Perennia
Nova Scotia's Food Development Agency

DEVELOPMENT OF FISH (HERRING) MILT PROTOTYPES FOR HUMAN CONSUMPTION

Prepared for:
Great Lakes St. Lawrence Governors & Premiers (GSGP)

Prepared by:
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Date:
January 14, 2026

This report documents pilot-scale, proof-of-concept prototype development conducted for internal evaluation purposes only. Products described herein are not intended for retail sale or consumer testing.

1. PROJECT SCOPE

The Great Lakes St. Lawrence Governors & Premiers (GSGP) engaged Perennia Food and Agriculture Corporation to assess the feasibility of developing value-added food products from lake herring milt. Using client-supplied raw material, the project focused on small-scale, pilot plant–level development of four primary prototypes:

- Raw frozen herring milt, intended for further cooking or processing
- Steamed, ready-to-eat frozen herring milt
- Steamed, battered/breaded (tempura-style) frozen herring milt
- Pickled, acidified refrigerated herring milt

In addition, a supplementary spread/dip prototype was prepared as an exploratory concept to assess potential versatility of cooked milt.

2. PROJECT BACKGROUND

Herring milt, the sperm of male herring, is an underutilized by-product of the seafood industry. It is rich in proteins, lipids, and bioactive compounds, offering potential as a nutritious and functional food ingredient. Despite this, limited knowledge exists regarding its handling, processing, and suitability for various food applications in North America.

Recognizing this opportunity, GSGP engaged Perennia to explore the technical feasibility of transforming herring milt into safe, edible, value-added products. The project aimed to generate pilot-scale data to inform internal decision-making, and assess the versatility of milt across multiple product formats.

By focusing on controlled, small-scale processing, the work demonstrated proof-of-concept while identifying considerations for product handling, processing techniques, and potential applications.

3. MATERIALS & GENERAL METHODS

3.1 Raw Material Receipt

A total of 10 bags of herring milt, weighing 4.5 kg in total, were supplied by the client. The samples were shipped frozen in sealed plastic bags and received under controlled conditions at 0 °C (32 °F). The material was immediately stored frozen at –18 °C upon receipt and remained unopened until the day of processing. Upon opening, the milt appeared dark red in color with visible blood, had a soft texture, and

exhibited a strong fishy odor typical of raw herring milt. The packaging remained intact with no leaks or damage. The material was considered suitable for pilot-scale feasibility trials.

Figure 1. Frozen herring milt as received

3.2 Food Safety Controls

Pilot-scale activities were conducted under standard food safety practices, including:

- Sanitization of equipment and work surfaces
- Use of personal protective equipment by all staff
- Temperature control during thawing, cooking, and storage
- Monitoring critical steps to minimize microbial and chemical hazards

3.3 Ingredient Sourcing

All additional ingredients used in prototype development were sourced from reputable suppliers. Formulations and quantities were recorded for reproducibility in pilot-scale trials. Detailed ingredients are described under each prototype section.

3.4 Facilities and Equipment

Processing was conducted in Perennia's controlled pilot plant environment equipped with:

- Steamers, fryers, mixers, and refrigeration units
- Equipment appropriate for small-scale batching and pilot evaluation

- Standard hygiene and temperature monitoring procedures

4. PROTOTYPE DEVELOPMENT

Five main product formats were produced using client-supplied raw material. All processing was conducted under controlled pilot plant conditions with strict food safety measures in place, and observations were recorded for feasibility assessment.

4.0 General Cleaning and Handling Procedures

Before prototype-specific processing, the raw herring milt was prepared to ensure quality and reduce potential contamination.

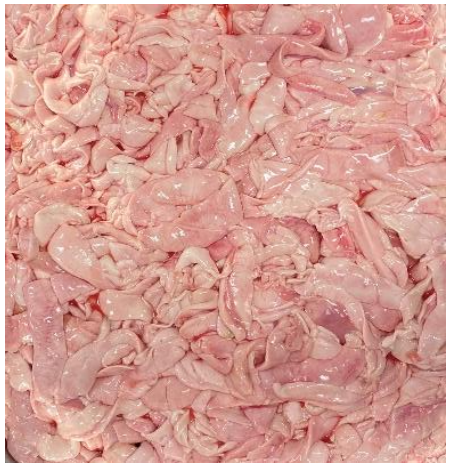
Cleaning Steps:

1. Raw frozen herring milt was partially thawed at 0–4 °C to allow handling.
2. The milt was rinsed repeatedly under chilled, potable water to remove visible blood, clots, and impurities. This process was repeated several times until the rinse water was clear and the milt appeared visually clean.
3. After the final wash, the milt appeared pale pink to whitish in color.
4. The cleaned milt was drained thoroughly, in the refrigerator, to maintain a temperature of ≤ 4 °C.

Temperature Control:

- Raw milt was maintained at ≤ 4 °C at all times during handling to minimize microbial growth.
- Equipment and containers were pre-chilled when necessary to help maintain low temperature.

