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Pre-contact baseline ecological reconstruction in Burrard Inlet

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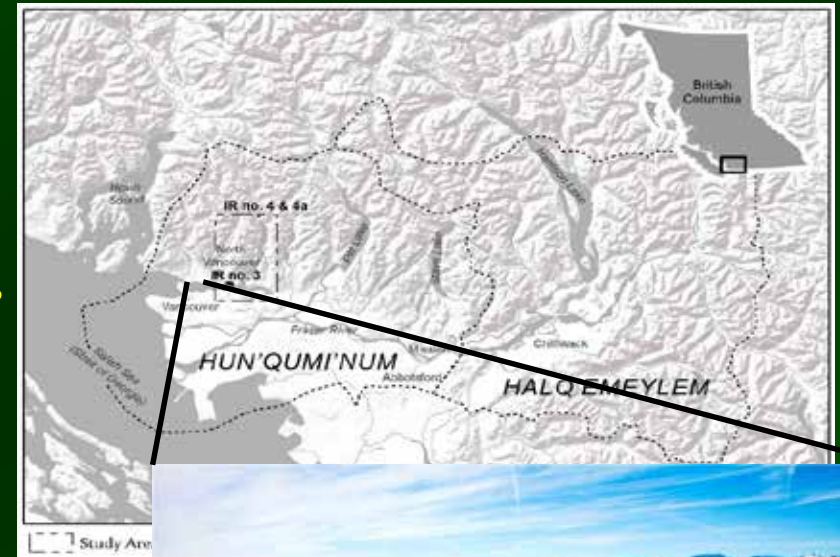
Pre-Contact Baseline Ecological Reconstruction in Burrard Inlet



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What Are We Trying to Restore? The Problem of Shifting Baselines in Burrard Inlet

- It is a very high priority for Tsleil-Waututh Nation to restore the health of Burrard Inlet.
- The fish, shellfish, birds and other foods from these waters sustained their ancestors here for thousands of years.
- But now those species are absent, toxic, or simply too depleted to harvest.
- If we want to restore the health of the inlet, we need to know the composition of the pre-contact ecological conditions.
- The archaeological record here is provides a detailed record of local resource use since 1000 BC.



- Burrard Inlet, looking west

What Are We Trying to Restore? The Problem of Shifting Baselines in Burrard Inlet

- We will use these archaeological data to reconstruct pre-contact baseline marine ecological conditions.
- This avoids the issue of shifting historic baselines.
- This is an applied archaeology project, partially guided by Pauley's (1998) *Back to the Future* approach.
- We will use well-dated samples of archaeofauna, historical records, Tsleil-Waututh oral history and traditional use study information and mass balance modelling to reconstruct pre-contact baseline ecology.
- Specific techniques will include ancient and modern DNA analysis of salmonids and herring, and isotopic sclerology of shellfish.

Early And Intensive Impacts

- First industry then urbanization had severe impacts to the local marine ecology
- Herring, while formerly plentiful were extirpated as early as 1898.
- Shellfish beaches killed off by pollutants by 1912.
- Collapse of salmon fisheries by 1950's



• Barnett Mill 1900



• Ioco oil refinery 1912



• Hastings Mill 1886

A Modern Port and Metropolis

- While environmental regulations have certainly become more stringent, negative impacts to the marine ecology have only increased.
- Greater Vancouver now has 2.4 million people (and growing rapidly).
- Port Metro Vancouver handles 50% of container cargo moving in and out of Canada (and growing rapidly).
- Canadian government has approved a project to massively increase bitumen shipments to ~1 tanker per day.
- So that is to say, the marine ecology is on the ropes...

