

AK LEGISLATURE SPECIAL COMMITTEE FILES SCOMM 147 3164₈

OCEAN BEAUTY

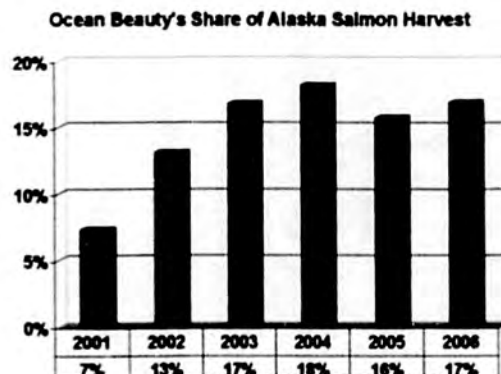
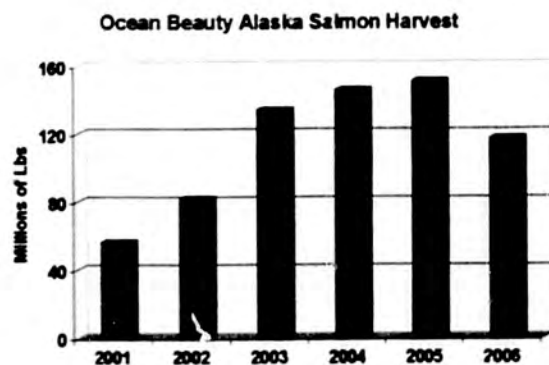
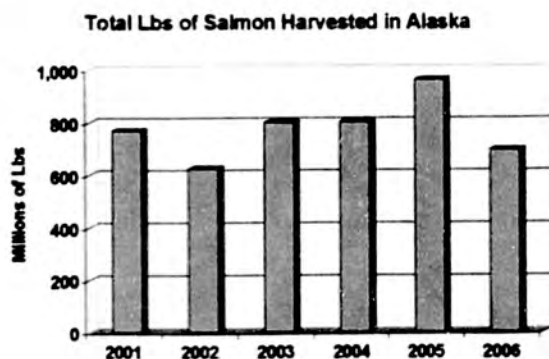
SEAFOODS, INC.

AN OVERVIEW OF OCEAN BEAUTY'S 2006 SEASON

The Alaska fisheries are universally recognized as the best managed fisheries in the world, and our annual harvest numbers provide the proof. The states resource of salmon, halibut, cod, pollock and crab are all healthy, economically viable and for the most part increasing in overall value.

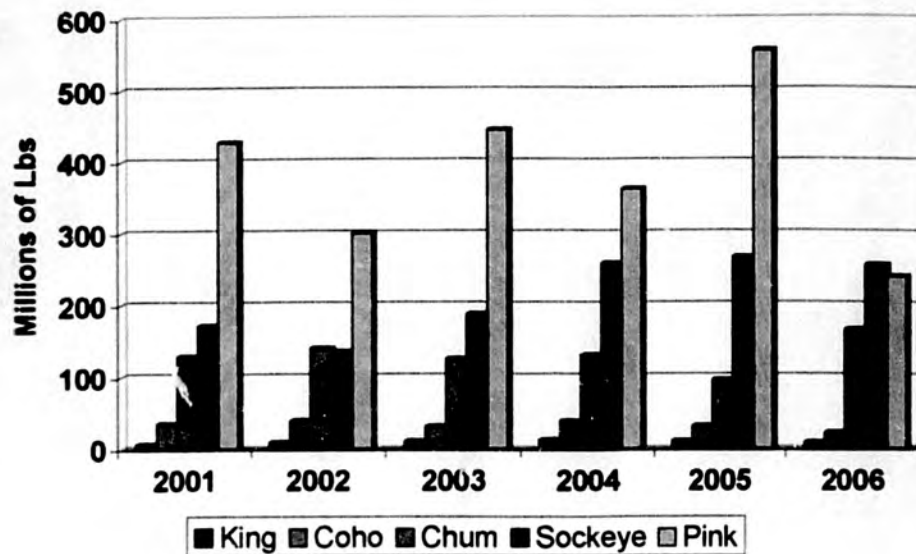
Ocean Beauty continues to grow, now employing over 2,000 people in Alaska. Our commitment to shore-side processing and the coastal communities that rely on them has never been stronger. To this end we are continuing to invest in value-added capacity and infrastructure at our plants, including a new skinless/boneless canning line in Kodiak this spring.

2006 SALMON CATCH FIGURES



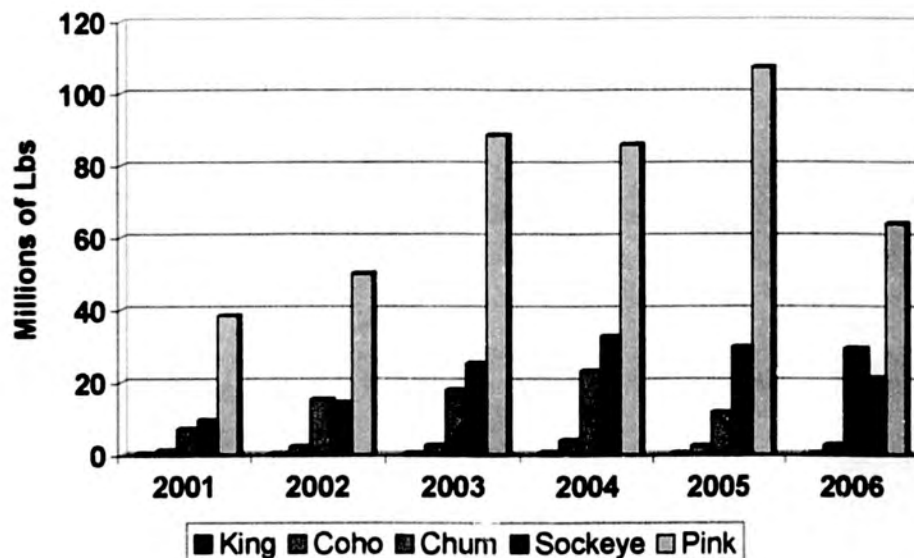
As evident in these figures, the 2006 catch was substantially lower than 2005, which is a reflection of 2006's weak pink salmon run. Despite this, Ocean Beauty's proportion of the total salmon catch increased in 2006.

Statewide Salmon Harvest by Species



The poor pink harvest in 2006 was mitigated somewhat by another very strong year for sockeye, particularly in Bristol Bay.

Ocean Beauty Salmon Harvest by Species



Because Ocean Beauty's production facilities are distributed across almost all salmon fisheries, we did somewhat better with pink salmon than the industry as a whole.

MARKET DYNAMICS

Japan: The 2006 salmon season marks the first time in Ocean Beauty's history that we did not export a single container of frozen Bristol Bay sockeye to Japan. What was once the most competitive market in the world for sockeye was unable to compete with Europe and the USA in 2006. The bright spot in Japan was in the Ikura market, where brisk sales and competitive prices allowed us to move our inventories into the market much faster than in 2005.



Eastern Europe and Russia: Eastern Europe continues to grow at a dramatic rate. With Romania and Bulgaria joining the EU in 2006 we are investigating new opportunities in these markets. Moving to protect their domestic market for salmon roe, Russia changed import regulations in 2006 that resulted in denying entry to most of the US produced salmon roe. We still feel Russia will be one of our most important markets for the future; it will just take some cooperation from a regulatory standpoint.

China: Excess manufacturing capacity and attractive labor rates continue to fuel increased demand for raw material in China. Much of the growth in domestic USA demand is the result of value added products produced in China from Alaska raw material. Ocean Beauty's exports to China doubled in 2006.

Western Europe: Sales to smokers and retail continued to increase in 2006 as both cold smoked sockeye and coho are highly sought after, particularly in the UK. Interest in a broad range of Alaskan salmon products continues to be high on the continent, including sockeye, coho, and chum fillets, chum caviar, and pink blocks. Fresh sockeye programs in the UK have successfully translated into frozen refresh programs there, expanding sales over the entire year.

2006 CANNED SALMON MARKET

Canned Pink Salmon: The combined Alaska pink pack is down 57% versus 2005's record harvest, leading to substantially higher prices. It does not appear at this point that consumers have abandoned the more expensive canned pinks, but have simply slowed down consumption as one would expect with higher prices. Now that consumers have had a year to become accustomed to higher prices, we are anticipating that we can hold on to much of the increase next year, even when the harvest returns to normal levels. We believe this will play out due to increased production of frozen pink salmon, as well as an increase in skinless/boneless forms. Inventory levels appear to be in balance with demand.

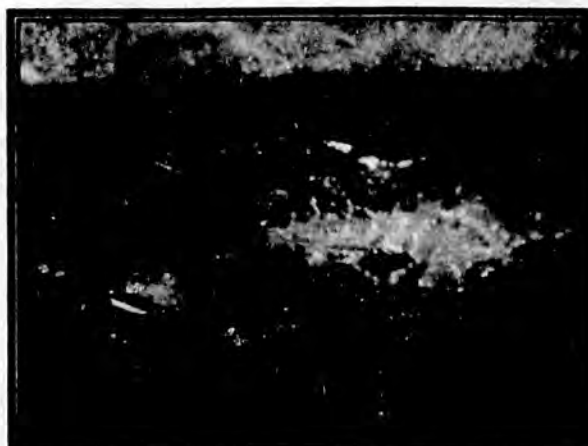
Canned Sockeye Salmon: The market price for canned sockeye has remained stable from 2005. However, the cost of production has increased faster than the industry has been able to raise prices. Particular emphasis needs to be paid to developing new markets.

USDA: The USDA purchase programs are crucial to our ability to regulate supply with demand and keep the industry out of the oversupply imbalance that has plagued canned pink salmon over the past decade. Our hope is that these purchases can be timed

to match industry needs, and be held in late summer/early fall, and post-Lenten periods. In the late summer we have a good grasp of our inventory and pricing, and can sell off excess inventory soon after harvest, minimizing our holding and storage costs. Post-Lent is excellent timing as well, allowing us to reduce year-to-year carryover and purchase aggressively.

Exports:

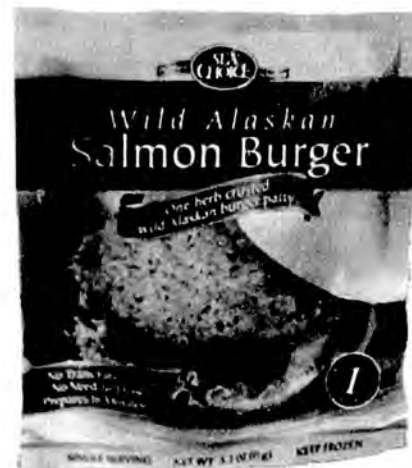
Demand for skinless/boneless sockeye and pink salmon continues to grow. King Oscar's expansion into eastern Europe has the potential to increase export demand substantially.



VALUE ADDED PROCESSING

By utilizing the tax credit for value-added salmon products (Senate Bill 164) Ocean Beauty spent an additional \$2 million in value-added processing equipment in our Kodiak and Southeast Alaska shore based plants. The result was the creation of 60 new jobs with \$900,000 in additional payroll. Almost 3 million pounds of salmon were processed into value added products that otherwise would have been placed in traditional cans or not processed at all. The ex vessel price paid to Alaskan fishermen also increased as a result of this investment.

In 2007 we have identified over \$1 million of additional spending to make significant improvements in our Value-Added capacity in Alaska.



Producing skinless/boneless products in Alaska has enabled us to improve product quality, and in the process create jobs and increase the price paid to the fishing fleet. It allows us to expand our overall production capacity, gives us the freedom to purchase more fish, and also gives us the ability to keep the plant open later in the season. In both cases, incremental jobs are created that extend later into the season.

