NFWG Activities

• Meet in conjunction with TWG and AMWG meetings
• Evaluate proposed and ongoing activities potentially affecting native fish in Grand Canyon region
• Contribute to development of the program of experimental flows
• Provide technical input and comment to agencies and organizations, including GCDAMP
NFWG Activities: Examples

• Arizona Game and Fish Commission: Rules Revision on Possession, Transport, and Use of Crayfish
• Arizona Game and Fish Department: Review of Watershed-based Fisheries Management Documents
• Summary of Comments: Recovery Goals for Colorado River Endangered Fishes
Upper Colorado River Basin
Humpback Chub Population Estimates

### Desolation/Gray Canyons
- Sampling since 1985 with trammel nets, hoop nets and electrofishing
- First mark/recapture for population estimates in 2001
- No population estimate available

### Yampa Canyon
- Collections 1998-2000
- Estimated population in 2000 approximately 100-2000 individuals
- Reliable population estimate seems out of reach for reasonable effort

### Cataract Canyon
- Sampling since 1979 (14 of 22 years), but no population estimate
- Perhaps 500 HBC
- Only 138 HBC of all size classes collected 1979-1999
Elements of the Reasonable and Prudent Alternative

- Develop a program of experimental flows
- Implement a selective withdrawal program and determine feasibility
- Develop a management plan for the Little Colorado River Basin
- Determine responses of endangered fish to water temperatures and flows
- Develop actions to help ensure continued existence of razorback sucker
- Establish a second spawning aggregation of humpback chub below Glen Canyon Dam
Other Threats to Endangered Fish in Grand Canyon

- Existing exotic fish, parasites, and disease organisms
- New invading exotic fish, parasites, and disease organisms
- Surface water and groundwater diversions and depletions
- Catastrophic events such as toxic spills
Grand Canyon Region Nonnative Fish

Common carp

Brown trout

Red shiner

Channel catfish
Year 2000 Experimental Releases from Glen Canyon Dam
Fish of Lake Powell

Striped bass

Threadfin shad

Largemouth bass

Walleye

Carp

Red shiner

Crappie
What Could go Wrong?

- Cold water temperatures suppress important diseases, parasites, competitors, and predators of the native fish.
- Therefore, warming the water could result in negative impacts to native fish, including the endangered humpback chub.
Upper Colorado River Basin Recovery Implementation Program

- Developed a non-native fish control strategic plan
- Conducting mechanical removal of non-native fish
- Evaluated and modified non-native fish stocking policies
- Developing tributary basin management plans
Non-native Control: Basic Themes

- Prevent non-natives from entering the system
- Remove non-natives from areas occupied by native fish
- Exclude non-natives from interactions with larval and juvenile native fishes
Strategic Approach to Non-native Control

- In what geographic areas would control measures have the most benefit?
- Which life history stages of endangered fishes are most susceptible?
- Which non-native species pose the most serious threats?
- Which control methods will be most effective?
Figure 18. Locations of nine aggregations of humpback chub in the Colorado River through Glen and Grand Canyons. Percentage of total captures are indicated for 1990–1993. (Valdez and Ryel 1995)
Strategic Approach to Non-native Control

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- Which control methods will be most effective?
Native Fish Susceptibility

- In general, highest susceptibility to predation is in larval to juvenile stages
- Higher susceptibility in confined habitats, such as nearshore rearing habitats and tributaries
- Higher susceptibility during periods of foraging
Figure 18. Locations of nine aggregations of humpback chub in the Colorado River through Glen and Grand Canyons. Percentage of total captures are indicated for 1990–1993. (Valdez and Ryel 1995)
Strategic Approach to Non-native Control

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Nonnative fish species listed as presenting problems for native fish fauna in the Colorado River Basin and southwestern United States.

