Environmental Health Technical Brief

Eating Fish: Risks and Benefits

Environmental & Occupational Health Assessment Program

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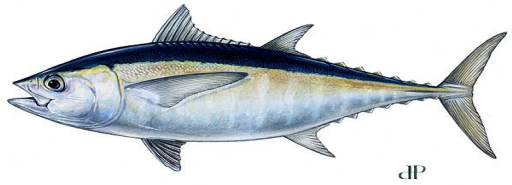
Background



In recent years, CT DPH has expanded its fish advisory program to include fish bought in supermarkets and fish stores. With this major expansion of our advisory program to cover a food source utilized by a wide portion of Connecticut's population, we had to be careful not to scare people away from eating fish. Reduced fish consumption could lead to the possible loss of the health benefits of omega-3 fatty acids that are found at high levels in some commercially available fish species. There is mounting evidence that omega-3s have a positive effect on neurobehavioral development in children born to mothers who ate fish high in omega-3s during pregnancy (Oken 2005). Omega-3s have also been associated with cardiovascular health improvements and a decreased risk of heart attacks (Mozaffarian and Rimm 2006).

At the same time there is growing consensus that eating fish high in mercury can result in developmental delays in children born to mothers who ate contaminated fish during pregnancy (Grandjean et al. 1997; NRC, 2000; Oken, 2005). These effects are the basis for CT DPH's commercial fish advice (http://www.ct.gov/dph/fish) and the 2004 FDA-EPA fish advisory (USFDA, 2004). There is also evidence that excessive mercury ingestion can lead to adverse cardiovascular effects in adults (Guallar et al. 2002).

There have been conflicting reports in the press, claiming that fish consumption advisories are not called for and that pregnant women should ignore federal and state advice and eat more fish in general (Healthy Mothers – Healthy Babies 2007). The funding and controversy around some of these studies and claims are discussed in an article in Science (Couzins 2007). Even some government sources have concluded that fish consumption "benefits far outweigh the risks" (NOAA 2006). However, these have not been careful risk/benefit analyses and instead have looked at health outcomes in people consuming fish without paying attention to which kind of fish they ate. The more careful studies have shown that the type of fish eaten really matters because fish vary greatly in their levels of mercury and omega-3 fatty acids (Mahaffey et al. 2007; Stern et al. 2007).

CT DPH Analysis

In an effort to answer questions raised by these conflicting messages, CT DPH conducted a quantitative analysis of the risks and benefits of fish consumption. (Ginsberg & Toal 2009). In this analysis we looked

at adverse impacts of mercury, and positive effects of omega-3s. It is interesting and useful that these two fish constituents impact similar outcomes (neuro-development and cardiovascular). This allowed for a direct analysis of the counteracting effects of mercury and omega-3s on similar endpoints.

Based on epidemiology studies, a mathematical model was built for the positive and negative impact on a cardiovascular endpoint (cardiovascular mortality or first heart attack-CHD) and neurodevelopment in infants (evaluation of visual recognition memory – VRM). The VRM study looked at mercury and omega-3 consumption in the mothers of infants that were tested (Oken et al. 2005, 2008), while the CHD studies looked at omega-3 consumption from adult subjects (Mozzafarian and Rimm 2006; Guallar et al. 2002).

As part of this analysis, CT DPH used published levels of omega-3s and mercury in some of the most common fish species sold in supermarkets:

Table 1

The following fish concentration data were used in the risk benefit model for CHD & VRM outcomes in relation to specific fish species:

Fish species	Omega-3[a] (mg/6 oz)	MeHg[b] (µg/g)
Cod, Atlantic	269	0.11
Flounder/sole	852	0.05
Halibut	1,398	0.26
Herring, Atlantic	3,424	0.04
Lobster	1,129	0.24
Pollack	922	0.06
Salmon, Atlantic, farmed	3,658	0.014
Sea bass	1,295	0.27
Shark	1,170	0.99
Shrimp	536	0.01
Swordfish	1,392	0.97
Tilapia	240	0.01
Trout	1,744	0.03
Tuna, canned, light	425	0.12
Tuna, canned, white	1,462	0.35
Tuna, fresh, yellowfin	474	0.325

[a]Omega-3 FA represents the sum of EPA and DHA. Shark data from Mozaffarian and Rimm (2006); other data from USDA (2005), [b]MeHg data from FDA (2006); data for salmon reported as fresh/frozen and not distinguished according to source.

The results of the CT DPH analysis are presented in Figures 1 and 2. Positive readings to the right side of these figures, indicate species where the positive effects of omega 3s outweigh the negative effects of mercury. As you can see there are a number of species that come out on this "good" side, especially in figure 2 for cardiovascular health. Salmon is especially beneficial for both CHD and VRM.

