Salmon

Karen Pendergrass · Heavy Metal Index, Institute of Contaminant Standards

HEAVY METAL INDEX · INGREDIENT PROFILE October 2026

DOI 10.83376/hmi.ingredient.salmon

CITE AS

Pendergrass, K. (2026). Salmon. Heavy Metal Index. https://doi.org/10.83376/hmi.ingredient.salmon

CORRESPONDENCE

Corrections are logged publicly on the article page, each with its date, the affected value, and the source that resolved it.

KEYWORDS

heavy metals, food safety, dietary exposure

PUBLICATION HISTORY

This revision 2026-10-22.

Abstract

Salmon in the HMI library has 284 reported results for lead, cadmium, total arsenic, inorganic arsenic, dimethylarsinic acid, total mercury, methylmercury, nickel, chromium, aluminum, tin, uranium, Cu, Fe, Mn, Zn, Se, AsB, AsSugar-OH, AsSugar-PO4, AsSugar-SO3, AsSugar-SO4, DBT, DOT, oAs, OTC_sum_as_Sn, sumOTC, TBT, TPhT, TPT and unknown As from 27 sources. WHO gems/food submissions reported lead in salmon as sold from 503 results in 4 reporting regions, with a subgroup median of 5.1 µg/kg. In the US Total Diet Study, cooked salmon had a median lead result below 4 µg/kg across 27 composites from 2017-2020.

1 | Salmon overview

Across 2 other studies of ordinary farms and markets, reported lead means and medians on an as-sold or fresh-weight basis ranged from 22 µg/kg (Simionov et al. 2023) to 180 µg/kg (Litrenta et al. 2025).[4,7] For cadmium, 3 studies on an as-sold or fresh-weight basis reported means and medians from 1 µg/kg (Simionov et al. 2023) to 20 µg/kg (Litrenta et al. 2025).[4,7] Higher results came from contaminated or exposed settings rather than ordinary supply. Salmon as sold from escaped farmed salmon caught at sea (Norway) had total arsenic higher at 1,680 µg/kg, against 860 µg/kg for farmed salmon (Norway) in the same study.[3]

For a buyer the practical points are the form bought, the basis a result is reported on, where the salmon came from and the laboratory's reporting limit. Testing finds contamination but does not remove it.

2 | What counts as salmon

This page covers salmon in 4 forms kept separate in every comparison: salmon as sold (255 results), canned salmon (17 results), cooked salmon (10 results) and salmon powder or ground (2 results).[1,2,3,4,5,6]

Results stay on the basis each source reports: as sold or fresh weight, dry weight, or unstated. Dry-weight, as-sold and unstated results are never pooled, and no moisture conversion is applied.

3 | How metals reach salmon

The evidence on how metals reach salmon comes from studies that compared exposed and ordinary settings. Salmon as sold from escaped farmed salmon caught at sea (Norway) had total arsenic higher at 1,680 µg/kg, against 860 µg/kg for farmed salmon (Norway) in the same study.[3] In another study, salmon as sold from captured had total mercury higher at 18 µg/kg, against 17 µg/kg for all samples of species in the same study.[8]

These are observational comparisons from single studies; the size of the difference depends on the site, metal and distance.

4 | Which forms and regions measured lower

For total arsenic, the HMI reference median was lowest for salmon as sold (47 µg/kg) cooked and highest for salmon (240 µg/kg); forms differ in water content, so this compares foods as sold or eaten, not uptake.[1,2,6] The hmi reference for lead in salmon as sold pools 56 subgroup units from 3 sampling families, with a median of below 10 µg/kg and a middle half spanning below 4.35 (lower quartile) and below 10 µg/kg (upper quartile).[1,3,6] cooked for lead in salmon, the reference median was below 4 µg/kg, with a middle half from below 4 to below 4 µg/kg across 28 units.[2,9] for cadmium in salmon as sold, the reference median was below 2 µg/kg, with a middle half from below 0.158 to below 10 µg/kg across 29 units.[1,3,6]

Among GEMS/Food reporting regions, salmon as sold had the lowest total arsenic subgroup median in EURO (141 µg/kg) and the highest in EURO (1,230 µg/kg); reporting regions are markets, not growing areas.[1] For total mercury, the lowest regional median was in PAHO (10 µg/kg) and the highest in WPRO (70 µg/kg).[1]

Targeted salmon as sold samples in EURO had total arsenic lower at 520 µg/kg, against 556 µg/kg for EURO in the same study.[1] In another study, targeted salmon as sold samples in PAHO had total mercury lower at 12.7 µg/kg, against 30 µg/kg for PAHO in the same study.[1]

5 | Processing, cooking and preparation

No processing study for metals in this food is in the library yet.

