Puget Sound Nearshore Forage Fish Surveys

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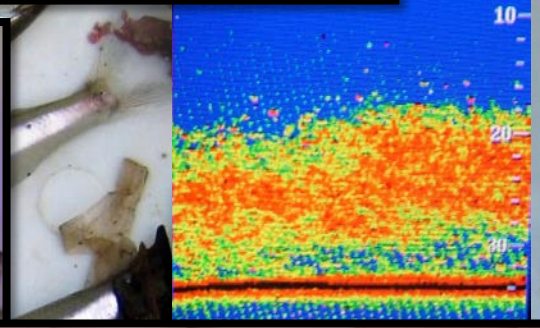
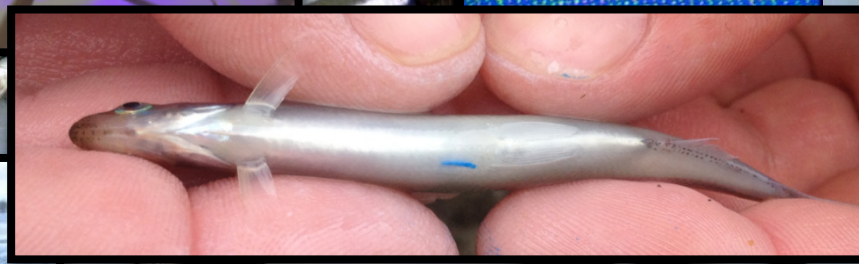
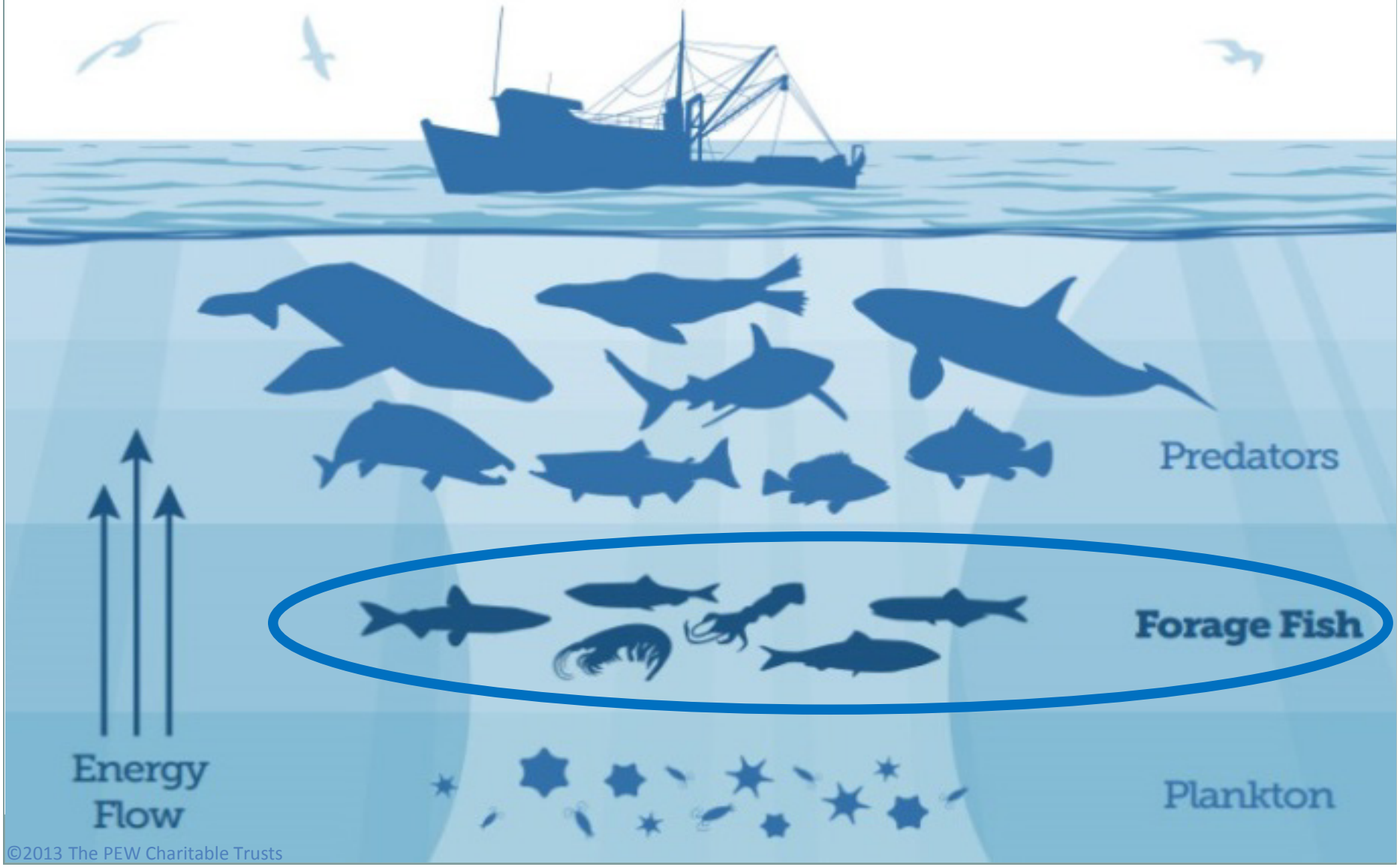
Thanks to:

- WCC
- Point Defiance Zoo & Aquarium
- USGS
- DNR
- DFW Marine Fish Unit
- Point No Point Treaty Council
- Suquamish Tribe
- Friday Harbor Labs
- NW Straits Commission
- County MRCs
- Nisqually Nature Center
- Squaxin Island Tribe
- NOAA
- FOSJ
- Audubon Society
- Lummi Tribe
- Evergreen College
- PSEMP
- and many more…



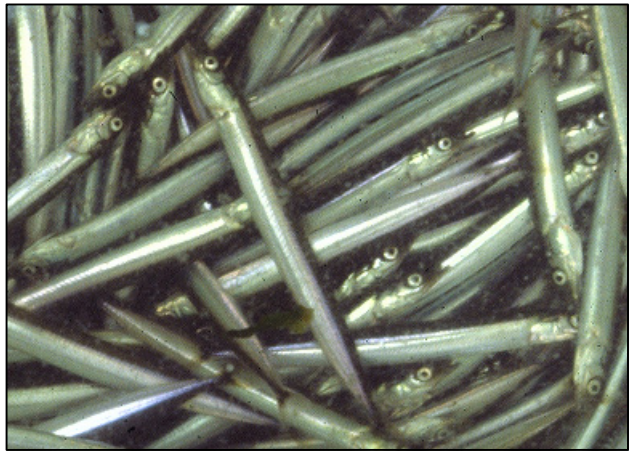
What are Forage Fish and Why are they Important?



