# Off channel native fish monitoring on Bill Williams and Cibola National Wildlife Refuges

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**COLORADO RIVER AREA BIOLOGISTS ANNUAL MEETING**
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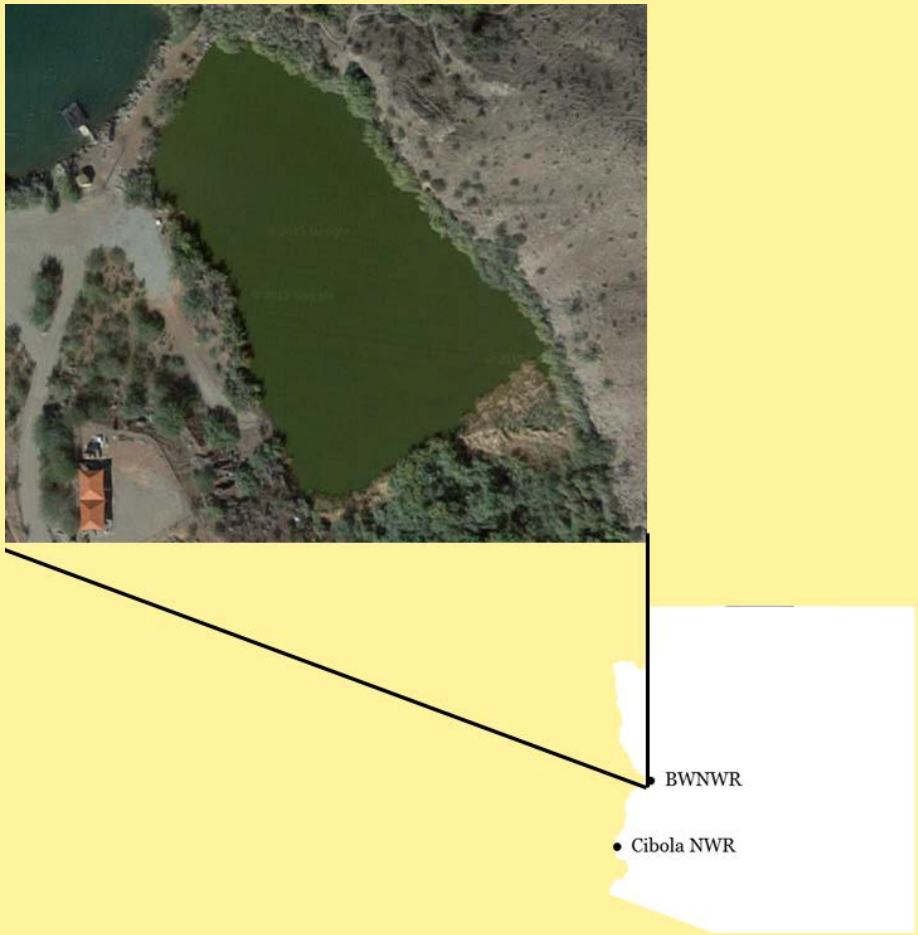
# Background

- Razorback sucker and bonytail are both listed as endangered
  - Both are completely reliant on stocking within the Lower Colorado River
  - Bonytail are functionally extirpated
- Conservation plan requires off channel habitats dedicated to native fishes
- Nonnative free and of sufficient water quality to support naturally reproducing populations

