Balancing the Scales II: Incorporating Fish Consumption Benefits into the Fish Advisory Process

November 1, 2007

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Office of Environmental Health Hazard Assessment
California Environmental Protection Agency
FDA to revise warning on mercury in fish
Dangers of tuna, particularly albacore, may get special attention

Jane Kay, Chronicle Environment Writer
Sunday, February 29, 2004
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URL: sfgate.com/cgi-bin/article.cgi?file=/c/a/2004/02/29/M9Q5AUA21.DTL

As the U.S. Food and Drug Administration prepares to issue a new advisory to protect consumers from unsafe levels of mercury in fish, it is scrutinizing one of the nation's favorite meals -- the tuna sandwich.
Eatsmart

BY JEAN CARPER

Reuters Health Information (2002-02-21): Low fish consumption in pregnancy linked to preterm delivery

Epidemiology

Low fish consumption in pregnancy linked to preterm delivery

Last Updated: 2002-02-21 19:01:53 EST (Reuters Health)

NEW YORK (Reuters Health) - Results of a population-based study by Danish researchers reported in the February 23rd issue of the British Medical Journal indicate that pregnant women who consume low amounts of fish during early pregnancy are at increased risk for preterm delivery and delivering low birthweight infants.

Many decades have found that eating fish reduces the risk of stroke and heart attack. What is surprising about this one is that it shows how little fish -- one to three meals a month of virtually any fish or shellfish, like salmon sushi, tuna on rice, broiled lobster or even McDonald's Fish Sticks-- appears to produce the maximum benefit you get.

"But in our study, we found a threshold. Further fish did not provide further benefit," said Dr. Martha Davi, a preventive-medicine specialist at Northwestern University Medical School in Chicago who led a 1997 study of fish and stroke risk in 1,800 employees of a Chicago electric company. "Everyone wonders: Is it some other component of fish, some combination, or what?"

Quick to say that they thought it would be irresponsible to suggest that anyone eat only deep-fried fish, like that found in fish sticks and fast-food restaurants.

They would still get the benefits of the fish, Dr. He said, but the fried breading is full of salt and trans fatty acids, which have been associated with heart disease.
WHAT ARE WE SUPPOSED TO DO?

WILL IT BE THE MAD COW BEEF, THE HORMONE CHICKEN, OR THE MERCURY FISH?

UM... I THINK I'LL GO WITH THE VEGETARIAN DISH.

PESTICIDE OR HEPATITIS?

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Goals:

- Review the adverse health effects of methylmercury
- Review the benefits of fish and fish oil consumption
- Review national fish consumption rates and recommendations
- Show how benefits from fish can be incorporated into the fish advisory process
The Risks of Fish Consumption
MERCURY FACTS

- Fish are the major source of exposure
- Almost all fish contain mercury
- Most mercury in fish is “methylmercury” (MeHg)
- Methylmercury is more toxic than mercury
- Mercury in our environment comes from a combination of natural and man-made activities
Historic Gold and Mercury Mines in California

Source for Gold and Mercury Mines data:
Bioaccumulation of mercury in fish

Fish at top of food web (predators) have the most mercury in their flesh
METHYLMERCURY TOXICITY IN ADULTS

- Observed in major poisoning events in Japan and Iraq in the 1950s-1970s
- Target organ – Brain
- Early signs & symptoms – numbness and tingling of the mouth, hands and feet
- At very high doses can progress to tremors, loss of gait coordination, slurred speech, and blindness
- Only a few possible cases of adult MeHg toxicity from fish consumption reported in the U.S.
How can children be affected by methylmercury?

Placental transfer

MeHg

Neuro-developmental Effects
METHYLMERCURY IN THE FETUS AND CHILDREN

- Nervous system is highly sensitive while developing.
- Babies exposed to very high levels during their mother’s pregnancy have been affected even without symptoms in mothers.
What is considered a safe level of methylmercury exposure?