Figure 2. Herring milt after cleaning and draining



Notes:

- These general cleaning and handling procedures were applied to all prototypes before cooking, steaming, or pickling.
- Cleaning was essential to improve product appearance and reduce potential off-odors in cooked or value-added products.

4.1 Prototype 1: Raw Frozen Herring Milt

Objective:

Produce raw frozen herring milt suitable for further cooking or processing by the end user, preserving quality and integrity.

Materials:

- Cleaned and drained herring milt
- Sealed plastic bags or vacuum-sealed containers
- Labeling materials
- Freezer at –18 °C

Procedure:

1. **Portioning:**
    - Weigh cleaned milt to the desired portion size (e.g., 100–200 g per bag).
    - Handle gently to avoid breaking the soft tissue.
2. **Packaging:**
    - Place each portion into clean, food-grade plastic bags.
    - Remove as much air as possible for vacuum-sealing to prevent freezer burn.
    - Label each package.
3. **Freezing:**
    - Place the packaged portions immediately into a freezer maintained at –18 °C (in single layer in blast freezer (–30°C), or –18°C freezer).
    - Allow the milt to freeze completely before moving or stacking.

Notes:

- No cooking, seasoning, or additional processing was applied.
- This prototype serves as a reference product for evaluation or further processing by the end user.
- Raw frozen herring milt must be fully cooked before consumption.
- Portions can be thawed in the refrigerator or cooked directly from frozen.

- Cook until the internal temperature reaches ≥ 70 °C to ensure safety.
- These instructions are provided for reference and were not validated as part of this pilot-scale study.

Figure 3. Raw herring milt (300g) portioned and packaged for freezing
Packaging size: 21cm/8.3in × 19cm/7.5in

5cm/1.96in

4.2 Prototype 2: Steamed Ready-to-Eat (RTE) Herring Milt

Objective:

Produce a fully cooked, ready-to-eat frozen herring milt product suitable for thawing and consumption with optional reheating for quality.

Materials:

- Cleaned and drained herring milt (from Section 4.0)
- Steamer (pilot-scale, 95–100 °C full steam)
- Vacuum-sealable bags
- Labels and markers
- Thermometer for internal temperature measurement
- Blast chiller or cold room
- Freezer at –18 °C

Step-by-Step Procedure:

Steam Cooking (Kill Step to decrease or eliminate potential pathogens and bacteria – Critical)

- Preheat steamer to 95–100 °C.
- Arrange cleaned and drained raw milt portions in a single layer to allow uniform cooking.
- Steam until internal temperature reaches ≥ 70 °C.
- Verify temperature using a calibrated thermometer; check multiple portions.

Rapid Cooling (Critical)

- Transfer cooked milt immediately to a blast chiller or refrigerated cold room (≤ 4 °C) to rapidly reduce product temperature. Cooling should achieve ≤ 4 °C prior to packaging.

Packaging

- Move cooled milt to a clean packaging area.
- Place portions into vacuum-sealable bags.
- Vacuum seal each package to minimize air and preserve quality.
- Label packages

Freezing

- Arrange vacuum-sealed portions in a single layer in the freezer.
- Freeze quickly and store at –18 °C until evaluation or distribution

Observations:

- After steaming, the milt became firmer and changed color from pale pink to light brownish.
- The long portions tended to curl or roll slightly during steaming.
- Odor was reduced compared to raw milt but remained characteristic.

Consumer Serving Instructions (Informational):

- Fully cooked and ready to eat after thawing.
- Optional reheating for improved flavor/texture:
  - Steam 3–5 minutes
  - Microwave gently
  - Lightly pan-sear
- Keep frozen until use; thaw under refrigeration (< 4 °C).
- Do not refreeze once thawed.

Figure 4: Steamed herring milt after cooking, before packaging

Figure 5: Vacuum-packed, ready-to-freeze portions of RTE milt (300g)
Packaging size: 21cm/8.3in × 19cm/7.5in

5cm/1.96in

4.3 Prototype 3: Steamed + Battered/Breaded (Tempura-Style) Frozen Herring Milt

Objective:

Produce a fully cooked, frozen herring milt product with a light tempura coating, suitable for evaluation or consumer testing. The product is safe to eat after thawing, with optional reheating for optimal flavor and texture.

Materials:

- Steamed herring milt (from Section 4.2)
- Tempura batter ingredients: all-purpose flour, cornstarch, ice-cold water, egg, baking powder, salt
- Predust flour (all-purpose or rice flour)
- Panko/breadcrumbs
- Cooking oil for par-frying
- Vacuum-sealable bags
- Freezer at –18 °C
- Lined trays and cooling rack

Step-by-Step Procedure:

Prepare Tempura Batter

Ingredients:

- 1 cup (120 g) all-purpose flour
- ¼ cup (30 g) cornstarch
- 1 cup (240 mL) ice-cold water
- 1 large egg
- ½ tsp (2 g) baking powder
- Pinch of salt (1–2 g)

Procedure:

- Place a bowl inside another bowl filled with ice to keep batter cold.
- Crack egg into the bowl and whisk gently.
- Add ice-cold water and mix lightly.
- In a separate bowl, combine dry ingredients: flour, cornstarch, baking powder, salt.
- Add dry ingredients to the cold egg-water mixture all at once.
- Stir gently with a fork.
- Adjust texture if needed:
    - Too thick → add 1–2 tbsp ice water
    - Too thin → add 1 tbsp flour

Prepare Coatings

- Predust: all-purpose flour or rice flour
- Tempura batter
- Panko/breadcrumbs

Coating Step

- Dust steamed herring milt pieces lightly with flour.
- Dip into tempura batter.
- Roll in panko/breadcrumbs.
- Transfer coated pieces to a lined tray in a single layer.

