Western Edge Seafood™

The Fish People

The Tilapia Handbook

Version 3.0

Introduction

This is a fish story. A Tilapia story to be exact. This handbook traces the chain of events that happen before your Tilapia arrives into your hands. An exceptional product is the result of many combining factors, and so the importance of a greater understanding of the Tilapia story helps to make more educated and informed decisions.

Farming and processing methods vary widely throughout the industry. The life cycle of cultured Tilapia depends substantially on matters such as farm location, farming practices, feed content, and water supply. Not all Tilapia are created equal.

The information that follows will tell the story of Tilapia and explain current industry practices from start to finish. It is a complex process, but quite simply said: A superior fish is created at the farm, and processing seeks to preserve that excellence.

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History

A Brief History

Tilapia has been nourishing human beings for thousands of years. Tilapia's most appealing attributes are that it is easy to farm, and its very mild flavor that makes it wonderful to eat. It is no wonder that Tilapia is prized far and wide, and it has made its mark on history.

The Name

Tilapia is the latin form of the African word "Thiape" which means fish. Tilapia was given its name by Andrew Smith, a Scottish zoologist in 1840. Nicknamed "St. Peter's Fish" thought to be derived as the fish harvested from the Sea of Gallilee, tilapia is believed to be the fish that was used in the biblical allegory to feed the multitudes.

Andrew Smith, Scottish Zoologist.

Tllapia's origin is recorded in history as

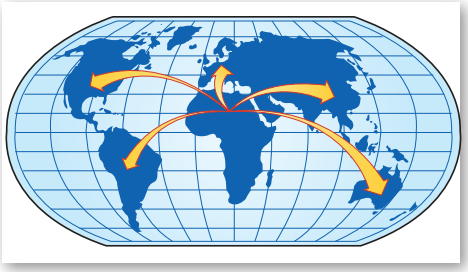
The Origin

Tilapia origins have been traced back as far as 3,000 years to Ancient Egypt. Evidence of Tilapia being cultured has been discovered in the heiroglyphics on the walls of ancient tombs.

Worldwide Expansion

In the 1940's Tilapia began its wordlwide expansion. Being introduced into Far East culture first, Tilapia rapidly spanned the globe and came to the Americas by 1960. Over the past 40 years, tilapia aquaculture has made its way into 85 different countries. Though the Mossambique Tilapia was the first Tilapia to be cultured outside of Africa, the Nile Tilapia and its hybrids account for 83% of all Tilapia farm raised worldwide.

Tilapia has grown to become one of the most consumed fish in the world over the past couple years. The ability of Tilapia to adapt to varying water qualities, feeding habits, and temperatures has allowed it to become one of the premier farm raised species of fish in the world.



Tilapia is now farmed in over 85 countries worldwide.

Species

Nile Tilapia are the most durable of all Tilapia, making them the perfect aquaculture species. More than 90 percent of all the commercially farmed tilapia outside of Africa are Nile tilapia such as the large fisheries in Asia and South America.

Oreochromis Niloticus
Nile Tilapia
Commonly sold today as Black Tilapia

Mossambique Tilapia were one of the originating species of Tilapia, and through escape and human interaction, broke off into other species. Mossambique Tilapia were thought to be the best Tilapia to farm, but were a low yield fish, and were very selective with water and feed.

Oreochromis Mossambicus
Mossambique Tilapia

Blue Tilapia are generally used in industrial aquatic systems to rid the water of algae and other organisms that grow in the water systems. The blue tilapia hails from north Africa, contributing to its nickname of "Nile perch". They generally grow larger than their relatives because of their habitat.

Oreochromis Aureus
Blue Tilapia

The original Red Tilapia hybrid was created in Taiwan, when a mutant pigmented female Mossambique Tilapia was cross bred with a male Nile Tilapia. Another red strain of Tilapia was developed in Florida in the 1970's by cross breeding a female Zanzibar Tilapia with a male reddish - gold Tilapia Mossambique.

Oreochromis Mossambicus X Niloticus
Red Tilapia

Current Trends

Tilapia's unbelievable command of the seafood market shows no signs of slowing down.

In recent years Tilapia has become a household name, and a staple seafood protein on menus throughout the national restaurant chains. It hasn't gained the popularity yet to rival Salmon among consumers, but Tilapia's low price point and preparation versatility should be key factors in the trend of future growth.

Over the past decade, Tilapia has seen a consistent overall growth in U.S. consumption. The consistency in growth is impressive because Tilapia consumption continues to grow despite overall seafood consumption experiencing decline. Tilapia has even began to distance itself from its next closest competitor in Pollock over the last two years.

