CHAPTER 14

Sturgeon as Staple: Fishing Strategy at the Ruskin Dam Site (DhRo-59) on the Stave River

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Introduction

Ethnographic and ethnohistoric literature indicate sturgeon were an important resource for groups living in the Lower Fraser River Region (Lord 1886; McHalsie 2007; Suttles 1974). However, ichthyofaunal assemblages from most archaeological sites in the region often contain relatively large numbers of salmon bones, but sturgeon bones are absent or represented in low numbers. At the Ruskin Dam Site (DhRo-59) located on the Stave River (Figure 1), significantly more sturgeon bones were recovered compared to any other fish species. This suggests congruence with ethnographic accounts, but is anomalous when compared to other archaeological sites in the region. This chapter considers several explanations for this observed pattern and argues that sturgeon were a staple food at the site from 3000 years BP onwards.

Fraser River Sturgeon

Habitat and Ecology

Two species of sturgeon are present in the Lower Fraser River: white sturgeon (*Acipenser transmontanus*) (Figures 2 and 3), and green sturgeon (*A. medirostris*). White sturgeon are the largest fresh water fish in North America, reaching an impressive 6 m long and 600 kg in weight (Scott and Crossman 1973). Definitely anadromous, there are many records of these fish being caught in marine waters, and they are reported to prefer mouths of large rivers (Scott and Crossman 1973:91). They spawn in fresh water in the Spring. Scott and Crossman report that the flesh of green sturgeon has an unpleasant smell and taste (1973:91) that make it less preferable than white sturgeon, which has a mild and pleasant taste. White sturgeon have a large geographic distribution in the Fraser River that extends from the mouth where it empties into the Salish Sea, upstream to as far north as McBride, a distance of over 1,100 km (Hatfield 2005). They are also present in tributaries including the Harrison and Pitt Rivers (Ptolemy and Vennesland 2003).

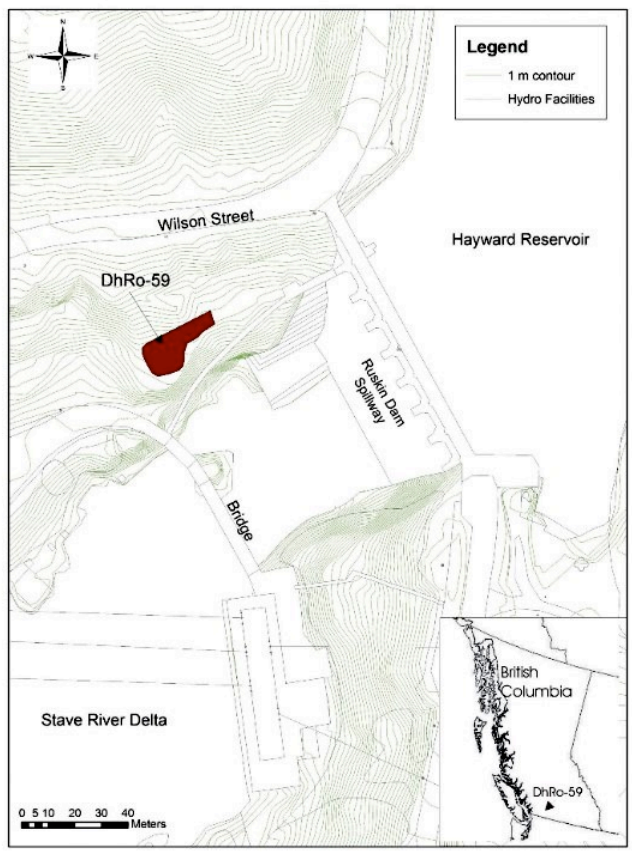

Figure 1. Location of the Ruskin Dam Site (DhRo-59) within the BC Hydro Ruskin Dam Facility east of Maple Ridge, B.C.

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Figure 2. Sturgeon caught in the Lower Fraser River; photo by Charles Bradbury, 1897. Image G-07274 courtesy of the Royal BC Museum and Archives.

Sturgeon typically inhabit deep, near-shore pools adjacent to high-flow locations (Hatfield 2005:14). They spawn in the Spring or Summer in high velocity, coarse substrate environments (Hatfield 2005). During the winter (December through March) they gather in deeper areas of the river where the flow velocity is reduced (Hatfield 2005:14).