- Significant research to identify lowest dose of methylmercury with adverse effects
- Large studies on children in seafood-consuming populations
- Faroe Islands, Seychelles Islands, New Zealand
FAROE ISLANDS
1990s

- Marine mammals and fish
- No maternal effects
- Subtle effects in highest exposed children
- Differences in attention, fine-motor function, visual-spatial abilities, and verbal memory
- Required sophisticated testing to recognize
- Effects occurred at exposures about 50 times U.S. average
How are these data used to set exposure limits?

- USEPA sets oral reference dose (RfD)
- Estimate of daily exposure likely to be without significant risk of adverse effects during a lifetime
- Incorporates uncertainty factors to account for incomplete data and individual variability (for MeHg, UF = 10)
- Hazard Quotient (HQ) = Exposure/RfD
- Methylmercury RfD was developed to protect young children and women who are pregnant or could become pregnant
Methylmercury Exposure in U.S. Women of Childbearing Age

Populations at Higher Risk

- About 16.5% of Asian, Pacific Islander, Native American, and multiracial women of childbearing age have blood mercury concentrations that correspond to intakes above the RfD.

Women Who Might Become Pregnant, Women Who are Pregnant, Nursing Mothers, Young Children

Eat up to 12 ounces (cooked) per week of a variety of fish that are lower in mercury. You may eat up to 6 ounces (one average meal) of albacore tuna per week. In the absence of local advice, you can eat up to 6 ounces (one average meal) per week of fish you catch from local waters, but don’t consume any other fish during that week. Do not eat shark, swordfish, King mackerel, or tilefish.
Joint FDA and U.S. EPA National Advice for Mercury in Fish

Women Who Might Become Pregnant, Women Who are Pregnant, Nursing Mothers, Young Children

Five of the most commonly eaten fish that are low in mercury are:

Shrimp, canned light tuna, salmon, pollock, and catfish
The Benefits of Fish Consumption
FATTY ACIDS

Saturated
Beef
Dairy

Monounsaturated
Olive Oil
Canola Oil

Polyunsaturated

Omega-6
Safflower Oil,
Corn Oil,
Peanuts,
Soybean

Omega-3
Fish, Walnuts,
Flaxseed,
Soybean,
Canola Oil

Trans
Hydrogenated Oils
Beef, Dairy

The current recommended ratio of omega-6 to omega-3 fatty acids is about 5-10:1

(Adapted from DeFilippis and Sperling, 2006)
Major Dietary Omega-3 Fatty Acids

- alpha-Linolenic acid (ALA)
  \(18:3n-3\)
- Eicosapentaenoic acid (EPA)
  \(20:5n-3\)
- Docosahexaenoic acid (DHA)
  \(22:6n-3\)
Omega-6 Fatty Acids

- Corn Oil
- Soybean Oil
- Safflower Oil
- Peanuts

Omega-3 Fatty Acids

- Flaxseed Oil
- Walnuts
- Canola

Omega-6 Derived Eicosanoids
- LA (18:2n-6)
- AA (20:4n-6)

Omega-3 Derived Eicosanoids
- ALA (18:3n-3)
- EPA (20:5n-3)
- DHA (22:6n-3)

**Competitive Inhibition**

- Fish Oil
- Breast Milk

Conversion: <5%

(Adapted from Robinson and Stone, 2006; Parker et al., 2006)
<table>
<thead>
<tr>
<th>Outcome</th>
<th>Clinical Effect</th>
<th>Strength of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHD Mortality</td>
<td>≈35% decrease</td>
<td>Strong</td>
</tr>
<tr>
<td>CHD death</td>
<td>≈50% decrease</td>
<td>Strong</td>
</tr>
<tr>
<td>Sudden death*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ischemic Stroke</td>
<td>≈30% decrease</td>
<td>Moderate</td>
</tr>
<tr>
<td>Nonfatal CHD</td>
<td>Modest benefit?</td>
<td>Equivocal</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>≈30%+ decrease</td>
<td>Limited</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>≈30% decrease</td>
<td>Limited</td>
</tr>
</tbody>
</table>

*Results in a predicted decrease in total mortality in a population of about 15% - similar to statins.

