

SEAFOOD TESTING GUIDE

Finfish

PRACTICAL, REGULATORY & TECHNICAL REFERENCE

PURPOSE

This guide is intended to support seafood industry stakeholders, including processors, harvesters, exporters, and quality assurance/food safety staff, by clarifying which finfish products require testing, what hazards should be monitored, which parts of the product should be sampled, how often testing should occur, how to prepare and ship samples, where to send them, and how to interpret results. This guidance aligns with Canadian regulatory frameworks (Canadian Food Inspection Agency (CFIA) and Health Canada) and international best practices.

SCOPE

Covers biological (microbiological) and chemical (marine biotoxin hazards, additives) hazards. Applicable to raw, frozen, fillet/meat portions, and processed ready-to-eat (RTE) products.

DISCLAIMER

This guide summarises current Canadian and international standards as of 2026. It is intended for informational purposes only. Operators must verify specific export market/buyer requirements, keep up with regulatory updates, and integrate testing into their Preventive Control Plan (PCP) under the Safe Food for Canadians Regulations (SFCR).

1. HAZARDS & TESTING OVERVIEW

1.1 HAZARD CATEGORIES

Microbiological hazards

- *Listeria monocytogenes* (a concern for RTE products), *Salmonella* spp., *Escherichia coli* (including O157:H7), *Staphylococcus aureus*, yeasts/molds, Total Aerobic Count (TAC), psychrotrophs.
- **Parasites:** nematodes (e.g., *Anisakis* spp. and *Pseudoterranova* spp.), cestodes (e.g., *Diphyllobothrium* spp.) and trematodes (e.g., *Clonorchis* spp., and *Opisthorchis* spp.) especially in raw/undercooked fish. Routine laboratory testing for parasites is uncommon; control is primarily achieved through visual inspection and removal, validated freezing or cooking treatments, and supplier verification.

Chemical

- Heavy metals (Mercury (Hg), Cadmium (Cd), Lead (Pb), Arsenic (As)), PCBs, dioxins, veterinary drug residues, **histamine / scombroid poisoning** (tuna, mackerel, mahi-mahi, anchovies).

1.2 KEY MESSAGE

Product and environmental testing must be **risk-based**. Required tests depend on **species** (large predatory fish such as swordfish or tuna, versus small pelagic species like herring or redfish), product form (raw whole, fillet, frozen, or ready-to-eat/processed), processing method (smoking, canning, freezing), target market (domestic or export), and risk factors (harvest area, handling, and process controls). Proper sampling, use of accredited laboratories, and documented results are critical for compliance and brand protection.

2. CHEMICAL CONTAMINANTS & ADDITIVES

Table 2.1: Chemical Contaminants and Additives.

Sources

Appendix 3: Canadian Guidelines for Chemical Contaminants and Toxins in Fish and Fish Products

Species / Product Group	Key Chemical / Toxin Tests	Canadian Action Level / Limit	Part to Sample
All fish products (except high-mercury species)	Mercury (Hg)	0.5 ppm	Edible portion / fillet
High-mercury fish (Swordfish, Shark, Fresh/Frozen Tuna, Escolar, Orange Roughy, Marlin)	Mercury (Hg)	1.0 ppm	Edible portion / fillet
Fish Protein Concentrate	Arsenic (As)	3.5 ppm	Product as sold
Fish Protein Concentrate	Lead (Pb)	0.5 ppm	Product as sold
Fish Protein Concentrate	Fluoride (F)	150 ppm	Product as sold
All fish products	2,3,7,8 TCDD (Dioxin)	20 ppt	Product as sold
All fish products	DDT	5.0 ppm	Product as sold
All fish products	PCB	2.0 ppm	Product as sold
All fish products	Other agricultural chemicals or their derivatives	0.1 ppm	Product as sold
Dried cod	Piperonyl butoxide	1.0 ppm	Product as sold
Enzyme-ripened products e.g., anchovies, anchovy paste, fish sauce	Histamine	20 mg/100 g	Edible portion / fillet
All other scombroid products, e.g., canned, fresh, frozen tuna, mackerel, mahi-mahi	Histamine	10 mg/100 g	Edible portion / fillet
All fish and fish products (except marine mammal meat)	Nitrites	15 ppm	Product as sold
All fish and fish products	Nitrates	15 ppm	Product as sold

Table 2.1

Notes

- High-mercury species require regular monitoring.
- Scombroid-prone fish require lot-level histamine testing.
- For additives that are intentionally added, refer to the Lists of permitted food additives – Health Canada [Lists of permitted food additives – Health Canada](#).

