UVic Sustainability Scholars Program

Tsawout First Nation Clam Population Assessment

for Cultural, Ceremonial, and Food Harvest

Amy Migneault and Mikayla Mitchell, UVic Sustainability Scholars, 2025

Lais Chaves, Assistant Manager and Marine Use Planner, Tsawout First Nation

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Disclaimer

This report is a product of the UVic Sustainability Scholars Program, a partnership between UVic and various on- and off-campus organizations offering internship opportunities to graduate students working on sustainability-focused research projects that advance sustainability in the region. This project was conducted under the mentorship of Tsawout First Nation Fisheries staff.

Territorial Acknowledgement

This work took place on Tsawout First Nation and their Indigenous Protected and Conserved Areas (IPCA.) We are humbled and grateful to have been invited to aid in their sovereignty and self-determination on these lands and waters in which their symbiotic relationship and stewardship continues to this day since time immemorial.

1. Introduction

Clam harvesting serves as a food source and a practice of self-determination for Tsawout First Nation (TFN). It is also an ongoing battle against colonial ways of thinking to prove that these practices do just as much for the Earth and sea life as they do for the people. TFN has been excluded from local water stewardship for over 170 years. Furthermore, developments in the area have impacted marine health and the Indigenous communities have not been allowed access to traditional harvesting sites.

The clams included in the population assessments are varnish clams, (*Nuttallia obscurata*), butter clams (*Saxidomus gigantea*), cockle ssp. (*Clinocardium nuttallii*), horse clams (*Tresus capax*), macoma ssp. (*Macoma nasuta*), littleneck clams (*Leukoma Staminea*), and softshell clams (*Mya arenaria*). These clams have been a food source for TFN and other First Nations in the Pacific Northwest for thousands of years, in particular the butter clam, cockle, and littleneck clam. Despite algal bloom, contaminants, and government restrictions on harvesting, subsistence harvest of clams remain one of the only reliable and accessible food systems available to those who live on reserve. The benefit of clam harvest extends to the land as well. Elders from TFN insist that the act of turning over sand during harvest regenerates ideal habitat for clam reproduction. More to this idea, several Tsawout members share the idea that separating Indigenous ecological theory from actionable items for marine conservation derived from Western epistemologies only serves to regenerate methods of ecological stewardship that prioritizes colonial development above all else.

TFN Fisheries Office has combined DFO's methods of population survey with Traditional Ecological Knowledge to better understand the health and population of marine relatives. This data can be used to possibly make an argument to re-open some sites to the community for harvest, and identify what obstacles are preventing other sites from being safe to harvest and consume. Additionally, interviews are in the process of being conducted to learn about sites and methods for future studies, as well as development of community-led stewardship to maintain or improve the quality of clam harvests, and to resist settler-colonial methods of conservancy.

2. Methods

2.1 Site Selection

The locations of five traditionally harvested beaches were identified based on knowledge from TFN: both inner and outer Tixen, Swallow Holes, James Island, and Darcy Island. These sites were chosen as they are culturally significant to TFN (Table 1). However, one area (Darcy Island) was unable to be surveyed during the 2025 fieldwork season due to rocky substrate and too shallow water, making it difficult for the TFN landing craft to successfully dock on a surveyable beach. Therefore, only four locations within the IPCA were able to be surveyed during the 2025 fieldwork season (Table 1, Figure 1).

Table 1. Locations, dates, and coordinates from the TFN Clam Survey beaches in 2025.

TFN Site Name	Survey Date	Latitude	Longitude
Tixen (Inner)	2025-05-27	48°35'40"N	123°22'27"W
Swallow Holes	2025-06-24	48°35'32"N	123°22'38"W
Tixen (Outer)	2025-07-24	48°35'26"N	123°22'19"W

