Population dynamics of razorback sucker in Lake Mohave

Brian Kesner, Abraham Karam, Carol Pacey, and Paul Marsh

Colorado River Aquatic Biologists Meeting
January 11-12, 2012
Laughlin, NV
Model structure

Five size class model

One – 30.0 cm or less
Two – 30.1 to 35.0 cm
Three – 35.1 to 40.0 cm
Four – 40.1 to 45.0 cm
Five – 45.1 cm or more
Model structure

Post-stocking survival based on size-survival relationship
Model structure

Growth from one size class to another based on NFWG database

<table>
<thead>
<tr>
<th>Size Class</th>
<th>One</th>
<th>Two</th>
<th>Three</th>
<th>Four</th>
<th>Five</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Two</td>
<td>14</td>
<td>24</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Three</td>
<td>4</td>
<td>26</td>
<td>19</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Four</td>
<td>1</td>
<td>4</td>
<td>7</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>Five</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>17</td>
<td>52</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size Class</th>
<th>One</th>
<th>Two</th>
<th>Three</th>
<th>Four</th>
<th>Five</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>0.14</td>
<td>0.02</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Two</td>
<td>0.64</td>
<td>0.44</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Three</td>
<td>0.18</td>
<td>0.47</td>
<td>0.68</td>
<td>0.03</td>
<td>0.00</td>
</tr>
<tr>
<td>Four</td>
<td>0.05</td>
<td>0.07</td>
<td>0.25</td>
<td>0.50</td>
<td>0.00</td>
</tr>
<tr>
<td>Five</td>
<td>0.00</td>
<td>0.00</td>
<td>0.07</td>
<td>0.47</td>
<td>1.00</td>
</tr>
</tbody>
</table>
Model structure

Three values of adult survival were tested - 70, 75, and 80%
Model assessment

- Stocking records from 1992 – 2010 assigned to the five size classes
- Population size simulated based on model parameters of growth and survival
- Population estimates were not used to constrain the model
Stocking simulations

• Three different stocking regimes were simulated to estimate long-term stable population size
• Each stocking vector was based on an actual stocking year representing three target release sizes
  – 30 cm - 2002, 56% of razorback sucker stocked into Lake Mohave were larger than 30 cm
  – 35 cm - 2005, 69% of stocked razorback sucker were larger than 35 cm.
  – 50 cm - 2008, 56.5% of 978 fish stocked in 2008 were larger than 45 cm at release
Results

The graph shows the relationship between release numbers and population size over time. The data indicates an exponential growth pattern, with population size increasing as release numbers rise. The lines represent different scenarios or groups, each with a distinct growth rate.

- The x-axis represents release numbers, ranging from 0 to 15,000.
- The y-axis represents population size, ranging from 0 to 35,000.

The graph highlights the significant impact of release numbers on population growth, suggesting that higher release numbers lead to larger population sizes.
Results

Simulations based on the updated size survival relationship the equilibrium population was always **8.3 times greater** for the 50 cm target than for the 30 cm target.

Simulations based on the 2005 size-survival relationship the equilibrium for the 50 cm target was **4.7 times greater** than for the 30 cm target, cutting in half the benefit of annually stocking large fish.
Remote sensing 2011