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Pre-contact baseline ecological reconstruction in Burrard Inlet

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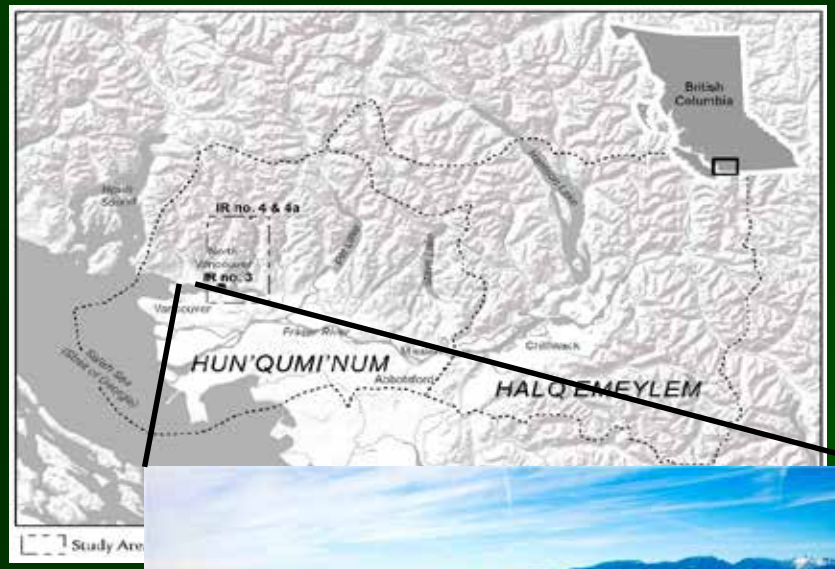
What Are We Trying to Restore? The Problem of Shifting Baselines in Burrard Inlet