Sturgeon have no teeth and use their downward-oriented mouths to create suction to ingest food on river bottoms. Their diet consists of invertebrates, insects and fish (Scott and Crossman 1973). Mature individuals tend to eat larger anadromous fish (eulachon and salmon), and will move throughout the lower Fraser River in order to exploit these resources at specific locales (Hatfield 2005). For an in-depth account of sturgeon in the Fraser River see Nelson et al. (2001).

Currently, the lower Fraser River sturgeon population is classified as "imperiled" by the British Columbia Conservation Data Centre (CDC), and as "endangered" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2003). The decline in sturgeon population is attributed to commercial over-fishing, loss of habitat and sport fishing (McKenzie 2000:1; see also Echols 1995; Rochard et al. 1990). Conservation regulations introduced in 1994 saw a resurgence in the species with increased abundance into the early 2000s; however, since that time abundance has decreased and was estimated to be 20% lower in 2015 than in 2003 (Nelson et al. 2016). Only catch-and-release fishing of Fraser River sturgeon is currently permitted.

Ethnography and Ethnohistory of Sturgeon Fishing and Consumption

The best time of year to catch sturgeon is February through April, as they are well-fed and their meat has a high fat content during this time due feeding on abundant spawning eulachon (Ham et al. 1982; Lord 1886:180). Suttles (1960) notes that sturgeon fishing locations were owned by specific families in much the same way they had proprietary rights to particular salmon fisheries, although Duff (1952) suggests that ownership of sturgeon fishing locations may not have been as exclusive as salmon fisheries.

Several different techniques were employed to catch sturgeon. Suttles (1955:21, 1990) states that trawl netting and gill netting were used in the Pitt River, and Duff (1952) suggests that during spawning season, hook and line fishing may also have been employed. In more open waters such as shallow bays at river mouths, sturgeon were speared using the same toggling harpoon technology used for large sea mammal hunting (Suttles 1974). Because of their large size, spearing these fish in open water sometimes necessitated use of an outrigger to stabilize the canoe while the fish was being brought aboard (Suttles 1974).

Figure 3. Quint Stubbington of Kwantlen First Nation with a small white sturgeon caught and released on the Fraser River. **Photo courtesy of Scott Gabriel.**

Figure 4. Sturgeon fishing on the Fraser River. Image adapted from Lord (1886).

According to Lord (1886), the preferred method of catching sturgeon in the Fraser River was to spear them on the river bottom. This method appears to be the most ubiquitous as many other accounts describe this method of harvesting (Birch 1976; Burnaby 1859; Duff 1952; Stewart 1977:68-71; Suttles 1955, 1974, 1990; Swan 1857). This type of fishing involved several canoes drifting downriver, the person in the bow carefully probing the bottom of the river with a long harpoon to feel for the sturgeon's head and/or back (Figure 4). Eagle feathers attached to the prong tips were used to help the harpoonist feel the bottom for sturgeon (Stewart 1977:70). Upon locating a sturgeon, the tip was plunged vertically into its back. The tip was a bone, mussel-shell or ground slate armed toggling harpoon head (Stewart 1977; Suttles 1974). The injured sturgeon, now enraged, would come to the surface to determine the source of the annoyance. Another harpoon spear was then forced into the fish, at which point a long battle commonly ensued as the canoe, its crew and gear were dragged up and down the river. A stone weight dragged overboard and/or outrigger on the canoe was sometimes used to tire the sturgeon and provide stability to the canoe (Stewart 1977). Once tired, the sturgeon was secured by tipping the canoe so it could slide over the gunwale, after which the water was bailed out of the canoe (Suttles 1974:121). If the sturgeon could not be easily manoeuvered into the canoe, it was hauled ashore and promptly butchered for ease of transport.

Various ethnohistoric accounts suggest that sturgeon were an important food source. Demand for sturgeon was high because of its excellent taste, and consequently demanded a high price (Lord 1886:177). Swan (1857:27-28) notes that sturgeon were an important food source during the lean winter months. McHalsie (2007:103) recounts a creation story where winter famine was avoided by the transformation of a man and his wife into sturgeon, who were then consumed to avoid starvation.

Many different parts of the sturgeon were consumed. As noted above their flesh was a critical source of protein during the winter months, and sturgeon caught during spring, summer and fall months could be processed and stored for consumption when needed. This was accomplished by drying fillets of sturgeon on a rack in the sun after which it could be stored indefinitely (Suttles 1974:122). Dried sturgeon was eaten as-is, or after being boiled, and was said taste as good, or better, than dried salmon (Suttles 1974: 122).

