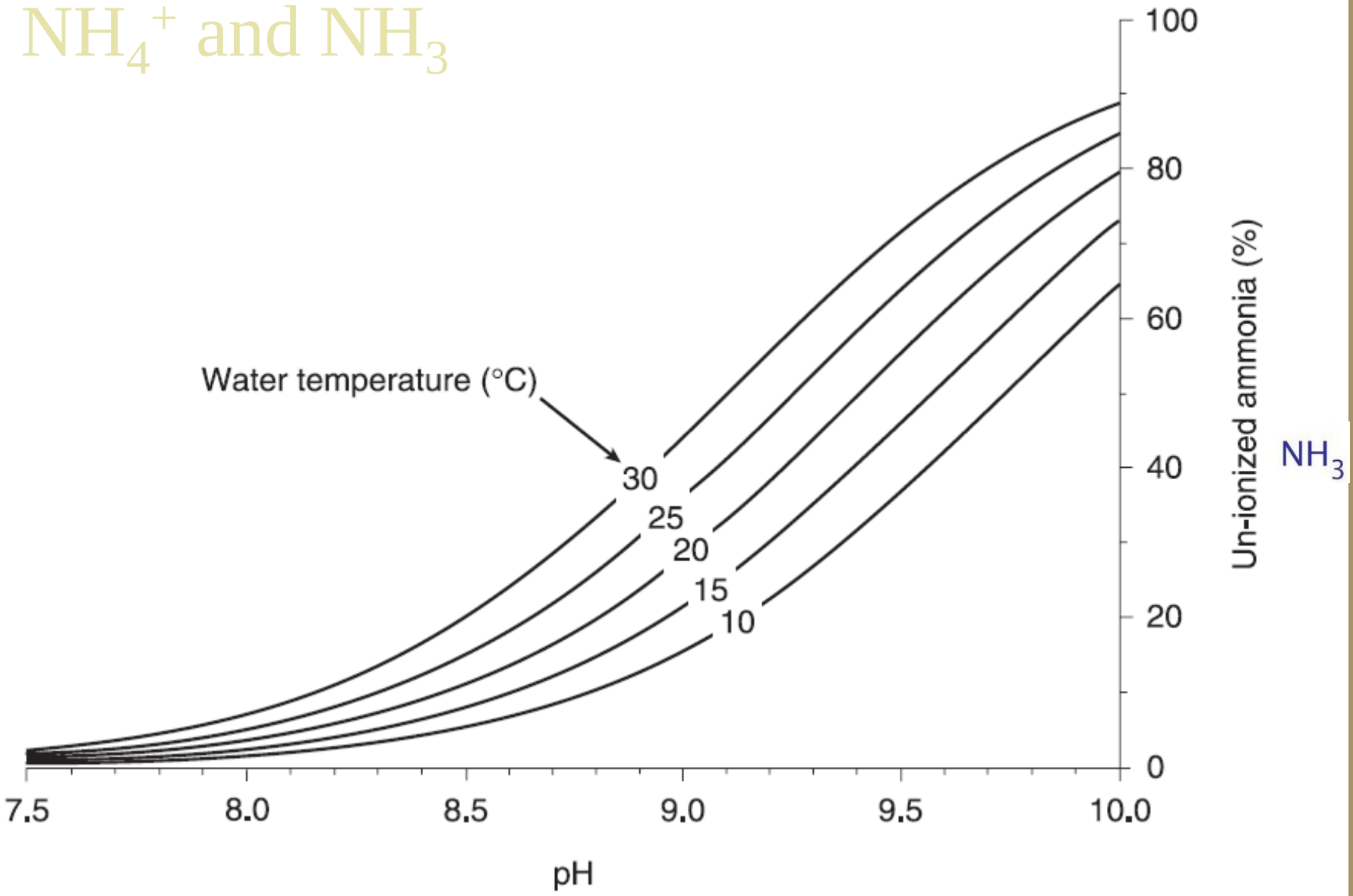
5 gal. jugs 29% ammonium hydroxide

Testing for ammonia levels in the area

AREA
CLOSED

EXPERIENCE YOUR AMERICA

NH_4^+ and NH_3

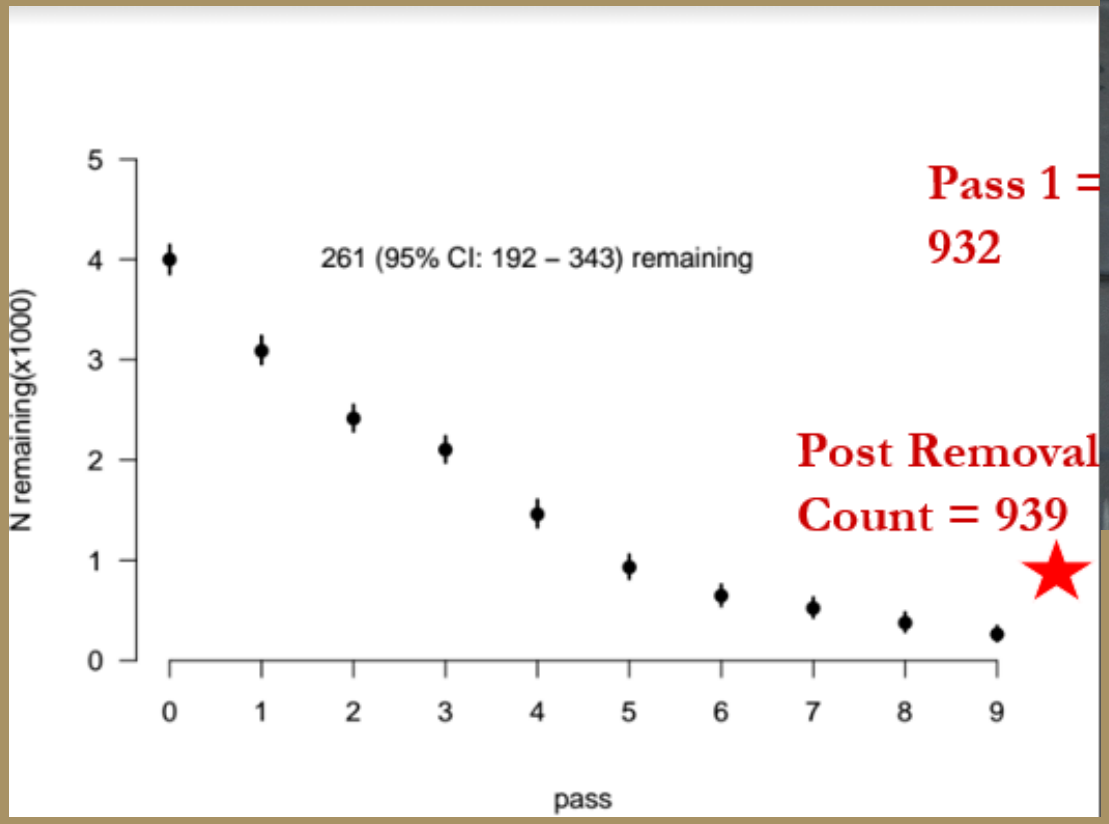


Temperature = minor effect on toxicity
pH = Large effect on toxicity

EPA toxicity values for selected aquatic organisms

Species	Ammonia (mg/L)	Nitrite mg/L
Rainbow trout	1.09	2.5
Brown trout	0.701	
Brook trout	1.05	
Northern whitefish	0.473	
Red shiner	3.16	
Fathead minnow	3.44	2.61
White sucker	2.22	
Channel catfish	3.8	1.39
Mosquitofish	3.2	
Green sunfish	2.11	
Bluegill	2.97	
Smallmouth bass	1.78	
Largemouth bass	1.7	1.14
Walleye	1.1	

ML estimate of number of GSF remaining after each pass



Pass 1 = 932

Post Removal Count = 939

Preliminary results provided by Charles Yackulic (GCMRC).

Upper/Lower Slough Division point

Colorado River
Colorado River
Colorado River

Advantages of Ammonia

- Stays toxic for 35-40 days (temperature dependent)
- Highly soluble in water - no mixing needed
- Inexpensive ($213 for a 55 gallon drum)
  - Logistically feasible on a large scale
- Already labeled as a pesticide – just not labeled for aquatic use
- Will not harm terrestrial animals

Disadvantages

- Toxic fumes prior to mixing with water
- Can Create an algae bloom
- Not effective at Low pH and less effective at cold water temperature

What’s Next

Refine effective minimum dose

Addidtional Experiments in natural systems

Flowing water - drip applications