Eating Fish

Maximizing Benefits & Minimizing Risks

Kenneth D. Rosenman, M.D.

Professor of Medicine

Michigan State University

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No commercial conflicts of interest

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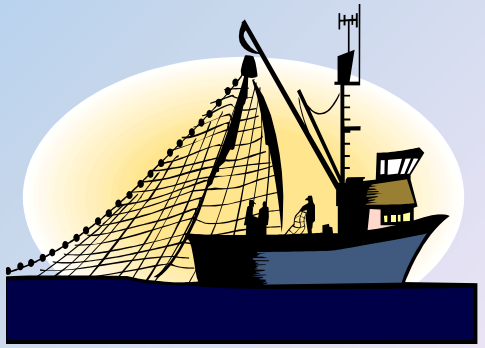
Objectives

- Benefits of Eating Fish/Fish oil
- Risks of Eating Fish/Fish oil
- Store Bought vs. Recreational Caught Fish
- Talking to Patients
- Available Resources



AHA 2006 Diet and Lifestyle Recommendations for Cardiovascular Disease Risk Reduction

- Balance calorie intake and physical activity to achieve or maintain a healthy body weight.
- Consume a diet rich in vegetables and fruits.
- Choose whole-grain, high-fiber foods.
- Consume fish, especially oily fish, at least twice a week.
- Limit your intake of saturated fat to <7% of energy, *trans* fat to <1% of energy and cholesterol to <300 mg per day.
- Minimize your intake of beverages and foods with added sugars.
- Choose and prepare foods with little or no salt.
- If you consume alcohol, do so in moderation.
- When you eat food that is prepared outside of the home, follow the AHA Diet and Lifestyle Recommendations.

(Circulation 2006; 114:82-96)

Major Classes of Fatty Acids

FAMILY	FATTY ACIDS	FORMULA	SOURCE
Omega-9	Oleic acid	C18:1	Most vegetable oils (canola, olive); animal fats
Omega-6	Linolenic acid	C18:2	Many vegetable oils (corn, safflower, soybean)
	Arachidonic acid	C20:4	Poultry, meats
Omega-3	α-linolenic acid	C18:3	Selected vegetable oil (flaxseed, canola)
	EPA	**C20:5**	**Marine oils and fish**
	DHA	**C22:6**	**Marine oils and fish**
Saturated fats	Palmitic acid	C16:0	Animal and vegetable fats
	Stearic acid	C18:0	Butter, palm oil, kernel oil, coconut oil, and animal fats

DHA = docosahexaenoic acid; EPA = eicosapentaenoic acid.
(*J Am Coll Card* 2009;54:585-594)

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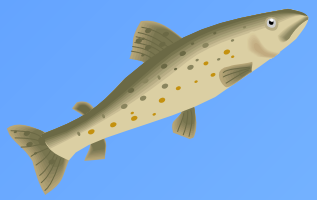
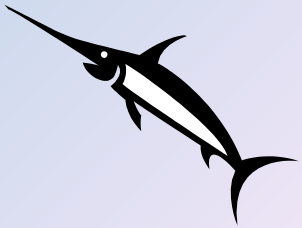
Oily Fish



Salmon	Swordfish
Trout	Bloater
Mackerel	Cacha
Herring	Carp
Sardines	Hilsa
Pilchards	Jack Fish
Kipper	Katla
Eel	Orange Roughy
Whitebait	Pangas
Tuna (fresh only)	Sprats
Anchovies	

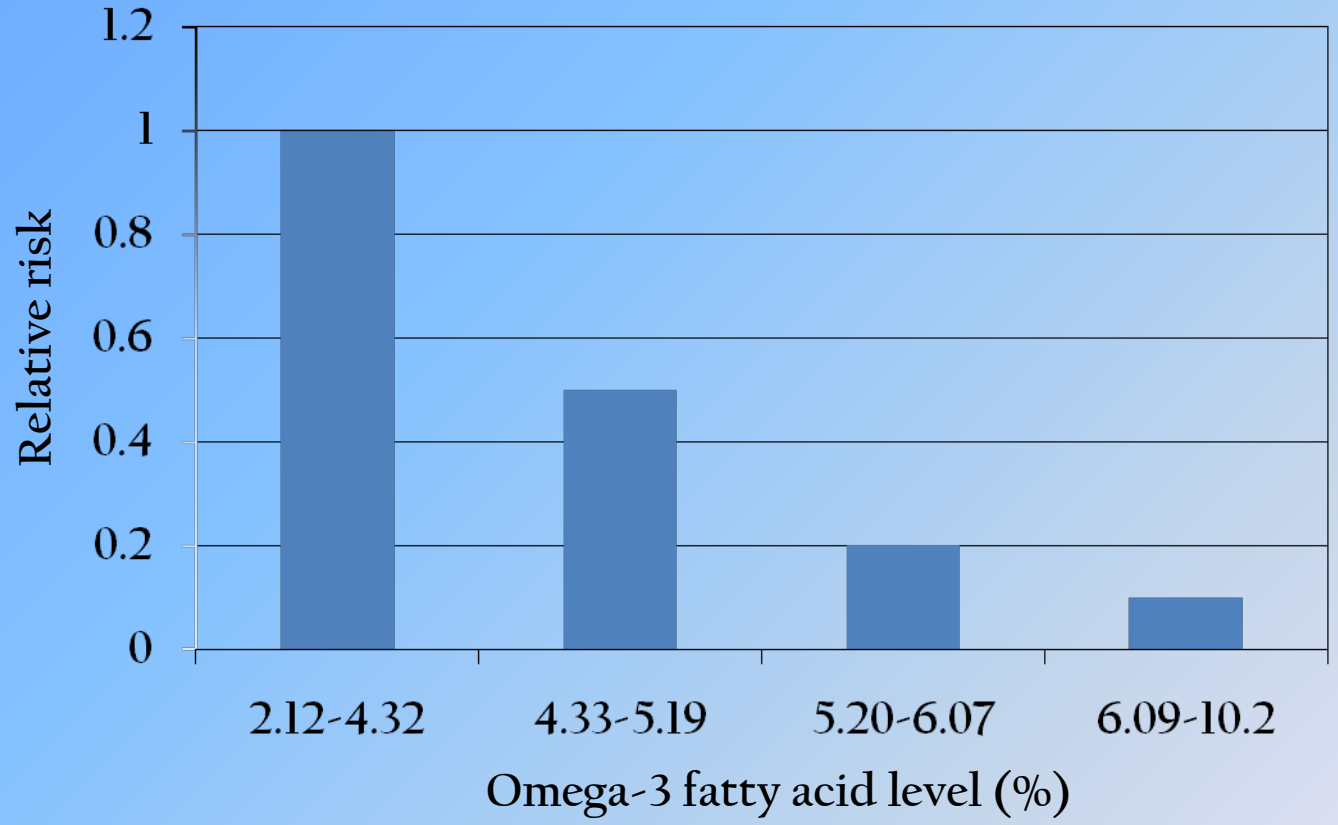


Potential EPA and DHA Effects

- Anti-arrhythmic effects
- Improvements in autonomic function
- Decreased platelet aggregation
- Vasodilation
- Decreased blood pressure
- Anti-inflammatory effects
- Improvements in endothelial function
- Plaque stabilization
- Reduced atherosclerosis
- Reduced free fatty acids and triglycerides
- Up-regulated adiponectin synthesis
- Reduced collagen deposition

