

the global aquaculture advocate

The Global Magazine for Farmed Seafood

May/June 2010



THAT WHICH SUSTAINS US MUST ALSO BE SUSTAINABLE.

Our business is dependent on the sustainability of the oceans' resources as the most efficient and environmentally sound way to feed a growing global population. We believe that sustainability is as much about feeding people as it is about managing the world's natural resources. To that end, we work tirelessly with our global supply network to ensure a consistent supply of the products our customers demand, while protecting and replenishing our common resource: the ocean.



SLADE GORTON
NO ONE ELSE.

SLADE GORTON & CO., INC • WWW.SLADEGORTON.COM
BOSTON 800-225-1573 • MIDWEST 800-524-8237
SOUTHEAST 877-885-5499 • WEST COAST 800-567-5002

may/june 2010

production

- 24 Biofloc Technology Expanding At White Shrimp Farms
Nyan Taw, Ph.D.
- 28 Microbial Flocs Spare Protein In White Shrimp Diets
Alberto J. P. Nunes, Ph.D.; Leandro Fonseca Castro, M.S.; Hassan Sabry-Neto, M.S.
- 31 Bioreactor Technology For Tilapia Advances In Latin America
Sergio Zimmermann
- 32 Water Temperature In Aquaculture
Claude E. Boyd, Ph.D.
- 35 Smoked Fish – Old Product With New Appeal Offers Enhanced Taste, Shelf Life
George J. Flick, Jr., Ph.D.
- 38 New Zealand Addresses Social Factors In Aquaculture Development
Wendy Banta
- 40 GESIT Tilapia: Indonesia's Genetic Supermales
Ratu Siti Aliah, Komar Sumantadinata, Maskur, Sidrotun Naim
- 42 Chile's Salmon Industry Addresses Health Crises
Adolfo Alvial
- 45 Varied Feed Additives Improve Gut, Animal Health
Pedro Encarnação
- 48 Fish Vaccines In Aquaculture – Proactive Treatment Protects Salmon, Catfish, Other Fish
Dr. Julia W. Pridgeon, Dr. Phillip H. Klesius
- 51 Managing Tilapia Health In Complex Culture Systems
Neil Wendover, B.S.
- 54 Disease Factors For Shrimp Production In Brazil
Victoria Alday-Sanz, Ph.D.; Ana C. Guerrelbas, B.S.; João L. Rocha, Ph.D.

marketplace

- 58 Fish Farming Supports Ecological Efficiency
Neil Anthony Sims
- 60 Consumer Attitudes Toward Aquaculture – Spanish Study Correlates Knowledge, Opinions
José Fernandez-Polanco, Ph.D.; Ladislao Luna, Ph.D.; Ignacio Llorente
- 62 Farmed Or Wild? Both Types Of Salmon Taste Good And Are Good For You
Pamela D. Tom; Paul G. Olin, Ph.D.
- 65 Bangladesh Seeks Export Markets For Striped Catfish
Dr. Peter Edwards, Md. Sazzad Hossain
- 69 Shrimp Problems In Indonesia? Imports From Ecuador Continue Strong As White Conversion Continues; Norwegian, U.K. Salmon Fillets Jump As Chile Recovers From Earthquake; Fresh Tilapia Fillet Prices Spike After Lent, Frozen Imports Set Monthly Record
Paul Brown, Jr.; Janice Brown; Angel Rubio

innovation

- 72 Life Cycle Assessment In Aquaculture – 'Not A Single Event, But A Combination Of Processes'
William Davies



On the cover:

Ongoing advances in tilapia breeding have resulted in lines of fast-growing fish that have helped make tilapia the world's second most-produced fish species.



page 24

Biofloc technology provides high productivity, low feed-conversion ratios and a stable culture environment that delivers sustainable production at lower cost.

page 58

Sustainably farmed fish may represent 60 times more efficient use of baitfish than wild fish. Farmed fish have more efficient life cycles, trophic transfer and by-catch.



- 75 Biofloc: Novel Sustainable Ingredient For Shrimp Feed
David D. Kuhn, Ph.D.; George J. Flick, Jr., Ph.D.; Gregory D. Boardman, Ph.D.; Addison L. Lawrence, Ph.D.
- 78 Two-Stage Selection Key For Fast Shrimp Growth In Mexico
Héctor Castillo-Juárez, Ph.D.; Hugo H. Montaldo, Ph.D.; Gabriel R. Campos-Montes, Ph.D.
- 80 SPF Shrimp Breeding In Brazil – Genetic, Phenotypic Trends After Generation Of Selection
João L. Rocha, Ph.D.; Ana C. Guerrelbas; Ana K. Teixeira; Flávio A. Farias; Ana P. Teixeira
- 83 Seafood Chilling, Preservation With Ice Slurry
Ming-Jian Wang, Ph.D.
- 85 Ultrasound Helps Stage Sturgeons For Caviar Production
Brian C. Donahower, Ph.D.; Steve DuMond; Leo Ray; Linda Lemmon; Gary Fornshell; Terry Patterson; Jodi Rockett; Madison S. Powell; Wendy M. Sealy

advocacy

- 87 The True Cost Of Thai Shrimp
Robins McIntosh

Farmed Or Wild?

