

Forage Fishes & the Beach

Forage fish
habitat research,
restoration and
protection



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Friends *of the*
San Juans

Shorelines Dominate the San Juans

- > 400 Islands
- 621 square miles
 - 174 sq. mi LAND
 - 447 sq. mi WATER
- 410 miles of marine shoreline in San Juan County
- Stretched out SJC shores would reach from Eugene, Oregon to Vancouver, BC!



SJC Marine Shorelines

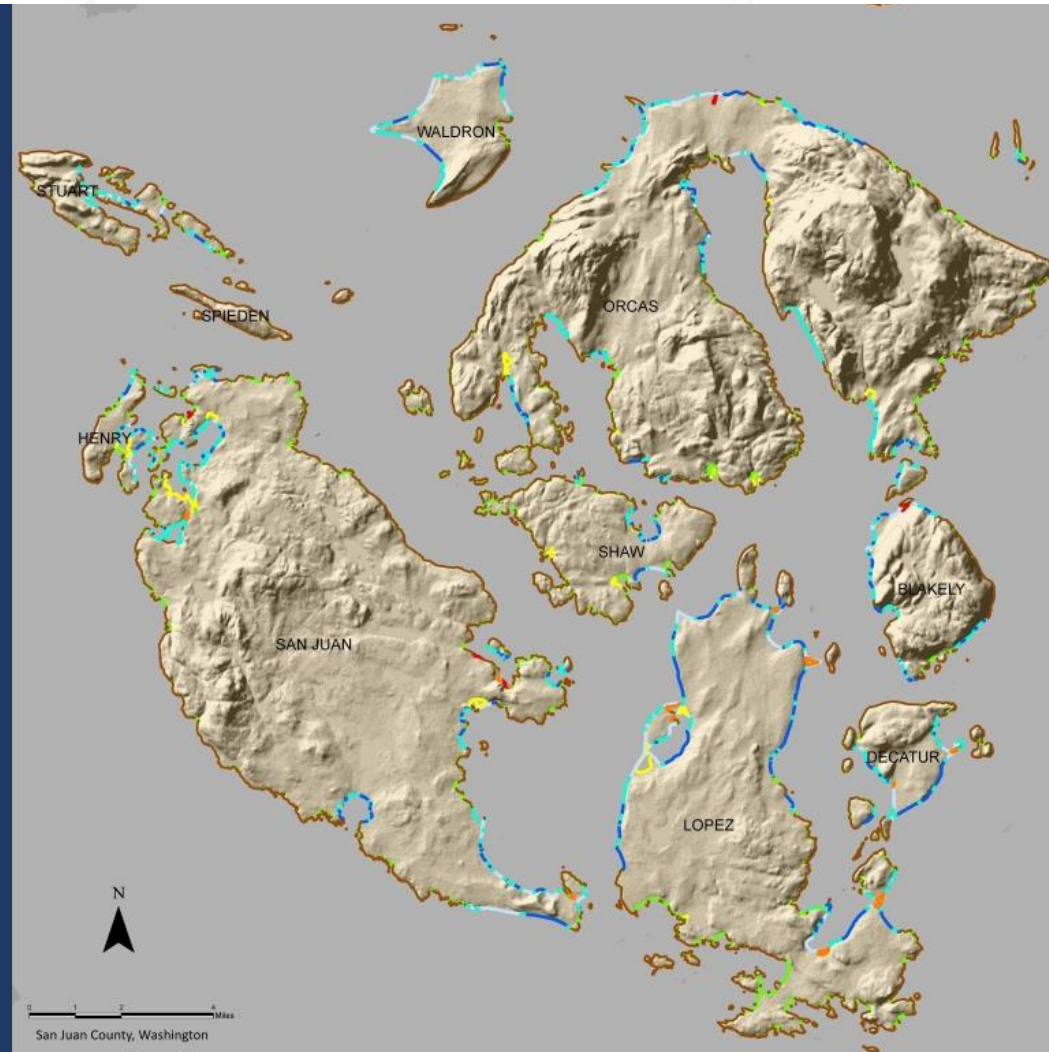
- diverse shoreline types
- high ecological values
- local and regional ecosystem services
- > 90% parcels private