Nearshore Forage Fish:

Surf Smelt
(*Hypomesus pretiosus)*

Pacific Sand Lance
(*Ammodytes personatus)*



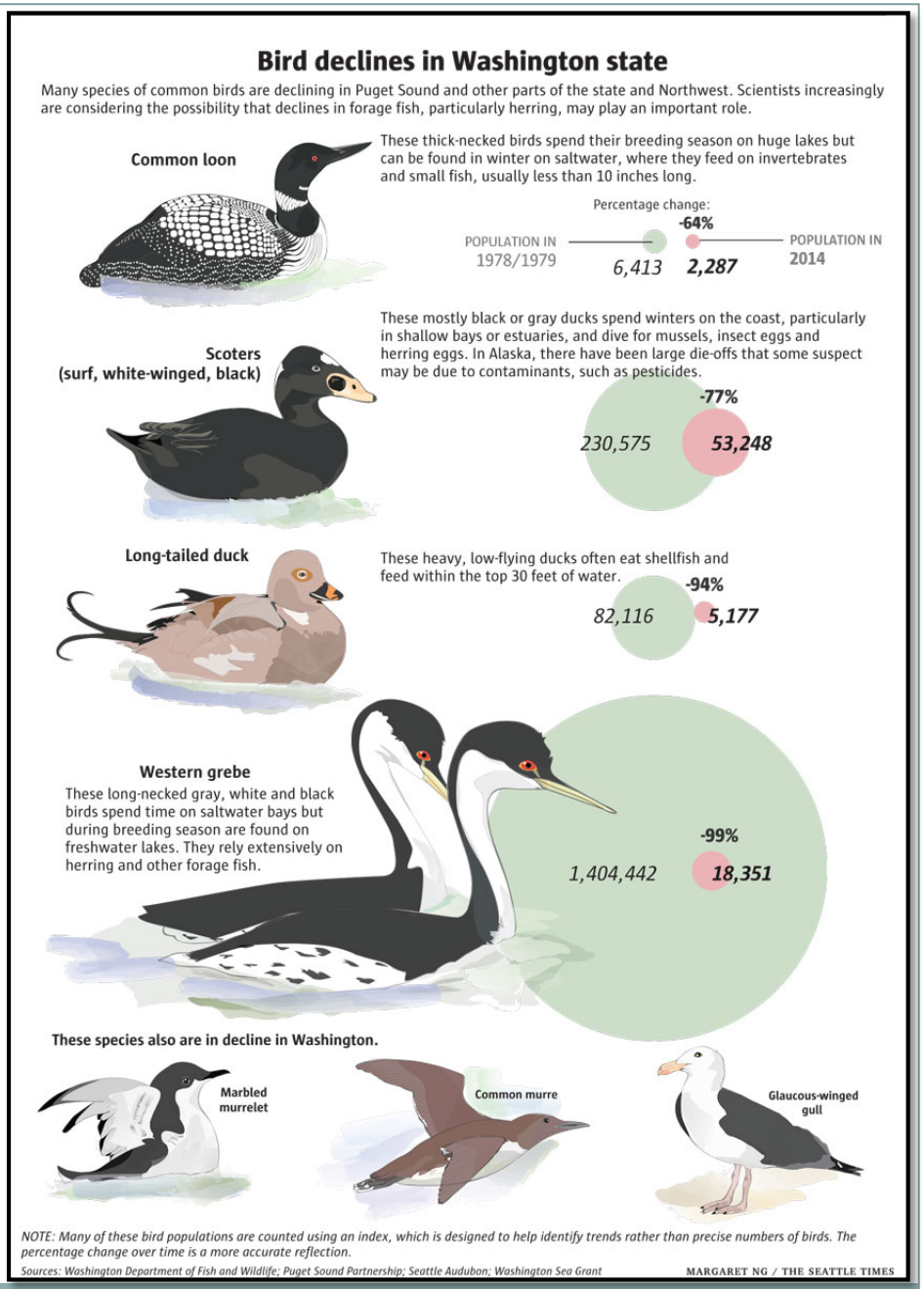
Pacific Herring
(*Clupea pallasii)*

Warning signs:

Warning signs:

Bird declines in WA State

-Birds that dive and forage for fish in the Salish Sea, including this western grebe, are 11 times more likely to experience population declines than other birds in the area. (*Joe Gaydos, journal of Conservation Biology*)



Challenges Facing Forage Fish

Fora e to:

Over fishing

Habitat Loss

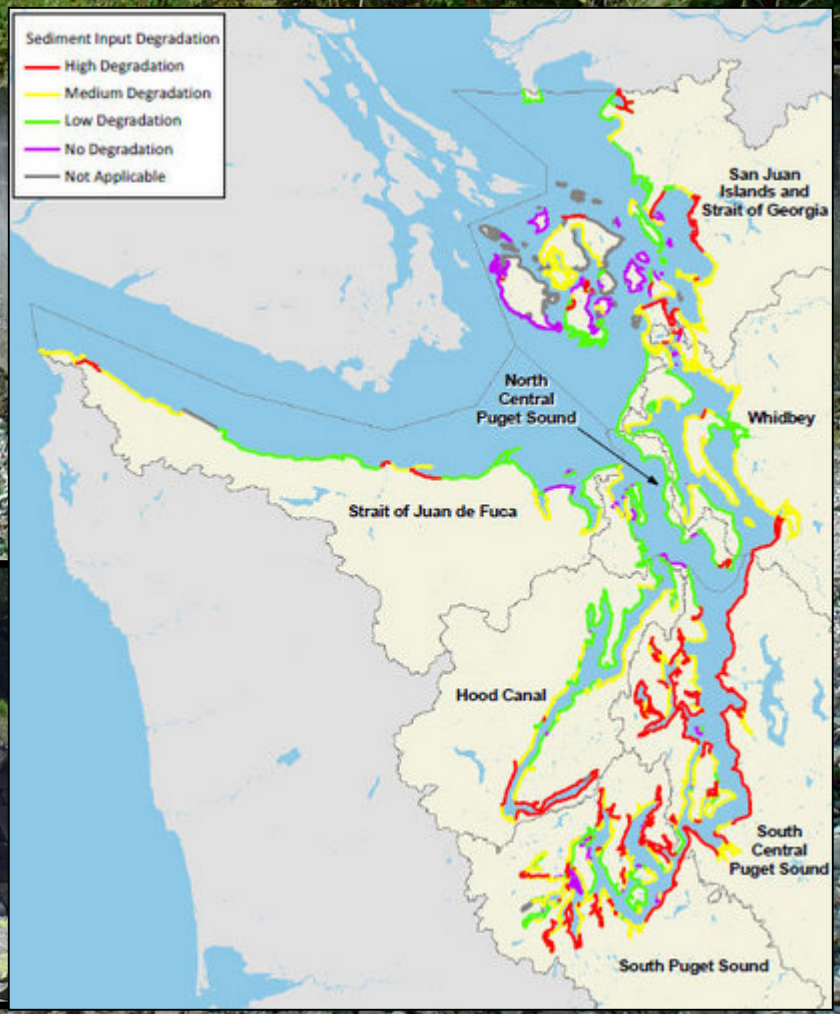
Surf Smelt & Sand Lance spawn on the beach