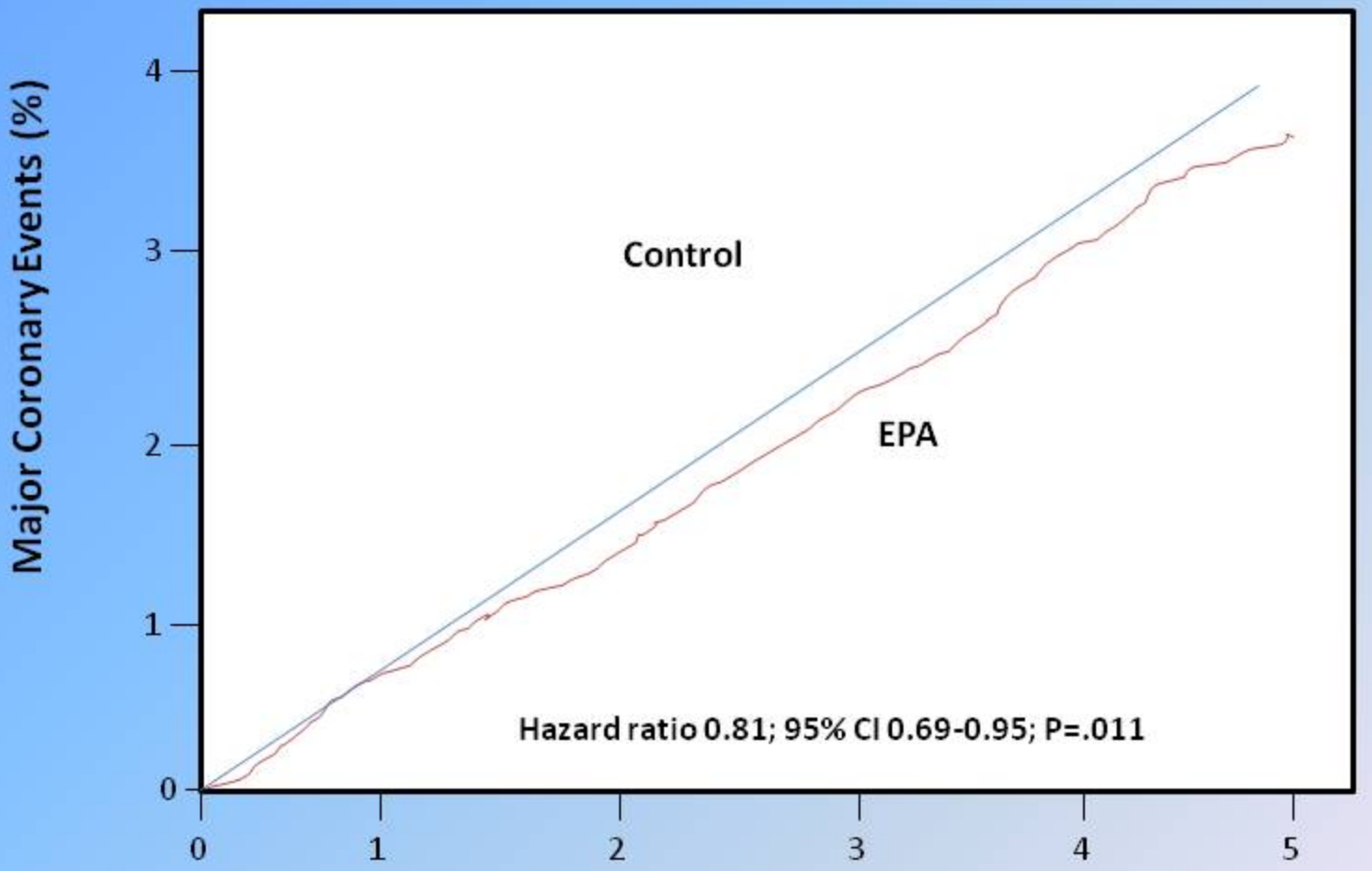
(*J Am Coll Card* 2009;54:585-594)

Relative risk of sudden cardiac death (SCD) according to baseline blood levels of omega-3 fatty acids as percentage of total fatty acids.



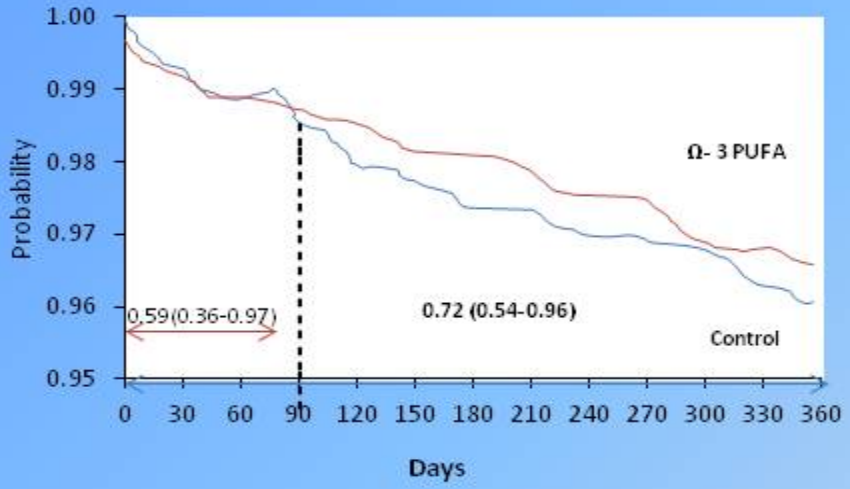
(J Am Coll Card 2009;54:585-594 (Data from Albert et al. originally printed Lee et al.))

EPA in Primary Prevention 1.8 g/day Reduced the Incidence of Major Adverse Coronary Events in the JELIS (Japan EPA Lipid Intervention Study) Trial by 19%

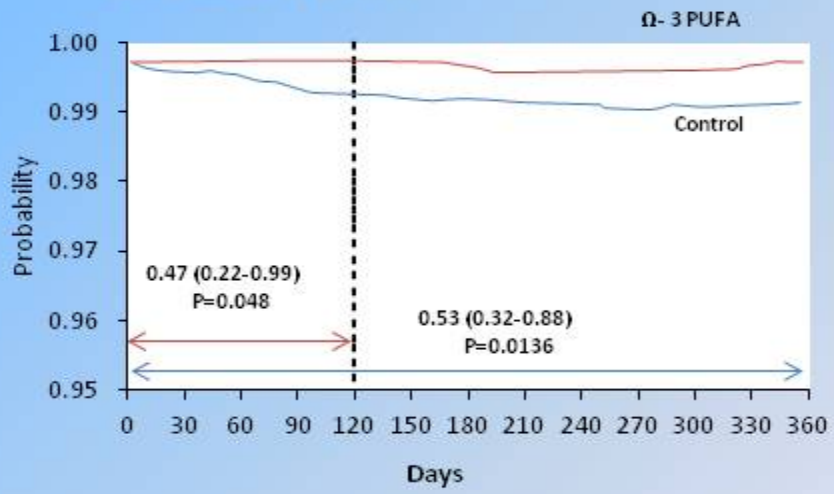


Fish Oil And Post-mi Prognosis Early Benefit of Omega-3 Polyunsaturated Fatty Acid Therapy on Total Mortality, Sudden Death, Coronary Heart Disease Mortality, and Cardiovascular Mortality

