The Beginning
Development of an online hatchery release data mapping application

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OFWIM 2011 Conference and Annual Meeting
October 17-20, 2011
Drury Plaza Hotel at the Arch, St. Louis, Mo
FPC Hatchery Map Development Team

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OFWIM 2011 Conference and Annual Meeting
October 17-20, 2011
Drury Plaza Hotel at the Arch, St. Louis, Mo
Columbia River Gorge – between Oregon and Washington
Bonneville Dam and Locks
Fish Passage Center provides technical assistance and information to fish and wildlife agencies and tribes and the public on juvenile and adult salmon and steelhead passage through the mainstem hydrosystem in the Columbia River Basin.
• Database contains data for anadromous salmon species released from State, Federal, and Tribal hatcheries in the Columbia River Basin.

• Data are used for:
  • Hydrosystem fish passage management
  • Research and monitoring
  • Fishery Management
Expand FPC data system to include spatial data
Primary goals for hatchery mapping application

• User selects a hatchery and the map zooms to the extent of the hatchery and its associated release sites

• The release data are downloadable in MS Excel format
Secondary mapping application goals

• In an interactive mapping system, the user can “see” the location of sites in relation to geographic features and other hatcheries and release sites.
  • Where are sites located (river drainage)
  • What is around them
Advantages Web Mapping

- Services designed for the web
- Scalability
- Distributed audience
- Training users
- Rich feature mapping and imagery
- Standards based
Commercial vs. Open Source

• Why Open Source:
  • Easy access and installation
  • Excellent support
  • Cost
  • Integrate data from multiple sources
  • Customization
  • Standards based
  • Interoperability
  • Both websites and web services
Why not commercial or API

• API disadvantages:
  • Service limitations
  • Interfaces change
  • Cannot host critical infrastructure in-house
  • No 24/7 paid support
  • Limited ability to incorporate your own data layers
  • Potential threat of advertising in future

• Commercial disadvantages:
  • Vendor lock-in
  • Proprietary formats
  • Required experience and data
  • Cost: expensive
The Decision

- Aware of reluctance to use open source
- Examples in our area of successful organizations using open source - Trimet
  - OpenLayers, PostGreSQL, and GeoServer
- Decided advantages outweigh the disadvantages – went with open source
Designed for Audience Ease of Use

- Navigation – used familiar controls
- Search form elements
- Query Access to Data
- Table like spreadsheet
- Downloads into spreadsheet
- Output map in .pdf format
- Application functionality
- Online help
### Application functionality

<table>
<thead>
<tr>
<th>In</th>
<th>Select</th>
<th>Out</th>
</tr>
</thead>
</table>
| **Data table** | **Attribute query**  
- Hatchery name  
- Release site name  
- Species  
- River zone  
- Drainage basins (HUCs) | **Data table** |
| **Map** | **Spatial onscreen query**  
- Map points by type  
- Map lists by name  
- River zone  
- Drainage basins (HUCs)  
- Rectangle  
- Plus attributes  
- Basemap features - non-selecting  
  - Cities  
  - Lakes, reservoirs  
  - Counties  
  - Shaded relief | **Data Download**  
- Excel  
- CSV  
- PDF  
- Map |
**HatcheryMap Stack**

**BACK-END TIER**
- Spatial Database server: PostgreSQL / PostGIS
- Data conversion tools: GDAL / OGR
- Spatial Data

**MIDDLE TIER**
- UMN MapServer
- Tile cache
- PHP, MapScript

**FRONT TIER**
- p.mapper
- PHP, MapScript
Components of a MapServer Application

**F R O N T T I E R**
- **HTML Template**
  - Page layout
  - Map navigation
  - JavaScript or other

**M I D D L E T I E R**
- **MapServer**
  - Map generation
  - Query execution
  - Request execution
  - WMS standards
- **Mapfile**
  - Layers
  - Symbology
  - Annotation
  - Reference map

**B A C K - E N D T I E R**
- **PostGreSQL, POSTGIS, OGR / GDAL**
- **GIS Data**
  - Shapefiles
  - Rasters
  - ArcSDE
  - PostGIS