TOP 10 SEAFOOD U.S. CONSUMPTION BY SPECIES

2005		2006		2007		2008		2009		2010	
1. Shrimp	4.10	**1.** Shrimp	4.40	**1.** Shrimp	4.10	**1.** Shrimp	4.10	**1.** Shrimp	4.10	**1.** Shrimp	4.00
2. Canned Tuna	3.10	**2.** Canned Tuna	2.90	**2.** Canned Tuna	2.70	**2.** Canned Tuna	2.80	**2.** Canned Tuna	2.50	**2.** Canned Tuna	2.70
3. Salmon	2.43	**3.** Salmon	2.026	**3.** Salmon	2.364	**3.** Salmon	1.84	**3.** Salmon	2.04	**3.** Salmon	1.999
4. Pollock	1.468	**4.** Pollock	1.639	**4.** Pollock	1.730	**4.** Pollock	1.34	**4.** Pollock	1.454	***4. Tilapia***	***1.45***
5. Catfish	1.025	***5. Tilapia***	***0.996***	***5. Tilapia***	***1.142***	***5. Tilapia***	***1.19***	***5. Tilapia***	***1.208***	**5.** Pollock	1.192
6. Tilapia	***0.848***	**6.** Catfish	0.969	**6.** Catfish	0.876	**6.** Catfish	0.92	**6.** Catfish	0.849	**6.** Catfish	0.800
7. Crab	0.643	**7.** Crab	0.664	**7.** Crab	0.679	**7.** Crab	0.61	**7.** Crab	0.594	**7.** Crab	0.573
8. Cod	0.572	**8.** Cod	0.505	**8.** Cod	0.465	**8.** Cod	0.44	**8.** Cod	0.419	**8.** Cod	0.463
9. Clams	0.435	**9.** Clams	0.440	**9.** Clams	0.449	**9.** Flatfish	0.43	**9.** Clams	0.413	**9.** Pangasius	0.405
10. Flatfish	0.366	**10.** Scallops	0.305	**10.** Flatfish	0.305	**10.** Clams	0.42	**10.** Pangasius	0.356	**10.** Clams	0.341
Total	**16.2**	**Total**	**16.5**	**Total**	**16.3**	**Total**	**16.0**	**Total**	**15.8**	**Total**	**15.8**

2011		2012		2013		2014		2015		2016	
1. Shrimp	4.20	**1.** Shrimp	3.80	**1.** Shrimp	3.60	**1.** Shrimp	4.00	**1.** Shrimp	4.00	**1.** Shrimp	4.10
2. Canned Tuna	2.60	**2.** Canned Tuna	2.40	**2.** Canned Tuna	2.70	**2.** Salmon	2.307	**2.** Salmon	2.87	**2.** Salmon	2.18
3. Salmon	1.952	**3.** Salmon	2.02	**3.** Salmon	2.30	**3.** Canned Tuna	2.30	**3.** Canned Tuna	2.20	**3.** Canned Tuna	2.10
4. Pollock	1.312	***4. Tilapia***	***1.476***	***4. Tilapia***	***1.43***	***4. Tilapia***	***1.436***	***4. Tilapia***	***1.381***	***4. Tilapia***	***1.18***
5. Tilapia	***1.287***	**5.** Pollock	1.167	**5.** Pollock	1.154	**5.** Pollock	0.981	**5.** Pollock	0.97	**5.** Pollock	0.96
6. Pangasius	0.628	**6.** Pangasius	0.726	**6.** Pangasius	0.771	**6.** Pangasius	0.690	**6.** Pangasius	0.743	**6.** Pangasius	0.89
7. Catfish	0.559	**7.** Crab	0.523	**7.** Cod	0.605	**7.** Cod	0.657	**7.** Cod	0.60	**7.** Cod	0.66
8. Crab	0.518	**8.** Cod	0.521	**8.** Catfish	0.566	**8.** Catfish	0.517	**8.** Catfish	0.555	**8.** Catfish	0.54
9. Cod	0.501	**9.** Catfish	0.500	**9.** Crab	0.548	**9.** Crab	0.508	**9.** Crab	0.579	**9.** Crab	0.51
10. Clams	0.331	**10.** Clams	0.347	**10.** Clams	0.352	**10.** Clams	0.342	**10.** Clams	0.329	**10.** Clams	0.34
Total	**15.0**	**Total**	**14.6**	**Total**	**14.5**	**Total**	**14.6**	**Total**	**15.5**	**Total**	**14.9**

Raw data from National Marine Fisheries Service. The Top Ten List was calculated by Howard Johnson, H.M. Johnson & Associates for NFI. (U.S. Per-Capita Consumption By Species in Pounds)

Current Trends

U.S. Tilapia Imports, Volume By Selected Sources (In Thousands Of Pounds)

