Bonytail post-stockling monitoring in Lake Havasu

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CRAB
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Study Area – Lake Havasu

- Lower Colorado River basin regulatory reservoir
- Last wild bonytail captured in Lake Havasu in the 1970’s
- Over 216,000 bonytail stocked since 1981
- Limited evidence of long-term survival
- No population established
Study Area – Lake Havasu

- LCR MSCP Reach 3
- Davis to Parker Dam
- Non-native sport fish:
  - Striped bass
  - Largemouth bass
  - Flathead catfish

Regional Park Moabi

Blankenship Bend

Bill Williams River
Study Objectives

- Short-term survival estimates (1-3 months)
- Monitor movements and/or movement patterns of individual bonytail
- Identify specific habitat types used or preferred
Acoustic Telemetry

- **Surgeries**
  - PT-4 or IBT-96-9-I acoustic transmitters (Sonotronics, Inc.)
  - Radio tags at Laughlin Lagoon
  - Abdominal cavity
  - Tricaine methanesulphonate (MS-222)

- **Active tracking**
  - Towable omnidirectional hydrophone
  - Directional hydrophone (triangulate)
  - Underwater diver receiver (UDR, recover tags)

- **Passive tracking**
  - Submersible ultrasonic receivers (SURs) deployed throughout the study area targeting passageways of fish movement
SUR Deployment

Season
- Autumn
- Spring

Lake Havasu, Colorado River

Regional Park Moabi

Blankenship Bend

Bill Williams River
Passive Integrated Transponder (PIT) Scanning

- Remote PIT scanning systems deployed throughout the study area following release of PIT tagged bonytail
# Study Fish

<table>
<thead>
<tr>
<th>Season</th>
<th>Location</th>
<th>Telemetry study fish</th>
<th>Mean TL (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring 2013</td>
<td>Bill Williams River</td>
<td>6</td>
<td>325</td>
</tr>
<tr>
<td>Autumn 2013</td>
<td>Blankenship Bend</td>
<td>10</td>
<td>306</td>
</tr>
<tr>
<td>Spring 2014</td>
<td>Blankenship Bend</td>
<td>12</td>
<td>346</td>
</tr>
<tr>
<td>Autumn 2014</td>
<td>Bill Williams River</td>
<td>19</td>
<td>324</td>
</tr>
<tr>
<td>Spring 2015</td>
<td>Regional Park Moabi</td>
<td>14</td>
<td>349</td>
</tr>
<tr>
<td>Winter 2015/16</td>
<td>Laughlin Lagoon</td>
<td>12 (acoustic) 12 (radio)</td>
<td>402</td>
</tr>
</tbody>
</table>
SUR Deployment Bill Williams

Autumn 2014

- Permanent SUR
- Additional SUR

1 0.5 0 1 Kilometers

Lake Havasu City
Arizona
Area of Detail
California
Blankenship Bend Autumn 2013

Number of Fish

Sample Week

fish available
fish contacted
Blankenship Bend Spring 2014

Number of Fish

Sample Week

- fish available
- fish contacted
SUR Deployment Park Moabi
Predation

- Do not attribute mortalities to surgical techniques
  - Dummy tags
  - No fish remains at tag recovery sites
- Trammel netting
  - 2 bonytail mortalities inside the digestive track of a non-native largemouth bass at Blankenship Bend

(Photo Credit: Rick Wydoski [BOR])
Avian predation

- Tags contacted under known Double-Crested Cormorant roost sites
  - Powerlines and downstream from Parker Dam
  - 5 acoustic tags
  - 14 PIT tags
Avian predation

- Talon markings
- Increased avian activity after stocking
- Observed predation events by Great Blue Heron
- Radio and acoustic
  - 12 radio
  - 12 acoustic

- Radio tags detectable out of the water but may be missed in deep water

- Acoustic undetectable out of water but work at depths
SUR Deployment Laughlin Lagoon

Winter 2015 - 2016
Recovered Radio Tag at Laughlin Lagoon
Telemetry Results

The chart shows the percentage of study fish for different study iterations and locations, categorized by mortality, lost in study area, left study area, and active status. The study iterations include:

- Spring 2013, Bill Williams River:
  - Mortality: 6%
  - Lost in study area: 4%
  - Left study area: 3%
  - Active: 1%

- Autumn 2014, Blankenship Bend:
  - Mortality: 17%
  - Lost in study area: 4%
  - Left study area: 1%
  - Active: 2%

- Autumn 2013, Regional Park Moabi:
  - Mortality: 3%
  - Lost in study area: 2%
  - Left study area: 1%
  - Active: 4%

- Spring 2014, Regional Park Moabi:
  - Mortality: 1%
  - Lost in study area: 2%
  - Left study area: 4%
  - Active: 9%

- Spring 2015, Winter 2015 - 2016, Laughlin Lagoon:
  - Mortality: 8%
  - Lost in study area: 7%
  - Left study area: 5%

- Acoustic, Radio:
  - Not applicable to the categories listed.
Comparison of recovered tags

- Five radio tagged bonytail were confirmed mortalities
  - 3 on land
  - 2 in water

- Eight acoustic tagged bonytail were confirmed mortalities
  - 2 in deep water

- If 25% of telemetry tags (3 of 12 radio tags) are expelled on land, this would account for 3 of the 4 missing acoustic tags
Minimal Movement and Habitat Data

- 49 – 84% passive contacts sundown

- Movement
  - Park Moabi & Bill Williams River: 3/43 permanently emigrated
  - 201/227 still in marina area of Laughlin Lagoon
  - Blankenship Bend: 3x greater (spring 2014 main channel release)

- Bulrush use
  - 20% of active contacts at Regional Park Moabi
  - Direct observation
Contacts within 2 weeks post stocking:
Blankenship Bend Jan 2014 97%
Bill Williams River Sep 2014 77%
Bill Williams River Dec 2014 84%
Regional Park Moabi Apr 2015 73%
Bonytail Persistence PIT Scanning

![Bar chart showing frequency of days at large for different bins.]

- [0, 60] days: 1780
- (60, 120] days: 75
- (120, 180] days: 5
- (180, 240] days: 2
- (240, 300] days: 1
- (300, 360] days: 0
- > 360 days: 7
Bonytail Size at Release and Persistence

Proportion contacted

TL at release (mm)

0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
250 300 350 400
10 25 108 233 743 698 858 862 7237 2052 5124 867 666 525 418 4320
Razorback Sucker Size at Release and Persistence

Proportion contacted vs TL at release (mm)
Summary

- Post stocking survival of bonytail is low
  - Predation by non-native fish and birds of prey (Double-Crested Cormorants and Great Blue Herons) contribute to low bonytail survival
  - Lost study fish within SUR confined study areas may be due to avian predation
- PIT scanning may be an effective means of monitoring post-stockling bonytail survival
  - PIT scanning data complement telemetry data
  - Sharp decreases in contacts after two weeks post release
- Most telemetry fish were lost or confirmed mortalities within a month after release, and few fish were available long enough post release to determine movement patterns and habitat selectivity
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