Risks to forage fish habitat include:

-Direct habitat loss

-Loss of riparian cover

-Change sediment supply and transport



Forage Fish Protection

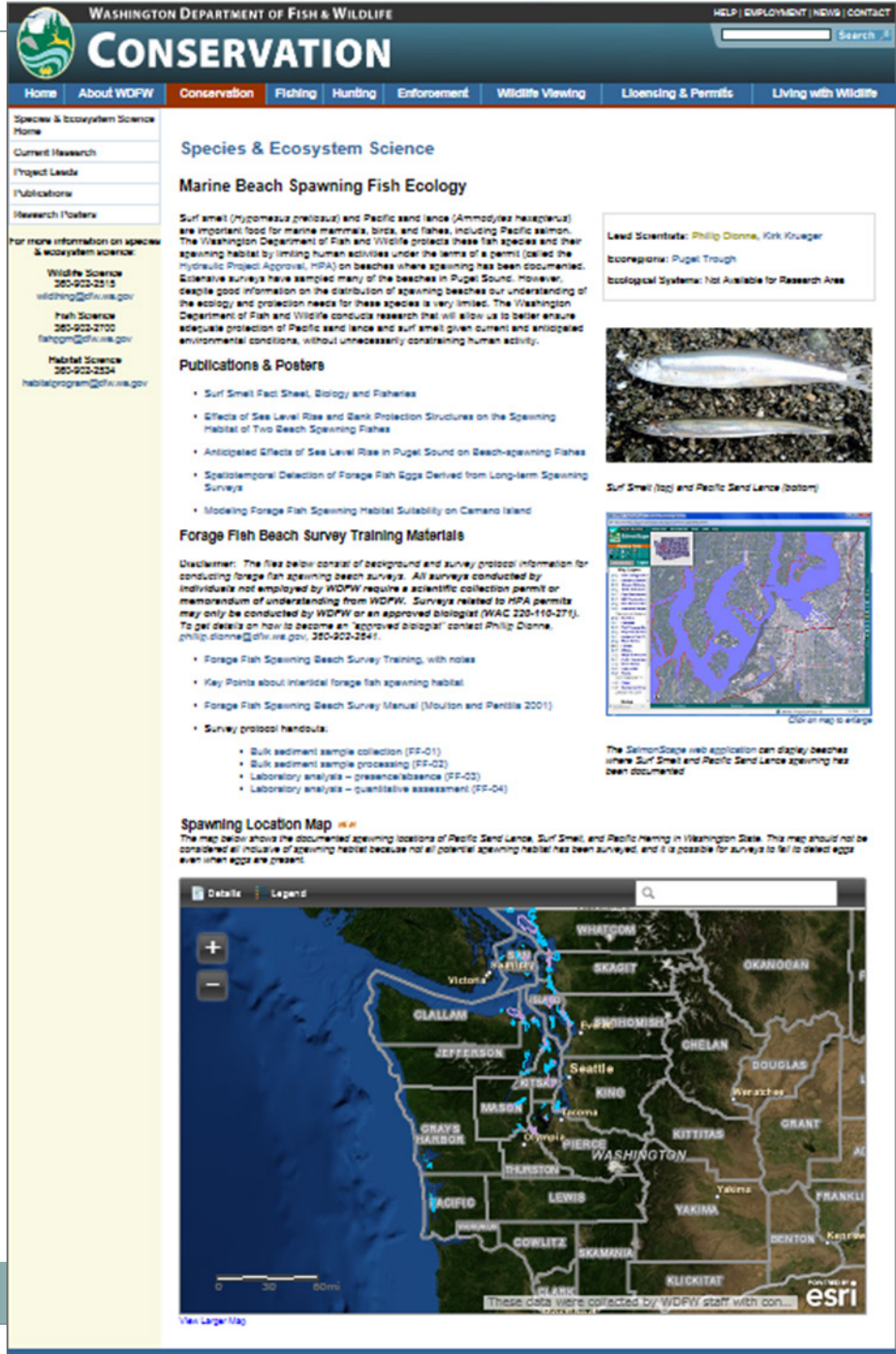
Protected by law:

...the **construction** of all bulkheads or other bank protection **must not result in a permanent loss of** surf smelt or Pacific sand lance **spawning beds**...

Beach Surveys

Current Survey Goals:

- Update Forage Fish Map
  - Interactive map of documented forage fish spawning habitat (*wdfw.wa.gov/conservation/research/projects/marine_beach_spawning/*)
- Model Habitat
  - Use distribution and timing of spawning to develop statistical model to predict when and where eggs may be present
- Occupancy Model
  - Use habitat model and surveys to assess if spawning distribution is changing over time