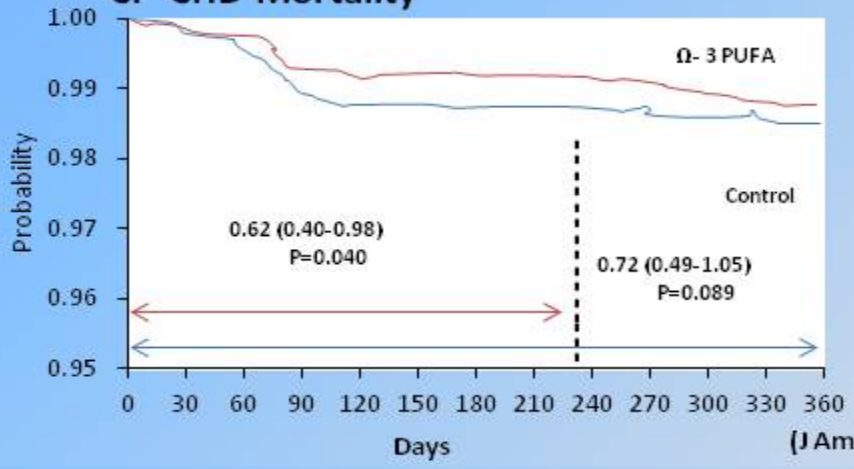
A. Total Mortality



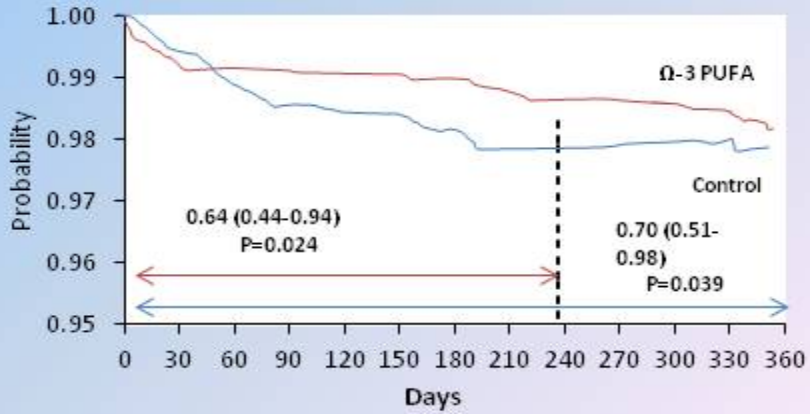
B. Sudden Death



C. CHD Mortality



D. Cardiovascular Mortality



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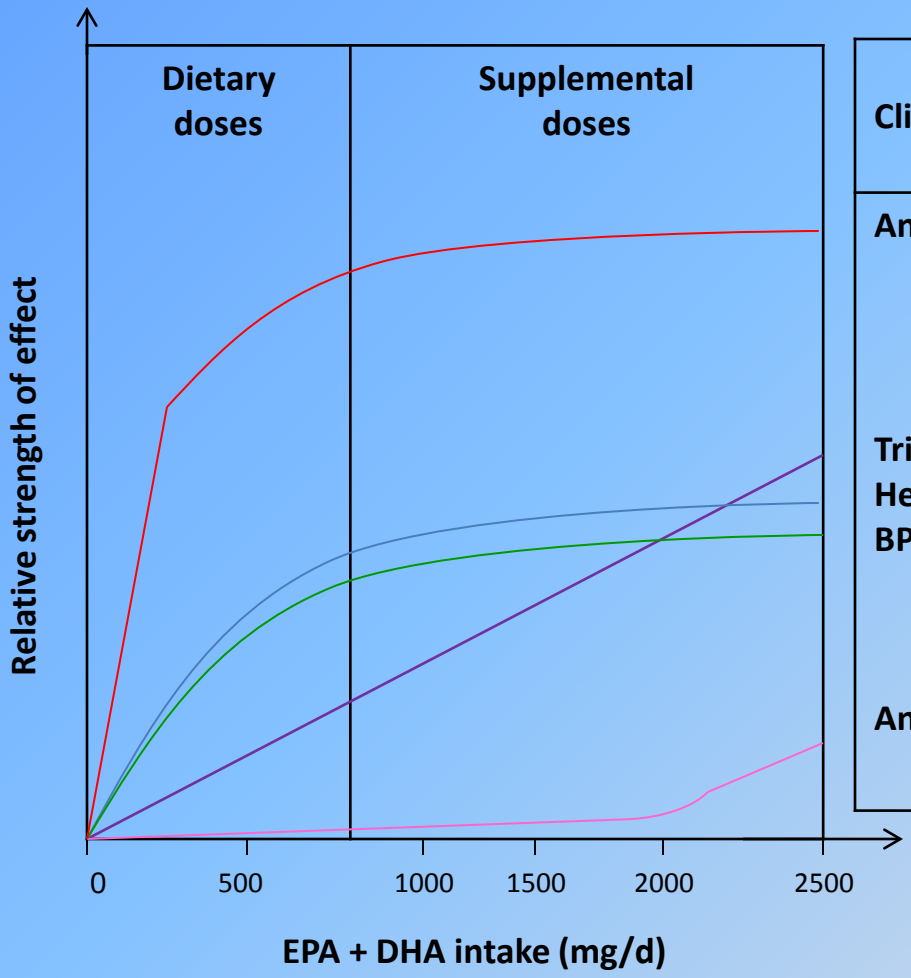
Fish Oil Dosing and Cardiovascular Impact



Clinical effect	Time course to alter clinical events
Antiarrhythmia	Weeks
Triglyceride lowering	Months to years
Heart rate lowering	Months
BP lowering	Months to years
Antithrombosis	Weeks

(J Am Coll Card 2009;54:585-594 (Reprinted, with permission, from Mozaffarian and Rimm))

Omega-3 Fatty Acids and Secondary Prevention of Cardiovascular Disease- Is it Just a Fish Tale?

Meta Analysis of Randomized Double-Blind Placebo-Controlled Trials 14 Studies supplemental Omega-3 Fatty Acids

Archives Internal Med 2012; 172:694-696

- More recent studies- no effect Omega-3

  More cardio protective Tx: Statin use 85-94%

  vs. 23-29%
- Maybe only effective primary prevention
- Questioned exclusion 2 key Positive Studies

n-3 Fatty Acids and Cardiovascular Outcomes in Patients with Dysglycemia

Diabetes or high risk diabetes & increased Risk CV events, n=12,536

No Protective Effect - Death (NEJM 2012; 367:309-317)

n-3 Fatty Acids and Cardiovascular Events after Myocardial Infarction

S/P MI, n= 4,837 (NEJM 2010;363:2015-2026)

No Protective Effect –Death and CV Events

Possible Reasons for Negative Results

- Positive studies ‹3 months s/p MI
- More cardio protective therapy in current studies
- Not effective in diabetes or those increased risk diabetes

Summary of Cardiovascular Benefits of Ingesting Fish/Fish Oil

Primary Prevention
19% Reduction in CV Events (0.5 gm/day)
S/P MI
23% Reduction (0.5 gm/day)
Arrhythmias
30% Reduction Risk of Atrial FIB (0.5 gm/day)
CHF
5-10% Reduction Mortality (0.5 gm/day)
Triglycerides
30-40% Reduction (FDA Approved 4gm/day)

Cognitive Decline and Dementia

- Randomized/Control studies - negative

  both in cognitively normal and those with dementia

  Brit J Nutrition 2012

  Cochrane Data Base System Review 2012

Childhood Cognitive &Visual Development

DHA Accumulates Second Half ofPregnancy

- Neural Cortex & Retinal Membrane Synopses

Observational Studies - Positive Association

- High-Grade Stereoacuity
- Vocabulary Comprehension
- Receptive Vocabulary
- Verbal Intelligence Quotient
- Higher Cognitive Scores

Gestational Benefits

Benefits to Mother

- Reduce Pre-Eclampsia - 7.5 fold decease
- Reduce Incidence Pre term delivery - 1.9% vs. 7.1%
- Reduce Post-Partum Depression

Benefits to Child

- Reduction allergic disease
- Improved eye and hand coordination
- Enhanced cognitive and behavioral function
- Improved sleep behavior
- Decreased risk of Type 1 diabetes
- Decreased risk cerebral palsy
- Improved IQ at 4 years of age

(Genuis SJ. Reproductive Toxicology 2008; 28: 81-85)

Randomized Controlled Trial of Fish Oil Supplementation in Pregnancy on Childhood allergies

Allergy 2013; 68: 1370-1376

Randomized Control Trial - Atopic pregnant women,
368 received 900 mg omega3 capsule and
368 received vegetable oil capsule from 21 weeks of gestation until birth.

No reduction in IgE associated allergic disease in first 3 years of child' life

Systemic Review & Meta Analysis

Am J Clinical Nutrition 2013; 97: 531-544

Eleven Randomized Control Studies

- **Reduce Developmental Delay** but no effect on mean Developmental Standard Score at 18 months
- Motor & Language Development
- Visual Development

"Does not support or refute"

A Quantitative Assessment of the Net Effects on Fetal Neurodevelopment from Eating Commercial Fish (As Measured by IQ and also by Early Age Verbal Development in Children)

May 2014

Overall

Average Neurodevelopment benefit

0.7 IQ points (95% CI 0.39-1.37)

Sensitive End Point

Average Verbal IQ points 1.41 (95% CI 0.91-2.00)

Maximum Improvement – 3 IQ points if all pregnant women average 12 ounces/week

http://www.fda.gov/Food/FoodborneIllnessContaminants/Metals/ucm393211.htm

ACOG Practice Advisory: Seafood Consumption during Pregnancy

June 10, 2014

"ACOG encourages women to follow the updated FDA recommendations that pregnant women, women who might become pregnant, and breastfeeding mothers should eat at least 8 and up to 12 ounces per week of a variety of fish lower in mercury."

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Mercury Poisoning
Episodes & Symptoms

Minamata, Japan, 1943-1961

Ingestion of fish from bay with mercury pollution

Iraq, 1961 & 1971

Ingestion of mercury fungicide contaminated grain

Adults

Ataxia, memory loss, paresthesias, blurred vision and hearing loss

Children

Mental retardation, cerebral palsy, deafness blindness and dysarthria after exposure in utero

0.1 µg/kg-day (EPA 2005)

