

DEVELOPMENT OF NEW PRODUCTS AND MARKETS FOR THE GLOBAL TILAPIA TRADE

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Abstract

Tilapia production surged around the world during the 1990's and early 2000's. Tilapias are now the second most popular farmed fishes after the carps, with global production well over 1,526,000 mt in 2003. This has been accomplished by developing large consumer markets in North America and Europe, which are purchasing fish grown in tropical countries with year-round production and relatively low costs. These markets have evolved in a similar manner, starting with immigrant communities, moving into high cost, white tablecloth restaurants, then casual dining chains, hypermarkets and club stores and finally to traditional seafood counters and frozen foods of local groceries.

With this rapid development in markets have come a variety of new product forms and commercial by-products. This has been a critical factor in the continued rise of tilapia in the ranks of popular seafoods and is a result of thoughtful marketing and product development, as well as increasing demands from retailers and consumers. A variety of product forms are described along with methodologies used to develop new markets for these products. By-products including leather goods, pharmaceutical products, and decorative objects made from tilapia scales are also described.

Introduction

Tilapia products (fresh and frozen fillets, whole and gutted fish) have become important commodities in the international seafood trade. Tilapia is a common item on the menus of American restaurants and is rapidly making inroads into European dining. Tilapia aquaculture has grown to a highly domesticated livestock industry with sales in excess of US\$ 2,000,000,000 per year. Tilapia have been domesticated faster and to a greater extent than any other group of fish.

World production of farmed tilapia exceeded 1,526,188 metric tons (mt) in 2003. Global production curves for tilapia have closely followed those by salmon and shrimp as they were fully domesticated and aquaculture production operations began to supplant the wild catch (Figure 1). China is the world's major producer and consumer of tilapia. Mainland provinces in 2002 produced 706,585 mt while Taiwan produced another 90,000 mt. Other East Asian countries produced an additional 307,000 mt. We have little

information regarding the production of fish in South Asia, but several articles in this proceedings may provide some of this data.

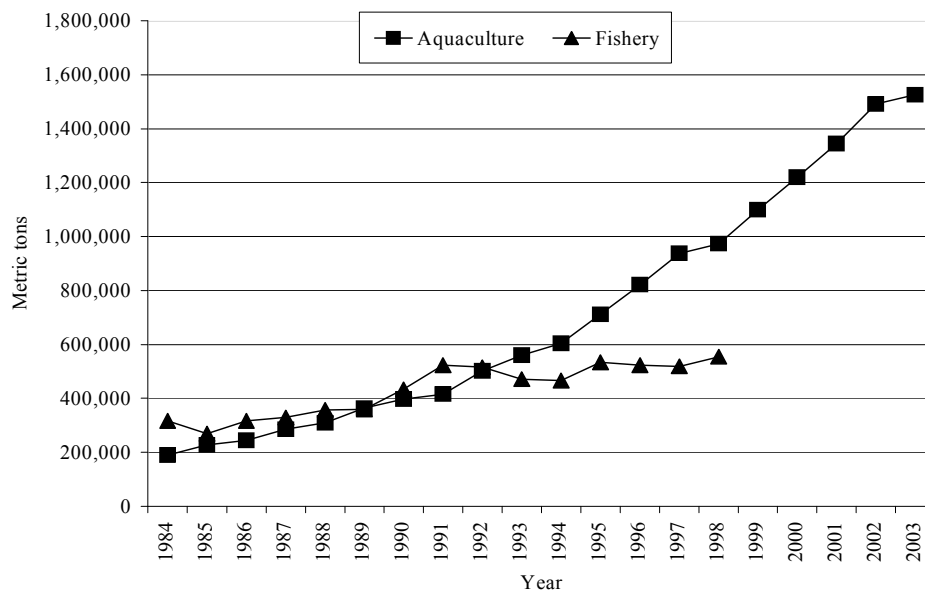


Figure 1. Global aquaculture production of tilapia.

Central and South America are the next leading producers. Mexico has a long established tilapia aquaculture program. However, some of the production data is actually derived from restocking programs into large reservoirs. The actual percentage of fish that are harvested that were actually stocked from state hatcheries is probably minimal. On the other hand, many small farms are missed in the surveys, so the total number is still close to accurate. Brazil is the next largest producer and may soon pass Mexico. Commercial tilapia culture in Brazil got its real start as a source of red tilapia for the fee fishing industry. Customers enjoyed the sporting aspects as well as the fine eating of the fish and eventually started looking for it in restaurants and seafood counters. The Brazilian government in 2000 changed regulations to allow cage culture in reservoirs in the Northeast of Brazil. This represents a tremendous resource and has encouraged a boom in production. Colombia was a pioneer in tilapia production and international trade in the 1980's. In the early 1990's the domestic market was so strong, international exports ended and Colombia became a net importer. Since 2000, production has increased again with several large cage operations in Huila province. Colombia has begun exporting again and expects to continue increases.