3. MICROBIOLOGICAL GUIDELINES

Table 3.1: Microbiological Guidelines.

Sources

[CFIA Bacteriological Guidelines for Fish and Fish Products \(End Product\)](#)
[Microbial Guidelines for Ready-to-Eat Foods – Health Canada](#)

Test Organism / Parameter	Product Type	Sample Units	Limit / Acceptance	Notes / Interpretation
<i>Escherichia coli</i>	Raw finfish	5	Acceptable: 2 Samples ≤4 CFU/g Unsatisfactory; if any sample >40 CFU/g or 1 or more samples >40 CFU/g	Routine hygiene indicator for raw products Unsatisfactory if ≥3 samples exceed 4 CFU/g or if any sample exceeds 40 CFU/g.
<i>Escherichia coli</i>	Cooked / RTE fish	5	Acceptable: 1 Sample ≤4 CFU/g Unsatisfactory; if any sample >40 CFU/g or 1 or more samples > 40 CFU/g	Unsatisfactory if ≥2 samples exceed 4 CFU/g or any sample exceeds 40 CFU/g, process control check
Coagulase-positive <i>Staphylococcus aureus</i>	All fish types	5	Acceptable: 1 sample ≤1000 CFU/g Unsatisfactory; if any sample >10,000 CFU/g or 1 or more samples >10,000CFU/g	Unsatisfactory if ≥2 samples exceed 1000 CFU/g or any sample exceeds 10,000 CFU/g, hygiene/process control indicator
<i>Salmonella</i> spp.	All fish types	5	Absent in each 25 g (or pooled 125 g)	Any detection of <i>Salmonella</i> spp. is unsatisfactory, required for safety verification
<i>Listeria monocytogenes</i>	RTE fish	5	Category 1: absent in 125 g; Category 2A: ≤100 CFU/g; Category 2B: ≤100 CFU/g; growth will not occur throughout the stated shelf-life (that is, increase not exceeding 0.5 log CFU/g throughout the stated shelf-life)	Pathogen; Unsatisfactory if detected / exceeds limits- applies to Category 1 only Category 2A and 2B: unsatisfactory if any sample is >100 CFU/g.
Aerobic Colony Count	RTE Fish	-	Unsatisfactory ≥ 10 ⁵ CFU/g	High levels indicate poor handling, post-processing temperature abuse, inadequate cooking, storage, or sanitation
Total <i>Coliforms</i>	RTE Fish	-	Unsatisfactory ≥10 ³ CFU/g	Indicate inadequate processing or post-processing contamination.

Yeast and mould	RTE Smoked, dried, fermented, salted, vacuum-packed	-	No defined regulatory limit available	May cause spoilage (off-odours, flavours, colours); some intentionally added for flavour
<i>Listeria</i> spp. (environmental swabs)	RTE processing areas	Risk-based; both food-contact surfaces (FCS) and non-food contact surfaces (non-FCS); zone-based sampling required	FCS: Non-detect; Non-FCS: trend monitoring. Any positive <i>Listeria</i> environmental result (FCS or non-FCS) requires a corrective action plan	Environmental hygiene check

Table 3.1

Notes

Listeria spp. (environmental swabs): Environmental monitoring programs for *Listeria* spp. should be developed and implemented in accordance with Health Canada's [Policy on *Listeria monocytogenes* in ready-to-eat foods](#)

RTE CATEGORIES & VALIDATION

- Category 1: RTE foods which support the growth of *L. monocytogenes* under reasonable foreseeable conditions of distribution, storage and use throughout the stated shelf-life; detection is unsatisfactory.
- Category 2A: RTE foods in which the growth of *L. monocytogenes* may be **limited** to levels not exceeding 100 CFU/g under reasonable foreseeable conditions of distribution, storage and use throughout the stated shelf-life.

This includes RTE foods that:

1. Are known to occasionally contain low levels of *L. monocytogenes* and their processing does not involve heat-treatment (based on validation), and
 2. Refrigerated foods with a stated shelf-life of ≤ 5 days.
- Category 2B: RTE foods in which the growth of *L. monocytogenes* will not occur under reasonable foreseeable conditions of distribution, storage and use throughout the stated shelf-life, and RTE foods that do not support the growth of *L. monocytogenes* throughout the stated shelf-life. Category 2B RTE manufacturers should regularly monitor the physico-chemical parameters of the food such as pH and a_w , formulation etc. (if not frozen) to demonstrate that it continues to meet the criteria that justify its categorization as a Category 2B food.

