Addressing the Data Gap for Intertidal Forage Fish Spawning Habitat in British Columbia

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ADDRESSING THE DATA GAPS

Surf smelt and Pacific sand lance

Spawning ecology in British Columbia

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INTRODUCTION
Sea Watch Society and the
BC Shore Spawners Alliance Project
Pacific Sand Lance and Surf Smelt spawning habitats

RESULTS/DISCUSSION
1. Positive Spawning Beaches Detected
2. Forage Fish Data Atlas
3. Spawning Seasons and Spawning Duration
4. Habitat Attributes
5. Forage Fish spawning Habitat Assessments
6. Habitat Restoration

SUMMARY and ACKNOWLEDGEMENTS
SEA WATCH SOCIETY

• Provide scientific oversight and expertise to DFO, Provincial and Municipal governments

• Train and oversee community-based citizen science teams to assist with spawning surveys

• The BC Shore Spawners Alliance
  35 communities strong and growing

• ALL VOLUNTEER EFFORT!
  - no government funding
  - some limited funding from Pacific Salmon Foundation
Pacific sand lance
Spawning habitat

- spawn on gravel/sand to sand beaches
- November – February
- In British Columbia, no government surveys to identify spawning habitat
Surf smelt
Spawning habitat

- WA State: Spawning sediments range from coarse gravels to fine pea gravels
- WA: Spawning restricted to beach face on upper 1/3rd of the intertidal zone
- WA: Summer, winter and year round spawning stocks

BC - Commercial and Recreational Fisheries
BC: No government surveys to document spawning areas
Puget Sound Washington State

Surf smelt and Pacific Sand Lance Spawning Habitat Surveys
Over 40 years of data collection and critical habitat protection

Figure 4. Documented Puget Sound surf smelt spawning beaches as of October 2005.

Figure 6. Documented Puget Sound sand lance spawning beaches as of October 2005.
1. British Columbia Spawning Locations Prior to 2000

- Furry Creek, Howe Sound
- Sandy Cove, West Vancouver
- Wreck Beach, Vancouver
- White Rock
- Dundarave Beach, West Van
- Port Renfrew

No data on sand lance spawning sites

Surf Smelt Spawning Locations

- Spawning Survey
- Adults recreationally fished
- Furry Creek, Howe Sound
- Sandy Cove, West Vancouver
- Wreck Beach, Vancouver
- White Rock
- Dundarave Beach, West Van
- Port Renfrew

ONE BIG DATA GAP!
1. Spawning Sites for Surf Smelt and Sand Lance to Dec 2013

Survey Effort:
Throughout Strait Of Georgia and West Coast Vancouver Isl

Total Beaches

Monitored: 100+
Positive: 69
PSL: 43
SS: 26

BC Forage Fish Atlas
2. Online - Forage Fish Data and Management Atlas

Surf smelt spawning sites – Dundarave Beach, West Vancouver
Modified shoreline

Surf smelt spawning sites – Wreck Beach, Vancouver
Natural shoreline

All meta, attribute, and egg data are available on our Forage Fish Atlas designed by Sea Watch Society

Funded by Emerald Sea Biological and Department of Fisheries and Oceans
3. BC SPAWNING SEASONS and DURATION OF SPAWNING

- Pacific Sand Lance – Nov-January
- Surf Smelt Spawning Stocks – summer and winter spawning stocks
- Prior to our surveys, BC literature only referred to summer surf smelt spawning stocks.
- Surf Smelt – evidence is growing for year round spawning at North & Central Saanich & Victoria

BUT, the Department of Fisheries and Oceans still has not developed timing windows or basic guidance policies to protect spawning habitats.
4. HABITAT ATTRIBUTES—Beach Sediments & Drift Cell Zone

**BEACH SEDIMENTS**

Percentage of Positive Beaches by Sediment Category

<table>
<thead>
<tr>
<th>Sediment Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td>51%</td>
</tr>
<tr>
<td>Pea pebble</td>
<td>41%</td>
</tr>
<tr>
<td>Medium Pebble</td>
<td>7%</td>
</tr>
<tr>
<td>Coarse Pebble</td>
<td>0%</td>
</tr>
</tbody>
</table>

**DRIFT CELL BEACH TYPES**

Percentage of Positive Beaches by Drift Cell Type

<table>
<thead>
<tr>
<th>Drift Cell Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosion</td>
<td>38%</td>
</tr>
<tr>
<td>Transport</td>
<td>33%</td>
</tr>
<tr>
<td>Accretion</td>
<td>63%</td>
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</tbody>
</table>

Surf smelt and Pacific sand lance spawn in all three drift cell zones.

Majority of spawning in Transport and accretion zones.

Smelt spawn on coarse pebble
4. HABITAT ATTRIBUTES—
Vertical Elevation of Spawning
South Coast Data

Vertical height above
Canadian Chart Datum (meters)

PUGET SOUND

Pacific Sand Lance
Lower limit = +5 feet US Chart Datum
OR Canadian Chart Datum
= +6.5 feet or +1.98 m

PSL +1.34 – 5.0 meters
SS +1.5 – 4.5 meters

For Pacific sand lance, results are lower than Puget Sound
4. HABITAT ATTRIBUTES – Fetch and Exposure

MAXIMUM FETCH (KM) Rating of Positive Spawning Beaches

Fetch – distance wind travels over open water

BEACH EXPOSURE

Exposure – Semi-exposed beach

EXPOSURE CLASSES

POSITIVE BEACHES

<table>
<thead>
<tr>
<th></th>
<th>Protected</th>
<th>Semi-Protected</th>
<th>Semi-Exposed</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSL</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>SS</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>9</td>
</tr>
</tbody>
</table>
5. Forage Fish Spawning Habitat Suitability Model

