Advancing Aquaculture in the Midwestern Region: Farm Site Visits

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Photos were taken by the authors or provided by the producers.

Cover photos (clockwise from top): an aerial view of ponds at Big House Fish Farm in Illinois, a pond being seined at Gollon Brothers Wholesale Live Bait Inc. in Wisconsin, a market-sized shrimp at RDM Shrimp in Indiana, outdoor grow-out tanks at Freshwater Farms of Ohio, minnows at Ozark Fisheries Inc. in Missouri, and two barramundi at Hanilu Farms in Indiana.

Introduction

Site visits were made to a selected group of aquaculture producers within the North Central region of the United States for the purpose of discussing various aspects of their aquaculture production business, to gain information on their marketing strategies and overall business model, and to learn about their successful methods for producing high-value aquaculture products. The purpose of this publication is to share this information with others within the North Central region as a model for developing a successful aquaculture enterprise.

This project is one aspect of a recently funded U.S. Department of Agriculture (USDA) North Central Regional Aquaculture grant entitled, "Advancing Aquaculture Production within the Midwestern Region." One of the objectives of this project was to learn about the various aspects required for expanding aquaculture in the Midwest by exploring how to design efficient and cost-effective production systems and how to expand aquaculture sales and increase profitability.

The project had these additional objectives:

- Summarize trends and outlook for U.S. and Midwestern aquaculture
- Conduct a needs assessment of the aquaculture industry
- Conduct a survey of aquaculture consumer preferences
- Provide business models and enterprise budgets for aquaculture operations
- Develop and publish aquaculture educational and outreach materials for use by producers as well as for those interested in investing in an aquaculture enterprise. These educational materials will also provide information to consumers on the sustainability of U.S. aquaculture production as opposed to imported seafood practices and products

Site visit summaries

Ten operating aquaculture farms were visited in Missouri, Illinois, Indiana, Ohio, Wisconsin and Michigan. These sites included operations producing and selling ornamental fish, largemouth bass, barramundi, yellow perch, trout, tilapia, marine shrimp and baitfish. The farmers sold both processed and unprocessed products to retail and wholesale markets, and fish and shrimp to individuals for stocking ponds and recirculating aquaculture systems.

During the site visits, the growers were asked what were their greatest successes, challenges or potentials. These were their answers:

1. Improvements in software to track pond fish stocks and sales have played an important role in ornamental fish production and sales profitability.
2. The main challenge in largemouth bass production is ensuring farm profitability.
3. Knowledge supporting barramundi fish farming comes more from farm experience than meetings and fish farm tours.
4. A major challenge yellow perch farmers face is obtaining high-quality, cost-effective feed supply.
5. A major challenge for marine shrimp production is ensuring a high survival

rate and providing a reliable source of shrimp postlarvae (PLs) for stocking.
6. Successful fish farmers must be passionate about raising fish because of the long hours and effort required.
7. A major challenge for selling tilapia fillets is import price competition and the need to sell to ethnic fish markets in the U.S.
8. A promising aquaculture candidate to replace yellow perch is native bluegill sunfish.
9. A major challenge for trout farmers is addressing and correcting misinformation about fish farming.
10. The baitfish industry would benefit from leadership to help influence state and federal regulatory policies.

The detailed site visits summaries are provided in this report.

1. Ozark Fisheries Inc.

Figure 1.1. Ozark Fisheries entrance and administrative offices.

Ozark Fisheries Inc. (ozarkfisheries.com)
1100 Ozark Fisheries Road
Stoutland, MO 65567

Owner-operator: Margaret Cleveland
Email: margaret@ozarkfisheries.com

Overview

Margaret Cleveland is a fourth-generation fish farmer and has served for the past six years as senior vice president of operations at Ozark Fisheries Inc. (OF). OF owns and operates about 300 acres of fishponds at its Missouri location and an additional 300 acres at its Indiana location.

Margaret's great-grandfather started the operation in 1926. He was interested in growing trout, but at the time there was little market demand for trout. He had a friend who operated a five-and-dime through whom he discovered that goldfish could be marketed as novelty items at those stores, and thus was born OF's ornamental fish business.

