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Surveillance for Antibiotic-Resistant E. coli in the Salish Sea Ecosystem

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Surveillance for antibiotic resistant *E. coli* in the Salish Sea ecosystem

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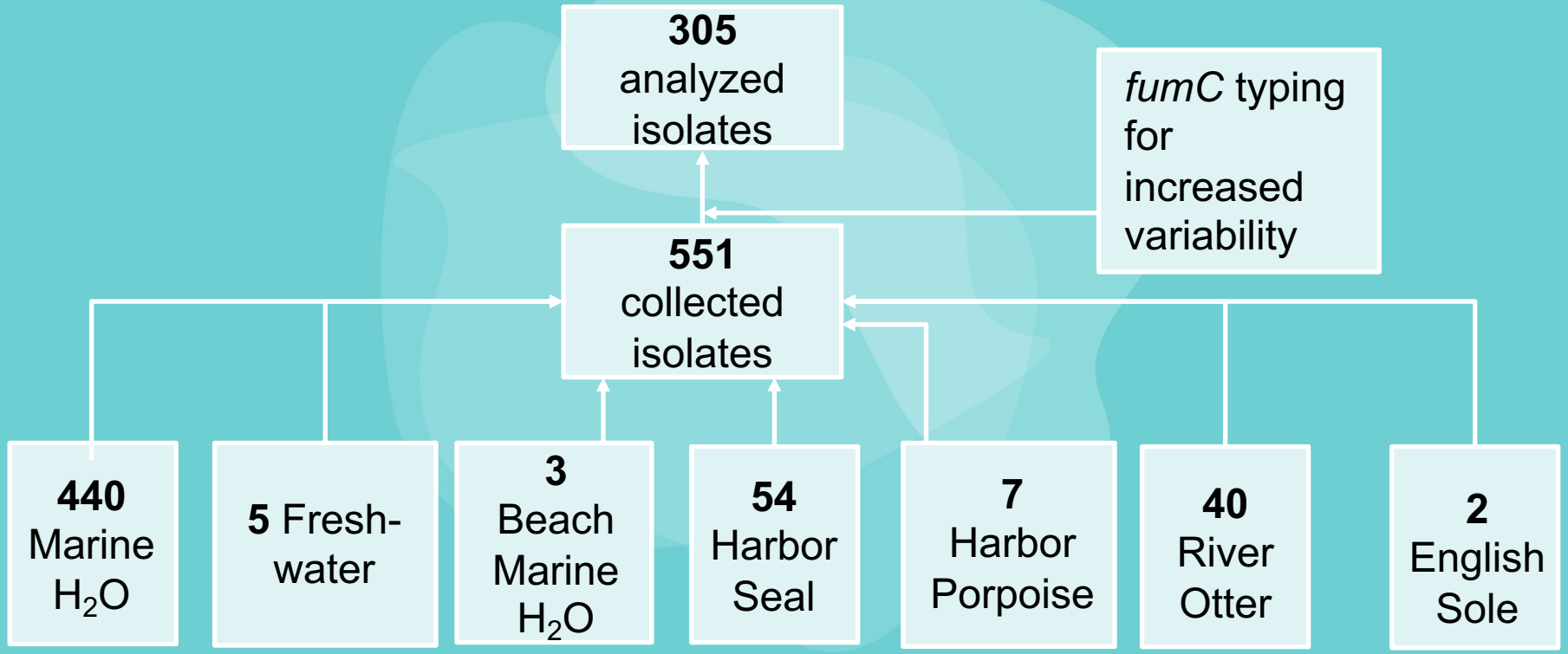
Background

- Antibiotics and their residues → Aquatic environments → Antibiotic Resistant Bacteria (ARB)
- Surveillance can inform us of ARB contamination on aquatic ecosystems, and humans and animals that live within it

