Aquaculture Blog--Aquacultured versus wild fish in a healthy diet

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Aquaculture, the production and husbandry of aquatic plants and animals in controlled environments, also called fish farming, is coming of age. First applied by the Chinese over 2,000 years ago, aquaculture has enjoyed an enormous increase in its practice and acceptance. Since the 1960s when aquaculture was a cottage industry, this agricultural pursuit has grown worldwide from 10 million metric tons of production in 1984 to 38 million metric tons in 1998 (1). During the same time period because of overfishing, many wild fish populations crashed and have few, if any, prospects for full recovery (2). By the year 2030, aquaculture will account for more than 50% of all fisheries products consumed in the world (1).

By other agricultural standards such as terrestrial crop production or ranching, commercial aquaculture is still developing. The aquaculture industry has not fully achieved its stated goals to provide products that make the best use of available resources and are as wholesome and nutritionally appropriate for the consumer as possible, but has made great strides toward them (1).

As a consumer there are at least five nutritional issues that should be considered before choosing between farmed and wild fish: 1) omega-3 fatty acid content, 2) organic residues such as PCBs and others, 3) heavy metal contamination, 4) synthetic carotenoids, and 5) residual antibiotics. Clearly cost is an important factor for all consumers, and environmental considerations may come into play for others.

To date, virtually all studies of farmed versus wild species show a slight reduction in the ratio (which is different than amount per serving) of omega-3 fatty acids to other fatty acids present within fisheries products (3, 4). With that in mind, there is no doubt that farmed fisheries products of all kinds contain generous amounts of omega-3 fatty acids. Indeed, for example, because farmed Atlantic salmon and rainbow trout contain a higher percentage of total fatty acids than their wild counterparts, the farmed varieties actually contain more grams of omega-3 fatty acids per serving (3, 4).

Today steps are being taken by shrimp feed and fish feed manufacturers to rectify any perceived or actual disparity between omega-3 levels in farm-raised and wild fish and shellfish. Recent research has shown that late-stage feeding with feeds containing high concentrations of omega-3 or linseed oil allows the receiving muscle tissues to quickly "catch up" (5, 6). The result is a farmed product that, overall, requires less omega-3 in its diet over its lifetime, and an

omega-3 concentration in the tissue at harvest that is on par with or higher than wild product (6). This strategy will help to minimize the amount of expensive fish meals and fish oils used by the aquaculture industry, will still provide us with abundant amounts of omega-3 fatty acids in our diet, and spare valuable wild populations of fish and shellfish from unnecessary and destructive over-harvest. Many within the aquaculture industry understand and appreciate this issue, and are taking steps now to correct real and perceived disparities.

When sited properly on land or at sea, aquaculture operations provide the kind of relative isolation from contaminants that is often not possible in the wild. However, some salmon net-pen operations are exceptions, and may have experienced contamination from an unlikely source—fish feed. Supposedly, in Europe and to a lesser extent in the Americas, feed contaminated with PCBs and other organic compounds was fed to aquacultured salmon and produced unacceptable residues in fish (7)—an issue that has commanded attention. While some express concern, others view the data with skepticism or interpret them much differently (8, 9). In fact, one analysis reexamined the data and determined that the PCB threat is low, and the threat from beef is actually 40-80 times higher than salmon (9).

Heavy metals such as mercury and cadmium have been discovered in both aquacultured and wild salmon, with higher or lower concentrations found in aquacultured or wild fish by some researchers than others (10, 11, 12). As a result of the ecological process of bioaccumulation, other large "top-predator" fishes such as wild tuna also tend to harbor elevated levels of mercury (13, 14).

Some people wonder about the new labeling seen at fish counters proclaiming "Color Added," the purpose of this labeling, and the potential effects on human health. While these labels seem to imply that colors or dyes are somehow injected or added directly to fish, this is not the case. Natural carotenoid pigments (astaxanthin and canthaxanthin; similar to vitamin A) are added to fish feeds which impart color to fish flesh. These pigments are extracted from algae, yeast, plants, crustaceans, or synthesized from beta-carotene precursors. Indeed, astaxanthin is the primary carotenoid pigment found in wild salmon. Contrary to some reports designed to cast aquacultured fish as unsafe and unhealthy, uncolored fish flesh is white, not gray, and these pigments are extremely safe at levels normally consumed by people (15).

Pollution or other environmental damage is an often-heard complaint about aquaculture (16)—in particular, ocean-based salmon production facilities that discharge metabolic wastes to the environment. These claims are controversial and disputed by others (17). Large salmon net pens systems are arrayed at the surface or anchored below the surface and confine stocks to a defined space. In the past, producers relied solely on currents and dilution to carry fish wastes from the vicinity. Today's new net-pen technologies incorporate waste recovery, including land application and composting of dewatered, solid wastes. Turning liabilities into assets and "Best Environmental Practice" management strategy are the new philosophies. The same is true for land-based, freshwater operations, where wastewater from fish tanks is directed into plant-producing greenhouses—a process now dubbed aquaponics.

Other issues include the use of antibiotics to preserve fish health. Unlike terrestrial cattle production, antibiotics are used only to treat disease outbreaks. Only approved antibiotics are used, and fish stocks are withdrawn from their treatment for specified periods of time before slaughter. Despite withdrawal, some antibiotics may persist in fish tissues (18), or may spill over to nearby environments during the treatment process (19). For these reasons aquaculturists are developing and currently using relatively benign substances that stimulate fish immune systems such as beta-glucans, stabilized forms of vitamin C, probiotic bacteria, and refined management strategies to reduce the use of antibiotics (20).

Aquaculture was born out of a desire to stem the tide of overfishing and gain more control over our collective health and nutritional future. Regardless of your choice to eat aquacultured fish or wild fish, your decision involves some associated risk and implications for our world and its environments, particularly with regard to salmon and other predatory species that are widely produced and consumed. If you are concerned about pesticides, heavy metals, or antibiotic residues in your diet, salmon (farmed or wild) may not be the choice for you. There are many alternatives (farmed or wild) that may suit you better. You may avoid large predatory fishes such as salmon and tuna, and opt for herbivorous species or those lower on the so-called ecological food chain such as shrimp, tilapia, and catfish, or top predators produced in land-based systems such as hybrid striped bass and rainbow trout.

By most accounts, fish are our best sources of the omega-3 fatty acids DHA and EPA that we require in our diets. Totally eliminating fish from your diet could lead to health consequences that far outweigh the alternatives.

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