James Island Spit	2025-08-07	48°37'01"N	123°22'27"W
Darcy Island	N/A	N/A	N/A

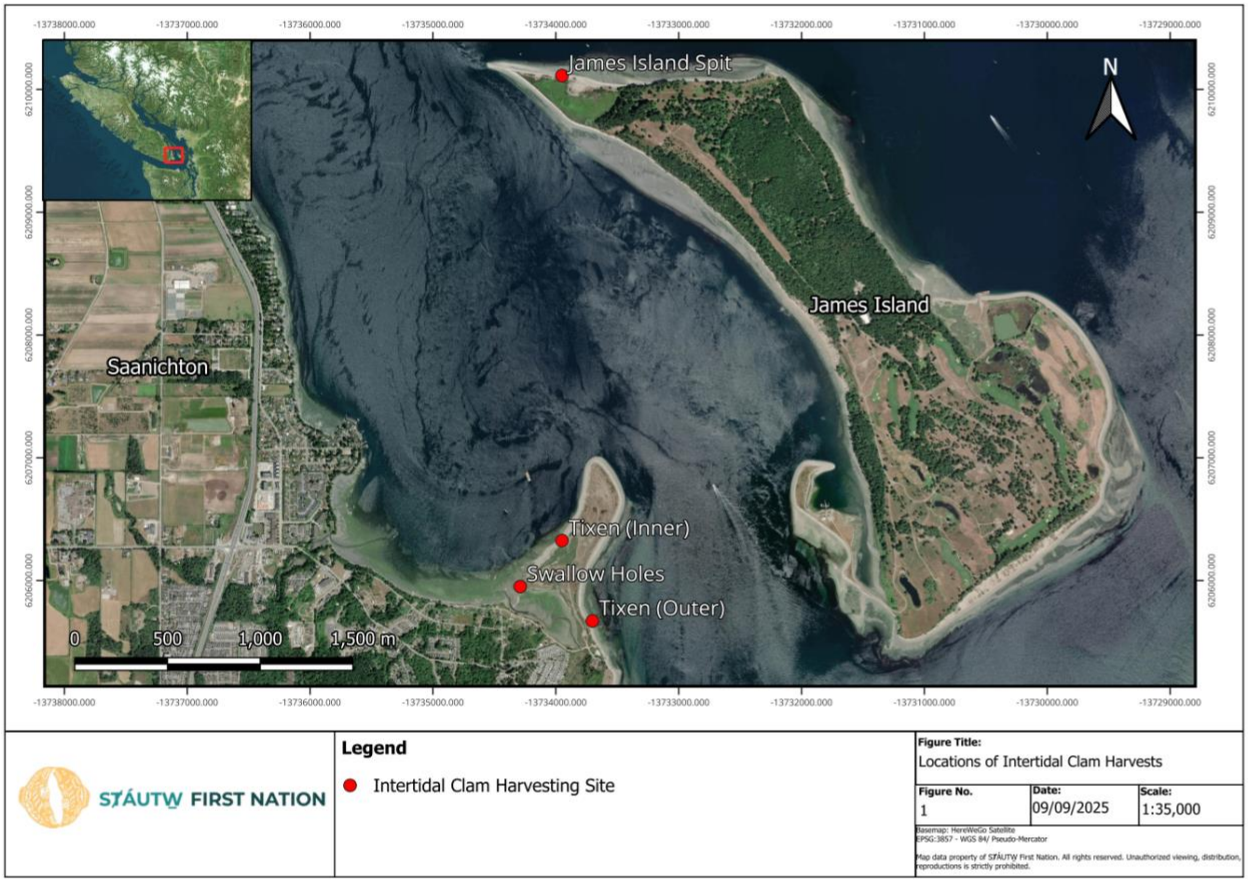


Figure 1. Map indicating the locations of the four intertidal clam survey sites conducted in 2025.

2.2 Field Sampling

The Fisheries and Oceans Canada standardized clam survey protocol was followed for all clam surveys conducted in 2025 (Gillespie & Kronlund 1999). This involved using simple random sampling to estimate clam abundance and biomass. First, survey dates for each site were chosen when the low tide level was ideally equal to or less than 1 m above chart datum. Once the sampling crew arrived at the beach, a sandy area with a shallow to moderate slow was identified. When necessary, a test hole was dug to look for signs of clams. The 30 m x 30 m survey grid (the X and Y coordinates) was then placed on the beach. Within this grid, 30 quadrants (numbered 1-30) were randomly assigned. A 1 m2 area at each quadrant was then dug to a depth of approximately 0.2m using pitchforks or shovels. The sediment within each quadrant was overturned and any clams (all sizes and species) found were placed in the quadrant bucket or bag.

Once all 30 quadrants within the grid had been dug, a flat area of the beach was used to process the numbered clam bags. Every clam found in each clam bag was identified by species, measured (length, width, height), and weighed (in grams) (Figure 2). If the species was identified as Macoma spp., only a batch weight measurement was taken (the number of Macoma sp. clams were counted and weighed at the same time). This decision was made due to the increased number of Macoma clams within the survey sites, and because TFN did not identify this species as one that is usually harvested by the community. All data was recorded in electronic tablets or on paper and later transcribed.