- 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…

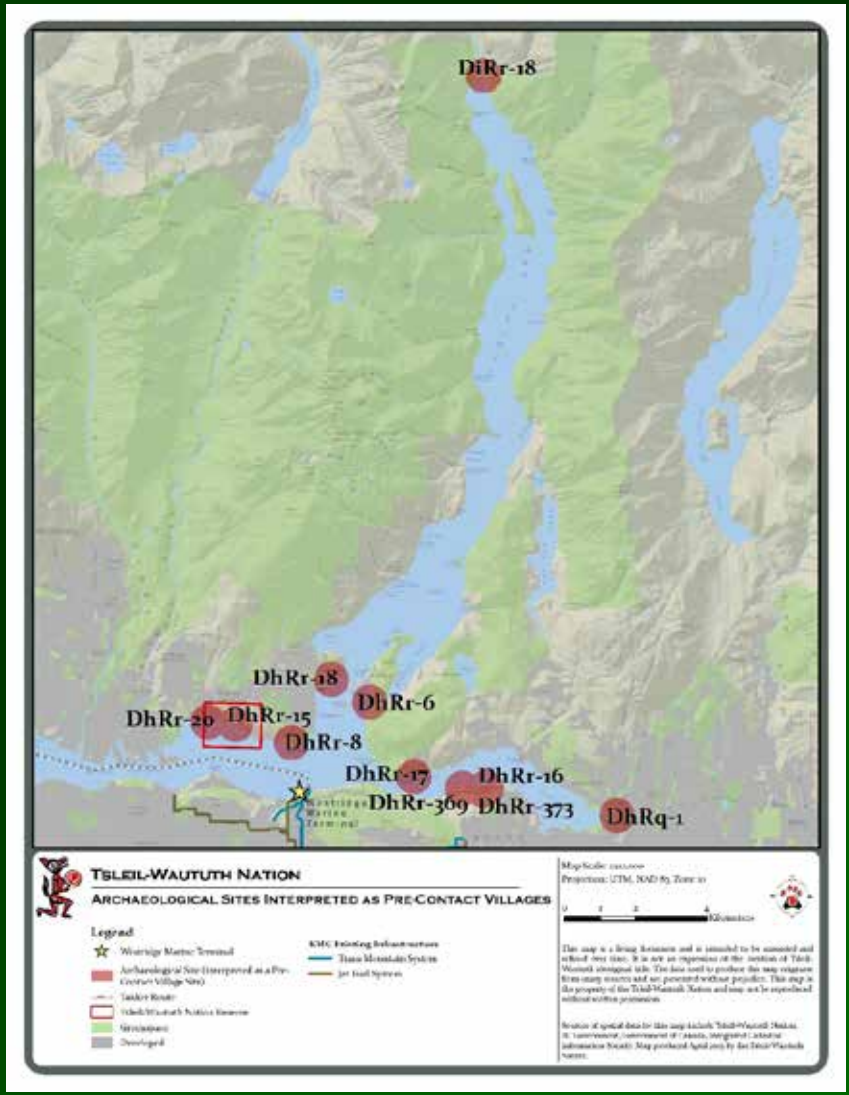
- Burrard Inlet looking northeast

- Burrard Inlet looking east

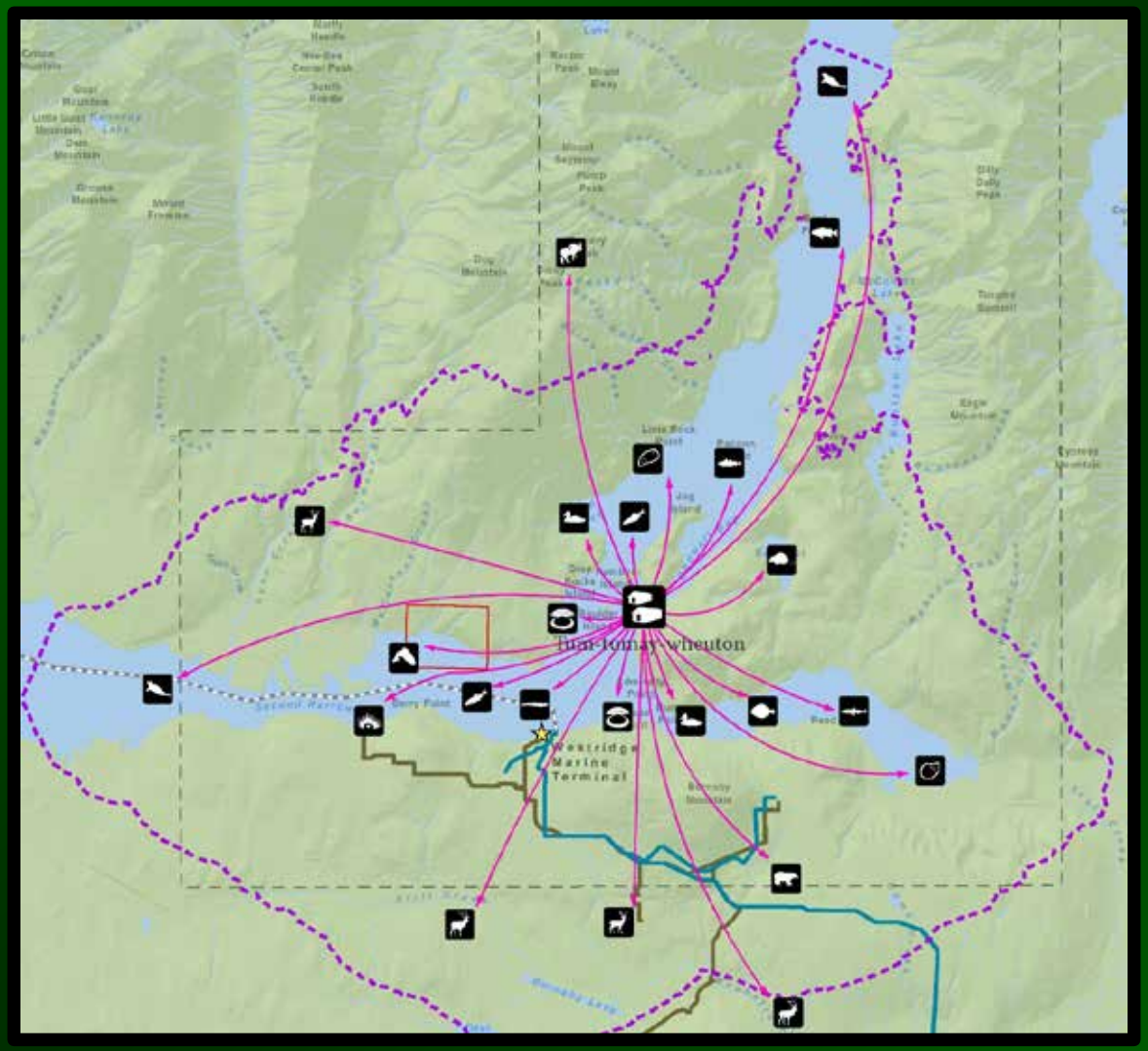
And Underneath All This….

- 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.