In cases where validation was conducted for categorization, the manufacturer should have documentation of adequate validation studies substantiation that *L. monocytogenes* cannot grow throughout the stated shelf-life.

RTE PHYSICO-CHEMICAL CRITERIA FOR 2B CLASSIFICATION (NO VALIDATION NEEDED IF THESE APPLY):

- pH < 4.4 at any a_w (water activity)
- a_w < 0.92 (regardless of pH)
- combination of pH < 5.0 AND a_w < 0.94
- Product is frozen until consumption (product must be labelled "keep frozen" on the package).
- Other RTE foods in which *L. monocytogenes* does not increase in numbers by more than 0.5 log CFU/g throughout the stated shelf-life based on validation.

VALIDATION REQUIREMENTS

- If RTE products have a longer shelf-life (>5 days), partial kill steps, or use anti-*Listeria* additives/treatments, supporting validation data must demonstrate limited growth (<0.5 log CFU/g) to classify as 2B or 2A.

4. SAMPLING & LABORATORY SUBMISSION

4.1 HOW TO COLLECT SAMPLES

- Randomly select units across the lot/batch that are representative of the entire lot and production conditions and meet the sample size requirements of the lab; avoid bias.
- Define lot: production run, harvest day, or batch with same source/date.
- Matrix / sample part: edible portion for chemical/heavy metals and histamine; fillet for microbiology.
- Avoid cross-contamination: use aseptic techniques, gloves, sterile bags, sanitized utensils, clean surfaces.
- Document product name, lot, sample units, date/time, sampler and temperature.
- Keep retention samples frozen at –18 °C or lower (or as per internal procedure) as an archive until all laboratory results have been reviewed and confirmed. Re-testing is needed when:
 - » Laboratory results are inconclusive, invalid, or there is a justified reason to question the result (e.g., suspected sampling or analytical error).
 - » Investigation is required for suspected contamination, non-compliance, or quality deviation.
 - » Follow-up testing is requested by a regulatory authority (e.g., CFIA) or internal quality assurance team.

4.2 PREPARING SAMPLES FOR LABORATORY SUBMISSION

- Confirm with lab: Contact the accredited laboratory to confirm sample size, matrix, composite rules, analytical method, acceptable packaging and temperature requirements, receiving hours, sample acceptance criteria, and shipping instructions.
- Use sterile food-grade bags, disposable utensils, insulated cooler, ice/dry ice, absorbent material, chain-of-custody forms. Example sources: laboratory and food-sampling suppliers ([Neogen – Sample Collection Solutions](#)).
- Label with product, matrix, lot, collector, sample ID, temperature.
- Seal, place in secondary container with absorbent material, ship same day/overnight.
- Maintain chain-of-custody; retain archive sample.

5. SAMPLING FREQUENCY & PCP INTEGRATION

- **Frequency planning:** Testing frequency must be defined in your Preventive Control Plan under the SFCR and based on a risk assessment considering your product, process, supplier/source, historical results, and target market.
- **Key influencing factors:** Product type (ready-to-eat vs. raw), processing method, historical results, supplier performance, export or buyer requirements, and production volume/frequency.

5.1 ENVIRONMENTAL SAMPLING FREQUENCY - LISTERIA

Table 5.1 below presents recommended FCS testing frequencies when preparing the highest risk Category 1 RTE food.

FCS testing frequency per production line according to the relative risk level for the highest risk Category 1 RTE foods: smoked seafood and cooked ready to eat crustaceans.

Production volume	No antimicrobial agent or post-lethality treatment	Antimicrobial agent	Post-lethality treatment	Antimicrobial agent and post-lethality treatment
Very small	Once per month	Once every 2 months	Once every 2 months	Once every 3 months
Small	Twice per month	Once per month	Once per month	Once every 2 months
Medium	3 times per month	3 times every 2 months	3 times every 2 months	Once per month
Large	4 times per month	Twice per month	Twice per month	Once per month

Table 5.1

Table 5.2 presents recommended FCS testing frequencies for RTE foods not covered by Table 5.1.