Diverse shoreline geology= diverse habitats

Artificial Embayments - Estuary Feeder Bluff Rocky Shoreline
Barrier Beach Embayments - Lagoon Pocket Beach Transport Zone

Shoreform	Count	Length in Miles
Artificial	11	2.6
Barrier Beach	185	25
Transport Zone	404	34
Feeder Bluff	432	30
Embayment-estuary	38	12
Embayment-lagoon	16	5
Pocket Beach	945	48
Rocky Shores	1,185	250
sum	3,216	408 miles



Nearshore Fish Utilization

- 69 species of fish- SJC has high nearshore fish diversity
- Forage fish 40% catch (sand lance dominant)
- Juvenile salmon 10% catch (chum, pink, chinook & coho)
- Every region & shoretype of SJC had juvenile salmon but some much more likely= bluffs and pocket beaches!
- Genetics showed 20 of 22 Puget Sound chinook stocks present plus Vancouver Island and mainland BC stocks



Forage Fish Key in Marine Food Webs

Important for juvenile & adult chinook salmon



J. Newley

Critical Food Web



12 species of marine mammals, including Minke whales, harbor seals and Dall's Porpoise depend on surf smelt, Pacific herring and Pacific sand lance.

Critical Food Web

Over 45 species of fish in the Salish Sea depend on forage fish as important prey items.

Forage fish are dominant food items for coho & Chinook salmon, ling cod and dogfish.



Critical Food Web

- Out-migrating juvenile salmon rely heavily on larval & juvenile forage fish as a food source.
- Juvenile salmon also eat insects from terrestrial sources including shoreline forests, wetlands and streams.
- Another major component of the juv. salmon diet is plankton.



Critical Food Web

Forage fish are an important food source for 40 species of birds in our region



Including the federally listed Marbled Murrelet.

3 key species of forage fish in San Juan County

All three depend on healthy shoreline habitats for spawning



Pacific sand lance



Surf smelt



Pacific herring



Sand lance & surf smelt spawn on beaches



Herring spawn on eelgrass & other SAV

Known Forage Fish Spawning Beaches in San Juan County

2018/2019 field surveys
documented 5 'new'
sand lance spawning
beaches and 2 'new'
surf smelt spawning
beaches



- surf smelt documented spawning beach
- pacific sand lance documented spawning beach
- surf smelt and pacific sand lance combined beach (WDFW/ FSJ 1990-2002)
- Herring Spawn (WDFW 2012)

Shoreline Threats- the science

Beaches with hard armoring/bulkheads have:

- 50% lower surf smelt egg survival
- Less overhanging and buffer vegetation
- Less beach wrack, driftwood and invertebrates
- Steeper, coarser beach
- Less food in juvenile salmon stomachs
- Less resilience to sea level rise



Beach Spawning FF Habitat Surveys

- Exploratory surveys to identify new sites
- Monitoring of beach habitat restoration sites
- Increase awareness by engaging waterfront property owners, students and community volunteers
- Data informs shoreline management, salmon recovery



Volunteers Key to Project Success

Roles & Responsibilities

1. Complete training in all aspects of spawn surveys

- field, processing and lab analysis
- attend workshop & assist with 1-2 field survey days

2. Regular sampling of assigned sites

- 1-2 times per month Nov.-Feb. **Tide dependent!**

3. Data collection and submittal

- timely submission of samples, completed field forms and survey images

Details matter!

Methods- field surveys

- Tides below +7 MLLW
- Site name and ID
- Collect beach substrate sample
- Complete field data sheet
- Sample # on tag AND on sheet AND in sample bag



Methods- field surveys



Field sheet

MUST be completed: date, island, beach number, sample number, common name in comment field: shaw county park, jacksons beach etc.