Other parts of the sturgeon were also utilized. Sturgeon eggs were harvested and eaten covered in oil (Lord 1886), as well as boiled into soup (Suttles 1974:123). The head could be cooked for a long time and then cut like bread and eaten, the spinal cord eaten raw, and even some of the digestive tract cooked and eaten (Suttles 1974:123). Tissues attached to the backbone and gills were removed and dried, to be used as glue.

Given their size and importance as a primary protein food source, it is not surprising that sturgeon are also mentioned in stories and included in ceremonies. Sturgeon were referred to as "sister" (Suttles 1974:123, 1955). Sturgeon are also referred to as ancestors of humans, and as such require special ceremonies and treatment similar to salmon, such as the First Sturgeon ceremony performed by people at Squha'men (Thom 1997).

Archaeology

Given the documented importance of sturgeon in ethnographic literature, one would expect sturgeon remains to comprise a significant amount of the ichthyofaunal assemblages from archaeological sites excavated in the lower Fraser River region. Surprisingly, although sturgeon remains are identified at a number of sites in the lower Fraser Valley, they are rarely an abundant fish taxon. Low numbers of sturgeon bones were uncovered at sites in the Fraser River delta including the Glenrose Cannery site (DgRr-6) (Casteel 1976), Marpole site (DhRs-1) (Arcas 1989), Crescent Beach site (Matson 2010) (DgRr-1), Pitt River site (DhRq-21) (Patenaude 1985).

Wetsite component excavation at the St. Mungo site (DgRr-2) revealed sturgeon was the most abundant fish species during selective collection of fauna (Eldridge and Fisher 1997:40). Sturgeon comprised 38% and 42.5% of the fish assemblage for Trench A and Trench B respectively. However, a detailed analysis of selected column samples indicates that salmon were the more abundant species (83% of the column sample fish assemblage) when compared to sturgeon (only 4% of the column sample fish assemblage) indicating that recovery methods and sampling strategy significantly influenced the results. Other excavation at this site revealed a similar percentage of sturgeon (7%) (Ham et al. 1982).

Sites further up the Fraser Valley often suffer from poor faunal preservation and the relative importance of different fish species becomes more difficult to assess. Sites with significant excavation include Maurer (DhRk-8) (Schaepe 1998), Hatzic Rock (DgRn-23) (Mason 1989); Katz site (DiRj-1) Hanson (1970), and Scowlitz (DhRl-16) (Lepofsky et al. 2000) sites. No sturgeon remains were reported at any of these sites, although reports generally make reference to the importance of sturgeon based on ethnographic and/or local oral information.

The Ruskin Dam Site

The Ruskin Dam site (DhRo-59) is located at the south end of Stave Lake in southwestern B.C. The confluence of the Stave and Fraser Rivers is approximately 3 km south of the site. Its location at a natural constriction point, the beginning of the Stave River Canyon, made it an excellent fishery, as eddies and deep pools at the lower end of the canyon are ideal locations where sturgeon can rest. Ethnographic accounts indicate that the area around Stave River Canyon was a renowned salmon fishing location (Dandurand et al. 1996), at least prior to construction of the BC Hydro Dam in AD 1929. Summer camps were also located along the Stave for fishing and salmon drying (Dandurand et al. 1996).

The landscape around the site has been heavily altered by construction of a railway and BC Hydro's Ruskin Dam in AD 1930 (see Gray et al. 2010). Excavation of the Ruskin Dam Site was undertaken to mitigate impacts related to land-altering altering seismic upgrades around the dam. In AD 2009, a total of 102 1 x 1 m units were hand excavated to basal sterile deposits (Figure 5), and precise stratigraphic control was maintained for these units. At the conclusion of hand excavations, a total of 137 additional 1m^2 units (39 partial and 98 complete) were removed by machine and screened to expedite the excavation process. The majority of machine-excavated deposits were removed from the east end of the site which was significantly impacted during dam construction. Approximately 296 m^3 of deposits were excavated from DhRo-59. A small portion (approximately 40 m^3) of the southern end of the site remains intact.