Studies of Fish Eating Populations

Seychelles
Faroe Islands
New Zealand

Decreased Performance on neuropsychological tests

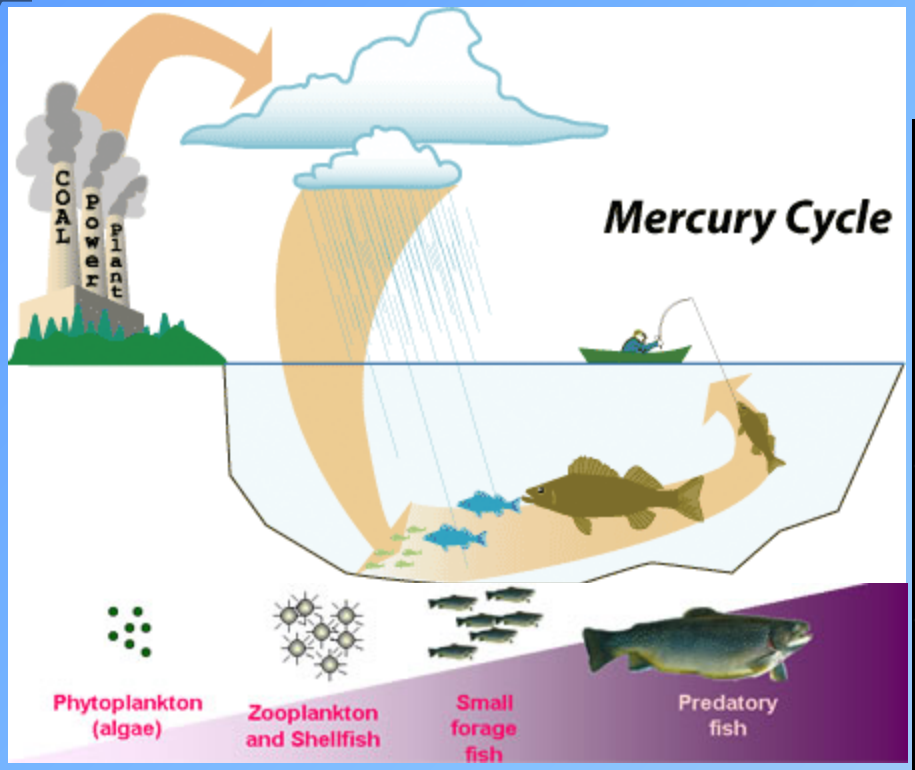
0.1 µg/kg-day (EPA 2005)

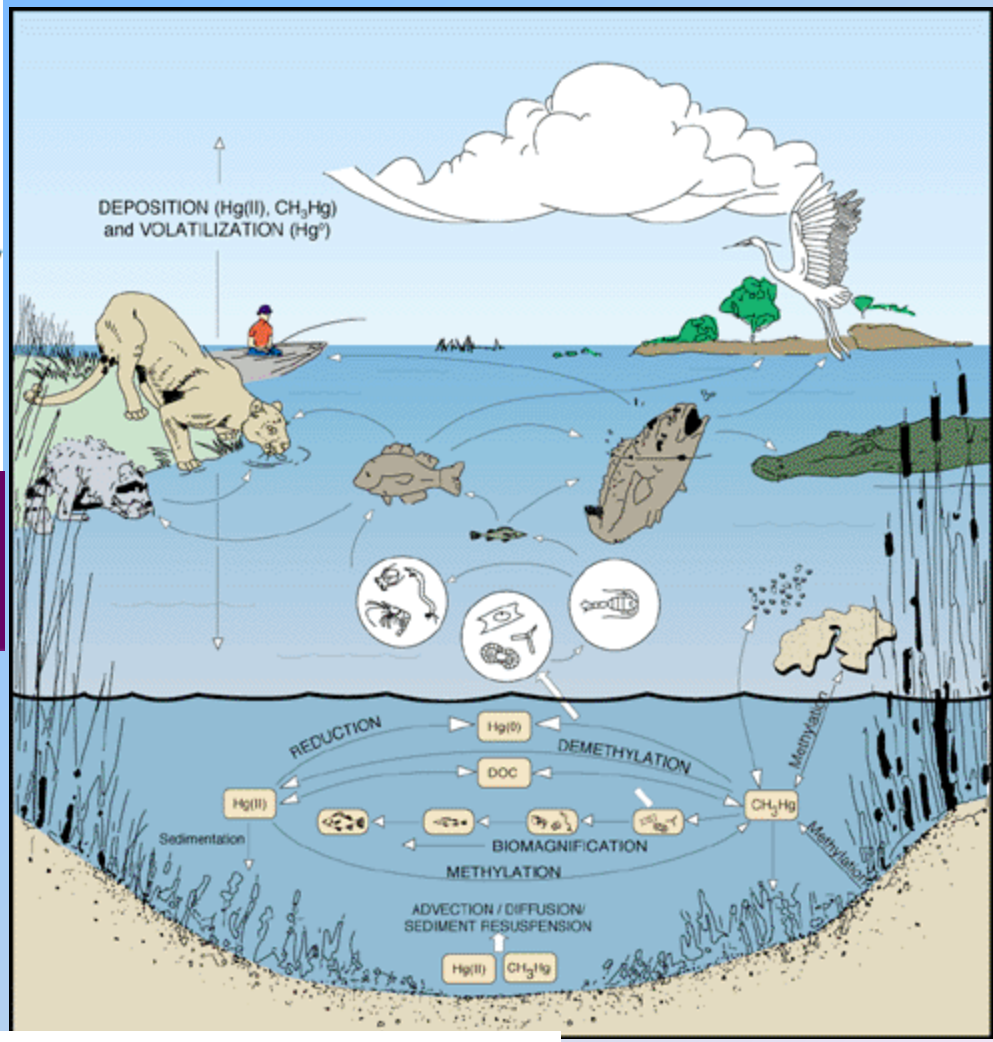
1.0 PPM (FDA)

Mercury, Fish Oils and Risk of Acute Coronary Events and Cardiovascular Disease, Coronary Heart Disease, and All Cause Mortality in Men in Eastern Finland with Hair Mercury >2.03µg/g

	OR	95% CI
Acute Coronary Event	1.6	1.2-2.1
CVD	1.7	1.2-2.4
CHD	1.6	0.99-2.5
Death Any Cause	1.4	1.2-1.7

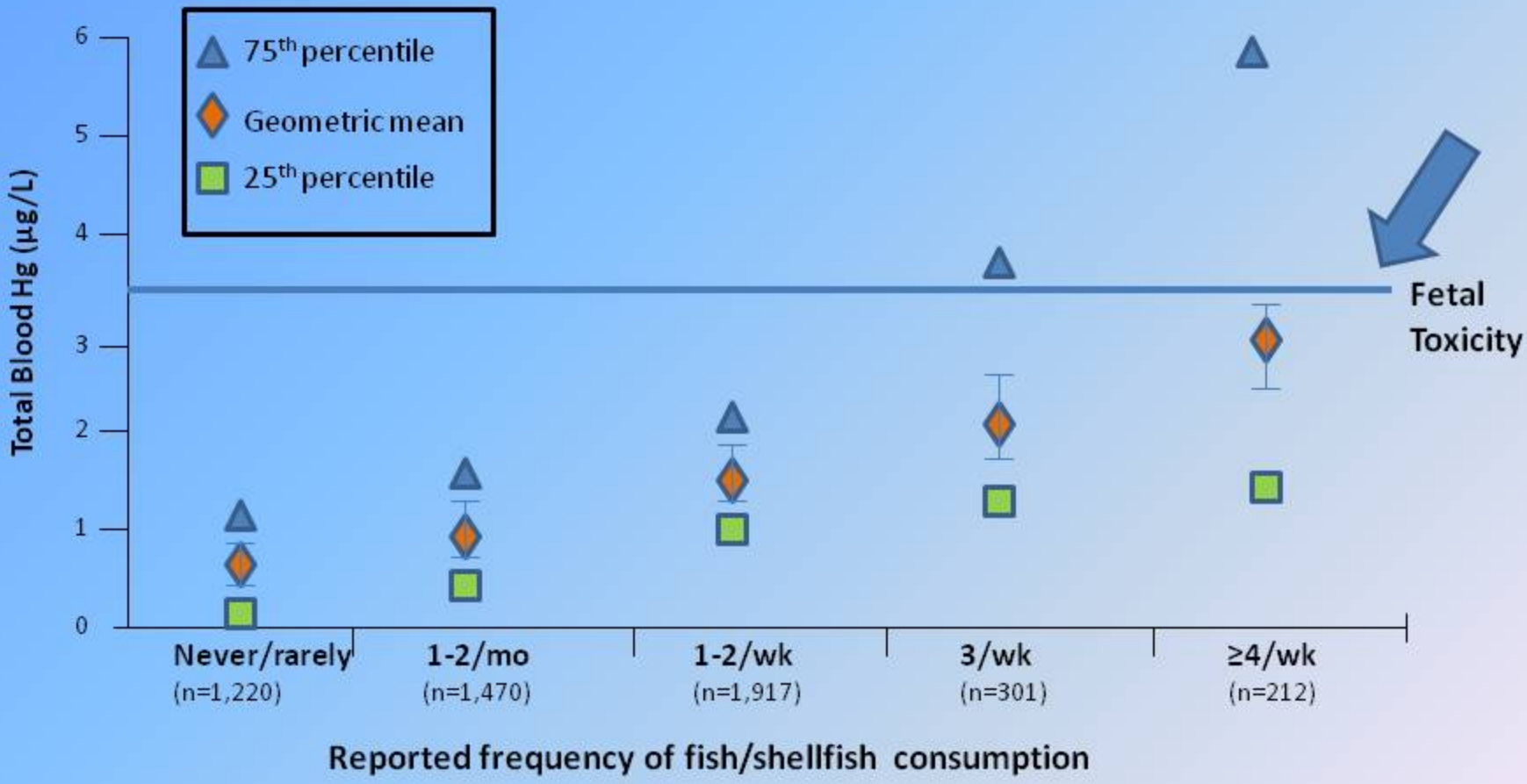
(Arterioscler Thromb Vasc Biol 2005; 25:228-233)