Forage Fish Spawning Beach Survey (see back for codes)

Month	Day	Year
Camera ID:		

Last High Tide
Time (24-hr):
Elevation:

2nd Effective High Tide
Time (24-hr):
Elevation:

Location:

County:

Page ____ of ____

Beach station #	Time (24-hr)	Latitude (decimal degrees)	Longitude (decimal degrees)	Beach Uplands	Width	Length	Sample #	Landmark	Sample Zone	Tidal Elevation	Shading	Sample Type	Smelt	Sand lance	Rock sole	Photo #	Comments
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	

Samplers:

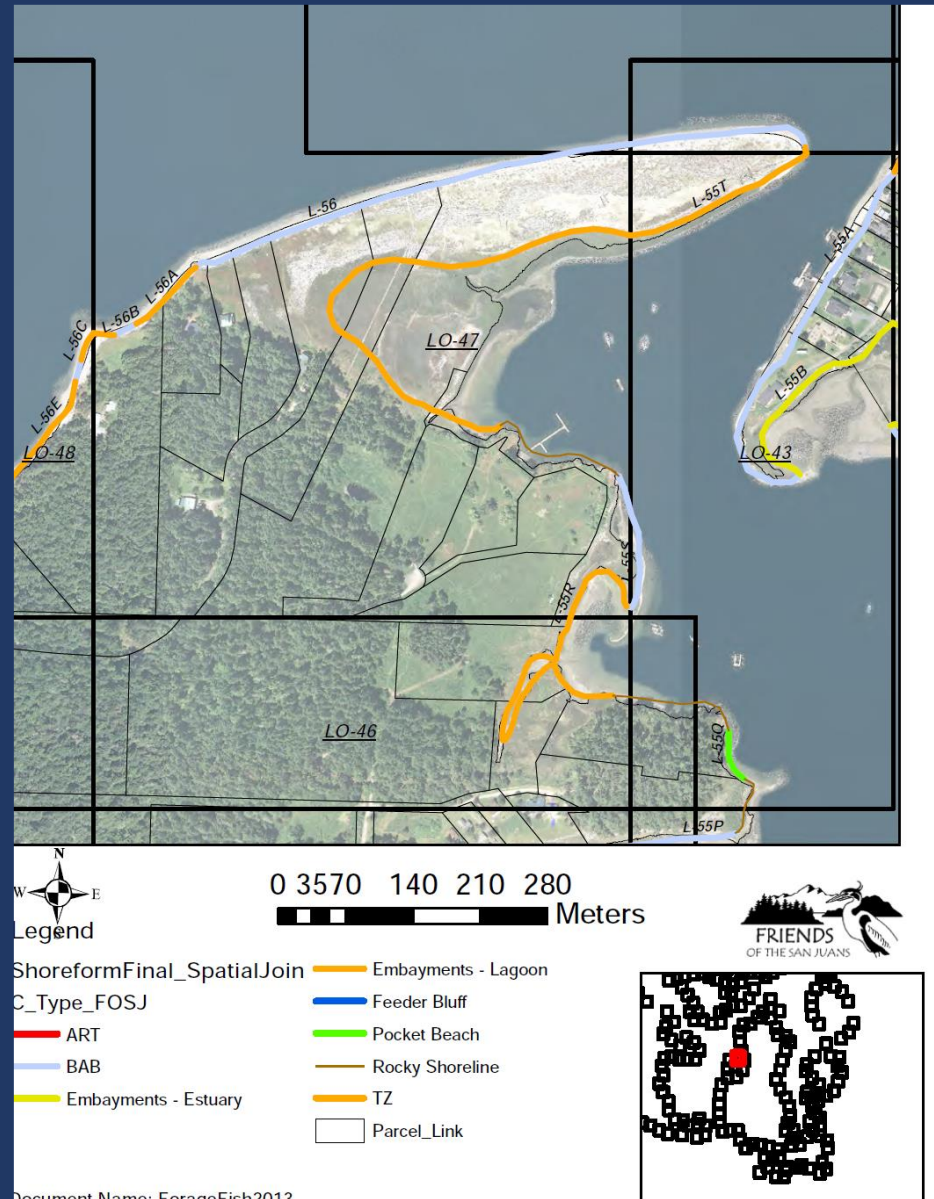
(print names here, sign back)