Costa Rica and Honduras (Teichert-Coddington and Green 1997) are major suppliers of fresh fillets to the United States. A small number of very large farms with sophisticated production, processing and marketing have developed strong brands that enjoy widespread demand globally. A large number of small farms supply indigenous markets. Ecuador has also become a major exporter to the United States and European Union. Ecuador has taken a

somewhat different development path from other major tilapia producers. Tilapia have been grown in shrimp ponds that were abandoned due to major disease outbreaks, or were grown in polyculture systems with much lower densities of shrimp. Each outbreak of a viral disease in Ecuador has been immediately followed by a jump in tilapia production. Building on the existing infrastructure that had been developed for shrimp has allowed tilapia production and marketing to boom. Polyculture has also provided some health and productivity gains for shrimp culture. Ecuador still has tremendous excess capacity from the shrimp industry. At time of writing, United States was imposing anti-dumping tariffs of 7% on Ecuadorian shrimp. With these tariffs levied, tilapia might take yet another jump similar to those seen from shrimp disease outbreaks.

Table 1. Current production of farmed tilapia (live weight).

	Production in metric tons	Last year with data or estimate
East Asia		
China	706,585	2002
Taiwan	90,000	2002
Philippines	122,277	2002
Thailand	100,000	2003
Indonesia	50,000	2002
Vietnam	25,000	2002
Malaysia	15,000	2001
Myanmar	4,000	2003
Korea	1,000	2003
Middle East		
Egypt	52,755	2001
Israel	7,000	2001
Jordan	1,000	2001

	Production in metric tons	Last year with data or estimate
Americas		
Mexico	110,000	2003
Brazil	75,000	2003
Colombia	40,000	2003
Cuba	39,000	2001
Ecuador	27,000	2002
Costa Rica	17,000	2002
Honduras	13,000	2002
United States	9,200	2003
Jamaica	5,200	2001
Canada	500	2003
Africa		
Zimbabwe	5,000	2001
Nigeria	4,471	2000
Kenya	1,000	2001
Eritrea	500	2003

El Sayed, A.F.M. (2001); Fitzsimmons, K. (2000, 2001); Fonticiella, D.W. and L. Sonesten (2000); Neira, I. and C. Engle (2001).

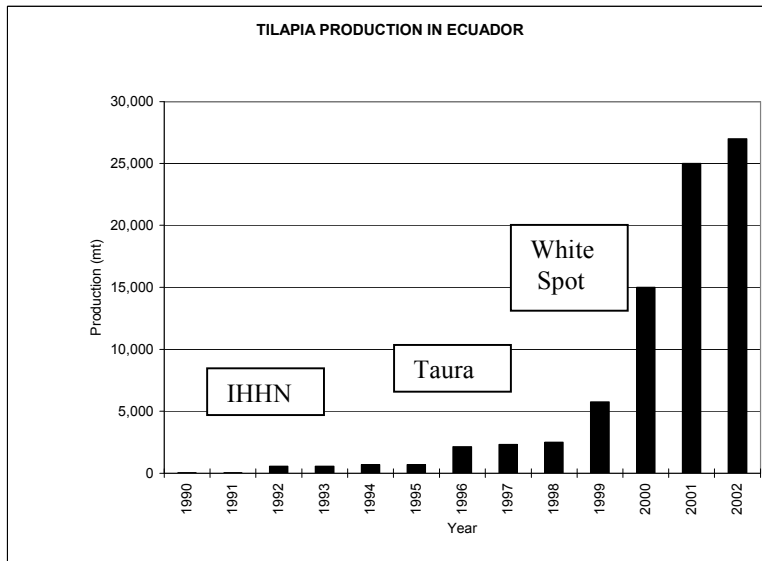


Figure 2. Growth of tilapia farming in Ecuador in relation to shrimp disease outbreaks.

The US is the world's major importer of tilapia. 2003 imports were 91,246 mt with an import value of \$241,205,610. The products were divided between frozen whole fish, frozen fillets and fresh fillets. These products represent a live weight of 177,552 mt. Linked with 2003 domestic production of 9,200 mt, sets the 2003 US consumption of live weight fish at 186,752 mt or 412 million pounds. Tilapia have steadily risen the ranks of popular seafood items in the United States. Import figures have only been collected since 1992, when it was first recognized as a significant commodity. National production figures were first estimated by the industry in 1982. In 2000, tilapia ranked as the 11th most popular seafood item, moving to 10th in 2001 and 9th in 2002. It seems certain to increase to 8th in 2003 or 2004.