		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Total																
5700	China (Mainland)	12,627	29,744	29,960	58,391	100,266	132,126	165,428	228,871	264,888	262,908	287,527	349,479	318,298	382,278	370,732
5830	China (Taiwan)	55,057	39,070	65,761	52,133	49,416	61,086	60,112	47,048	35,494	40,857	34,657	41,370	30,685	27,900	40,894
3310	Ecuador	4,435	7,600	11,441	15,159	21,444	22,954	24,101	24,513	27,316	20,170	22,439	18,733	17,987	18,478	12,494
5600	Indonesia	2,527	2,691	4,889	5,677	7,911	9,377	14,635	16,298	19,060	21,589	19,332	22,540	20,342	26,383	26,076
2150	Honduras	1,745	2,306	3,168	6,347	6,286	8,910	14,488	15,988	18,936	18,720	15,689	16,212	17,929	17,618	18,218
2230	Costa Rica	5,093	5,917	6,854	7,073	8,819	9,053	8,485	5,903	10,987	12,292	12,824	13,180	11,949	12,576	14,974
Whole Frozen																
5700	China (Mainland)	10,891	25,622	23,964	43,245	63,412	70,229	68,044	89,342	71,708	63,998	65,459	50,575	56,686	51,417	53,633
5830	China (Taiwan)	48,640	35,073	60,890	45,503	43,351	55,097	53,319	40,132	29,851	35,015	29,056	35,927	26,883	23,019	36,063
5490	Thailand	104	43	108	550	267	317	358	1,298	373	7,309	1,994	2,613	1,253	1,089	915
2250	Panama	4	5	330	229	224	992	842	290	558	144	349	447	336	314	
5520	Vietnam	42	135	15	2	91	55	1,155	634	152	469	292	247	333	561	400
3310	Ecuador	329	53	210	36	316	167	143	135	340	480	0	4	35	158	191
Fillets, Fresh																
3310	Ecuador	3,982	7,171	10,923	14,524	20,717	22,407	23,370	23,966	26,184	18,640	19,974	17,321	16,848	16,246	10,723
2150	Honduras	1,701	2,288	3,168	6,347	6,286	8,910	14,488	15,984	17,377	18,368	14,356	15,973	17,814	17,200	18,066
2230	Costa Rica	5,093	5,917	6,854	7,068	8,810	9,018	8,232	5,903	10,610	12,271	12,613	12,843	11,837	12,112	14,388
Fillets, Frozen																
5700	China (Mainland)	1,652	3,991	5,575	13,285	34,966	61,897	97,384	139,529	193,141	198,910	222,022	298,904	261,612	330,415	316,647
5600	Indonesia	2,527	2,685	4,804	5,671	7,899	9,371	14,172	15,665	19,028	21,228	19,308	22,491	20,298	26,265	26,017
5830	China (Taiwan)	6,076	3,815	4,703	6,087	5,445	5,953	6,793	6,916	5,643	4,604	5,142	4,957	3,030	3,858	3,309
5490	Thailand	253	393	461	753	2,072	1,618	1,917	436	30	970	1,497	2,327	2,909	5,360	3,214
3310	Ecuador	124	376	308	599	411	379	588	411	792	1,050	2,465	1,407	1,104	2,074	1,579

Raw data acquired from www.ers.usda.gov

U.S. Imports

It is clear what country/region is the most powerful in terms of exporting Tilapia to the U.S., and that is China. The amount of growth that Tilapia as a species has experienced as an imported item into the U.S. has been astounding.

To illustrate this, we are making comparisons from the year we created the original Tilapia Handbook (2006) to 2013's import statistics.

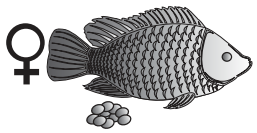
In 2006, when we created the original Tilapia Handbook, 85.3% of all Tilapia imported into the U.S. was a product of China and the P.R.C. (People's Republic Of China) at around 280 Million Pounds. In 2013, according to the Economic Research Service of the U.S. FDA , 85% of all Tilapia imported into the U.S. was a product of China and the P.R.C., weighing in at about 412 Million Pounds. China and the P.R.C. maintained their strength in percentage of the U.S. imports, while increasing the poundage imported by 47%.

World Trade

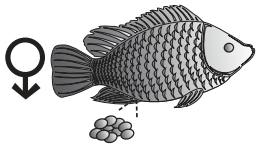
The Central and South Amerian regions have always been the superpower in providing the world with fresh Tilapia. In 2006, Ecuador at 24 Million pounds was easily ahead in exports of fresh Tilapia to the U.S., nearly 10 Million pounds ahead of Honduras, its nearest competitor. In 2013, Ecuador, down to 11 Million pounds exported to the U.S., has lost not only the top spot to Honduras at 18 Million pounds, but has even relinquished even the second spot to Costa Rica at 14 Million pounds. This makes it apparent that not only is the Central and South American region much more competitive, but the frozen industry has taken an even greater stronghold on the global Tilapia market.