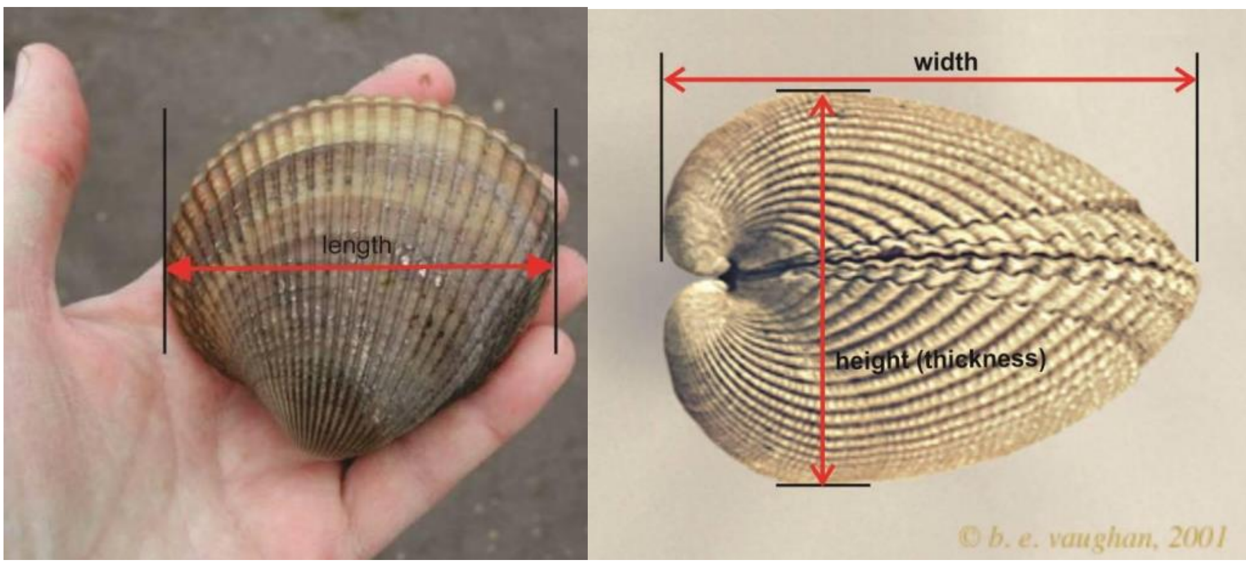


Figure 2. Pictures of cockle (*Clinocardium* spp.) measurements taken from the Clam Monitoring Manual created by the Ha-ma-yas Stewardship Council (a summarized version of the Fisheries and Oceans Canada clam survey protocol).

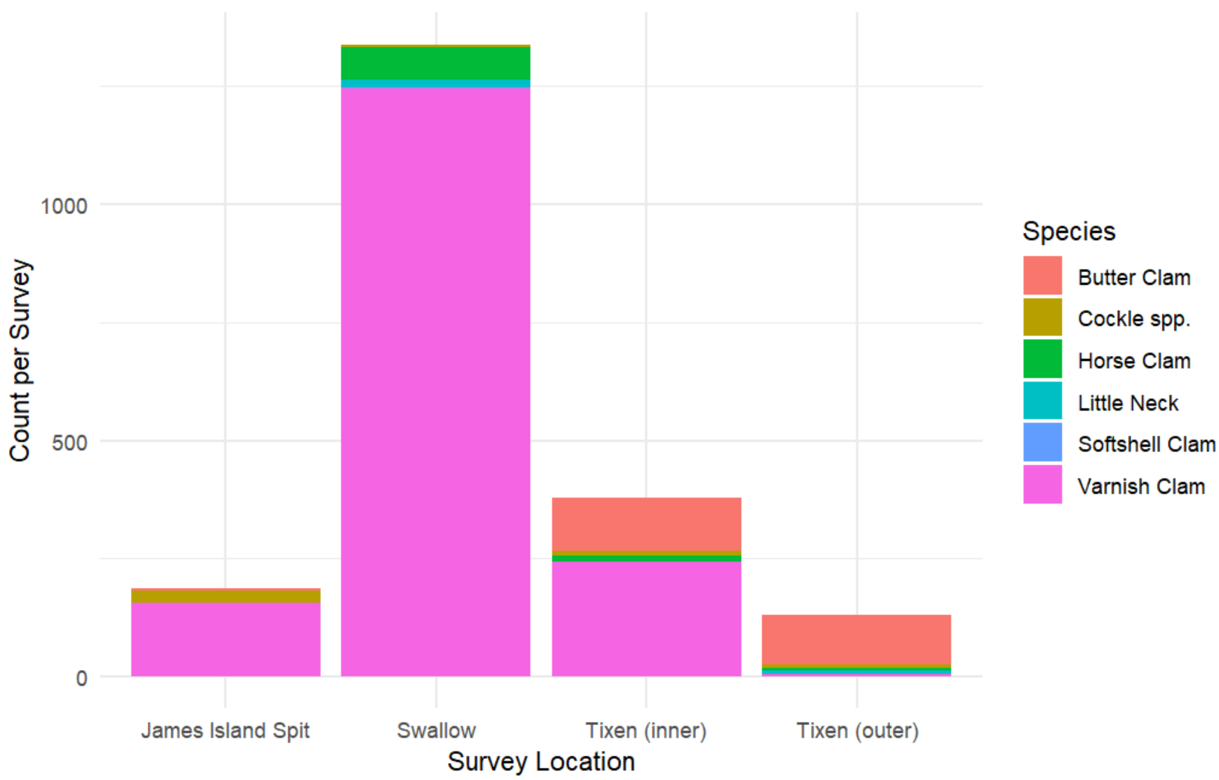
2.3 Tissue Sampling and Laboratory Analysis