Need to produce tools that produce results faster:

- Lack of spawning surveys, maps, extremely limited “professional capacity” AND no funding
- Dismantling of DFO Habitat Department AND no government staff
- Revisions to *Fisheries Act* weakening habitat protection
- Ineffective “Best Management Practices”
- Rapid development of industries and resources impacting our shores

BC: RESULTS of “Best Management Practices” policies

- Boat ramps
- Loss of spawning habitat
- Denman Island beaches as roads
1. Grain-Sizes – Surf smelt

Surf smelt:

• “bulk of the sediment 1-10 mm”

(WDFW, Dan Penttila, 2001)
5. Forage Fish Spawning Habitat Suitability Model

1. Grain Sizes – Surf Smelt - Positive beaches

- WDFW, D. Penttila published data, 2001 and de Graaf unpublished data

- Potentially 4-5 distinct beach types when we critically examine ALL these data

- Curves are statistically different from each other
5. Forage Fish Spawning Habitat Suitability Model

1. Grain-Sizes – Pacific sand lance

Pacific sand lance:
“bulk of the sediment for 67% of the samples 0.2-0.4 mm

“bulk of the sediment for 25% of the samples 1-7 mm”

WDFW, Dan Penttila, 2001
5. Forage Fish Spawning Habitat Suitability Model

2. Grain Sizes – Pacific sand lance - Positive beaches – WDFW describes 2 beach types

- WDFW, D. Penttila published data, 2001
  and de Graaf unpublished data

- Potentially 3 distinct beach types when we critically examine ALL these data

- Curves are statistically different from each other
Science-based method to determine suitability of beach units

- Step 1:
  Grain-size curves of “positive” samples are compared to “potential” samples.

- Step 2:
  Principal Component Analysis and Similarity Indices of beach metrics of “positive” samples are compared to “potential” samples.

Database developed of positive and negative results.

5. Forage Fish Spawning Habitat Suitability Model

PCA – Primer 6 software

Positives – Surf Smelt
  triangles (2 Beach Types)
  red diamonds (2 Beach Types)

“Potentials”
  light blue Squares
  pink circles

“Suitable”: = Ovals
5. Forage Fish Spawning Habitat Suitability Model

Examples:

North Pender Forage Fish Suitable Spawning Beaches

Islands Trust Fund Sensitive Ecosystem Mapping With Sea Watch Society
6.0 HABITAT RESTORATION – LAWSON CREEK

SHORELINE EROSION MITIGATION PROJECT
West Vancouver

2007 - City launched a program to rebuild beaches lost to sea walls for storm wave protection

Community stewardship groups monitor beaches for surf smelt spawning

RESULTS
Beach elevation has dramatically increased 2010
• Surf Smelt spawning detected
• Bull kelp
• 56 Coho came back
6.0 HABITAT RESTORATION

• North Arm Lower Fraser River Eulachon

Oolichan fisherman, Terry Slack, has produced an “traditional knowledge” report showing where oolichan once spawned (5 locations; multiple beaches).

Location: Oak Street Bridge, Vancouver, BC

South Coast eulachon runs are depressed

Fraser River stock: Canadian Government may soon list them under COSEWIC
SUMMARY

SPAWNING – 69 Positive Beaches

SEASONS AND SPAWNING DURATION

Pacific sand lance spawning season: November- Jan (Feb sampling missing)
Surf smelt: Summer and Winter spawning stocks mixed throughout the SOG
- several Year-Round Spawning beaches

HABITAT ATTRIBUTES

1. Sediments – PSL and SS utilize the full range of sand/pebble sizes

2. Drift Cell zone – SS spawn detected in all three zones; PSL detected in all zones but majority of sites were in transport and accretion zones

3. Spawning Vertical Elevation – PSL/SS lower than that recorded in Puget Sound

4. Fetch – SS spawning beaches: 32-73 km Maximum Fetch
   PSL spawning beaches: 2-100+ km Maximum Fetch
   Maximum Fetches may be higher than in Puget Sound

5. Beach Exposure Classes: PSL and SS spawn detected in all three exposure classes
SUMMARY

FORAGE FISH SPAWNING HABITAT SUITABILITY MODEL
A science-based methodology to assess forage fish habitats
• 4-5 surf smelt beach types
• 3 Pacific sand lance beach types
• Assessments have been completed and are under way for large areas of the South Coast

HABITAT RESTORATION OPPORTUNITIES
West Vancouver – Lawson Creek

North Arm Fraser River, Vancouver – Oolichan spawning habitat restoration opportunities exist
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Edi Johnson, Dorrie Woodward, Denman Is. Crew Tony Quinn, Hornby Is. Crew John Dunn, Michelle Ferrby, Kim Pepler, Nanaimo Crew

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Haida First Nation, World Wildlife Fund, James Casey, Lynn Lee, Jason Shafto, Patrick Fairweather, Sharon Jeffery

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**Surf smelt**
North American Distribution
Aleutian Islands to Mexico

North East Pacific Ocean
Japan to AK – Mexico
(subspecies: *Hypomesus pretiosus japonicas*
Japanese surf smelt”

**Pacific sand lance**
North American Distribution
Southern Beaufort Sea to Baja California

(there are other “sand eel” species with similar distribution)