

A Description of the Ecological Condition of the Columbia River Estuary using EMAP Data

✧ *Selection and evaluation of indicators*

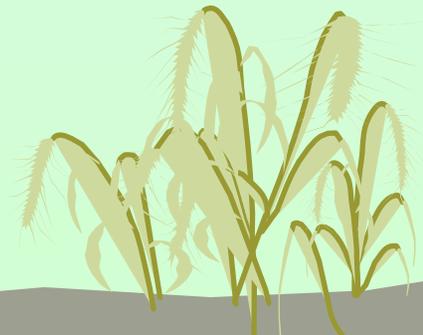
Gretchen Hayslip,

EPA Region 10, Seattle



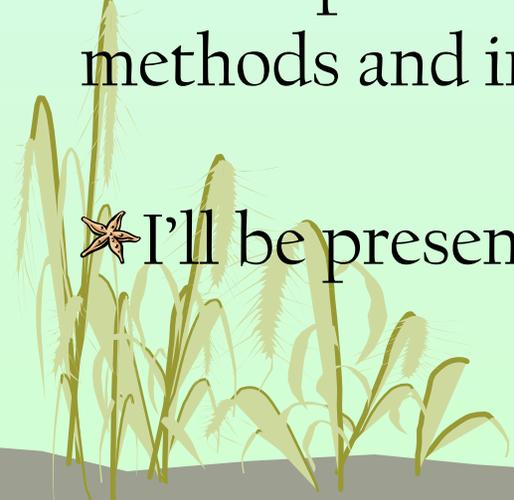
The Columbia River Estuary

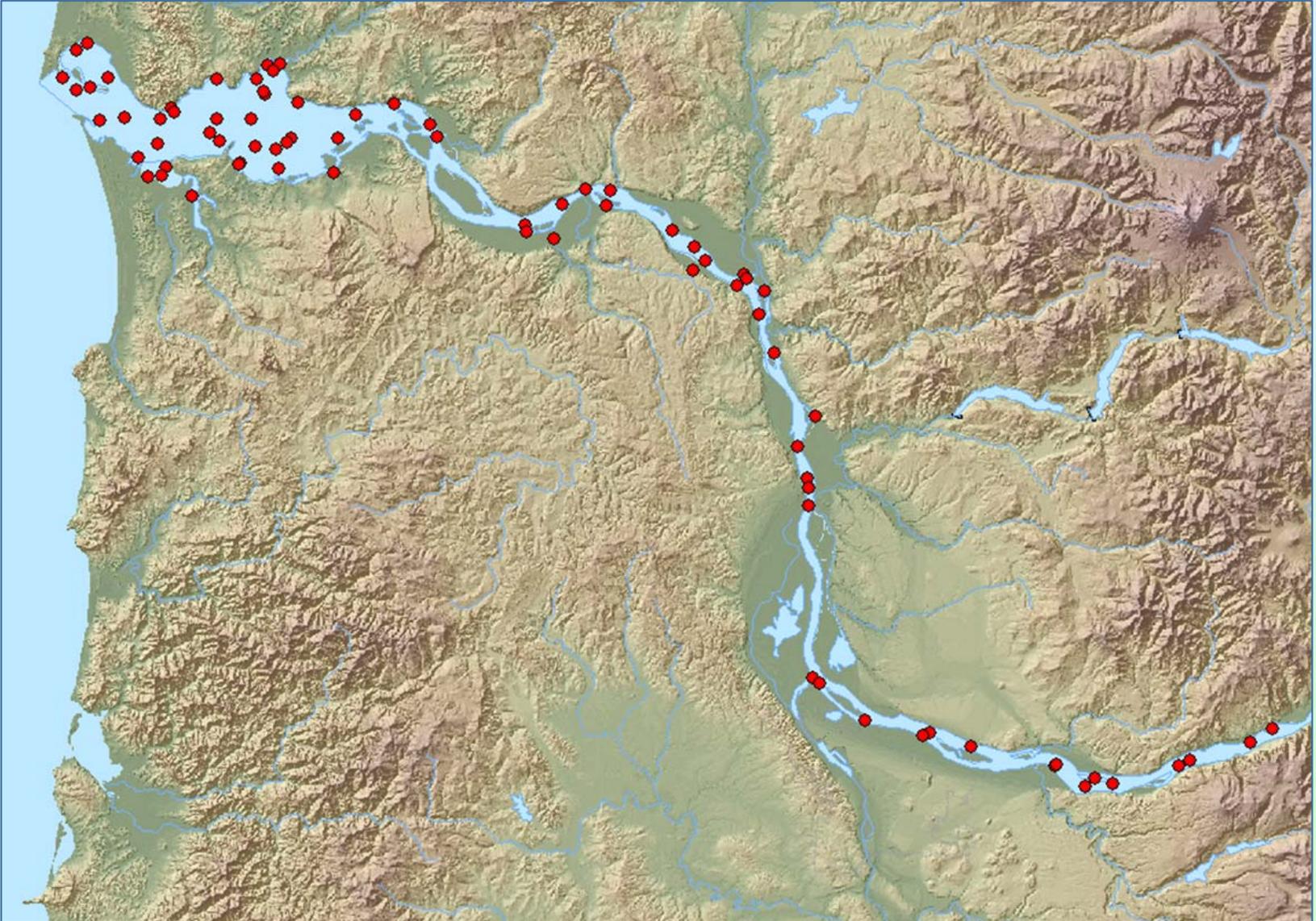
- ✧ extends downstream from the Bonneville Dam to the mouth of the Columbia River (146 miles),
- ✧ forms the border between Washington and Oregon,
- ✧ is one of 28 estuaries in EPA's National Estuary Program (NEP), and,
- ✧ it is a national priority, as it was identified as one of seven large aquatic ecosystems in EPA's 2006-2011 Strategic Plan.