(Adapted from Mozaffarian and Rimm, 2006)
<table>
<thead>
<tr>
<th>Emerging Evidence for Effects of Consumption of Fish or Fish Oil on Other Health Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reduced preterm birth</strong></td>
</tr>
<tr>
<td><strong>Improved brain function, motor and visual benefits to infants and children</strong></td>
</tr>
<tr>
<td><strong>Significantly reduced rates of age-related cognitive decline and dementia, including Alzheimer’s Disease</strong></td>
</tr>
<tr>
<td><strong>Sharply reduced incidence of early age-related macular degeneration and late AMD</strong></td>
</tr>
<tr>
<td><strong>Reduced need for traditional anti-inflammatory drugs in treatment of rheumatoid arthritis</strong></td>
</tr>
<tr>
<td><strong>Treatment or prevention of depression and other mood disorders, including postpartum depression</strong></td>
</tr>
</tbody>
</table>
Potential Mechanisms of the Benefits of Fish Consumption

- Increased consumption of omega-3 fatty acids
- Decreased dietary omega-6 to omega-3 fatty acid ratio
- Replacement of high (saturated) fat protein sources with fish
- Other nutritive or non-nutritive factors that may covary with fish consumption
U.S. Fish Consumption Patterns

Recommended minimum fish consumption (e.g., AHA, ADA):
24 g/day (6 ounces/week)

NHANES 1999-2002 average fish consumption: 14 g/day

Highest average fish consumption rate:
40-59 year old males
21.6 g/day

Average portion size:
~3 ounces (89 g)
Recommended vs. Actual DHA+EPA Intakes

DHA + EPA Intake (mg/day)

Range of Recommended Intakes

Mean Intake of US Women Aged 16-49¹

¹IOM, 2007
Of top 10 most consumed species, only salmon is a rich source of EPA+DHA (~2000 mg per 3 ounce serving)

Except for salmon, the “low mercury” fish choices that FDA and U.S. EPA recommend for women of childbearing age and children are poor sources of EPA+DHA
Recommendations to Encourage Seafood Consumption*

Dietary Guidelines Advisory Committee Report (DHHS and USDA):

“Consumption of two servings (approximately eight ounces) per week of fish high in EPA and DHA is associated with reduced risk of both sudden death and heart disease death in adults. To benefit from the potential cardioprotective effects of EPA and DHA, the weekly consumption of two serving of fish, particularly fish rich in EPA and DHA, is suggested.”

*Noted in IOM, 2007
Recommendations to Encourage Seafood Consumption*

American Heart Association:

Patients without documented heart disease: Eat a variety of (preferably fatty) fish at least twice a week.

Patients with documented heart disease: Consume about 1 g of EPA+DHA per day, preferably from fatty fish. EPA+DHA supplements could be considered in consultation with the physician.

Patients who need to lower triglycerides: 2 to 4 grams of EPA+DHA per day provided as capsules under a physician’s care.

*Noted in IOM, 2007
Recommendations to Encourage Seafood Consumption*

**USDA’s My Pyramid:**
*Eat fish rich in omega-3 fatty acids, such as salmon, trout, and herring, more often*

**American Diabetes Association:**
*Eat 2-3 servings of fish per week to lower the risk of diabetes and protect your heart and blood vessels*

*Noted in IOM, 2007*
Recommendations to Encourage Seafood Consumption

United Kingdom Scientific Advisory Committee on Nutrition:

*Eat two servings of fish per week, one of which should be oily, to provide approximately 450 mg/day of EPA+DHA*
Recommendations to Encourage Seafood Consumption

National Healthy Mothers, Healthy Babies Coalition:

Pregnant, breastfeeding and postpartum women are recommended to consume a minimum of 12 ounces of seafood per week (salmon, tuna, sardines), or DHA-fortified eggs. Six ounces of the recommended fish per week can come from albacore tuna.
Summary of Fish Consumption Recommendations