Emissions and Speciation → Atmospheric Transport and Deposition → Ecosystem Transport, Methylation, and Bioaccumulation → Consumption Patterns → Dose Response

Fish Intake and Blood Mercury Level in US Women 1999-2004, NHANES



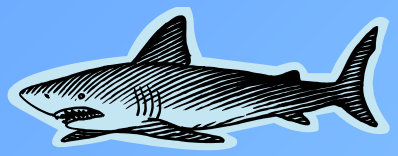
(EHP 2009; 117 47-53)

Summary of Trends in Blood Methyl Mercury (MeHg) and Fish Consumption, Women Aged 16-49 years, NHANES 1999-2010

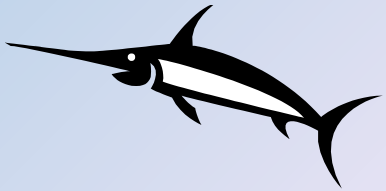
NHANES Survey Years	Blood MeHg Mean µg/L(95%CI)	Fish eaten in 30 days Mean gms (95% CI)	Blood MeHg for women who ate fish 0 times in 30 days Mean µg/L (95% CI)	Blood MeHg for women who ate fish 6+ times in 30 days Mean µg/L (95% CI)
1999-2000	0.94 (0.74,1.19)	255 (213, 296)	0.61 (0.50,0.72)	3.36 (2.76,3.97)
2001-2002	0.71 (0.57,0.90)	311 (275, 346)	0.43 (0.33,0.54)	2.34 (1.92,2.75)
2003-2004	0.56 (0.40,0.78)	270 (235, 305)	0.38 (0.27,0.50)	2.07 (1.68,2.46)
2005-2006	0.60 (0.44,0.82)	323 (277, 368)	0.37 (0.25,0.48)	1.84 (1.61,2.08)
2007-2008	0.55 (0.40,0.75)	259 (229, 290)	0.36 (0.25,0.47)	1.95 (1.54,2.37)
2009-2010	0.69 (0.56,0.86)	309 (269, 348)	0.50 (0.40,0.60)	2.11 (1.87,2.35)

(Adapted from EPA-823-R-13-002, July 2013)

Store Bought Fish with the Highest Levels of Mercury (about 1 ppm)



	Omega-3 fatty acids (grams per 3-oz. serving)	Mean mercury level in parts per million (ppm)
Tilefish (golden bass or golden snapper)	0.90	1.45
Shark	0.83	0.99
Swordfish	0.97	0.97
King mackerel	0.36	0.73

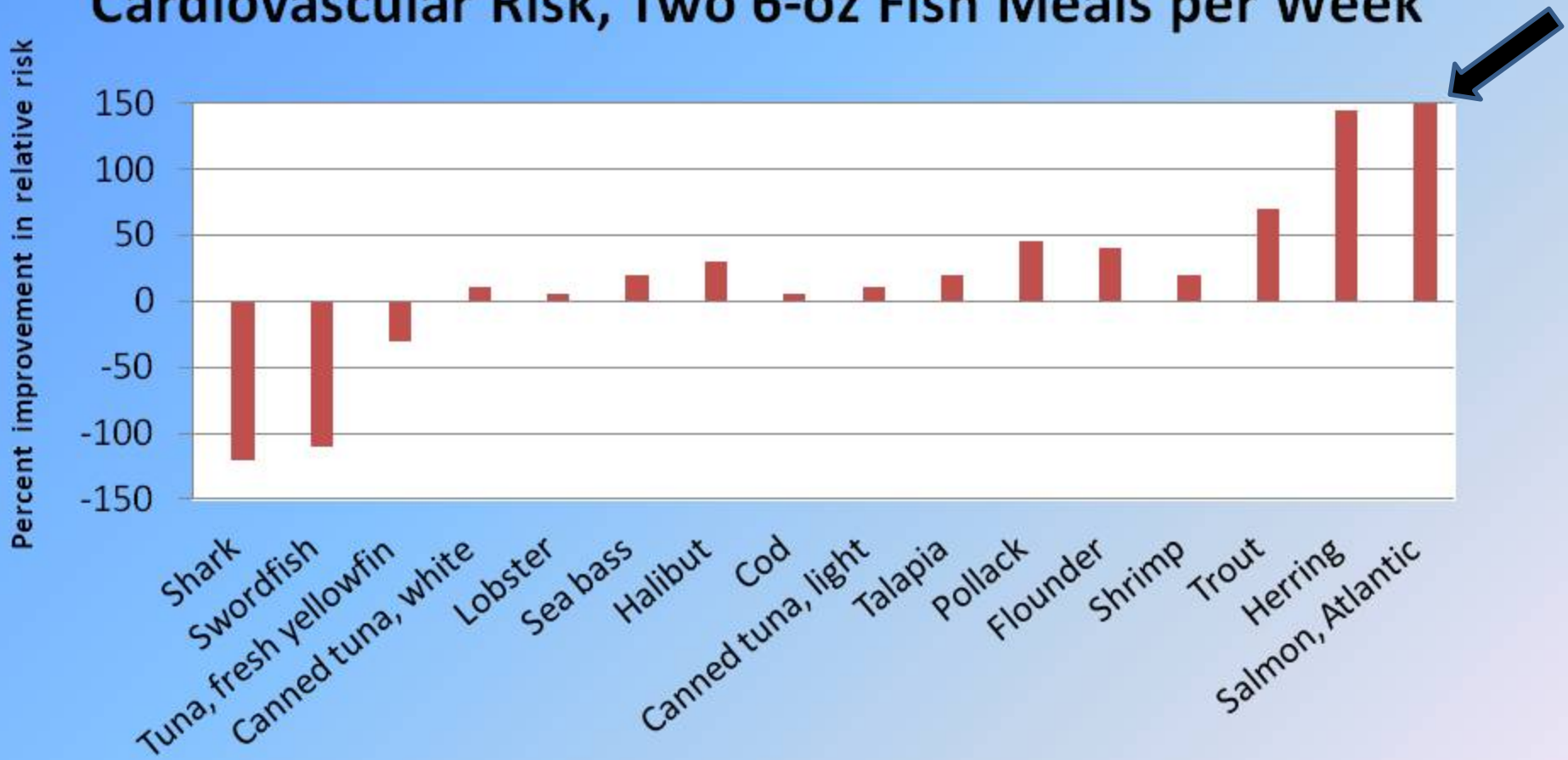


Omega-3 and Mercury Levels of Top 10 Fish and Shellfish in the United States Based on Consumption

	Omega-3 Fatty Acids (grams per 3-oz. serving)	Mean Mercury Level in Parts per Million (ppm)
Canned Tuna (light)	0.17–0.24	0.12
Shrimp	0.29	ND*
Pollack	0.45	0.06
Salmon (fresh, frozen)	1.1–1.9	0.01
Cod	0.15–0.24	0.11
Catfish	0.22–0.3	0.05
Clams	0.25	ND*
Flounder or Sole	0.48	0.05
Crabs	0.27–0.40	0.06
Scallops	0.18–0.34	0.05

* ND – mercury concentration below the Level of Detection (LOD=0.01ppm)

Estimated Net Effect of Mercury and Fish Oils on Cardiovascular Risk, Two 6-oz Fish Meals per Week



EHP 2009; 117: 267-275

Chlorinated Hydrocarbons

	FDA Limits
DDT -TDE and DDE metabolites	5.0 PPM
PCB's	2.0 PPM
Dioxin	1.0 ppt

Adverse Health Effects of Chlorinated Hydrocarbons

Polychlorinated Biphenyls (PCB's)
• Rice Oil Poisoning – Japan 1968 and Taiwan 1979
✓Adults - Chloracne
✓Children – cognitive abnormalities and swollen gums, deformed nails, hyperpigmentation, acne, Decreased IQ when older
• Chronic Studies
✓Michigan and North Carolina Cohorts
o Multiple neurocognitive defects in children
o Short term memory deficits, Decreased IQ
o Decreased muscle tone and activity in infants
• Cancer
Dioxin
• Anti-estrogen effects
• Cancer
• Diabetes
• Immune suppression

Populations at Increased Risk for Mercury/PCB Toxicity

- Children <15
- Pregnant women
- Women of child-bearing age

Populations at Increased Risk for Accumulation of Toxins from Fish

- Urban subsistence fishers
- Certain immigrant populations (e.g., Hmong)

