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November 19, 1991

Douglas J. Tomchuk
Remedial Project Manager
U.S. Environmental Protection Agency
Emergency & Remedial Response Division
26 Federal Plaza - Room 747
New York, NY 10276

Re: Factors Affecting PCB Intake From Fish Consumption

Dear Mr. Tomchuk:

In General Electric's (GE's) comments on the EPA Hudson River Phase I Report, we pointed out to you a number of facts you did not consider when estimating the hypothetical PCB intake due to consumption of contaminated fish. As we have discussed, we believe the estimated PCB intake rates are unrealistically high and need to be adjusted downward.

Another factor we did not discuss directly, but is very important, are the methods employed to fillet fish prior to preparation. As the attached article (Contaminants in Sport Fish: Managing Risks, Cornell Cooperative Extension, Fact Sheet - June 1990) shows, simple trimming techniques can reduce PCB levels in consumable tissue by approximately 50%.

GE believes you need to consider this factor in your preparation of the Hudson Risk Assessment as well as during any evaluation of fishery management techniques. Please include a copy of this document and letter in the site Administrative Record. If you have any questions, I can be contacted at (518) 458-9108.

Very truly yours,

John G. Haggard
Technical Project Manager

Enclosure

cc: Al D'Bernardo, TAM's (w/enclosure)

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SEA GRANT

CORNELL COOPERATIVE EXTENSION

Contaminants in Sport Fish: Managing Risks

Ken Gall and Michael Voiland

Sea Grant Extension

New York's coastal and inland waters provide abundant, diverse fishing opportunities. Each year over 3 million anglers land more than 200 different species. Many popular game fish are good to eat, but anglers who eat their catch need to understand the benefits and potential risks associated with their fish consumption practices.

The benefits derived from eating fish are many; it tastes good and can also be good for you when used and prepared properly. Fish provides a good source of easily digested, high quality protein, as well as many vitamins and minerals. Fish is low in fat and sodium, making it a good choice for the low-fat, lower-calorie diets now widely recommended. In addition, the unique type of fats found in fish—called omega-3 fatty acids—are believed to provide other health benefits that could decrease an individual's risk of cardiovascular disease.

Although sport-caught fish can provide nutritional benefits, anglers should also be aware of the health risks associated with some species of fish from certain waters. Some fish contain elevated levels of potentially harmful environmental contaminants, and eating them may pose a health risk. This fact sheet will help anglers understand how to select and prepare their fish to minimize possible health risks.

What Are the Problems?

A wide variety of chemicals are used in industry, commerce, agriculture, and in the home. Some of these chemicals are potentially harmful and can enter our waters in a number of ways. The most obvious route is from dumping or accidents that directly discharge industrial or municipal wastes containing chemicals like PCBs or heavy metals. Other, less obvious sources of chemicals include improperly built or maintained landfills, improper pesticide use on agricultural lands and home gardens, and runoff and weather conditions that can carry contaminants far from their point of origin. Some potentially toxic chemicals like mercury occur naturally in the environment.

Chemicals tend to accumulate over time in fish that live in contaminated waters. Fish can absorb contaminants from the food they eat or, to a lesser extent, directly from the water. The amount of a chemical that a fish accumulates can vary greatly depending on its species, fat content, size, age, sexual maturity, feeding areas and habits, behavioral and migratory patterns, and geographical range.

Since several factors affect the development of a contaminant problem in any given species from a particular body of

water, it is difficult to generalize about contaminants in fish. If trout from a particular lake, for example, are found to contain a contaminant, it does not necessarily mean that trout from other nearby waters are contaminated, nor that other species from the same lake contain similar amounts of chemical contaminants.

State and federal agencies that have testing programs for chemical contaminants in fish, wildlife, and other foods focus their monitoring efforts on bodies of water likely to be contaminated, and on those species prone to accumulate these contaminants. The information gathered is evaluated by authorities to determine what action may be necessary to protect public health. Commercial products and raw agricultural products, including fish, that exceed established health standards for chemical residues are not allowed in or are removed from the marketplace.