Tissue samples from butter clams, horse clams, littleneck clams, and varnish clams were collected at each survey site by shucking the clams and placing the tissue in species specific Ziploc bags on ice in a cooler. Any personnel handling the tissue samples wore nitrile gloves which were replaced between species. Tissue samples were then sent to M.B. Labs in Sidney, BC, for subsequent testing for heavy metals, biotoxins, contaminants, and pesticides. At sites where an above-mentioned species was either not found or not found in high abundance, those species were excluded from tissue analysis at that site.

3. Results

3.1 Species Composition and Abundance

Seven species (or groups of species) were recorded during the 2025 clam surveys: butter, cockle spp., Macoma spp., varnish, littleneck, horse, and soft-shell clams. Varnish clams were found in by far the highest abundance with 1649 found across all sites, butter (n = 225), horse (n = 86), cockle (n = 47), littleneck (n = 24), and soft-shell clams (n = 4). In all surveyed beaches apart from Tixen (outer), varnish clams made up the majority of clams found at each beach (64% - 93%) (Figure 3, Table 1). In Tixen (outer), butter clams were instead found at the highest abundance at 81% (Table 1), best represented by removing varnish clams from the dataset as seen in the bottom of Figure 3. Butter clams were found in the second highest abundance in Tixen (inner), at 30% (Table 1).