At Excursion Inlet we have a state-of-the-art mincing operation that produces "once frozen" Alaskan wild salmon burgers. In the most recent syndicated retail grocery data (supplied by IRI for the period ending 12-3-06) the Ocean Beauty salmon burger was the fastest growing salmon burger and has claimed the #1 spot in the US retail market. This is a shore-based value-added operation that produces a product second to none in quality and, most important of all, can't be produced anywhere in the world for a lower cost than 30 miles west of Juneau.

NEW PRODUCTS

Our new product development has focused on underutilized species: pink salmon, chum salmon, and Bristol Bay sockeye. Although all species are important, we firmly hold that the only way to achieve a true renaissance in Alaska salmon is to increase the value of these species, which in 2006 comprised 85% of Alaska's salmon catch by weight. The following is a partial list of new products based on these species.



➤ Marinated Pink Salmon Portion

- Long John Silver's
- Safeway Private Label
- Kroger Private Label

➤ Single Serve Pink Salmon Portion

- Kroger
- Safeway
- Giant
- Tops
- Shaws
- Grand Union
- Harris - Teeter

➤ Salmon Burger Single Serve, 4-Pack, and 8-Packs

- Kroger
- Safeway
- BJ's
- Harris - Teeter
- Giant
- Crosby
- Big Y
- Grand Union



In addition, we continue to gain new placements of hot smoked sockeye and hot smoked sockeye cream cheese spreads, both made from Bristol Bay fish.

IMPORTANCE OF MARKETING GRANTS

The salmon marketing grants have, in our opinion, served a crucial function in opening up new markets to Wild Alaska Salmon. Ocean Beauty used these funds to develop and place a larger number of new value-added products with major customers in the US and Europe. Highlights include:

1) *Penetrating New Markets:*

In conjunction with Rieber Foods, we placed canned pink salmon in eight eastern European countries under the King Oscar brand. (Poland, Hungary, the Czech Republic, Slovakia, Romania, Latvia, Lithuania, and Estonia.) King Oscar is the #1 brand in tinned fish in these markets. These countries have the highest per capita consumption of canned seafood in the world, but up to now Alaska salmon has not been widely available. A 1% share of canned seafood in these markets would account for 64 truckloads annually.

2) *New Product Placement:*

Much of the funding we received through the Fisheries Revitalization Program and the Alaska Fisheries Marketing Board were used to gain placements of products with major retail and foodservice customers. A partial list of these customers includes:

Kroger	Long John Silver's	Hannaford
Wal*Mart	Harris Teeter	H.E. Butt
Trader Joe's	Giant	Big Y
SuperTarget	Henry's	Fresh Market
Albertson's	Stop & Shop	BI-LO
Publix	Jewel	Demoulas

OVERVIEW OF ASMI

For the last three years Ocean Beauty President Mark Palmer has had the pleasure to serve as Chairman of the Alaska Seafood Marketing Institute. Under Ray Ruitta's leadership we have made great strides to integrate ASMI, harvesters, and processors under a very focused marketing plan.



ASMI's changes in modes of communication and committee structure are proving has led to increased participation across all industry segments. These communications are now far enough in advance of marketing cycles to maximize effective planning. For example, ASMI publishes its consumer marketing activities in a comprehensive calendar on its website, available to anyone in the industry, so that industry sales representatives are aware of what ASMI is doing and can align their promotions with ASMI's support. Recurring annual events have put us on the calendar of both retail and foodservice operators during those times of the year when industry benefits the most from increased inventory movement.

We have created new marketing committees for domestic retail and foodservice, empowered them with budget creation and oversight, and have active participation and input from those chairs with the board of directors in real decision making. This change has put ASMI's committee structure in step with ASMI's staff and has vastly improved planning and budgeting.

Members of the Alaska Seafood Industry have been working through the Alaska Seafood Marketing Institute to leverage its marketing dollars and promote Alaska Seafood on the world stage. We have been very successful over the past several years raising the visibility of our Alaska Seafood brand and the value of our products. This has resulted in more dollars in the hands of our fisherman and the state of Alaska. In fact, the value of the Alaska Salmon harvest paid to fisherman alone has risen from a low of \$155M in 2002 to over \$300M this past year.

ASMI was originally established as a public-private partnership, with the State of Alaska contributing general funds to match funds put up by the Alaska seafood industry. Over the years the state withdrew funding from that partnership, but last year, for the first time in over a decade, the Legislature once again provided some general funds to support our efforts. As an industry we are pleased to see that partnership renewed, and hope that it will continue and flourish in the years ahead. Last year, the Alaska Seafood industry provided ASMI with over six and a half million dollars to promote the Alaska Seafood brand. By itself, this is a pretty modest sum for marketing a global brand but our impact can be many times greater when we work hand in hand in partnership with the state.

While prices are improving modestly, the fundamental stresses on the Alaskan salmon industry have not disappeared: We still face competition by farmed fish products; we still need to spend heavily in marketing; and high fuel costs put a drag on fishing and processing efforts. ASMI's leadership in building the Alaska Seafood brand is crucial to our future.

HARVESTER – PROCESSOR JOINT QUALITY IMPROVEMENT PROJECT

For the 2007 salmon season Ocean Beauty has developed a program aimed at increasing the availability of high quality Sockeye, Chum and King salmon harvested in Bristol Bay. This pilot program will start with two tenders to service a limited number of participating harvesters in an iced, bled, and improved handling program. Harvesters, tenders and processor will all be held to stringent guidelines that will yield a top quality fish that will compete in any market in the world.

The Bristol Bay Economic Development Corporation will be participating as Ocean Beauty's partner in developing and implementing this quality handling program. Identifying the right partner in this endeavor was its most critical component. With the BBEDC we have found a partner with shared goals and a common vision of where we would like to be in the years ahead. The aims of this project are:

- To increase the value of Bristol Bay fishery to the region.
- To increase participation of community/villages in processing.
 - The initiation of top quality value added operations.
- To increase the availability of top quality raw material.
- To create shore based employment opportunities for Bristol Bay residents.

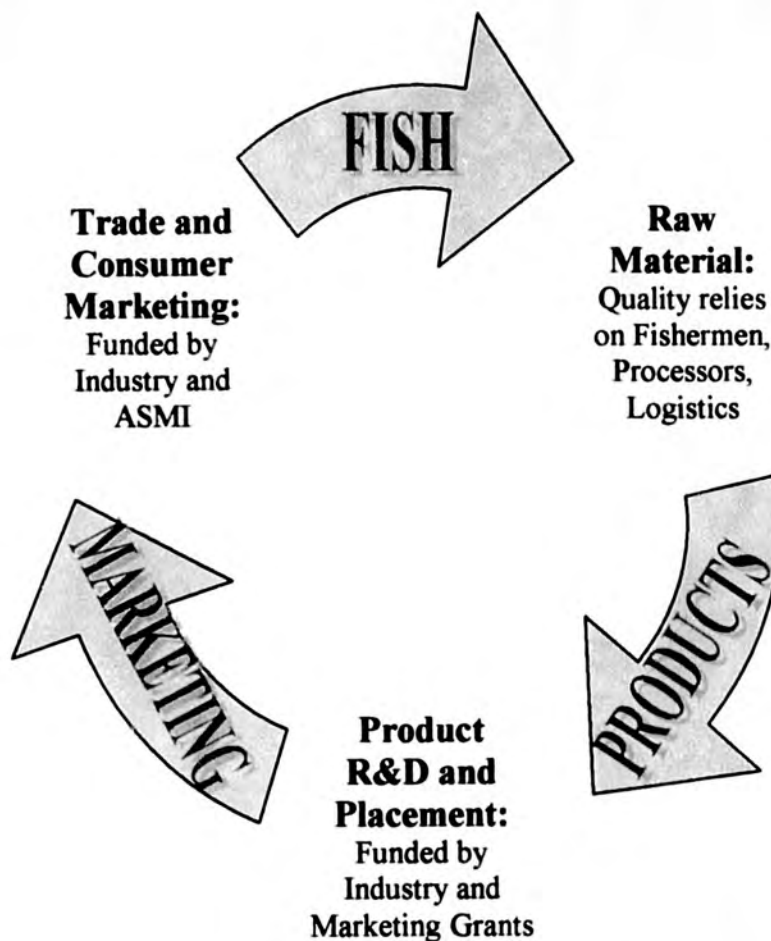
We believe that the combination of Ocean Beauty with BBEDC will expand the market for premium Bristol Bay salmon products. Aligning Ocean Beauty's brands, value added



capabilities, and direct distribution with BBEDC's support of local fishermen through slush bags, ice barges, etc., will make a substantial contribution to the overall well-being of the Bristol Bay salmon fishery and the local communities that rely on it.

THE WAY FORWARD

Every bit of progress we make is dependent on the quality of the raw material we begin with. We have developed a broad range of value-added Wild Alaskan Seafood products, and have leveraged the support of state and federal marketing grants to place these products in front of consumers. But in order to fully realize the potential of these funds, we need to improve the quality of the raw material that we receive from the fishermen, improve our processing methods, and improve the logistics of getting those products to market. Only by focusing our efforts on improving the fishing, processing, and logistics infrastructure behind the raw material will we make the most of the excellent efforts we have made in the past few years in product development and marketing.



EMERGING ISSUES FOR MARKETING ALASKAN SEAFOOD

Market-driven environmental initiatives

As you are no doubt aware, about a year ago Wal*Mart has launched a comprehensive environmental program that is having a profound impact across virtually all industries, and is now being widely imitated. Wal*Mart have created fourteen "networks" to effect these changes, one of which is dedicated to packaging, and this scorecard is how packaging efficiency will be measured. We are going to walk through what it means to mar.age through this scorecard and what these changes mean to our industry.

We work in one of the world's most pristine environments, producing the world's cleanest and healthiest food. But our production methods are in danger of becoming out of sync with how our major customers define good business practices. Led by Wal*Mart, American retailers are aligning behind initiatives intended to reduce greenhouse gas emissions, increase recycling, reduce fuel consumption, and generally reduce their impact on the environment. Safeway has joined the California Climate Action Registry and the Chicago Climate Exchange, and have publicly stated their commitment to reduce their carbon output by 25% by 2025, and the company is now one of the largest purchasers of wind energy in the US.

They are doing this because they see this as good business. They haven't been taken over by environmentalists or out of a sense of responsibility to the earth – after all, Wal*Mart's mantra is still "Always Low Prices – Always" – but because they see this as good business that will give them a competitive advantage over the competition. Wal*Mart CEO Lee Scott stated that this program is all about efficiency, and that Wal*Mart is all about efficiency, so this should give them an advantage in the marketplace. Wal*Mart is doing this because they see it as consistent with their mission of providing products at the lowest possible price.

It's only a matter of time until other customers come on line. European customers already typically have far more stringent environmental expectations than US customers.

On February 1, 2007 Wal*Mart's packaging scorecard came into effect and as of that date every supplier will be graded according to the following criteria:

CRITERIA	INDUSTRY STATUS
▪ 15% - based on GHC/CO2 per ton of production	need help
▪ 15% - based on material value	our responsibility
▪ 15% - based on product/package ratio	our responsibility
▪ 15% - based on cube utilization	our responsibility
▪ 10% - based on transportation	need help
▪ 10% - based on recycled content	our responsibility
▪ 10% - based on recovery value	our responsibility
▪ 5% - based on renewable energy	need help

- 5% - based on innovation

our responsibility

All suppliers scores will be published within Wal*Mart and buyers will have incentives to improve their group's overall score. As you can see, a full 30% of the grading criteria are comprised of areas in which we need support and could be at a disadvantage compared with non-Alaskan suppliers.

Alaskan industry faces some special challenges in order to meet these standards. The remote nature of our business, difficulty of power generation, our heavy fuel use (a can of pink salmon has a tremendously high proportion of its price wrapped up the cost of fuel) – these all add up to trouble for us unless we address these issues.