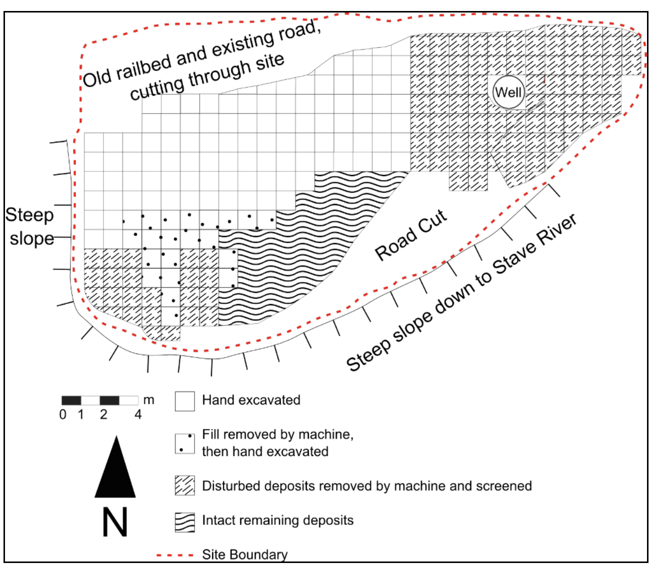

Figure 5. Map showing excavated areas at the Ruskin Dam Site.

During the excavations, all sediments were wet-screened through nested 6 mm and 3 mm meshes, and all observed fauna collected. The majority of machine excavated deposits were screened through 3 mm mesh but matrices from the disturbed eastern portion of the site were screened through 6 mm mesh. Because of differences in faunal recovery for mesh sizes, this paper focuses primarily on the faunal data recovered from the hand-excavated portion of the site where 3 mm mesh was employed.

In-depth description and analysis of stratigraphy, chronology, features, artifacts and ecofacts from the site are presented in Gray et al. (2010). Radiocarbon samples from the site (Table 3) indicate it was occupied from as early as 7200 BP during up until Euro-Canadian contact. Two small (ca. 4 x 6 m) house features, hearth features, stone slab storage boxes, stake and post moulds and a variety of artifacts (lithic waste, projectile points, adzes, ground stone beads, copper rings, a labret, and ground stone knives) were recovered during excavations.

Table 1. Select radiocarbon dates for Ruskin Dam Site.

Beta Analytic Sample No.	Layer	Uncalibrated Conventional ^{14}C Radiocarbon Age
264275	Disturbed	**140 +/- 40 BP**
273153	III	**370 +/- 40 BP**
271240	III	**880 +/- 40 BP**
273156	V	**2260 +/- 40 BP**
284093	IV	**2740 +/- 40 BP**
264278	IV/V	**2740 +/- 40 BP**
273155	V	**2860 +/- 40 BP**
284095	IV	**2890 +/- 40 BP**
284094	IV	**2940 +/- 40 BP**
284092	V	**3050 +/- 40 BP**
273154	IV	**4030 +/- 40 BP**
264277	V or VIII	**6090 +/- 50 BP**
273152	VIII	**7190 +/- 50 BP**

Results

The fish remains assemblage from the Ruskin Dam site is of modest size but has very few taxa identified. The bulk of the assemblage, calculated by the number of identified specimens (NISP) is sturgeon and salmon (67% and 22% respectively). The use of NISP to calculate abundance is discussed in the site report (Gray et al. 2010) and Grayson (1984). In addition to these two taxa, a few fresh water fish elements were identified (Table 2).

Sturgeon elements were mainly identified by their distinctive texture, although a few more complete elements could be identified on general shape. Not all sturgeon bones have this texture, and those elements that lack it are highly fragmented such that it is difficult to identify them even as fish. The two species of sturgeon are difficult to differentiate skeletally, even when whole bones are present, thus specimens in this sample assemblage were only identified to genus. Due to the highly fragmented nature of the assemblage, no size estimates based on element size could be ascertained for sturgeon.

Sturgeon is the dominant fish taxon in all the layers except Layer VII. A single identifiable bone fragment (salmon) was recovered from Layer VII; this low number is far too small for any meaningful assumptions to be made about differences between sturgeon and salmon abundances. Layer IV/V and III have the highest counts (Table 2) and densities (Figure 6) of sturgeon bones, reaching highest density in Layer IV. Overall, there is a significant increase in sturgeon during the Locarno period (Layer IV/V), while the density of salmon remains relatively constant throughout the entire occupation of the site.

Table 2. Number of identified fish specimens for each layer and for the site overall.