Par-Frying & Cooling

- Par-fry or partially deep-fry pieces in oil at 170–180 °C for 1.5 - 3 minutes until coating is set and lightly golden.
- Remove using tongs or a slotted spoon.
- Place on a rack to drain and release steam for 2–3 minutes (do not cool fully at room temperature).

- Transfer to a tray in a single layer; pieces must not touch.
- Place tray in the fridge (≤ 4 °C) and cool for 20–40 minutes until:
  - Surface is no longer warm
  - Internal temperature is below 10 °C (approaching 4 °C)

Freezing

- Move tray from fridge to freezer (–18 °C or colder).
- Freeze in a single layer until pieces are completely hard.

Packaging (After Fully Frozen)

- Remove frozen pieces from tray.
- Transfer into vacuum bags or zip bags.
- Package frozen, not warm or soft.
- Vacuum-pack or seal tightly.
- Store at –18 °C or colder.

Notes:

- This product is fully cooked and safe to eat after thawing.
- Reheating is optional for optimal flavor and texture.
- Recommended reheating methods:
  - Air fry at 190 °C for 8–12 minutes
  - Bake at 200 °C for 15–20 minutes
- Serve hot; keep frozen until use.

Figure 6. Coated herring milt pieces after battering and panko, before frying.

Figure 7. Fully frozen, packed tempura-style herring milt (300g).
Packaging size: 21cm/8.3in × 19cm/7.5in

5cm/1.96in

4.4 Prototype 4: Pickled Herring Milt

Objective:

Produce a refrigerated, acidified herring milt product that is safe to consume, with fully developed flavor and texture. The product is heat-assisted by pouring hot pickling brine over the milt to ensure microbial safety.

Materials

- Herring milt
- Non-iodized salt (for pre-salting and pickling brine)
- White vinegar (5% acidity)
- Cold water
- White sugar
- Bay leaf
- Yellow mustard seeds
- Black peppercorns

- Fresh dill (Spices are Optional for additional Flavoring)
- Stainless steel pot (for heating brine)
- Bowls or containers for soaking/holding milt
- Fine mesh strainer
- Sanitized jars or food-grade containers with lids
- Calibrated pH meter
- Colander or wire rack (for draining)
- Thermometer (to check brine temperature 80–90 °C)
- Sanitized utensils (spoon, tongs, etc.)
- Refrigerator

Batch Size:

- 500 g herring milt
- 1,000 mL pickling brine

Step-by-Step Procedure

1. Pre-Salting / Firming (Optional Step)

8% Brine Preparation:

- 80 g non-iodized salt
- 1 L cold water

Procedure:

1. Chill brine to 0–4 °C.
2. Submerge milt in the brine for 30–60 minutes, depending on initial texture.
3. Remove milt and drain for 10–15 minutes in a colander or on a wire rack.
- Do not rinse.

2. Pickling Brine Preparation (Heat-Assisted Acidification)

Brine Composition (1 L):

- 400 mL white vinegar (5% acidity)
- 400 mL cold water
- 90 g white sugar (adjust 80–100 g to taste)
- 50 g non-iodized salt (adjust 40–60 g to taste)

Optional Spices (for flavor, strained out):

- 1 bay leaf

- 1 g yellow mustard seed
- 1 g black peppercorns
- 2–3 g fresh dill

Procedure:

- Combine vinegar, water, sugar, and salt in a stainless steel pot.
- Heat to 80–90 °C (do not boil) and stir until sugar and salt dissolve.
- Add spices and hold at 80–90 °C for 10–15 minutes for flavor extraction.
- Strain the brine to remove all spices, yielding a clear, spice-free brine.

3. Pickling / Heat-Assisted Acidification

- Place drained milt into sanitized jars or containers.
- Pour hot (80–90 °C) strained pickling brine over the milt, ensuring full submersion.
- Remove trapped air by gently tapping the jars or using a sanitized utensil.
- Allow the product to cool under refrigeration (≤ 4 °C) with jars loosely covered.
- Once fully cooled, seal jars with clean lids and return to refrigerated storage.

Storage & Equilibration

- Store at ≤ 4 °C at all times.
- Allow 3–7 days for full flavor development and acid penetration.

Figure 8. Pickled herring milt (300g)
Packaging size: Standard 500ml (16.9oz) mason jar.