Growth Stages

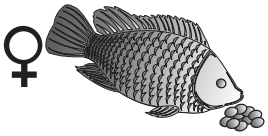
1. The female Tilapia will choose a location to lay her eggs where they are easily accessed by males.



2. The male Tilapia will dispurse sperm on the eggs in order to fertilize them.



3. Once the eggs have been fertilized, the eggs are then picked up by the female and hatched in her mouth.

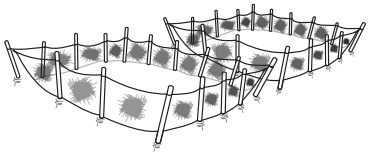


4. The female and eggs are kept in a conditioning hapa until the fry have reached the size to be harvested.

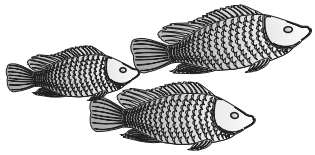
5. Once the eggs have hatched, they are in a "sac fry" form for 10-14 days.

6. They grow into what is known as "swim up fry" until they reach 6-7mm in size, where they are collected from the edge of the hapa.

7. Once the swim up fry are collected, they are manually sexed and then placed into a nursery hapa, where they will become fingerlings.



8. Once a fingerling reaches 50g in size, they are then moved to a growout pond where they will spend the rest of the time until harvest.

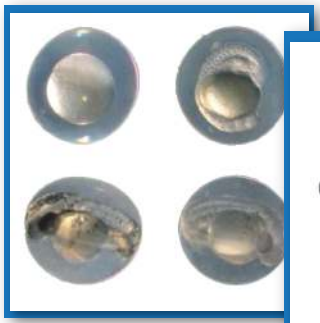


Egg to Fry

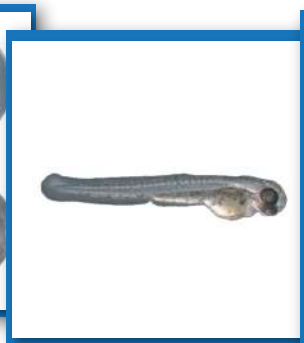
Tilapia in China are typically bred in using the broodfish-hapas system. A hapa can be a fiberglass tank of 1x1 meter or a very dense net which in places into a large tank or small pond. Broodfish are mature male and female specimens, and spend time in "conditioning hapas" where they are isolated by sex and fed a high protein feed consisting of 30-40% protein. During times of ovulation by the female, broodfish are placed into the "breeding hapas" at a ratio of about 4 females to 1 male. Tilapia are "mouth breeders" which is to say that the fertilized eggs are kept inside the mothers mouth in an "oral incubation". Hatching occurs in 3-5 days. The fish are then known as "sac-fry" because of the continuing reliance on an attached embryonic sac. Sac-fry may continue stay within close proximity to their mothers' mouth for a period of 10-14 days. After this time, the come be known as "swim-up fry". Swim-up fry tend to stray away from their mother and are easily collectable, as they tend to seek the outer barriers of the hapas. Once the fry are 6-7mm at about 30 days old, they can be collected and placed into a nursery pond where they will grow into "fingerlings". This is important as the fry are potential food for the adult breeder tilapia once they reach this size.

Fingerlings

At the end of the fry stage, tilapia usually spend time in a nursery pond before going to the final grow-out pond. To put the small tilapia into a grow-out pond directly would be an inefficient use of the ponds, i.e. too much pond for too little biomass of fish. The tilapia may be mixed sex. The tilapia are offered small pellet feed (see "feed composition") and are grown in a fertilized environment (see "fertilization"). They are grown to an advanced fingerling size of over 50g. As it is easier to manually sex select tilapia as they get larger, the process may be included at this step. Tilapia may spend 2-3 months in a nursery before moving onto the grow-out phase. The fingerlings that have progressed to the grow-out phase will spend the next 6-8 months increasing to a harvestable size of about 350g - 1,000g.