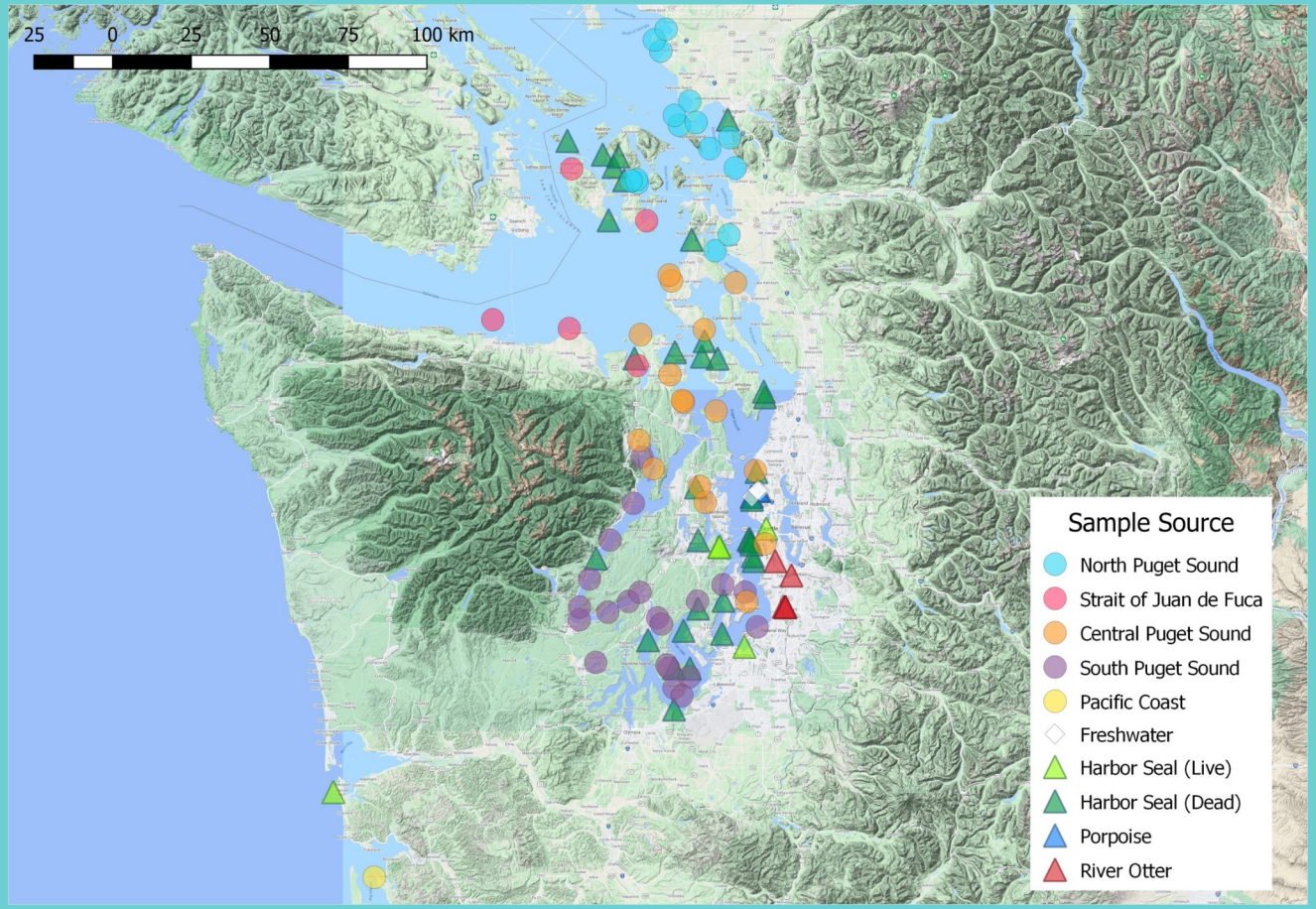
Project Aims

- Aim 1: **Sample** marine water, freshwater, marine mammals, and fish for *E. coli*
- Aim 2: **Determine % resistance** in the *E. coli* isolated from all samples.
- Aim 3: Analyze the relationships between antibiotic resistant *E. coli* using **Whole Genome Sequencing (WGS) and Multilocus Sequence Typing (MLST).**