4.5 Product 5: Herring Milt Spread / Dip (Ready-to-Eat)

Objective:

To develop a ready-to-eat herring milt spread to explore its suitability for use in value-added food applications.

Materials

- Steamed herring milt (fully cooked, chilled, ≤ 4 °C)
- Canola oil
- Non-iodized salt
- White vinegar (5% acidity) or bottled lemon juice
- Fresh dill (optional)
- Cold potable water (optional, for texture adjustment)
- Blender or food processor
- Stainless steel mixing bowl
- Cold stainless-steel utensils
- Digital thermometer
- Sanitized food-grade containers (tubs or jars) with lids
- Food-grade gloves
- Refrigerator (≤ 4 °C)

Step-by-Step Procedure

1. **Raw Material Preparation**
   - Use steamed herring milt prepared as described in Prototype 2.
   - Ensure the milt is fully cooked, chilled, and stored under refrigeration (≤ 4 °C) prior to blending.
2. **Blending / Emulsion Preparation**

   Formulation

Ingredient	%	Weight
Steamed herring milt	—	600 g
Canola oil	10%	60 g
Non-iodized salt	1.5%	9 g
White vinegar (5%) or bottled lemon juice	1.5%	9 g
Fresh dill (finely chopped)	—	1–2 g
Optional water (if too thick)	—	5–10 g

Procedure:

- Chill blender, bowl, and utensils prior to use.
- Combine all ingredients in the blender.
- Blend until a smooth, uniform spread is obtained.
- Monitor temperature during blending and maintain product temperature at ≤ 10 °C.
- Adjust consistency with small amounts of cold water if required.
- Fill spread into sanitized food-grade tubs or jars.
- Seal containers immediately after filling.
- Label and store refrigerated at ≤ 4 °C at all times.

Figure 9**.** Herring milt spread (300g)

Packaging size: 21cm/8.3in × 19cm/7.5in

Packaging size: Standard 4 oz mason jar

5. LABORATORY ANALYSIS

Summary of Microbiological Results

Test / Organism	Raw Frozen Herring Milt	Steamed Frozen Herring Milt	Tempura- Style Frozen Herring Milt	Herring Milt Spread/Dip	Pickled Herring Milt
Aerobic Bacteria Count	390	<10	<10	770	<10
Coliforms	<10	<10	<10	<10	<10
E. coli	<10	<10	<10	<10	<10
Salmonella	Absent	Absent	Absent	Absent	Absent

Listeria monocytogenes	__	Absent	Absent	Absent	Absent
Staphylococcus aureus	<5	<5	<5	<5	<5
Yeasts	—	—	<5	1,200	<5
Molds	—	—	<10	<10	<10

Microbiological testing of representative pilot-scale samples demonstrated that pathogenic organism (*Salmonella*, *Listeria monocytogenes*, *E. coli*, and *Staphylococcus aureus*) were not detected in any prototype. Raw frozen herring milt exhibited low aerobic counts consistent with minimally processed seafood, confirming acceptable raw material quality while reinforcing the need for a full cooking step prior to consumption.

Processed products (steamed, tempura-style, and pickled milt) showed very low or non-detectable aerobic counts, indicating that thermal processing, acidification, and frozen or refrigerated storage were effective at controlling microbial growth under pilot-scale conditions. Compared with other processed prototypes, the multi-ingredient herring milt spread showed detectable but low aerobic plate counts and measurable yeast levels, which is expected for an emulsified, refrigerated product produced at pilot scale.

Overall, the results support the technical feasibility and microbiological control of multiple herring milt product formats when processed under controlled pilot-scale conditions. These results are indicative only and are not intended to establish validated shelf life, regulatory compliance, or commercial readiness.

Nutritional analysis of all prototypes is underway and will be shared with the client by the end of January 2026.

6. OBSERVATIONS & TECHNICAL NOTES

6.1 Raw Material Characteristics

- Herring milt arrived frozen in sealed plastic bags and was handled under controlled temperature conditions.
- Upon opening on the day of processing, the milt was dark red in color with visible residual blood, soft texture, and a characteristic fish odor.
- Multiple washing steps were required to remove residual blood and surface impurities.
- After final washing and draining, the milt appeared pale pink to whitish in color with improved visual quality and reduced odor.

- Effective washing and draining were critical for improving color, odor, and overall suitability of the milt for food applications.

6.2 Handling & Temperature Control

- Maintaining the milt at ≤ 4 °C during handling was essential to preserve quality and minimize microbial risk.
- Draining in refrigerated conditions prevented temperature abuse and limited moisture accumulation.
- Rapid cooling after heat treatments (steaming, par-frying) was effective in maintaining texture and appearance.
- Temperature control was identified as a key control point throughout all prototype developments.

6.3 Effects of Thermal Processing

- Steaming resulted in visible protein coagulation, firming the milt and changing color from pale pink to light brownish.
- Longer milt pieces tended to curl or roll during steaming due to protein contraction.
- Steamed milt maintained structural integrity and was suitable for freezing and further processing.
- Steaming provided an effective kill step while preserving product integrity for multiple value-added formats.