Egg Development



Sac Fry

Mouth Breeding

Swim Up Fry

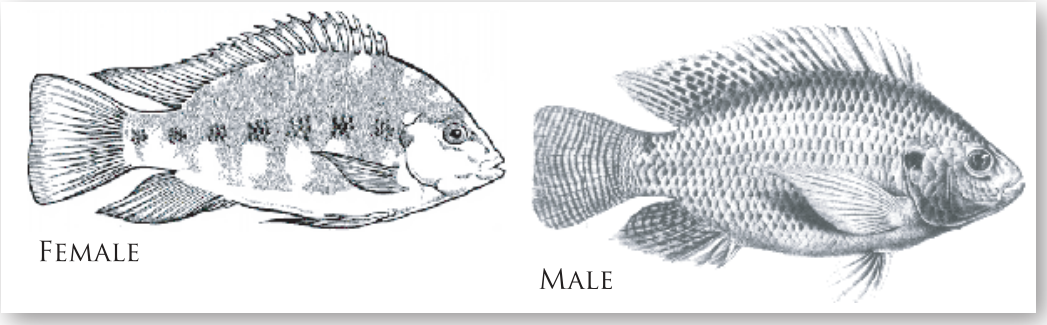
Fingerling

Sex Selection

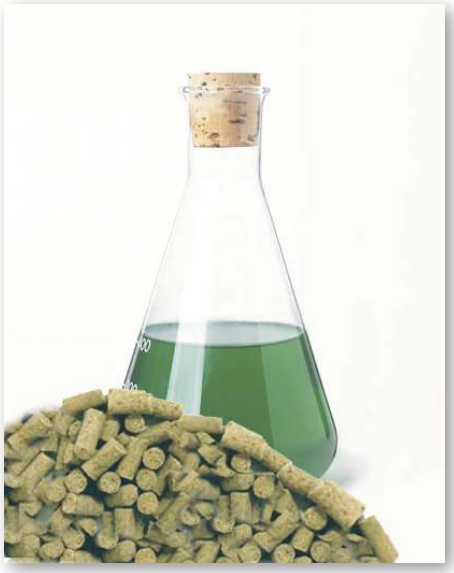
Sexing methods occur in the early stages of tilapia development. Gender separation is critical in the development of tilapia and many methods are used.

Gender Differences

Only the male tilapia are chosen for cultivation. Male fish grow bigger and faster than females with less food. A mixed sex population might also incur uncontrolled reproduction in the grow out ponds.



Male & Female Tilapia



Hormone Therapy Using Feed

Hormone Therapy

In hormone therapy, farmers will feed the fry hormones such as methyltestosterone. Controversy surrounds the use of such steroids, but the use of hormones is perfectly safe because the hormone is not detectable in adult fish after 90 days of growout.

Other Methods

Less widely used sexing methods include hybridization and genetic manipulation.

Genetic manipulation involves hormone therapy and chromosome modification.

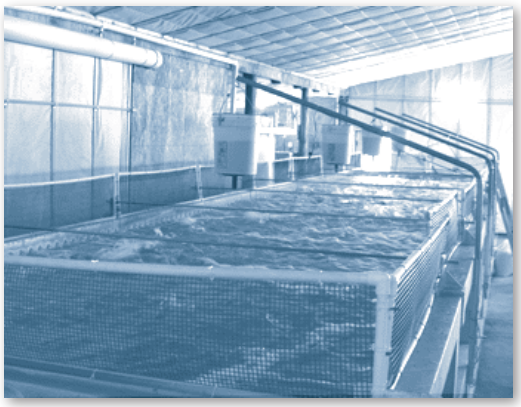
Hybridization techniques use complex breeding methods which pair different species. This method is complex and not 100% reliable

Genetic Manipulation by Injection

Growing Systems

Tank Systems

Tank Systems are also known as recirculation systems. These systems are used when land availability is of short supply, or the environment is not suited for farm raising of the fish. The drawbacks of these systems have been the cost, due to the energy needed to run the system, man power to operate and maintain the system, and overall feed costs due to the lack of natural nutrients and feed found in other methods.



Tank System

Floating Cage System

Floating Cage Systems

Floating Cage Systems are systems used in lakes, reservoirs, and rivers. Cages are usually built out of nylon, along with supportive material such as bamboo or hollow pipe, which provides stability, as well as enabling the cage to float in the water, alowing the fish to grow in a natural environment. Although found to have advantages in raising species such as Catfish, it is found to have some limitations in raising Tilapia. The reason Tilapia have not flourished in this setting is that as a species, they are primarily vegetarians, and seek much of their food source from algae grown in pond settings. The lack of such resources in a cage setting increases the need for floating feed, and more of it, thus incurring greater costs. Also, there has been risk of downstream contamination from other sources thay may be present within the same water supply.

Pond Systems

There are two types of pond systems commonly used in pond aquaculture today. These two types are commonly known as low and high intensity farming. The intensity statement refers to the intensity of the population being grown per volume and size of a pond. High intensity farming takes place where land is less available due to land cot or the overall terrain of the land mass. The preferred method of farming is the low intensity method.

This method is available where land costs are lower and the natural environmental factors are most suited for aquaculture. This is the reason that the majority of Tilapia farming is done in the Asian region where favorable environmental factors such as inexpensive land and proper terrain with adequate water resources are available.

Pond System

Growing Systems

Pond Site Selection & Preparation

There are two common types of land composition to be found in pond farming. The two types are earth ponds, which are also commonly known as mud bottomed ponds, and sand bottomed ponds. Sand bottom ponds are the preferred type due to their capabilties for fertilization as well as sanitation. Sand bottomed ponds have a stronger ability to handle fertilization for algae growth, and they are easier to sanitize in between grow outs than mud bottomed ponds. The process of preparation begins with the digging of the ponds.