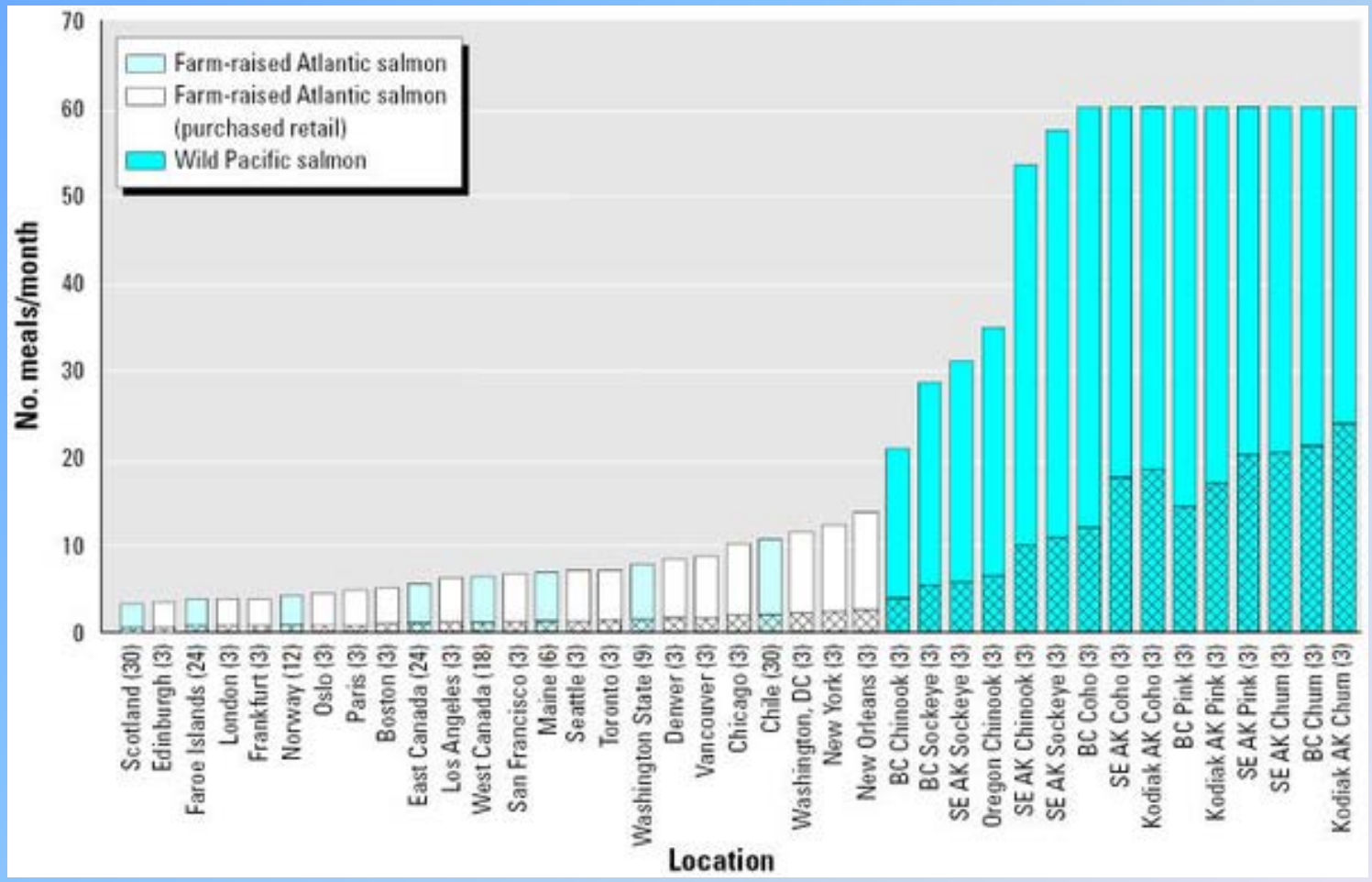
Fish vs. Fish Oil

Fish 340 gm, (Two 6-oz servings per week)	Fish Oil 500-1000 mg EPA & DHA per day
Positive	
Benefits in Epi Studies	Benefits in Epi Studies
Other Nutrients • Vitamin D • Selenium	Absent
Negative	
Contaminants • Chlorinated hydrocarbons • Mercury	Less www.edf.org/page.cfm?tagID=16536

Life Span and Contaminants of Farmed vs. Wild Fish

Farmed Fish	Wild Fish
Life Span	
Atlantic: 1.5-2 years	Pacific: 1-7 years
Concentrations Omega 3/Contaminants	
Depends on feed source • Omega 3 • Chlorinated hydrocarbons • Mercury	

Risk-based Consumption Advice Farm VS. Wild Salmon Based on Dioxin/Dioxin Like Contamination



(EHP 2005; 113: 552-556)

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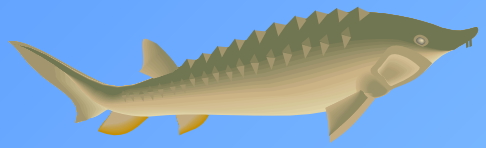
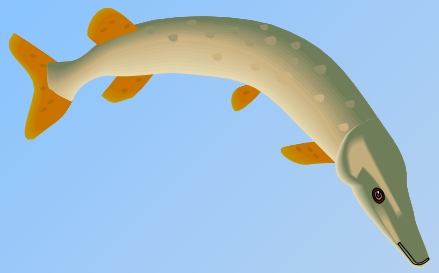