Organization:

Reviewer:

WHERE to sample

The little numbers on the
beach outlines are your
beach number



Field sheet

MUST be completed: date, island, site number, sample number, common name in comment field: shaw county park

MUST
write in
pencil
Water
proof
paper

Forage Fish Spawning Beach Survey (see back for codes)

Month	Day	Year
Camera ID:		

Last High Tide
Time (24-hr):
Elevation:

2nd Effective High Tide
Time (24-hr):
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Location:

County:

Page ___ of ___

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14																		
15																		

Samplers:

(print names here, sign back)

Organization: _____

Reviewer: _____

FIELD sheet- CODE descriptions on back for in field use

Field Observation Sampling Code

Beach: Sediment character of the upper beach (particle size range in inches)

- 0 = mud (<0.0025)
- 1 = pure sand (0.0025-0.079)
- 2 = pea gravel (0.079-0.31, "fine gravel") with sand base
- 3 = medium gravel (0.31-0.63) with sand base
- 4 = coarse gravel (0.63-2.5) with sand base
- 5 = cobble (2.5-10.1) with sand base
- 7 = boulder (>10.1) with sand base
- 8 = gravel to boulders without sand base
- 9 = rock, no habitat

Uplands: Character of the uplands (up to 100 ft. from high water mark)

- 1 = natural, 0% impacted (no bulkhead, rip-rap, housing, etc.)
- 2 = 25% impacted
- 3 = 50% impacted
- 4 = 75% impacted
- 5 = 100% impacted

Width: Width of the potential spawning substrate band to the nearest foot. Judged by character of sediment and presence of spawn, when possible.

Length: Length of the beach up to 1,000 feet (500 feet on either side of the station).

Landmark: landmark for determining sample zone where collection occurs

- 1 = down beach from last high tide mark
- 2 = up beach from last high tide mark
- 3 = down beach from second to last high tide mark
- 4 = down beach from upland toe
- 5 = up beach from waterline at the time noted

Sample Zone: Distance of sample zone transect parallel to the landmark, in feet to the nearest ½ foot. Used to determine the tidal elevation of the spawn deposit.

Tidal Elevation: Determined in the office using location and time data provided.

Shading: Shading of spawning substrate zone, averaged over the 1,000 foot station and best interpretation for the entire day and season

- 1 = fully exposed
- 2 = 25% shaded
- 3 = 50% shaded
- 4 = 75% shaded
- 5 = 100% shaded

Sample Type: S=Scoop; V=Visual; B=Bulk; E=Elevation; P=Permit

Smelt, Sand Lance, Rock Sole: subjective field assessment of spawn intensity apparent to the naked eye:

- 0 = no eggs visible
- L = light, but apparent
- M = medium, readily visible
- H = heavy, broadly abundant
- W = eggs observed in winnow

Photos: Take 6 site photos standing near the center of the site, and record the file number of the 1st photo in the 6 photo series.

***Photo 1:** Completed sample tag

***Photo 2:** Sediment w/ scale at transect

Photo 3: Beach backshore

Photo 4: Beach right

Photo 5: Beach foreshore (towards water)