OF grows and sells five types of ornamental goldfish, two types of koi, crayfish, bullfrogs, tadpoles, snails, mosquito fish and catfish. The primary sales objective is to offer fish that appear bright and colorful to the consumer.

Production cycle

Spawning of the fish is carried out in May to June, depending on pond water temperature. When the water reaches the optimal temperature of 72 degrees F, the ponds are seined, and brood fish are brought to an indoor spawning facility where the fish spawn. The eggs are allowed to attach to plastic mats, after which the brood fish are removed and returned to the ponds. The egg-covered mats are transferred to hatchery tanks where they are held in water at 71 to

Figure 1.2. Ozark Fisheries indoor spawning facility.

Figure 1.3. Ozark Fisheries grow-out ponds in Missouri.

Figure 1.4. Fish are held in raceways and sorted by color and size before being transferred to shipping areas.

72 degrees F with a high dissolved oxygen concentration.

The eggs begin to hatch after two or three days. After hatching, the fry are held and fed in the tanks for two to three days until they are stocked in ponds. The fry are transferred to the grow-out ponds in bags. The bags are allowed to float in the ponds until the temperature of the water in the bags equalizes to the pond water temperature. Then, the fry are released into the pond.

In the grow-out ponds, the fish are fed sinking feed to minimize bird predation. Feed is distributed into ponds by blowers from trucks carrying feed bins. The fish are fed once a day.

After being seined from the pond, the fish are transferred via a "water slide," or PVC tube, discharging from a tank truck into holding raceways where they are acclimated to either pond or spring water temperatures in preparation for shipping. Salt is added to the water in the raceways to eliminate external parasites. In the raceways, fish are hand sorted by color and size before being transferred to the shipping area.

Figure 1.5. Additional raceways in which fish are held prior to packing and shipping.

Figure 1.6. Ozark Fisheries shipping warehouse.

Shipping process

Individual fish orders are sorted into buckets with flowing water, the fish having been transferred from holding raceways after being seined from grow-out ponds.

Any order received before 10 a.m. will ship that day for arrival to the buyer the next day. At the shipping facility, customer orders are filled by 1 p.m. for shipping via Federal Express or by 3 to 5 p.m. for UPS. The fish are shipped in various sized cardboard boxes containing double plastic bags inflated with pure oxygen. OF patented the shipping-in-a-box concept, which is now widely used throughout the industry. Shipping boxes contain Styrofoam, foil and freezer packs to maintain low temperatures in transit.

Most OF sales are to wholesale dealers such as pet stores and water gardens. Plus, they drop-ship to online retailers.

Software developed by OF is used to determine the best shipping method for a buyer's location. The semiautomated packing processes track the weight of individual orders to minimize freight costs.

Extra fish are included in each order to ensure customers receive the number ordered. OF guarantees live delivery. OF's typical refund rate for fish lost in transit averages less than 3% of total sales.

Figure 1.7. Ozark Fisheries packing and shipping operations.

Largest production costs

Shipping is OF's No. 1 operating expense, and labor is second.

Opportunities and successes

Demand for goldfish increased during the COVID-19 pandemic. At that time, the public was restricted to their homes, and consequently, people developed increased interest in purchasing pets. The cost of raising and owning a dog is about $2,500 a year, a cat around $1,300 a year, whereas fish only cost around $250 a year.

Improvements in technology have played an important role in OF's success and profitability. In particular, the tracking of pond fish stocks within the Missouri and Indiana ponds, the status of customer orders, shipping locations, and best shipping methods are all managed using software developed by OF with help from programing consultants (Software 1 and 2).

2. Big House Fish Farm

Big House Fish Farm
6770 Giant City Road
Carbondale, IL 62902

Owner-operator: Jim Hawkinson
Email: jimhawkinson99@yahoo.com

Figure 2.1. Aerial view of Big House Fish Farm.

