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Comparing nutrients in wild and farmed fish

Aquaculture Department, Southeast Asian Fisheries Development Center

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Fish stocking in the grow-out compartment. The fingerlings are released from the nursery compartment by lowering one side of the net until all the fish have gone out. In Laguna de Bay, the stocking density of milkfish or tilapia is regulated by the Laguna Lake Development Authority (LLDA) at 25 000 ind/ha. For a polyculture system utilizing tilapia, silver carp, bighead carp, and common carp, a stocking density of 40 ind/m^3 is suggested, spread out at the ratio of 30 tilapia: 5 silver carp: 4 bighead carp: 1 common carp. Selective harvesting of tilapia may be done at intervals of 4-5 months since tilapia reach marketable size (100 g) earlier than the rest of the stock.

Feeding. Fish are not usually given supplemental feeds as long as primary productivity is high, especially during summer. However, during times when food production is low, fine rice bran may be broadcast on the water surface at 10-15 sacks/ha.

Pen maintenance. The area is inspected daily for possible damage to nets. Security around and inside the fishpen especially during nighttime should be provided to check on poachers. Guardhouses should be strategically located around the fishpen.

Harvest. Fish can be harvested when they attain a minimum size of about 100 g (10 pieces to a kilo) for milkfish and tilapia and 1.5-2.0 kg each for bighead and silver carps. Fish are harvested by purse seine, gill net, or cast net. About 15-20 people are needed to operate a purse seine.

Item Three: Cage Grow-out Management in Lakes

The cage may be a floating or stationary type. The former is suitable for deeper portions of the water body while the latter is best for the shallower portions. The floating type of cage is moored to keep it in place. Size of cage varies from a small 3m x 3m x 1.5m to a large 9m x 16m x 1.5m or 18m x 20m x 1.5m.

Fish stocks. In the Philippines, tilapia are the most commonly used species for cage culture. Tilapia are stocked at 10-30/m^2 of cage depending on the season. In Laguna Lake, 5-cm tilapia fingerlings are stocked at 20/m^2 during the months of April to July when natural food is abundant. In 75-120 days, the fish may attain a size range of 150-180 g each. A lower stocking density is recommended during September to February when natural food density is low. However, stocking density can be increased if supplemental feeding of rice bran is used.

Maintenance of cages. The nets are periodically cleaned of algae and freshwater sponges that attach to the net as well as to the bamboo posts. These materials tend to clog the nets and thus limit water circulation in and out of the cage. During inclement weather, cages which are provided with cover may be submerged at least a foot beneath the water surface to prevent damage from strong waves.

Harvest. Total harvest of fish may be done when majority of the stock have reached the desired size for market. Partial harvest is done only for fish of harvestable size while the smaller ones are allowed to grow further.

Source: Armando C. Fermin, "Grow-out Culture Management for Freshwater Finfishes" (lecture notes in *Aquaculture Management* training course, April 1990), SEAFDEC/AQD, Tigbauan, Iloilo.

COMPARING NUTRIENTS IN WILD AND FARMED FISH

Do farmed fish measure up to their wild cousins in nutrient? They certainly do in protein. It is important that farmed fish should not be compromised in this respect because protein is one of the most important nutrients from fish. As shown in Figure 1, protein content is not an issue. Both farmed and wild fish have essentially the same amount of protein, although figures are from only a few species.

Fat content, however, differs widely. Figure 2 shows that for every species of fish studied to date, farmed fish are fatter than their wild counterparts. As a result, farmed fish are higher in calories. For example, 100 g of wild rainbow trout would have about 110 calories while the same portion of farmed trout would have 155 calories on a raw weight basis.

While amount of fat is important, the composition of fat is where the action is. Fish swam into the headlines on their content of omega-3 fatty acids - substances with the potential to reduce one's chances of developing or dying from heart disease. These beneficial omega-3s are unique to fish and shellfish. What makes aquaculture unique is the opportunity to harvest fish with a virtual guarantee of abundant omega-3 fatty acids.

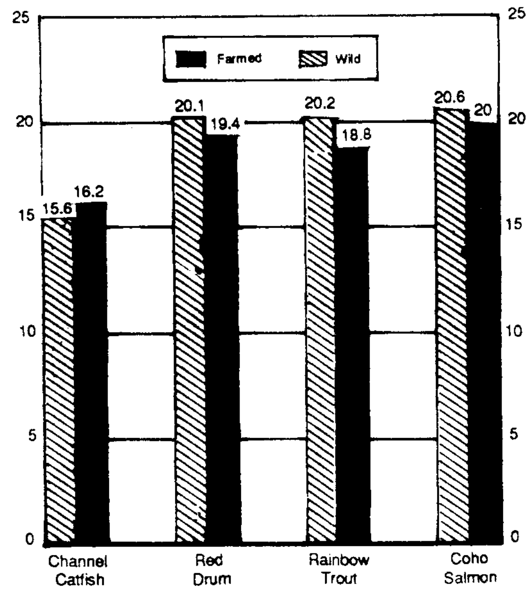


Fig. 1. Protein content (g/100 g fillet) in wild and farmed fish.

