Investigation Into the Microbial Culture and Molecular Screening of Exhaled Breaths of Endangered Southern Resident Killer Whales (SRKW) and Pathogen Screening of the Sea-Surface Microlayer (SML) in Puget Sound

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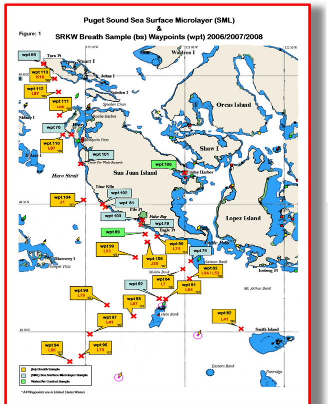
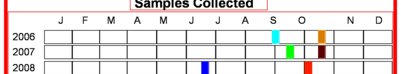
WAYPOINTS, SAMPLING & EQUIPMENT



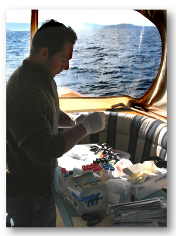
Samples Collected



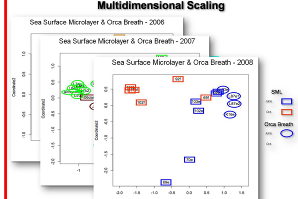
Sea Surface Microlayer (SML)
5 sites sampled all 3 years (69, 70, 101, 102, 103)
1 site sampled for 2 years (92)
2 sites sampled for 1 year (74, 76, 106)

Orca Breath
12 orcas sampled
4 repeat samples (2006-2007 ; 2007-2008)

J pod	K pod	L pod	
J1	K16	L7	L76
		L41	L79
		L53	L85
		L74	L87



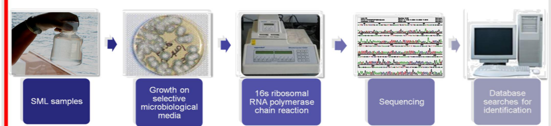
Multidimensional Scaling



- The microbial profile of orca breath is very different from the proximal sea surface microlayer.
- SML microbial profiles can be very similar across a larger geographic area.
- There is a temporal effect on microbial profiles. This may be related to tidal cycle, currents, wind effects, or other physical factors.

MICROBIAL TESTING & DATA

IDENTIFICATION OF POTENTIAL PATHOGENS USING GENETIC ANALYSIS



DRUG RESISTANCE RESULTS

Bacteria (Gram-negative)	Human health risk	Enrofloxacin	Excenel	Gentamycin	Neomycin	Ampicillin-Sulbactum	Sulfa-Trimethroprim	Tetracycline	Florfenicol
Vibrio alginolyticus	1	R	S	S	R	S	S	S	S
Aeromonas sp.	2	S	S	S	S	R	S	S	S
Burkholderia glumae	3	S	S	S	R	S	S	S	S
Burkholderia glumae	3	S	R	S	R	R	S	S	S
Halomonas sp.	3	S	S	S	S	S	S	S	S
Pseudomonas fluorescens	3	S	R	S	R	R	R	R	R
Psychrobacter immobilis	3	S	S	S	S	S	S	S	S
Psychrobacter sp.	3	S	S	S	R	R	R	S	S
Exiguobacterium sp.	4	S	S	S	S	S	R	S	S
Halomonas marina	4	S	S	S	S	S	S	S	S
Listonella anguillarum	4	S	R	S	R	R	S	S	S
Photobacterium damselae	4	S	R	S	R	R	R	S	S
Photobacterium phosphoreum	4	S	S	S	R	S	S	S	S
Pseudoalteromonas haloplanktis	4	S	S	S	S	R	S	R	S
Pseudoalteromonas sp.	4	S	S	S	S	S	S	S	S
Vibrio wodanis	4	S	S	S	R	S	S	S	S
Salmonella enterica Heidelberg	1	S	S	R	S	R	S	S	R
Burkholderia sp.	2	S	S	S	S	S	S	S	S
Alteromonas sp.	3	S	S	S	S	S	S	S	S
Psychrobacter phenylpyruvicus	3	S	S	S	S	S	S	S	S
Rheinheimera sp.	4	S	S	S	R	S	S	S	R
Shewanella hanedai	4	S	S	S	S	S	S	S	S
Vibrio splendidus	4	S	S	S	S	R	S	S	S
Pseudomonas sp.	2	S	S	S	S	S	S	S	S
Stenotrophomonas sp.	2	S	R	S	S	R	R	S	S
Stenotrophomonas sp.	2	S	R	S	S	R	S	S	S