The data – Coastal EMAP:

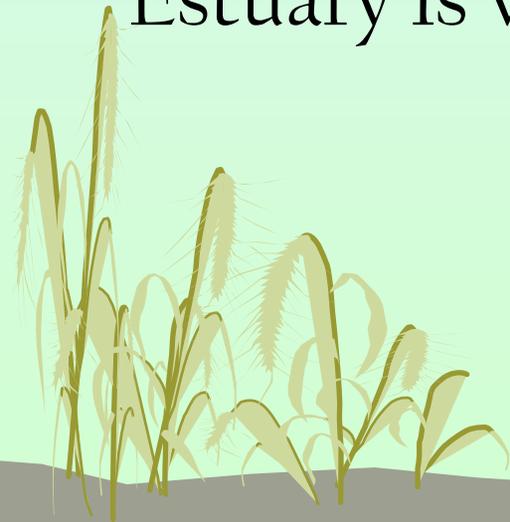
- ✧ A cooperative effort between Washington DOE, Oregon DEQ, NOAA, and EPA (Region 10 and ORD)
- ✧ Sites were selected using EMAP design.
- ✧ Sampling was conducted by during 1999-2000.
- ✧ Sampling was carried out using Coastal EMAP/NCA methods and indicators.
- ✧ I'll be presenting a small subset of the results.





To assess whether or not a specific indicator or metric indicates good or poor condition, a benchmark, cutpoint, criteria, or target is needed for comparison.

But the question for the Columbia River Estuary is which ones do you use.....



First a little background

- ✧ 70% of the area was freshwater ($< 5\text{psu}$)
- ✧ 30% was of intermediate salinity (> 5 and $< 25\text{psu}$).



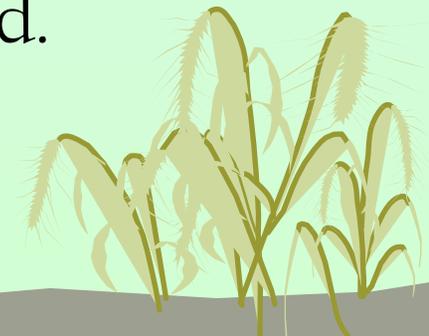
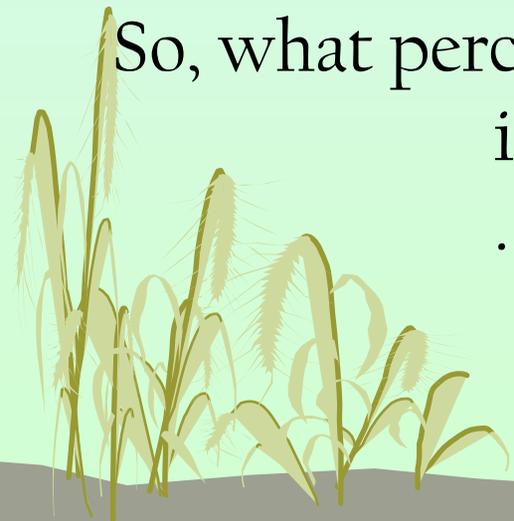
Dissolved Oxygen (DO)

Oregon DO criterion for estuaries, that applies to the Columbia River Estuary is 6.5 mg/L .

Washington's DO criteria for the Columbia River estuary is 8.0 mg/L.

The National Coastal Assessment used (5 mg/L).

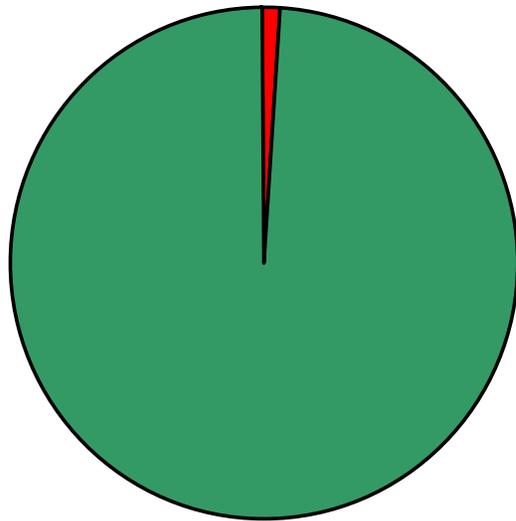
So, what percent of the Columbia River Estuary
is in good or poor condition?
...depends upon the cutpoint used.