- Burrard Inlet looking east

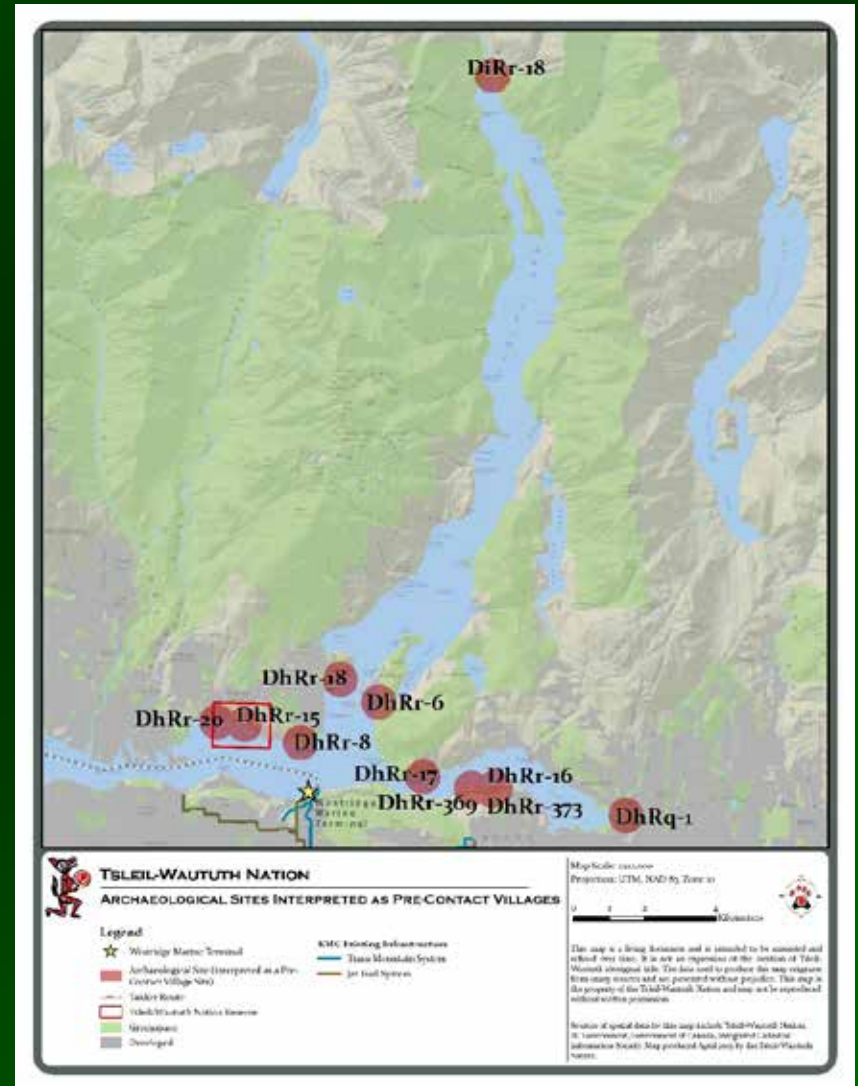


- Burrard Inlet looking northeast

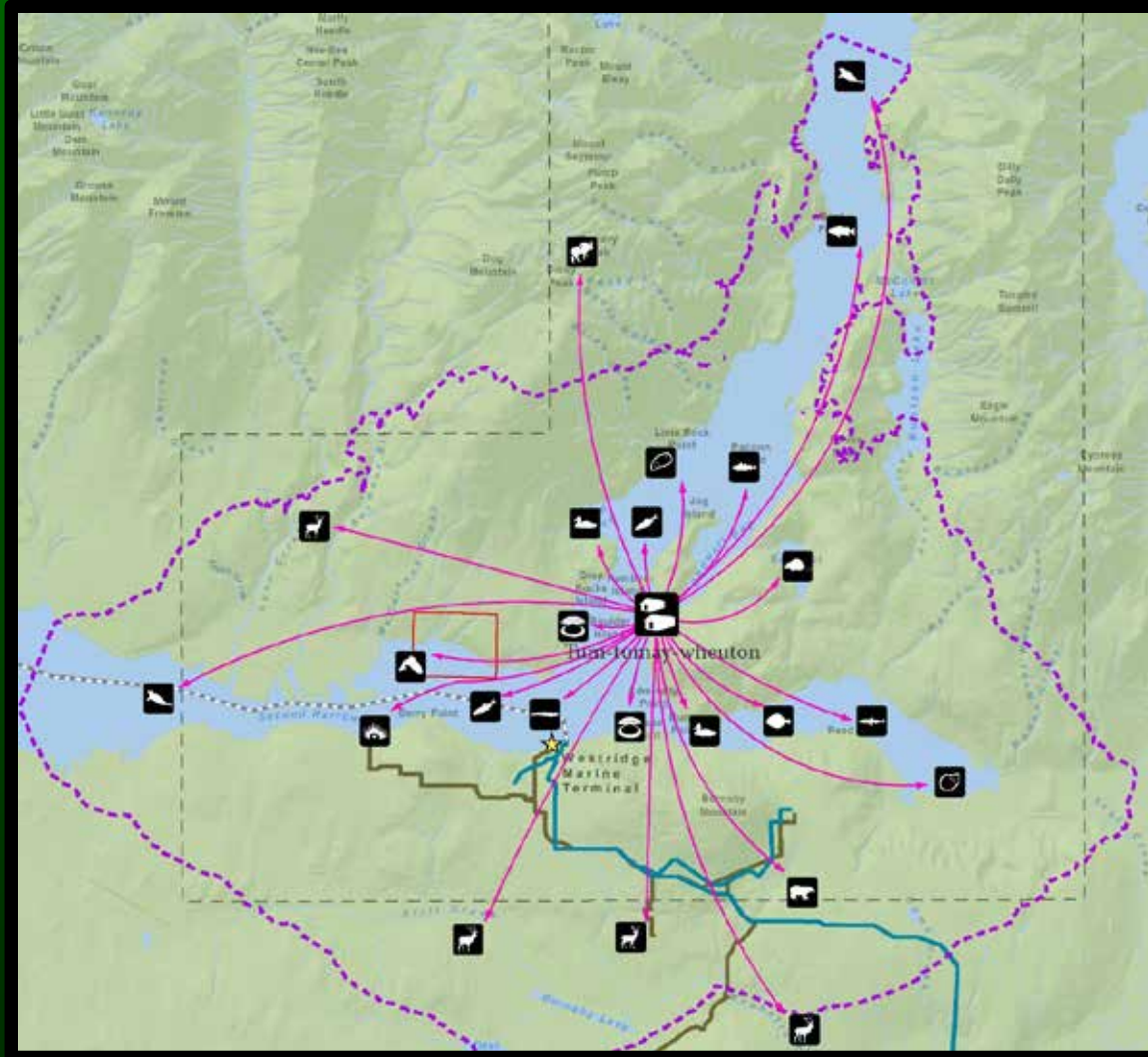


And Underneath All This....

- While west of the Second Narrows, the archaeological record is nearly completely obliterated, east of there are the remains of several pre-contact village sites.
- Most of these pre-contact Tsleil-Waututh village sites are large shell middens.