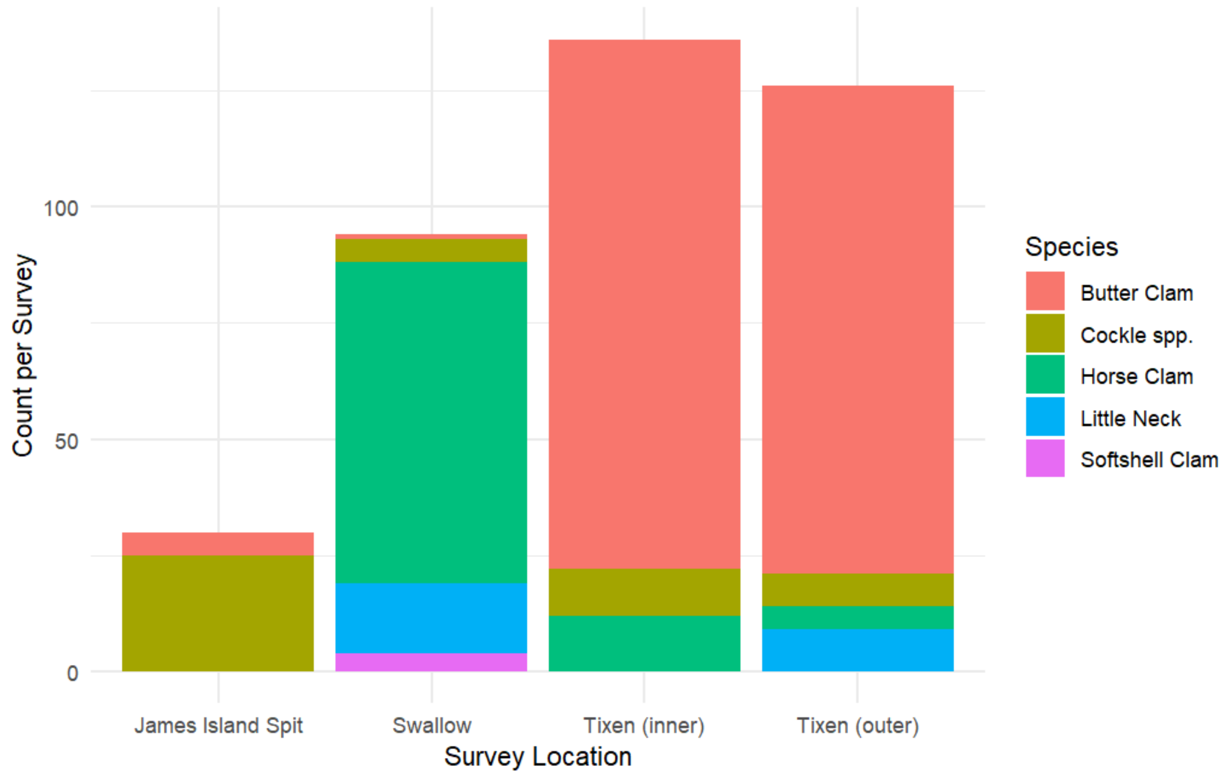


Figure 3. Stacked bar plots of species counts of clam species at each survey location in Tsawut First Nation Territory. Top figure represents all species (Butter clams, cockle spp., horse clams, littleneck clams, Macoma spp., soft-shell clams, and varnish clams). Bottom figure excludes varnish clams and Macoma spp. clams.

Table 1. Summary table from four clam surveys conducted within the Tsawout First Nation territory, including species counts and percentages of species found at each survey location.

Survey	**Species**	**Count**	**Percentage (%)**
James Island Spit	Butter	5	2.6
	Cockle	25	13.4
	Varnish	152	83.9
Swallow	Butter	1	0.07
	Cockle	5	0.37
	Horse	69	5.11
	Littleneck	15	1.12
	Soft-shell	4	0.30
	Varnish	1245	93.0
Tixen (inner)	Butter	114	30.1
	Cockle	10	2.6
	Horse	12	3.2
	Varnish	243	64.1
Tixen (outer)	Butter	105	80.8

	Cockle	7	5.4
	Horse	5	3.8
	Littleneck	9	6.9
	Varnish	4	3.0

3.2 Morphometrics

Results revealed notable variation in clam morphometrics across both species and beaches. At James Island Spit, butter and varnish clams exhibited relatively large shell dimensions and weights compared to other taxa, suggesting the presence of older or faster-growing individuals. In contrast, Swallow supported smaller-bodied clams overall, with most species displaying compressed size ranges and lower weights. Tixen inner and Tixen outer showed more diverse size distributions, with some species (e.g., horse clams) spanning a wide range of shell dimensions and weights, indicating mixed age classes. Several species (cockles, littleneck, and soft shell clams) consistently showed smaller median sizes across sites, contributing less to overall biomass (Figure 4).