Fish, however, is a unique food because of the large quantities that are harvested directly by anglers and used for personal consumption. Even when potential health risks have been identified, anglers can continue to catch fish which they may then choose to eat. *Advisories* are issued to help anglers minimize potential health risks from contaminants in sport fish.

How Can Anglers Manage Health Risks?

With each successful fishing trip, anglers must decide:

- Whether or not to keep the fish that they catch;
- Whether or not to eat these fish; and if so,
- How to dress and prepare these fish.

Information about the fish, the waters in which they were caught, and current health advisories is needed to help decide which fish to keep and eat. After you have evaluated this information and decide to eat fish—even though they could contain contaminants—consider using trimming and cooking techniques that help reduce the amount of contaminants in the edible flesh. In short, by making informed decisions about how you select and use your catch, you can help to minimize potential health risks.

Deciding Whether Or Not to Keep and Eat Your Catch

Consider the following information when deciding whether or not to eat the fish that you have caught:

• **Where the fish were caught.** Historically, contamination problems have been more prevalent in freshwater fish than in saltwater fish. In New York, more than 20 different species of freshwater fish, but only three species of saltwater fish (striped bass, eels, and bluefish) are believed to contain elevated levels of some contaminant. In fact, the first two saltwater species mentioned above spend part of their lives in fresh water.

Waters near industrial or urban centers are likely to be more contaminated than waters in more remote areas, but it is not always safe to assume that the latter are free from contaminants. It is a good idea to obtain as much information as possible about unfamiliar waters.

- **The species of fish.** Contaminant levels tend to be higher in larger fish and those higher up in nature's food chain. Many species (fish that eat other fish) often have elevated contaminant levels. Certain fish that feed on or near the bottom may also tend to accumulate contaminants that are concentrated in sediments. Striped bass may accumulate more contaminants than other saltwater species because they spend part of their lives in freshwater areas like the Hudson River, which is known to be contaminated with PCBs. There are numerous reasons, many not obvious, why some fish species may accumulate more contaminants than others.

- **Size of the fish to be eaten.** Contaminants accumulate in fish over time. Older, larger fish are more likely to have higher levels of contaminants. Anglers who consistently pursue and eat large trophy fish may ingest more contaminants and be at higher risk. Releasing some larger fish and selecting smaller fish of legal size for the dinner table may reduce overall contaminant intake.

- **Amount of fish to be eaten.** Those who eat large amounts of fish of a species or from a body of water known to be contaminated may take in larger amounts of any contaminants present. Eating smaller portions could decrease the amount of contaminants consumed.

- **The frequency of consumption.** How often as well as how much potentially contaminated fish is eaten must be considered to reduce the total amount of contaminants consumed over time. An angler who decides to eat smaller portions of fish at each meal, but at the same time eats his or her catch more frequently is not likely to significantly decrease the total amount of contaminants that are consumed.

- **Current Fish Consumption Health Advisories.** Public health authorities consider the factors above, along with information from contaminant monitoring programs, when they develop *fish consumption health advisories*. These advisories provide guidance on the species, size, amount, source waters, and meal frequency of fish that might pose some health risks when eaten.

In New York, as in many other states, fish consumption advisories are reviewed and issued each year by the Department of Health. The advisories in New York consist of three parts:

- A *general advisory*, which recommends that you eat no more than one meal (1/2 pound) of fish per week from the state's fresh waters, the Hudson River estuary, or New York City harbor.
- *More specific advice for higher risk individuals.* This part of the advisory recommends that women of childbearing age, infants, and children under age 15 eat no fish with elevated contaminant levels.
- A *specific listing* of the individual bodies of water where fish with elevated contaminant levels are found, and the species and sizes of fish in those waters which may pose a health risk. This part of the advisory suggests a maximum amount of fish that might be consumed per week or per month to minimize potential health risks.

Fish consumption advisories are published each year in

the *New York State Fishing Regulations Guide*, available wherever fishing licenses are sold, or from state Department of Environmental Conservation regional offices, local or state health department offices, or from other public education programs such as Sea Grant and Cornell Cooperative Extension.