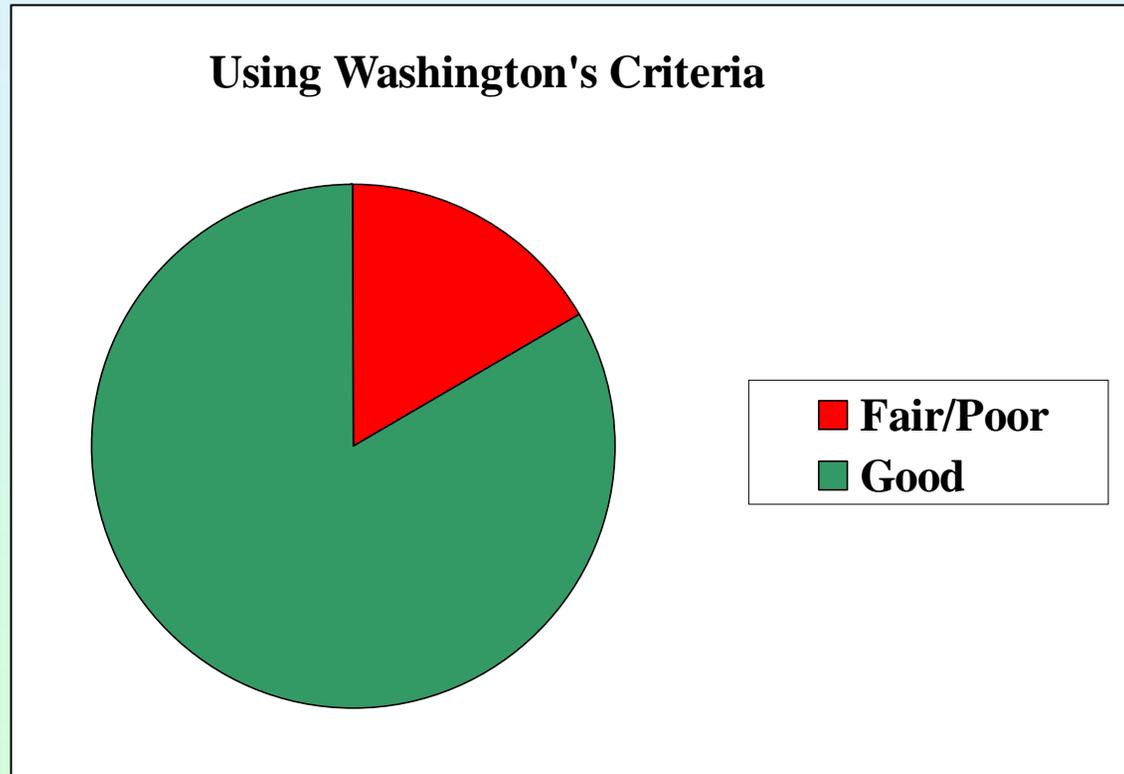
For DO, using the NCA cutpoint (5 mg/L)

...all is well!!

Using National Coastal Assessment Cutpoint

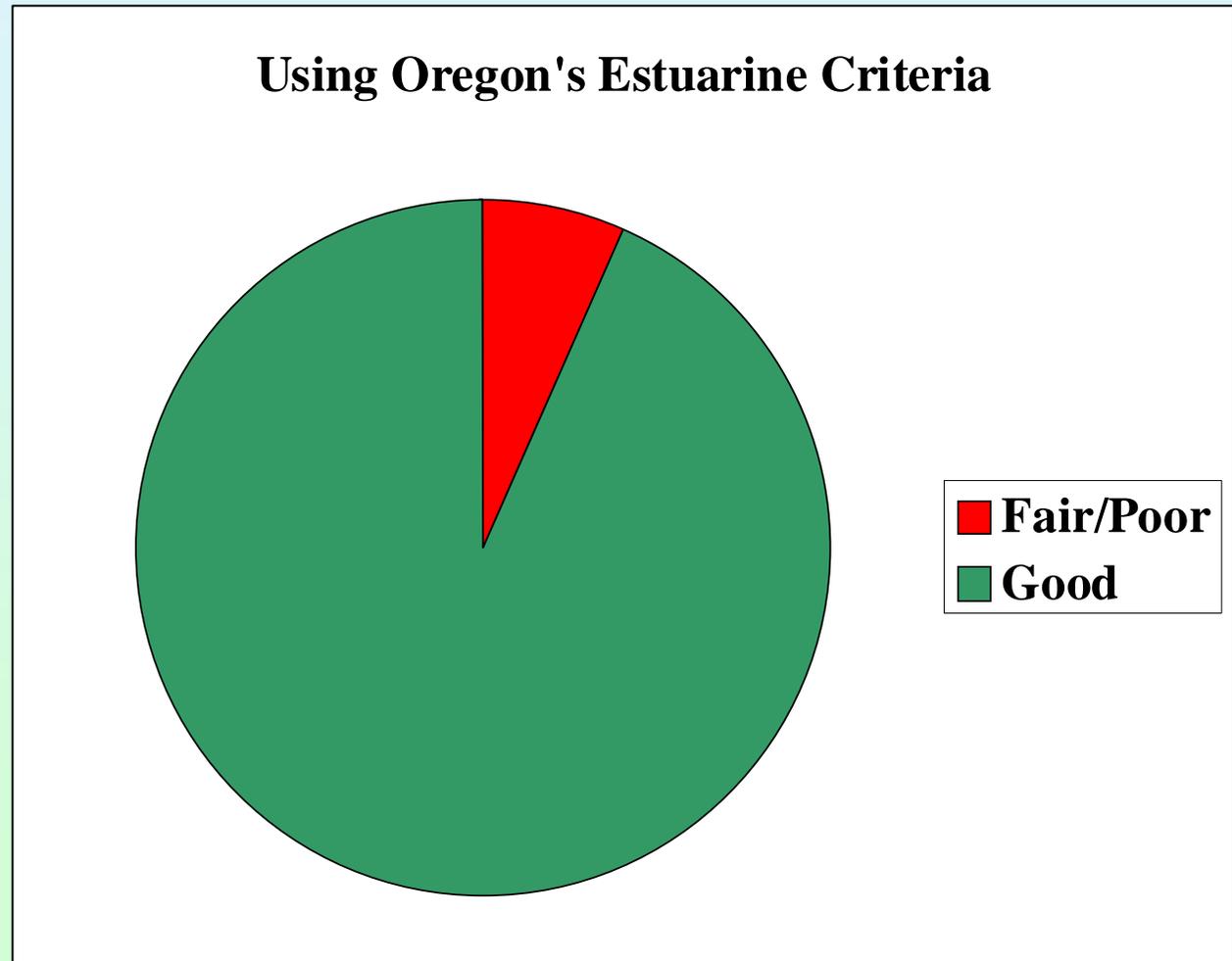


For DO, using the Washington's (8.0 mg/L) criteria...not so great!!