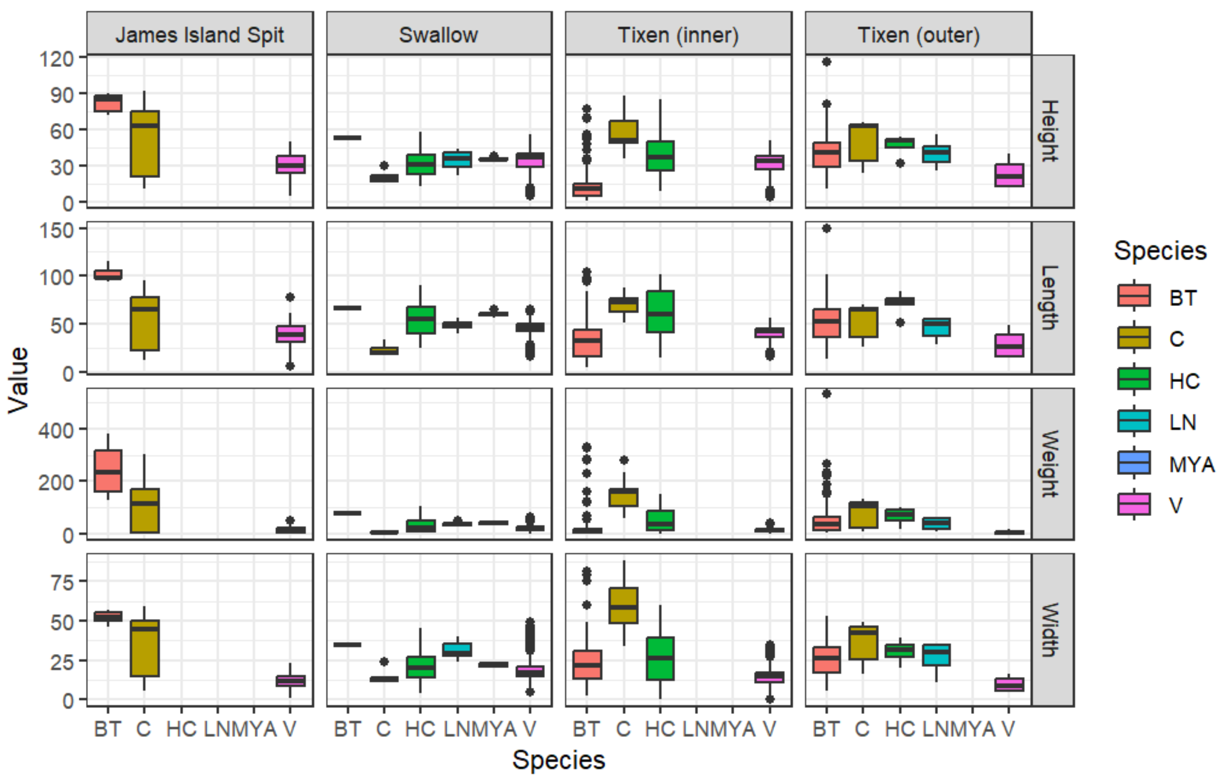


Figure 4. Size and weight distributions of clam species across four surveyed beaches (James Island Spit, Swallow, Tixen inner, and Tixen outer). Boxplots display median values (horizontal line), interquartile range

(box), and range (whiskers), with outliers shown as points. Measurements include shell height, shell length, shell width, and tissue weight.

3.3 Biomass & Density Estimates

Biomass estimates based on total clam weight per quadrat area revealed clear differences among beaches and species. Beaches with higher clam densities tended to exhibit greater standing stock, though in some cases a few larger individuals also contributed substantially to biomass. For example, Swallow and Tixen (inner) supported relatively high biomass of varnish clams compared to Tixen (outer) and James Island Spit, where the same species occurred at lower densities. Conversely, littleneck clams contributed little to total biomass at all sites, reflecting both low abundance and small body size (Figure 5). These results highlight spatial variability in harvestable resources, with certain beaches providing more substantial food reserves for the Tsawout community. Importantly, the total weight per unit area metric offers a direct link to food provisioning potential, and can be used to scale up estimates of clam availability across the intertidal zone of each site.

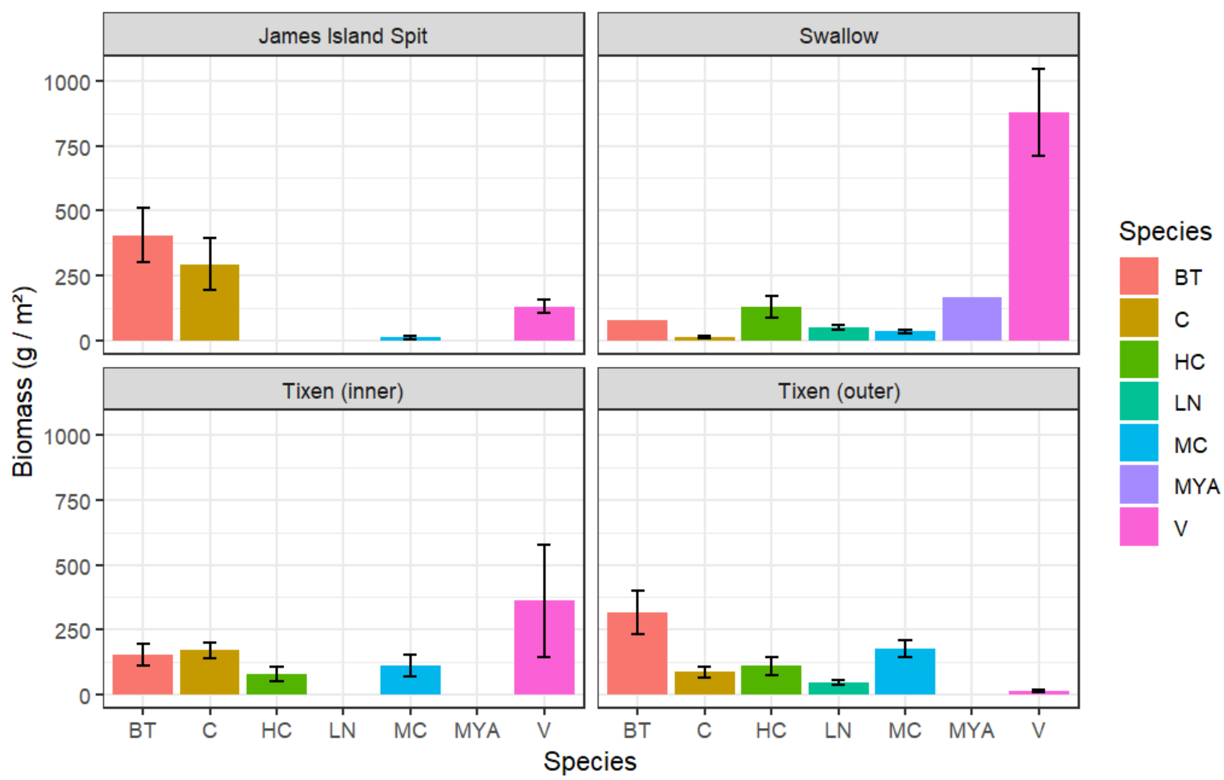


Figure 5. Mean biomass of clam species per beach, calculated as total clam weight per quadrat area (g/m²). Error bars represent standard error of the mean. This measure reflects the harvestable standing stock, or the amount of clam tissue available per unit area, providing an estimate of the food resource accessible to harvesters. Macoma spp. were included in this figure as biomass was calculated.