From Wal*Mart's or Safeway's or any other customer's perspective, we aren't in the Alaska seafood business, or even the seafood business at all: we are in the larger Food business. We will be compared against other manufacturers who have more streamlined and predictable business conditions. Club stores (including Wal*Mart's club channel Sam's Club) already carry Chilean canned salmon. If we can't show good progress against these packaging and environmental goals, we will be at a severe disadvantage against those manufacturers whose processes are greener than ours.

What the industry will need assistance with:

- Capital improvements aimed at improving raw material quality
- Community fish meal and fish oil plants
- Fuel efficiency programs
- Remote power generation improvements
- Renewable energy and biofuels
- State ferry system support
- Consumer communication (through ASMI)

The areas that are within industry's capacity to deal with effectively:

- Trade marketing of our own products (in-store promotions)
- Product Research and Development
- Packaging design and implementation
- Lower 48 and international logistics

We have reached the point where we have no choice but to change some of our business practices in fundamental ways in order to meet our customers' expectations. We accept the responsibility for those things that are within our control, and you should hold us accountable for success in these areas. But those areas that aren't fully within our control leave us vulnerable. If we can react to these market-driven initiatives we will be able to raise the value of Alaskan seafood. But we need to keep in mind that Alaska seafood is substitutable with other products, and if we do not meet our customers' expectations, we will inevitably see the value of Alaska seafood decline.

SCOMM

147:9



Fish Advisories Home

Basic Information

Where You Live

Newsletter

National Listing of
Advisories

Consumption Advice

National Guidance

Reports & Chemical
Fact Sheets

Publications

Federal, State & Tribal
Contacts

State Data Entry
(Password Required)

Related Links

About PDF Files

U.S. Environmental Protection Agency

Fish Advisories

[Recent Additions](#) | [Contact Us](#) | [Print Version](#) Search:

GO

[EPA Home](#) > [Water](#) > [Water Science](#) > [Fish Advisories](#) > [National Guidance](#) > [Guidance for Assessing Chemical Contaminant Data for Use In Fish Advisories](#) > [Volume 2: Risk Assessment and Fish Consumption Limits - Third Edition](#)

National Guidance

Guidance for Assessing Chemical Contaminant Data for Use In Fish Advisories

Volume 2: Risk Assessment and Fish Consumption Limits - Third Edition

SECTION

Download the desired chapter of the **Risk Assessment and Fish Consumption Limits** in the Adobe Acrobat PDF format.

• Read...

- [Figures](#)
- [Tables](#)
- [Acknowledgements](#) (PDF, 8K)
- [Acronyms](#) (PDF, 15K)

○ Download...

- [Cover Page](#) (PDF, 92K)
- [Table of Contents](#) (PDF, 42K)
- [Executive Summary](#) (PDF, 19K)

1. [Introduction](#) (PDF, 56K)
2. [Risk Assessment Methods](#) (PDF, 345K)
 - 2.1 Introduction
 - 2.2 Hazard Identification
 - 2.3 Dose-Response Assessment
 - 2.4 Exposure Assessment
 - 2.5 Risk Characterization
 - 2.6 Summarizing Risk Data
3. [Development and Use of Risk-Based Consumption Limits](#) (PDF, 122K)
 - 3.1 Overview and Section Organization
 - 3.2 Equations Used to Develop Risk-Based Consumption Limits
 - 3.3 Default and Alternative Values for Calculating Consumption Limits

- 3.4 Modification of Consumption Limits for a Single Contaminant in a Multispecies Diet
- 3.5 Modification of Consumption Limits for Multiple Contaminant Exposures
- 4. Risk-Based Consumption Limit Tables (PDF, 71K)
 - 4.1 Overview & Section Organization
 - 4.2 Consumption Limit Tables
- 5. Toxicological Profile Summaries for Target Analytes (PDF, 357K)
 - 5.1 Introduction
 - 5.2 Metals
 - 5.3 Organochlorine Pesticides
 - 5.4 Organophosphate Pesticides
 - 5.5 Chlorophenoxy Herbicides
 - 5.6 Polycyclic Aromatic Hydrocarbons (PAHs)
 - 5.7 Polychlorinated Biphenyls (PCBs)
 - 5.8 Dioxins
- 6. Mapping Tools for Risk Assessment and Risk Management (PDF, 323K)
- 7. Literature Cited (48 KB)

Appendix

- A Reviewers of First Edition of Guidance Document (PDF, 12K)
- B Population Exposure Assessment & Consumption Patterns and Surveys (PDF, 132K)
- C Dose Modification Due to Food Preparation and Cooking (PDF, 90K)
- D Guidance for Risk Characterization (PDF, 122K)
- E Additional Developmental toxicity Issues (PDF, 28K)
- F Summary of Limits of Detection for the Recommended Target Analytes (PDF, 15K)

List of Figures

- 1-1 Series Summary: Guidance for Assessing Chemical Contamination Data for Use in Fish Advisories
- 2-1 Elements of Risk assessment and risk management
- 2-2 Schematic of exposure categories in upper half of a normal population distribution
- 6-1 GIS Data Layers may use raster or vector Representation techniques
- 6-2 Examples of GIS Displays from EPA's BASINInfo Maps-on-Demand Facility
- 6-3 Map showing active fish and wildlife advisories for a state

List of Tables

- 1-1 Target Analytes Recommended for Fish Sampling Programs
- 1-2 Comparison of FDA Action Levels and Tolerances with EPA Screening Values
- 1-3 Fish Consumption Rates for Various Fisher Populations
- 2-1 Uncertainty Factors and Modifying Factors for Estimating Exposure Limits for Chronic Effects
- 2-2 Mean Body Weights of Children and Adults
- 2-3 Categories of Information Necessary for a Population Exposure Assessment
- 2-4 Exposure Data Template
- 2-5 Risk Estimates
- 2-6 Risk Characterization
- 2-7 Risk Summaries for a Waterbody
- 2-8 Risk Summaries for a Geographic Area
- 3-1 Risk Values Used in Risk-Based Consumption Limit Tables
- 3-2 Input Parameters for Use in Risk Equations
- 3-3 Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints & Chlordane
- 3-4 Monthly Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints- Chlordane
- 3-5 Average Body Weights and Associated Multipliers
- 4-1 Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - Arsenic
- 4-2 Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Cadmium
- 4-3 Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Methylmercury
- 4-4 Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Selenium
- 4-5 Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Tributyltin
- 4-6 Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - Chlordane
- 4-7 Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - DDT
- 4-8 Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Dicofof
- 4-9 Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints -Dieldrin

- 4-10 Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Endosulfan
- 4-11 Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Endrin
- 4-12 Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - Heptachlor Epoxide
- 4-13 Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - Hexachlorobenzene
- 4-14 Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - Lindane
- 4-15 Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - Mirex
- 4-16 Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - Toxaphene
- 4-17 Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Chlorpyrifos
- 4-18 Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Diazinon
- 4-19 Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Disulfoton
- 4-20 Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Ethion
- 4-21 Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Terbufos
- 4-22 Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Oxyfluorfen
- 4-23 Monthly Fish Consumption Limits for Carcinogenic Health Endpoint - PAHs
- 4-24 Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - PCBs
- 4-25 Monthly Fish Consumption Limits for Carcinogenic Health Endpoint - Dioxins/Furans
- 5-1 Health and Toxicological Data Reviewed for Target Analytes
- 5-2 Toxicity Equivalent Factors for Various PAHs
- 5-3 Relative Potency Estimates for Various PAHs
- 5-4 Reported Concentrations (ppm) of Dioxin-Like Congeners in Commercial Aroclor Mixtures
- 5-5 PCB and Dioxin Concentrations (ppb) in Channel Catfish
- 6-1 Comparison of Raster- Versus Vector-Based GIS Programs

For more information on EPA's Fish Advisory Program, contact: Jeffrey Bigler at US

EPA, 1200 Pennsylvania Ave., NW (4305T), Washington, DC 20460; e-mail:
bigler.jeff@epa.gov

[EPA Home](#) | [Privacy and Security Notice](#) | [Contact Us](#)

Last updated on Monday, February 27th, 2006
URL: <http://www.epa.gov/waterscience/fishadvice/volume2/>

SECTION 4

RISK-BASED CONSUMPTION LIMIT TABLES

4.1 OVERVIEW AND SECTION ORGANIZATION

This section provides consumption limit tables for carcinogenic and chronic health endpoints for the general adult population for all of the target analytes listed in Table 1-1.

Variables used to calculate the consumption limits include fish meal size, consumer body weight, contaminant concentration in the fish tissue, the time-averaging period selected (monthly), the reference dose for noncarcinogenic health endpoints, and the cancer potency factor and the maximum acceptable risk level for carcinogenic health endpoints. Default values for the variables are presented in Section 3 and described in greater detail in Section 2.

Each consumption table lists, by chemical, the maximum number of fish meals per unit time (monthly) that may be safely eaten. Readers may use these tables by: determining the chemical contaminant concentration in fish surveyed in local fish sampling and analysis programs and reading the value for the maximum number of meals per month that may be safely eaten for each contaminant for noncancer and cancer endpoints. For those contaminants with monthly fish consumption limits calculated for both the noncancer and cancer endpoints, EPA recommends using the more conservative of the two values. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.

Some of the contaminant concentrations shown in the consumption limit tables are below current laboratory detection limits. Because of improvements in chemical analysis procedures and associated technologies, however, chemical detection limits regularly decrease. The fish tissue concentrations that are currently below the limit of detection are provided so that risk managers may use them once lower detection limits are achievable through improvements in analytical procedures. **Note:** The reader should be aware that detection limits presented here are derived from state-of-the-art state, regional, and national fish monitoring programs and may not be representative of detection limits achievable in all laboratories. Readers should consult with the analytical chemists in their state responsible for analyzing fish tissue samples to ensure that their detection limits are comparable to those presented. If the detection limits presented are lower than those achieved in the state's program, the reader should make

necessary adjustments to the tables. The detection limits presented here are to provide general guidance on detection limits typically achievable using current analytical procedures. The reader should review Section 6 of Volume 1 for further information on chemical analysis procedures and associated detection and quantitation limits for the target analytes.

4.2 CONSUMPTION LIMIT TABLES

Tables 4-1 through 4-25 are consumption limit tables for carcinogenic and chronic systemic health endpoints for each of the target analytes. Readers using the tables as a basis for fish consumption advisories should note that the values given in the tables are valid **only** for single contaminants in single-species diets. Sections 3.4 and 3.5 describe methods for calculating consumption limits for multiple contaminant situations and for multiple fish species diets.