However, it is designated as “Salmonid Spawning/Rearing“. The criteria for salmonid spawning, rearing, and migration is 8.0 mg/L, but the Salmonid rearing and migration only criteria is 6.5 mg/L.

For DO, using the Oregon's estuarine criteria
6.5 mg/L... some where in between!

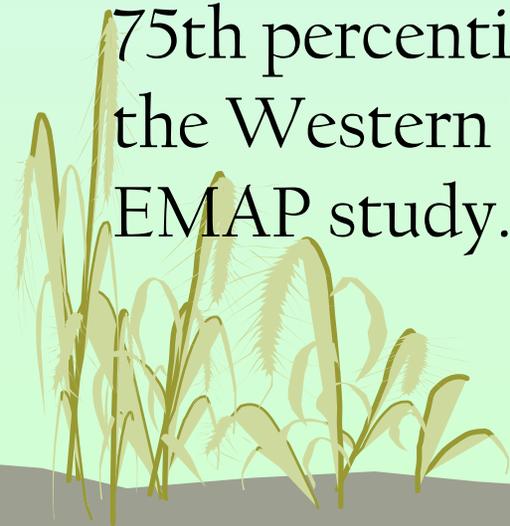


Nitrogen

Neither Oregon or Washington has criteria for nitrogen.

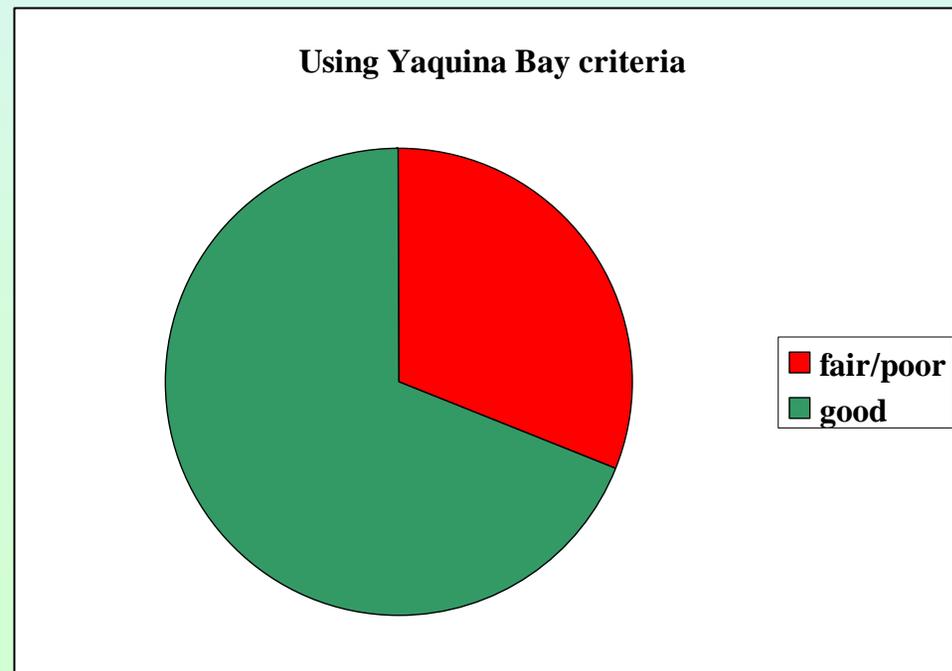
A case study was conducted in the Yaquina estuary in Oregon (Brown et al, 2007). They proposed a criteria for nitrogen ($>.168$ mg/L is fair/poor) for the more freshwater portion of Yaquina bay.

In addition, this value was very similar to those from the 75th percentile of reference conditions of larger rivers in the Western Mountain ecoregion from the Western EMAP study.



Using these criteria, 31% of the estuarine area was considered in fair/poor condition, and 69% was in good condition.

In contrast, if we used the NCA cutpoint for nitrogen (>.5 mg/l is fair/poor), 100% of the Columbia River Estuary would be considered in good condition for nitrogen.