Photo 6: Beach left

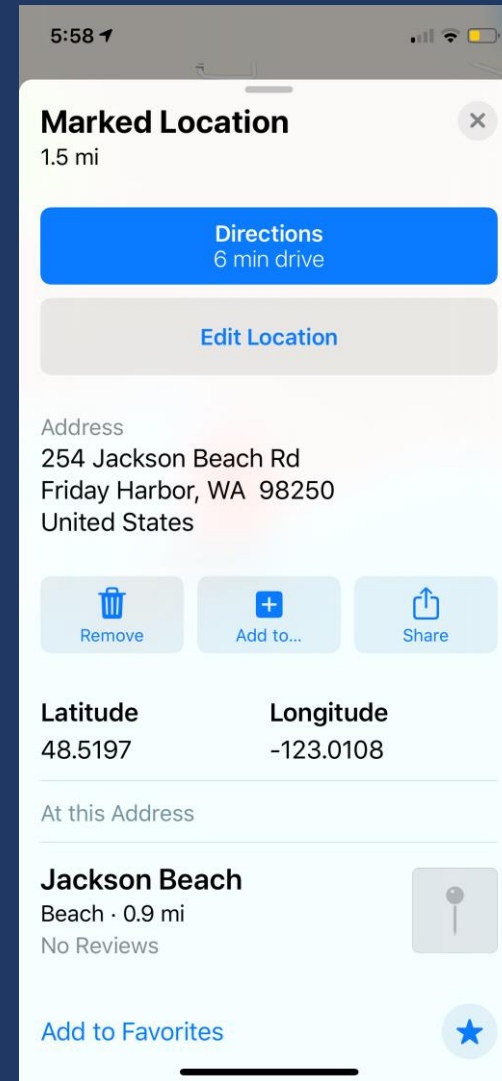
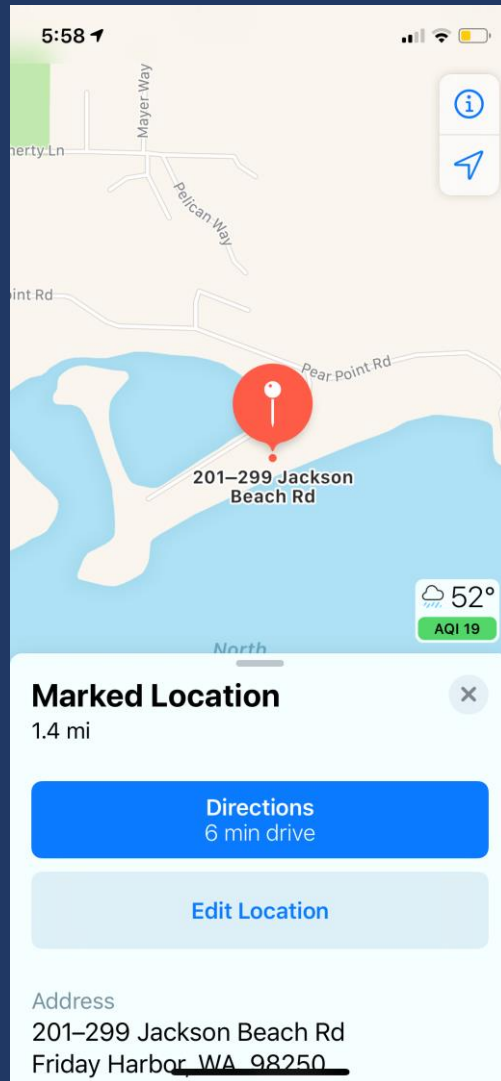
**If multiple samples are collected at a single station, then only photos 1 and 2 need be repeated for each subsequent sample.*

****I certify that to the best of my abilities, the surveys recorded on this data sheet and the associated samples were collected and documented in accordance with WDFW approved protocols, and the information I am providing are the true and accurate results of these surveys.**

Lead Signature: _____

Back of field sheet !

GPS point using google maps



Sample tag- printed sample number for field sheet, also matches field sheet site, data but goes IN BAG with collected gravel

**MUST write in
PENCIL
Waterproof
paper**

Date: Location: Beach Station # Sample #	Date: Location: Beach Station # Sample #	Date: Location: Beach Station # Sample #
Date: Location: Beach Station # Sample #	Date: Location: Beach Station # Sample #	Date: Location: Beach Station # Sample #
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Figure 12. Sheet of sample tags. *Do not copy – for reference only.*