Sampling Methods

Sample Collection

Reducing Sample Volume

Egg Extraction

Lab Analysis

Sampling Methods Updated

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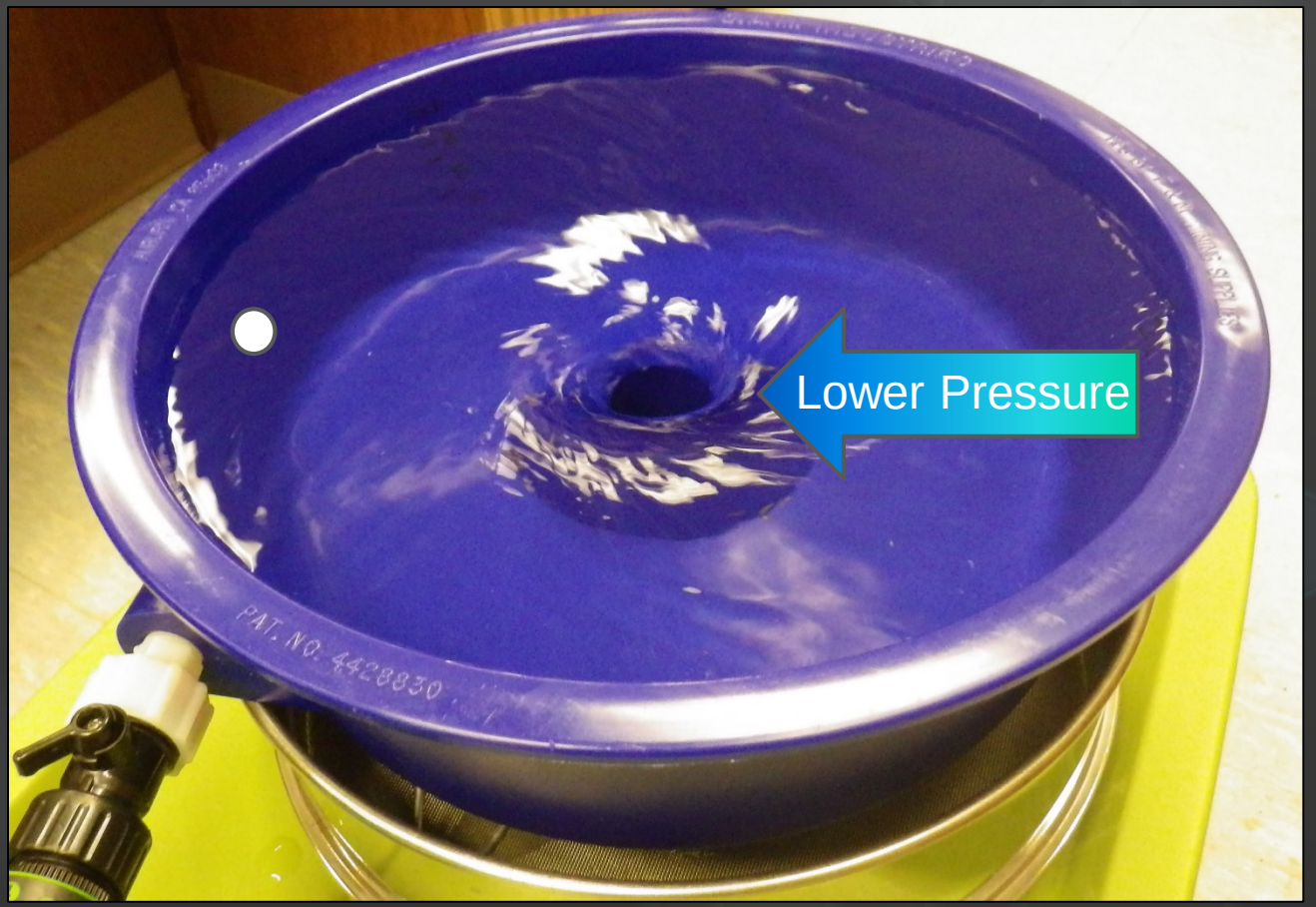
Vortex Method

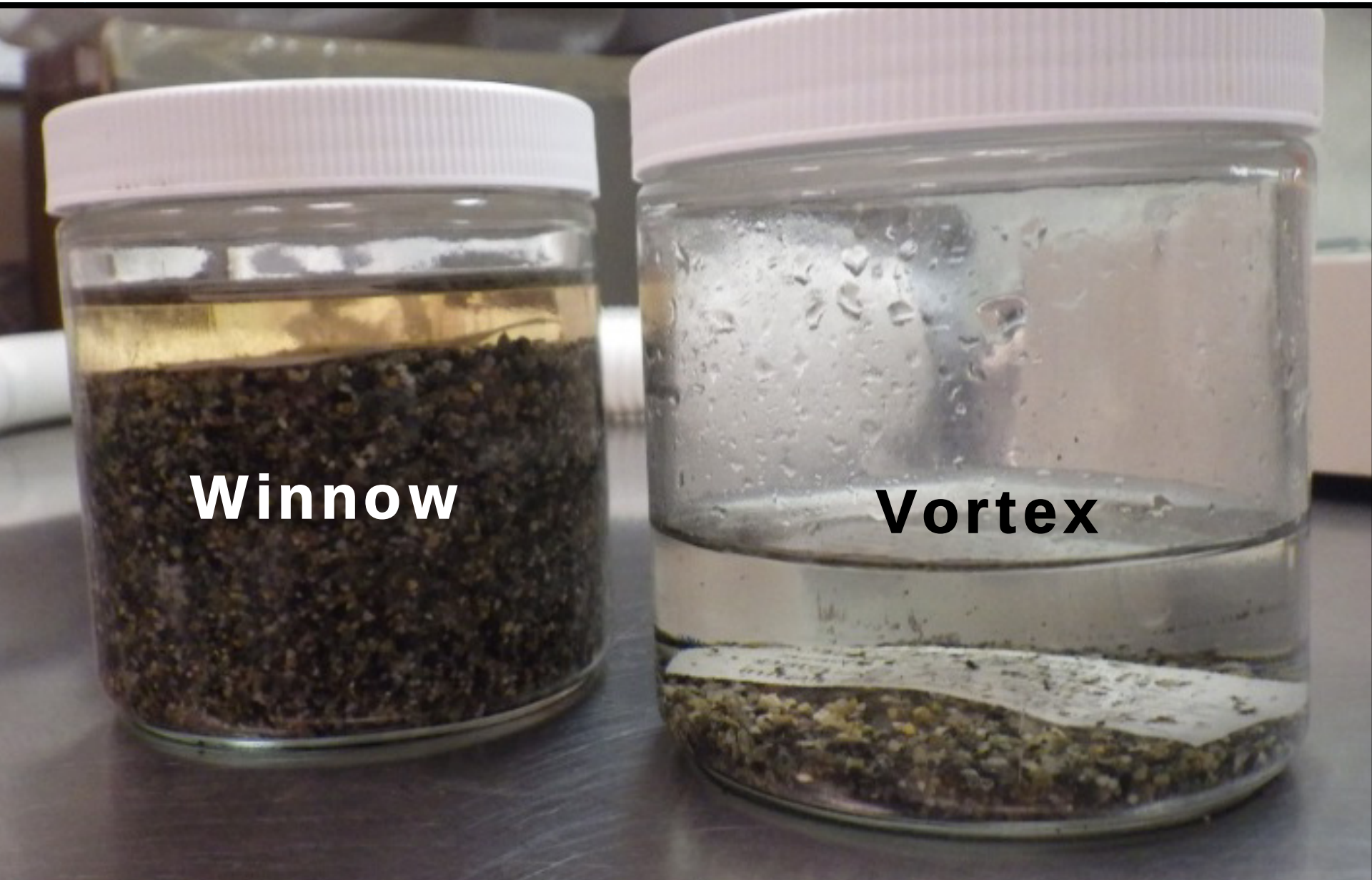
How it works:

The movement of the water creates a pressure gradient

- Material moves from high pressure to low pressure in the middle



Seeded Smelt Egg Trials



Historical Surveys Vs. Current Surveys

Historical Surveys:

Maximize potential to document spawning:

- **Distribute effort in times and places where spawning is thought to be most likely**

SmeltSurveys.exe
SmeltSurveysManual.exe

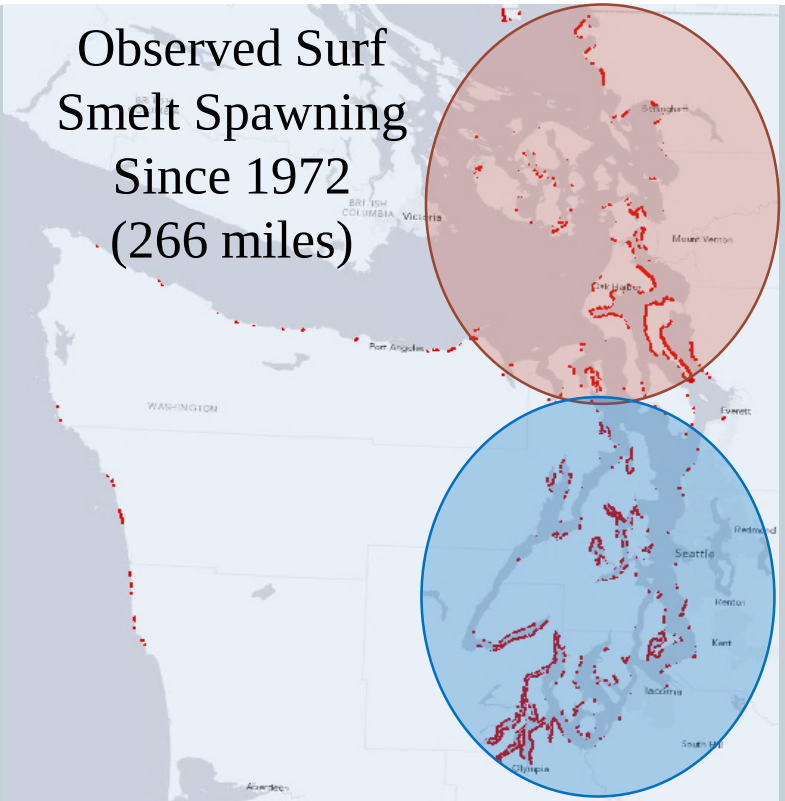
Current Surveys:

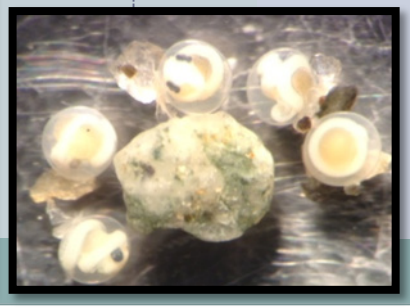
Systematic Sample of Puget Sound to model occurrence:

Surf Smelt

- Spawn Year round
  - North Sound, peak spawning in summer
  - South Sound, peak spawning in winter
  - Little known about life history, ecology, or abundance.

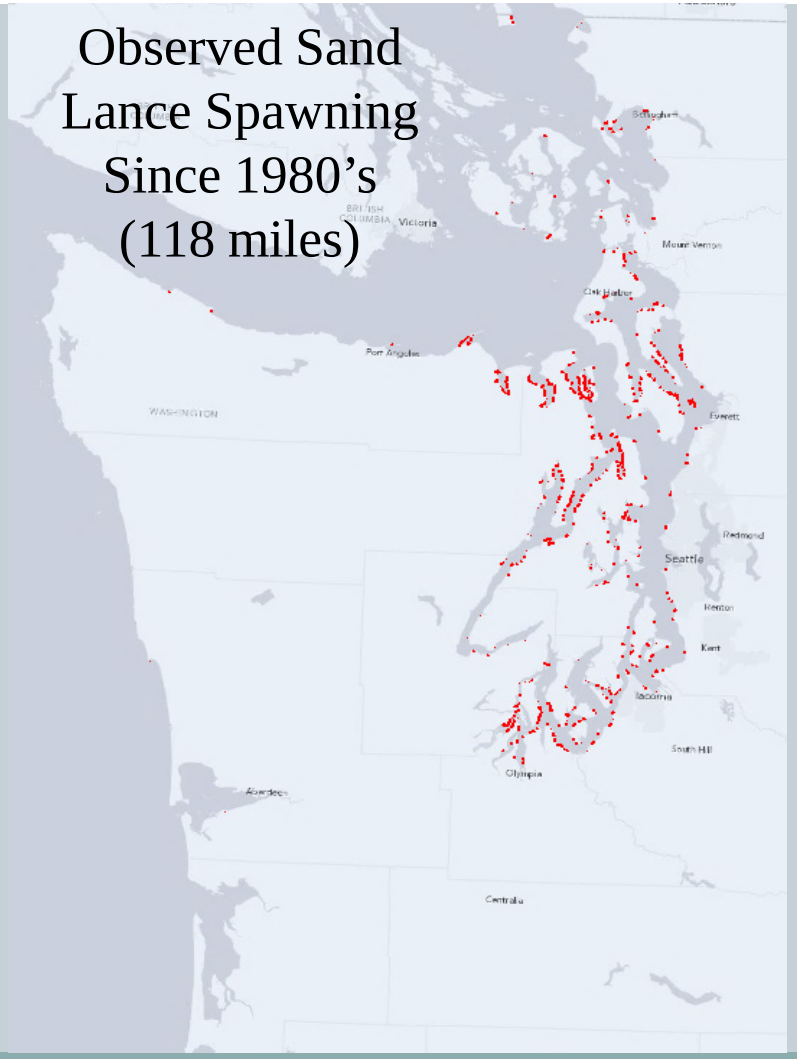
Observed Surf Smelt Spawning Since 1972 (266 miles)





Sand Lance

- Spawn during winter on fine grain beaches
- Bury in sand to avoid predators and conserve energy
  - Little else known about life history or ecology
  - No population estimates or stock delineation work to date



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Historical Surveys:

Maximize potential to document spawning:

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Current Surveys:

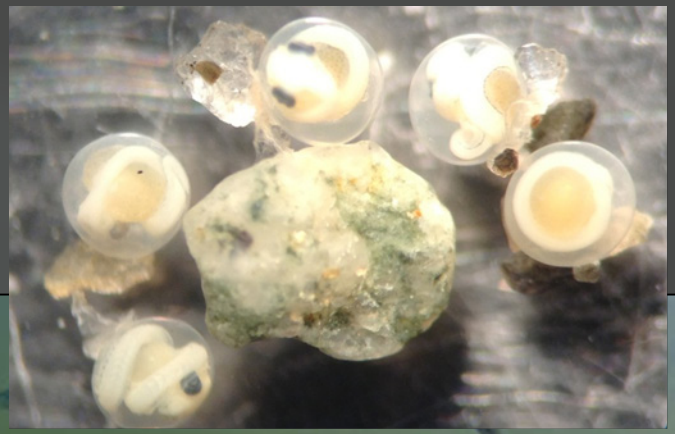
Systematic Sample of Puget Sound to model occurrence:

- **Sample year round and distribute effort around the Sound**
- **Established index sites to sample monthly**
- **Sample 150-200 sites per month**
- **Sites at least 1.2 km apart**
- **Typical field day: sample cluster of 20 sites**

January – July 2016…

Then started all over again in August with a new set of points.

Thank you!

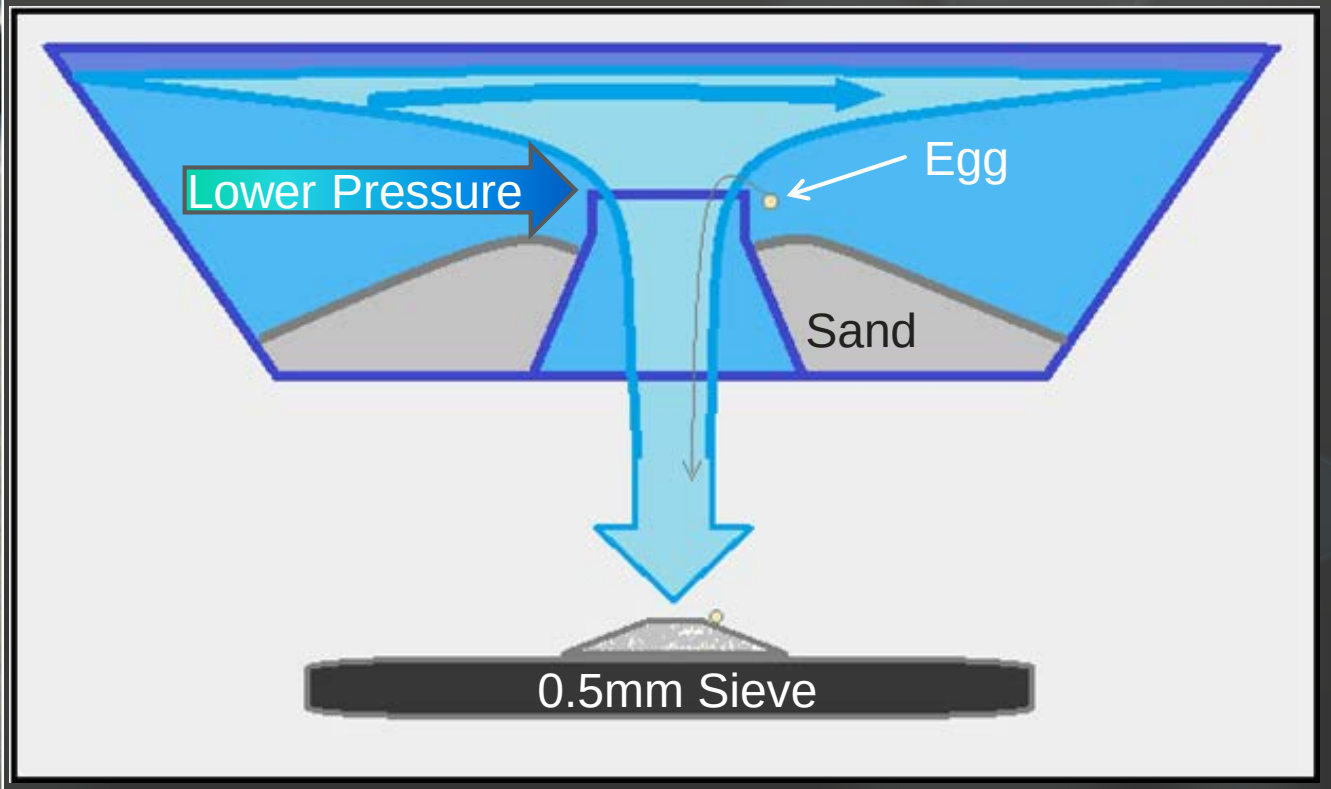


Vortex Method

How it works:

The movement of the water creates a pressure gradient

- Material moves from high pressure to low pressure in the middle
- The elevated cone in the middle reduces the amount of sand that leaves the bowl
- The sieve collects only the material large enough to be an egg