FCS testing frequency per production line according to the relative risk level (RRL) for RTE foods not covered by Table 5.1.

RTE risk category	No antimicrobial agent or post-lethality treatment	Antimicrobial agent	Post-lethality treatment	Antimicrobial agent and post-lethality treatment
Category 1	Once per month	Once every 2 months	Once every 2 months	Once every 3 months
Category 2A	Once every 3 months	Once every 6 months	Once every 6 months	Once per year
Category 2B	Once every 6 months	N/A	Once per year	N/A

Table 5.2

Table 5.3 presents recommended finished product testing frequencies.

Product sampling frequency according to the relative risk level (RRL).

RTE risk category	No antimicrobial agent or post-lethality treatment	Antimicrobial agent	Post-lethality treatment	Antimicrobial agent and post-lethality treatment
Category 1	Once per month	Once every 6 weeks	Once every 6 weeks	Once every 2 months
Category 2A	Once every 2 months	Once every 3 months	Once every 3 months	Once every 6 months
Category 2B	Once every 6 months	N/A	Once per year	N/A

Table 5.3

Source for Table 5.1, 5.2 & 5.3: [Control measures for *Listeria monocytogenes* in ready-to-eat foods](#)

Document rationale: Record your frequency plan and the justification for the chosen frequency (based on risk) in the PCP. Increase testing if there are new risks e.g., non-conforming results, changes in environmental factors, new suppliers, new species, new export markets, etc.

6. WHERE TO SEND SAMPLES / LABORATORY SELECTION

- Use accredited laboratories (ISO/IEC 17025 or equivalent).
- Confirm lab scope: species, matrix, method, turnaround, reporting format.
- Ensure lab is recognized for export or meets buyer requirements (export certificate, chain-of-custody).

7. HANDLING NON-CONFORMING RESULTS

If a test result is out-of-spec:

1. Immediately segregate the lot or batch. Do not ship until a decision is made.
2. Investigate root causes: supplier variation, harvest area change, process/temperature control lapse, lab or sampling error.
3. Apply corrective actions: On a case-by-case basis, determine appropriate measures based on the identified root cause. Examples may include cleaning and sanitizing equipment, reviewing harvest or handling conditions, adjusting processing or chilling, or retraining staff.
4. Retest as appropriate: Only perform re-testing when justified, based on risk assessment or identified reason. Examples include inconclusive, invalid, or suspected sampling or analytical error, or verification of corrective actions in a subsequent lot. Re-testing should not be done automatically for every out-of-spec result; valid, confirmed results from accredited laboratories generally do not require re-testing unless there is reason to doubt the initial result.
5. Document all actions in your PCP record.
6. If results exceed regulatory thresholds (e.g., maximum metals or toxins), consider recall or notification per regulatory obligations.
7. Review sampling plan/frequency and increase if necessary.

8. EXPORT & MARKET-SPECIFIC CONSIDERATIONS

- Verify buyer/export country limits (metal, histamine, additives).
- Export markets may require additional pathogen or histamine testing.
- Maintain traceability, lab certificates, and proper labelling.

9. KEY TAKE-AWAY

Risk-based testing ensures safety, quality, and regulatory compliance. Testing should be aligned with species, product form, processing method, and target market. Sampling, lot identification, laboratory results, corrective actions, and trends must be properly documented.

10. REFERENCES

- [Appendix 3: Canadian Guidelines for Chemical Contaminants and Toxins in Fish and Fish Products](#)
- [CFIA Bacteriological Guidelines for Fish and Fish Products \(End Product\)](#)
- [Control measures for Listeria monocytogenes in ready-to-eat foods](#)
- [Health Canada — Maximum Levels for Chemical Contaminants in Foods](#)
- [ISO/IEC 17025:2017 – Testing and Calibration Laboratories Competence Requirements](#)
- [Lists of permitted food additives – Health Canada](#)
- [Microbial Guidelines for Ready-to-Eat Foods – Health Canada](#)
- [Perennia Food and Agriculture Inc.: Sampling Seafood for Microbiological Analysis \(Fact Sheet – Dec 2022\)](#)
- [Policy on Listeria monocytogenes in ready-to-eat foods](#)
- [Public Health Ontario Laboratory Guide – Public Health Ontario](#)
- [Requirements and guidance by food commodity: Fish – Canadian Food Inspection Agency](#)
- [Safe Food for Canadians Regulations \(SOR/2018-108\)](#)