History

Big House Fish Farm, located on a 60-acre farm on the southern outskirts of Carbondale in southern Illinois, produces largemouth bass (LMB). It is co-owned by three friends: Stacey Sisk, Chris Barrett and Jim Hawkinson. According to Jim, the three had never seen themselves as fish farmers, but when a friend proposed the idea to him, he was intrigued. The friend owned a goose-hunting club and needed more water acres on the property to attract more geese and to grow and sell LMB. The friend wanted to build a half-acre pond on his property, but after a preliminary financial analysis and looking at potential fish sales revenue, decided that the low annual revenue would not offset the high startup costs of investing in a half-acre pond.

However, after conducting some additional research on producing LMB, Jim realized that there was a much larger demand and market for this fish than they previously thought. He also learned that to make the investment more economically feasible, they needed to think on a much larger scale — a half-acre pond wouldn't do — and that is how he, Stacey and Chris came up with Big House Fish Farm. The idea then evolved into creating a larger, more-profitable fish-farming business with multiple ponds, so they bought 60 acres of land for their fish farm. The farm construction took longer than expected because the ground was a harder-to-move dirt. They dug two ponds in the first year and five in the second year. The seven ponds range in size from 2 to 3 acres for a total of 18 water acres. They dug all their ponds from a flat field, with the depth ranging from 4 feet at one end to 8 feet at the other end purposely to handle freezing and hold fish over the winter months.

Big House Fish Farm has been in business since 2018. They chose to raise LMB because it had a much higher retail market value than other species they considered, such as tilapia and catfish. They also realized there was too much import competition for tilapia and catfish products from overseas, mainly China. The live fish market is very much a niche market, and that's what they decided to stay with. They do not process any of their fish but just sell live fish to their customers.

Fish farming system

The farm started operations growing LMB from fingerlings of about 1 to 1½ inches in size to market size of about 1 to 1½ pounds in outdoor ponds. They obtained fingerlings from Arkansas. When they started, they were using advanced fingerlings and targeting seven months grow-out with an aggressive feeding regimen, but they quickly realized that they were putting too much pressure and stress on the fish and having water-quality issues. According to Jim, in the early years, the fish growth process had been a scientific learning experience for them. Now, they start with fingerlings of about ¼ to ½ inches, hold them over the winter months, and grow them to market size in 12 to 15 months. This adjustment in fingerling size along with changes in feeding practices brought improvement in fish health, behavior and growth.

The production cycle usually starts with about 90,000 fingerlings for grow-out on the farm, ending up at about 5,000 to 6,000 fish per acre during the growing season. Fish are usually fed once or twice a day, depending on the weather. Upon arrival at the farm, the fingerlings are stocked in one large 3-acre pond. As the fish grow a little larger, they are dispersed and moved into separate ponds according to size to avoid overcrowding. LMB school together and eat aggressively, so thinning them out as they grow helps with water quality. According to Jim, stocking the fish in ponds over the season makes managing them a bit easier, the aggressive feeding behavior keeps LMB active as they grow, and they stay healthy.

Fish are usually harvested from ponds about two days prior to sales. They are harvested with seine nets, weighed, loaded into small trucks and transferred into holding tanks on the farm. The number of fish harvested from the ponds depends on prearranged sales in coordination with buyers and is done as needed.

After a pond has been completely harvested, it is drained, and hydrated lime is applied to the pond bottom and allowed to dry before the pond is refilled with water. Applying hydrated lime disinfects the pond by temporarily raising the pH of the mud to kill any residual diseases and pests that could affect the next crop of fish.

Figure 2.2. Fish harvesting at Big House Fish Farm.

Work environment and job satisfaction

According to Jim, day-to-day life on the fish farm is intense and a lot more work than they initially anticipated. When they started, they thought they would just feed the fish twice a day and not stay around the farm all day. But they found that there's a lot more work to do at the farm than just feeding. They had to arrange for

supplies, keep up with the aerators in the ponds, monitor water quality, maintain farm equipment, coordinate sales and labor, weed, fix fences and do general farm upkeep. Jim said there is always something breaking down on the farm that needs to be fixed, and they must constantly ensure adequate maintenance on the farm.

Figure 2.3. Fish being loaded from holding tanks onto customer truck.