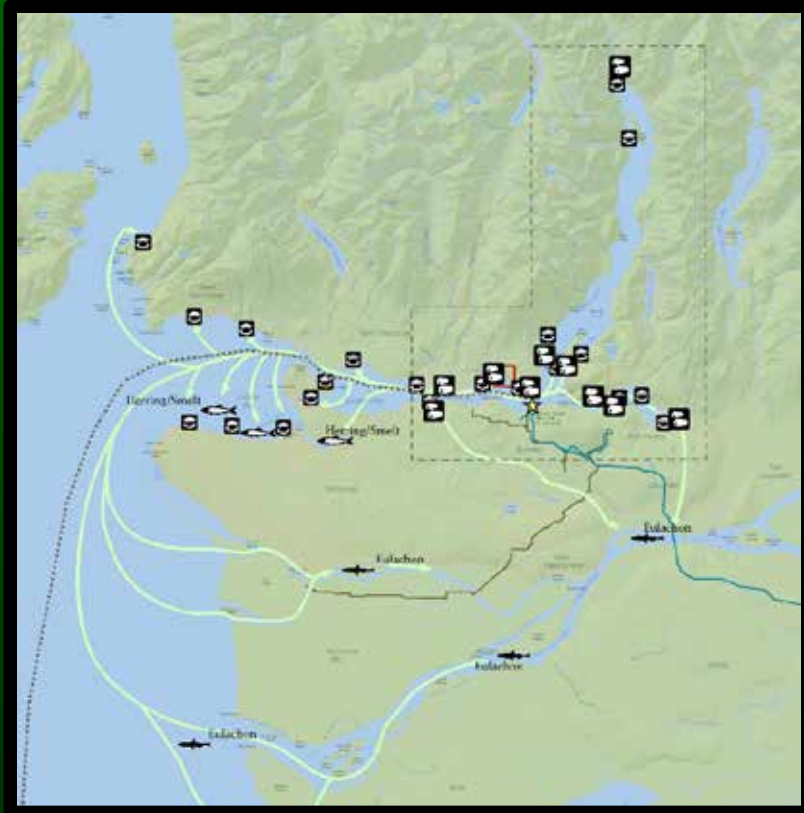


Villages are Central Places for Local Catchments: Tum-tumay-wheuton



- Probable harvesting areas for resources recovered from Tum-tumay-wheuton/ Belcarra (Morin 2015).
- Least Cost Catchment area (2 h by foot or canoe)
- Known or probable resource habitat

Villages are Central Places in a Seasonal Round



- Relocation to spring herring and eulachon fishing settlements



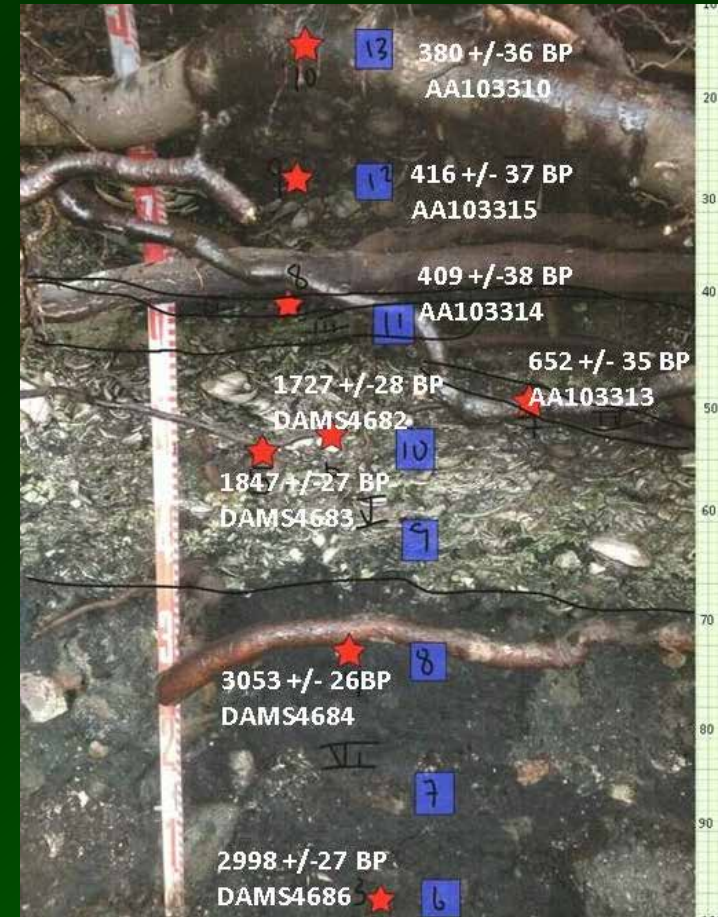
- Relocation to summer hunting and berry harvesting camps

Shell Middens of Burrard Inlet

- The large are typically deeply stratified (1-3 m deep) accumulations of shellfish, fish and animal bones, fire-cracked rocks, artifacts, etc.
- They not just refuse heaps, but places of dwelling.
- Structural remains of plank houses and other structures.
- We have already very-well dated (radiocarbon) sequences from most of these sites in Burrard Inlet



- Shell midden at Whey-ah-wichen/Cates Park.