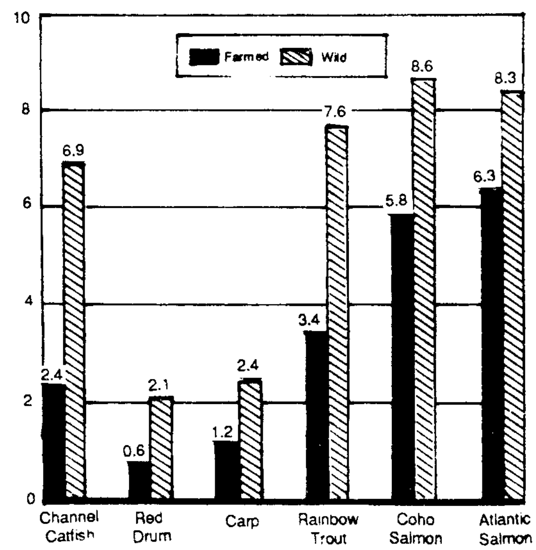


Fig. 2. Fat content (g/100 g fillet) in wild and farmed fish.

Omega-3s in wild and farmed fish. What happens to omega-3 levels in farmed fish is shown in Figure 3. Wild channel catfish, red drum, and carp, skimpy in omega-3s at the best of times, fare about the same on the farm. Even fattening the fish did not substantially boost the total amount of omega-3s. Undoubtedly this result reflects the type of oil in the feed. For these species, present farming practices do not reduce omega-3 levels but neither do they enhance them.

Salmonids are a different story. Naturally rich in omega-3s, wild coho and Atlantic salmon have more omega-3s than their captive cousins, in spite of having less fat. This observation reflects the ability of salmon to selectively retain these particular fatty acids.

Farmed rainbow trout, on the other hand, have more fat and more omega-3s than their wild brethren, undoubtedly because of their cuisine. Rainbow trout make it clear that with aquaculture, omega-3 fatty acid content can be retained and even boosted.

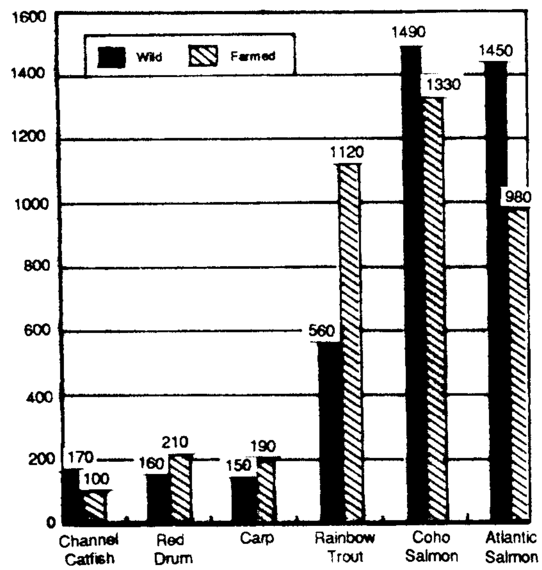


Fig. 3. Omega-3 fatty acid content (mg/100 g fillet) in wild and farmed fish.

To what extent omega-3 fatty acid content be manipulated in salmonids or other species is debatable. In fact, it is uncertain how many fish farmers, researchers, and government regulators consider this issue.

"Omega-3 fatty acid content in farmed fish is highly dependent upon the diet," explained Dr. D. Higgs of the Department of Fisheries and Oceans in Vancouver, British Columbia. "In coho salmon, omega-3 fatty acid content can be increased by changing the amount and kind of oil fed to the fish. For chinook salmon, a wide range in omega-3 fatty acid content was observed according to the feed."

But species differences cannot be ignored. If omega-3 levels of salmonids are boosted, can it be done for other species, especially those requiring very little omega-3s? Dr. T. Lovell of Auburn University in Alabama (U.S.A.) says it is definitely possible with channel catfish. He is unsure whether it is advisable. He fed levels of menhaden oil to channel catfish, up to 6% of the diet, and observed steadily increasing amounts of omega-3s in the fish. The fish, however, had a fishy flavor that was generally disliked by tasters. Greater amounts of unsaturated fatty acids also increased the likelihood of rancidity.

Effects of different fats. Scientists working on Atlantic salmon raised in net pens observed that oil in the fish closely mirrored the composition of the oil in its diet. Oils used were that of herring, menhaden, soybean, or beef tallow. All fish received sufficient omega-3 fatty acids from herring or menhaden oil to meet their requirements and conserved these acids efficiently. Even those fed beef tallow had as much omega-3s in their flesh as those fed herring oil. In addition, those fed the most omega-3s had the most omega-3s in their flesh. This indicates that Atlantic salmon selectively concentrate omega-3 fatty acids when adequate levels are fed and will increase storage if given more. Similar observations have been reported for chinook salmon.