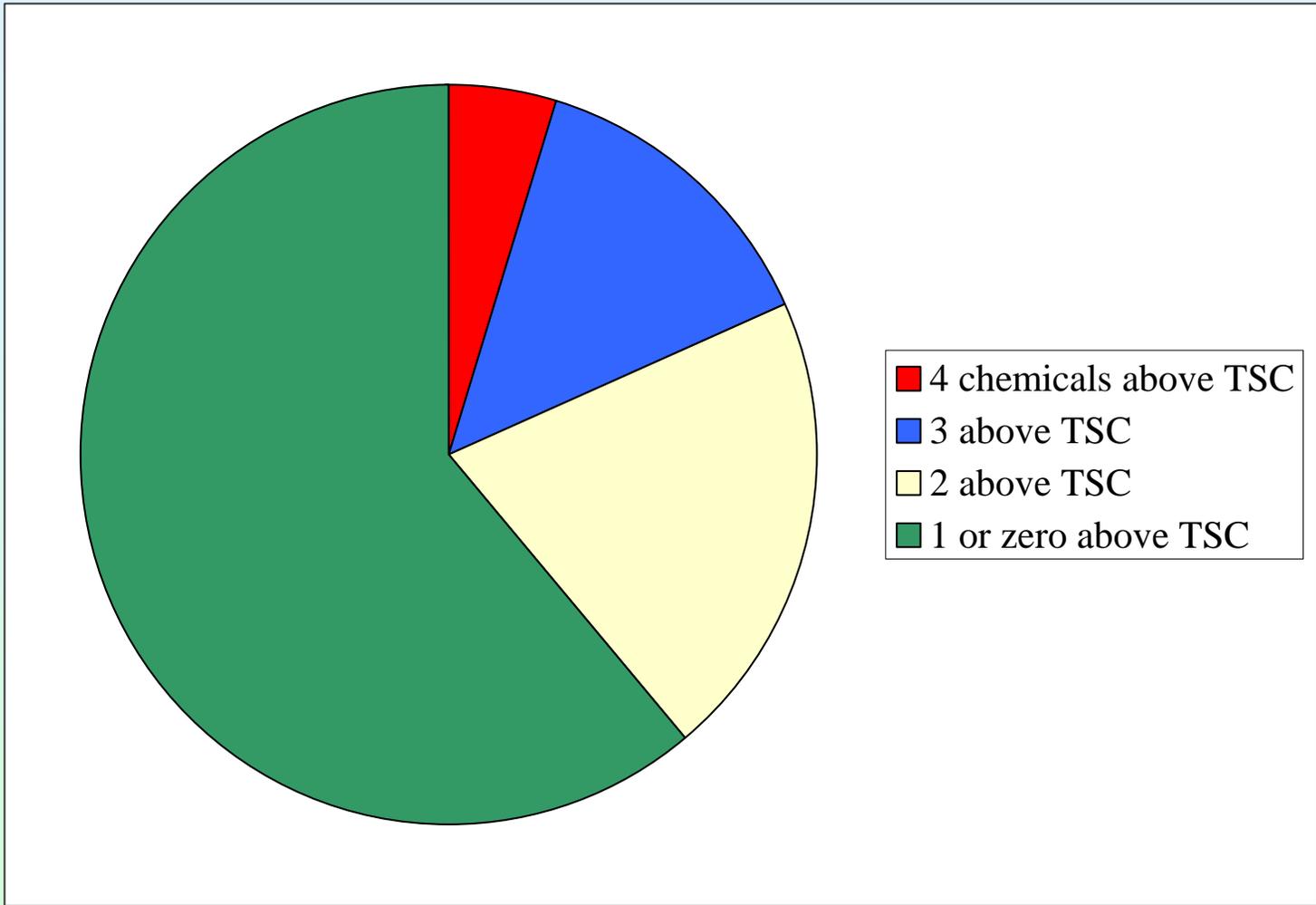


Chemicals in Fish Tissue

The Toxic Tissue Screening Criteria (TSC) are tissue residue levels that, when exceeded, may be harmful to fish.

- ✧ 4.6% of the estuarine area had 4 chemicals exceeding the TSC at the same site.
- ✧ 13.7% had 3 chemicals
- ✧ 20.6% had 2
- ✧ 61.0 % had one or zero

Only those sites with one or zero chemicals exceeding the TSC were considered good, everything else was considered fair/poor



Summary of Chemicals in Fish Tissue.

Benchmarks for Contaminants in Fish Tissue

The benchmark that the NCA uses is the EPA Advisory Guidance values for fish consumption by humans using whole-fish contaminant concentrations.

They found that 46 percent of all stations sampled where fish were rated poor (using the TSC showed 39% were rated poor).

However, since the fish collected in this study were not targeted to fish that people actually eat, we believe that using a more ecological based benchmark (TSC) is more appropriate.