# Office cove

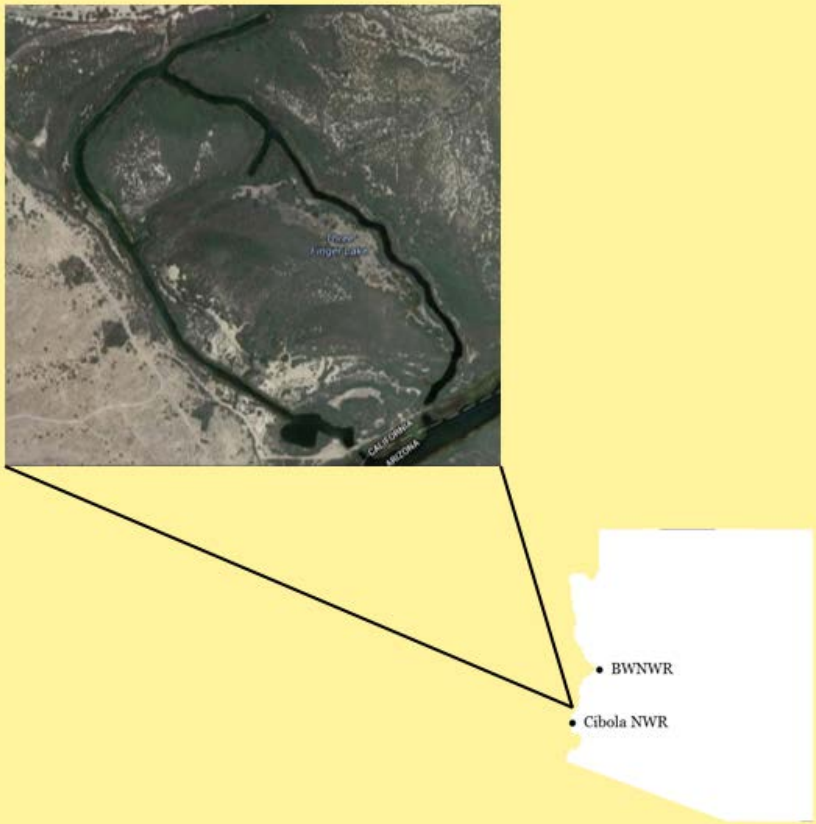



- Located on the Bill Williams National Wildlife Refuge
- Constructed in 1993 as a grow out pond for razorback sucker and bonytail
- 0.92 hectares in size with a max depth of 3.2 m.
- *Gambusia affinis* and *Dorosoma* spp. are present
- Total of 2189 fish stocked since 2006
  - 1707 bonytail
  - 482 razorback sucker

# Cibola high levee

- Located on the Cibola National Wildlife Refuge
- 1.74 hectares in size with a max depth of 3.5 m
- Renovated in 1993 and again in 2008
- Supports naturally reproducing razorback sucker and bonytail
- Total of 2760 fish stocked since 2008
  - 1946 razorback sucker
  - 814 bonytail

# Three fingers




- Historic oxbow located at Cibola National Wildlife Refuge
- 11.5 hectares in size and a max depth of 4.6 m
- Suite of nonnatives
  - Largemouth bass, warmouth, bluegill, carp, flathead catfish, western mosquitofish
- Could not locate stocking records
  - Stocked with 185 razorback sucker in 2008 from Achii Hanyo

# Stockings

| Stocking location | Stocking date | Number stocked | Species | Mean TL (mm) | Origin |
|---|---|---|---|---|---|
| **Office Cove** | 14 Dec 2006 | 1707 | GIEL | 311 | Achii Hanyo |
| | 7 April 2011 | 373 | XYTE | 373 | Bubbling Ponds |
| | 3 May 2012 | 34 | XYTE | 311 | Hualapai Harvest |
| | 25 Nov 2014 | 75 | XYTE | -- | Willow Beach |
| **Cibola High Levee** | 16 Oct 2008 | 1252 | XYTE | 354 | Bubbling Ponds |
| | 9 Dec 2008 | 535 | GIEL | 340 | SNARRC |
| | 15 Sep 2015 | 279 | GIEL | 293 | SNARRC |
| | 7 April 2011 | 550 | XYTE | 373 | Bubbling Ponds |
| | 13 May 2012 | 144 | XYTE | 336 | Hualapai Harvest |

# Sampling methods

- Primarily sampled with trammel nets
  - Two sampling periods (a mark and capture period) within the three backwaters
  - Nets were fished for two nights spaced one week apart
  - Nets were deployed at approximately 17:00 and emptied of fish at 21:00 the same night and 08:00 the next morning

# Sampling methods

- Office cove
  - Nov 16-17 and Nov 23-24
  - Two 300 ft 1.5 in mesh trammel nets
  - Three 150 ft 3 in mesh trammel nets
- Cibola High Levee
  - Nov 30-Dec 1 and Dec 7-8
  - Five 150 ft 3 in mesh trammel nets
  - 5 hoop nets only during the first sampling period
- Three fingers lake
  - Nov 30-Dec 1 and Dec 7-8
  - Five 150 ft 3 in mesh trammel nets

# Fish processing

- Measured to the nearest mm and weighed to the nearest gram
- Scanned for 134 kHz PIT tag
- If no tag present 134 kHz PIT tag was inserted
- Datasheets were scanned and some have been sent to Carol.

# Population estimate

- Modified Lincoln-Peterson formula (Chapman Estimator)

- $N^{\wedge *} = \frac{(M+1)(C+1)}{(R+1)}$

- 95% Confidence intervals
  - Obtained low and high values of *R* using a Poisson distribution table based on the number of recaptures
  - New R values were substituted into the above formula to obtain upper and lower confidence limits.