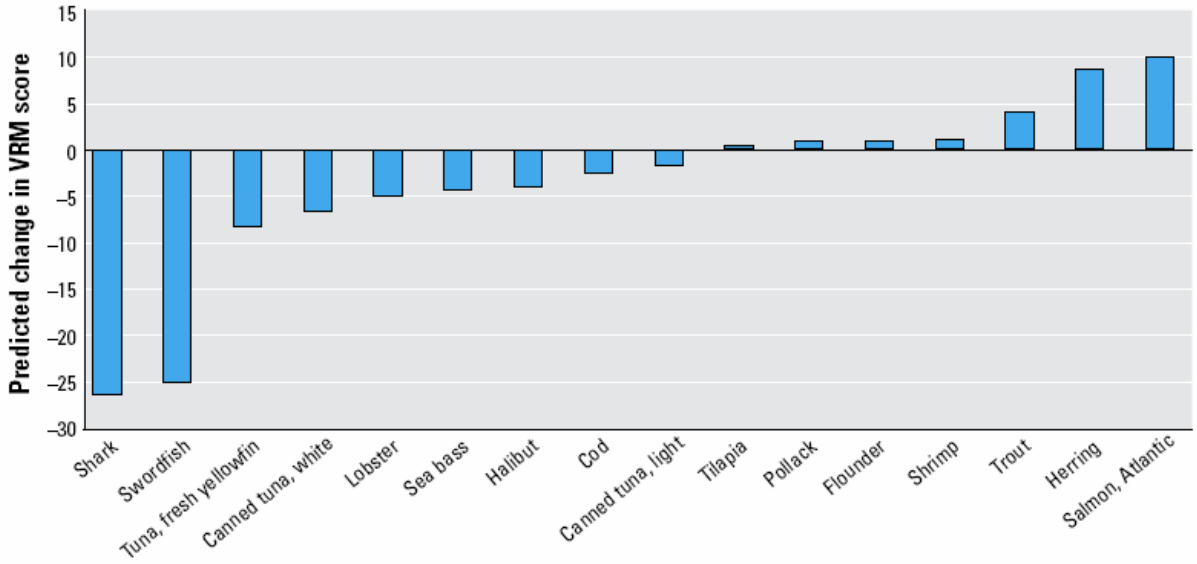


Figure 1. Estimated net effect of MeHg and fish oils on neurodevelopment at 6 months of age, one 6-oz fish meal per week.

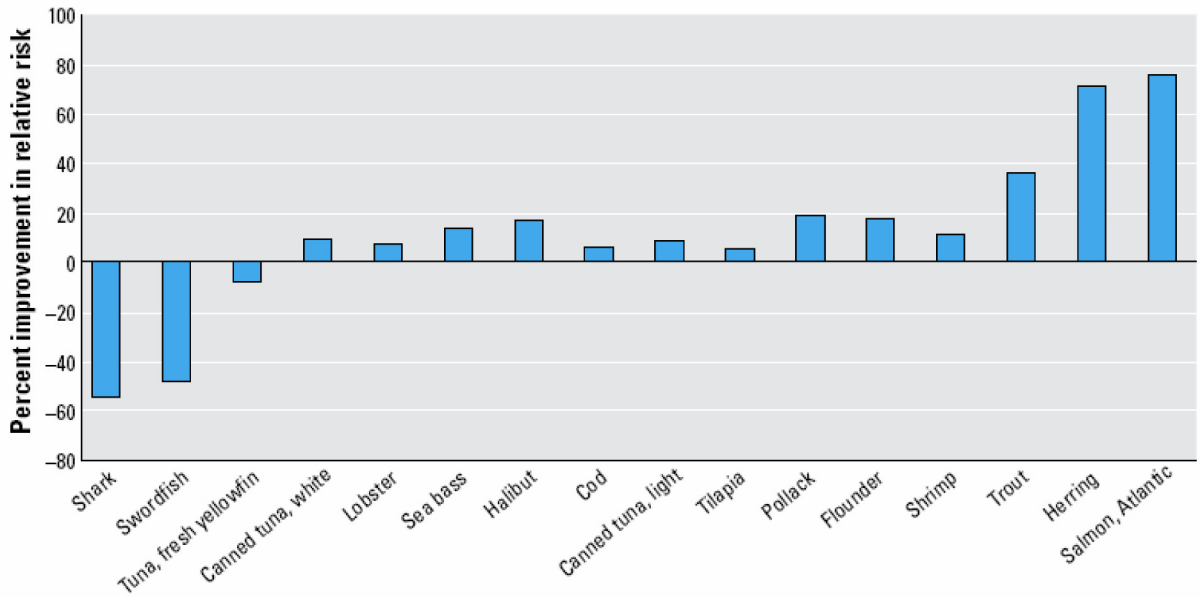


Figure 2. Estimated net effect of MeHg and fish oils on cardiovascular risk, one 6-oz fish meal per week.

Discussion

This risk/benefit analysis by CT DPH is an innovative way of looking at contaminant and nutrient data together. CT DPH is currently using the results of this analysis in a qualitative manner to adjust our advice to consumers about store bought fish. As a result, we are one of the first government agencies that is

recommending "unlimited" consumption for species that show very positive results. We are really looking at those species that fall far to the right or left to change our advice. Species that have small positive or negative deflections should be evaluated by traditional assessment methods. It is important to acknowledge that this analysis is only for a small number of species and is based on limited exposure data. For example, even though farmed salmon comes out as a net benefit in this analysis, there are other contaminants in farmed salmon (e.g., dioxins, persistent pesticides) we did not analyze but which create some concern. This prevents us from recommending any more than one meal per week of this species.

CT DPH hopes that others will take this risk/benefit example and apply it more broadly. The bottom line of this analysis is that we can direct people toward specific species and away from other species, to help them get maximum benefit from fish consumption. The latest CT DPH fish consumption advice for commercial and locally caught fish can be found at http://www.ct.gov/dph/fish

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