6.4 Freezing & Frozen Storage Performance

- Raw, steamed, and battered prototypes froze well at –18 °C when frozen in a single layer prior to packaging.
- Freezing before packaging reduced piece deformation, prevented sticking, and preserved coating integrity.
- No visible freezer burn was observed during short-term pilot storage.

6.5 Coating & Frying Performance (Tempura-Style Product)

- Predusting improved batter adhesion and coating uniformity.
- Maintaining cold batter temperature was critical for achieving a light, crisp coating.
- Par-frying set the batter without overcooking the milt, resulting in good structure after freezing and reheating.
- This prototype demonstrated strong potential as a consumer-friendly, familiar product format.

6.6 Acidification & Pickling Behavior

- Pre-salting improved firmness prior to pickling.
- Heat-assisted acidification (hot brine pour) partially cooked the milt and improved microbiological safety.
- Texture remained soft but cohesive after equilibration.

- The combined use of heat, acid, salt, and refrigeration provided multiple preservation hurdles suitable for pilot-scale production.

6.7 Emulsification & Spreadability (Milt Spread)

- Steamed milt blended smoothly into a stable spread when processed under cold conditions.
- Oil and acid additions improved flavor balance and texture.
- Temperature control during blending was important to prevent emulsion breakdown.
- The spread prototype demonstrated versatility of cooked milt beyond intact-piece products.

6.8 General Feasibility Observations

- Pilot-scale results confirm that herring milt can be processed into multiple edible, food-grade formats using proper food safety controls.
- These observations support further exploration of formulation optimization, sensory evaluation, and potential product development.

7. CONCLUSIONS & NEXT STEPS

7.1 Conclusions

- Pilot-scale work demonstrated that herring milt is a technically viable ingredient for value-added food products.
- Steaming, freezing, frying, pickling, and blending all performed effectively to create distinct product formats while maintaining safety and quality.
- Temperature control, proper handling, and process sequencing were critical for achieving consistent product quality.
- The prototypes developed (raw frozen, steamed ready-to-eat, tempura-style, pickled, and emulsified spread), show potential for different market applications.

7.2 Next Steps (Future Considerations)

Potential activities for further evaluation include:

- Sensory and consumer acceptance testing to assess market potential.
- Formulation optimization, including seasoning, texture, and portion sizes.
- Shelf-life validation through extended microbiological and physicochemical testing.
- Regulatory and labeling review for commercial production.
- Commercial-scale feasibility and cost assessment.

7.3 Closing Statement

This feasibility study provides a foundation for future exploration of herring milt as a value-added ingredient. While additional testing is required prior to commercialization, pilot-scale results indicate strong technical promise across multiple product formats.

Disclaimer / Limitations

This project did not include consumer testing, commercial-scale manufacturing, or regulatory approval activities. All procedures, observations, and outcomes described in this report are specific to pilot-scale work conducted for feasibility assessment and internal evaluation purposes only and should not be interpreted as validated processes, established shelf life, or evidence of regulatory compliance. Prototype formulations, processing methods, and laboratory analyses were developed using professional judgment and best practices appropriate for small-scale research; they have not been validated for commercial production, regulatory compliance, or formal shelf-life determination. Processing parameters and product handling may require modification, hazard analysis, and validation during scale-up. Estimated storage conditions and shelf-life ranges are based on pilot-scale observations and professional judgment and should not be interpreted as formal recommendations for industrial production or consumer use. Any future commercialization, distribution, or consumer-facing use of the products described herein would require additional product development, process validation, and regulatory review beyond the scope of this project.

8. APPENDICES

Lab reports (Microbiology)

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Fredericton, NB E3B 6Z9
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Tel: 506.452.1212
www.rpc.ca

Certificate of Analysis

Perennia Food and Agriculture
173 Dr. Bernie MacDonald Dr.
Bible Hill, NS B6L 2H5

Report ID: *25-017986-MICRO*
Report Date: *2026-01-05*

Attention: Gabylis Baby
Project: 25-017986
Location: n/a

Sample Received: 2025-12-31
Client Job Number: n/a
PO No.: n/a

Microbiological Analysis

			RPC Sample ID	25-017986-1-1	25-017986-2-1	25-017986-3-1
			Client Sample ID	Raw Frozen Herringb Milt	Steamed Herring Milt	Tempura- Style Frozen Herring Milt
			Matrix	Food	Food	Food
			Date/Time Sampled	2025-12-29 08:30:00	2025-12-29 08:30:00	2025-12-29 08:30:00
Analyte	**Units**	**RL**				
Aerobic Bacteria Count	cfu/g	-		390	< 10	< 10
Coliforms	cfu/g	-		< 10	< 10	< 10
E. coli	cfu/g	-		< 10	< 10	< 10
Listeria monocytogenes	25g	-			a	a
Salmonella	25g	-		a	a	a
Staphylococcus aureus	cfu/g	-		< 5	< 5	< 5
Yeasts	cfu/g	-				< 10
Molds	cfu/g	-				< 10