# Office Cove

- Marking period
  - 78 razorback sucker
  - 1 bonytail (stocked in 2006)
  - 30 tagged and 49 untagged
- Capture period
  - 47 razorback sucker (41 released into the river at Needles Dredge Yard)
  - 2 bonytail (1 was recap from previous week)
  - 32 tagged and 17 untagged
- 25 recaps
- Mean TL of 458 mm and mean weight of 867 grams
- 102 total razorback captured and 35 fish had a stocking record
  - 26 on 4/6/2011 from Bubbling Ponds
  - 4 on 5/3/2012 from the Hualapai harvest
  - 5 on 11/25/2014 from Willow Beach

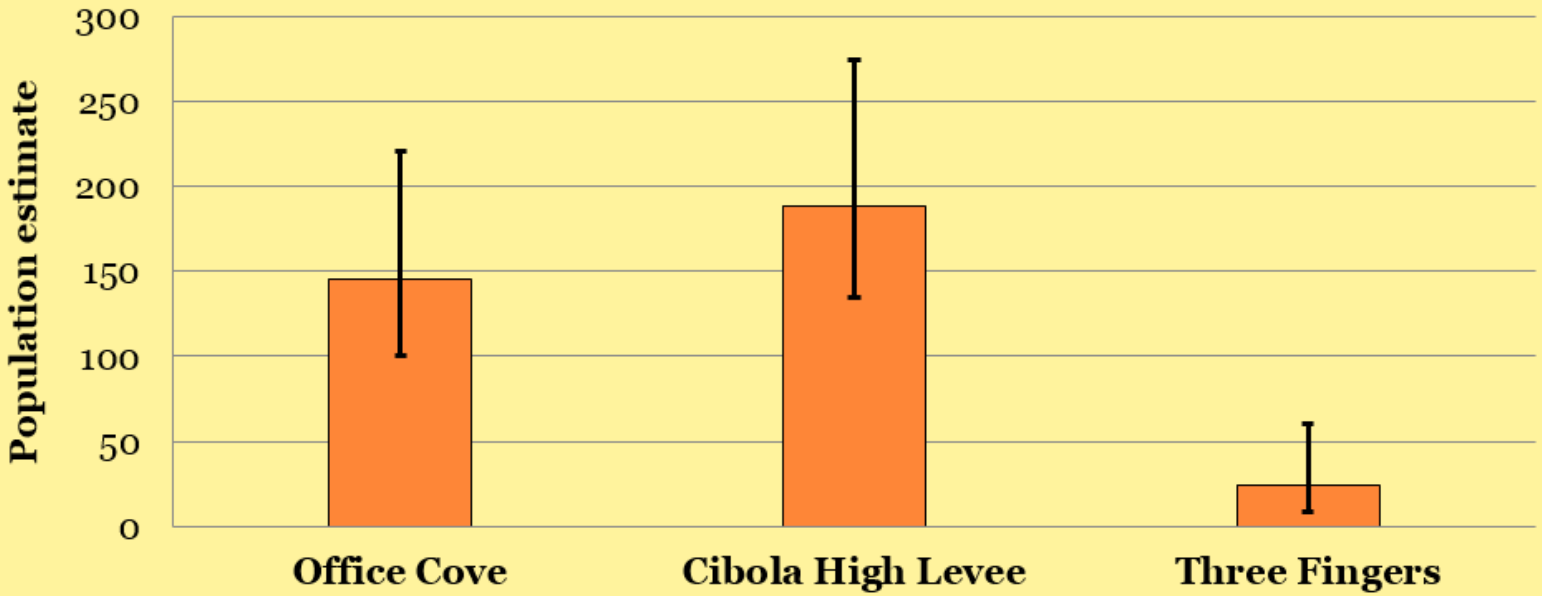
# Cibola high levee

- Marking period
  - 83 razorback sucker
  - 15 bonytail (all untagged juveniles in hoop nets)
  - 68 tagged and 15 untagged
- Capture period
  - 71 razorback sucker (All released into the river at Park Moabi)
  - 61 tagged and 10 untagged
- 31 recaps
- Mean TL of 549 mm and mean weight of 1742 grams
- 132 total fish captured and 119 fish had a stocking record
  - 21 on 10/16/2008 from SNARCC
  - 79 on 4/6/2011 from Bubbling Ponds
  - 19 on 5/3/2012 from the Hualapai Harvest

# Three fingers

- Marking period
  - 8 razorback sucker
  - All untagged
- Capture period
  - 7 razorback sucker
  - 5 untagged and 2 tagged
- 2 recaps
- Mean TL of 583 mm