The average size of the ponds is usually found to be 10 to 12 acres (4-8 hectares) in size, and 6 feet (2 meters) deep. However, in Asia on the coastal and island regions, traditionally the pond size is generally 2+ acres (1 hectare). Once the ponds are dug, they are then ready for fertilization. The fertilization encourages beneficial algae growth in the ponds, which is a major source of nutrition for Tilapia.

Land preparation for earth ponds

Land preparation for sand bottom ponds

Abundant Clean Water Supply

Water

Once the ponds have been dug and fertilized, they are now ready for water. The quality of the water and the amount of the flow will have a profound effect on the quality of the Tilapia being produced. Site selection is critical in attaining beneficial water supply. The most suitable sites are those where a plentiful and pure water source is available. The avoidance of polluted areas is of the utmost importance when developing a site. Use of poor water is a major factor in the development of pond disease, which leads to the need for chemicals and anitibiotics to be introduced into the system. The introduction of fluoroquinlones, nitrofuran, and fungicides such as malachite green have been traced back to operations with poor water supply.

Treatment & Fertilizers

Lime coating treatment is sometimes done during pond preparation, and also in between crops. The treatment is done in order to not only sanitize the pond soil, but also to ensure that the chemical composition of the soil is prepared for the next crop or initial growth.

The use of fertilization must be managed very carefully or even avoided. Excess fertilization in an attempt to reduce food costs can result in the development of off flavors.

There are two different styles of fertilizers used in production of Tilapia. The commercially manufactured style, and what is known as the natural style.

Pond Management

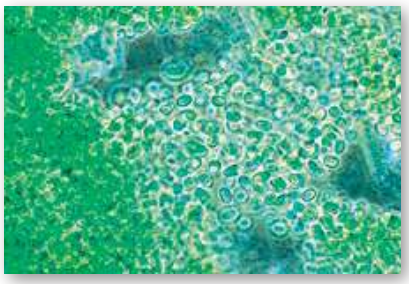
Story Of Algae

The contribution of naturally growing feed to the fish is essential as far as grow out costs are concerned when growing Tilapia. Naturally growing feed refers to the plant life that grows in the pond during the grow out cycle. This is most prevalent in low intensity farming, where a naturally growing feed is a major part of the feeding system. Algae is often used as a catch-all term used when describing a feed growth in a Tilapia farming operation. When speaking of algae, not all algae is created equal.

Algae is a plant organism that is grown in Tilapia ponds as a natural feed for the Tilapia. Healthy forms of algae are a great source of nutrients forthe Tilapia. Having a clean and plentiful water supply and taking the proper steps during pond preparation will help to develop healthy algae growth. Poor water quality, and improper pond preparation will lead to the possible growth of what is known as blue green algae.

Blue green algae, which in actuality is not a form of alage, but a bacteria which has the appearance of algae in the water. The correct name for this growth is cyanobacteria, which as its name infers, is a bacteria, not an algae. This is a main factor in Tilapia products in the forming of geosmin, also known as earthy flavor.

Healthy water supply, as well as proper sanitation of the ponds, is needed to keep this pesky little bacteria at bay. In the processing of Tilapia, chemicals are often used to rid the fillets of the taste caused by this bacteria.



Blue Green Algae

Algae

Feed

In addition to naturally growing algae, the Tilapia also feed on prepared feeds. Feeds can vary in specific ingredients, but they all serve to meet the nutritional requirements of the fish. The difference in feeds depends on the amount of natural resources available locally to produce the feeds. Where plentiful resources are available, the farmers blend a natural plant material along with proteins made from fish by-products, sourced locally to produce the feed. A true advantage of this method is that the traceability of the protein is achievable. Where local resources are not available to produce feed, the farmers must import their feed from other regions of the country, or at other times even other parts of the world. When importing feed, the traceability of the proteins is much harder to achieve. Also, with outside manufactured feed not produced naturally, there exists the risks of manufacturing practiced which include the addition of chemicals such as melamine, a substance which is banned by the US FDA. Similar to the fertilizer process, other animal proteins are often introduced the feed.

Pellet Feed

Feeder Systems

There are two basic ways that fish pellet feed is distributed in. Hand feeding is a very common method, whereas a barrel of pellet feed is kept at each pond site, and the pellet feed is scooped up out of the barrel and tossed onto the water by hand. The other method is to use a motorized spreader, where pellets are loaded from a storage box onto a controlled metal arm, and the arm releases, spreading the feed over the water evenly.