The co-owners all work on the farm with different responsibilities. Each team member has a different perspective and different motivation for getting into fish farming. The team enjoys the autonomy of managing the farm and setting their own schedules. Chris loves the outdoors and handles the day-to-day operations on the farm, making sure everything on the farm is working the way it should be. Stacey handles overall farm operations with a focus on problem-solving. Jim likes the excitement and challenge of starting a brand-new business. He comes from a retail-customer-type business background and is the business manager.

Sales and logistics

Big House Fish Farm primarily sells their fish live to fish haulers and wholesalers who ship to New York and Canada. Those markets take about 90% of their total fish production, and the remainder is sold to fish brokers and live haulers from other states as well as to other interested entities.

When a truck arrives on the farm, fish are weighed and loaded live from the holding tanks onto trucks with tanks and an oxygen supply. Jim said that he and his partners feel a sense of accomplishment anytime a truck arrives on the farm, gets loaded with 5,000 to 10,000 pounds of live healthy fish, and then drives off headed to market. That feeling of accomplishment comes from them having seen the fingerlings grow over a 12-to-15-month period and now be their way to market.

Challenges and future plans

The main challenge Big House Fish Farm faces is maintaining farm profitability. Jim said that they are constantly comparing year-to-year cash flows and profitability to ensure the sustained economic viability of the farm. The farm is a huge investment with mortgage payments and operating expenses on fingerlings, feed, labor, maintenance, etc., so they cannot afford to slack on managing the farm finances. The fish farm has experienced some challenges, but Jim said they now have a plan that seems to have put it in good financial shape going forward. Despite the challenges, there is a sense of optimism about the future and the farm's potential among the co-owners.

Looking ahead, they want the farm to be sustainable, ensuring it is a viable, profitable business that can last for decades and become a generational legacy, giving the three friends the potential to pass the farm down to future generations. They also want to make the business profitable to attract investors for expansion.

3. Hanilu Farms

Hanilu Farms (hanilufarms.com)
1481 W. County Road 1000 N.
Cutler, IN 46920
Phone: 765-605-1479

Owner-operator, Leland Meador
Email: ldmfarms@gmail.com

History

Leland Meador is the owner of Hanilu Farms in Cutler, Indiana, which is about 30 miles west of Lafayette. The farm is a traditional Midwestern family farm started in 1923 and is in its fourth generation of ownership. The farm originally started with all forms of traditional agriculture, including corn, soybean, cattle, hogs and poultry. The livestock barn was built in 1980 for raising hogs, but due to low hog prices in the late 1990s, Leland decided to explore aquaculture. He started by getting into the pond-stocking business raising fish in ponds in 2010.

Figure 3.1. Hanilu Farms logo.

In 2013, Leland decided to raise fish for the market, did thorough research and eventually worked on a fish farm. Through that work experience, he learned how to raise fish in aquaculture for the market. Then, he decided to get completely out of the hog business and start a fish farm.

Leland's former employer raised fish, bought fish from other fish farmers, and sold fish to the live market. He was influential in

Figure 3.2. Barramundi.

Leland's decision to start his own fish farm and on what species to raise. The former employer suggested five species that had good and ready markets. Leland decided on barramundi because it has the most readily available fingerlings supply and can be produced year-round.

Production cycle

Barramundi fingerlings are sourced from Australia monthly. They come in at ¼ gram, or about ¾ inch long. On arrival, the fingerlings are acclimatized in smaller nursery tanks and fed with appropriately size feed. As

Figure 3.3. Nursery tanks.

Figure 3.4. Grow-out tanks.

Figure 3.5. Purge tanks with false bottom.

the fingerlings grow, they are graded, sorted and distributed into bigger tanks.

Hanilu Farms has two fish nurseries — a primary and a secondary nursery. As the fish grow, they are transferred into grow-out tanks to grow them to market size, which is from about 1¼ pounds to just under 2 pounds. It takes about six to eight months to grow barramundi to market size, but with experience, Hanilu Farms can now get them to market size in about six months.