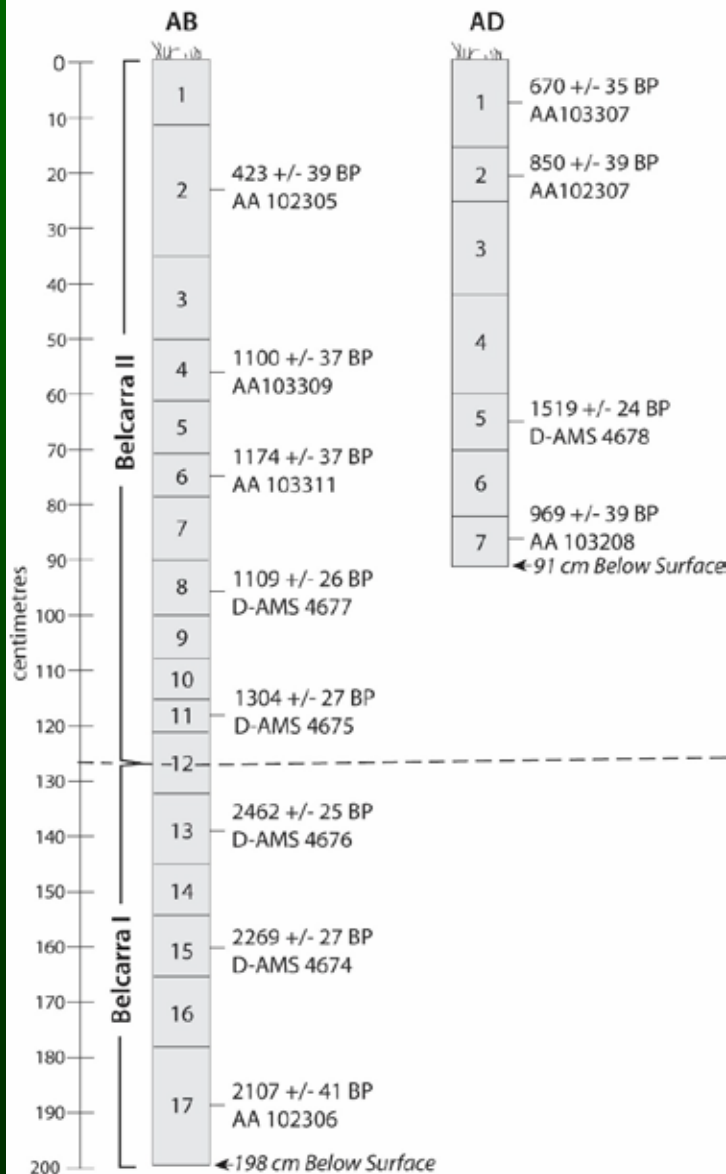
- Shell midden column from Sleil-Waututh (IR 3) with associated radiocarbon dates spanning 3000-380 BP.