Color Key:
in breath sample only; in SML sample only; in breath & SML sample; in air/human control sample
1 known pathogen(s); 2 opportunistic pathogen(s); 3 rare pathogen(s); 4 non-pathogenic
resistant to antibiotic; sensitive to antibiotic

Bacteria (Gram-positive)	Human health risk	Enrofloxacin	Erythromycin	Gentamycin	Lincomycin	Penicillin	Sulfa-Trimethroprim	Tetracycline	Florfenicol
α-hemolytic Streptococcus	1	S	S	S	S	S	S	S	S
Staphylococcus sp.	1	S	R	S	S	S	S	S	S
Staphylococcus sp.	1	S	S	S	S	R	S	S	S
Rothia dentocariosa	2	S	S	S	S	S	S	S	S
Staphylococcus epidermidis	2	S	R	S	S	S	S	R	S
Staphylococcus epidermidis	2	S	S	S	S	S	S	S	S
Staphylococcus warneri	2	S	S	S	S	S	S	S	S
Bacillaceae bacterium	3	S	S	S	R	R	S	S	S
Staphylococcus pasteuri	3	S	S	S	S	S	S	S	S
Macrocccus equipericicus	4	S	R	S	S	S	S	S	S
Macrococcus caseolyticus	4	S	S	S	R	S	S	S	S
Staphylococcus xylosus	4	S	R	S	R	S	S	R	S
Kocuria sp.	2	S	R	S	S	S	S	S	S
Staphylococcus capitis	2	S	S	S	S	R	S	S	S
Staphylococcus cohnii cohnii	2	S	R	S	R	S	S	S	S
Microbacterium sp.	3	S	S	S	S	S	R	S	S
Arthrobacter sp.	4	R	S	S	R	S	S	S	S
Bacillus lichenformis	4	S	S	S	R	R	S	S	S
Bacillus sp.	4	S	S	S	R	R	R	S	S
Bacillus sp.	4	S	R	S	R	S	S	S	S
Staphylococcus epidermidis	2	S	R	S	R	R	S	R	S
Staphylococcus lugdunensis	2	S	S	S	S	S	S	S	S
Bacillus sp.	3	S	S	S	R	R	S	S	S
Arthrobacter sp.	4	S	S	S	S	S	S	S	S
Arthrobacter sp.	4	S	S	S	S	S	S	S	S
Arthrobacter sp.	4	S	S	S	S	S	S	S	S
Sporosarcina sp.	4	S	S	S	R	S	R	S	S

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MICROBIAL DIVERSITY

Total of 56 microbial genera < 37 bacterial / 19 fungal

Bacteria

Acinetobacter	Gelidibacter	Pseudomonas
Aeromonas	Halomonas	Psychrobacter
Alteromonas	Leewenhoekiella	Rahnella
Arthropbacter	Listonella	Rheinheimera
Bacillacae	gammaproteobacterium	Rothia
Bacillus	Kocuria	Salmonella
Burkholderia	Macrococcus	Shewanella
Clostridium	Marinomonas	Sporosarcina
Cobetia	Microbacterium	Staphylococcus
Curtobacterium	Moritella	Stenotrophomonas
Enterobacter	Photobacterium	alphaStreptococcus
Exiguobacterium	Pseudoalteromonas	Streptomyces
		Vibrio

Fungi

Alternaria	Hormodendrum
Aureobasidium	Hypocrea
Aspergillus	Mucor
Botrytis	Penicillium
Candida	Phialophora
Cladosporidium	Phoma
Doratomyces	Rhodotorula
Epicoccum	Tametes
Fusarium	Trichoderma
	Verticillium

CUMULATIVE STRESSORS = IMMUNE SUPPRESSION

global research & rescue

http://www.grrescue.org

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