Both Types Of Salmon Taste Good And Are Good For You



Farm-raised Atlantic salmon are raised and harvested under controlled conditions that provide a year-round supply of fish. Photo courtesy of the British Columbia Salmon Farmers Association.

Pamela D. Tom
University of California – Davis
Sea Grant Extension Program
Food Science and Technology Department
1 Shields Avenue
Davis, California 95616 USA
pdtom@ucdavis.edu

Paul G. Olin
University of California
Cooperative Extension
Sea Grant Extension Program
Santa Rosa, California, USA 95403

and their commercial harvest is limited. Farm-raised fish are hatched, raised and harvested under controlled conditions comparable to other farmed animals. Farmed Atlantic salmon are available year-round in fresh or frozen forms.

Most wild-caught salmon are one of five species of Pacific salmon. They are harvested by fishing with a variety of gear types, mostly in the north Pacific from June through September. Fresh wild Pacific salmon are available during this time. The rest of the year, frozen or canned wild salmon are available.

How are farmed and wild salmon similar?

Farmed and wild salmon have very similar nutrients. Atlantic salmon and Pacific salmon look similar on the outside. But between species and even within the same species, each type of salmon can have different flavors, textures and flesh color. How the fish is processed and handled can also dramatically influence these characteristics.

In taste tests between farmed and wild salmon, sometimes farmed salmon is preferred. Sometimes taste panels prefer wild fish. However, these taste tests often compare farmed and wild salmon of different species and are not really designed to tell the differences between the tastes of the farmed and wild versions of the same type of salmon.

Often, wild salmon is priced higher than farmed salmon. Especially when buying fish fillets, it can be hard to tell the difference between how farmed and wild salmon look. It may take DNA analysis to confirm the identity of the species. Species substitutions sometimes occur, either accidentally or through business practices that mislead consumers. Consumers should buy salmon from trustworthy retailers and restaurants with good reputations.

What do salmon eat?

For survival and growth, both farmed and wild salmon need a well-balanced diet of protein, carbohydrates, fats, vitamins, minerals and pigments. In the wild, salmon eat zooplankton and fish. About 4.50 kg of prey is needed to make 0.45 kg of wild salmon. This means wild salmon have a feed-conversion ratio (FCR) around 10:1.

Farmed salmon need the same well-balanced diet to live and grow. They are fed a combination of fishmeal, fish oil and other

Table 1. USDA nutrition information for 100 g of farmed and wild salmon cooked under dry heat.

	Calories	Protein (g)	Fat (g)	Saturated Fat (g)	Sodium (mg)	Cholesterol (mg)	Omega 3 (g)*
Farmed							
Atlantic	206	22.1	12.3	2.5	61	63	2.1
Coho	178	24.3	8.2	1.9	52	63	1.2
Wild							
Chinook	231	25.7	13.3	3.2	60	85	1.7
Sockeye	216	27.3	10.9	1.9	66	87	1.2
Coho	139	23.4	4.3	1.0	58	55	1.0
Pink	149	25.5	4.4	0.7	86	67	1.3
Chum	154	25.8	4.8	1.0	64	95	0.8

* Omega-3 values equal the sum of eicosapentaenoic acid and docosahexaenoic acid.

land-based protein sources. The FCR is around 1:1. However, it should be noted that the water content in live prey items is much higher than in feed.

Some nutrients in prey and feed are considered essential because fish are unable to make them, so they must come from the diet. One such nutrient is the orange pigment astaxanthin, which is in the same family of nutrients as vitamin A. It is a powerful antioxidant that is thought to be involved in the ovarian development, hatching, survival, growth and respiration of salmon. Astaxanthin is also what causes the reddish-orange color of salmon flesh.

The color of wild and farmed salmon can vary widely from red to orange-red, rose, pink and even white. The color depends mostly on the amount of astaxanthin in the diet. Wild salmon get natural astaxanthin from the prey they eat. Farmed salmon get natural or added astaxanthin from the feed they eat.

How does eating farmed and wild salmon make people healthier?

Both farmed and wild salmon are healthful choices that are low in total fat and high in protein (Table 1). Both are rich in vitamins, minerals and omega-3s. In recent years, research has linked eating seafood to many health benefits throughout life.

Babies of moms who eat fish during pregnancy have the best possible brain and eye development. Adults who eat fish twice a week have up to 40% lower risk of dying from a heart attack. And a seafood-rich diet can help prevent depression and dementia as people age.