Studies show that farmed salmon thrive on a wide variety of fats provided their requirements for essential omega-3 fatty acids are met and that large excesses of other fatty acids are avoided. Blends of fish oils with various vegetable and animal fats appear suitable for fish growth and human nutrition interests. This is especially important in view of the limited supplies and high costs of fish oils. Further, the final fatty acid composition of fish raised in aquaculture can be adjusted through dietary changes in 4-6 weeks prior to harvest.

Does it taste better? Fiddling with fats may be all well and good in the laboratory but do such specimens pass the fork test? Does menhaden oil or tallow make the fish taste fishy or beefy? According to a study, the different fats had no effect on the flavor and palatability of coho salmon. Similar results have been reported by others studying rainbow trout. Not so for channel catfish. Catfish reared on menhaden oil were reported "fishy tasting" and less appealing to most tasters. The catfish industry believes one of the reasons behind the success of farmed catfish has been its mild, distinctively unfishy flavor. No sensible catfish grower is going to risk success for a nutritional advantage he may not be able to sell.

Farmed fish can look different from wild fish but not all consumers are discerning. Wild salmon often have a deeper red color and firmer flesh. But color also varies with species. Farmed salmon has been described as paler, milder, and softer in texture. Color can be manipulated by feeding the same pigments as found in the crustaceans normally eaten by wild fish yet pale - fleshed fish have their own market advantages. When color was disguised by means of colored lights, taste panelists scored wild and farmed coho salmon equally high. Except for knowledgeable consumers, most people lack the experience to distinguish between wild and farmed fish either by taste or appearance. Some might argue that the widespread availability of farmed fish may be setting the standard for the species.

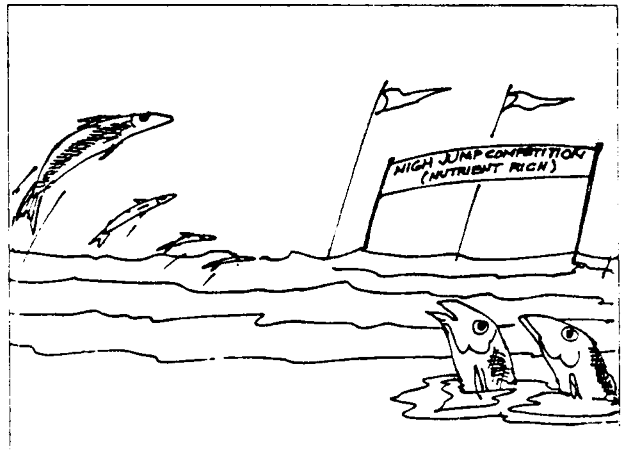
What lies downstream? *Unusual feed fats*: Acceptability of animal fats and increased availability of vegetable oils like canola, low in saturates and generous in linolenic acid increase the diversity of fats suitable for fish feeds. Blends of animal fats with vegetable oils appear feasible. Partially hydrogenated fish oil which has no omega-3 fatty acids is another possibility. Increasing the variety of fats and oils used may ease the pressure for costly marine oils. Adjustment of the fatty acid composition of the fish prior to harvest by using different "finishing" feeds may improve the nutrient profile for the fish consumer.

Omega-6 fatty acids: Fish lay unique claim to omega-3 fatty acids but their response to omega-6 fatty acids cannot be ignored. Research showed that salmonids concentrate omega-6 fatty acids, particularly linoleic acid, in much the same way as omega-3s. The result may or may not be desirable for human nutrition. Many people favor boosting omega-3 fatty acid content since people consume so few of them. If at the same time omega-6s - which interfere with omega-3 uptake - is increased, the nutritional advantages may be limited. Such an argument may be largely theoretical in view of the enormous consumption of omega-6s- from other foods.

Saturated fatty acids: Keeping an eye on the saturated fatty acid content of farmed fish is prudent, given the negative implications of these fatty acids for heart disease. In chinook salmon, a study found that even when widely differing amounts of saturated fatty acids were fed, the young fish tended to retain rather similar levels of saturated fatty acids. Saturates in the fish were related to the amount consumed but large differences in dietary levels were reflected by much smaller differences in the body levels.

Fish might respond to saturates differently from polyunsaturates because the two types of fatty acids are used differently by the body. Saturates supply energy while polyunsaturates go into membranes and other metabolic processes. Using more saturated fats in fish feeds is likely to affect the processing and digestibility of the feed more than final fatty acid composition of the fish but that has not been demonstrated conclusively.

Author Nettleton challenges: "Aquaculture offers unparalleled opportunities for improving the quality and availability of fish throughout the country. The nutrient composition of wild fish offers one yardstick by which to evaluate the products of fish farming. The idea of enhancing the nutrient profile of an already excellent food through fine-tuning fat content and composition is a possibility at the forefront of both aquaculture and nutrition. It is an opportunity that demands full support for the necessary research."



"Waddaya mean the guy is a natural? Of course he is; he was raised in a fish farm."