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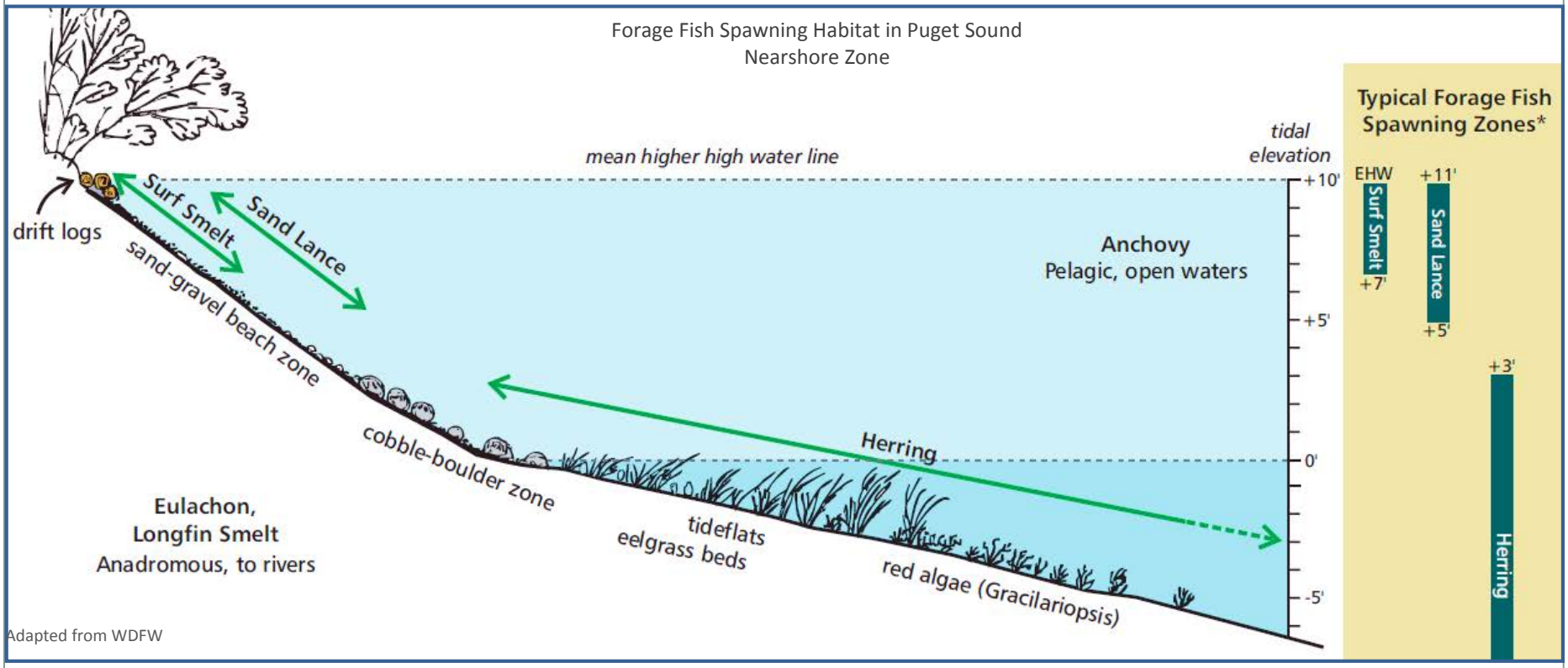
Questions?

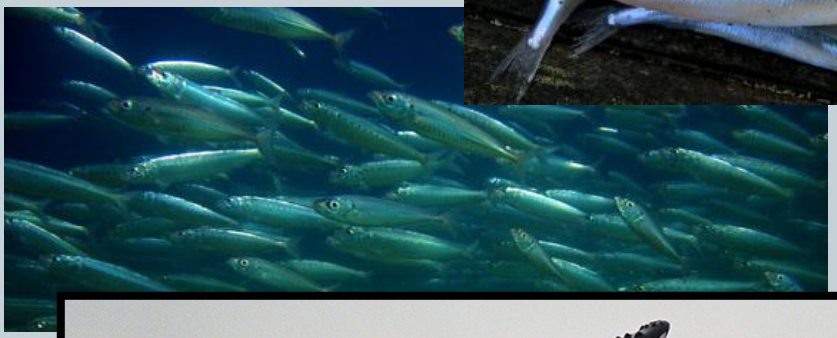
Forage Fish Spawning Habitat in Puget Sound
Nearshore Zone



Adapted from WDFW

Overview

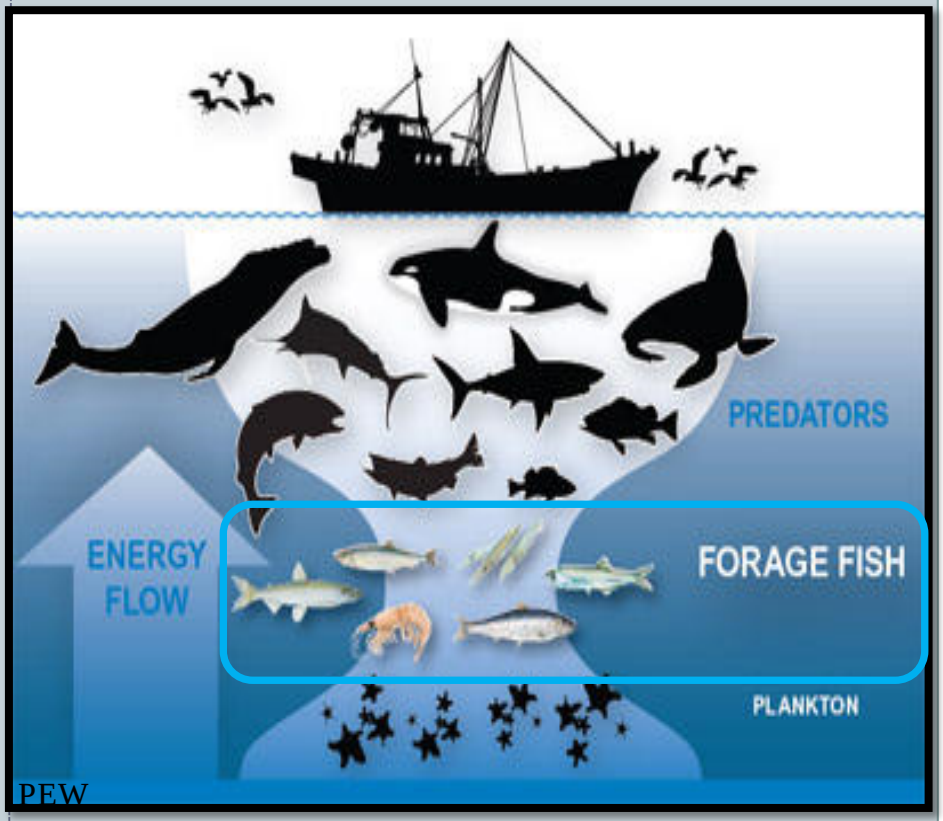
- **Forage fish**
  - **What they are and why are they important**
- **Beach Surveys**
  - **Spawning distribution**
    - ***Side note on methods***
- **Questions?**



Forage fish

Forage fish are:

- **An ecological, not genetic, group**
- **Generally small, highly fecund, schooling fish at the middle of food webs**
- **A vital conduit between primary producers and higher level consumers**
- Commercially, recreationally, and culturally important
  - Currently account for over $^{1}/_{3}$ of overall marine harvest by weight
- A valuable indicator species of ecosystem health