The farm has four grow-out tanks, each with a capacity of 16,000 gallons and holding up to 6,500 fish. Hanilu Farms constructed their own grow-out tanks from regular grain bin rings that they lined with food-grade liners. Each grow-out tank has a center drain in the middle that sucks the fish waste off the bottom of the tank into the filtration room for processing; then biofiltered water is pumped back into the tanks through a 6-inch pipe.

Feed and feeding

The size of feed used on the farm ranges from 0.2 to 5 millimeters and is sometimes as large as 7.5 millimeters. Hanilu Farms pride themselves in using feed with no chemicals or antibiotics — just water and fish. The fish are fed every 30 minutes using automatic feeders.

Feed is the No. 1 production cost, posing the most challenging part of the business. Feed prices have been cyclical; higher feed prices arise from shipping cost of feed ingredients from around the world. However, feed prices over the decade before COVID-19 had been steady. After COVID-19, feed prices have increased due to general inflation. The farm has avoided switching feeds because they are happy with the feed they currently use and do not want to risk fish growth by introducing a new feed. Another challenge the farm considers is that every feed has a different effect on the water quality in the system.

Market and marketing

When fish reach market size, they are put in purge tanks that have a false bottom. From the purge tanks, fish are graded and sorted by hand for the live market. Customers include live fish haulers with trucks — semis and flatbeds — who then sell at wholesale markets and other secondary markets.

Challenges and advice to prospective farmers

The main post-COVID-19 challenge the farm has faced is inflation, which has affected almost every input needed at the farm, including fingerlings, feed, tanks and filters, as well as interest rates. Hanilu Farms plans to expand — but not in the immediate future; probably when input costs stabilize.

Leland's advice to anyone thinking about getting into aquaculture is to attend as many aquaculture meetings as possible; do your own extensive research; and work on a fish farm for six months to a year to acquire knowledge, obtain an understanding of fish production and get "your feet wet" through real-life experience. Following this advice will help a prospective fish farmer make better-informed business decisions and avoid failure. There have been several failures in the fish farm industry because prospective fish farmers with little knowledge invested in structures, tanks, filters, and other seemingly right equipment but did not have real-life experience producing fish. Leland said the knowledge to become a fish farmer is acquired mainly through working on a farm, which is much more valuable than conducting online research, attending aquaculture meetings and touring fish farms.

4. Millcreek Perch Farm LLC

Millcreek Perch Farm LLC
9676 Harriot Road
Marysville, OH 43040
Phone: 614-579-6381

Owner-operators: Bill Lynch and Kayley Smith
Email: msmillperch@gmail.com

History

Bill Lynch and Kailey Smith co-own and operate Millcreek Perch Farm in Marysville, Ohio. The farm started in 2001 with four levee ponds, which were completed by 2002. Bill started the farm with a partner who owned the land. In 2009, that partner turned over his share of the farm to Bill, who ran it solo for many years. Then in 2021, Bill brought Kailey Smith on as partner. Matt Smith, Kailey's husband, helps on the farm.

Bill, who worked with yellow perch while at Ohio State University, started by producing yellow perch for the food fish market. With experience, he came to realize that producing yellow perch as food fish was less profitable and more hassle than producing and selling the fish as stockers. Today, the farm is a wholesale yellow perch farm producing fish for recreational stocking.

Figure 4.1. Millcreek Perch Farm.

Figure 4.2. From left, Bill Lynch, Matt Smith's father and Matt Smith.

Farm infrastructure

Millcreek Perch Farm consists of four 1-acre ponds and two half-acre ponds. One of the 1-acre ponds is the broodstock pond, and the other three are used for grow-out. The farm also has a small barn with six 1,000-gallon tanks, two 600-gallon and one 400-gallon tank — a total of nine fish tanks for various purposes, including nursery, feed training, sorting and holding fish before sale. In the spring, several of the tanks are used for egg incubation and contain artificial pine tree branches. Egg ribbons are collected from the broodstock pond in the spring around the second warm-up every morning. Enough egg ribbons to fill a tank are collected from around the pond edges and moved into the incubation tanks. Each tank holds ribbons from the same day so that the fry hatched are of the same age. Any egg ribbons left over in the pond from the day are racked out in the

Figure 4.3. Egg incubation tank.