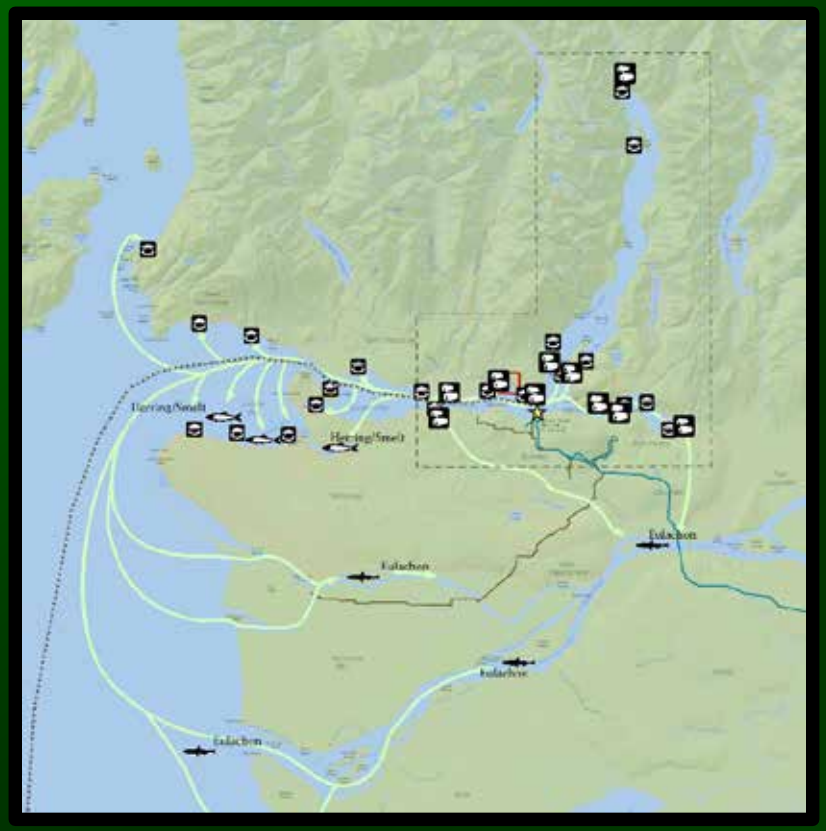


Villages are Central Places for Local Catchments: Tum-tumay-wheuton



- 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

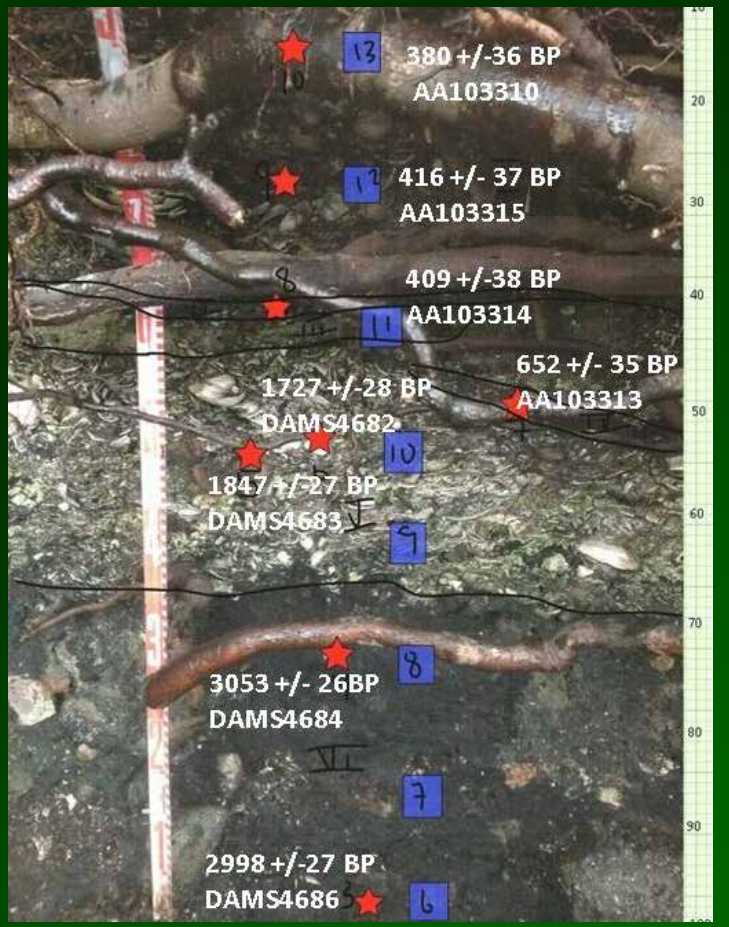


- Relocation to spring herring and eulachon fishing settlements
- Relocation to summer hunting and berry harvesting camps

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.