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-1. Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - Arsenic (inorganic)

Risk Based Consumption Limit ^a	Noncancer Health Endpoints ^b	Cancer Health Endpoints ^c
Fish Meals/Month	Fish Tissue Concentrations, (ppm, wet weight)	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.088	0 - 0.002
16	>0.088 - 0.18	>0.002 - 0.0039
12	>0.18 - 0.23	>0.0039 - 0.0052
8	>0.23 - 0.35	>0.0052 - 0.0078
4	>0.35 - 0.7	>0.0078 - 0.016
3	>0.7 - 0.94	>0.016 - 0.021
2	>0.94 - 1.4	>0.021 - 0.031
1	>1.4 - 2.8	>0.031 - 0.063
0.5	>2.8 - 5.6	>0.063 - 0.13
None (<0.5)	>5.6	>0.13

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

^c Cancer values represent tissue concentrations at a 1 in 100,000 risk level.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg, an RfD of 3×10^{-4} mg/kg-d, and a cancer slope factor (CSF) of $1.5 \text{ (mg/kg-d)}^{-1}$.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for arsenic is 5×10^{-3} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-2. Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Cadmium

Risk Based Consumption Limit ^a	Noncancer Health Endpoints ^b
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.088
16	>0.088 - 0.18
12	>0.18 - 0.23
8	>0.23 - 0.35
4	>0.35 - 0.7
3	>0.7 - 0.94
2	>0.94 - 1.4
1	>1.4 - 2.8
0.5	>2.8 - 5.6
None (<0.5)	>5.6

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg and an RfD of 1×10^{-3} mg/kg-d.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for cadmium is 5×10^{-3} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-3. Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Methylmercury

Risk Based Consumption Limit^a	Noncancer Health Endpoints^b
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.029
16	>0.029 - 0.059
12	>0.059 - 0.078
8	>0.078 - 0.12
4	>0.12 - 0.23
3	>0.23 - 0.31
2	>0.31 - 0.47
1	>0.47 - 0.94
0.5	>0.94 - 1.9
None (<0.5)	>1.9

* The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg and an interim RfD of 1×10^{-4} mg/kg-d.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for methylmercury is 1×10^{-3} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-4. Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Selenium

Risk Based Consumption Limit ^a	Noncancer Health Endpoints ^b
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 1.5
16	>1.5 - 2.9
12	>2.9 - 3.9
8	>3.9 - 5.9
4	>5.9 - 12
3	>12 - 16
2	>16 - 23
1	>23 - 47
0.5	>47 - 94
None (<0.5)	>94

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg and an RfD of 5×10^{-3} mg/kg-d.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for selenium is 17×10^{-3} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-5. Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Tributyltin

Risk Based Consumption Limit^a	Noncancer Health Endpoints^b
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.088
16	>0.088 - 0.18
12	>0.18 - 0.23
8	>0.23 - 0.35
4	>0.35 - 0.7
3	>0.7 - 0.94
2	>0.94 - 1.4
1	>1.4 - 2.8
0.5	>2.8 - 5.6
None (<0.5)	>5.6

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg and an RfD of 3×10^{-4} mg/kg-d.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for tributyltin is 2×10^{-3} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-6. Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - Chlordane

Risk Based Consumption Limit^a	Noncancer Health Endpoints^b	Cancer Health Endpoints^c
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.15	0 - 0.0084
16	>0.15 - 0.29	>0.0084 - 0.017
12	>0.29 - 0.39	>0.017 - 0.022
8	>0.39 - 0.59	>0.022 - 0.034
4	>0.59 - 1.2	>0.034 - 0.067
3	>1.2 - 1.6	>0.067 - 0.089
2	>1.6 - 2.3	>0.089 - 0.13
1	>2.3 - 4.7	>0.13 - 0.27
0.5	>4.7 - 9.4	>0.27 - 0.54
None (<0.5)	>9.4	>0.54

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

^c Cancer values represent tissue concentrations at a 1 in 100,000 risk level.

Notes:

- Consumption limits are based on an adult body weight of 70 kg, an RfD of 5×10^{-4} mg/kg-d, and a cancer slope factor (CSF) of $0.35 \text{ (mg/kg-d)}^{-1}$.
- None = No consumption recommended.
- In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
- The detection limit for chlordane is 1×10^{-3} mg/kg.
- Instructions for modifying the variables in this table are found in Section 3.3.
- Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-7. Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - DDT

Risk Based Consumption Limit^a	Noncancer Health Endpoints^b	Cancer Health Endpoints^c
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.015	0 - 0.0086
16	>0.015 - 0.029	>0.0086 - 0.017
12	>0.029 - 0.039	>0.017 - 0.023
8	>0.039 - 0.059	>0.023 - 0.035
4	>0.059 - 0.12	>0.035 - 0.069
3	>0.12 - 0.16	>0.069 - 0.092
2	>0.16 - 0.23	>0.092 - 0.14
1	>0.23 - 0.47	>0.14 - 0.28
0.5	>0.47 - 0.94	>0.28 - 0.55
None (<0.5)	>0.94	>0.55

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

^c Cancer values represent tissue concentrations at a 1 in 100,000 risk level.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg, an RfD of 5×10^{-4} mg/kg-d, and a cancer slope factor (CSF) of $0.34 \text{ (mg/kg-d)}^{-1}$.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for DDT is 1×10^{-4} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-8. Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Dicofof

Risk Based Consumption Limit^a	Noncancer Health Endpoints^b
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.088
16	>0.088 - 0.18
12	>0.18 - 0.23
8	>0.23 - 0.35
4	>0.35 - 0.7
3	>0.7 - 0.94
2	>0.94 - 1.4
1	>1.4 - 2.8
0.5	>2.8 - 5.6
None (<0.5)	>5.6

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg and an RfD of 4×10^{-4} mg/kg-d.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for dicofof is 1×10^{-3} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-9. Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - Dieldrin

Risk Based Consumption Limit^a	Noncancer Health Endpoints^b	Cancer Health Endpoints^c
Fish Meals/Month	Fish Tissue Concentration (ppm, wet weight)	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.015	0 - 0.00018
16	>0.015 - 0.029	>0.00018 - 0.00037
12	>0.029 - 0.039	>0.00037 - 0.00049
8	>0.039 - 0.059	>0.00049 - 0.00073
4	>0.059 - 0.12	>0.00073 - 0.0015
3	>0.12 - 0.16	>0.0015 - 0.002
2	>0.16 - 0.23	>0.002 - 0.0029
1	>0.23 - 0.47	>0.0029 - 0.0059
0.5	>0.47 - 0.94	>0.0059 - 0.012
None (<0.5)	>0.94	>0.012

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

^c Cancer values represent tissue concentrations at a 1 in 100,000 risk level.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg, an RfD of 5×10^{-5} mg/kg-d, and a cancer slope factor (CSF) of 16 (mg/kg-d)⁻¹.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for dieldrin is 1×10^{-4} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-10. Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Endosulfan

Risk Based Consumption Limit ^a	Noncancer Health Endpoints ^b
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 1.8
16	>1.8 - 3.5
12	>3.5 - 4.7
8	>4.7 - 7
4	>7 - 14
3	>14 - 19
2	>19 - 28
1	>28 - 56
0.5	>56 - 110
None (<0.5)	>110

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg and an RfD of 6×10^{-3} mg/kg-d.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for endosulfan is 5×10^{-3} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-11. Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Endrin

Risk Based Consumption Limit^a	Noncancer Health Endpoints^b
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.088
16	>0.088 - 0.18
12	>0.18 - 0.23
8	>0.23 - 0.35
4	>0.35 - 0.7
3	>0.7 - 0.94
2	>0.94 - 1.4
1	>1.4 - 2.8
0.5	>2.8 - 5.6
None (<0.5)	>5.6

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

^c Cancer values represent tissue concentrations at a 1 in 100,000 risk level.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg and an RfD of 3×10^{-4} mg/kg-d.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for endrin is 1×10^{-4} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-12. Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - Heptachlor Epoxide

Risk Based Consumption Limit^a	Noncancer Health Endpoints^b	Cancer Health Endpoints^c
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.0038	0 - 0.00032
16	>0.0038 - 0.0076	>0.00032 - 0.00064
12	>0.0076 - 0.01	>0.00064 - 0.00086
8	>0.01 - 0.015	>0.00086 - 0.0013
4	>0.015 - 0.031	>0.0013 - 0.0026
3	>0.031 - 0.041	>0.0026 - 0.0034
2	>0.041 - 0.061	>0.0034 - 0.0052
1	>0.061 - 0.12	>0.0052 - 0.01
0.5	>0.12 - 0.24	>0.01 - 0.021
None (<0.5)	>0.24	>0.021

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

^c Cancer values represent tissue concentrations at a 1 in 100,000 risk level.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg, an RfD of 1.3×10^{-5} mg/kg-d, and a cancer slope factor (CSF) of $9.1 \text{ (mg/kg-d)}^{-1}$.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for heptachlor epoxide is 1×10^{-4} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-13. Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - Hexachlorobenzene

Risk Based Consumption Limit^a	Noncancer Health Endpoints^b	Cancer Health Endpoints^c
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.23	0 - 0.0018
16	>0.23 - 0.47	>0.0018 - 0.0037
12	>0.47 - 0.63	>0.0037 - 0.0049
8	>0.63 - 0.94	>0.0049 - 0.0073
4	>0.94 - 1.9	>0.0073 - 0.015
3	>1.9 - 2.5	>0.015 - 0.02
2	>2.5 - 3.8	>0.02 - 0.029
1	>3.8 - 7.5	>0.029 - 0.059
0.5	>7.5 - 15	>0.059 - 0.12
None (<0.5)	>15	>0.12

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

^c Cancer values represent tissue concentrations at a 1 in 100,000 risk level.

Note:

1. Consumption limits are based on an adult body weight of 70 kg, an RfD of 8×10^{-4} mg/kg-d, and a cancer slope factor (CSF) of $1.6 \text{ (mg/kg-d)}^{-1}$.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for hexachlorobenzene is 1×10^{-4} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-14. Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - Lindane

Risk Based Consumption Limit^a	Noncancer Health Endpoints^b	Cancer Health Endpoints^c
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.088	0 - 0.0023
16	>0.088 - 0.18	>0.0023 - 0.0045
12	>0.18 - 0.23	>0.0045 - 0.006
8	>0.23 - 0.35	>0.006 - 0.009
4	>0.35 - 0.7	>0.009 - 0.018
3	>0.7 - 0.94	>0.018 - 0.024
2	>0.94 - 1.4	>0.024 - 0.036
1	>1.4 - 2.8	>0.036 - 0.072
0.5	>2.8 - 5.6	>0.072 - 0.14
None (<0.5)	>5.6	>0.14

^a The assumed meal size is 8 oz (0.227 kg). A range of chemical concentrations are presented that are conservative, e.g. the 12 meal per month levels represent the concentrations associated with 12 meals up to 15.9 meals.

^b Chronic, systemic effects.

^c Cancer values represent tissue concentrations at a 1 in 100,000 risk level.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg, an RfD of 3×10^{-4} mg/kg-d, and a cancer slope factor (CSF) of 1.3 (mg/kg-d)⁻¹.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for lindane is 1×10^{-4} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-15. Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Mirex

Risk Based Consumption Limit^a	Noncancer Health Endpoints^b
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.059
16	>0.059 - 0.12
12	>0.12 - 0.16
8	>0.16 - 0.23
4	>0.23 - 0.47
3	>0.47 - 0.63
2	>0.63 - 0.94
1	>0.94 - 1.9
0.5	>1.9 - 3.8
None (<0.5)	>3.8

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

^c Cancer values represent tissue concentrations at a 1 in 100,000 risk level.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg and RfD of 2×10^{-4} mg/kg-d
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for mirex is 1×10^{-4} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-16. Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - Toxaphene

Risk Based Consumption Limit^a	Noncancer Health Endpoints^b	Cancer Health Endpoints^c
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.073	0 - 0.0027
16	>0.073 - 0.15	>0.0027 - 0.0053
12	>0.15 - 0.2	>0.0053 - 0.0071
8	>0.2 - 0.29	>0.0071 - 0.011
4	>0.29 - 0.59	>0.011 - 0.021
3	>0.59 - 0.78	>0.021 - 0.028
2	>0.78 - 1.2	>0.028 - 0.043
1	>1.2 - 2.3	>0.043 - 0.085
0.5	>2.3 - 4.7	>0.085 - 0.17
None (<0.5)	>4.7	>0.17

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

^c Cancer values represent tissue concentrations at a 1 in 100,000 risk level.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg, an RfD of 2.5×10^{-4} mg/kg-d, and a cancer slope factor (CSF) of 1.1 (mg/kg-d)⁻¹.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for toxaphene is 3×10^{-3} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-17. Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Chlorpyrifos

Risk Based Consumption Limit ^a	Noncancer Health Endpoints ^b
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.088
16	>0.088 - 0.18
12	>0.18 - 0.23
8	>0.23 - 0.35
4	>0.35 - 0.7
3	>0.7 - 0.94
2	>0.94 - 1.4
1	>1.4 - 2.8
0.5	>2.8 - 5.6
None (<0.5)	>5.6

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg and an RfD of 3×10^{-4} mg/kg-d.*
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for chlorpyrifos is 2×10^{-3} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

* Because of the potential for adverse neurological development effects, EPA recommends the use of a Population Adjusted Dose (PAD) of 3×10^{-5} mg/kg-d for infants, children to age six, and women aged 13-50.