Figure 4.4. Holding tanks.

evening and discarded to ensure that fresh egg ribbons are collected the next morning and transported to the incubation tanks. The amount of egg ribbons produced by the female perch depends on several factors, including the broodstock, the weather, and the depth, size and age of the pond.

Production

Hatching is not done in the incubation tank. Bill said that the incubated eggs are removed from the tank just before they hatch, when black eyes appear. The eggs are siphoned from the incubation tanks into a 5-gallon bucket, and air stones are used to aerate the water for about 15 minutes. Hatching occurs in these buckets, and then the fries are transferred to the grow-out ponds; fries from each tank go to a different pond. The fish stay in the grow-out ponds for about six to seven weeks. The ponds are fertilized with inorganic liquid fertilizer, primarily to stimulate the growth of phytoplankton, which serves as a food source for zooplankton and subsequently for the fish fry. When the fish get to a size of about ¾ to 1 inch, they are seined and transferred back to the indoor tanks. So as not to over fill the tanks, about 25,000 fry are placed in the big tanks and about 15,000 in the smaller tanks. Once in the tanks, feed training begins, historically, in mid-May and runs 17 to 21 days. Sometime in early June, the fish are returned to the pond in which they were raised and are held in seine nets until they are adjusted and feeding well. The seine nets are then removed, and the fist are fed continuously until about the end of September, which is about the time that they back off feeding, when the cold months start. At that time, the fish are brought into the indoor tanks to be sorted for the market. According to Bill, fish loss is very minimal.

Marketing

By the end of September, most of the fish are 5 to 7 inches or 4 to 5 inches. The biggest market is for 5-to-7-inch and over-7-inch yellow perch, which can sell at about $7.50 per pound. Once the temperature is below 55 degrees F, the fish are ready to be handled and sold. If the temperature is over 55 degrees F, fungus can grow on the fish. Only part of the pond is harvested if the order is small or it's the first order of the season. As more orders come in, the entire pond is

Figure 4.5. Bill Lynch sorting perch.

seined back and forth a few times to ensure that no fish is left behind. The fish are then transported back to the barn where they are unloaded and sorted into tanks by size. Any fish smaller than 4 inches is taken back to the pond to grow larger before being sold. Before the fish are sorted and counted, the water in the tank is salted to protect the fish from disease, parasites, stress and slime coating.

Buyers typically call in the spring and summer with the number of fish they would like to purchase in the fall. In the fall, the buyers come the farm and the fish are loaded. Bill said that before transferring the fish from the holding tanks into a customer's hauling truck, he ensures that customers are providing proper aeration and are salting the water.

Millcreek Perch Farm typically produces 150,000 to 200,000 fish a year. Typically, two-thirds of the fish are sold in the fall and one-third in the spring. In a busy year, all the fish will be sold by the end of the fall season. Millcreek Perch Farm also sells to retail shops in and out of state. Most of the fish sold are picked up from the farm by the buyer. The selling price is a minimum of $1 per fish, depending on size.

Competition

Only a few farmers grow yellow perch for recreational stocking, so competition is light. There is no competition from Lake Erie because it is unlawful to harvest from the lake for pond stocking. Harvesting from Lake Erie for food fish, however, is legal and is cheaper than raising yellow perch for food fish.

Challenges and opportunities

The main challenge that Millcreek Perch Farm faces is that their feed supplier has moved to Canada. Consequently, they are anticipating an increase of about 25% and now must find an alternative feed supplier. Besides the supply challenge, either feed prices are too expensive or feed is not good quality for yellow perch. They have used feed from three companies over the years: Purina AquaMax in all sizes from powder to 3-millimeter pellets, Zeigler feed, and Skretting feed. Feed companies typically require large orders, a minimum of 10,000 pounds of any feed.

The farm has a portable backup generator, but they've seen energy costs going up and are in the process of having a large backup generator installed. For now, power outages have not caused problems because Bill's house is on the same power line as the farm, so if he is home, he knows when power has gone out and he needs to get to the farm to start the generator.