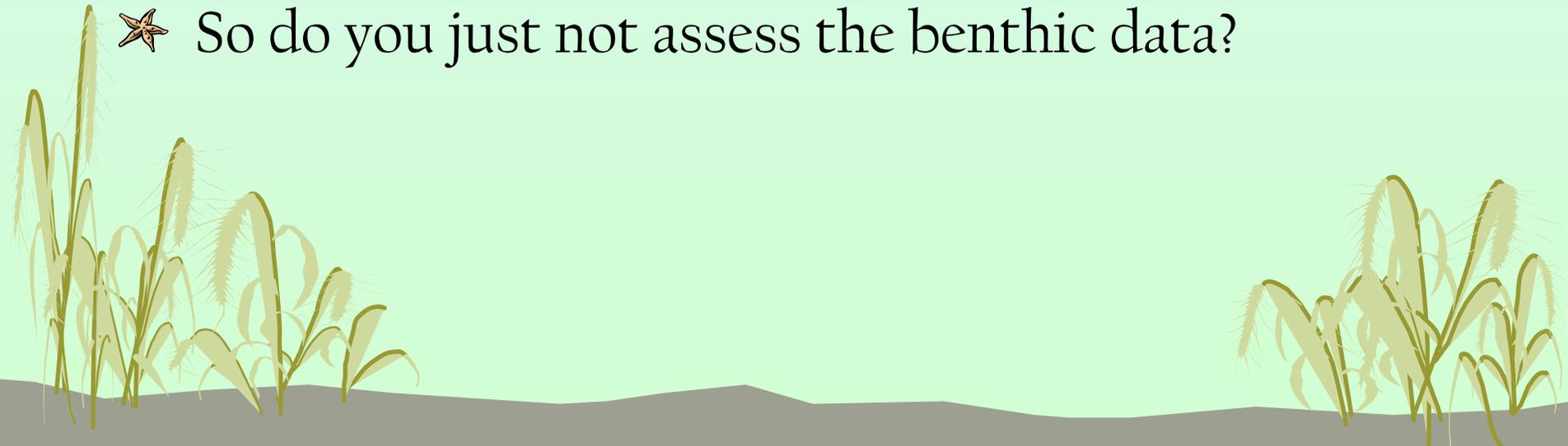


Benthic Invertebrates

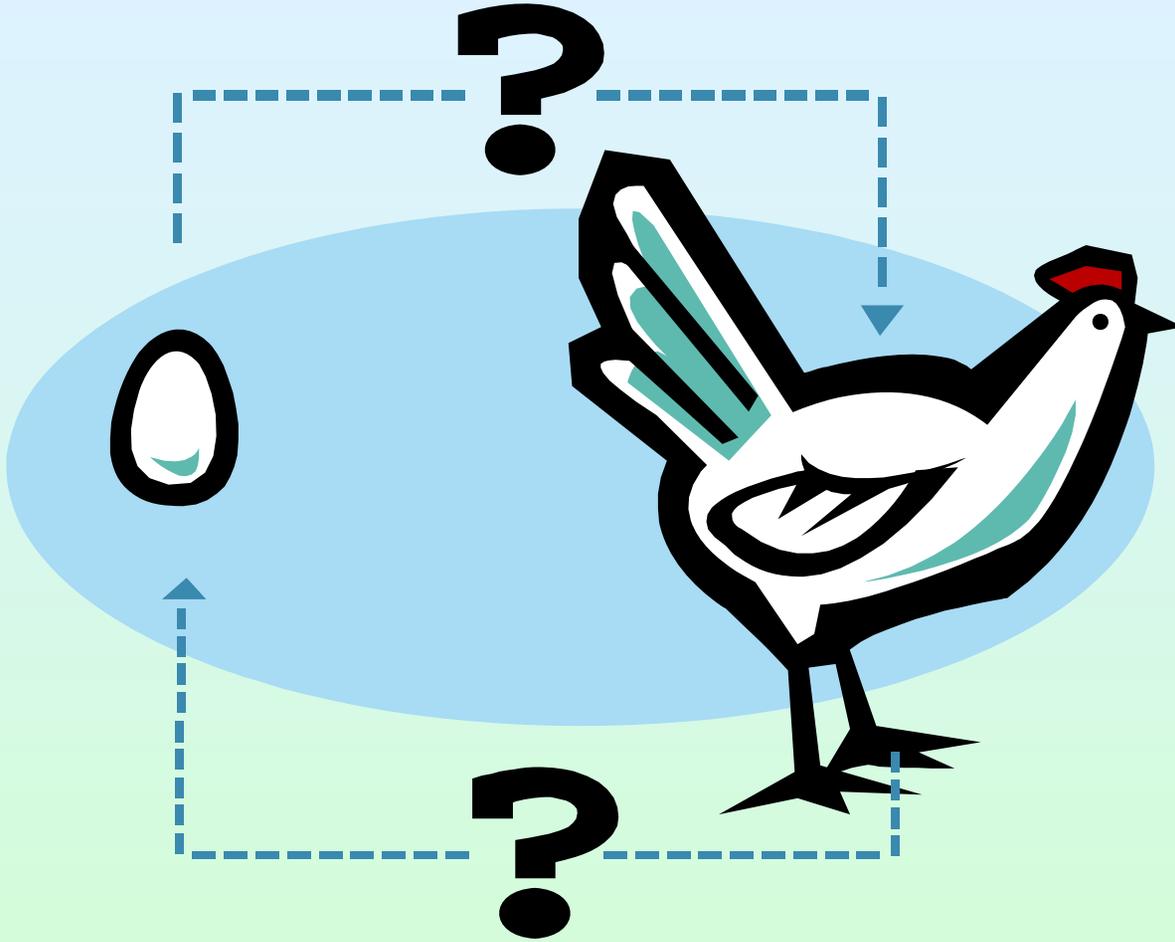
✧ There is no benthic index that has been developed for the Columbia River Estuary

✧ Many of the indices that have been developed are either for completely freshwater systems or for much more saline estuarine systems

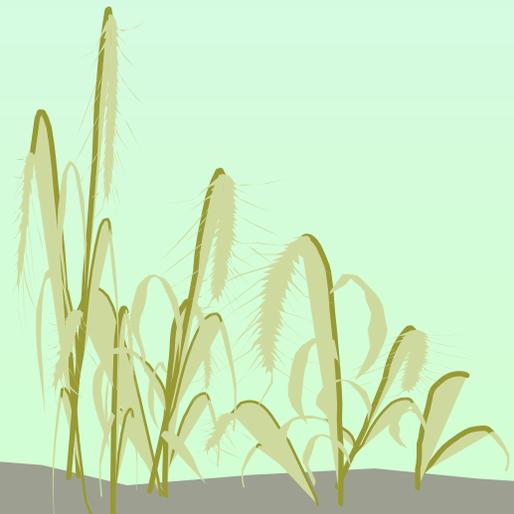
✧ So do you just not assess the benthic data?