- **Toxicology Camp:**
  
  Do not exceed consumption limits designed to minimize HQ

- **Nutrition/Physician Camp:**
  
  Increase fish and/or omega-3 fatty acid consumption with little regard for contaminants
Fish Consumption

Contaminant Risk

Omega-3 Benefit

Contaminant Risk

Omega-3 Benefit

Contaminant Risk

Fish Consumption
Efforts to Balance Benefits and Risks of Fish Consumption
Seafood Choices:
Balancing Benefits and Risks

Institute of Medicine (IOM)
2007

Committee on Nutrient Relationships in Seafood:
Selections to Balance Benefits and Risks

Malden C. Nesheim and Ann L. Yaktine, Editors
Balancing the Benefits and Risks to Arrive at Guidance for Healthy Consumption:

Females who are or may become pregnant or who are breastfeeding, and children up to age 12:

- A reasonable intake would be two 3-ounce (cooked) servings but can safely consume 12 ounces per week.
- Can consume up to 6 ounces of white (albacore) tuna per week.
- Should avoid large predatory fish such as shark, swordfish, tilefish, or King mackerel.
Balancing the Benefits and Risks to Arrive at Guidance for Healthy Consumption:

Adolescent males, adult males, and females who will not become pregnant:

- May lower their risk for heart disease by consuming seafood regularly, e.g., two 3-ounce servings per week
- Those who eat more than two servings a week should choose a variety of types of seafood to reduce the risk for exposure to contaminants from a single source
DHA+EPA Intakes and HQs Resulting From Theoretical Fish Meals
Theoretical Meals – Five Most Commonly Consumed Commercial Seafood Species Based on Average Fish Consumption By Women 15-45 Years in the U.S.:

<table>
<thead>
<tr>
<th>IF YOU ATE 13.4 g/day of:</th>
<th>EPA+DHA (mg/day)**</th>
<th>HQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canned light tuna*</td>
<td>36</td>
<td>0.23</td>
</tr>
<tr>
<td>Canned Albacore tuna</td>
<td>115</td>
<td>0.68</td>
</tr>
<tr>
<td>Shrimp*</td>
<td>42</td>
<td>0</td>
</tr>
<tr>
<td><strong>Salmon</strong></td>
<td><strong>288</strong></td>
<td><strong>0.03</strong></td>
</tr>
<tr>
<td>Pollock*</td>
<td>63</td>
<td>0.10</td>
</tr>
<tr>
<td>Catfish*</td>
<td>24</td>
<td>0.12</td>
</tr>
</tbody>
</table>

*Low fat fish

**Calculated from USDA Nutrient Data Laboratory
### Theoretical Meals – Five Most Commonly Consumed Commercial Seafood Species

#### AHA Recommendation
At least two 3-oz meals (preferably fatty) per week*:

<table>
<thead>
<tr>
<th>IF YOU ATE:</th>
<th>EPA+DHA (mg/day)</th>
<th>HQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albacore Tuna/Farmed salmon</td>
<td>387</td>
<td>0.64</td>
</tr>
<tr>
<td>Albacore tuna/Albacore tuna</td>
<td>207</td>
<td>1.20</td>
</tr>
<tr>
<td>Light tuna**/Light tuna**</td>
<td>65</td>
<td>0.4</td>
</tr>
<tr>
<td>Albacore tuna/Farmed channel catfish**</td>
<td>126</td>
<td>0.71</td>
</tr>
<tr>
<td>Light tuna**/Pollock**</td>
<td>90</td>
<td>0.29</td>
</tr>
<tr>
<td>Shrimp**/Light tuna**</td>
<td>71</td>
<td>0.20</td>
</tr>
<tr>
<td>Light tuna**/Farmed channel catfish**</td>
<td>55</td>
<td>0.31</td>
</tr>
</tbody>
</table>

*~1.7 times higher than national average consumption rate

**Low fat fish
Theoretical Meals – Five Commonly Consumed Commercial Seafood Species Based on Maximum Recommended Fish Consumption By FDA for Pregnant and Nursing Women:

<table>
<thead>
<tr>
<th>IF YOU ATE 6 ounces per week each (12 ounces total)* of:</th>
<th>EPA+DHA (mg/day)</th>
<th>HQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light tuna**/Light tuna**</td>
<td>131</td>
<td>0.81</td>
</tr>
<tr>
<td>Light tuna**/Shrimp**</td>
<td>142</td>
<td>0.40</td>
</tr>
<tr>
<td>Light tuna**/Atlantic cod**</td>
<td>104</td>
<td>0.81</td>
</tr>
<tr>
<td>Light tuna**/Pollock**</td>
<td>179</td>
<td>0.58</td>
</tr>
<tr>
<td>Light tuna**/Farmed salmon</td>
<td>587</td>
<td>0.46</td>
</tr>
<tr>
<td>Canned albacore tuna/Light tuna**</td>
<td>275</td>
<td>1.61</td>
</tr>
<tr>
<td>Canned albacore tuna/Shrimp**</td>
<td>286</td>
<td>1.21</td>
</tr>
<tr>
<td>Canned albacore tuna/Cod**</td>
<td>276</td>
<td>1.6</td>
</tr>
<tr>
<td>Canned albacore tuna/Pollock**</td>
<td>323</td>
<td>1.39</td>
</tr>
<tr>
<td>Canned albacore tuna/Farmed salmon</td>
<td>731</td>
<td>1.27</td>
</tr>
</tbody>
</table>

*3.5 times higher than national average consumption rate **Low fat fish
Theoretical Meals –
Women of Childbearing Age and Children are Recommended **NOT TO CONSUME** These Commercial Fish Species
Two 3-oz meals per week*:

<table>
<thead>
<tr>
<th>IF YOU ATE:</th>
<th>EPA+DHA (mg/day)**</th>
<th>HQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swordfish</td>
<td>197</td>
<td>4.18</td>
</tr>
<tr>
<td>Shark</td>
<td>253</td>
<td>4.23</td>
</tr>
<tr>
<td>King Mackerel</td>
<td>96</td>
<td>3.13</td>
</tr>
<tr>
<td>Tilefish</td>
<td>217</td>
<td>6.21</td>
</tr>
</tbody>
</table>

*~1.7 times higher than national average consumption rate

**Calculated from USDA Nutrient Data Laboratory
The Bottom Line

- Substantial evidence exists that fish consumption has profound health benefits, including decreased mortality.

- The U.S. consumer is eating, on average, only about \( \frac{1}{2} \) the recommended intake of fish and, because of the species of fish that they choose to eat, only about \( \frac{1}{4} \) of the recommended EPA+DHA intake.

- Fish advisories need to incorporate the benefits of fish and specifically evaluate DHA+EPA content of individual fish species.
How can benefits from fish be incorporated into the advisory process?
Previous Advisories

- Multiple advice frequency categories in stoplight colors (red, orange, yellow, and green), including 1 meal/month
- No effort to identify high omega-3 fatty acid fish
- “Best Choices” and “Good Choices” identified solely by contaminant concentration
- Goal to maintain the lowest reasonable HQ
Examples of Prior Advisory Formats

California Environmental Protection Agency
Office of Environmental Health Hazard Assessment

PUBLIC HEALTH ADVISORY
Fish are nutritious and should be part of a healthy, balanced diet. As with many other kinds of food, however, it is possible to consume fish in moderation, particularly when chemical contaminants such as methylmercury are present in fish at concentrations that pose a concern for public health. OEHHHA provides the following consumption advice to the public so that people can continue to eat fish from these locations without putting their health at risk.

FISH AND SHELLFISH CONSUMPTION GUIDELINES FOR CLEAR LAKE AND CACHE CREEK

Women of childbearing age and children 17 years and younger may eat:

Once a month
Largemouth bass, smeltmouth bass, channel catfish, white catfish, brown bullhead, green sunfish, black crappie, white crappie, Sacramento blackfish.