Corrie Maston
Microbiology

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Sample Received: 2025-12-31
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PO No.: n/a

Microbiological Analysis

Analyte	Units	RL	RPC Sample ID: 25-017986-4-1	RPC Sample ID: 25-017986-5-1
			Client Sample ID: Herring Milt Spread/Dip	Client Sample ID: Pickled Herring Milt
			Matrix: Food	Matrix: Food
			Date/Time Sampled: 2025-12-29 08:30:00	Date/Time Sampled: 2025-12-29 08:30:00
Aerobic Bacteria Count	cfu/g	-	770	< 10
Coliforms	cfu/g	-	< 10	< 10
E. coli	cfu/g	-	< 10	< 10
Listeria monocytogenes	25g	-	a	a
Salmonella	25g	-	a	a
Staphylococcus aureus	cfu/g	-	< 5	< 5
Yeasts	cfu/g	-	1,200	< 10
Molds	cfu/g	-	< 10	< 10

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Methods

Test	RPC SOP
Aerobic Bacteria Count	MICRO54
Coliforms and E. coli (Rapid)	MICRO57
Listeria monocytogenes	MICRO08
Salmonella (Rapid)	MICRO45
Staphylococcus aureus	MICRO07
Yeasts and Molds (Petrifilm)	MICRO55

Report Information

This report relates only to the sample(s) and information provided to the laboratory.

Reported results are expressed on an as-received basis.

Legend:
RL = Reporting Limit; MAC = Maximum Allowable Concentration; MPN = Most Probable Number; cfu = Colony-Forming Unit; gc/mL = genomic copies/mL; ug/L = micrograms per liter; P = present; A = absent; pp = presumptive positive; E = Estimate; ND = Not Detected; OG = Overgrown; TNTC = Too Numerous to Count

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Attention: Gabylis Baby
Project: 25-017986
Location: n/a

Sample Received: 2025-12-31
Client Job Number: n/a
PO No.: n/a

Summary of Date Analyzed:

RPC Sample ID	Test / Analysis	Date Extracted	Date Analyzed
25-017986-1-1	Aerobic Bacteria Count	-	2025-12-31
25-017986-1-1	Coliforms and E. coli (Rapid)	-	2025-12-31
25-017986-1-1	Salmonella (Rapid)	-	2025-12-31
25-017986-1-1	Staphylococcus aureus	-	2025-12-31
25-017986-2-1	Aerobic Bacteria Count	-	2025-12-31
25-017986-2-1	Coliforms and E. coli (Rapid)	-	2025-12-31
25-017986-2-1	Listeria monocytogenes	-	2025-12-31
25-017986-2-1	Salmonella (Rapid)	-	2025-12-31
25-017986-2-1	Staphylococcus aureus	-	2025-12-31
25-017986-3-1	Aerobic Bacteria Count	-	2025-12-31
25-017986-3-1	Coliforms and E. coli (Rapid)	-	2025-12-31
25-017986-3-1	Listeria monocytogenes	-	2025-12-31
25-017986-3-1	Salmonella (Rapid)	-	2025-12-31
25-017986-3-1	Staphylococcus aureus	-	2025-12-31
25-017986-3-1	Yeasts and Molds (Petrifilm)	-	2025-12-31
25-017986-4-1	Aerobic Bacteria Count	-	2025-12-31
25-017986-4-1	Coliforms and E. coli (Rapid)	-	2025-12-31
25-017986-4-1	Listeria monocytogenes	-	2025-12-31
25-017986-4-1	Salmonella (Rapid)	-	2025-12-31
25-017986-4-1	Staphylococcus aureus	-	2025-12-31
25-017986-4-1	Yeasts and Molds (Petrifilm)	-	2025-12-31
25-017986-5-1	Aerobic Bacteria Count	-	2025-12-31
25-017986-5-1	Coliforms and E. coli (Rapid)	-	2025-12-31
25-017986-5-1	Listeria monocytogenes	-	2025-12-31
25-017986-5-1	Salmonella (Rapid)	-	2025-12-31
25-017986-5-1	Staphylococcus aureus	-	2025-12-31
25-017986-5-1	Yeasts and Molds (Petrifilm)	-	2025-12-31

Perennia
Nova Scotia's Food Development Agency

DEVELOPMENT OF FISH (HERRING) MILT PROTOTYPES FOR HUMAN CONSUMPTION

Analytical Results Summary

Prepared for:
Great Lakes St. Lawrence Governors & Premiers (GSGP)

Prepared by:
Gabylis Baby
Seafood Scientist
Perennia Food and Agriculture Corporation

Date:
January 21, 2026

Perennia
Nova Scotia's Food Development Agency

Summary of Analytical Results

Herring Milt Prototype Products

A comprehensive nutritional analysis was conducted on the raw frozen herring milt to establish a full baseline profile, including proximate composition, fatty acid profile, cholesterol, sugars, calories, and minerals. The processed prototype products (steamed, tempura-style frozen, spread/dip, and pickled) were analyzed for basic compositional parameters only (moisture, protein, fat, ash, and where applicable, peroxide value).
All results are reported on an as-received basis.