# Population estimates




| | Office Cove | Cibola High Levee | Three Fingers |
|---|---|---|---|
| **Mark** | 78 | 83 | 8 |
| **Capture** | 47 | 71 | 7 |
| **Recaps** | 25 | 31 | 2 |
| **Pop Est. (95% CI)** | 146 (100-220) | 189 (134-275) | 24 (9-60) |

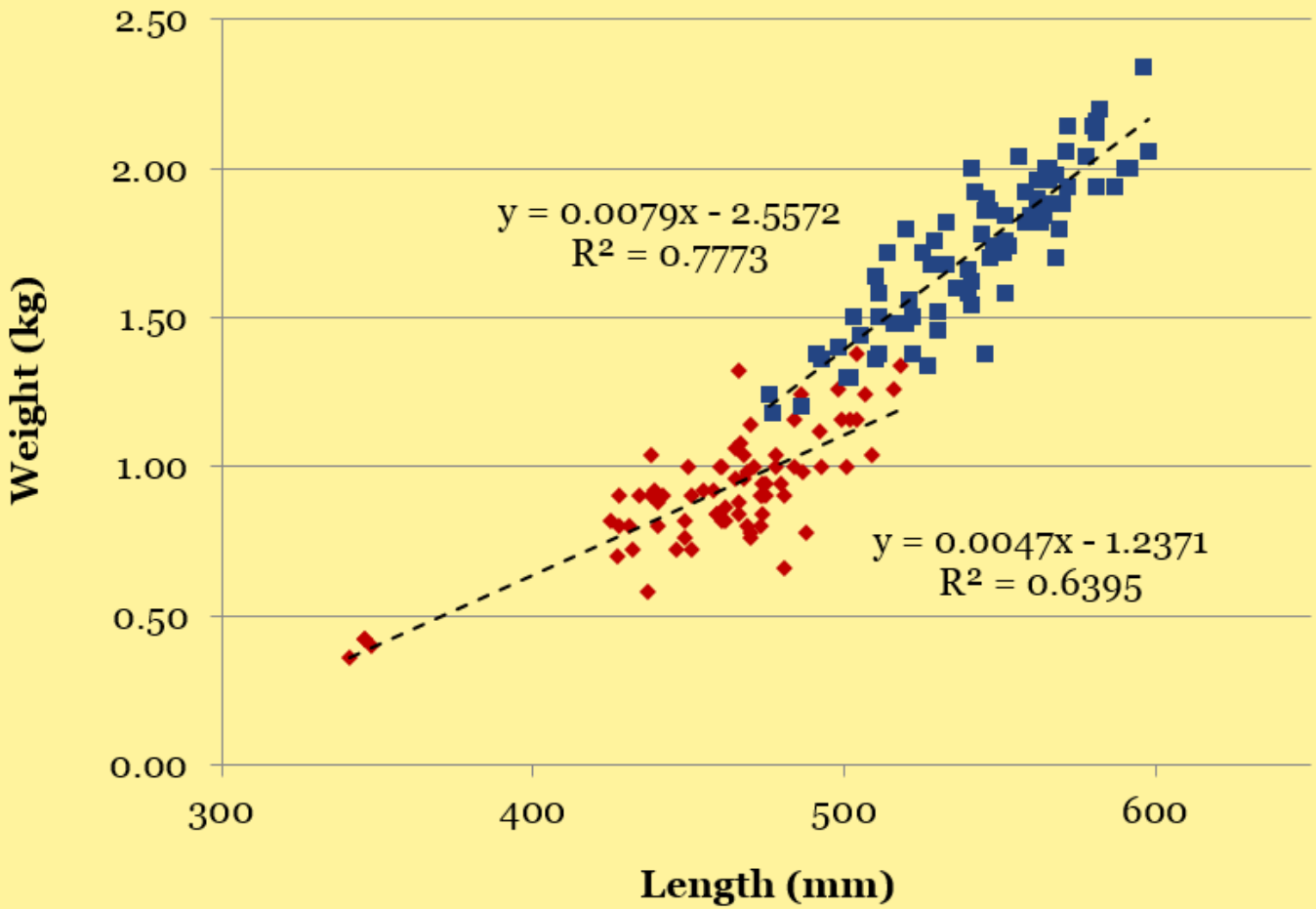
# Office cove fish

- 18 fish had ‘milky’ eyes
- Fitness was poor
- Bad water quality?
- Above carrying capacity
- At least two bonytail
  - Stocked in 2006

# HLP fish

- Fitness was high
- Bonytail recruitment
- Mueller et al. calculated population estimates of 7500 bonytail and 1100 razorback sucker pre 2008 renovation