Once a week
Bluegill, lunker, carp, trout, or crayfish

Women beyond childbearing age and men may eat:

Once a week
Largemouth bass, smeltmouth bass, channel catfish, white catfish, brown bullhead, green sunfish, black crappie, white crappie, Sacramento blackfish.

3 times a week
Bluegill, lunker, carp, trout, or crayfish

FISH AND SHELLFISH CONSUMPTION GUIDELINES FOR BEAR CREEK

Do Not Eat
No one should eat any fish or shellfish from Bear Creek

MANY OTHER WATER BODIES ARE KNOWN OR SUSPECTED TO HAVE ELEVATED MERCURY LEVELS. Guidelines are not already in place for the water body where you fish, women of childbearing age and children 17 and younger may eat up to one sportfish meal per week, and women beyond childbearing age and men may eat up to three sportfish meals per week from any location.

EAT SMALLER FISH OF LEGAL SIZE. Fish accumulate mercury as they grow.

DO NOT COMBINE FISH CONSUMPTION ADVICE. If you eat multiple species or saltfish from more than one area, the recommended guidelines for different species and locations should not be combined.

For example, if you eat a meal of fish from the one meal per week category, you should not eat another fish species containing mercury for at least one month.

SERVE SMALLER MEALS TO CHILDREN. Meal size is assumed to be 8 ounces for a 100-pound adult. If you weigh more or less than 100 pounds, add or subtract one ounce to your meal size, respectively, for each 20-pound difference in body weight.

CONSIDER YOUR TOTAL FISH CONSUMPTION. Fish from many sources (including stress and crustaceans) can contain elevated levels of mercury and other contaminants. IF YOU EAT FISH WITH LOWER CONTAMINANT LEVELS (INCLUDING COMMERCIAL FISH) YOU CAN SAFELY EAT MORE FISH. The American Heart Association recommends that healthy adults eat at least two servings of fish per week. Shrimp, king crab, scallops, flounder, catfish, wild salmon, oysters, tilapia, flounder, and sole generally contain some of the least levels of mercury.

For more information, contact OEHHHA at 510-622-3170 or visit www.oehha.ca.gov

SAFE EATING GUIDELINES
For Women of Childbearing Age, Pregnant and Breastfeeding Women, and Children 17 Years and Younger

BASED ON MERCURY IN FISH FROM THE SAN JOAQUIN RIVER FROM THE PORT OF STOCKTON TO FRANT DAM

BEST CHOICES
Eat up to 4 servings* a week
(Total of 12 ounces cooked fish a week)

Best: Bluegill or other sunfish, or crayfish

GOOD CHOICES
Eat up to 2 servings* a week
(Total of 6 ounces cooked fish a week)

Catfish, crappie, carp, or sucker

AVOID
Do Not Eat
Largemouth, smeltmouth, or spotted bass

Follow the “No Consumption” warnings where signs are posted for the Port of Stockton area

* The recommended serving size for adults is three ounces of cooked fish (four ounces prior to cooking)

For more information, call (510) 622-3170 or visit www.oehha.ca.gov (Click on “Fish”)
Advisory Changes

- Drop one-meal-a-month category
- Identify fish species with high and low omega-3 fatty acid content in advisories
  - Analyze local species for DHA + EPA
- Combine “Best Choices” and “Good Choices”
- HQ goal is 1 to encompass benefits
Proposed Advisory Format

DRAFT SAFE EATING GUIDELINES
For Women of Childbearing Age,
Pregnant or Breastfeeding Women, and
Children 17 Years and Younger

BASED ON MERCURY* IN FISH FROM
"FAKE LAKE"

GOOD CHOICES

<table>
<thead>
<tr>
<th>Bluegill or other sunfish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eat up to 2 servings** a week (Total of 12 ounces cooked fish a week)</td>
</tr>
<tr>
<td>OR</td>
</tr>
<tr>
<td>Eat up to 1 serving** a week (Total of 6 ounces cooked fish a week)</td>
</tr>
<tr>
<td>Rainbow trout*** under 16 inches in length</td>
</tr>
</tbody>
</table>

DO NOT EAT

Largemouth, smallmouth, or spotted bass; catfish; rainbow trout over 16 inches in length; or Chinook salmon

*Mercury cannot be removed from fish by any method including soaking, cooking, or cleaning

**The serving size for adults is based on six ounces of cooked fish (eight ounces prior to cooking), which is about the size of two decks of cards. Smaller children should eat about half as much as adults.