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-18. Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Diazinon

Risk Based Consumption Limit^a	Noncancer Health Endpoints^b
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.21
16	>0.21 - 0.41
12	>0.41 - 0.55
8	>0.55 - 0.82
4	>0.82 - 1.6
3	>1.6 - 2.2
2	>2.2 - 3.3
1	>3.3 - 6.6
0.5	>6.6 - 13
None (<0.5)	>13

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects

^c Cancer values represent tissue concentrations at a 1 in 100,000 risk level.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg and an RfD of 7×10^{-4} mg/kg-d.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for diazinon is 2×10^{-3} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-19. Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Disulfoton

Risk Based Consumption Limit ^a	Noncancer Health Endpoints ^b
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.012
16	>0.012 - 0.023
12	>0.023 - 0.031
8	>0.031 - 0.047
4	>0.047 - 0.094
3	>0.094 - 0.13
2	>0.13 - 0.19
1	>0.19 - 0.38
0.5	>0.38 - 0.75
None (<0.5)	>0.75

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg and an RfD of 4×10^{-5} mg/kg-d.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for disulfoton is 2×10^{-3} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-20. Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Ethion

Risk Based Consumption Limit ^a	Noncancer Health Endpoints ^b
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.15
16	>0.15 - 0.29
12	>0.29 - 0.39
8	>0.39 - 0.59
4	>0.59 - 1.2
3	>1.2 - 1.6
2	>1.6 - 2.3
1	>2.3 - 4.7
0.5	>4.7 - 9.4
None (<0.5)	>9.4

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg and an RfD of 5×10^{-4} mg/kg-d.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for ethion is 2×10^{-3} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-21. Monthly Fish Consumption Limits for Noncarcinogenic Health Endpoint - Terbufos

Risk Based Consumption Limit^a	Noncancer Health Endpoints^b
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.0059
16	>0.0059 - 0.012
12	>0.012 - 0.016
8	>0.016 - 0.023
4	>0.023 - 0.047
3	>0.047 - 0.063
2	>0.063 - 0.094
1	>0.094 - 0.19
0.5	>0.19 - 0.38
None (<0.5)	>0.38

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg and an RfD of 2×10^{-5} mg/kg-d.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for terbufos is 2×10^{-3} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-22. Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - Oxyfluorfen

Risk Based Consumption Limit^a	Noncancer Health Endpoints^b	Cancer Health Endpoints^c
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.88	0 - 0.04
16	>0.88 - 1.8	>0.04 - 0.08
12	>1.8 - 2.3	>0.08 - 0.11
8	>2.3 - 3.5	>0.11 - 0.16
4	>3.5 - 7	>0.16 - 0.32
3	>7 - 9.4	>0.32 - 0.43
2	>9.4 - 14	>0.43 - 0.64
1	>14 - 28	>0.64 - 1.3
0.5	>28 - 56	>1.3 - 2.6
None (<0.5)	>56	>2.6

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects.

^c Cancer values represent tissue concentrations at a 1 in 100,000 risk level.

Noted:

1. Consumption limits are based on an adult body weight of 70 kg, an RfD of 3×10^{-3} mg/kg-d, and a cancer slope factor (CSF) of 0.0732 (mg/kg-d)⁻¹.
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for oxyfluorfen is 1×10^{-2} mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-23. Monthly Fish Consumption Limits for Carcinogenic Health Endpoint - PAHs

Risk Based Consumption Limit^a	Noncancer Health Endpoints^b	Cancer Health Endpoints^c
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	NA	0 - 0.0004
16	NA	>0.0004 - 0.0008
12	NA	>0.0008 - 0.0011
8	NA	>0.0011 - 0.0016
4	NA	>0.0016 - 0.0032
3	NA	>0.0032 - 0.0043
2	NA	>0.0043 - 0.0064
1	NA	>0.0064 - 0.013
0.5	NA	>0.013 - 0.026
None (<0.5)	NA	>0.026

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects. An RfD is not available (NA) for this compound.

^c Cancer values represent tissue concentrations at a 1 in 100,000 risk level.

Notes:

1. Consumption limits are based on an adult body weight of 70 kg and a cancer slope factor (CSF) of 7.3 (mg/kg-d)⁻¹. No RfD was available (June 1999).
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for PAHs is 1 x 10⁻⁶ mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-24. Monthly Fish Consumption Limits for Carcinogenic and Noncarcinogenic Health Endpoints - PCBs

Risk Based Consumption Limit ^a	Noncancer Health Endpoints ^b	Cancer Health Endpoints ^c
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)	Fish Tissue Concentrations (ppm, wet weight)
Unrestricted (>16)	0 - 0.0059	0 - 0.0015
16	>0.0059 - 0.012	>0.0015 - 0.0029
12	>0.012 - 0.016	>0.0029 - 0.0039
8	>0.016 - 0.023	>0.0039 - 0.0059
4	>0.023 - 0.047	>0.0059 - 0.012
3	>0.047 - 0.063	>0.012 - 0.016
2	>0.063 - 0.094	>0.016 - 0.023
1	>0.094 - 0.19	>0.023 - 0.047
0.5	>0.19 - 0.38	>0.047 - 0.094
None (<0.5)	>0.38	>0.094

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects

^c Cancer values represent tissue concentrations at a 1 in 100,000 risk level.

* Concentration reported in parts per quadrillion (nanogram per kg or 10⁻⁹ g/kg).

Notes:

1. Consumption limits are based on an adult body weight of 70 kg, and RfD of 2x10⁻⁵, and a cancer slope factor (CSF) of 2 (mg/kg-d)⁻¹.
2. NONE = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for PCBs (sum of Aroclors) is 2 x 10⁻² mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).

4. RISK-BASED CONSUMPTION LIMIT TABLES

Table 4-25. Monthly Fish Consumption Limits for Carcinogenic Health Endpoint - Dioxins/Furans

Risk Based Consumption Limit ^a	Noncancer Health Endpoints ^b	Cancer Health Endpoints ^c
Fish Meals/Month	Fish Tissue Concentrations (ppm, wet weight)	Fish Tissue Concentrations (ppt*-TEQ, wet weight)
Unrestricted (>16)	NA	0 - 0.019
16	NA	>0.019 - 0.038
12	NA	>0.038 - 0.05
8	NA	>0.05 - 0.075
4	NA	>0.075 - 0.15
3	NA	>0.15 - 0.2
2	NA	>0.2 - 0.3
1	NA	>0.3 - 0.6
0.5	NA	>0.6 - 1.2
None (<0.5)	NA	>1.2

^a The assumed meal size is 8 oz (0.227 kg). The ranges of chemical concentrations presented are conservative, e.g., the 12-meal-per-month levels represent the concentrations associated with 12 to 15.9 meals.

^b Chronic, systemic effects. An RfD is not available (NA) for this compound.

^c Cancer values represent tissue concentrations at a 1 in 100,000 risk level.

* Concentration reported in parts per trillion (nanogram per kg or 10⁻⁹ g/kg)

Notes:

1. Consumption limits are based on an adult body weight of 70 kg and a cancer slope factor (CSF) of 1.56x10⁵ (mg/kg-d)⁻¹. No RfD available (June 1999).
2. None = No consumption recommended.
3. In cases where >16 meals per month are consumed, refer to Equations 3-1 and 3-2, Section 3.2.1.2, for methods to determine safe consumption limits.
4. The detection limit for dioxins/furans is 1 x 10⁻⁶ mg/kg.
5. Instructions for modifying the variables in this table are found in Section 3.3.
6. Monthly limits are based on the total dose allowable over a 1-month period (based on the RfD). When the monthly limit is consumed in less than 1 month (e.g., in a few large meals), the daily dose may exceed the RfD (see Section 2.3).



**Alaska Departments of Health & Social Services, Fish & Game, and
Environmental Conservation**

February 9, 2007

Alaska Fish Consumption Guidelines Under Development

Recommendations for women of childbearing years and young children may change

Eating Fish is Good For You

- Fish is an excellent source of lean protein, healthy omega-3 fatty acids, antioxidants, and vitamins.
- Fish is an important part of a healthy diet for everyone, including pregnant and nursing women, and young children.
- The health benefits of eating fish far outweigh any potential risk from minor amounts of contaminants in Alaska fish. If you are concerned about the mercury level in fish, your risk can be minimized by choosing fish lower in mercury, such as salmon.

New Research Creates Need to Re-evaluate Guidelines

- Recent data from the Department of Environmental Conservation fish monitoring program reveal a wide variation of mercury content among the 23 Alaska species sampled between 2004 and 2006. More than 2,200 fish have been sampled.
- At this time the Division of Public Health is considering adjusting fish consumption guidelines for women of childbearing years and young children, especially for fish with an average mercury level of greater than 0.4 ppm (parts per million). For comparison, a can of albacore tuna averages 0.407 ppm, a can of light chunk tuna averages 0.118 ppm.
- Fish with average mercury concentration above 0.4 ppm are lingcod, yelloweye rockfish, shark, spiny dogfish, and halibut over 50 lbs (average commercially caught halibut is 26 lbs).
- The primary concern would be for women of childbearing years or young children who would consume many portions from one large fish containing higher mercury levels.
- Health guidelines are expected to be completed by spring of 2007.

Testing Continues

- The Department of Environmental Conservation is continuing its fish monitoring program. The Division of Public Health will continue to evaluate the new data and refine any recommendations.
- Public Health continues its statewide hair mercury bio-monitoring program. The state encourages any Alaska woman of childbearing years to participate free of charge through her local health provider. To date, tests of 359 samples have revealed a median value of 0.53 ppm mercury in the hair of all women tested; far below the World Health Organization's "No Observed Effect" level of 14 ppm mercury in maternal hair.

Contact: Greg Wilkinson (HSS), (907) 269-7285, Cell (907) 382-7032
Tim Barry (F&G), (907) 465-6137, Cell (907) 321-5212
Lynda Giguere (DEC), (907) 465-5009, Cell (907) 321-5491

#

Alaska Department of Environmental Conservation Fish Monitoring Program
Total Heavy Metal Concentrations *(ppm) for Fish Species Collected

Update January 2007 *from 2001 cumulative*

	Number of fish	Mean	Std Dev	Median	Min	Max
DUSKY ROCKFISH						
Arsenic	6	0.347	0.079	0.348	0.225	0.447
Cadmium	6	< DL**		< DL**	< DL**	< DL**
Chromium	6	0.046	0.022	0.045	0.026	0.068
Lead	6	0.027	0.030	< DL**	< DL**	0.088
Nickel	6	0.041	0.025	< DL**	< DL**	0.073
Selenium	6	0.445	0.052	0.456	0.347	0.489
Total Mercury	6	0.097	0.107	0.061	0.026	0.309
PACIFIC OCEAN PERCH						
Arsenic	68	1.220	0.478	1.262	0.184	2.355
Cadmium	68	< DL**	< DL**	< DL**	< DL**	< DL**
Chromium	68	0.152	0.250	< DL**	< DL**	1.378
Lead	68	< DL**	< DL**	< DL**	< DL**	< DL**
Nickel	68	0.039	0.031	< DL**	< DL**	0.196
Selenium	68	0.477	0.173	0.424	0.252	1.028
Total Mercury	78	0.056	0.041	0.054	< DL**	0.262
YELLOWEYE ROCKFISH						
Arsenic	31	0.895	0.611	0.739	0.194	2.938
Cadmium	31	< DL**	< DL**	< DL**	< DL**	< DL**
Chromium	31	0.039	0.019	< DL**	< DL**	0.094
Lead	31	0.030	0.049	< DL**	< DL**	0.247
Nickel	31	0.029	0.014	< DL**	< DL**	0.088
Selenium	31	0.523	0.122	0.498	0.328	0.852
Total Mercury	31	0.513	0.286	0.466	0.144	1.263
SABLEFISH						
Arsenic	110	0.928	0.423	0.834	0.200	2.612
Cadmium	110	0.006	0.001	< DL**	< DL**	0.014
Chromium	110	0.045	0.093	< DL**	< DL**	0.723
Lead	110	< DL**	< DL**	< DL**	< DL**	< DL**
Nickel	110	0.029	0.024	< DL**	< DL**	0.249
Selenium	110	0.236	0.064	0.222	0.137	0.488
Total Mercury	191	0.182	0.192	0.107	< DL**	1.192