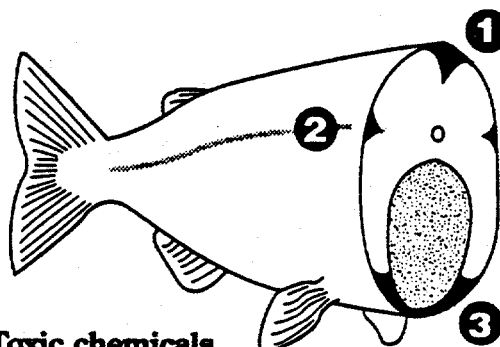
Anglers should become familiar with the advisories that apply to waters where they fish. Anglers should also keep in mind that some higher risk individuals (e.g., nursing mothers and pregnant women) may be unaware of health advisories and should be informed of them when given any sport-caught fish.

Preparing Fish to Reduce Contaminants

Once all fish contamination factors and consumption health advisories have been considered, and an individual still decides to eat sport fish that may contain contaminants, specific preparation techniques can be used to reduce contaminants.

Certain trimming and cooking methods can reduce the amount of fat-soluble chemicals like PCBs and pesticides that may be present in the edible parts (usually fillets) of fish. These techniques may not work equally well on all fish or for all types of chemical contaminants, nor do they necessarily make contaminated fish "safe" to eat. Nevertheless, trimming and cooking techniques may reduce the amount of contamin-

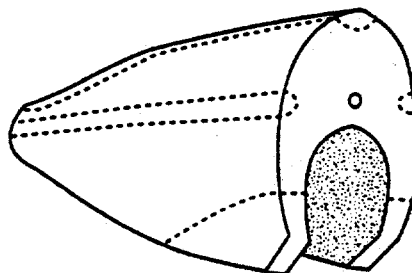
CUTTING OUT THE RISKS



Toxic chemicals tend to concentrate in the fatty tissue, shown in black above, found in the:

- 1) dorsal area.
- 2) lateral line.
- 3) belly flaps.

When cleaning fish, always skin it and trim away fatty areas, as shown below:



SOURCE: MICHIGAN DEPARTMENT OF PUBLIC HEALTH

Figure A.

Milton Moore/Soundings

nants that are consumed. In lowering the total amount of contaminants consumed over time, these methods may also reduce an individual's overall health risk.

Trimming techniques. In general, most chemical contaminants are likely to be concentrated in various internal organs of the fish, especially the liver, which filters toxic residues, or in the gills and skin which may be directly exposed to any contaminants in the water or sediment. The internal organs of fish from potentially contaminated waters should never be eaten, and fish should be carefully handled and gutted to prevent these organs from contaminating other parts of the fish.

Where a particular contaminant might be found in fish is largely determined by the chemical properties of that contaminant. The two different classes of chemical contaminants found in fish are those that are *water-soluble* and those that are *fat-soluble*. Water-soluble chemicals can be dispersed throughout the fish, whereas fat-soluble chemicals are concentrated in the fatty areas.

The water-soluble chemicals of concern in fish are primarily the "heavy metals" like mercury and cadmium, which tend to be more concentrated in some organs, such as the liver. They can also be found in other parts of the fish including the fillet portion. Trimming does not effectively decrease the amount of water-soluble contaminants in the edible fillet portion.

Fat-soluble chemicals include PCBs and pesticides like DDT, mirex, and dieldrin. These chemicals, if present, are likely to be found in those parts of the fish that are high in fat, such as along the back (dorsal area) and the lateral lines, in the belly area, and in a thin fatty layer just under the skin. Trimming away these fatty areas can remove a significant amount of the fat-soluble contaminants stored there. Typically, these fatty areas can be easily identified because they are darker in color than the leaner parts of the muscle or fillet meat around them. Figure A shows where these fatty areas are located in whole fish.

Scientific studies have shown that chemicals like PCBs are removed from the edible fillet portion of a fish when fat trimming techniques are used. The amount of contaminants removed varies from one species to another. Table 1 summarizes several studies on the effects of trimming on fat-soluble contaminant levels in various species of fish.