Fish	Shellfish
Big skate (<i>Raja binoculata</i>)	Barnacle sp. (<i>Balanus</i> spp.)
Blackfin sculpin (<i>Malacocottus cf kincaidi</i>)	Blue mussel (<i>Mytilus edulis</i>)
Buffalo sculpin (<i>Enophrys bison</i>)	Butter clam (<i>Saxidomus gigantean</i>)
Capelin (<i>Mallotus cf pretiosus</i>)	Clam spp.
Cod (<i>Gadidae</i>)	Crab spp. (<i>Decapoda</i>)
English sole (<i>Parophrys vetulus</i>)	Gastropod
Eulachon (<i>Thaleichthys pacificus</i>)	Green sea urchin (<i>Strongylocentrotus droebachiensis</i>)
Flatfish spp. (<i>Pleuronectiformes</i>)	Horse clam (<i>Tresus</i> spp.)
Flathead sole (<i>Hippoglossoides elassodon</i>)	Nuttall's cockle (<i>Clinocardium nuttallii</i>)
Lingcod (<i>Ophiodon elongatus</i>)	Pacific littleneck clam (<i>Protothaca staminea</i>)
Longfin smelt (<i>Spirinchus sf villosus</i>)	Snail spp.
Northern anchovy (<i>Engraulis mordax</i>)	
Northern sculpin	Land Mammals
Pacific herring (<i>Clupea pallasii</i>)	Artiodactyl sp.
Pacific staghorn sculpin (<i>Leptocottus armatus</i>)	Beaver (<i>Castor canadensis</i>)
Peamouth chub (<i>Mycheilus caurinus</i>)	Black bear (<i>Ursus americanus</i>)
Perch (<i>Embiotocidae</i>)	Black-tailed deer (<i>Odocoileus hemionus</i>)
Pile perch (<i>Rhacochilus vacca</i>)	Marten (<i>Martes americana</i>)
Plainfin midshipman (<i>Porichthys notatus</i>)	Mink (<i>Mustela vison</i>)
Ratfish (<i>Hydrolagus colliiei</i>)	Mountain goat (<i>Oreamnos americanus</i>)
Red irish lord (<i>Hemilepidotus cf hemilepodtus</i>)	Raccoon (<i>Procyon lotor</i>)
Rock greenling (<i>Hexagrammos lagocephalus</i>)	Small canid (<i>Candiae</i>)
Rock sole (<i>Lepidopsetta bilineata</i>)	Snowshoe hare (<i>Lepus americanus</i>)
Rockfish (<i>Sebastes</i> spp.)	Wapiti (<i>Cervus elaphus</i>)
Salmon (<i>Oncorhynchus</i> spp.)	
Sand sole (<i>Psettichthys cf melanostictus</i>)	Birds
Sculpin spp. (<i>Cottidae</i>)	American wigeon (<i>Anas americana</i>)
Shiner perch (<i>Cymatogaster aggregata</i>)	Bald eagle (<i>Haliaeetus leucocephalus</i>)
Silverspotted sculpin	Bay ducks (<i>Athaya</i> sp.)
Smelt spp. (<i>Hypomesus</i> spp.)	Bonaparte's gull (<i>Larus philadelphia</i>)
Spiny dogfish (<i>Squalus acanthias</i>)	Bufflehead/goldeneye (<i>Bucephala</i> spp.)
Starry flounder (<i>Platichthys stallatus</i>)	Canada goose (<i>Branta canadensis</i>)
Surf scoter (<i>Melanitta perspicillata</i>)	Gadwall (<i>Anas strepera</i>)
Surf smelt (<i>Hypomesus pretiosus</i>)	Harlequin duck (<i>Historionicus historionicus</i>)
Three-spine stickleback (<i>Gasterosteus aculeatus</i>)	Mallard (<i>Anas platyrhynchos</i>)
Whitespotted greenling (<i>Hexagrammos stelleria</i>)	Northern pintail (<i>Anas acuta</i>)
	Northern shoveler (<i>Anas clypeata</i>)
Sea Mammals	
Delphinidae	
Harbour seal (<i>Phoca vitulina</i>)	

Archaeofauna and Resource Use: Tum-tumay-wheuton:

- Archaeofauna recovered from Tum-tumay-wheuton (Charlton 1980; Pierson 2011)
- Very diverse (n = 71 species)
- Dominated by three groups of resources – salmon, herring/anchovy/smelt, and shellfish.
- Probably ~90% of diet from these three resource groups

Belcarra
 DhRr 6
 Pierson's Auger Samples (2011)