Table 2. Consumption and relative popularity of seafood items in the United States.

Per capita consumption in lbs. (NOAA, 2003)		
2000	2001	2002
Tuna 3.5	Shrimp 3.4	Shrimp 3.7
Shrimp 3.2	Tuna 2.9	Tuna 3.1
Pollock 1.6	Salmon 2.0	Salmon 2.0
Salmon 1.5	Pollock 1.2	Pollock 1.1
Catfish 1.1	Catfish 1.1	Catfish 1.1
Cod 0.8	Cod 0.6	Cod 0.66
Clams 0.5	Clams 0.5	Crabs 0.57
Crabs 0.4	Crabs 0.4	Clams 0.54
Flatfish 0.4	Flatfish 0.4	Tilapia 0.40
Scallops 0.3	Tilapia 0.35	Flatfish 0.32
Tilapia 0.28		

The global supply of tilapia grew quickly in the 1990s and early 2000's. Massive increases in eastern Asia, especially China have been a major reason. Increases in Latin America have been fueled by export industry as well as strong local demand. The tilapia industry is currently in the middle stage of the market developments previously seen in the salmon and shrimp industries. Commodity prices, that were dependent on wild catches and seasonal availability, have been overtaken by the year-round availability and quality of farm-raised product. Rapid expansion of tilapia aquaculture in over 100 countries has had the effect of depressing prices to the grower in virtually every nation. Rapid improvements in technology, feeds, genetics, and experience levels of farmers have allowed producers to reduce costs enough to remain profitable.

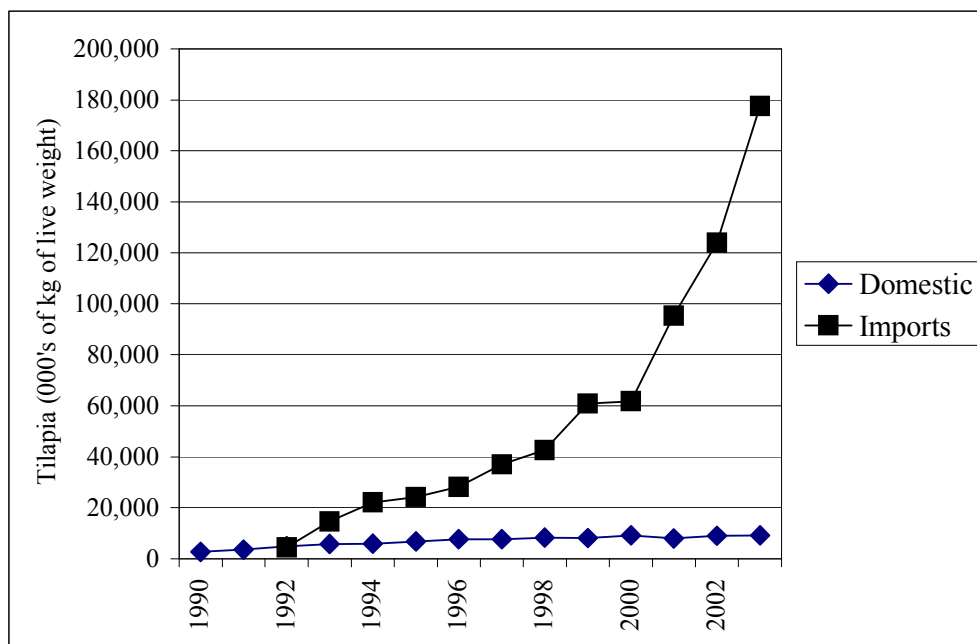


Figure 3. US consumption of tilapia from domestic and imported sources.

Product forms

One of the most important characteristics of the astonishing growth of tilapia has been the proliferation of product forms. The first products sold in international trade were whole frozen tilapia, mostly produced in Taiwan. This is still a major product and still represents most of the tilapia sold from Taiwan and China. However, US retail and restaurant markets prefer fillet products. In the 1980's fresh fillets from Jamaica, Colombia and Costa Rica opened new markets. Frozen fillets from Indonesia and Taiwan developed additional markets. In 2004, the number of product-forms is large and diverse. Fillets are available in different sizes, packages, skin-on, skin-off, deep-skinned, ozone dipped, carbon monoxide-treated, individually quick frozen (IQF), smoked, sashimi grade, and as izumi-dai. Whole and gutted tilapia are still available and primarily are sold into ethnic markets in the United States and the European Union.