Makroum et al. (2026) measured arsenic, mercury, lead, and cadmium in three Mediterranean marine fish species (thinlip gray mullet, sardines, sand smelt) from the Damietta Coast, Egypt, and found that frying and grilling significantly reduced metal concentrations in cooked muscle compared to raw (Table 3). The study notes that risk assessments based on raw fish may overstate exposure for consumers of cooked fish. Evidence from marine fish muscle (cooking effects on arsenic, mercury, lead, and cadmium), not measured in salmon.[13]

6 | Mitigation for salmon

Lot testing against the applicable limit is the check that can be verified.

7 | Trade-offs and limits of controls

Avoiding exposed growing areas lowered the metal measured in the studies available, but no study measured the cost or supply effect of doing so.[3] Metals do not move together, so a lot that passes a lead limit says little about cadmium, arsenic or nickel unless those are tested as well.

8 | Testing salmon for metals

Results depend on the method and its reporting limit. Reporting limits for lead ranged from 0.11 µg/kg (WHO GEMS/Food) to 3,000 µg/kg (WHO GEMS/Food), so a non-detect from a less sensitive method says much less.[1] Reporting limits for cadmium ranged from 0.017 µg/kg (Zmudzinska et al. 2022) to 1,000 µg/kg (WHO GEMS/Food), so a non-detect from a less sensitive method says much less.[1,10] Reporting limits for total arsenic ranged from 0.567 µg/kg (WHO GEMS/Food) to 247 µg/kg (WHO GEMS/Food), so a non-detect from a less sensitive method says much less.[1]

A useful lot result names the form, the basis and a quantification limit well below the limit that applies.

9 | Buying and verifying salmon

No maximum level for metals in salmon was verified from primary text for this page; buyers should confirm the limit that applies in the destination market.

10 | Exposure from salmon

No source in the library converted salmon concentrations into a verified estimate of intake for a defined population. Concentrations describe the food, not individual risk.

11 | Evidence review and remaining gaps

Every source record that names salmon was decided on its content: 27 occurrence extracted, 27 records in all. The occurrence table renders every extracted result; held values remain visible with their reason.

References identify the sources used in these answers. The Sources index preserves additional discovery links; inclusion there does not mean a source has been reviewed for this assessment. Corrections, completed searches, new direct evidence and changes in requirements should reopen the relevant answer.

12 | Salmon FAQs

The library reports lead, cadmium, total arsenic, inorganic arsenic, dimethylarsinic acid, total mercury, methylmercury, nickel, chromium, aluminum, tin, uranium, Cu, Fe, Mn, Zn, Se, AsB, AsSugar-OH, AsSugar-PO4, AsSugar-SO3, AsSugar-SO4, DBT, DOT, oAs, OTC_sum_as_Sn, sumOTC, TBT, TPhT, TPT and unknown As in salmon, most often lead, cadmium and total arsenic.[1,2,3,4] WHO gems/food submissions reported lead in salmon as sold from 503 results in 4 reporting regions, with a subgroup median of 5.1 µg/kg.[1]

In the studies available, salmon from contaminated or exposed settings carried more metal than salmon from the same study's control.[3] salmon as sold from escaped farmed salmon caught at sea (Norway) had total arsenic higher at 1,680 µg/kg, against 860 µg/kg for farmed salmon (Norway) in the same study.[3]

For total arsenic, the HMI reference median was lowest for salmon as sold (47 µg/kg) cooked and highest for salmon (240 µg/kg); forms differ in water content, so this compares foods as sold or eaten, not uptake.[1,2,6]

Among GEMS/Food reporting regions, salmon as sold had the lowest total arsenic subgroup median in EURO (141 µg/kg) and the highest in EURO (1,230 µg/kg); reporting regions are markets, not growing areas.[1] For total mercury, the lowest regional median was in PAHO (10 µg/kg) and the highest in WPRO (70 µg/kg).[1]

Inorganic arsenic, the more toxic form, was measured in 11 results from 3 sources, far fewer than total arsenic.[1,11,12] WHO GEMS/Food submissions reported inorganic arsenic in salmon as sold from 194 results in 3 reporting regions, with a subgroup median of 1.25 µg/kg.[1]