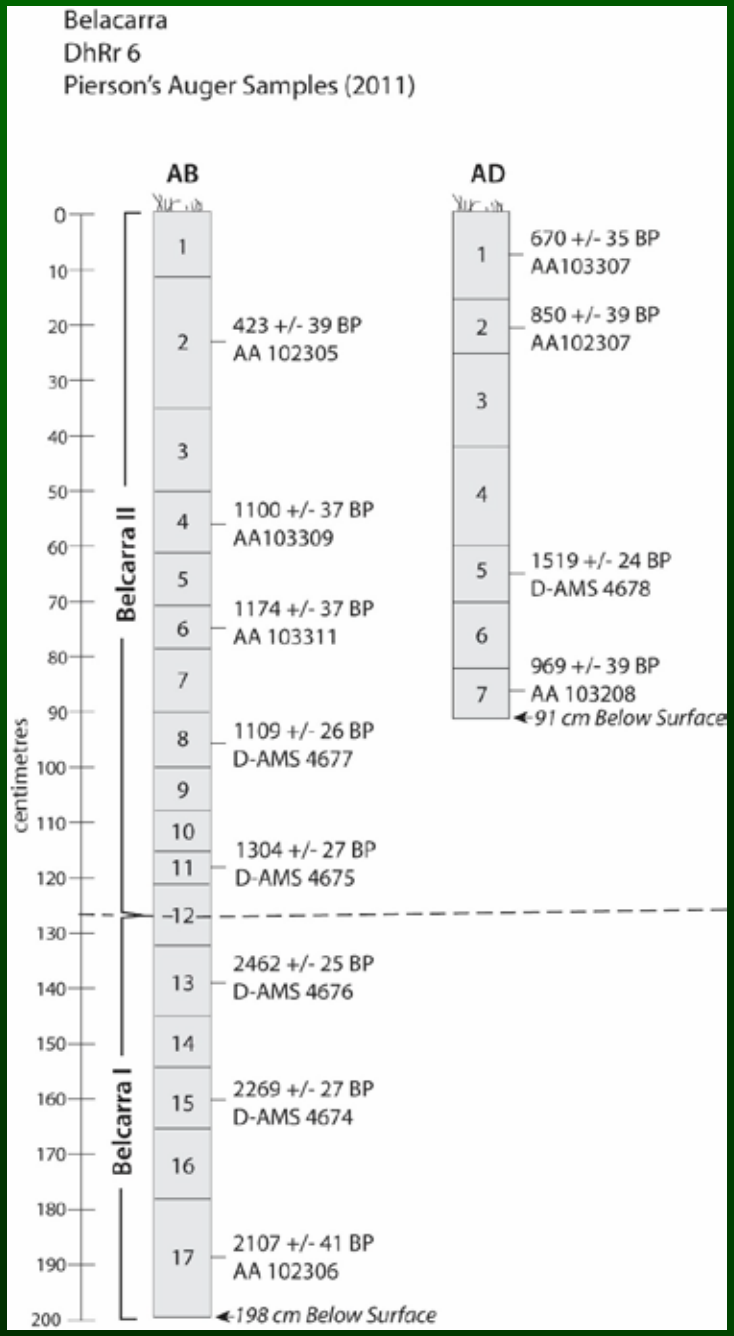


- Shell midden column from Sleil-Waututh (IR 3) with associated radiocarbon dates spanning 3000-380 BP.