***Bolded fish in the “good choices” category are considered “heart healthy” and may provide more of other health benefits than fish that are not bolded. These fish may provide a more healthy choice as long as they are not eaten in more than the recommended amounts.
New Risk/Benefit Paradigm for Fish Consumption Advisories

- Addresses consumers’ desire to delineate “good fish/bad fish”
- Attempts to increase benefits while maintaining acceptable risk
- Allows us to coordinate our advice with that provided by the nutrition and medical communities
### Theoretical Meals – Local Sport Fish

#### AHA Recommendation

At least two 3-oz meals (preferably fatty) per week:

<table>
<thead>
<tr>
<th>IF YOU ATE:</th>
<th>EPA+DHA (mg/day)</th>
<th>HQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wild salmon (river)/Rainbow trout (planted)</td>
<td>339</td>
<td>0.21</td>
</tr>
<tr>
<td>Wild salmon (river)/Rainbow trout (resident)</td>
<td>339</td>
<td>0.66</td>
</tr>
<tr>
<td>Wild salmon (Trinity)/Rainbow trout (Trinity)</td>
<td>339</td>
<td>1.14</td>
</tr>
<tr>
<td>Striped bass*/Rainbow trout (resident)</td>
<td>234</td>
<td>1.43</td>
</tr>
<tr>
<td>Striped bass*/Rainbow trout (planted)</td>
<td>234</td>
<td>1.09</td>
</tr>
<tr>
<td>LM bass (S. Delta)/Rainbow trout (planted)</td>
<td>210</td>
<td>0.75</td>
</tr>
<tr>
<td>Sunfish**/Wild catfish**</td>
<td>45</td>
<td>1.11</td>
</tr>
</tbody>
</table>

*Maximum Hg levels of <0.469 ppm

**Low fat fish
For most of the general population, balancing benefits and risks associated with seafood consumption can be achieved by selecting seafood from available options in quantities that fall within accepted dietary guidelines.
Conclusions of the IOM Report:

For the specific subgroups identified, making such selections requires that consumers are aware of both nutrients and contaminants in the seafood available and are provided useful information on both benefits and risks to inform their choices.
Nutrient Profile of Fish

High EPA+ DHA fish (≥500 mg per 3 oz serving):
Anchovy, mackerel (not King*), pompano, salmon, sardines, bass, swordfish*, shark*, tilefish*, trout, Pacific oysters, albacore tuna, bluefin tuna, striped bass, black bass, sea bass

Low EPA+DHA fish (<500 mg per 3 oz serving):
Carp, catfish, clams, conches, cod, crabs, croaker, flounder, frogs, haddock, lobster, mullet, octopuses/squid, orange roughy, perch, pike, pollock, porgy, scallops, shrimp, snapper, light tuna, and whiting

*Not recommended for consumption by women of childbearing age and children
High Omega-3, Lower Mercury Seafood for All Populations:

- Salmon (farmed or wild)
- Herring
- Anchovies
- Mackerel (not King)
- Oysters (wild)
- Trout
- Sardines
- Canned albacore tuna (no more than 6 ounces per week for women of childbearing age and children)
Additional High Omega-3, Moderate Mercury Seafood for Women Beyond Childbearing Age and Men:

- Largemouth, smallmouth or spotted bass (black bass)*
- Striped bass*
- Seabass
- Bluefin or albacore tuna steaks

*Follow local advisories for this population group