Date:
Location:
Beach Station #
Sample #

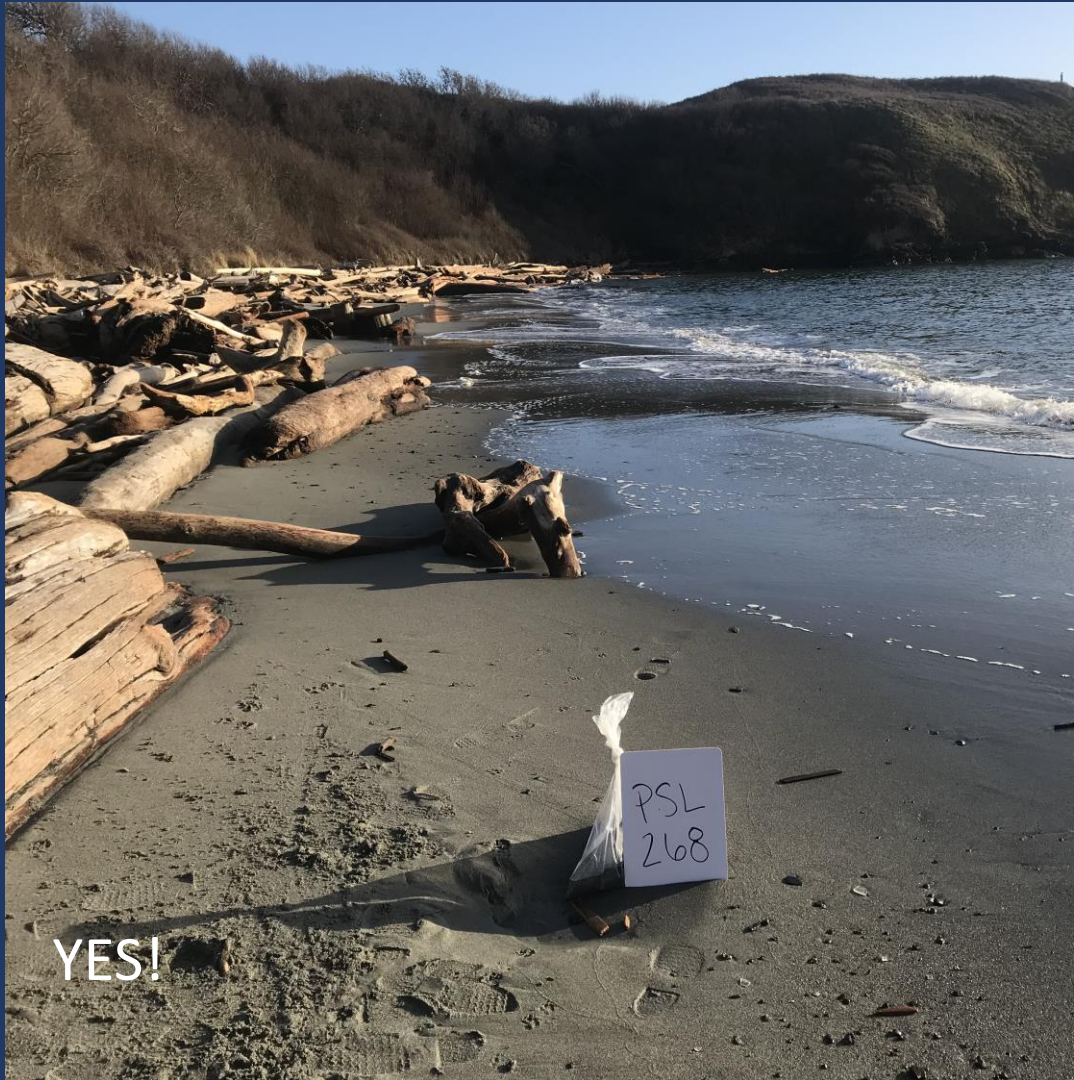
Sample Photos 1 per site



Landscape orientation, wide range of view



NOT zoomed in on sign board



YES!