Need to
have an
index
developed



Need to
collect
data

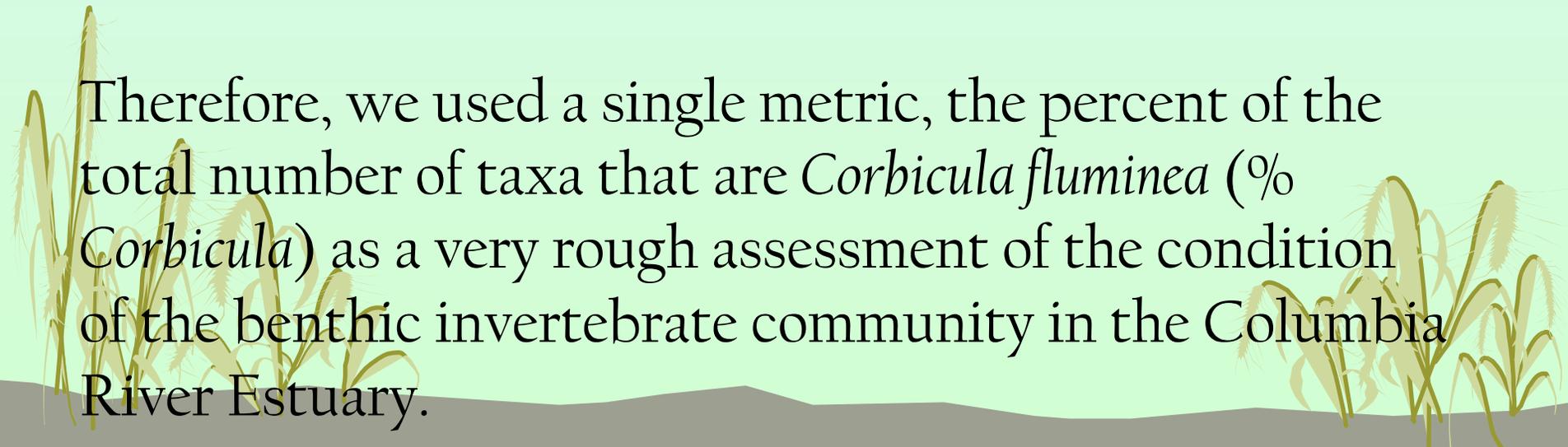


Invasive species represent a threat to the fundamental ecological integrity of aquatic ecosystems throughout the U.S. (Lee and Thompson, 2003).

Corbicula fluminea is a non-indigenous clam species that occurs in both fresh and marine waters.

Metrics using *Corbicula* have been proposed for rivers (Kerans and Karr, 1994).

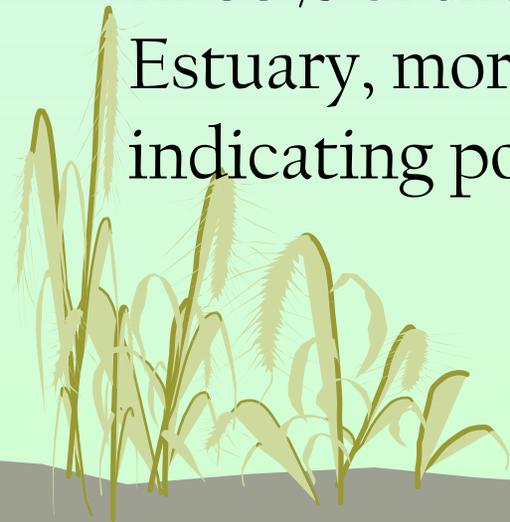
Therefore, we used a single metric, the percent of the total number of taxa that are *Corbicula fluminea* (% *Corbicula*) as a very rough assessment of the condition of the benthic invertebrate community in the Columbia River Estuary.



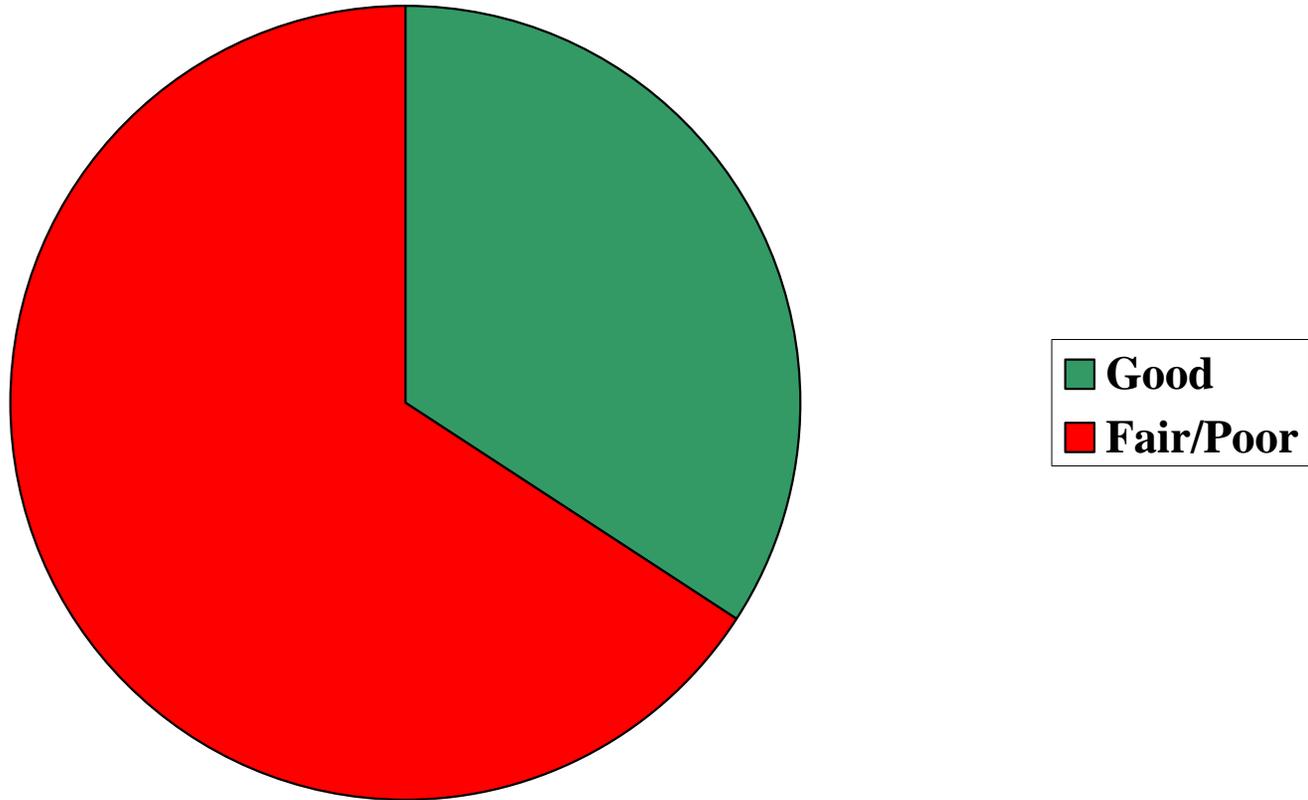
By definition, zero percent is what the historic level of any non-indigenous species (such as corbicula) would have been zero (27% of the estuarine area had zero *Corbicula*)