References

[1] GEMS/Food Contaminants database heavy-metal exports
World Health Organization · GEMS/Food Contamination Monitoring and Assessment Programme · 2026 · extranet.who.int
DATASET

[2] FY2018-FY2020 TDS Elements Analytical Results
U.S. Food and Drug Administration · FDA Total Diet Study · 2022 · www.fda.gov
DATASET

[3] PCBs and Heavy Metals in Farmed, Escaped and Wild
Unknown authors · Peer-reviewed article · 2020 · doi.org/10.3390/foods9121901
PEER-REVIEWED

[4] Bisphenols, Toxic Elements, and Potentially Toxic Elements in Ready-to-Eat Fish and Meat Foods and Their Associated Risks for Human Health
Litrenta F, Nava V, Potortì AG, Lo Turco V, Sgrò B, and Di Bella G · Toxics 2025, 13, 433 · 2025 · doi.org/10.3390/toxics13060433
PEER-REVIEWED

[5] Mercury, lead, arsenic, and cadmium in Norwegian seafood products and consumer exposure
Naess S, Aakre I, Lundebye AK, Ornsrud R, Kjellevold M, Markhus MW, et al. · Food Additives & Contaminants: Part B · 2020 · doi.org/10.1080/19393210.2020.1735533
PEER-REVIEWED

[6] Determination of toxic elements (mercury, cadmium, lead, tin and arsenic) in fish and shellfish samples. Risk assessment for the consumers
Olmedo P, Pla A, Hernandez AF, Barbier F, Ayouni L, and Gil F · Environment International · 2013 · doi.org/10.1016/j.envint.2013.05.005
PEER-REVIEWED

[7] Human health risk assessment of potentially toxic elements and microplastics accumulation in products from the Danube River Basin fish market
Simionov IA, Calmuc M, Iticescu C, Calmuc V, Georgescu PL, Faggio C, et al. · Environmental Toxicology and Pharmacology · 2023 · doi.org/10.1016/j.etap.2023.104307
PEER-REVIEWED

[8] Analysis of the Mercury Content in Fish for Human Consumption in Poland
Brodziak-Dopierala B and Fischer A · Toxics · 2023 · doi.org/10.3390/toxics11080717
PEER-REVIEWED

[9] Infants' and young children's dietary exposures to lead and cadmium: FDA total diet study 2018-2020
Spungen JH and et al. · Food Additives & Contaminants: Part A · 2024 · doi.org/10.1080/19440049.2024.2396910
PEER-REVIEWED

[10] Health Safety Assessment of Ready-to-Eat Products Consumed by Children Aged 0.5–3 Years on the Polish Market
Zmudzinska A, Puscion-Jakubik A, Bielecka J, Grabia M, Soroczynska J, Mielcarek K, et al. · Nutrients 14(11):2325 · 2022 · doi.org/10.3390/nu14112325
PEER-REVIEWED

[11] Determination of total arsenic and hydrophilic arsenic species in seafood
Luvonga C, Rimmer CA, Yu LL, and Lee SB · Journal of Food Composition and Analysis · 2021 · doi.org/10.1016/j.jfca.2020.103729
PEER-REVIEWED

[12] The First Hong Kong Total Diet Study: Inorganic Arsenic
Centre for Food Safety FEHD HKSAR · Centre for Food Safety, Food and Environmental Hygiene Department, Government of the Hong Kong Special Administrative Region · 2012 · www.cfs.gov.hk
GOVERNMENT

[13] Health hazard assessment and cooking effects on toxic metals in marine fish from the mediterranean sea at the Damietta Coast, Egypt
Makroum AH, Zakaria AI, Elshebrawy HA, Sallam KI · Scientific Reports · 2026 · doi.org/10.1038/s41598-025-33257-3
PEER-REVIEWED

STATUS AND LICENCE

Editorially reviewed in-house; no external peer review has been completed on this ingredient profile. Published as an institutional technical report with its review state tracked on the article page. Released under CC BY 4.0.

COMPETING INTERESTS

The Heavy Metal Index reports what the peer-reviewed and regulatory literature supports. It is operated separately from any certification program, does not evaluate or endorse brands, and does not use certification thresholds as evidence for the statements made here.

DATA AVAILABILITY

Every source behind this ingredient profile is listed with its own source record at https://heavymetalindex.com/ingredients/salmon#sources.

PUBLICATION HISTORY

This revision 2026-10-22. The full dated record is maintained at https://heavymetalindex.com/ingredients/salmon.