Taxon	NISP, all identified specimens								% of entire assemblage
	I/II	III	IV/V	VI	VII	VIII	Total	NISP	% of Aassem-blage
Sturgeon (*Acipenser* sp.)	144	49	241	7		30	471	652	66.94%
Salmon (*Oncorhynchus* sp.)	47	3	98	4	1	7	160	219	22.48%
Chub sp. (Cyprinidae)			1				1	1	0.10%
Peamouth chub (*Mylocheilus caurinus*)								1	0.10%
Sucker sp. (*Catostomus* sp.)	1		6				7	8	0.82%
Sucker/Chub (Catostomidae/ Cyprinidae)	2	3	3				8	9	0.92%
Unidentifiable fish (Pisces)	33	3	26			5	67	84	8.62%
Total fish	**227**	**58**	**375**	**11**	**1**	**42**	**714**	**974**	**100.00%**

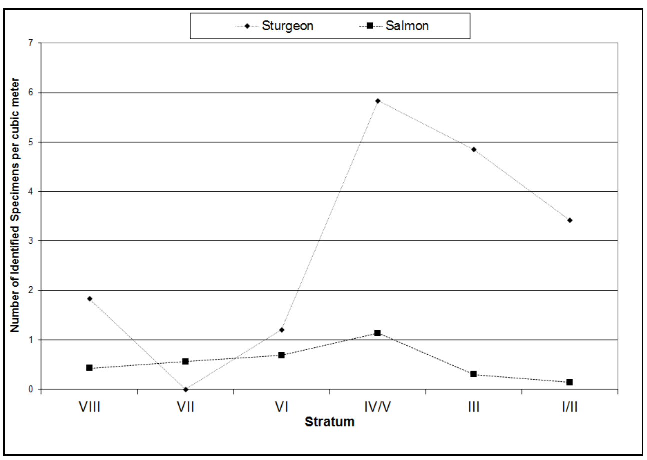

Figure 6. Density of Sturgeon and Salmon Bones by Layer.

Unfortunately, the detailed investigations yielded little additional proxy evidence of sturgeon fishing. A large number of chipped stone bifaces (a variety of shapes and sizes) were uncovered at the site which may have been used for arming sturgeon harpoons. Stewart (1977) notes that tips of sturgeon spears may have been made from slate, and significant amounts of chipped and ground slate were found at the site, including ground slate points (n=7) and ground slate knives (n=39). This suggests slate points for sturgeon fishing were manufactured at the site, and that processing of fish was also occurring. No direct evidence for net fishing (e.g., fish net weights) was identified. Another line of evidence for the importance of sturgeon fishing versus salmon fishing might be found in seasonality studies. The best time to fish for sturgeon is in late Winter and early Spring when eulachon spawn. Sturgeon harvesting would have been particularly important at this time of year, when stored salmon ran low. Unfortunately, no hard evidence for seasonality was found at the site.

Table 3. Frequency of identified salmon elements.

Head	Neurocranial elements	1
	Articular	3
	Dentary	1
	Quadrate	2
	Teeth	49
	Teeth\bone	22
	Gill rakers (primary)	1
	Total head elements	**79**
Body	Pelvic spine	3
	Vertebra #1	5
	Vertebrae (abdominal)	8
	Vertebrae (caudal)	3
	Vertebrae fragments	103
	Caudal bony plate	1
	Hypural	8
	Hypural #3	1
	Hypural #7	2
	Parapophyses	2
	Ribs	1
	Total body elements	**295**

Discussion

Excavations at the Ruskin Dam site reveal much higher abundances of sturgeon than salmon, and we suggest that sturgeon fishing and processing were important activities that provided a significant source of protein for site inhabitants. However, biases due to taphonomic processes should be given consideration, as these affect the number of identified specimens for all fish taxa. Given the large size of sturgeon, they were most likely butchered off-site, whereas salmon, being much smaller, could have been brought to the site whole. Based on the identified salmon elements from the site (Table 3), which include bones from both the body and head, it appears whole salmon were being brought to the site. If off-site butchery of sturgeon was occurring, this would result in lower numbers of sturgeon bones in the Ruskin Dam site assemblage rather than over-representation of sturgeon.