Is salmon safe to eat?

Most foods contain traces of substances other than nutrients. Scientists have compared concerns with eating fish to concerns with limiting or avoiding fish. They found that the biggest risk is limiting or avoiding fish, which results in thousands of extra heart disease deaths per year and less than optimal brain development in children.



The essential nutrient astaxanthin, which causes the red-orange coloration of salmon, is also involved in growth and reproduction. Wild fish get astaxanthin from their prey, while farmed fish receive it in their feed. Photo courtesy of Camanchaca, Inc.

Summary:

Whether farmed or wild, salmon are tasty fish and a healthy protein choice. They look and taste nearly the same. Wild Pacific salmon are harvested by fishing, mostly in the north Pacific from June through September. Frozen or canned wild salmon are available outside this period. Farmed Atlantic salmon are hatched, raised and harvested under controlled conditions, and available fresh year-round, usually at lower prices than wild-caught fish.

Salmon is the second most-popular fish consumed in the United States. It tastes savory and earthy, yet slightly sweet, and is among the richest sources of long-chain omega-3 fats. It is also full of high-quality protein, vitamins and minerals.

Research shows that eating fish like salmon promotes healthy hearts and brain development. All types of commercial salmon are healthful to eat. The most readily available kinds in the U.S. are wild Pacific and farmed Atlantic salmon. Farmed and wild salmon are very similar in many ways.

Salmon FAQs

How do farmed and wild salmon differ?

Farmed and wild salmon are usually different species of fish. Most farmed salmon are Atlantic salmon, *Salmo salar*. Wild populations of Atlantic salmon are generally at very low levels,

OxyGuard Atlantic

Single-channel instrument with many advanced features

CO2 Analyzer

Measures the CO2 that affects the fish!

Handy Polaris 2

Hand-held DO meter

With Datalogger and USB link for download of data to PC.

World Leaders in Water Quality Monitoring and Control

OxyGuard International A/S oxyguard@oxyguard.dk www.oxyguard.com

OxyGuard®



Both wild and farmed salmon are healthful choices that are low in total fat and high in protein, vitamins, minerals and omega-3s. Photo courtesy of the California Salmon Council.

• Mercury, PCBs

Methylmercury, an organic form of mercury, and polychlorinated biphenyls (PCBs) are not a health concern associated with eating farmed or wild salmon.

Minute quantities of mercury are detectable in air, water, soil and all living matter. The Institute of Medicine reported that salmon, whether farmed or wild, is one of the species lowest in mercury levels and highest in omega-3 fatty acids. A 2008 study by Barry Kelly and co-authors found mercury in all salmon samples ranged from 0.03 to 0.10 ppm. This was well below the action level of 1.0 ppm enforced by the U.S. Food and Drug Administration (FDA). Negligible differences in mercury concentrations were observed between the various species of farmed and wild salmon.

Until the late 1970s, PCBs were manufactured globally and used in many electronic products. Health concerns about PCBs led to a ban on their use, and since then, the levels of PCBs in food products and the environment have declined significantly.

Currently, over 90% of PCBs that remain in Americans' foods comes from sources other than seafood. PCB levels in farmed and wild salmon are low and generally range from 5 to 60 ppb. This is less than 3.1% of the FDA tolerance level of 2,000 ppb.

• Antibiotics

In the U.S., the FDA regulates antibiotics, which are used to treat ill farm-raised animals including fish, swine, cattle and chickens – except in certified organic animal culture. Veterinarians oversee the way antibiotics are used when they are needed.

Farmers must follow U.S. Environmental Protection Agency and FDA regulations that monitor antibiotic use and environmental impacts. These regulations also make sure antibiotics are used for the shortest time possible, so residual traces do not go above the FDA level of concern.

• Hormones

No hormones are used in salmon farming or added to salmon diets. So, hormones are not a concern when eating farmed or wild salmon.



Atlantic salmon, *Salmo salar*, are more closely related to brown trout than to the Pacific salmon of the genus *Onchorhynchus*. Atlantic salmon have been domesticated and selectively bred for many generations. The primary species used in fish farming, they are grown in net pens in nearshore coastal waters and are typically harvested at a weight of 3.6 to 4.5 kg and length of 71 to 76 cm.

Greatly reduced populations of wild Atlantic salmon still spawn in rivers on both sides of the Atlantic. Although historically of great commercial importance, today less than 1% of commercially available Atlantic salmon come from the wild.

Chinook salmon, *Onchorhynchus tshawytscha*, also known as king salmon, live from California, USA, to Japan, with successful new populations in the Great Lakes and New Zealand. Chinook is the largest and least abundant of the Pacific salmon species. Their average weight is about 9 kg, and they range from 76 to 100 cm in length. Small quantities of farmed Chinook salmon can be found in the marketplace.