Pellet Feed Spreader

Processing

Tilapia measured for average size

Pond Inspection

During harvesting, a quality inspector visits the pond to make sure everything meets established standards. The pond must be clean, containing no blue green algae overgrowth. Remember, geosmin affects the taste of the fish. Because the human nose is extremely sensitive to geosmin, the inspector will often cut into a fish to smell it. All fish must be of a good size, lack disease and fungi, and exhibit good health. Strong, healthy fish produce whiter, tastier flesh. Sick and weak fish are removed during processing. If all is well, the pond passes inspection and the fish are ready to be harvested.

Harvesting

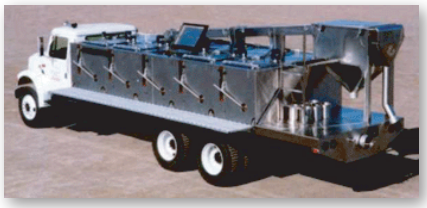
Tilapia have a grow out life cycle of 8 to 10 months. Once they reach a size between 350g and 1,000g they are ready to be harvested. When the fish are ready to be harvested, they are taken off of feed approximately 24 hours before being pulled from the ponds. This is done to ensure that the bellies are empty and most of the waste material has been emptied from them internally.

Harvesting of Tilapia through use of a large net and crane.

Transport

At the time of harvesting, the ponds are drained down for better access to the fish. Large nets are then lowered into the ponds to gather the fish. This is usually done with the assistance of a mechanical crane-like device for helping in the pulling and lifting of the nets. The nets are then emptied into live haul trucks to be transported to the processing plants live.

The trucking equipment is a truck specially equipped with water tanks that are connected to oxygen tanks that supply a constant stream of oxygen into the tanks in order to keep the fish alive while being transported.



Live transportation of Tilapia to the processing facility.

Purging And Preparation

Upon arrival at the seafood processing plants, the live hauled Tilapia will then be unloaded into purging tanks or purging raceways. The fish are then purged to free the meat from impurities. Purging by definition means to purify. The correct purging systems are ones that have plenty of free flowing water that will quickly carry away any of the waste materials being discharged from the Tilapia. The main purpose fo this process is to reduce or eliminate any odors or off flavors that may be present in the fish without purging.

Bleeding Tank

After purging the Tilapia, they are now ready for slaughter. From the purging tanks, or directly from the truck if the purging was done at the farms. The fish are placed ona conveyor system to take them into the plant where they will be inspected and killed. On the slaughter line the fish are inspected. Only Tilapia that are alive upon inspection will be killed. Dead fish found will be discarded and sold on the local markets. The reason for this is that once he fish are cut for bleeding, they must be alive and healthy in order to pump the blood from their system. After the intial cutting, the fish are then placed in a bleeding tank where they are to bleed in preparation of fillet cutting.

Processing

Inspection

Rigorous plant inspection occurs often. The Chinese Inspection and Quarantine (CIQ) is the overseas equivalent to U.S. FDA. Inspectors perform various microbiological analyses, testing for chemicals and doing bacterial counts. The CIQ makes sure that the fillets are true to taste and do not contain illegal veterinary drugs or banned substances. Reputable companies often implement third-party quality inspections over and above CIQ regulations. All farms must be registered with the CIQ in order to operate and every container must bear a stamp of approval before shipping out.

Inspection Of Tilapia

Cargo Vessel

Shipping

Once the fillets are packed and loaded, they are taken by refrigerated trucks to the port to prepare them for shipment. Containers are then loaded on vessels, and shipped to their final destinations.

The containers are kept frozen from the arrival port to the cold storage facility through the use of refrigerated trucks and gen-sets during transportation and unloading.

CIQ

The full and official name of the Chinese Inspection and Quarantine is the Administration of Quality Supervision, Inspection, and Quarantine (AQSIQ). This agency is responsible for the inspection of goods that are imported and exported into and from the People's Republic of China (PRC). As is the case with most agencies of the PRC, the CIQ has a hierachal construction with a centralized authority in Beijing and a provincial level authority in each province, and subsequent local authorities.

CIQ is the the responsible agency to ensure the integrity of Chinese goods. When it comes to tilapia, CIQ inspects for off flavor product, as well as the presence of illegal aquaculture drugs and additives.

All farms and processing facilities that produce fish for export must be registered and inspected by the CIQ. Each container of tilapia must have a CIQ inspection certificate before export is allowed. CIQ inspections are also to ensure that product quality and standards are coordinated with the USA in order to protect the very important United States - China trade relationship.

Chinese Inspection and Quarantine

Processing

Cutting & Trimming

After bleeding, the tilapia are divided into two lines: one line for whole fish preparation, and one for fillet preparation. Whole fish are simply gutted, scaled, and graded for size/quality. The tilapia that proceed down the filleting line are cut into uniform pieces with the skin intact. The fillets continue onward through a machine which removes skin to a desired depth (Super Shallow Skinned, Shallow Skinned, Deep Skinned, Super Deep Skinned). Next, at trimming stations, the remaining cartilage and pin bones are removed by hand. Some fillets are now redirected to the CO processing station, while all of the naturally processed fillets head straight to the ozonating station.