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <em>Ictalurus punctatus</em></td>
<td>channel catfish</td>
<td>1</td>
</tr>
<tr>
<td>2. <em>Cyprinella lutrensis</em></td>
<td>red shiner</td>
<td>2</td>
</tr>
<tr>
<td>3. <em>Esox lucius</em></td>
<td>northern pike</td>
<td>3</td>
</tr>
<tr>
<td>4. <em>Cyprinus carpio</em></td>
<td>common carp</td>
<td>4</td>
</tr>
<tr>
<td>5. <em>Lepomis cyanellus</em></td>
<td>green sunfish</td>
<td>5</td>
</tr>
<tr>
<td>6. <em>Pimephales promelas</em></td>
<td>fathead minnow</td>
<td>5</td>
</tr>
<tr>
<td>7. <em>Notropis stramineus</em></td>
<td>sand shiner</td>
<td>6</td>
</tr>
<tr>
<td>8. <em>Micropterus salmoides</em></td>
<td>largemouth bass</td>
<td>7</td>
</tr>
<tr>
<td>9. <em>Ameiurus melas</em></td>
<td>black bullhead</td>
<td>7</td>
</tr>
<tr>
<td>10. <em>Gambusia affinis</em></td>
<td>mosquitofish</td>
<td>8</td>
</tr>
<tr>
<td>11. <em>Morone saxitilis</em></td>
<td>striped bass</td>
<td>8</td>
</tr>
<tr>
<td>12. <em>Catostomus commersoni</em></td>
<td>white sucker</td>
<td>8</td>
</tr>
<tr>
<td>13. <em>Stizostedian vitreum</em></td>
<td>walleye</td>
<td>9</td>
</tr>
<tr>
<td>14. <em>Pylodictus olivarus</em></td>
<td>flathead catfish</td>
<td>9</td>
</tr>
<tr>
<td>15. <em>Oncorhynchus clarki</em></td>
<td>cutthroat trout</td>
<td>9</td>
</tr>
<tr>
<td>16. <em>Oncorhynchus mykiss</em></td>
<td>rainbow trout</td>
<td>9</td>
</tr>
<tr>
<td>17. <em>Salmo trutta</em></td>
<td>brown trout</td>
<td>9</td>
</tr>
<tr>
<td>18. <em>Salvelinus fontinalis</em></td>
<td>brook trout</td>
<td>9</td>
</tr>
<tr>
<td>19. <em>Ameiurus natalis</em></td>
<td>yellow bullhead</td>
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</tr>
<tr>
<td>20. <em>Richardsonius balteatus</em></td>
<td>redside shiner</td>
<td>10</td>
</tr>
<tr>
<td>21. <em>Micropterus dolomieui</em></td>
<td>smallmouth bass</td>
<td>10</td>
</tr>
</tbody>
</table>
Which non-natives to control in Grand Canyon?

- Negative Impact to Native
- Susceptibility of Non-native

Optimum
<table>
<thead>
<tr>
<th>Non-native species</th>
<th>Humpback chub</th>
<th>Razorback sucker</th>
<th>Flannelmouth sucker</th>
<th>Bluehead sucker</th>
<th>Speckled dace</th>
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</thead>
<tbody>
<tr>
<td>Brown trout</td>
<td>P</td>
<td>P?</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>Channel catfish</td>
<td>D, P</td>
<td>P</td>
<td>D, P</td>
<td>D, P</td>
<td>D, P</td>
</tr>
<tr>
<td>Black bullhead</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>Common carp</td>
<td>P?,D</td>
<td>P?,D</td>
<td>P?,D</td>
<td>P?,D</td>
<td>P,D,H</td>
</tr>
</tbody>
</table>

P = Predation; D = Disease and Parasites; C = Competition; H = Habitat Alteration
<table>
<thead>
<tr>
<th>Study</th>
<th>% of predators</th>
<th>Predator(s)</th>
<th># chub consumed</th>
<th># assumed predators</th>
<th>Annual predation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Douglas and Marsh (1996)</td>
<td>3.0%</td>
<td>Channel catfish, rainbow trout combined</td>
<td>2.3/week</td>
<td>1,000</td>
<td>3,588</td>
</tr>
<tr>
<td>Valdez and Ryel (1995)</td>
<td>10.4%</td>
<td>Brown trout, rainbow trout, channel catfish</td>
<td>2.0/day 1.0/day</td>
<td>3,000 5,000 500</td>
<td>227,760 27,373 2,738 257,871</td>
</tr>
<tr>
<td>Valdez and Ryel (1995) transformed</td>
<td>10.4%</td>
<td>Brown trout, rainbow trout, channel catfish</td>
<td>2.0/day 1.0/day</td>
<td>333 333 333</td>
<td>3,602 260 260 4,122</td>
</tr>
<tr>
<td>Douglas and Marsh (1996), Valdez and Ryel (1995)</td>
<td>4.0% 10.4%</td>
<td>Channel catfish Brown trout</td>
<td>2.75/week 2.0/week</td>
<td>500 500</td>
<td>2,860 5,408 8,286</td>
</tr>
</tbody>
</table>
Strategic Approach to Non-native Control

• In what geographic areas would control measures have the most benefit?
• Which life history stages of endangered fishes are most susceptible?
• Which non-native species pose the most serious threats?
• Which control methods will be most effective?
Potential Nonnative Fish Control Actions

• Develop a nonnative fish control strategic plan
• Conduct mechanical or chemical control of more problematic and more susceptible species
• Evaluate control techniques for more problematic, but less susceptible species
• Investigate, and where appropriate, modify regulations to increase take (bag limits, gear)
• Take actions to prevent entry into the system
• Integrate dam management with other control mechanisms
"The objective is not to remove all nonnatives, as that is infeasible, but to reduce nonnative populations to a level where recovered endangered fish can co-exist."