4. Discussion

The 2025 TFN clam surveys revealed a diverse but uneven distribution of clam populations across TFN's IPCA. Seven species were recorded, with varnish clams dominating overall abundance across most sites. This reflects a regional trend in which varnish clams, an introduced species, have become highly successful competitors, often outnumbering culturally preferred species such as butter and littleneck clams (Dundas et al., 2007; Gordon et al., 2018). While varnish clams provided the highest biomass at Swallow and Tixen (inner), their dominance may obscure declines in more culturally and nutritionally important species. Notably, butter clams were most abundant at both Tixen inner and outer, where they accounted for 30-81% of the surveyed individuals, highlighting this site's potential value for future community harvest.

Size and weight distributions showed strong site- and species-specific differences. Larger-bodied individuals, such as butter and varnish clams at James Island Spit, suggest either lower harvest pressure or more favorable growth conditions (Hallmann et al., 2009; Toniello et al., 2019). In contrast, Swallow supported smaller clams overall, possibly reflecting environmental constraints, higher juvenile recruitment, or historical overharvest of larger individuals. The wide range of sizes observed for horse clams at both Tixen beaches indicates mixed age classes, which may reflect ongoing recruitment and potential for population persistence.

Biomass estimates highlighted the importance of considering both density and individual size when evaluating harvest potential. High densities of varnish clams translated into substantial biomass at Swallow and Tixen (inner), whereas fewer but larger clams contributed to biomass at James Island Spit. Littleneck, cockle, and soft-shell clams contributed minimally to standing stock across all sites, reflecting their limited abundance and smaller size. Importantly, the total weight per area metric provides a direct measure of harvestable standing stock, allowing future work to scale estimates up to the beach level and inform community harvest guidelines.

Reports of concern were made by TFN locals about shellfish contaminants from nearby sewage treatment plants as well as infrastructure along beaches coated with creosote. Lab result data has returned but is yet to be analyzed professionally. From what can be determined immediately, the levels of both creosote chemicals and fecal coliforms do not appear to be consistent with predictions made by TFN members. Further a limitation of this study is that fecal coliform levels change rapidly, and can not be reliable for long-term measurements.

Together, these results underscore the spatial variability of clam resources across Tsawout's IPCA. Certain sites, particularly Tixen (outer) and James Island Spit, appear to hold higher potential for FSC harvest of butter clams, while others are dominated by varnish clams. The findings also highlight the need for species-specific management, as not all beaches provide equal contributions to food security. Long-term monitoring, incorporating both scientific surveys and traditional knowledge, will be essential to track changes in population structure, biomass, and contaminant levels over time. This baseline dataset represents a critical first step toward restoring sustainable clam harvesting and supporting TFN's broader goals of food sovereignty and marine stewardship within its protected waters.

5. Recommendations

Based on the results from the 2025 clam surveys, we recommend that future clam surveys should focus on improving both spatial coverage and replication. While four beaches were successfully sampled in 2025, incorporating additional culturally important sites, including Darcy Island (when conditions permit), would provide a broader understanding of clam resources across TFN's IPCA. Within beaches, sampling multiple grids or habitat zones (such as inner and outer flats or sandy versus muddy areas) would capture within-site variability and lead to more accurate density and biomass estimates.

Additionally, increasing temporal coverage is also important. Conducting seasonal surveys, ideally in both spring and late summer, would allow TFN to track patterns in recruitment, growth, and biomass that may shift throughout the year. Establishing annual surveys at priority sites would provide a baseline for detecting long term changes and evaluating the effectiveness of stewardship practices.

Species-specific data collection should also be enhanced. While Macoma spp. are not typically harvested, measuring a subsample of these clams rather than only recording batch weights would provide insight into their role in the ecosystem and better reflect overall beach dynamics. At the same time, surveys should ensure that culturally important species such as butter, horse, cockle, and littleneck clams are sampled in sufficient numbers to allow robust estimates of density, biomass, and harvest potential. Standardizing quadrat size, but including replicate quadrats within each grid would improve estimates of error. TFN community members suggested increasing digging depth to capture more species, something that should be considered in the future. Additionally, future surveys should consider digging the low tide quadrants first to reduce the potential of scarring clams within the rest of the survey region. Combining these density data with GIS mapping of intertidal habitat would enable biomass estimates to be scaled up to the beach level, offering a more direct link to potential harvest availability.