In the 1980's many of the tilapia in international trade were marketed whole or gutted, and the fish were frequently transported in large containers holding hundreds of individually quick frozen (IQF) fish. Today IQF fish are almost always inserted into individual plastic bags that protect the skin and keep the fish from forming large blocks. Some are even placed onto individual styrofoam trays with plastic wrap for retail sales in the processing plant. Today, with more sophisticated processing in the tilapia producing countries, virtually any style of packaging is available. Most fillets are now packed into individual bags that are heat-sealed or vacuum-packed. The bags are normally put into a five or ten pound cardboard or plastic box. These boxes may be placed into an insulated master pack. Fresh fillets are normally packaged in five or ten pound plastic packs that can be resealed and are preferred by the restaurant trade.

Both frozen and fresh fillets are graded by size. Most common grades are 3 oz and under, 3-5 oz, 4-6 oz, 5-7 oz, 6-8 oz, and over 7 oz. Many plants have automatic sorting machines that separate fillets by weight. In some producing countries hand sorting is common and highly accurate, with scales used only for checking. With rapidly decreasing costs of weighing equipment and increasing costs in every developing country, conversion to autosorting and weigh checking will continue.

The variety of fillet forms continues to grow with size variations, skinning variations, and various treatments available. Deep skinning has become the preferred treatment. Removing more of the dark flesh along the lateral line and reducing the "chevron" of red in the otherwise white fillet is a more desirable product for many customers. Treating with carbon monoxide or liquid smoke is another product treatment that some customers request and that others receive without notification.

Most fillets now also go through hand trimming. Hand-trimmed fillets have the dorsal and ventral margins trimmed off leaving nicely rounded edges and smooth appearance. Many processing plants run their trimmed fillets through a water bath after trimming. In the past, some plants used a mild chlorine solution in the water to reduce bacteria and lengthen shelf life. Most plants have now replaced chlorine with ozone gas that is bubbled into the tank. Ozone treated fillets are not subject to the disinfection by-products that chlorine can form with organic molecules, nor does it leave any disagreeable taste that can be discerned by some consumers. Most plants use an on-site ozone generation system that supplies the small amounts of ozone needed to effectively disinfect fillets. Studies conducted at the University of Arizona demonstrated that bacterial counts could be lowered by several degrees of magnitude and shelf life could be extended by several days when fillets were rinsed with ozonated water compared to untreated fillets.

Table 3. Major tilapia products in international trade and main suppliers.

	Frozen whole fish	Frozen fillets	Fresh fillets	Skins	Leather goods
China	X	X			
Taiwan	X	X			
Ecuador		X	X	X	
Costa Rica			X	X	
Indonesia		X			
Thailand		X			
Honduras			X	X	
Zimbabwe			X		
Brazil		X			X

By-products

Tilapia skins are the most valuable by-product generated by the industry with three markets. First, skins have been used to make a variety of leather goods, clothing and accessories. In Brazil, several companies produce dresses, shirts, vests, wallets, belts, purses and briefcases. Tilapia skins recovered from the skinning machines in the processing plants are treated, dyed and cut into evenly shaped pieces. Some companies will work with these pieces, while others will assemble large sheets of skins sewn together and sold to a manufacturer. Snack foods represent the second market. Skins, with scales removed, are cut into thin strips and deep-fried. These are popular in Thailand and the Philippines where they are served as appetizers often with slices of onion and a cut lime. A third market for tilapia skins is as a pharmaceutical product. Several European firms are purchasing frozen or salted skins which are processed for gelatin used to make time-released medicines, substituting material from tilapia skins for mammalian products. The continuing concern over BSE and other prion related diseases is likely to increase the demand for this product.

Another by-product is the trimmings and heads. Heads are used for soups in some countries. Fillet trimmings and throat meat can be recovered and used for ceviche and other preparations using small amounts of fish. Equipment also exists to facilitate the recovery of flesh through de-boning of skeletons. The flesh recovered provides a base for fish sticks, fish sausage, fish balls, fish sauce or other highly-processed forms. Carcasses, heads, and trimmings are also used for animal feeds, especially hogs.

One of the most fascinating uses of tilapia by-products is the creation of “flower” ornaments made from dried and colored fish scales. In Brazil, a cottage industry has developed to collect, dry, and curl scales that are then arranged and glued to a base with a thin wooden stem to mimic various flowers (Figure 4).

