Jun 27th, 10:40 AM - 11:00 AM

Session A1 - Basinwide approaches to prioritizing stream connectivity projects

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Basinwide approaches to prioritizing stream connectivity projects

Jed Wright & Alex Abbott - USFWS
Tara Trinko Lake & Dan Kircheis – NMFS
Jesse O’Hanley – University of Kent
Background
Barrier inventory approach
Data summary
Basinwide connectivity approaches
Strengths and limitations
Next steps
Background

Where are they?

What’s their impact?

How do we assess them?

How do we fix them?
Maine Barrier Inventory Partners
Barrier Inventories  Maine Barrier Survey Manuals
Barrier Invenories

Essential for Navigation and Planning

Casco Bay
Barrier Survey Atlas
June 2009

Legend

<table>
<thead>
<tr>
<th>Map Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>A1 - A16</td>
<td>Map Codes</td>
</tr>
<tr>
<td>1 - 16</td>
<td>Page Numbers</td>
</tr>
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</table>

GPS Receiver
Digital Camera
Measuring Tools
Clipboard
Forms & Manuals
More than 25% of Maine Road Crossings Surveyed

Barrier Inventories
Severe Barriers (Blocked $\geq 50\%$ or Perched)

268

Lower Penobscot Barrier Surveys

Data Summary

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<tr>
<th></th>
<th>2007</th>
<th>%</th>
<th>Total</th>
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<td>Inaccessible</td>
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<td>Blocked Inlets</td>
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<td>Perched Outlets</td>
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<td>33</td>
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<tr>
<td>No Crossing Substrate</td>
<td>349</td>
<td>63</td>
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<td>Dams - Impassable</td>
<td>22</td>
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<td><strong>Severe Barriers</strong></td>
<td>268</td>
<td>49</td>
<td>778</td>
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Penobscot Barrier Surveys 2007 - 2010

Data Analysis & Priorities

Functional Networks (BAT)

Before Penobscot Project

Network Accessible to Diadromous Fish = 374 miles

Historical Network Accessible to Diadromous Fish = 5,500 miles

Mean Blocked Functional Network = 4.8 miles
Basinwide multi-barrier prioritization
Objective: Maximize habitat connectivity (habitat units, quality, type, length) while minimizing cost

Diadromous species: Upstream access

Resident species: Bi-directional connectivity
Jesse Rush
O’Hanley and
David
Tomberlin
(2005)

Watershed connectivity
assessment
$150,000
3.8 km
$26,316 / km

Watershed connectivity assessment
Model Inputs

• Site ID
• Cost to fully repair or remove a barrier
• Current upstream passability of a barrier
• Habitat/stream length upstream
• Number of downstream barriers and IDs
• Number of upstream barriers and IDs
GIS Based Atlantic Salmon Habitat Model
Based on dam and road-stream crossing inventories in the Penobscot River Watershed, the current fully accessible and suitable habitat is as follows:

- Grey (0) represents areas with no suitable habitat.
- Yellow (1) indicates areas with limited suitable habitat.
- Green (2) shows areas with moderate suitable habitat.
- Dark green (3) signifies areas with the highest suitable habitat.

The map provides a visual representation of habitat quality scores across the Penobscot River Watershed.
Based on dam and road-stream crossing inventories

Penobscot River Watershed

Current Fully Accessible and Suitable Habitat

5,221 habitat units

Habitat Quality Score

0
1
2
3
Watershed connectivity assessment
Watershed connectivity assessment

Portfolios 1-4

Acres

Portfolios 1-4

$- $2,000,000 $4,000,000 $6,000,000 $8,000,000 $10,000,000 $12,000,000 $14,000,000 $16,000,000

Acres

$- $2,000,000 $4,000,000 $6,000,000 $8,000,000 $10,000,000 $12,000,000 $14,000,000 $16,000,000

P1
P2
P3
P4
Portfolio 1
Budget: $2 million

Watershed connectivity assessment
Portfolio 2
Budget: $2 million

Watershed connectivity assessment
Portfolio 3
Budget: $2 million
Portfolio 4
Budget: $2 million
Bi-directional connectivity

Connectivity status (Deibel et al. 2009)

Measure of the access to and from the range of seasonal or developmental habitat types that a fish uses (baseline, 1 is a system with no barriers).

Takes into account the quality, distance and level of connectivity to different stream habitat types.

Connectivity weighted habitat status (O’Hanley et al. 2010)
Model Inputs

- Cost to fully repair or remove a barrier
- Current upstream passability of a barrier
- Current downstream passability of a barrier
- Strahler stream order
- Habitat quality
- Segment length
- Distance along the stream network between each beginning of a segment to the end of every other segment
- List of barriers that are found between the beginning of a segment to the end of every other segment
- Typical seasonal dispersal distance
Watershed connectivity assessment
Watershed connectivity assessment

C_{avg} = 0.41
Watershed connectivity assessment

$C_{avg} = 0.58$

Connectivity Improvement
- $0.000000000 - 0.183121000$
- $0.183121001 - 0.366242000$
- $0.366242001 - 0.549363000$
- $0.549363001 - 0.732484000$
- $0.732484001 - 0.915605000$
- Watershed

$1.6$ million
Optimization vs. prioritization/ranking
Budget - $10,000
Budget - $20,000
Budget - $30,000
Budget - $40,000
Cost data
Sensitivity analysis
Scenario testing
Integrate optimization within GIS
Data currency
Institutionalize surveys and databases
Prioritization within optimization
## Watershed connectivity assessment

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<td>0.995</td>
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Criteria for Connectivity
Spatial Decision Support Tools

- Dynamic
- Accessible/Interactive
- Expert input
- Transparent
- Multi-objective
- Scalable

Common needs – components exist Pool resources?
Thanks to the following individuals

**USFWS**: John Sweka, Scott Craig, Charles Soucy
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**The Nature Conservancy**: Josh Royte, Erik Martin