E. coli Samples



Map of samples E. coli isolates by source

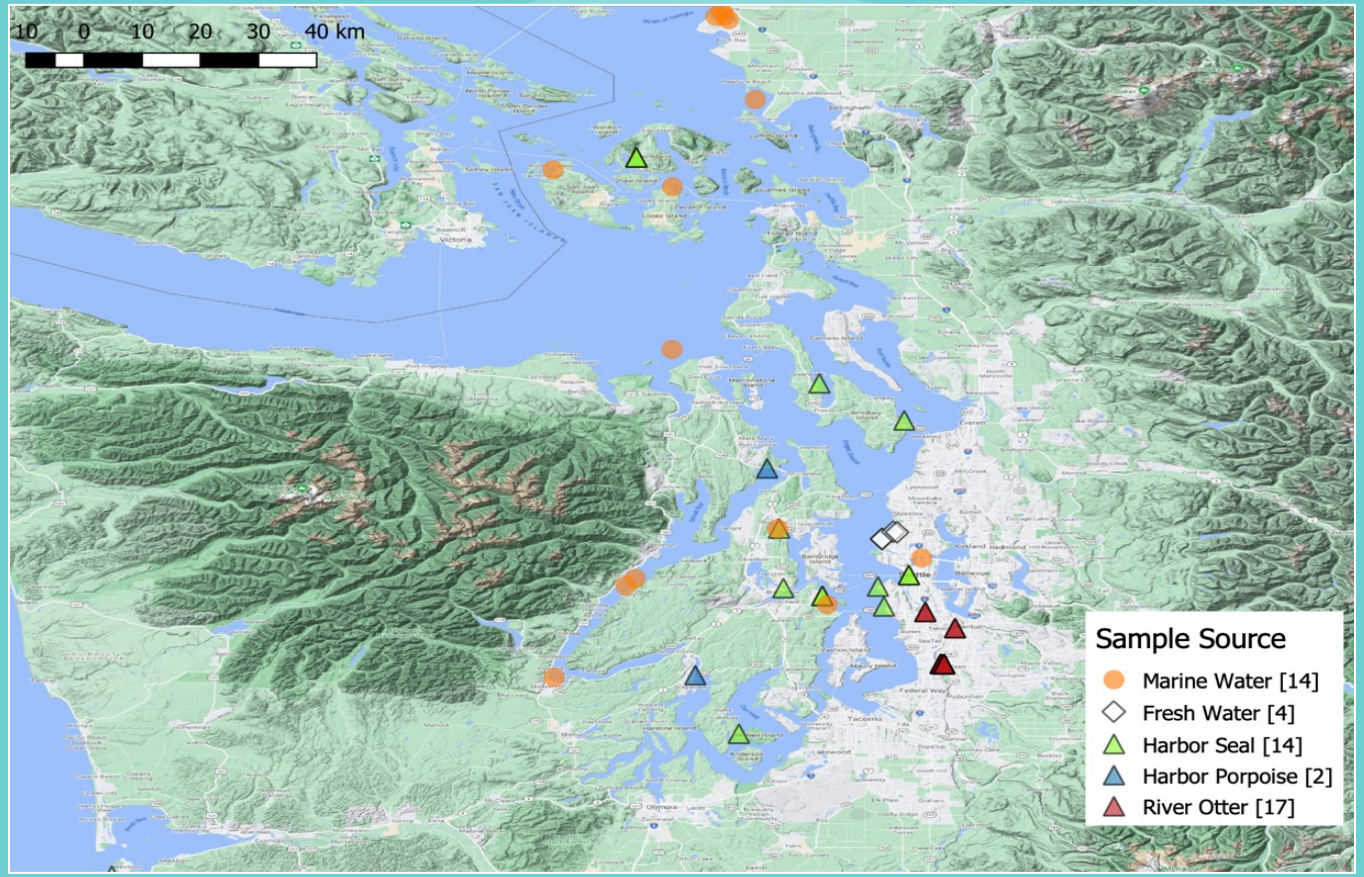


Results & Discussion

E. coli Isolates and Antibiotic Resistance

Sample Source (n=305)	Isolates Characterized	Intermediate	Resistant	Susceptible
Marine Water	**212**	**7 (3.3%)**	**7 (3.3%)**	**198 (93.4%)**
North Puget Sound	49	3 (6.1%)	4 (8.2%)	42 (85.7%)
Central Puget Sound	55	0 (0%)	2 (3.6%)	53 (96.4%)
South Puget Sound	56	3 (5.4%)	0 (0%)	53 (94.6)
Strait of Juan de Fuca	52	1 (1.9%)	1 (1.9%)	50 (96.2%)
Freshwater	**5**	**1 (20%)**	**3(60.0%)**	**1 (20.0%)**
Marine water by beaches	**3**	**0 (0%)**	**0 (0%)**	**3 (100%)**
Harbor Seal	**52**	**6 (11.5%)**	**8 (15.4%)**	**38 (73.1%)**
Dead Seal	35	6 (17.1%)	3 (8.6%)	26 (74.3%)
Live Seal	17	0 (0%)	5 (29.4%)	12 (70.6%)
Harbor Porpoise	**7**	**2 (28.6%)**	**0 (0%)**	**5 (71.4%)**
River Otter	**24**	**4 (16.7%)**	**13 (54.2%)**	**7 (29.2%)**
Sole	**2**	**0 (0%)**	**0 (0%)**	**2 (100%)**
Total	**305**	**20 (6.6%)**	**31 (10.2%)**	**254 (83.3%)**