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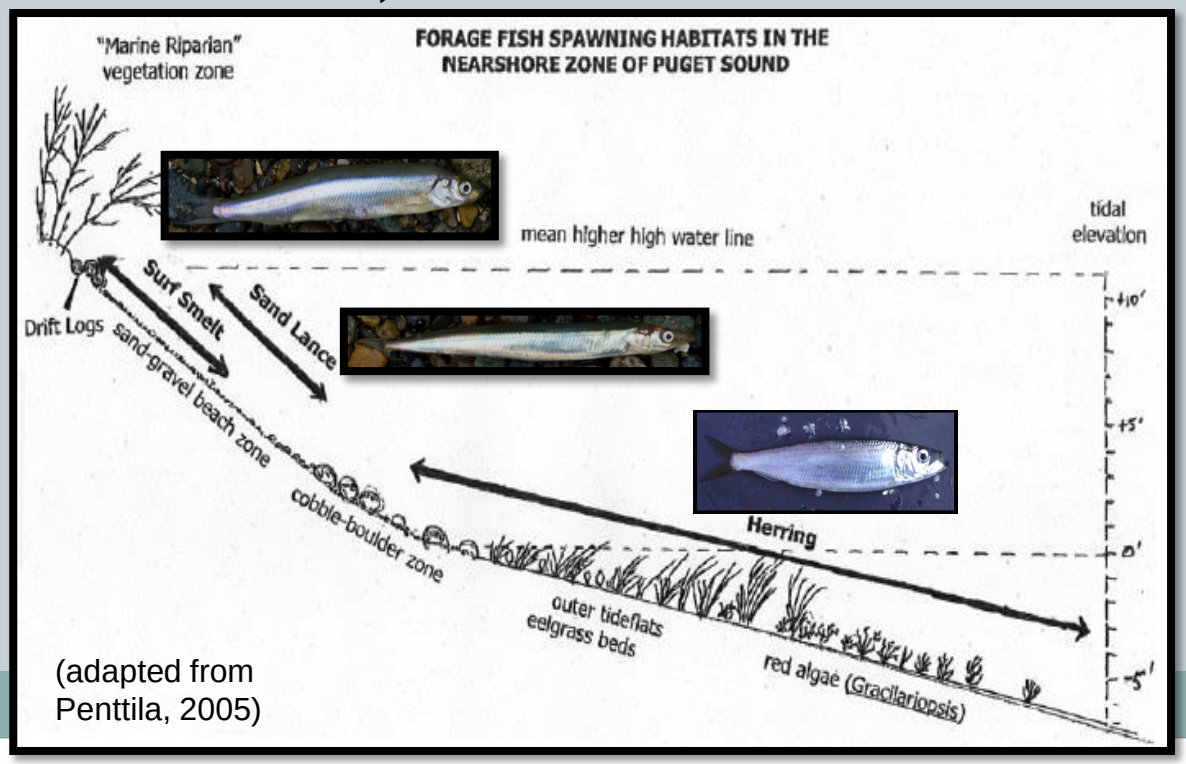
Puget Sound Forage Fish Surveys

Forage fish protection

Washington State Law protects forage fish and their spawning habitat to:
avoid "*permanent loss of critical food fish and shellfish habitat*" (WAC 220-660)



(adapted from Penttila, 2005)

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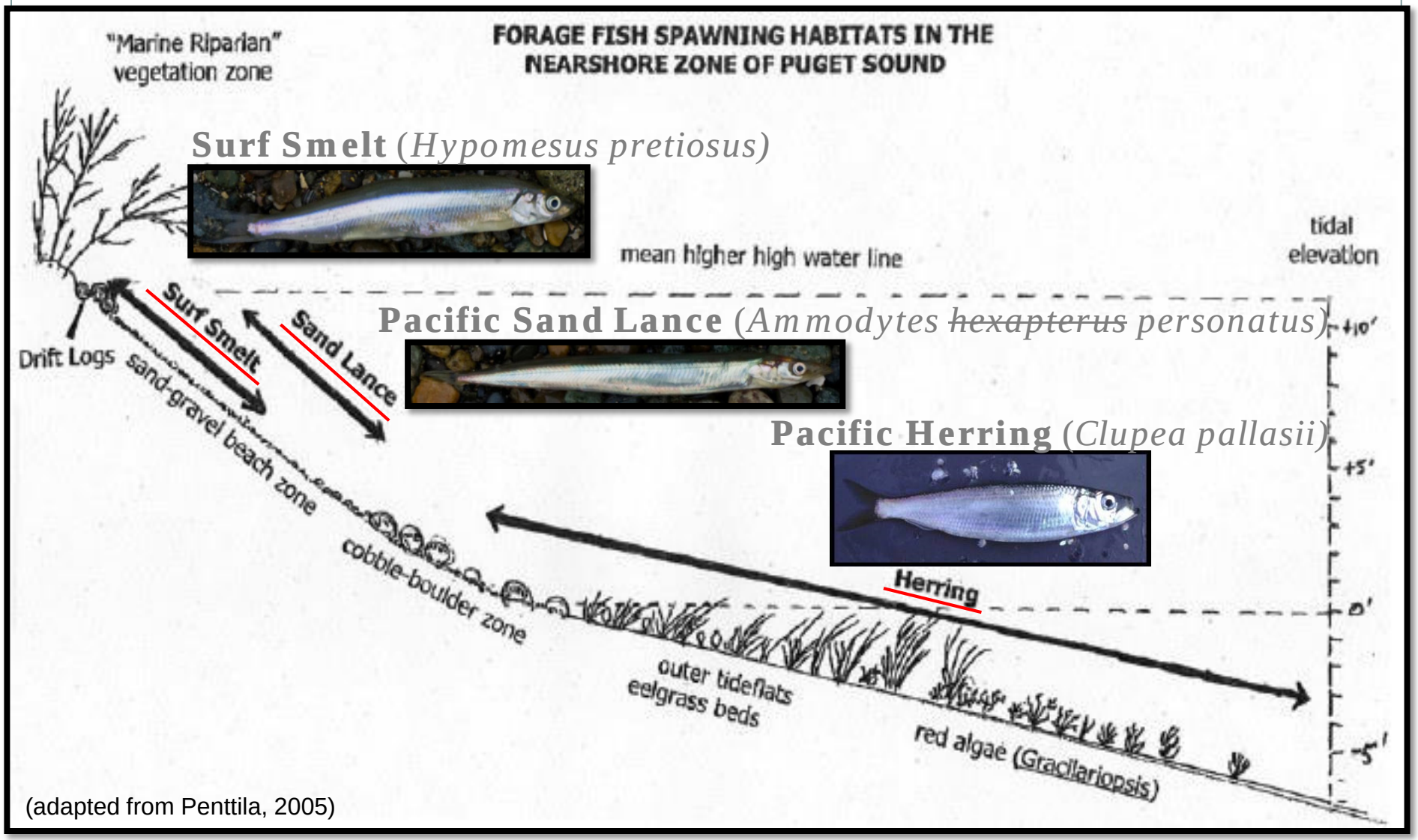

(adapted from Penttila, 2005)

Surf Smelt & Sand Lance are Forage Fish

Isolating the “light-fraction”: winnowing method