* Concentration expressed as ppm (parts per million, mg/kg)

** <DL: Below Detection Limit

Values below the Analytical Detection Limit are treated as 1/2 the Detection Limit for calculation purposes

Alaska Department of Environmental Conservation Fish Monitoring Program
Total Heavy Metal Concentrations *(ppm) for Fish Species Collected
Update January 2007

	Number of fish	Mean	Std Dev	Median	Min	Max
ALL SALMON						
Arsenic	455	0.345	0.206	0.289	0.110	1.647
Cadmium	455	0.007	0.005	< DL**	< DL**	0.082
Chromium	455	0.033	0.036	< DL**	< DL**	0.324
Lead	455	0.018	0.070	< DL**	< DL**	1.484
Nickel	455	0.033	0.040	< DL**	< DL**	0.373
Selenium	455	0.254	0.052	0.247	0.169	0.685
Total Mercury	765	0.040	0.021	0.038	< DL**	0.159
CHINOOK SALMON (KING)						
Arsenic	54	0.706	0.314	0.681	0.288	1.647
Cadmium	54	0.006	0.001	< DL**	< DL**	0.011
Chromium	54	0.026	0.004	< DL**	< DL**	0.052
Lead	54	< DL**	< DL**	< DL**	< DL**	< DL**
Nickel	54	< DL**	< DL**	< DL**	< DL**	< DL**
Selenium	54	0.262	0.052	0.252	0.189	0.385
Total Mercury	115	0.064	0.028	0.058	< DL**	0.159
CHUM SALMON						
Arsenic	122	0.237	0.125	0.207	0.112	1.103
Cadmium	122	0.007	0.009	< DL**	< DL**	0.082
Chromium	122	0.034	0.040	< DL**	< DL**	0.324
Lead	122	0.015	0.050	< DL**	< DL**	0.067
Nickel	122	0.033	0.043	< DL**	< DL**	0.373
Selenium	122	0.259	0.039	0.252	0.175	0.392
Total Mercury	174	0.043	0.015	0.041	< DL**	0.103
PINK SALMON						
Arsenic	66	0.321	0.136	0.288	0.138	0.845
Cadmium	66	< DL**	< DL**	< DL**	< DL**	< DL**
Chromium	66	< DL**	< DL**	< DL**	< DL**	< DL**
Lead	66	< DL**	< DL**	< DL**	< DL**	< DL**
Nickel	66	< DL**	< DL**	< DL**	< DL**	< DL**
Selenium	66	0.242	0.039	0.237	0.173	0.342
Total Mercury	120	0.019	0.010	< DL**	< DL**	0.064
RED SALMON (SOCKEYE)						
Arsenic	119	0.286	0.064	0.285	0.136	0.473
Cadmium	119	0.007	0.003	< DL**	< DL**	0.029
Chromium	119	0.040	0.041	< DL**	< DL**	0.321
Lead	119	0.015	0.003	< DL**	< DL**	0.044
Nickel	119	0.038	0.050	< DL**	< DL**	0.285
Selenium	119	0.260	0.074	0.249	0.169	0.685
Total Mercury	202	0.038	0.015	0.038	< DL**	0.082

* Concentration expressed as ppm (parts per million, mg/kg)

** <DL: Below Detection Limit

Values below the Analytical Detection Limit are treated as 1/2 the Detection Limit for calculation purposes

Alaska Department of Environmental Conservation Fish Monitoring Program
Total Heavy Metal Concentrations *(ppm) for Fish Species Collected
Update January 2007

	Number of fish	Mean	Std Dev	Median	Min	Max
BURBOT						
Arsenic	7	0.277	0.230	0.218	0.059	0.775
Cadmium	7	< DL**		< DL**	< DL**	< DL**
Chromium	7	0.031	0.014	< DL**	< DL**	0.063
Lead	7	< DL**		< DL**	< DL**	< DL**
Nickel	7	0.029	0.010	0.025	< DL**	0.052
Selenium	7	0.360	0.129	0.309	0.230	0.566
Total Mercury	10	0.533	0.254	0.558	< DL**	0.854
PACIFIC COD						
Arsenic	57	5.917	3.067	5.290	1.209	13.137
Cadmium	57	< DL**		< DL**	< DL**	< DL**
Chromium	57	0.078	0.093	< DL**	< DL**	0.457
Lead	57	< DL**		< DL**	< DL**	< DL**
Nickel	57	0.038	0.038	0.025	< DL**	0.277
Selenium	57	0.237	0.053	0.223	0.158	0.422
Total Mercury	110	0.133	0.097	0.108	< DL**	0.496
GRAYLING						
Arsenic	7	0.019	0.006	0.021	0.010	0.026
Cadmium	7	< DL**		< DL**	< DL**	< DL**
Chromium	7	< DL**		< DL**	< DL**	< DL**
Lead	7	< DL**		< DL**	< DL**	< DL**
Nickel	7	< DL**		< DL**	< DL**	< DL**
Selenium	7	0.698	0.520	0.543	0.240	1.453
Total Mercury	7	0.090	0.028	0.088	0.057	0.141
HALIBUT						
Arsenic	391	1.450	0.981	1.205	0.157	6.054
Cadmium	391	0.006	0.000	< DL**	< DL**	0.013
Chromium	391	0.045	0.082	< DL**	< DL**	0.912
Lead	391	< DL**		< DL**	< DL**	< DL**
Nickel	391	0.027	0.019	0.025	0.025	0.279
Selenium	391	0.353	0.121	0.333	0.141	0.969
Total Mercury	643	0.325	0.290	0.222	< DL**	1.947

* Concentration expressed as ppm (parts per million, mg/kg)

** <DL: Below Detection Limit

Values below the Analytical Detection Limit are treated as 1/2 the Detection Limit for calculation purposes

Alaska Department of Environmental Conservation Fish Monitoring Program
Total Heavy Metal Concentrations *(ppm) for Fish Species Collected
Update January 2007

LINGCOD	Number of fish	Mean	Std Dev	Median	Min	Max	
Arsenic	62	0.656	0.399	0.582	0.166	2.552	
Cadmium	62	< DL**	< DL**	< DL**	< DL**	< DL**	
Chromium	62	0.035	0.015	< DL**	< DL**	0.077	
Lead	62	0.016	0.005	< DL**	< DL**	0.053	
Nickel	62	0.026	0.006	< DL**	< DL**	0.070	
Selenium	62	0.388	0.070	0.382	0.259	0.622	
Total Mercury	75	0.490	0.364	0.502	0.033	1.428	
NORTHERN PIKE							
Arsenic	12	0.141	0.090	0.119	0.044	0.348	
Cadmium	12	< DL**	< DL**	< DL**	< DL**	< DL**	
Chromium	12	< DL**	< DL**	< DL**	< DL**	< DL**	
Lead	12	< DL**	< DL**	< DL**	< DL**	< DL**	
Nickel	12	< DL**	< DL**	< DL**	< DL**	< DL**	
Selenium	12	0.267	0.093	0.291	0.144	0.478	
Total Mercury	104	0.272	0.261	0.185	< DL**	1.202	
WALLEYE POLLOCK							
Arsenic	57	1.169	0.541	0.985	0.417	3.403	
Cadmium	57	< DL**	< DL**	< DL**	< DL**	< DL**	
Chromium	57	< DL**	< DL**	< DL**	< DL**	< DL**	
Lead	57	< DL**	< DL**	< DL**	< DL**	< DL**	
Nickel	57	0.026	0.005	< DL**	< DL**	0.062	
Selenium	57	0.227	0.042	0.230	0.147	0.356	
Total Mercury	143	0.052	0.067	< DL**	< DL**	0.389	
BLACK ROCKFISH							
Arsenic	21	0.376	0.115	0.360	0.165	0.638	
Cadmium	21	< DL**	< DL**	< DL**	< DL**	< DL**	
Chromium	21	0.040	0.035	< DL**	< DL**	0.158	
Lead	21	< DL**	< DL**	< DL**	< DL**	< DL**	
Nickel	21	0.032	0.017	< DL**	< DL**	0.089	
Selenium	21	0.487	0.106	0.472	0.308	0.721	
Total Mercury	26	0.134	0.076	0.106	0.044	0.349	

* Concentration expressed as ppm (parts per million, mg/kg)

** <DL: Below Detection Limit

Values below the Analytical Detection Limit are treated as 1/2 the Detection Limit for calculation purposes

Alaska Department of Environmental Conservation Fish Monitoring Program
Total Heavy Metal Concentrations *(ppm) for Fish Species Collected
Update January 2007

	Number of fish	Mean	Std Dev	Median	Min	Max
SILVER SALMON						
Arsenic	94	0.356	0.125	0.348	0.110	0.829
Cadmium	94	0.007	0.003	< DL**	< DL**	0.030
Chromium	94	0.036	0.044	< DL**	< DL**	0.324
Lead	94	0.031	0.152	< DL**	< DL**	1.484
Nickel	94	0.036	0.044	< DL**	< DL**	0.269
Selenium	94	0.244	0.038	0.242	0.177	0.340
Total Mercury	154	0.037	0.015	0.036	< DL**	0.113
SHARK						
Arsenic	9	1.360	0.510	1.403	0.680	2.431
Cadmium	9	0.014	0.011	< DL**	< DL**	0.032
Chromium	9	0.041	0.018	< DL**	< DL**	0.067
Lead	9	0.020	0.015	< DL**	< DL**	0.061
Nickel	9	< DL**	< DL**	< DL**	< DL**	< DL**
Selenium	9	0.248	0.026	0.242	0.204	0.291
Total Mercury	9	1.182	0.286	1.191	0.758	1.568
SPINY DOGFISH						
Arsenic	49	2.838	0.646	2.726	1.606	4.166
Cadmium	49	< DL**	< DL**	< DL**	< DL**	< DL**
Chromium	49	0.062	0.052	0.058	< DL**	0.273
Lead	49	0.020	0.022	< DL**	< DL**	0.154
Nickel	49	0.032	0.018	< DL**	< DL**	0.110
Selenium	49	0.184	0.021	0.184	0.146	0.227
Total Mercury	49	0.799	0.251	0.834	0.095	1.340
LAKE TROUT						
Arsenic	9	0.139	0.061	0.111	0.072	0.236
Cadmium	9	< DL**	< DL**	< DL**	< DL**	< DL**
Chromium	9	0.029	0.010	< DL**	< DL**	0.056
Lead	9	< DL**	< DL**	< DL**	< DL**	< DL**
Nickel	9	< DL**	< DL**	< DL**	< DL**	< DL**
Selenium	9	0.276	0.023	0.280	0.248	0.303
Total Mercury	9	0.303	0.126	0.323	0.113	0.455

* Concentration expressed as ppm (parts per million, mg/kg)

** <DL: Below Detection Limit

Values below the Analytical Detection Limit are treated as 1/2 the Detection Limit for calculation purposes