NO

Methods- sample processing

OLD SCHOOL



NEW METHODS



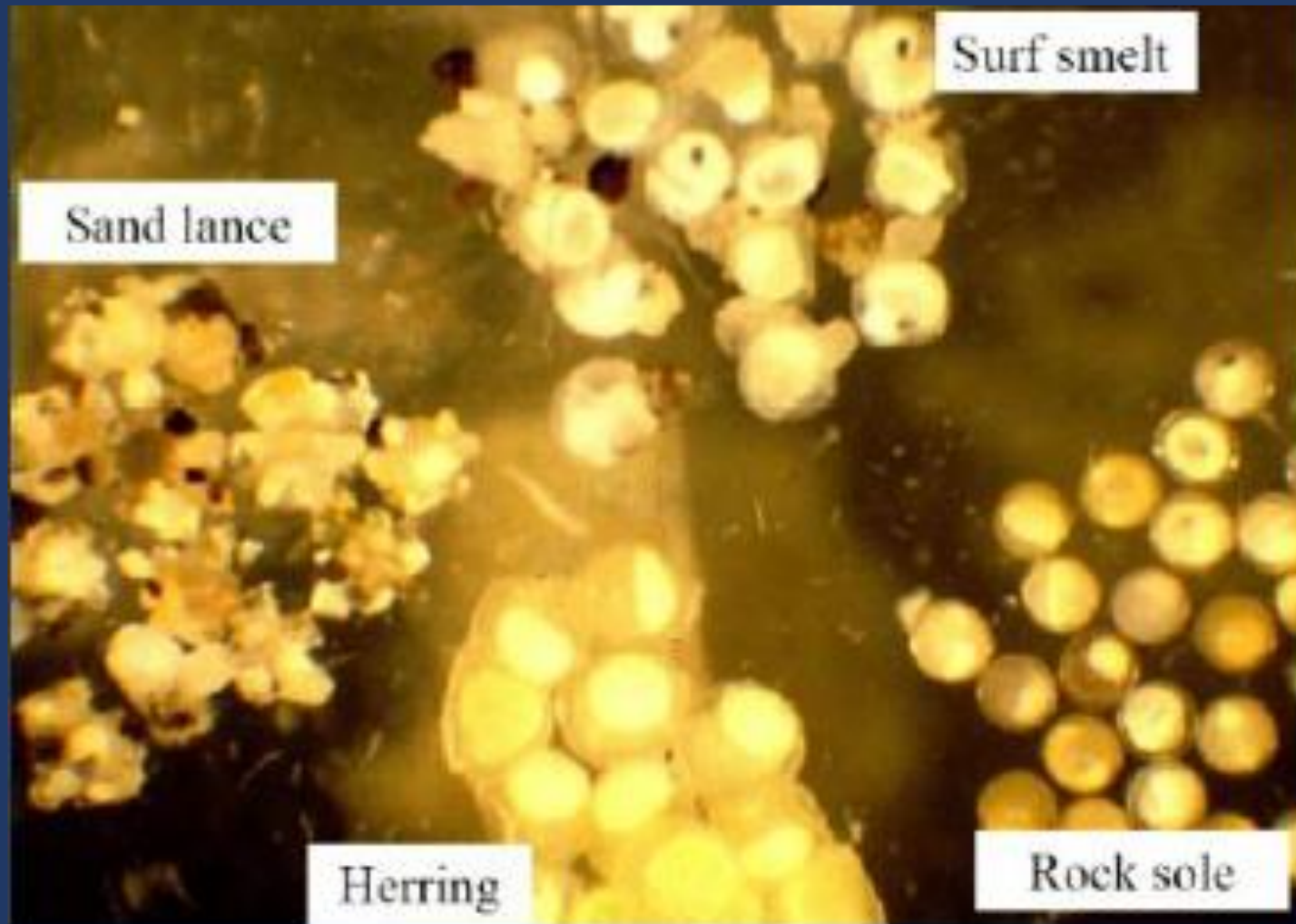
Better at finding sand lance eggs!