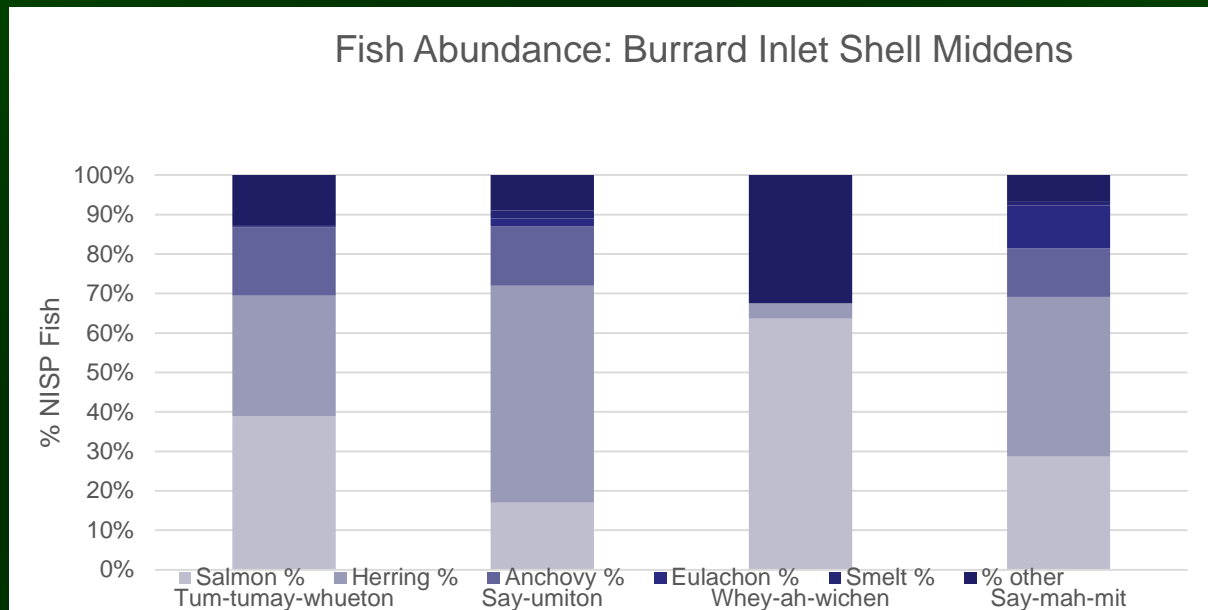


Refining the Record of Fish Harvesting in Burrard Inlet

- There are samples of salmon and herring from almost all of these dated layers.
- We will submit 100 samples of salmon vertebrae and 50 herring for DNA analysis (Dongya Yang, SFU) (summer 2018).
- This will identify the range of salmonids available in Burrard Inlet from about 200 BC to just prior to contact.
- Assess if there was a stable local herring population or if it was part of a migratory Salish Sea population.