Cutting and Trimming of Fillets

Ozonating

All tilapia must go through a phase which removes germs. At the ozonating station, the fillets are submerged in a bath of ozonated water which will eliminate 99% of surface bacteria. Ozone, in simple terms, is a molecule with three oxygen atoms which quickly change into familiar diatomic oxygen. It is extremely effective, harmless, and environmentally friendly.

Ozonated Water

Izumi Dai Tilapia Fillet

CO Processing

Tilapia have a naturally beautiful pink color. "Izumi Dai" is a Japanese term that has come to signify a specific step in fish preparation. Carbon Monoxide (CO), although seriously unhealthy to breathe, is a perfectly harmless and efficient gas used to preserve tilapia's natural color and taste.

Fillets are placed in a vacuum and flushed with CO gas for approximately 20 minutes. Izumi Dai literally means "red snapper", but is synonymous within the seafood industry with enhanced appearance.

Freezing

The entire process up until this point has been fairly short and it is time to freeze the fillets. The fish go through either a spiral or a cryogenic freezing system in which the core temperature of the fish must reach -18° C for packing.

Blast Freezer

Packing

Tilapia products are packed according to the buyer's specifications. Each fillet may be individually vacuum packed (IVP), individually quick frozen (IQF), or individually wrap packed (IWP). One method is not necessarily better than the other, and all facilitate ease of use for the desired final use of the product.

The product is then packed into specified further packaging, most commonly a master carton, and then it is sent to inspection.

Tilapia Master Case

The Western Edge Difference

Hands On Procurement

One of the things that we at Western Edge pride ourselves on is our procurement strategies and the implementation of those strategies in terms of consistent supply, quality control, competitive pricing, and taste profiles. We have an extremely high standard set for our packers that must be met in order for us to continue doing business with them. We adopted a "boots on the ground" strategy in our procurement process from the beginning, which eliminated a lot of misunderstandings and mistakes being made during the farming, processing, and production of the products that bear the Western Edge brand name. This has allowed Western Edge to experience a lot of success, and we continue to use the same core values, principles, and strategies that brought us those successes in order to grow and build our seafood program for the future.

It is essential to begin with selection of grow-out areas. A preferred location has lower population density and water supply not affected by industrial activity. Multiple areas planned as "geographical diversity" are use to protect against supply disruption due to disease or weather events.

Farms must be inspected and approved for export.

Guidance is given to farmers on Best Practices for production of clean tasting tilapia. Best practices include water exchanges, mechanical agitation, and proper feeding to control unwanted algae and bacteria in the grow-out environment that are the cause of off-flavors.

Only live fish received at the production facility are used for fillet production to achieve proper color and fillet texture.

Ozonated water is used at the end of fillet processing to effectively eliminate pathogens.

In addition to Chinese CIQ inspections, all product is produced under regime of third party verification for BRC (British Retail Consortium) food safety and Quality Control. BRC is widely seen as the most robust food safety protocol.

Additional Quality Assurance (QA) is performed in the USA after the importation of the fish. Attributes such as sizing, weights, moisture content are verified to insure that the final customer receives the finest product.

Glossary

Broodfish - sexually mature fish, especially those used in aquaculture.

CIQ - Chinese Inspection and Quarantine, the equivalent to the US FDA

Cryogenic freezing - blast freezing, q.v., accelerated by using liquid nitrogen or carbon dioxide sprays at -150°F or less. Used for individually quick frozen products

Fertilization - in aquaculture, the improvement of water productivity by addition of natural or artificial compounds.

Fingerling - an immature fish, less than one year old, or any fish too small to be of marketable size (and so up to 25cm long).

Geosmin - a compound produced by blue-green algae and actinomycetes giving an earthy-musty flavor to fish that have absorbed them. Such fish are unmarketable.

Hapa - a small net enclosure in shallow ponds used for deposition of eggs or to raise larval and juvenile fish before release into the general pond environment.

Hormone therapy - masculinization of tilapia by treating fish with methyltestosterone during early development

Izumi dai - a technique using CO gas, or "colorless smoke" to preserve color and quality pf tilapia.

Melamine - a trimer of cyanamide, it is used to produce countertops, glues, fabrics, inks, flame retardants, fertilizers and plastics.

Natural selection - determination of the sex of a fish, usually by external characters (secondary sex characteristics).

Ozonating - a water treatment process that destroys bacteria and other microorganisms.

Purging - a standard practice which empties fish of waste materials in order to avoid off flavors

Sac fry - a newly hatched fry that uses the yolk sac as a food source

The Tilapia Handbook

Version 3.0

Western Edge Seafood™

The Fish People