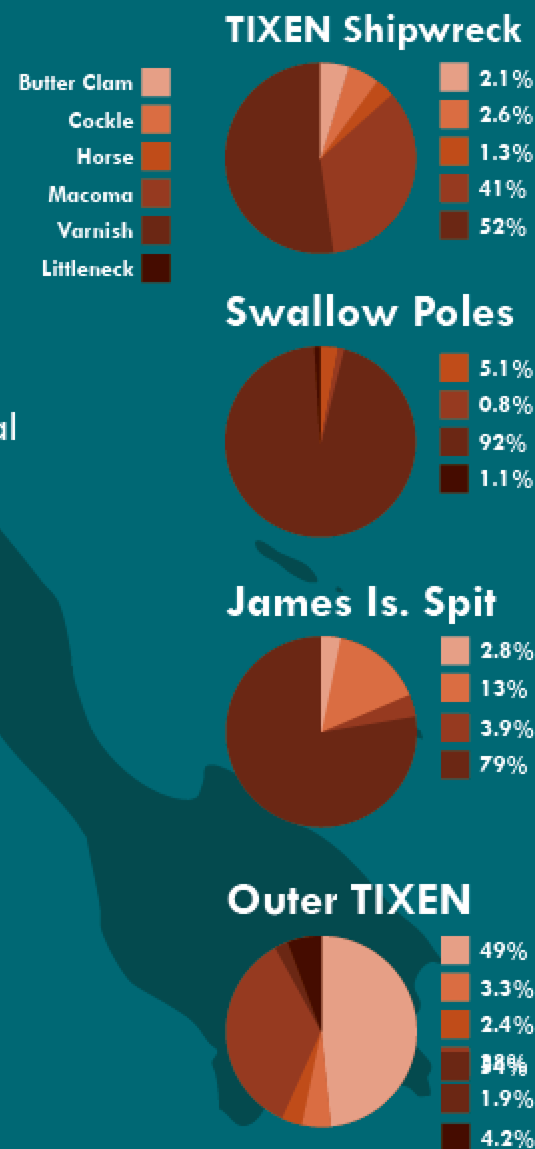
Tissue sampling and contaminant testing should also be expanded. Increasing the number of individuals collected per species per beach for laboratory analysis would strengthen conclusions about food safety and help identify spatial variability in contaminant exposure. Including species not usually harvested could also serve as an environmental health indicator.

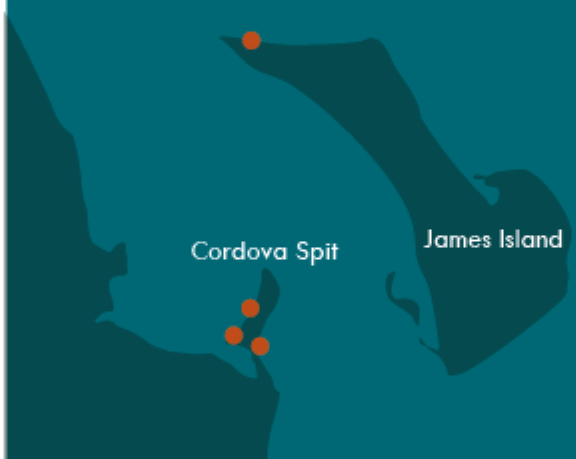
Finally, future surveys should continue to integrate Indigenous knowledge and community engagement. Elders and harvesters can provide valuable insight into historical abundance, traditional harvest timing, and areas of concern, helping to refine survey priorities. Expanding the involvement of TFN members in survey design, fieldwork, and data interpretation will build long-term monitoring capacity, while regular feedback sessions will ensure results remain meaningful and accessible to the community. To ensure this, TFN should perhaps conduct interviews on and off-site prior to the clam surveys. Standardizing electronic data entry, conducting statistical comparisons among sites, and generating size-frequency distributions will further strengthen the analysis.

STÁUTW FIRST NATION

Turning Over the Sand

Clam Population Surveys for Cutltural and Ceremonial Harvest





Community Stewardship Initiatives

We hope to continue to grow our relations to marine relatives through caring for clam harvest sites in ways that make sense to the local nations. These surveys can teach us how to move forward with harvesting and protecting to eventually lead to healthier people and ecosystems.

Figure 6. Informative graphic displayed to Tsawout First Nation at a community dinner to help visualize the population distribution of clams as well as to reiterate the mission of the project. Graphic made by Mikayla Mitchell.

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