Element	Method	Description	Detection Limit: ppm (mg/kg)	Number of fish	Mean	Std Dev	Median	Min	Max
SILVER SALMON									
Arsenic	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.019	84	0.386	0.125	0.348	0.110	0.828
Cadmium	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.012	84	0.007	0.003	<DL*	<DL*	0.030
Chromium	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.051	84	0.037	0.044	<DL*	<DL*	1.484
Lead	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.030	84	0.038	0.038	<DL*	<DL*	0.289
Nickel	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.050	84	0.244	0.038	0.243	0.177	0.440
Selenium	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.046	84	0.037	0.015	<DL*	<DL*	0.118
SHARK									
Arsenic	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.012	8	0.014	0.011	<DL*	<DL*	0.032
Cadmium	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.012	8	0.020	0.015	<DL*	<DL*	0.061
Chromium	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.051	8	0.248	0.028	0.194	0.134	0.281
Lead	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.030	8	1.182	0.368	0.368	0.188	1.66
Nickel	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.050	8	0.050	0.017	<DL*	<DL*	0.173
Selenium	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.046	8	0.050	0.017	<DL*	<DL*	0.173
SPINY DOGFISH									
Arsenic	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.019	48	0.050	0.020	0.030	0.010	0.170
Cadmium	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.012	48	0.005	0.002	<DL*	<DL*	0.015
Chromium	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.051	48	0.030	0.015	<DL*	<DL*	0.110
Lead	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.030	48	0.030	0.015	<DL*	<DL*	0.110
Nickel	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.050	48	0.030	0.015	<DL*	<DL*	0.110
Selenium	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.046	48	0.030	0.015	<DL*	<DL*	0.110
LAKE TROUT									
Arsenic	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.019	8	0.010	0.005	<DL*	<DL*	0.030
Cadmium	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.012	8	0.010	0.005	<DL*	<DL*	0.030
Chromium	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.051	8	0.010	0.005	<DL*	<DL*	0.030
Lead	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.030	8	0.010	0.005	<DL*	<DL*	0.030
Nickel	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.050	8	0.010	0.005	<DL*	<DL*	0.030
Selenium	EPA 6020A	Inductively Coupled Plasma/Mass Spectrometry	0.046	8	0.010	0.005	<DL*	<DL*	0.030
Mercury (total)									
EPA 7473		Thermal Decomposition, Amalgamation and Atomic Absorption	0.025	48	0.030	0.015	<DL*	<DL*	0.110

Alaska Department of Environmental Conservation Fish Monitoring Program
Total Mercury Concentration *(ppm) for fish species collected
Update January 2007

	Total	Mean (ppm)	Standard Deviation	Median (ppm)	Minimum (ppm)	Maximum (ppm)	Weight (pounds) Min. Max.	
Pacific Cod	110	0.133	0.097	0.108	<DL	0.496	1.8	23.2
Pacific Halibut	643	0.325	0.290	0.222	<DL	1.947	13.4	289.7
Lingcod	75	0.490	0.364	0.502	0.033	1.428	2.6	56.2
Walleye Pollock	143	0.052	0.067	<DL	<DL	0.389	0.7	7.3
Sablefish	191	0.182	0.192	0.107	<DL	1.192	1.8	16.7
Black Rockfish	26	0.134	0.076	0.106	0.044	0.349	3.1	7.5
Dusky Rockfish	6	0.097	0.107	0.061	0.026	0.309	2.4	5.5
Pacific Ocean Perch	78	0.056	0.054	0.041	<DL	0.262	0.5	2.5
Rougheye Rockfish	21	0.234	0.195	0.167	0.077	0.870	1.3	4.6
Yelloweye Rockfish	31	0.513	0.286	0.466	0.144	1.263	4.4	19.8
Shark	9	1.182	0.286	1.191	0.758	1.568	6' 5.9" **	7' 9.7" **
Spiny Dogfish	49	0.799	0.251	0.834	0.095	1.340	4.2	8.4
All Salmon	765	0.040	0.021	0.038	<DL	0.159		
King Salmon	115	0.064	0.028	0.058	<DL	0.159	1.3	31.5
Chum Salmon	174	0.043	0.015	0.041	<DL	0.103	2.9	13.9
Pink Salmon	120	0.019	0.010	<DL	<DL	0.064	1.3	7.1
Red Salmon	202	0.038	0.015	0.038	<DL	0.082	0.9	9.8
Silver Salmon	154	0.037	0.015	0.036	<DL	0.113	1.1	15.4
Burbot	10	0.533	0.254	0.558	<DL	0.854	0.3	6.8
Northern Pike	104	0.272	0.261	0.185	<DL	1.202	0.2	6.7
Sheefish	8	0.136	0.057	0.120	0.092	0.262	5.9	17.2
Lake Trout	9	0.303	0.126	0.323	0.113	0.455	1.5	6
Rainbow Trout	6	0.210	0.036	0.200	0.172	0.258	0.7	1.3
Grayling	7	0.09	0.028	0.088	0.057	0.141	1.1	1.8

*Concentration expressed as ppm (parts per million, mg/kg)

Detection Limit: 0.025 ppm

Values below the Analytical Detection Limit are treated as 1/2 the Detection Limit for calculation purposes

<DL: Below Detection Limit

** : Value is Length (feet, inches), since Weight is not available for this species

SUBLEGALS

-WE HOOK THE NEWS THAT'S FIT TO NET-

Vol. 13, No. 03

1 February 2007

13:03/04. MERCURY IN FISH FINDINGS LEAVE MANY SURPRISED. The Environmental Protection Agency (EPA) and Oregon State University (OSU) partnered to conduct a large-scale four year study to determine a "snapshot" of the dispersal distances and contamination levels of mercury in fish species in the west. The researchers recently published the project results in the journal of *Environmental Science & Technology*. The results shocked many: mercury was detected in every fish caught in every river tested. The study area spanned 626 rivers in 12 states covering almost 190,000 miles. Fish were sampled randomly with 2,707 fish tested overall. However, no salmonids were sampled to ensure that the experiment did not negatively effect already struggling anadromous populations.

These results suggested an expansive non-point source of mercury entering the watersheds and riparian zones. Mercury is a naturally occurring element in the environment due to volcanic activity and geothermal springs. However, previous research concluded that 2/3rds of mercury currently in the atmosphere is from man-made sources, i.e. coal-burning power plants, waste incinerators, forest fires, and cement kilns. Therefore, mercury deposition, falling from the atmosphere to Earth as rain or snow, is likely responsible for the wide breadth of mercury contamination in fish species throughout the west.

The EPA previously established a mercury threshold at 0.3 parts per million in fish tissues as safe for human consumption. While the majority of fish surveyed contained mercury levels lower than this threshold, some did not. The surveys also discovered that larger piscivorous (fish eating) fish on average had higher levels of mercury, a phenomenon called bioaccumulation. Of the large piscivorous fish, such as northern pike, bass, walleye, and pikeminnow, more than 50% met or exceeded the EPA health standards threshold. The research team suggested limiting consumption of these species to one or two times per month, especially for pregnant women and children.

The project staff recommended contacting local state and county agencies for more information concerning local mercury contaminated fish warnings. In fact, in response to the study, the Colorado Department of Health enacted new mercury warnings and fish consumption advisories for five lakes and reservoirs. Colorado limits mercury levels to 0.5 parts per billion, and these species and water bodies exceeded the state threshold. The Colorado State health department began a five-year program to assess mercury levels in fish and streams of Colorado.

The results of the EPA/OSU study are far reaching, yet it is important to note that while mercury levels may be lower than human health risk levels of concern it still negatively affects the wildlife and habitat. Also the study did not determine local sources of mercury, an important action for local agencies to undertake. Researchers called for follow-up studies to be conducted every couple of years to determine if the levels of mercury in the system are increasing or decreasing over time.

Information about the mercury in fish study results can be found in the 23 January Jeff Barnard piece in the *San Francisco Chronicle* at <http://sfgate.com/cgi-bin/article.cgi?file=/n/a/2007/01/23/national/a171046S79.DTL>, or in the 24 January Richard L. Hill article in *The Oregonian* at www.oregonlive.com/news/oregonian/index.ssf?/base/news/1169612728115700.xml&coll=7.

Survey Finds Mercury in Fish in West

By JEFF BARNARD, AP Environmental Writer

Tuesday, January 23, 2007

(01-23) 17:10 PST Grants Pass, Ore. (AP) --

Scientists looking for fish tainted by mercury found them in every fish and every river they sampled across the West, suggesting that industrial pollution generated around the world is likely responsible for at least some of it.

The survey of 2,707 fish randomly collected from 626 rivers in 12 states represents the biggest regional sampling yet of mercury in fish in the West, said Spencer A. Peterson, senior research ecologist EPA's National Health and Environmental Effects Research Laboratory in Corvallis.

The findings by scientists from the EPA and Oregon State University were reported in this month's issue of the journal *Environmental Science & Technology* and came out of an EPA survey of various environmental factors in rivers conducted between 2000 and 2004.

Though the survey found some fish with elevated mercury levels, suggesting a local source such as an old mercury mine, most levels were low, in line with canned tuna found in grocery stores, said Alan T. Herlihy, associate research professor in the OSU Department of Fisheries and Wildlife.

No attempt was made to specifically link the mercury in the fish to mercury in the atmosphere, but the low but widespread levels suggest the mercury came from deposition — mercury in the atmosphere falling to the earth in rain and snow, Herlihy added.

While generally below levels considered unsafe for people to eat from time to time, the mercury could pose a danger to fish and wildlife that depend on fish for their diet, said Robert M. Hughes, a fisheries and wildlife research associate professor at OSU who took part in the study.

Levels were generally higher in fish-eating fish, such as bass, walleye and pike, than in insect-eating fish, such as trout.

"What's important to note is that the levels are below what we consider a health concern in most fish," said EPA spokeswoman Suzanne Ackerman.

Elevated mercury levels have been linked to learning disabilities and developmental delays in children and to heart, nervous system and kidney damage in adults. Out of concern for the health effects, several states and the federal government have taken steps to cap mercury emissions.

It has long been understood that industrial emissions, such as coal-fired power plants, are responsible for some percentage of the mercury found in fish, said Steve Lindberg, a retired research fellow from the Oakridge National Laboratory, who did not take part in the study. The question is how much.

About two thirds of the mercury circulating in the atmosphere is generally considered to come from industrial or human sources, with the rest from things like volcanoes and other geologic sources, Lindberg said.

Lindberg said he is involved in research that has been tracking specific isotopes of mercury introduced into a lake watershed in Canada as they show up in fish, and will go on to see how mercury levels in the fish react when the mercury is cut off.

"It does suggest that concentrations in fish from mercury from the atmosphere are highly responsive to the amount of mercury being deposited from the atmosphere," he said. "We would argue in support of the notion of reducing industrial emissions to reduce the concentrations of mercury in fish."

<http://sfgate.com/cgi-bin/article.cgi?f=/n/a/2007/01/23/national/a171046S79.DTL>

Associated Press Sections

Go

© 2007 Hearst Communications Inc. | [Privacy Policy](#) | [Feedback](#) | [RSS Feeds](#) | [FAQ](#) | [Site Index](#) | [Contact](#)

Mercury found in all fish tested in the West

Dietary limits - The extent of the neurotoxin surprises Oregon scientists, who suspect the air is the source

Wednesday, January 24, 2007

RICHARD L. HILL

A sweeping study by Oregon scientists has found mercury-contaminated fish throughout the West.

FACTBOX

• [Fast facts and playing it safe](#)

In the most widespread survey of mercury in the nation's streams, four Corvallis researchers with the U.S. Environmental Protection Agency and Oregon State University sampled more than 2,700 fish in Oregon, Washington and 10 other Western

states. They found detectable -- and in some cases, high -- amounts of mercury in every fish sampled from 626 randomly selected rivers and streams that flow nearly 190,000 miles.