Once sturgeon bones were discarded, several behavioural and taphonomic factors influencing preservation must be considered. All fish bone recovered from the site was burnt, suggesting burning positively influenced preservation of both sturgeon and salmon. Salmon and sturgeon were processed in similar fashion, and although this reduces the size of the assemblage, it would not preferentially bias one species over the other. If, for instance, salmon was primarily eaten raw while sturgeon was always cooked, this could account for differences in NISP due to differential preservation between non-burnt and burnt bone. However, this is not the case. Another factor which influences preservation is the degree of robustness for each element for each species. Cranial bones of salmon are flaky and more fragile than sturgeon, the latter of which tend to survive longer in various depositional contexts. While this may partially account for the increased sturgeon abundance, experimental studies have concluded that differential preservation across taxa do not follow any general rules and are extremely difficult to account for empirically (Nicholson 1996; Steffen and Mackie 2005).

Identification and sampling bias are other possible factors influencing the results. Small sturgeon bone fragments are easily identifiable, whereas small salmon fragments less so, with the exception of teeth and vertebrae. However, sturgeon do not have teeth or bony vertebrae, therefore identification of salmon teeth and vertebrae increases in the NISP of salmon relative to sturgeon for these elements. Furthermore, there was a substantial amount of bone from the Ruskin Dam site that could not be classified (n=2,407). However, based on its texture and morphology, much of this fragmented bone is likely fragmentary sturgeon.

We are certain that more future research, and employment of improved methodological procedures relating to archaeological sampling, will help to more accurately reflect the relative abundance of sturgeon at other sites in the Lower Fraser River Region. We suspect sturgeon remains are often under-represented at other sites, primarily due to methodological considerations (mesh size), taphonomic biases, and identification biases. Use of bulk sampling and/or 3 mm mesh wet screening to recover and identify small fragmentary bone, conducting experimental or other research into the differences in taphonomic processes between fish taxa, and establishing improved reference collections that can be used to minimize identification bias will all help to provide the most accurate lines of evidence to interpret past fishing practices.

We argue here that taphonomic and identification biases do not account for all the observed differences between salmon and sturgeon abundances at the Ruskin Dam site, but rather that these differences represent a preference for sturgeon fishing and consumption. Based on the high density of sturgeon bones, there was an increase in sturgeon fishing relative to salmon around 3000 years ago (see Figure 6). Occupants of Ruskin Dam site may have engaged in intensive harvesting of sturgeon around this time to store as surplus, and/or for accruing other needed commodities through exchange with other villages in the region. Social capital may also have been gained by those conducting the fishing, as successful captures of these massive fish would have been a difficult, impressive and rewarding feat.

Around the same time as we see the increase in sturgeon at the Ruskin Dam site, Matson (2010) argues that a generalized fishing strategy at the Crescent Beach site (DgRr-1) located south of the outflow of the Fraser River into the Salish Sea, was replaced by an increasingly specialized, surplus-driven strategy. This shift in fishing patterns at both the Ruskin Dam and Crescent Beach sites coincides with other changes relating to increasing social complexity, and a more diverse material culture that is easily observed in the archaeological record in the Lower Fraser River Region.

Conclusion

Throughout the Lower Fraser River region, faunal assemblages of fish generally contain a greater percentage of salmon bones relative to most other species. Ethnographic sources suggest that while salmon were a critical resource, sturgeon have had equal importance for subsistence, particularly during the winter months. Overall, sturgeon appears to have been a primary food source over the long-term history of Ruskin Dam site. Salmon were only available seasonally, and while site inhabitants could process and store them for the winter, sturgeon were available year-round, even during winter when other protein sources were rare or difficult to harvest. Further research, taking into account methodological considerations for efficient recovery of small fish bones, will produce further insight into the long-term importance of sturgeon in this region over the last several millennia.

When more baseline data regarding sturgeon have been gathered from excavated sites in the region, there are many archaeological research avenues to pursue that pertain to sturgeon harvesting, consumption, social status, ritual importance, and regional distribution. Investigations into the relative importance of sturgeon as a dietary staple could focus on calculating size/weight estimates by counting bands in calcified head structures to determine age and estimate weight (Baremore and Rosati 2014). Theories regarding accumulation of wealth and increasing social complexity and their inter-relationship with salmon and sturgeon storage and surplus on the Northwest Coast (Ames 1994; Matson 1992) could be advanced and explored to determine the importance and role of sturgeon as a storage and surplus commodity, and its correlation with behavioural and material culture changes observed throughout the Lower Fraser River region.

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