# Length-weight regression




**ANCOVA**

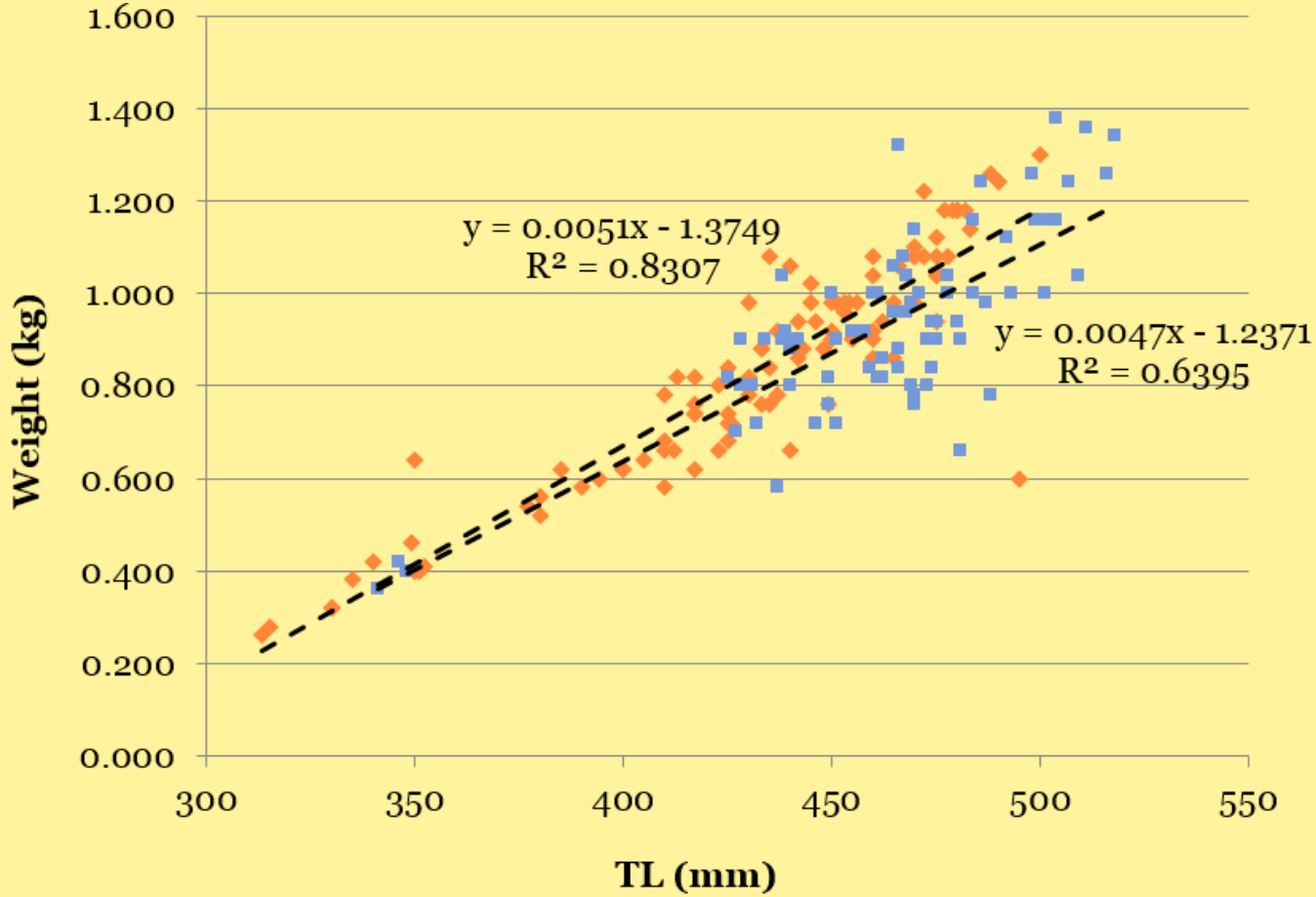
F = 84.02
DF = 1
P < 0.0001

**Homogeneity of Regressions**

F = 26.88
DF = 1
P < 0.0001

◆ Office Cove N=79
■ High Levee Pond N=84

# Historic office cove data




**ANCOVA**

F = 10.16
DF = 1
P = 0.002

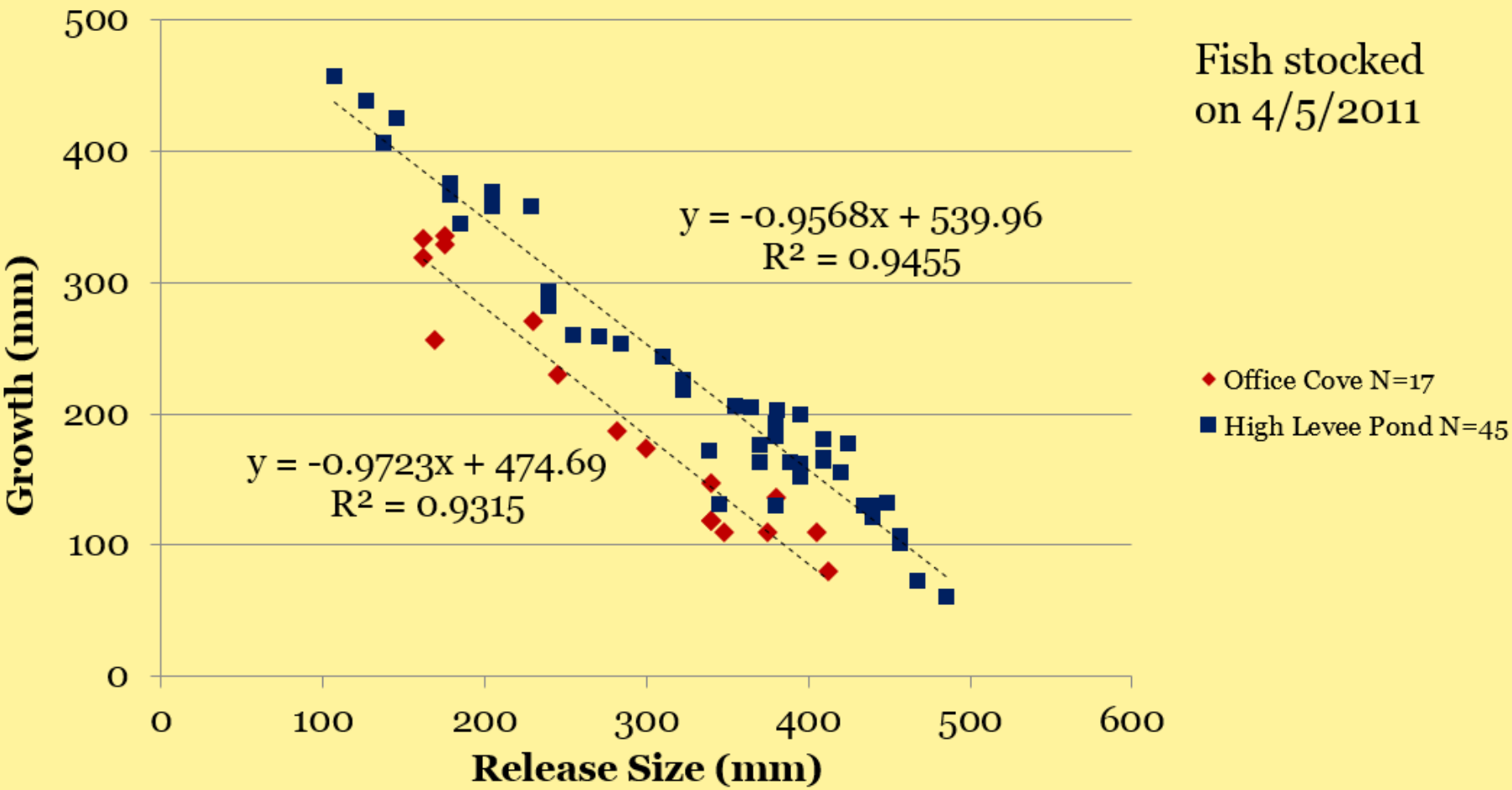
**Homogeneity of Regressions**

F = 0.95
DF = 1
P = 0.33

Office Cove 2009 N=100

Office Cove 2015 N=79

# Growth


Fish stocked on 4/5/2011
y = -0.9568x + 539.96
R² = 0.9455
y = -0.9723x + 474.69
R² = 0.9315
Office Cove N=17
High Levee Pond N=45
Growth (mm)
Release Size (mm)
0
100
200
300
400
500
600