Table 1. Reduction of contaminants in fish by trimming fatty areas.

Species	Average Percent Reduction		
	PCBs	mirex	DDT/DDE
Lake trout ¹	50	50	46
Brown trout ²	43	45	52
Coho salmon ¹	32	21	53
Chinook salmon ¹	25	15	nt
Smallmouth bass ²	64	64	54
Striped bass ³	60	nt	nt
American shad ¹	44	nt	40
Bluefish ⁴	44	nt	nt
Carp (skin removal only) ⁵	26	nt	nt

nt = not tested

¹ New York State Dept. of Environmental Conservation, 1981a and 1981b.

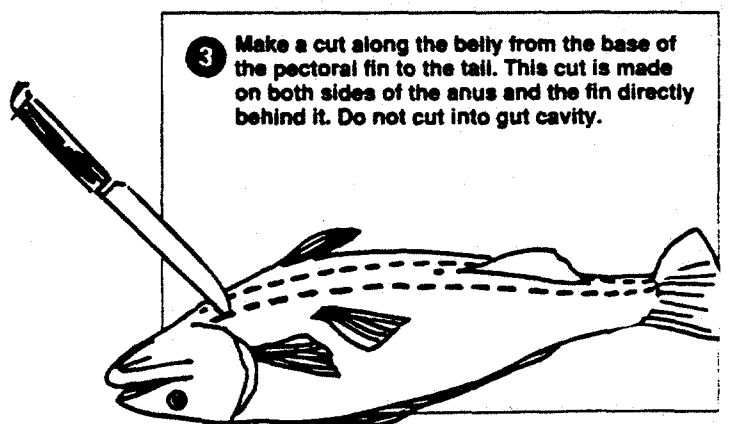
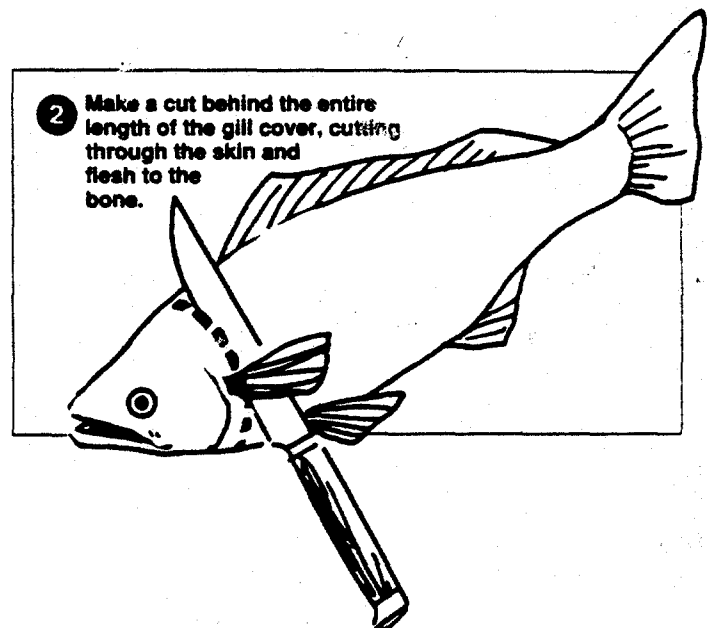
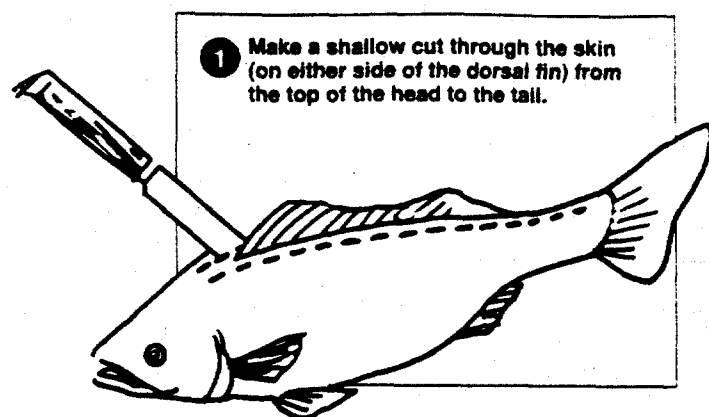
² Skea et al., 1979.