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

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

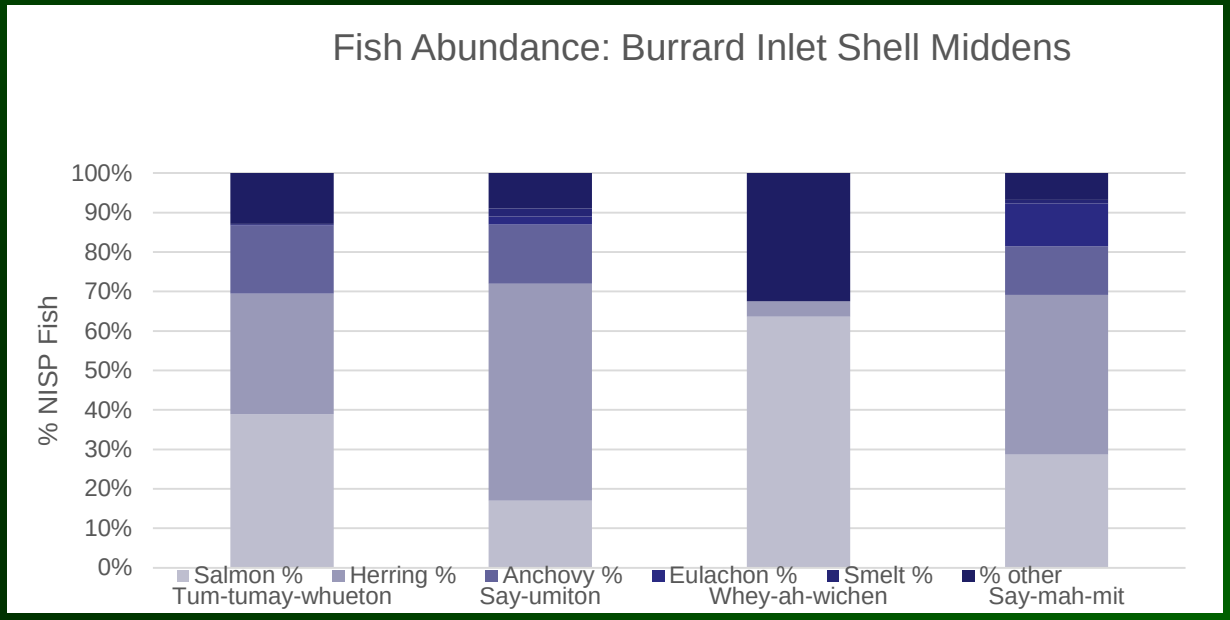


Refining the Record of Fish Harvesting in Burrard Inlet

- 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)

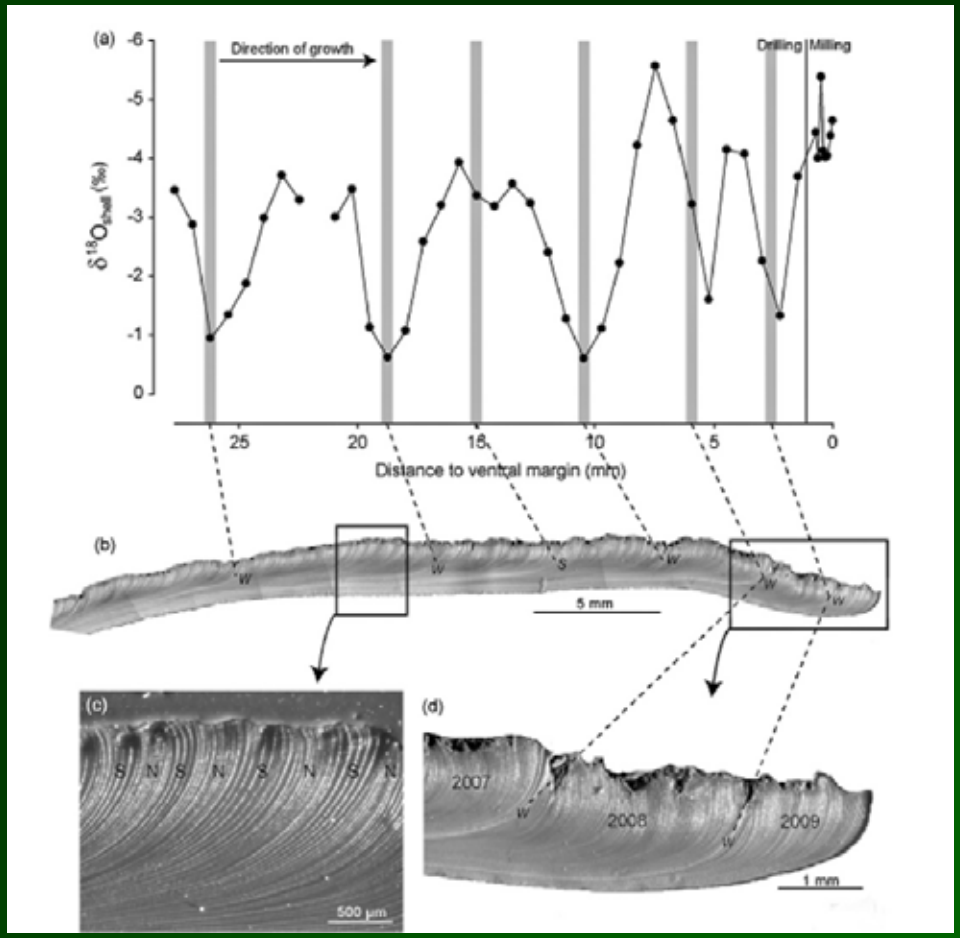
- Archaeofauna recovered from the large shell middens (villages) varies in the relative importance of specific species (e.g., finfish and shellfish, Pierson 2011; Trost 2005).
- These differences are probably attributable to local variability in abundance.
- There are no discernable changes through time, 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.