Although they found only a few fish with high enough mercury levels that could pose a risk to people who eat them frequently, the scientists suggested that consumers -- especially pregnant women and young children -- follow federal guidelines that limit intake of fish known to contain mercury. They, as well as federal officials, recommend calling state and county agencies for any advisories issued on locally caught fish.

The study found that the highest mercury concentrations were primarily in larger fish-eating species called "piscivores," comprising northern pike, bass, walleye and pikeminnow. The levels in more than half of the piscivore samples were similar to those found in cans of albacore or "white" tuna, for which federal officials already urge dietary limits. The EPA and the U.S. Food and Drug Administration recommend pregnant women eat no more than one 6-ounce can of albacore tuna each week.

Levels in trout and other salmonid species had far lower levels of mercury.

To the scientists, the findings signal more surprise than alarm.

"We found a relatively low concentration of mercury across a broad expanse," said Spencer Peterson, a research ecologist with the EPA in Corvallis. "I think the beneficial effects of eating fish outweigh the hazard potential."

But mercury levels varied by site and fish species. Nearly all fish contain trace amounts of mercury -- in a form called methylmercury -- that can accumulate over time in the flesh of long-lived fish such as piscivores.

Salmon not tested

The scientists did not test salmon -- which spend time in the ocean as well as inland rivers -- to avoid taking fish from protected populations of threatened or endangered species. The researchers speculate that mercury in salmon would be similar to the low levels found in trout.

Mercury is a neurotoxin. If consumed at high levels, it can impair the neurological systems of people and wildlife, especially in the infant and younger years. Mercury is emitted by natural sources such as volcanoes and geothermal springs -- making it a "background" element -- but also by coal-burning power plants, waste incinerators, forest fires and cement kilns.

Peterson and his colleagues, who report their findings this month in the journal *Environmental Science & Technology*, say most of the contamination appears to be from the movement of mercury in the atmosphere. "When we look at the entire West at these hundreds of sites, we're not seeing a lot of really high point-source signals," said Alan Herlihy, an OSU aquatic ecologist. "The mercury was at low levels everywhere, which means to me there's some sort of uniform source, and atmospheric deposition is something that would fit that."

Other exclusions

The survey did not examine local sources that might be involved in contamination. It also did not look at whether mercury has been increasing or decreasing in the streams.

"I was surprised that the mercury was everywhere and in measurable amounts," said Robert Hughes, an aquatic ecologist at OSU. "I'm concerned about fish-eating mammals and birds -- mink, otter, heron and osprey -- that depend on these fish, but I don't know how much they may be affected."

The EPA has set a threshold of concern for human health at 0.3 micrograms of mercury per gram -- or .3 parts per million -- of fish tissue. The survey found that only 2.3 percent of the streams had large -- 5 inches or longer -- trout and other salmonids with mercury levels at or above that level. The salmonids were found in 41 percent of the stream network.

However, large piscivores measuring 5 inches or more were found in only 10 percent of the streams, but more than half were at or exceeded the 0.3 level.

Sampling in '02, '04

In their sampling between 2000 and 2004, the researchers found only 13 fish from eight sites that had a high mercury concentration of 1 part per million or more.

Herlihy said two of those sites were in the Willamette River, one near Creswell and the other south of Corvallis. The fish were northern pikeminnow or largemouth bass.

"Our goal was to get a 'snapshot' of the extent and level of mercury contamination in streams across a wide area," Herlihy said. "That hasn't been done before. What we need to do now is do this on a regular basis, say every five years."

Richard L. Hill: 503-221-8238; richardhill@news.oregonian.com

Alaska Department of Environmental Conservation Fish Monitoring Program: Analysis of Organic Contaminants

The natural resources of the State provide a rich bounty of foods for Alaskan residents as well as the rest of the world. There has been a concern that Persistent Organic Pollutants (POPs) have been identified across the globe including Arctic climates and may negatively impact the environment. These pollutants can travel great distances in the atmosphere and in ocean currents from their source of origin, they resist chemical breakdown and bioaccumulate in the food chain. Limited sampling of Alaskan fishes for these contaminants has not found levels of concern, but questions about the safety of eating fish from the North Pacific still arise. Alaska Department of Environmental Conservation (ADEC) developed the Fish Monitoring Program in order to conduct a more rigorous examination of contaminant levels in Alaskan fishes. The program involves a general survey of selected marine and freshwater finfish species from around the state and testing these fishes for certain environmental contaminants.

In a collaborative effort with biologists from the Alaska Department of Fish and Game, the U.S. National Oceanic and Atmospheric Agency (NOAA), the International Pacific Halibut Commission (IPHC) and commercial and some Native fishermen, samples of salmon (all 5 species), halibut, Pollock, sablefish, Pacific cod, lingcod and rockfish were collected from primarily marine waters and at the mouth of rivers throughout the state. Northern pike were caught from lakes and rivers in the Koyukuk, Kuskokwim, Yukon and Susitna River drainages and sheefish from rivers draining in to Kotzebue Sound. Sheefish were collected in the winter of 2001 while the majority of the remaining fish were collected during the 2002 fishing season (June through August).

All samplers were trained to follow the standard protocol written in the Quality Assurance Project Plan to assure quality samples were submitted for analysis. Fish were caught, labeled, put in food grade plastic bags (fish sleeves) and placed in wetlock boxes. The samples were immediately shipped on ice, or frozen and then shipped to the Environmental Health Laboratory (EHL) in Palmer, Alaska. Over 600 samples were collected during this initial collection period. The fish were processed at EHL lab and chemical analysis was performed on the homogenized skinless fillets of individual fish. All of the fish samples were tested for heavy metals at the EHL Lab (methyl mercury, cadmium, lead, nickel, chromium, arsenic and selenium). Results for the heavy metal analysis can be found on the State web page:

<http://www.state.ak.us/dec/eh/vet/fish.htm> . These initial data support the Public Health Division's recommendation that all Alaskans, including pregnant women, women of childbearing age, and young children, continue unrestricted consumption of fish from Alaska waters

http://www.epi.hss.state.ak.us/bulletins/docs/b2001_06.htm .

Due to the high cost for the analysis of organic contaminants only a subset of all the fish samples were analyzed for polychlorinated biphenyls (PCBs), polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and organochlorine pesticides using approved USEPA Methods by AXYS Analytical Services Ltd. (AXYS) in British Columbia, Canada. Data results from AXYS were validated by an independent contractor using USEPA Region 10 Validation Methods. This subset of fish did not include all species collected during the study period. This report will present the data from 89 fish samples (18 chum, 17 Chinook, 24 sockeye, 11 halibut, 8 sheefish and 11 sablefish).

Table 1 Sample size by general area where the fish were collected.

Species (# of fish)	Gulf of Alaska	Bering Sea	Freshwater Drainage Kotzebue Sound
Chum (18)	0	18	
Chinook (17)	9	8	
Sockeye (24)	12	12	
Halibut (11)	11		
Sablefish (11)	11		
Sheefish (8)			8



The fishes evaluated in this study occupy different positions in the Alaskan ecosystem. Salmon are anadromous fish, born in fresh water streams they migrate out to mature in the North Pacific and return to their birth stream to spawn. Chinook salmon, Alaska's State fish, is the largest and the most long-lived of the Pacific salmon species and is known for its high oil content. Sockeye are an important commercial species which, like the Chinook, contain a high oil

content. Native fishermen harvest all species of salmon, which is the main protein source for traditional diet. Sheefish live in arctic rivers and annually migrate up stream to spawn. They are a favorite food for many Native communities and often pursued by recreational fishermen. Halibut are bottom fish found along the Pacific Coast from Washington State to the Bering Sea, as far north as Norton Sound. Like salmon, halibut are important to commercial, subsistence and recreational fisheries. Sablefish (also known as blackcod or butterfish) have a high oil content and range in the deep waters of the North Pacific from Western Canada to the Bering Sea. Generally, Sablefish are commercially harvested year-round from the Gulf of Alaska and Western Canada.

Table 2 Range, mean and standard deviation of the weight in kilograms (kg) of the fish collected

<u>Weight (Kilograms)</u>				
<u>Species (# of fish)</u>	<u>Mean</u>	<u>Std. Dev</u>	<u>Min</u>	<u>Max</u>
Chum (18)	3.47	0.82	2	5.4
Chinook (17)	5.6	2.64	2.3	13.8
Sockeye (24)	2.6	0.67	1.6	4
Halibut (11)	20.6	11.17	9.1	41.4
Sablefish (11)	1.3	0.35	0.8	1.7
Sheefish (8)	4.3	1.8	2.7	7.8

The oil or lipid concentrations vary considerably for different species of fish. The polyunsaturated fatty acids and omega 3 fatty acids contained in fish are responsible for many of the health benefits such as improved cardiovascular function and are essential for a healthy pregnancy and fetal neurodevelopment. Many of the organic contaminants are lipophilic and bioaccumulate in the fat component of the fish and it is important to know the relative lipid content of the different species when comparing the contaminant concentrations. As expected older and larger fish with higher percent lipid concentration would be expected to accumulate higher levels of organic contaminants. The percent lipid concentration of the fish analyzed is presented in Table 3.

Table 3 Lipid Concentration of Skinless Fillet tissue

<u>% Lipid Concentration</u>				
<u>Species (# fish)</u>	<u>Mean</u>	<u>Std Dev</u>	<u>Min</u>	<u>Max</u>
All Salmon (59)	7.29	4.24	1.98	23.6
Chum (18)	4.81	1.44	2.86	8.9
Chinook (17)	8.6	5.79	1.98	23.6
Sockeye (24)	8.22	3.67	2.17	16.1
Halibut (11)	0.46	0.25	0.15	0.9
Sablefish (11)	3.17	2.19	0.79	6.61
Sheefish (8)	1.47	0.74	0.22	2.89

Due to the limited sample numbers analyzed in this study and presented in this initial report correlations of contaminant concentration to physical parameters (weight, sex, age) and location were not performed.

Analytical Data results:

PCB Concentration-

The PCB concentration of the fish tissue (individual fish, homogenized skinless fillet) is reported as total PCBs ppb (parts per billion) or ng/g wet weight, which is the sum of 44 PCB congeners, eight of which were co-eluting congeners, are quantified. The list of congeners can be found in an attached Table 8 in the appendix to this report; co-eluting congeners are listed separated by a comma. These PCB congeners include the 12 designated by the World Health Organization to be the greatest of public interest, 14 being measured by the Arctic Monitoring and Assessment Program and the 26 congeners that the FDA considers important to assess in foods. The PCB congeners are listed using the International Union of Pure and Applied Chemistry (IUPAC) nomenclature. Table 4 lists the range of values, the mean and standard deviation of the PCB concentration for the three salmon species (chum, Chinook, sockeye) grouped together and then individually for each species.

Table 4 Total PCB concentrations in fish tissue sampled*

<u>SPECIES</u>	<u># Fish</u>	<u>Total PCB ppb (ng/gm)</u>			
		<u>Mean</u>	<u>Std dev</u>	<u>Min</u>	<u>Max</u>
All SALMON	59	7.19	4.87	1.59	18.78
Chum	18	2.52	1.20	1.59	6.21
Chinook	17	8.17	4.58	4.11	18.02
Sockeye	24	10.00	4.26	3.00	18.78
Halibut	11	1.15	0.94	0.30	3.12
Sablefish	11	4.79	3.87	0.67	13.53
Sheefish	8	2.47	1.17	0.62	3.88

All samples below the detection limit are reported as zero for the calculations
Mean of the Sample Specific Detection Limit** for individual PCB congeners was 0.1958 pg/gm wet wt

* Total PCBs based on the sum of 44 Congeners listed in appendix

** [The sample specific detection limits are determined for each individual sample from the data during the chemical analysis using lab reagent blanks and adjusting for sample volume. This converts the signal of the instrument measuring the chemical to a numerical concentration by comparison to a known chemical standard.]