Interactive Mapping and Dynamic Data Visualization – Eye Candy or Useful Tool for Fisheries Research?

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More Than Meets The Eye . . .

**BONO**  
Rockstar Lead Singer – U2  
22 Grammys. Rock and Roll Hall of Fame  
AKA Bono Vox. AKA Paul Hewson  
• Global Humanitarian Relief  
• AIDS Awareness  
• Nobel Peace Prize Nominee

**HEDY LAMARR**  
Actress – Golden Age of Hollywood  
AKA Hedwig Eva Maria Kiesler  
• Inventors Hall of Fame  
• Designed aircraft based on birds and fish  
• WWII – Invented spectrum and frequency hopping radio guidance system for torpedoes . . .

1) Prevented tracking & signal jamming  
2) Basis for Bluetooth & Wi-Fi

*Superficial examinations can be misleading*
Responsible for several relational commercial fishery databases in AK

A) CWT Release and Recoveries (Chinook and Coho – 1976 to present)
B) Otolith Thermal Mark Release and Recoveries (1994 to present).
C) +40 yrs Demographic data from numerous species and stocks.

Data for in-season fisheries management.

• How else can they be used?
• What questions can be asked and answered by examining such long-term and spatially diverse data sets?
• Example – How can I examine these data to determine if movements, recoveries, catch, etc, have changed in time and space within the context of environmental change to better inform fisheries management?

*Where do I even begin?*
Static Charts

**Pros**
- Easy to make & share
- Viewed on any platform

**Cons**
- Limited view of data
- Do not move or change
- Data are “fuzzy” (e.g. “0” may really be 0.2)
- Large values can make small values hard to see
- Limited # variables per chart

Data Courtesy of Google
Interactive Charts

Pros
• Dynamic – React to commands
• Present work with exact values

Cons
• Need support platform to view (Java)
• Special tools (Flash, JavaScript, etc)
• # variables per chart limited
How can fisheries data be combined with numerous variables to see if correlations exist? Better yet, how can this be done using data spanning many years and large areas?

**Interactive Maps (IM)**

Uses GIS to dynamically display data (catch, movements, etc) in relation to multiple variables ("layers") to visualize how they may influence patterns and relationships over space and time.
Dynamic displays provide a visualization of how variables interact to determine if any potential correlations exist.

- Display multiple layers simultaneously.
- Layers can be added/removed to clarify conditions and relationships.
- Dynamic displays provide a visualization of how variables interact to determine if any potential correlations exist.

Layers can include environmental variables like . . .
ARC GIS Online – user friendly with “out of the box” features
Google – Custom coding. Programming experience required.
SHINY App – Custom R-based coding. Programming experience required.
https://earth.nullschool.net/about.html
SST + Surface Ocean Current Estimates
Assess distribution, abundance, etc ... of groundfish & shellfish in AK
**Project Components**

Information from the INPFC/NPAFC High Seas Salmonid Tag Recovery Database (1956 to present).

<table>
<thead>
<tr>
<th>Component</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk Tags</td>
<td>CWTs</td>
</tr>
<tr>
<td>Data Storage Tags</td>
<td>Genetic Data</td>
</tr>
<tr>
<td>Otolith Marks</td>
<td>Etc.</td>
</tr>
</tbody>
</table>

**Disk Tag Recoveries (18,531)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Recoveries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pink</td>
<td>6,340</td>
</tr>
<tr>
<td>Chum</td>
<td>3,792</td>
</tr>
<tr>
<td>Sockeye</td>
<td>6,971</td>
</tr>
<tr>
<td>Coho</td>
<td>1,173</td>
</tr>
<tr>
<td>Chinook</td>
<td>166</td>
</tr>
<tr>
<td>Steelhead</td>
<td>89</td>
</tr>
</tbody>
</table>

**Data Storage Tags Recoveries (92)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Recoveries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chum</td>
<td>38</td>
</tr>
<tr>
<td>Sockeye</td>
<td>21</td>
</tr>
<tr>
<td>Coho</td>
<td>15</td>
</tr>
<tr>
<td>Pink</td>
<td>10</td>
</tr>
<tr>
<td>Chinook</td>
<td>7</td>
</tr>
<tr>
<td>Steelhead</td>
<td>1</td>
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</tbody>
</table>
Objectives

✓ Create customized dynamic maps of salmon distributions and movements

✓ Visualize ocean distribution and movement of salmon over time and space against environmental parameters such as:
  – SST
  – Chlorophyll
  – Climate indices

✓ View tag releases and recoveries by:
  – Species
  – Age
  – Origin
Accomplishments to Date (Funded by ADF&G)

• Prototype IMS (ArcGIS Pro v.2.1.2, ArcGIS Online, Web AppBuilder for ArcGIS)

• Created . . .
  1) Time series of Tag releases and recoveries
  2) Time-enable layer for SST (Monthly Averages for 1985 – 2009)
  3) Popups
  4) Map and Data Interaction Tools (“Widgets”)

<table>
<thead>
<tr>
<th>Charts</th>
<th>Printing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swipes</td>
<td>+ / - Layers</td>
</tr>
<tr>
<td>Time Lapse</td>
<td>+ / - Data</td>
</tr>
</tbody>
</table>

Result

• Dynamic display of spatial / temporal data that allows for interactive and customized examination of data.
Next Steps

• Integrate Data Storage Tag (DST) information
• Continue data discovery (Environmental Layer data)
• IMS Customization – “User Friendly”
Thoughts & Considerations

• IM provide insights into interactions that would otherwise be missed using traditional graphs. For salmon . . .

  Insights into movements and distributions relative to seasonal and environmental change.

• IM encourages data sharing, collaboration and public outreach by making complex related data easily accessible.

  1 Pic = 1000 words

• IM not quantitative – a visual way to examine lots of complex, relational data to help formulate questions and develop testable hypotheses to which quantitative and statistical approaches can be applied.