Raw Frozen Herring Milt (Baseline)

Raw frozen herring milt showed high moisture (74.5g/100g) and high protein content (23.2g/100g) with low fat (2.82g/100g). The lipid fraction contained meaningful levels of omega-3 fatty acids, including EPA, DHA, and DPA, and trans fats were negligible. Carbohydrates and sugars were present at trace levels only. Cholesterol was measured at 398mg/100g, which is typical for roe and milt products. Mineral analysis confirmed the presence of nutritionally relevant levels of sodium, potassium, iron, magnesium, and calcium. The low peroxide value <0.5 meq/kg indicates that the fats in the product were in good condition and showed no signs of early rancidity at the time of testing. Overall, the raw frozen milt provides a nutritionally dense and well-characterized baseline for subsequent processing and product development.

Steamed Herring Milt (Ready-to-Eat Prototype)

Steaming reduced moisture to 64.0g/100g and resulted in a concentration of protein (32.8g/100g) and moderate fat (8.3g/100g). The peroxide value of 1.0 meq/kg indicates low primary lipid oxidation, demonstrating acceptable oxidative quality for a cooked seafood product. These results support the suitability of steamed herring milt as a minimally processed, ready-to-eat format.

Tempura-Style Frozen Herring Milt

The tempura-style product showed a substantial increase in fat content (19.9g/100g) and a marked reduction in moisture (28.0g/100g), consistent with battering and frying. Protein content (18.1g/100g) reflects dilution by the coating and added fat. The composition supports positioning as a value added product suitable for retail or food service.

Herring Milt Spread / Dip

The spread/dip prototype displayed a balanced composition, with 27.5g protein and 18.7g fat per 100g, and a moisture level (55.3g/100g) suitable for spreadable or emulsified applications. Ash content (3.7g/100 g) reflects

added ingredients and formulation. This format demonstrates strong potential as a value-added specialty seafood product.

Pickled Herring Milt

Pickled herring milt had the highest protein content among all products (33.5g/100g) and moderate fat (9.3g/100g). The elevated ash content (5.2g/100g) is consistent with salt uptake during the pickling process. Moisture content (56.0g/100g) reflects the preserved nature of the product. These results indicate suitability for preserved high-protein product applications.

Overall Conclusions

- Raw frozen herring milt was fully characterized and serves as a robust nutritional baseline.
- All prototypes demonstrated high protein levels, ranging from 18.1 to 33.5g/100g, confirming herring milt as a nutritionally dense raw material.
- Processing method had a clear impact on moisture reduction, fat content, and nutrient concentration, enabling differentiated product formats.
- Lipid oxidation was low in the raw and steamed product, while additional oxidative stability testing is recommended for higher-fat and preserved formats as part of shelf-life evaluation.
- The analytical results support the technical feasibility and versatility of herring milt for both minimally processed and value-added seafood products.

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Certificate of Analysis

Perennia Food and Agriculture
173 Dr. Bernie MacDonald Dr.
Bible Hill, NS B6L 2H5

Report ID: *25-017986-FC*
Report Date: *2026-01-20*

Attention: Gabylis Baby
Project: 25-017986
Location: n/a

Sample Received: 2025-12-31
Client Job Number: n/a
PO No.: n/a

Nutritional Analysis

Analyte	Units	RL	RPC Sample ID: 25-017986-1-2
			Client Sample ID: Raw Frozen Herringb Milt
			Matrix: Food
			Date/Time Sampled: 2025-12-29 08:30:00
Fatty Acid Profile	g/100g	0.01	2.82
Saturated	g/100g	0.01	1.04
Cis-Monounsaturated	g/100g	0.01	0.51
Cis-Polyunsaturated	g/100g	0.01	1.15
Trans Fatty Acids	g/100g	0.01	< 0.01
Omega-3 Polyunsaturated	g/100g	0.01	0.72
Omega-6 Polyunsaturated	g/100g	0.01	0.43
EPA	g/100g	0.01	0.37
DPA	g/100g	0.01	0.10
DHA	g/100g	0.01	0.19
Carbohydrates	g/100g	0.1	< 0.1
Calories	/100g	1	118
Moisture	g/100g	0.3	74.5
Ash	g/100g	0.1	3.7
Protein	g/100g	0.2	23.2
Cholesterol	mg/100g	0.1	398
Total Sugars	g/100g	0.1	< 0.1
Glucose	g/100g	0.1	< 0.1
Fructose	g/100g	0.1	< 0.1
Sucrose	g/100g	0.1	< 0.1
Lactose	g/100g	0.4	< 0.4
Maltose	g/100g	0.4	< 0.4
Calcium	mg/100g	0.1	23.3
Iron	mg/100g	0.02	2.00
Magnesium	mg/100g	0.4	15.1
Potassium	mg/100g	1	59
Sodium	mg/100g	1	128

Bruce Phillips
Food Chemistry

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Report Date: *2026-01-20*

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Project: 25-017986
Location: n/a