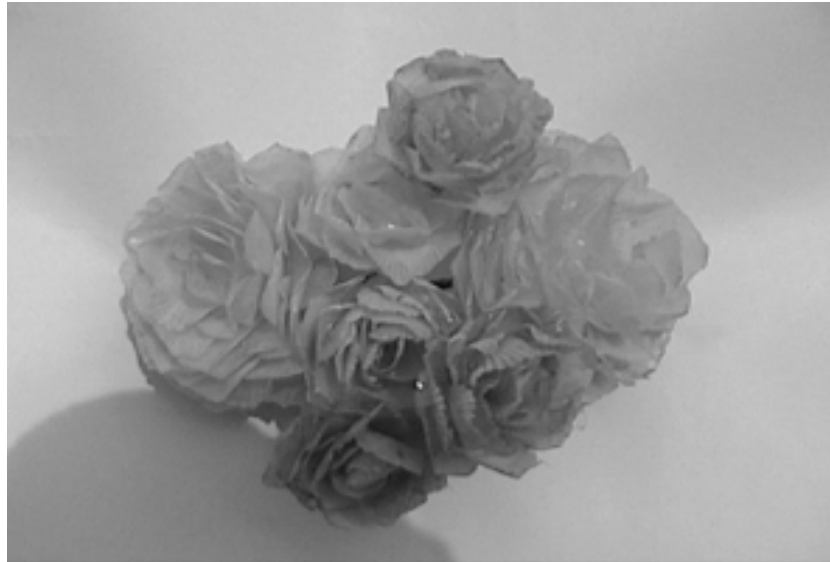


Figure 4. Ornamental flowers made from tilapia scales.

Market development and new products

Tilapia markets have shown two patterns of development. In the developing, mostly tropical countries, tilapia have first been grown as a low cost, alternative protein source by and for rural farmers. Over time, urban markets have developed, but still as a relatively low price fish product (Engle 1997; Funez *et al.* 2001). As production procedures improve and farmers learn to eliminate off-flavor, the restaurant trade and middle class consumers have started to purchase tilapia and it has moved into the mainstream of seafood products. In the Philippines most people are convinced that tilapia are native fish and a traditional part of the diet, even though it was introduced to the Philippines in the 1940's.

In the highly industrialized countries, small markets developed in the 1970's and 1980's amongst restaurants and groceries of immigrant communities of Asians, African, and Latin Americans. These markets have been supplied with live fish by local farms and with low cost frozen fish from their home countries. Fresh fillets from tropical producers began to work their way into these ethnic restaurants and then migrated into upper echelon restaurants that were looking for new products and appreciated the qualities of fresh tilapia. From there, tilapia simultaneously moved into the casual dining restaurant chains and the hypermarkets and club stores. These are the major markets that are feeding the explosive growth in consumption. Virtually all the casual dining chains in the United States now feature one or more tilapia preparations on their menus. The reasonable cost, year-round supply and flexibility in preparation are ideal for their needs. Large sales of tilapia fillets in traditional groceries and seafood counters have not yet occurred in any of the major industrial countries.

Europe is the next hot spot for tilapia markets. Most Europeans are just discovering tilapia. Their immigrant communities have been fueling growing imports for several years. The major supermarket chains are test marketing in their club stores and hypermarkets.

Restaurant chains are still a new phenomenon in Europe, but tilapia is sure to be one of their signature dishes as they develop. Europeans are constantly looking for new fish supplies to replace decreasing wild stocks. Tilapia has proven itself to be an excellent substitute for several traditionally captured species.

China is another major market that is still developing. Already the world's largest producer and consumer of tilapia, the market for more tilapia is still vast. The growing middle class in China is looking for processed fish products that are more convenient than the traditional large, bony, and frequently off-flavor carp. Tilapia is ideally suited to replace carp as a staple of Chinese seafood. With China's vast population, replacing just a fraction of carp consumption with tilapia will require much higher production. Korea, Vietnam and India are additional Asian populations that still have relatively low tilapia consumption rates, considering their high per capita consumption of seafood products.

Conclusions

Tilapia products will continue to increase in availability and variety. Demand is certain to increase as recognition of its attributes spreads and as supply is provided to more markets. Production costs will continue to drop as farmers switch to faster growing, more efficient stocks and as nutritional knowledge improves and producers learn to reduce feed costs. Huge markets are still available for expansion and the sophistication of the marketing firms has improved markedly. Tilapia has been referred to as the aquatic chicken. We are still in the earliest stages of the industry when compared to what has been accomplished by the poultry producers. It is a great time to be in the tilapia world.

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