**P. mapper**
- Php, mapscript
- **MapScript**
  - Links MapServer to HTML page
  - Customization
  - Perl/PHP/Python

**I/O From User**

**Map Requests**

**Data Retrieval**

**Map Images**
Why UMN MapServer

- Compatibility with the tools, languages and software we currently use
- Mapping standards
- Scalable to 64 bit
Why PostgreSQL and p.mapper

- **PostgreSQL advantages**
  - Capable to store the nonspatial and a spatial data
  - Powerful, open source relational database system.
  - PostGIS is a project which adds support for geographic objects in PostgreSQL

- **P.mapper advantages**
  - User-friendly interface to MapServer
  - P.mapper functionality meets our primary goals
**Development**

- **Mapped sites**
  - Developed Google api tool to ground-truth sites
  - Added some hatchery sites as release sites
  - For uncertain site locations, choose location ½ mile upstream from the mouth

- **Data creation and conversion**
  - Points were mapped in ArcMap, projected from the Google Spherical Mercator, converted using OGR and stored in PostgreSQL
MAPPED HATCHERY AND RELEASE LOCATIONS
- Install and test map stack software
- Decide search functions
- Establish unique geographic ids
  - Many to many relationship, spatial-temporal relationship
- Create HatRel Layer
Development

- Create prototype HatcheryMap app for spring Chinook
- Map file creation
  - Choose layers
  - Choose map feature symbology
  - Choose when layers become visible
  - Setup the four groups of layers
LAYER
NAME 'Major_streamsnames_2500000'
TYPE LINE
  CONNECTIONTYPE postgis
  CONNECTION "dbname='template_postgis'
    host='localhost' port='5432' user='*****'
    password='*******"
DATA "the_geom from (select the_geom, gid, name from crbmjrstreams) AS new_tab USING UNIQUE gid"
PROCESSING "CLOSE_CONNECTION=DEFER"
TOLERANCE 3
TOLERANCEUNITS pixels
  STATUS DEFAULT
PROJECTION
  "init=epsg:2153"
END
METADATA
"DESCRIPTION" "Major_streams"
"ows_title" "Major_streams"
END # Metadata
TRANSPARENCY 100
LABELITEM 'name'
CLASS
NAME 'crbmjrstreams'
STYLE
SYMBOL "circle"
SIZE 2
OUTLINECOLOR 76 153 229
COLOR 76 153 229
END
LABEL
COLOR 0 0 255
SHADOWCOLOR 211 211 211
SHADOWSIZE 2 2
TYPE TRUETYPE
FONT FreeSerifItalic
SIZE 10
ANGLE follow
OFFSET 0 0
ANTIALIAS TRUE
PARTIALS TRUE
POSITION auto
BUFFER 20
MINDISTANCE 20
minfeaturesize 50
END # end of label
END
MAXSCALEDENOM 2500000
MINSCALEDENOM 1600000
END
• Created custom User Interface
• Programmed search functions
• Tested
• Fixed and adjusted
• Deployed prototype
• Made changes

FPC Data System

Development...

```xml
<searchitem name="hatsite_suggest_pg" description="Type 1st ltr of hatchery for loc. and relsites">
  <layer type="postgis" name="HatRelSites_Data">
    <field type="s" name="site_hatnamedesc" description="Type 1st ltr of hatchery name" wildcard="2">
      <definition type="suggest" connectiontype="db" sort="asc" minlength="1" dependfld="site_hatnamedesc">
        <dsn encoding="UTF-8">
          postgres://mermaid37@localhost/template_postgis</dsn>
        <sql>SELECT DISTINCT site_hatnamedesc FROM allfish_hatrels_reldata WHERE site_hatnamedesc ~* '^[search]'
          ORDER BY site_hatnamedesc</sql>
      </definition>
    </field>
  </layer>
</searchitem>
```

Views (16)
- allfish_hatrels_reldata
- chfa_hat_reldata
- chfa_hatrels_reldata2
- chsp_hatrels_reldata
- chsu_hatrels_reldata
- chum_hatrels_reldata
- coho_hatrels_reldata
- cutr_hatrels_reldata
- pg_buffercache
- pg_freespacemap_pages
- pg_freespacemap_relations
- sock_hatrels_reldata
- stsu_hatrels_reldata
- stwi_hatrels_reldata

