May 2nd, 10:30 AM - 12:00 PM

**Monitoring the movements of a critical marine resource: tracking a forage fish in Puget Sound**

Theresa Liedtke  
*Geological Survey (U.S.), tliedtke@usgs.gov*

Ryan Tomka  
*Geological Survey (U.S.)*

Collin Smith  
*Geological Survey (U.S.)*

Lisa Gee  
*Geological Survey (U.S.)*

Dennis Rondorf  
*Geological Survey (U.S.)*

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Liedtke, Theresa; Tomka, Ryan; Smith, Collin; Gee, Lisa; and Rondorf, Dennis, "Monitoring the movements of a critical marine resource: tracking a forage fish in Puget Sound“ (2014). *Salish Sea Ecosystem Conference. 72.*  

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Monitoring the movements of a critical marine resource: tracking a forage fish in the Salish Sea

T. Liedtke, R. Tomka, L. Gee, C. Smith, & D. Rondorf

Western Fisheries Research Center
Columbia River Research Laboratory
U.S. Department of the Interior
U.S. Geological Survey
Background

- Forage fish guild: Important marine resource
- WDFW 30 year dataset on spawning
  - Spawning beaches
  - Seasonal timing
- Large data gaps
  - Movement and distribution
  - Site fidelity
  - Feeding ecology
Acoustic Telemetry

Powerful tool
- Monitor individual animals
- Fine-scale movement information

But…..
- Requires a big assumption: limited tag effects
- Best to have some baseline info to design monitoring

Our effort was a pilot study designed to:
1) Test fish handling & tag implantation procedures
2) Collect baseline data to inform future efforts
Methods

- **Vemco 69 kHz**
  - V7 tags (73 d life)
  - Compatible with other deployed receivers

- **Ross Pt in Sinclair Inlet**
  - Well document spawning beach
  - Popular recreational fishing site
  - Dip netting with local fishers

- **Tagged 12 males in Nov 2012**
  - Mean size: 167 mm FL and 43 g
  - Mean tag burden 3.8%
Also did limited mobile tracking in Sinclair Inlet

13 monitoring locations
> 90 d deployment

5 receivers
2 receivers
ATTENTION: SURF SMELT ANGLERS

TAG REWARD

- Made fish visually distinct
  - Dorsal beads & ventral stitches
- Signs at all fishing access points
- Word of mouth

[Images of fish with beads and stitches]
Results

All fish detected within a few days of release

Detections restricted to:
- Ross Pt: all individuals
- Port Washington Narrows: 1 individual

Port Washington Narrows
- Good detection across channel
- Ross Pt for 6 d after release
- Not detected again
Ross Pt

Station positioned to monitor the spawning beach

Spawning beach across the Inlet

Not within range of Ross Pt station
Ross Pt Results

- Average of 6 visits to the site (max 17)
- Residence time: 2.2 h (max 8 h)
- Lag time: 2.3 h (max 5 d)

Graphs showing:
- Number of fish detected over dates
- Number of days detected for individual fish

Mean number of days detected: 10 d
Maximum number of days detected: 44 d
Where did they all go?

No longer at Ross Pt
Not detected elsewhere

Possibilities:

- Fish died
- Left Sinclair Inlet without being detected
- Within Sinclair Inlet but outside of detection range
  - Detections at spawning beach on opposite shoreline (mobile)
- Captured by recreational or commercial fishers

1 reward issued
Large commercial effort
Ross Pt Detections

### Detections by Photoperiod

- **Daylight**: 81% (N=1481)
- **Crepuscular**: 6% (N=127)
- **Dark**: 3% (N=151)

### Tide Classification

- **Low Tide**
- **Highest Tide**

### Hourly Detections

- 00:00:00 - 06:00:00: 0 detections
- 06:00:00 - 12:00:00: 300 detections
- 12:00:00 - 18:00:00: 200 detections
- 18:00:00 - 24:00:00: 100 detections
Next Steps

- Full-scale effort in fall-winter of 2014-2015
  - Tag fish earlier in the season
  - Mix of males and females

- Focused monitoring in Sinclair Inlet
  - Head of the Inlet
  - Alternate spawning beach
  - Detailed movements around Ross Pt
Study Context

Part of a larger USGS program
- Coastal Habitats in Puget Sound (CHIPS)
- Interdisciplinary approach

Address some of the forage fish data gaps
- Focus on habitat

Current research topics include:
- Sand lance burrowing habitats
- Habitat use & food habits of juvenile sand lance & surf smelt
Study Relevance

Movement & phenology information useful for:

- Modeling efforts
  - Climate impacts
  - Contaminant exposure risk
  - Trophic dynamics
    - Predator-prey interactions
    - Seabirds, salmon, marine mammals

- Habitat protection & restoration

- Resource management
  - Stock monitoring
Special Thanks

Jerry Twogood & Chuck Gautier
Coastal Conservation Association of Washington
Doris Small & Chris Waldbilling
WDFW Port Orchard office
Questions?
Transmitter selection

- V7-2x-A69-1303
  - 73 day tag life
  - 45 second nominal pulse rate
  - 30-60 sec pulse rate range
  - 1.6g in air