Sockeye salmon, *Oncorhynchus nerka*, also known as red salmon, are an important commercial species in British Columbia, Canada, and Alaska, USA. Their bright red flesh is prized for canning and for fresh and frozen products. The average size of fish in the market is approximately 2.7 kg and 91 cm in length.

Coho salmon, *Oncorhynchus kisutch*, also known as silver salmon, range from northern Baja California to Korea. The average weight is 4.5 kg, and they range from 63 to 89 cm in length. Only small quantities of coho salmon are farmed.

Pink salmon, *Oncorhynchus gorbuscha*, are also known as humpback salmon because of the large hump males develop during spawning season. Pinks are the smallest but most abundant Pacific salmon, generally weighing 0.9 to 1.4 kg at a length of 76 cm. They live from Puget Sound to Russia. Most pinks are canned and tend to cost less than other types of salmon.

Chum salmon, *Oncorhynchus keta*, are also known as silver-bright, keta or dog salmon. The average weight is 3.6 kg, and they can grow to 68 cm long. They are relatively easy to farm, and large hatchery programs in Japan and southeast Alaska complement wild populations. Chum are harvested commercially in large numbers when they return to their release sites. Like the pink salmon, chums tend to cost less than other types of salmon. They are sold canned, smoked, fresh and frozen.

marketplace

Bangladesh Seeks Export Markets For Striped Catfish



Fish typically receive pelleted feed at larger farms. Smaller operators may use lower-quality feeds.

Summary:

Striped catfish have become an important fish for national food security in Bangladesh, especially for poor consumers. The catfish-farming industry in the country is dominated by relatively small-scale farms that produce fish primarily for local markets. Due to potential overproduction, large-scale producers will likely need to process and export about 25% of the current production to survive in the long term.

Commercial farming of striped catfish, *Pangasianodon hypophthalmus* (*Pangasius*), introduced from Thailand started about 1998 and expanded rapidly after 2000 in Mymensingh, Bangladesh. As production is almost entirely for the local domestic market, overproduction led to a recent market glut that depressed farm gate prices below production costs. For large-scale producers to survive in the long term, there is a need to process and export about 25% of the current farmed production.

Industry Structure

According to the Fish Culturists Association of Bangladesh, there are about 3,500 commercial farms exceeding 1.2 ha in Mymensingh and many thousands more smaller-scale farms.

About 70% of the commercial farms are less than 5 ha in area, 20% cover 5 to 10 ha, and only 10% are larger than 10 ha. Thus the industry is dominated by relatively small-scale farms, but only about 30% of the total production is of sufficiently high

Dr. Peter Edwards

Emeritus Professor and Consultant
Asian Institute of Technology
593 Lat Prao Soi 64
Bangkok 10310, Thailand
pedwards1943@gmail.com

Md. Sazzad Hossain

Director, Shushama Feed Ltd.
Gulshan, Dhaka, Bangladesh

quality for export. Most of the production is marketed locally at a relatively low price.

Development

When commercial farming of striped catfish started, the profit was very high, as the public initially confused the species with the scarce native catfish *Pangasius pangasius*, which today retails for U.S. \$4-6/kg. In 1994, the production cost of striped catfish was only \$0.44/kg compared to a farm gate price of \$1.76/kg, which was a major factor in the initial expansion of catfish farming in the country. Unfortunately, attempts to develop commercial culture of the native river catfish have been unsuccessful to date.

Total production of striped catfish reached 300,000 mt in 2008, which caused a market glut. The farm gate prices fell to U.S. \$0.66-0.68/kg – below the \$0.74/kg cost of production – and about 30% of farmers stopped raising the fish. When the production in 2009 fell to 200,000-250,000 mt, the farm prices rose once more to a profitable \$0.88-0.96/kg toward the end of 2009.

Local Benefits

Striped catfish have become an important fish for national food security, especially for poor consumers because of its relatively low price compared to the major Indian carp rohu, *Labeo rohita*, which retails for about twice as much. Rohu grow well only in large ponds and take a much longer two years to attain a marketable size of 1.5 kg.

Relatively poor farmers get in and out of striped catfish farming, reverting back to rice farming depending on the profitability of the fish and rice. Poor rice farmers who are unable or unwilling to farm fish can benefit from leasing or selling their land to fish farmers or be employed at large fish farms, which require several full-time workers per ha.

Farming System

The catfish ponds are shallow with a depth of only 1.5 m. As they are constructed in low-lying rice land, they could not be deeper since draining would not be possible. Large commercial farms are filled with groundwater pumped from 100-m-deep tube wells.

Although there are no government regulations concerning the use of groundwater, its level has remained unchanged after more than a decade's pumping. One-third of the pond water