The role of sonar in Copper River salmon escapement monitoring and commercial fisheries management

Bert Lewis, Alaska Dept. of Fish and Game
# Copper River Ten Year Average Commercial Salmon Harvest (1991-2000)

<table>
<thead>
<tr>
<th>Salmon Type</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sockeye salmon</td>
<td>1.5 Million</td>
</tr>
<tr>
<td>Chinook salmon</td>
<td>49,000</td>
</tr>
<tr>
<td>Coho salmon</td>
<td>300,000</td>
</tr>
<tr>
<td>Pink salmon</td>
<td>10,000</td>
</tr>
<tr>
<td>Chum salmon</td>
<td>18,000</td>
</tr>
</tbody>
</table>

| Total             | 1.9 Million |
Subsistence Salmon Harvest

Lower Copper River  3-5,000
Glennallen Subdistrict Subsistence  60-75,000
Chitina Subdistrict Subsistence  100-150,000
Copper River Salmon Management Difficulties

1) Glacially turbid water that prevents visual counts and

2) Lag time between fish passage through commercial fishery and their arrival at the spawning grounds
Copper River Salmon Management Difficulties

1) Glacially turbid water that prevents visual counts and

2) Lag time between fish passage through commercial fishery and their arrival at the spawning grounds
Bendix Sonar

Transducers operate at 515 kHz with alternating beam widths of 2 and 4 degrees.

The system is powered by one 12-volt battery continuously recharged by a solar panel.


Continuous use since then as one of primary management tools.
Bendix Oscilloscope
Bendix Sonar

The Bendix systems have become outdated

Difficult to repair and maintain

System cannot store raw acoustic data
Bendix Replacement

ADF&G began evaluating possible replacements
DIDSON

2 Frequency Multi-Beam Acoustic Lens Sonar

- 1.8 MHz freq: 96 - 0.3x12° beams
- 1 MHz freq: 48 - 0.6x12° beams
- Field of view: 29°
- Frame rate: 5-20 frames/s
- Weight in air: 15.4 lbs

Ray Diagram Top View

Beams formed by lens and curved element
DIDSON View Of Salmon
DIDSON Advantages

- High resolution
  - Moving targets easier to detect
- Simpler to aim
- Simpler to operate
- Accurate upstream/downstream target resolution
- Better coverage of water column
- Provides length and width of fish at short ranges
- Less multi-pathing
DIDSON Start-up Issues

- Expensive
- Power supply
- Memory storage
Power Supply
Power Supply
Data Management
South Bank Side-by-side Sonars
North Bank
Long Range Didson
PROMISING PRELIMINARY COMPARISON
- Timeseries plots of DIDSON and Bendix passage estimates (top) and the difference between the estimates, DIDSON minus Bendix, (bottom), Copper River 2003.
Time-series plots of DIDSON and Bendix passage estimates (top) and the difference between the estimates, DIDSON minus Bendix, (bottom), Copper River 2004.
• Residuals compared against quantiles of the standard normal (left) and fitted versus residual plots from the regressions of DIDSON and Bendix passage estimates with DIDSON used as the predictor variable (right)
CONCLUSION

Promising DIDSON/Bendix comparison
Transition of equipment
Validation of past escapement counts
ACKNOWLEDGEMENTS

Alaska Dept. of Fish and Game
Susan Maxwell and Dan Ashe

Miles Lake Field Crew
April, Karl, Don and Darce