However, we used a cut-point of 10% as a background level for % *Corbicula*.

In 66% of the estuarine area of the Columbia River Estuary, more than 10% of the total taxa were *Corbicula* indicating poor conditions.

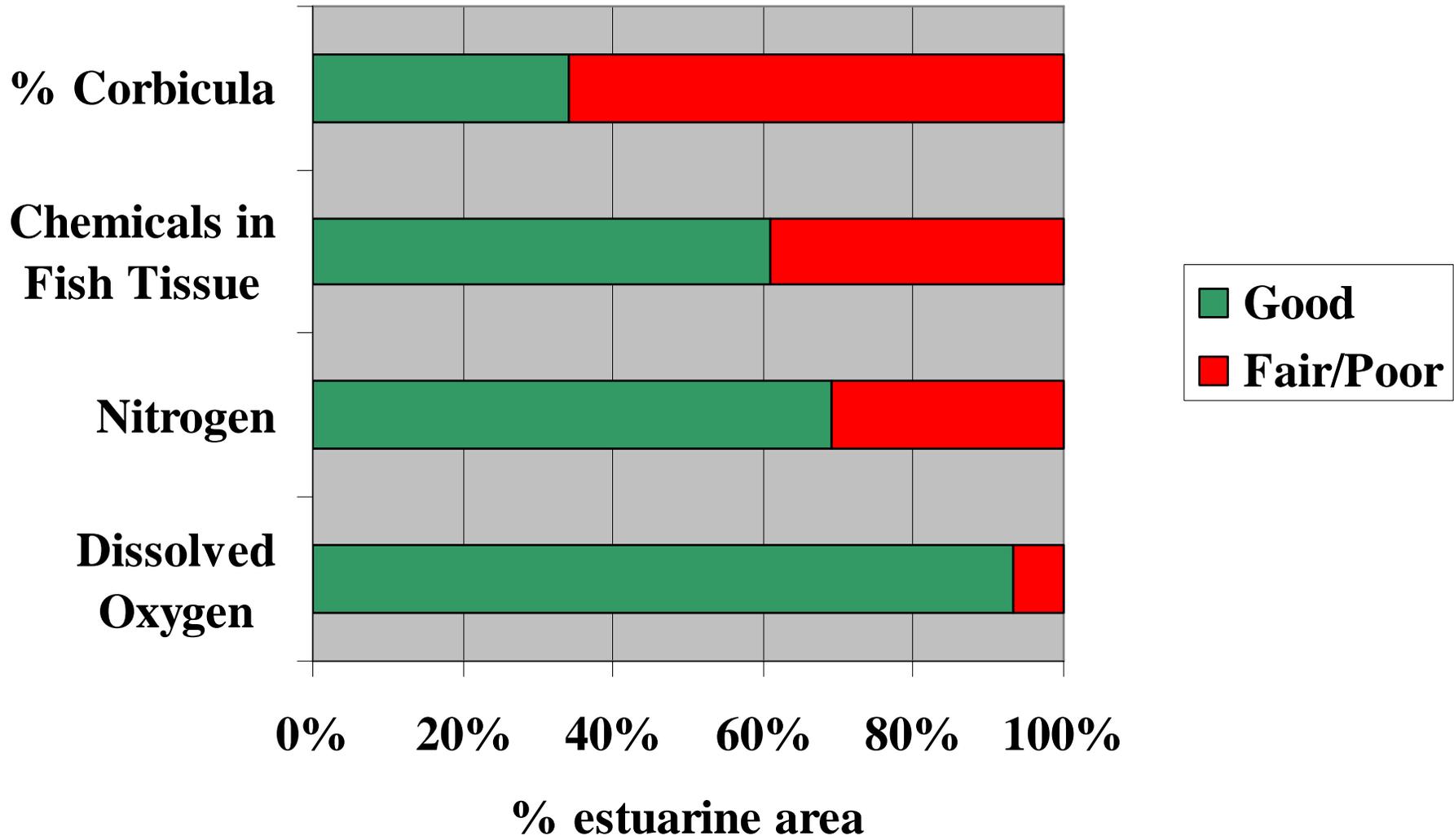


% *Corbicula*



Percent area of the Columbia River Estuary in good and fair/poor condition for % *Corbicula*.

Columbia River Estuary



ACKNOWLEDGEMENTS:

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✧ EPA's Office of Research and Development (ORD) in Newport and Corvallis