5. RDM Shrimp

RDM Shrimp (rdmshrimp.com)
101 N. 850 E.
Fowler, IN 47944
Phone: 765-299-9313

Owner-operator: Karlanea Brown
Email: rdmshrimp1@gmail.com

Figure 5.2. The Brown family, from left, Daryl, Levi and Karlanea.

History

RDM Shrimp is a family-owned Pacific white shrimp (*Litopenaeus vannamei*) farm operated by the Brown family, Karlanea and Daryl Brown and their son Levi. RDM Shrimp is in Fowler, Indiana. The farm started in 2010 after the family decided, in 1991, to exit the hog business and move from their original farm location because of odor complaints from neighbors, real estate development and low hog prices in the early 1990s. RDM Farms also operates acreages of corn and soybeans and an annual perennial greenhouse.

Figure 5.1. RDM Shrimp logo.

The idea of raising fish intrigued the Browns, and they started looking into aquaculture. After about 15 years of research, they settled on the Pacific white shrimp. Initially, they wanted to raise tilapia, but a shrimp farmer introduced them to shrimp farming, and they liked the idea because shrimp were cheaper to grow and were the most-consumed seafood in the U.S.

Daryl Brown started the farm and was later joined by Karlanea as a co-owner after she left her job of nine years as a cafeteria manager in a local school. Karlanea recalls some fish farmers discouraging them from getting into shrimp because it would not be economically feasible indoors in a recirculating aquaculture system (RAS) in the Midwest. But they were not discouraged and went ahead and launched their business. They have not only been successful but are also helping set up other shrimp farms in the U.S. and overseas.

Growing shrimp to market size

Karlanea said that growing shrimp to market size requires a lot of things, but most importantly maintaining water quality for the shrimp to grow well and survive at a higher rate. The Browns consider themselves "guardians of water" and not shrimp farmers because the everyday work on the farm is geared towards guarding the aquatic environment for the shrimp. RDM boasts of producing fresh shrimp with no antibiotics or hormones.

Postlarvae and the nursery

RDM sources its postlarvae (PLs) from hatcheries in Florida and Texas. They are about 10 days old, i.e., PL10, when they arrive. The farm usually receives about 100,000 PLs a month and raises them in nursery tanks for 25 days. At the nursery stage, PLs go through five stages of feed; they're fed five times a day on a very tight feeding schedule.

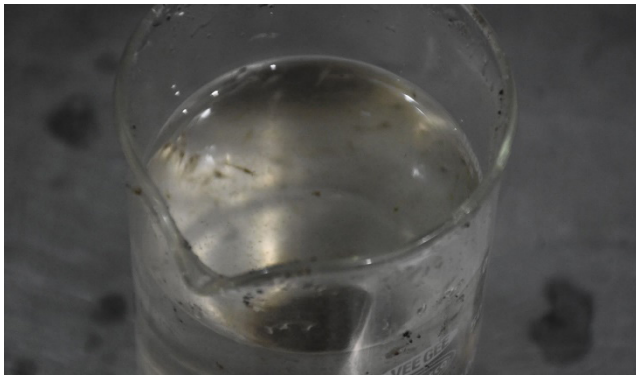

Figure 5.3. Postlarvae.

When the PLs first come into the nursery, they are acclimatized to a 32 parts per thousand (ppt) saltwater environment. Biofloc water from the production tanks is slowly added to the nursery tanks after the PLs have been in them for a week. After 25 days in the nursery, the PLs and their water are moved into intermediate tanks where they stay for an additional 25 days before they are transferred to the production, or grow-out, tanks.

RDM sells about 70% of its PLs from its intermediate tanks to other shrimp farmers RDM helped to set up and keeps 30% for its own grow-out operations. The 30% of RDM's PLs that are transferred into production tanks stay in the tanks for 90 days to grow to market size of about 18 to 22 grams.