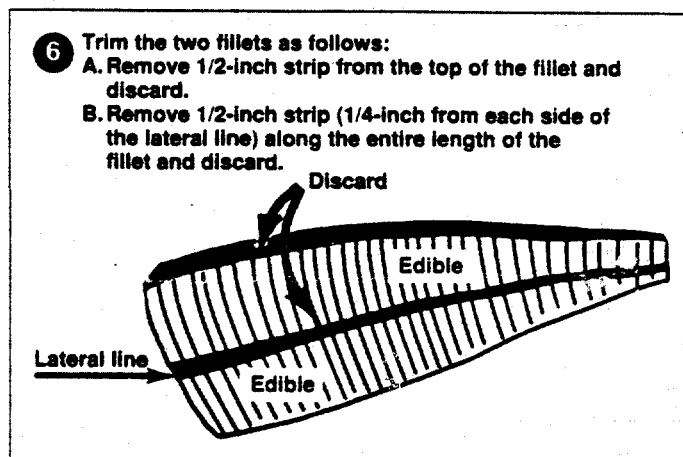
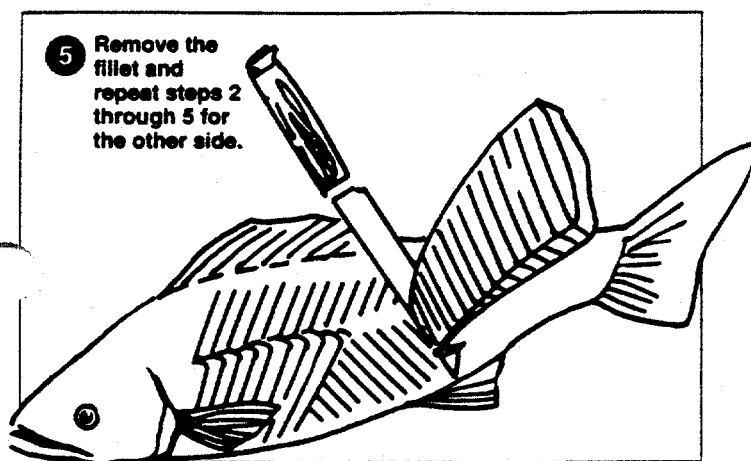
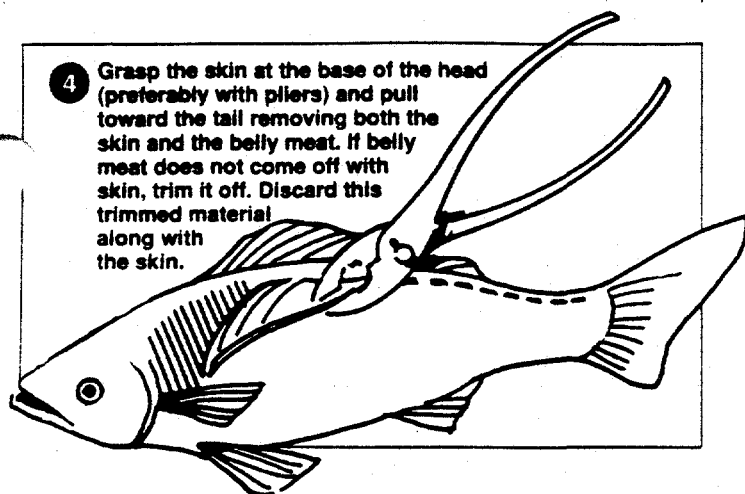
³ Average of findings reported in New York State Dept. of Environmental Conservation, 1981b, and White et al., 1985.

⁴ Averages of findings reported in Armbruster et al., 1989, and Sanders and Haynes, 1989.

⁵ Hora, 1981.