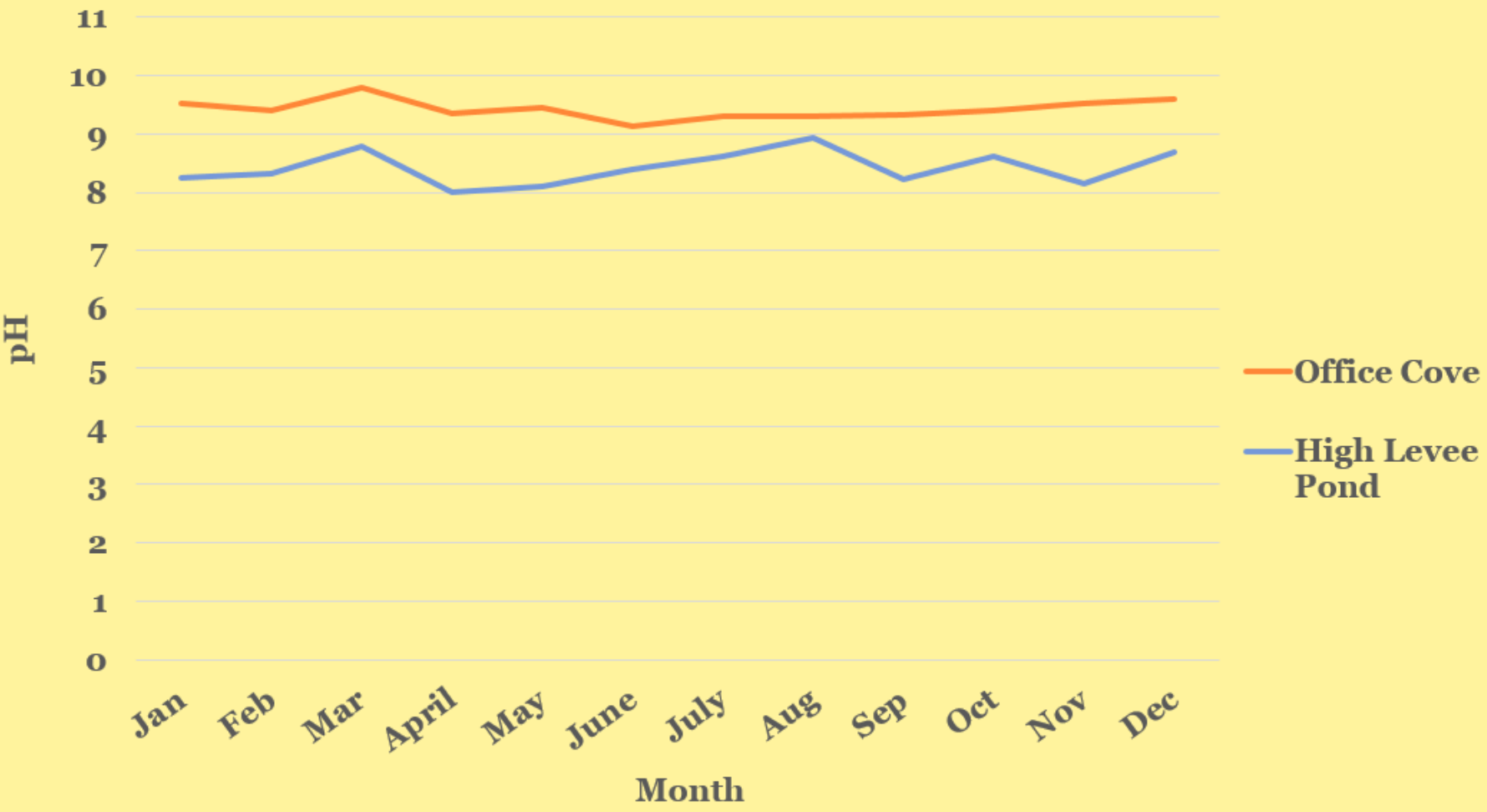
# Why the difference?

- Physical attributes?
  - HLP is larger with a  better hydrologic connection to the river
- Zooplankton community?
  - Office cove
    - 19 species of rotifers, 8 species of Cladocerans, 5 species of Copepods
  - HLP
    - 20 species of rotifer, 11 species of Cladocerans, 9 species of Copepods
  - Office cove is dominated by rotifers so biomass is generally low whereas zooplankton are more evenly distributed in HLP
- Water quality?
  - Temperature, DO, pH, Conductivity