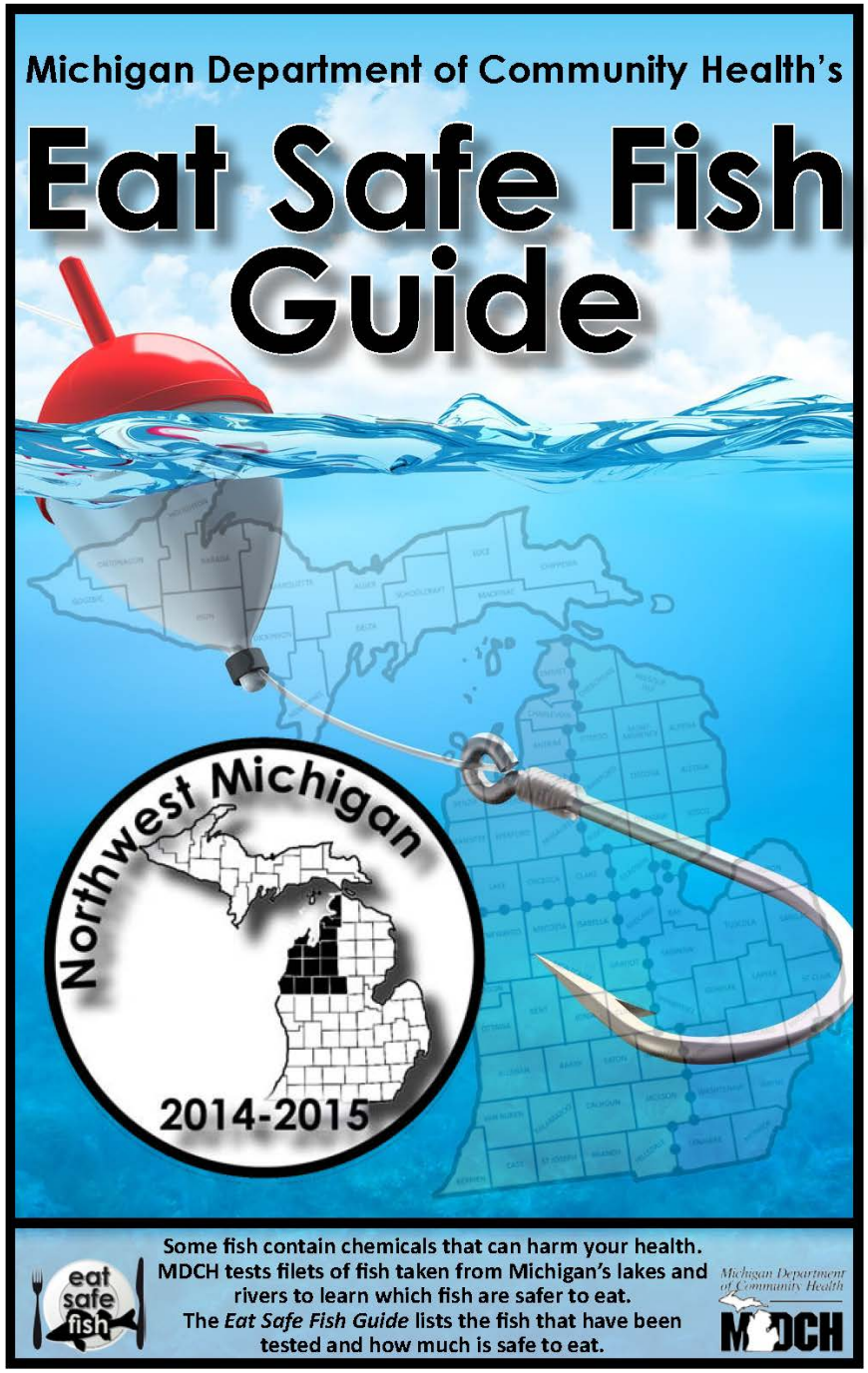


Michigan Fish

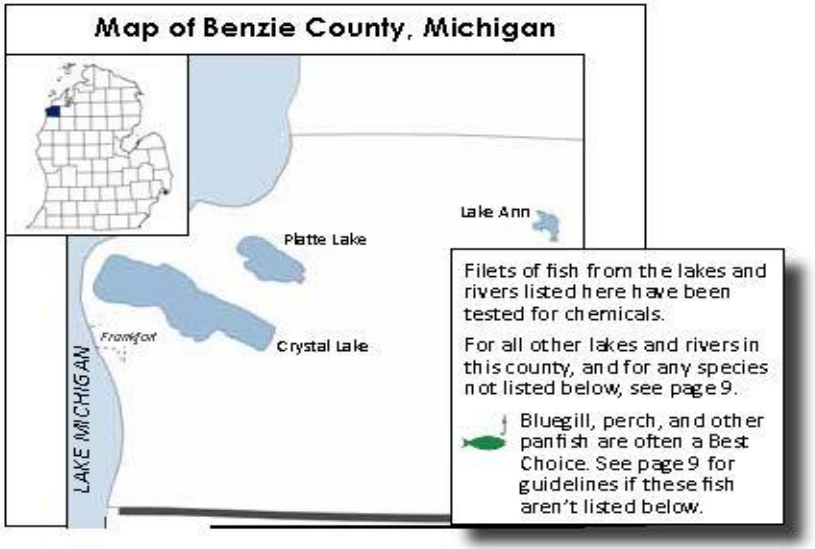
Bass – Large, Rock, Small Mouth	Perch – White, Yellow
Bluegill	Northern Pike
Black Buffalo	Salmon – Chinook, Coho
Brown Bullhead	Gizzard Shad
Carp	Sturgeon
Catfish, Channel	Suckers
Crappie, Black	Trout – Brown, Lake, Rainbow
Freshwater Drum	Turbot
Lake Herring	Walleye
Muskellunge	Lake Whitefish

Benefits & Risks of Store/Restaurant vs. Recreational Fish

Store- or Restaurant-Bought Fish	Recreationally-Caught Fish
Benefits	
Wider Variety	Able to Select Smaller Fish
Able to Select Oily Fish	Able to Select Fishing Locale
FDA standard for PCBs/Mercury	
Risks	
Highest Mercury Fish	Possibly Highly Contaminated


Michigan Department of Community Health's
Eat Safe Fish Guide
Northwest Michigan
2014-2015
Some fish contain chemicals that can harm your health.
MDCH tests filets of fish taken from Michigan's lakes and rivers to learn which fish are safer to eat.
The Eat Safe Fish Guide lists the fish that have been tested and how much is safe to eat.
eat safe fish
Michigan Department of Community Health
MDCH

Benzie County



Crystal Lake

Type of Fish	Chemicals of Concern	Size of Fish (length in inches)	MI Servings per Month*
Lake Trout	PCBs	Under 18"	2x
		Over 18"	1x
Sucker	PCBs	Any	2x
Yellow Perch	Mercury	Any	4

Lake Ann

Type of Fish	Chemicals of Concern	Size of Fish (length in inches)	MI Servings per Month*
Largemouth Bass	Mercury	Under 18"	2
		Over 18"	1
Northern Pike	Mercury	Any	1
Smallmouth Bass	Mercury	Under 18"	2
		Over 18"	1

*Can double serving if not mercury, not limited and follow the 3 C's

Use the Statewide Safe Fish Guidelines ONLY if:

- your lake or river is not listed in the regional *Eat Safe Fish Guide,* OR
- your lake or river is listed in the *Eat Safe Fish Guide*, but the fish species is not listed.

Statewide Safe Fish Guidelines

Type of Fish	Chemical of Concern	Size of Fish (length in inches)	MI Servings per Month*
Black Crappie	Mercury	Any Size	4
Bluegill	Mercury	Any Size	8
Carp	PCBs	Any Size	2
Catfish	PCBs & Mercury	Any Size	4
Largemouth Bass	Mercury	Under 18”	2
		Over 18”	1
Muskellunge	Mercury	Any Size	1
Northern Pike	Mercury	Under 30”	2
		Over 30”	1
Rock Bass	Mercury	Any Size	4
Smallmouth Bass	Mercury	Under 18”	2
		Over 18”	1
Suckers	Mercury	Any Size	8
Sunfish	Mercury	Any Size	8
Walleye	Mercury	Under 20”	2
		Over 20”	1
White Crappie	Mercury	Any Size	4
Yellow Perch	Mercury	Any Size	4

These guidelines are based on the typical amount of chemicals found in fish filets tested from around the state. Some fish may be higher or lower. If any of these fish are listed in the guidelines for the lake or river you are fishing in, use **those** guidelines instead of statewide guidelines. The *MI Servings* recommendation will be more exact for that lake or river because those filets have been tested.

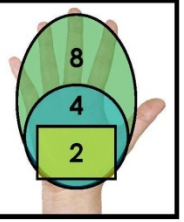
Choosing Safer Fish

The guidelines in the *ESF Guide* are set to be safe for everyone. **This includes children, pregnant or breastfeeding women, and people who have health problems, like cancer or diabetes.**

But the *ESF Guide* is also for healthy adults who want to avoid getting too many chemicals in their bodies. Chemicals like PCBs and dioxins are linked to cancer, diabetes, and other illnesses. Mercury can cause damage to your brain and nerves. MDCH uses chemical limits in the *ESF Guide* that will protect everyone who eats fish.

My Michigan, *MI Serving* Size

- ☑ 8 ounces of fish = size of an adult's hand (large oval)
- ☑ 4 ounces of fish = size of the palm of an adult's hand (small circle)
- ☑ 2 ounces of fish = size of half a palm of an adult's hand (rectangle)



How much is *MI Serving*?

Weight of Person	*MI Serving* Size
45 pounds	2 ounces
90 pounds	4 ounces
180 pounds	8 ounces

Weigh Less?

For every 20 pounds <u>less</u> than the weight listed in the table, subtract 1 ounce of fish.

For example, a 70 pound child's *MI Serving* size is 3 ounces of fish.
90 pounds - 20 pounds = 70 pounds
4 ounces - 1 ounce = a *MI Serving* size of 3 ounces

Weigh More?

For every 20 pounds <u>more</u> than the weight listed in the table, add 1 ounce of fish.

For example, a 110 pound person's *MI Serving* size is 5 ounces of fish.
90 pounds + 20 pounds = 110 pounds
4 ounces + 1 ounce = a *MI Serving* size of 5 ounces

Are you pregnant?

Fish is good for you and your baby! Use your pre-pregnancy weight to find your *MI Serving* size. It is best to avoid eating fish labeled as "Limited" if you're pregnant or breastfeeding.

Get to know the 3Cs

Choose, Clean, Cook

1 Choose

Going fishing?

Use the picture below to choose fish to catch that are generally safer for you and your family to eat. Be sure to check the *Michigan Fish Advisory* to find details about the lakes and rivers where you're fishing.

These fish are lower in chemicals, and are better to eat.

Better to eat

Check the Advisory

These fish are higher in chemicals.

Get a free copy of *Michigan Fish Advisory* by going to www.michigan.gov/eatsafefish or calling 1-800-648-6942.

2 Clean

Cleaning and cooking your fish the right way can remove up to half of the chemicals!

- ☑ Trim off the dark fatty tissue along the backbone, sides and belly. Most of the chemicals are stored in the fat, except for mercury. **Mercury cannot be removed from fish. See page 5 for more information.**
- ☑ Take out all organs, such as the liver and stomach. **Do not eat the organs.**

3 Cook

- ☑ Remove the skin or poke holes in it before cooking. This allows fat to drip off the fish.
- ☑ Cook the fish on a broiler pan or grill so that the fat can drip away through the grates.