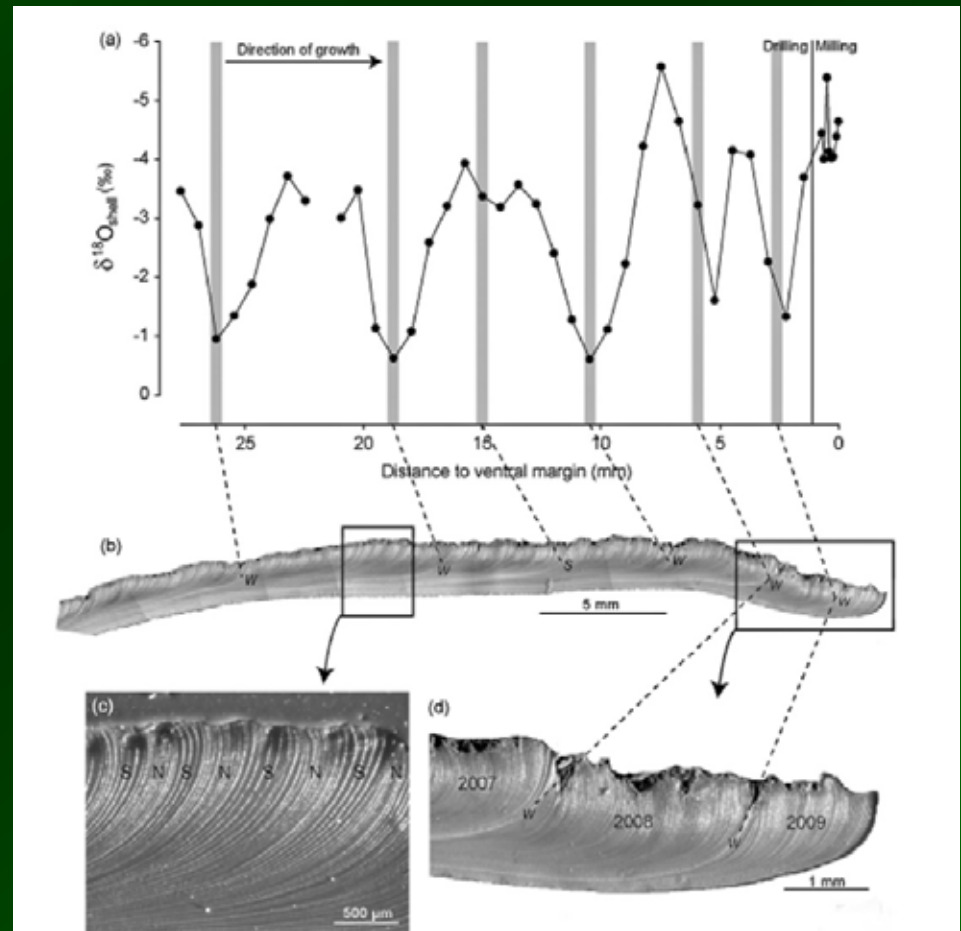
Archaeofauna: Insight into Pre-contact Ecology (1)

- Archaeofauna recovered from the large shell middens (villages) varies in the relative importance of specific species (e.g., finfish and shellfish, Pierson 2011; Trost 2005).
- These differences are probably attributable to local variability in abundance.
- There are no discernable changes through time, but this has not been a focus of research.
- Future research will assess species abundance and diversity through time.



Ancient Shellfish Use: Isotopic Paleosclerology

- To assess pre-contact shellfish abundance and diversity, we will utilize isotopic paleosclerology (Burchell, Memorial University) on shellfish from modern and archaeological contexts.
- This biogeochemical analysis of cross sections of clam shells will allow assessment of shellfish growth rates, interpretation of harvesting pressure, and identification of season of harvest.



- Identification of growing seasons in clam shells (Burchell et al. 2013).

Historical and Archival Records

- While all historical records are, by definition, post-contact, early historic records provide unique ecological details.
- These include explorer accounts, early settler accounts, colonial correspondence, newspaper articles, and early fish/shellfish stock assessments.
- Compilation of these extensive anecdotes helps identify the early historic ecological conditions, and perhaps more importantly, identify key historic changes.
- 1859 draft map of Burrard Inlet (Captain Richards)
- “Oyster”



Tsleil-Waututh Oral Histories and Traditional Use Study Data

- The Tsleil-Waututh community has accumulated local ecological knowledge spanning several millennia in Burrard Inlet.
- Oral histories are rarely (if ever) focussed on ecology, but these accounts do contain certain details of pre-contact or early historic ecological conditions.
- Traditional Use Study (TUS) information describes Tsleil-Waututh harvesting practices in the later half of the 20th century. These data provide details on species depletion and key ecological impacts.
- Compilation of these relevant accounts will provide further details on pre-contact baseline ecology.

Conclusions

- The Burrard Inlet marine ecosystem has experienced extensive negative impacts. These impacts are so extensive that historic baselines have shifted significantly from pre-contact ecological baselines.
- To identify the pre-contact baseline ecological conditions, we will undertake research in applied archaeology following the Back to the Future Approach.
- This pre-contact baseline will be used to inform and assess ecological rehabilitation efforts.