Methods- lab analysis



Photos: D. Novello

Methods- lab analysis



Methods- mapping & sharing results



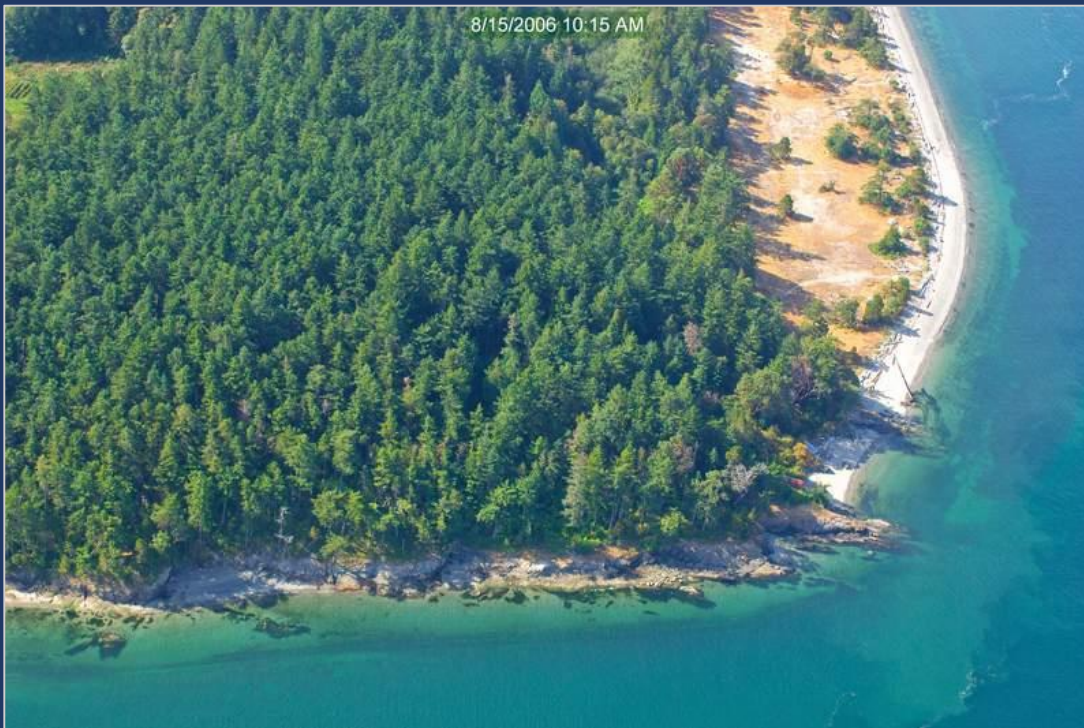
Legend

- Armoring
- Groin
- ▲ Improved Boat Ramp
- Derelict Pilings
- Dock
- ▲ Mooring Bouy
- Known Forage Fish Spawn Habitat
- Potential Forage Fish Spawn Habitat
- Deep Water Edge of Eelgrass
- Herring Spawning Grounds

Applying results-Habitat Protection

Voluntary and Regulatory Both Important

- Conservation easements, Acquisition
- Local, state and federal protection policies



Applying Results- Habitat Restoration

Salmon recovery plans prioritize the protection and restoration of nearshore marine habitat, especially beaches and bluffs



Before



After

Forage Fish Spawn Habitat Protection Project

Outcomes:

- Updated forage fish spawning habitat distribution maps
- Improved regulatory protection
- Improved voluntary protection
- Informed habitat restoration efforts
- Engaged community



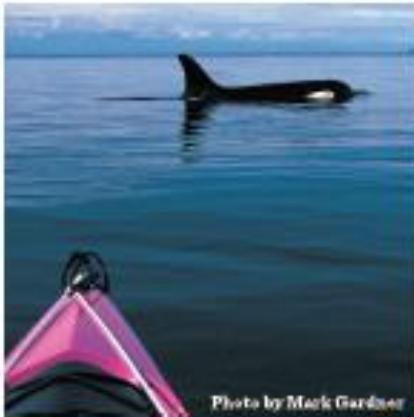


Photo by Mark Gardner



Photo by Katie Fleming



Photo by Andrew Zedong



Photo by Mark Gardner

ORCA

need

SALMON

need

**FORAGE
FISH**

need

**HEALTHY
SHORELINES**

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Friends *of the*
San Juans