.zoombox {
  position: relative;
  visibility: visible;
  width: 1px;
  height: 1px;
  border-color : #FF0000;
  border-width : 1px;
  border-style : solid;
  z-index:90;
  background: #eeeeee;
  layer-background-color: #eeeeee;
  filter: alpha(opacity=40);
  -moz-opacity:0.4;
}
• The database is dynamic and real-time
• Required the development of C# application to query the MSSQL server and copy the release data to the spatial database
• Developed apps for each species
• Developed a Launch Interface
  • Quick Instructions for app

• Documentation
  • Quick and online help
  • Manual
  • Metadata
• Developed separate Express and Pro Editions
Maintenance cycle
Maintenance...

- Release sites are added and moved
- Program to incorporate changes in release sites
FPC HatcheryMap app
FPC HatcheryMap app

Search for
Type 1st ltr of hatchery for loc. and relsites
Select hatchery for loc. and relsites
Type 1st ltr of relsite
Select release site
Type 1st ltr release river
Select release river
Select river zone for sites in zone
Select HUC number-name for sites in HUC
Select HUC name for sites in HUC

Select hatchery from list
KALA - Kalama Falls Hatchery
KLIH - Klickitat Hatchery
KOOS - Kooskia NFH
IMNH - Imnaha Acclim. Pond
IMQS - Imnques Acclim. Pond
IRR1 - Irrigon Hatchery Complex
KAL - Kalama Falls Hatchery
KLIH - Klickitat Hatchery
KOOS - Kooskia NFH
LEAB - Leaburg Hatchery
LEAV - Leavenworth NFH
To identify hatcheries, release sites or lakes using the Tool Tip Tool:

The Tool Tip tool is used to identify the names of several objects quickly. It allows the user to drag the mouse across the map and see the names of the objects in the Tool Tip dialog box. Note: All other data layers are identified by turning on label layers. Some data layers have their labels automatically turned on (i.e. stream layers and stream label layers are automatically turned on).

1. Click on the tool tip tool in the toolbar.

2. Choose either Hatcheries, Relsites or Lakes depending on the type of site you want to identify from the “Apply on layer” drop-down menu found in the upper right corner of the main map.

3. Drag the mouse cursor over an object from the chosen layer (chosen in step 2).

4. The object id, code, name other information will appear in the Tool Tip dialog box.
FPC HatcheryMap app
FPC HatcheryMap app

Query Hatchery Releases - All Salmonids

Layer: Hatcheries and RelSites - Data

<table>
<thead>
<tr>
<th>gid</th>
<th>data_id</th>
<th>site_hatch</th>
<th>site_relsitenamedesc</th>
<th>site_huc</th>
<th>site_hucnam</th>
</tr>
</thead>
<tbody>
<tr>
<td>1141</td>
<td>9912</td>
<td>CLAH</td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>5202</td>
<td>CLAHBLUE</td>
<td>BLUE - Blue River</td>
<td>17090004</td>
<td>McKenzie</td>
</tr>
<tr>
<td>149</td>
<td>4199</td>
<td>CLAH-CLAH</td>
<td>CLAH - Clackamas Hatchery</td>
<td>17090011</td>
<td>Clackama</td>
</tr>
<tr>
<td>149</td>
<td>4386</td>
<td>CLAH-CLAH</td>
<td>CLAH - Clackamas Hatchery</td>
<td>17090011</td>
<td>Clackama</td>
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<td>4167</td>
<td>CLAH-CLAH</td>
<td>CLAH - Clackamas Hatchery</td>
<td>17090011</td>
<td>Clackama</td>
</tr>
</tbody>
</table>

X: 152817  Y: 4968525

Regional Scale - 1 to 6 000 000
River Zone Scale - 1 to 2 500 000
Future Work

• Develop API map with aerial photographs
• Use HatcheryMap App as a model to develop other apps for specific research.

• Move to a 64 bit version of MapServer