Figure B. The following trimming procedure will reduce fat soluble contaminants in fish:





7 The four fillets are now ready to be cooked.

Adapted from NYSDEC, 1984. Reducing toxics: Fish filleting guide. Publ. No. FW-P116, Albany, NY. 2 pp.

Table 1 shows that the level of contaminant removal varies and can range from approximately 15 to 65 percent, depending on the species and the contaminant. Although the information available is not extensive, it does appear that fat trimming can significantly reduce the amount of fat-soluble chemicals like PCBs in most species. The fish trimming and filleting technique illustrated in Figure B is currently recommended by the New York State Department of Environmental Conservation to reduce toxic contaminants in fish.

Cooking techniques. Certain cooking techniques can further reduce some contaminant levels in some species of fish. The greatest amounts of contaminants are removed by trimming, with additional but smaller amounts lost during cooking. Because the loss of contaminants during cooking is primarily due to the rendering (melting) and draining away of body fats, cooking methods that allow fats and cooking juices to drain away are recommended.

Since it is difficult to predict what level of contaminant reduction can be achieved through cooking, **cooking - by itself - should not be used to remove contaminants.**

Proper trimming and cooking techniques used **together**, however, can maximize the total amount of fat-soluble contaminants removed.

Some research has indicated that *baking* and *broiling* can reduce chemical residues in fish. Fish should be baked or broiled on a rack so that the juices that drain away during cooking can be discarded.

Deep-frying was shown in one study to reduce the amount of contaminants in smallmouth bass. Fats and contaminants from the fish may be transferred to the cooking oil (fat) which, on that basis, should be discarded. No information is currently available on how *poaching*, *steaming*, or *boiling* affect chemical contaminant levels in fish. Presumably, some chemicals would be released into the cooking liquids when fish are prepared by these methods, so again, these liquids should be discarded. *Smoking* may also reduce the amount of some contaminants present in fish. Fish should be smoked in a way that allows fat to drain away. It is also advisable to arrange fish in the smoker so that the lower racks or layers of fish are not "basted" with juices and fats draining off and dripping from racks or layers above.

Pan frying should be avoided because it retains juices that may contain chemicals. Avoid making soups and chowders with fish that might be contaminated since the juices that contain chemicals would be retained. If you have to use such fish, trim them as above and cook in a way that allows juices to drain before adding the fish to the soup or chowder pot.

When preparing fish that may contain contaminants, the following should be kept in mind:

- Trim the fatty areas;
- Use cooking methods that allow fats to drain away, such as baking or broiling on a rack or deep frying;
- Avoid pan frying or making soups or chowders which contain fat-laden juices;
- Always discard drippings or cooking liquids for all preparation methods.

Risks and Benefits in Perspective

To compare the risks and the benefits of eating sport-caught fish, individuals might consider their personal medical status and long-term health goals, dietary needs, personal tastes and preferences, and other health risk factors. The scientific information now available suggests that, for some people, potential health benefits associated with fish oils (fats and the omega-3 fatty acids in them) may outweigh risks associated with eating fish that may contain some contaminants.

For example, individuals at high risk for heart disease may realize benefits that outweigh the risks of eating their catch. On the other hand, for women of child-bearing age the risks associated with eating sport-caught fish may outweigh any potential health benefits to them.

To avoid fish as food because of concern about contaminants or, oppositely, to indiscriminately eat any fish to gain potential health benefits would be unwise. The majority of fish species, including commercial products and almost all ocean fish, are not known to have contaminant levels that pose a health risk. These fish can be eaten and significant health benefits can be realized. At the same time, contaminant-related health risks can be reduced by careful selection and preparation of those fish known or likely to contain contaminants.

Summary

To more effectively manage and limit any risks that may be associated with consuming sport-caught fish, anglers should consider the:

- quality of the waters where fish are caught;
- species and size of fish that are eaten;
- amount and frequency of consumption;
- current fish consumption health advisories
- trimming and cooking methods that reduce fats and the contaminants stored in them; and
- risks and benefits associated with each individual's fish consumption patterns and personal needs.

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Cornell Cooperative Extension

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