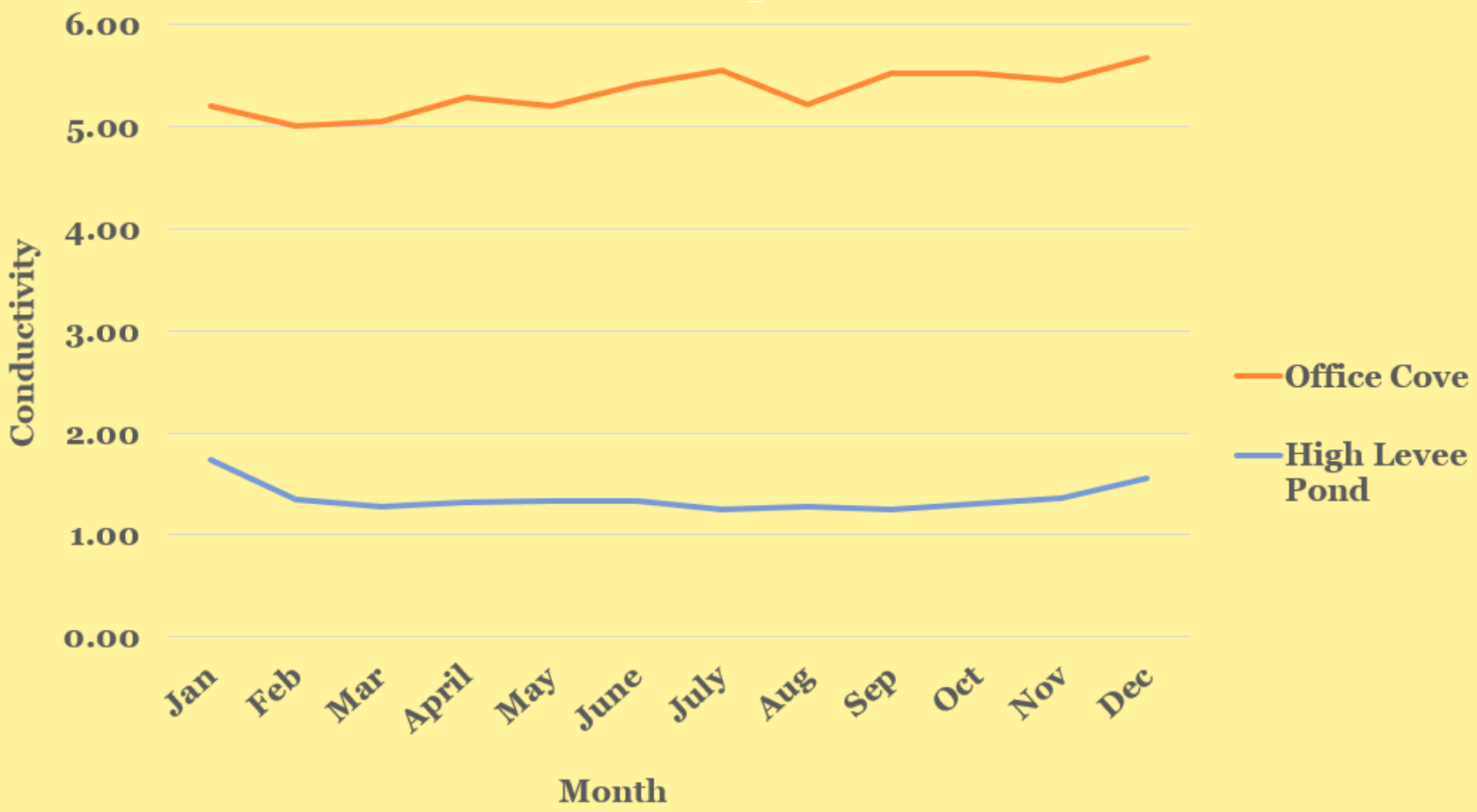
# Temperature?

# Dissolved Oxygen?

# pH


11
10
9
8
7
6
5
4
3
2
1
0
pH
Jan
Feb
Mar
April
May
June
July
Aug
Sep
Oct
Nov
Dec
Month
Office Cove
High Levee Pond

# Conductivity



# Conclusions

- Cibola High Levee is still a very valuable resource for native fish conservation in the lower river
- Office cove is questionable for razorback sucker
  - Possible recruitment?
  - Perhaps influx of freshwater (simulate upwellings in HLP) from Lake Havasu could provide better grow out conditions?
- Abundance of western mosquitofish in Office Cove could make for an abundant food source
  - Valuable backwater for bonytail?

# Future directions

- 156 and 200 razorback sucker from Achii were stocked into Office Cove and Cibola High Levee respectively
  - All under 300 mm
- Two scanners on loan from LCR-MSCP
  - Deploying biweekly in Office Cove
  - Investigate survival
- Bimonthly monitoring to observe growth and fitness in Office Cove
- HLP is the best in situ ‘laboratory’ on the river
  - Mueller and Marsh looked at habitat use of bonytail with telemetry
  - Look at habitat utilization and movement of multiple year classes of fish with remote PIT scanners?

# Acknowledgements


- John Naugle – AZFWCO
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