Sample Received: 2025-12-31
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PO No.: n/a

Food Chemistry

Analyte	Units	RL	RPC Sample ID	25-017986-1-2	25-017986-2-2	25-017986-3-2
			Client Sample ID	Raw Frozen Herringb Milt	Steamed Herring Milt	Tempura- Style Frozen Herring Milt
			Matrix	Food	Food	Food
			Date/Time Sampled	2025-12-29 08:30:00	2025-12-29 08:30:00	2025-12-29 08:30:00
Ash	g/100g	0.1			4.8	1.8
Fat (AH)	g/100g	0.5			8.3	19.9
Moisture	g/100g	0.3			64.0	28.0
Peroxide Value	mequiv/Kg	0.5		< 0.5	1.0	
Protein	g/100g	0.2			32.8	18.1

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Report Date: *2026-01-20*

Attention: Gabylis Baby
Project: 25-017986
Location: n/a

Sample Received: 2025-12-31
Client Job Number: n/a
PO No.: n/a

Food Chemistry

Analyte	Units	RL	RPC Sample ID: 25-017986-4-2	RPC Sample ID: 25-017986-5-2
			Client Sample ID: Herring Milt Spread/Dip	Client Sample ID: Pickled Herring Milt
			Matrix: Food	Matrix: Food
			Date/Time Sampled: 2025-12-29 08:30:00	Date/Time Sampled: 2025-12-29 08:30:00
Ash	g/100g	0.1	3.7	5.2
Fat (AH)	g/100g	0.5	18.7	9.3
Moisture	g/100g	0.3	55.3	56.0
Protein	g/100g	0.2	27.5	33.5

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Project: 25-017986
Location: n/a

Sample Received: 2025-12-31
Client Job Number: n/a
PO No.: n/a

Methods

Test	RPC SOP
Ash	OAS-FC02
Carbohydrates and Calories	-
Cholesterol	OAS-FC08; OAS-FC14
Fat (AH)	OAS-FC06
Fatty Acid Profile	OAS-FC07
Metals Microwave Prep	IAS-M41
Minerals in Food	IAS-M01/IAS-M29
Moisture	OAS-FC01
Peroxide	OAS-FC17
Protein	OAS-FC04
Sugars	OAS-FC09

Report Information

This report relates only to the sample(s) and information provided to the laboratory.

Reported results are expressed on an as-received basis.

Legend:
RL = Reporting Limit

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Report ID: *25-017986-FC*
Report Date: *2026-01-20*

Attention: Gabylis Baby
Project: 25-017986
Location: n/a

Sample Received: 2025-12-31
Client Job Number: n/a
PO No.: n/a

Summary of Date Analyzed:

RPC Sample ID	Test / Analysis	Date Extracted	Date Analyzed
25-017986-1-2	Ash	-	2026-01-08
25-017986-1-2	Cholesterol	-	2026-01-06
25-017986-1-2	Fatty Acid Profile	-	2026-01-13
25-017986-1-2	Moisture	-	2026-01-05
25-017986-1-2	Peroxide	-	2026-01-06
25-017986-1-2	Protein	-	2026-01-06
25-017986-1-2	Sugars	-	2026-01-09
25-017986-1-3	Minerals in Food	-	2026-01-08
25-017986-2-2	Ash	-	2026-01-08
25-017986-2-2	Fat (AH)	-	2026-01-05
25-017986-2-2	Moisture	-	2026-01-05
25-017986-2-2	Peroxide	-	2026-01-06
25-017986-2-2	Protein	-	2026-01-06
25-017986-3-2	Ash	-	2026-01-08
25-017986-3-2	Fat (AH)	-	2026-01-05
25-017986-3-2	Moisture	-	2026-01-05
25-017986-3-2	Protein	-	2026-01-06
25-017986-4-2	Ash	-	2026-01-08
25-017986-4-2	Fat (AH)	-	2026-01-05
25-017986-4-2	Moisture	-	2026-01-05
25-017986-4-2	Protein	-	2026-01-06
25-017986-5-2	Ash	-	2026-01-08
25-017986-5-2	Fat (AH)	-	2026-01-05
25-017986-5-2	Moisture	-	2026-01-05
25-017986-5-2	Protein	-	2026-01-06

Nutrition Facts
Valeur nutritive

Per 100 g / par 100 g

Calories 120	**% Daily Value*** **% valeur quotidienne***
Fat / Lipides 3 g	4 %
Saturated / saturés 1 g + Trans / trans 0 g	5 %
Carbohydrate / Glucides 0 g	
Fibre / Fibres 0 g	0 %
Sugars / Sucres 0 g	0 %
Protein / Protéines 23 g	
Cholesterol / Cholestérol 400 mg	
Sodium 130 mg	6 %
Potassium 50 mg	1 %
Calcium 20 mg	2 %
Iron / Fer 2 mg	11 %

*5% or less is **a little**, 15% or more is **a lot**

*5% ou moins c'est **peu**, 15% ou plus c'est **beaucoup**