Objectives

- Benefits of Eating Fish/Fish oil
- Risks of Eating Fish/Fish oil
- Store Bought vs. Recreational Caught Fish
- Talking to Patients
- Available Resources

Awareness of Health Advisories for Consumers of Great Lakes Sport Fish

- Great Lakes fish eaten by 8.4% (95 CI 7.6-9.2) of adults
- 60% (95 CI 53-68) Michigan residents aware of fish advisory

	OR	95% CI
Men	2.3	1.5 – 3.4
White	4.2	1.9 – 9.1
College Degree	3.1	1.3 – 7.6
Eating ≥24 Great Lakes fish meals per year	2.4	1.4 – 4.3

(*EHP* 1997; 105:1360-1365)

Changes in the amount of fish meals consumed during pregnancy compared to before pregnancy based on receiving information about eating fish during pregnancy; MN, PA, WI

Change	Fish consumption during pregnancy			
	Received sport-caught fish info (61.2%)		Received purchased fish info (77.2%)	
	No (%)	Yes (%)	No (%)	Yes(%)
Did not eat fish or shellfish before or during pregnancy	16.4	7.0	25.3	5.4
Ate more	7.8	6.2	5.5	7.8
Ate the same amount	30.6	28.4	31.8	28.5
Ate less	37.9	53.1	29.7	52.7
Stopped eating	7.3	5.3	7.7	5.6

(Adapted Environ Res 2014; 135:88-94)

Sample Statements & Focus Group Responses

Less Useful

Statement – "If you follow the fish consumption guidelines, you and your baby will get a lot of the health benefits and have very little risk."

Response - "It's long, and I kind of get lost in it."

Useful

Statement – "Fish are the only source of Omega-3 fats, which may be beneficial during fetal brain and eye development."

Response – "Why should I eat [fish]?.....And I feel like this says, "Well, eating this is good for you because of this."

(Adapted Environ Res 2014;135:88-94)

Populations at Increased Risk for Mercury/PCB Toxicity

- Children ‹15
- Pregnant women
- Women of child-bearing age

Populations at Increased Risk for Accumulation of Toxins from Fish

- Urban subsistence fishers
- Certain immigrant populations (e.g., Hmong)

Clinical Activity

1. Brief Dietary History
   www.aafp.org/afp/990315ap/1521.html
   Starting the Conversation -AJPM 2011; 40(1):67-71

2. Encouraging Fish Consumption

3. Advice for Cooking and Fish Selection
   MDCH Consumer Guide – Eat Safe Fish
   http://www.michigan.gov/mdch/0,1607,7-132-54783_54784_54785_58671-256887--,00.html

4. Advice on fish selection if patient or member of patient's family catch and eat fish
   http://www.michigan.gov/mdch/0,4612,7-132-54783_54784_54785_58671-296074--,00.html

General Principles of Preparing Fish Safely

1. Trimming and Cooking
   - Cut off all the fat.
   - Remove or poke holes in the fish's skin before cooking. This will help the fat and chemicals drain off the fish.
   - **Bake, broil or grill** the fish on a rack. Throw away the drippings.
   - Do not eat the guts, head, skin, bones or dark fatty areas.
   - Do not re-use the oil that was used to deep or pan fry fish.

2. Eat fish from different places such as the grocery store, restaurants, rivers and lakes.

3. **Eat smaller, younger fish.** Bigger and older fish have had more time to collect more chemicals in their bodies.

4. Don't eat fatty fish like carp and catfish from polluted waters. Most chemicals (except for mercury) collect in the fat. Buy catfish from your grocery store instead.

5. Mercury stays in the filet of the fish and cannot be cut or cooked away. Use the guides to choose fish that are low in mercury.

Do not eat any of the internal organs of any fish from any water body (example: liver). (MDCH)

Mercury Reference Values

Specimen	Half-Life	Normal	Allowable Workplace Level	Acute Toxicity
Urine	40 days	4µg/L	50µg/L	›300µg/L
Blood	1-2 days	A 4.6 µg/L C 1.9 µg/L	25µg/L	›50µg/L

Objectives

- Benefits of Eating Fish/Fish oil
- Risks of Eating Fish/Fish oil
- Store Bought vs. Recreational Caught Fish
- Talking to Patients
- Available Resources

Choosing Fish from Grocery Store/Restaurant

Eating Fish – *Maximizing Benefits & Minimizing Risks.*

Selected References and Resources for Health Professionals:

- Layie, CJ, Milani RV, Mehra MR, Ventura HO. Omega-3 Polyunsaturated Fatty Acids and Cardiovascular Diseases. J Am Coll Cardiol 2009; 54: 585-594
- De Caterina R. N-3 Fatty Acids in cardiovascular Disease. New Eng J Med 2011; 364: 2439-2450
- Association of Reproductive Health Professionals http://www.arhp.org/publications-and-resources/clinical-proceedings/RHE
- Fish Facts for Health Professional: Methylmercury Exposure and Health Effects and Four web based modules www.fish-facts.org

Healthy Fish Choices - Web based 10 CME credits
http://cores33webs.mede.uic.edu/healthyfishchoices/index.html

Resources for Patients:

EPA Fish Advisories
http://water.epa.gov/scitech/swguidance/fishshellfish/fishadvisories/index.cfm

FDA Mercury in Fish and Shellfish – Consumer Guide
http://www.fda.gov/Food/ResourcesForYou/Consumers/ucm110591.htm

Michigan Dept. of Community Health Eat Safe Fish
http://www.michigan.gov/mdch/0,1607,7-132-54783_54784_54785---,00.html

NRDC Mercury Calculator
http://www.nrdc.org/health/effects/mercury/calculator/start.asp

General Principles of Preparing Fish Safely – Michigan Department of Community Health

1. Trimming and Cooking
   - Cut off all the fat.
   - Remove or poke holes in the fish's skin before cooking. This will help the fat and chemicals drain off the fish.
   - Bake, broil or grill the fish on a rack. Throw away the drippings.
   - Do not eat the guts, head, skin, bones or dark fatty areas.
   - Do not re-use the oil that was used to deep or pan fry fish.
2. Eat fish from different places such as the grocery store, restaurants, rivers and lakes.
3. Eat smaller, younger fish. Bigger and older fish have had more time to collect more chemicals in their bodies.
4. Don't eat fatty fish like carp and catfish from polluted waters. Most chemicals (except for mercury) collect in the fat. Buy catfish from your grocery store instead.
5. Mercury stays in the filet of the fish and cannot be cut or cooked away. Use the guides to choose fish that are low in mercury. Do not eat any of the internal organs of any fish (example: liver).

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Ken Rosenman M.D. – Principal Investigator
Chief; Division of Occupational and Environmental Medicine – Michigan State University
Rosenman@msu.edu

*http://ohiodnr.com/tabid/20816/Default.aspx

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Mercury <u>cannot be removed from fish by trimming and cooking</u>. Use the following information to choose fish and seafood from the grocery store or restaurant.

http://www.oem.msu.edu/userfiles/file/Fish/EatingFishResourcePageSept12.pdf

Mercury Advisory

for Store-bought or Restaurant Fish

Going to the store or out to eat?

Fish are grouped and assigned points based on the amount of mercury in 6 ounces of fish (one meal). Fish with more mercury get more points.

The lower the score, the better the fish is for you to eat. Eat no more than 8 points of fish meals per month...

EAT no more than... **8** points per month

Per Meal 1 Point

Anchovies	Pollock
Catfish (farm-raised)	Salmon* (canned, frozen, fresh)
Crab	Sardines
Crawfish	Scallops
Flatfish (flounder, sole)	Shrimp
Herring*	Squid
Mullet	Tilapia
Oysters	Trout* (freshwater)
Perch* (ocean or freshwater)	Whitefish*

Per Meal 2 Points

Cod	Mahi mahi
Freshwater Drum* (aka Sheepshead)	Snapper
Jack smelt	Tuna (canned light)

Per Meal 4 Points

Bass* (sea, striped, rockfish)	Scorpion fish
Bluefish	Tuna (Albacore, canned white)
Halibut	Tuna (fresh, frozen)
Lobster	Weakfish (sea trout)
Sablefish	

Per Meal 8 Points

Grouper	Marlin
Mackerel	Orange Roughy

Do not eat these fish:
Shark, Swordfish, Tilefish, King Mackerel

- This chart is based on FDA fish fillet mercury data.
- Advice to eat no more than 8 points is good for everyone, including pregnant women & children.

* If you catch these fish in Michigan, please see the *Michigan Fish Advisory* at www.michigan.gov/eatsafefish.

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Summary

- To maximize the benefits of fish ingestion avoid certain types of fish.
- Children and women of child bearing age, in particular, should avoid/limit ingestion of certain types of fish.
- Availability of consumer guides on fish selection and preparation.

MSU/EPA Fish Group

CHM/Department of Medicine	COM
Gary Ferenchick, M.D.	Kari Hortos, D.O.
Kenneth D. Rosenman, M.D.	
CHM/OMERAD	
Deborah Sleight, Ph.D.	
David Solomon, Ph.D. (Also Dept Med)	

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