Non-susceptibility Summary

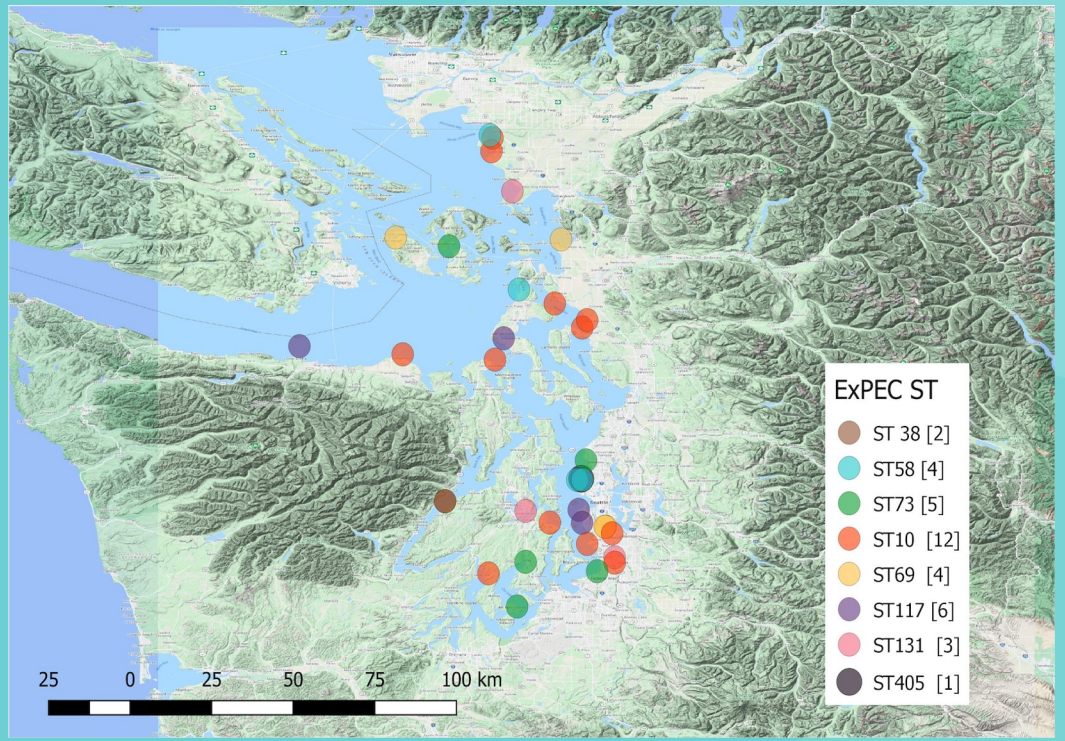


Statistical Analysis – Six Fisher's Exact Tests

	Non-Susceptible vs Susceptible	Resistant vs Susceptible
Puget Sound Quadrants	**P-value = 0.148**	**P-value = 0.089**
Marine Mammals and River Otters vs Marine Water	**P-value < 0.0001 OR 5.334 (99.2% CI 2.21-13.40)**	**P-value < 0.0001 OR: 8.877 (95% CI: 3.52– 24.67)**
Marine Mammals vs Marine Water	**P-value = 0.005 OR 3.014 (99.2% CI: 1.04-8.58)**	**P-value = 0.01**

MLST Diversity

Count of ST with # of Occurrences		
# of Occurrences	**Count**	**%**
1	139	70.92%
2	28	14.29%
3	10	5.10%
4	5	2.55%
5	7	3.57%
6	3	1.53%
7	2	1.02%
8	1.0	0.51%
12	1	0.51%
Total Count	**196**	**100%**



Map of Extra-intestinal pathogenic *E. coli* (ExPEC) associated ST

Takeaways

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Animal have the potential to be sentinels for antibiotic resistant bacteria

Diversity of ST in samples, with ExPEC and ExPEC-associated ST

Disconnect between phenotypic and genotypic susceptibility testing

Compare animal and environmental isolates to human isolates for further research

Thanks!

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Questions?