Biofloc and the grow-out system

The shrimp are grown in a recirculating biofloc system in tanks — an ecosystem that uses heterotrophic bacteria to handle the metabolic wastes in the production system. The heterotrophic bacteria convert ammonia to nitrites and then to nitrates, avoiding the use of biofilters as in a typical RAS. The bacteria are in the form of suspended aggregates or colonies, called bioflocs, in the water.

The advantages of raising shrimp in a biofloc system are mainly economic and environmental: lower costs because the system does not require biofilters, bioflocs are an additional feed source for shrimp thereby reducing feed costs, and no water exchange. The main disadvantage of a biofloc system is establishing the bacteria colonies; it takes about 12 to 18 months to develop heterotrophic bacteria. RDM has used its biofloc production water for 12 years.

The water is reused, but the heterotrophic bacteria population requires oxygen, and solid wastes in the water reduce the ability of the water to hold much oxygen. Therefore, there is a need to increase the total oxygen

Figure 5.4. Biofloc in tanks.

supply in the tank; RDM uses aeration, or oxygen supply from atmospheric air, as well as from aeration devices such as air diffuser stones. The air diffusers also keep the water in suspension.

Water-quality monitoring

Maintaining water quality is the main activity the Browns undertake on the farm. Monitoring, testing and maintaining the bacterial ecosystem takes care of the shrimp. Creating the best environment for the bacteria to grow and to thrive takes a lot of testing. Water-quality testing is done daily, but not for the same parameters. However, the Browns routinely test every single water quality parameter at least twice a week.

RDM reuses the biofloc water and has found that this reuse makes the bacteria perform efficiently as they maintain thousands of bacteria colonies in their biofloc systems. Because of the healthy ecosystem for the bacteria, the bacteria consume all the ammonia in the waste inside the tanks, maintaining a very clean aquatic environment for shrimp growth.

Sales and marketing

RDM sells 99% of the shrimp produced on the farm through its on-farm retail business, with customers driving to the farm to buy the shrimp. The farm sells about 2 to 3 pounds at a time at a price of $18 to $20 per pound, depending on shrimp size. A minute amount of RDM shrimp is sold to restaurants, and that only when there is a demand for it and if the restaurant is not going to freeze the shrimp. The Browns believe that once restaurants start freezing their shrimp, it then becomes a competitor with the frozen shrimp market. They want their shrimp to be sold live and fresh to maintain that niche market. RDM sells about 400 to 700 pounds of shrimp a month. Sales are usually lowest in November, December and January because of wintry road conditions that hinder customers from getting to the farm.

Shrimp sold from the farm are not processed and have their heads on as fresh products. Regular customers have become accustomed to seeing the shrimp with head on, but most customers don't know how to cook them. Karlanea Brown said cooking with the head on adds some sweetness to the meat and guarantees the freshness of the product.

Figure 5.5. Testing water-quality parameters.


Figure 5.6. Market-sized shrimp.

Karlanea's favorite way of cooking shrimp is grilling it with a slight coating of olive oil and a pinch of Cajun seasonings. She puts them on hamburger flippers and grills at 350 degrees F for about two minutes, turning the shrimp over after it turns pink.

Farm tours

RDM shrimp farm also offer tours, which the Browns consider to be a lot of fun because most people have never visited a shrimp farm anywhere, let alone in Indiana. They offer what they call a quick tour for individuals that takes about 20 minutes at a cost of $5 a person. These visitors get to see the shrimp production process.

For people interested in getting into the shrimp farming business, RDM offers a discovery tour that involves not only a tour of the facility but also a Q&A session and take-home information on shrimp farming. As a result of such tours, RDM has helped set up several shrimp farms across the U.S. and in international locations.

Finally, RDM also offers group tours. Groups usually consist of at least 10 people who are shown a 20-minute PowerPoint presentation about shrimp farming, guided on a tour the facility and provided with a sampling of shrimp. They have hosted Future Farmers of America (FFA) students tours, which usually involve about 950 students and are done over a four-day period.

RDM occasionally offers a shrimp fishing experience to school groups so the students can fish for shrimp for fun, plus it has a shop selling T-shirts, houseplants and other souvenirs from the farm.

Figure 5.7. An RDM Shrimp farm tour.

Challenges in shrimp farming

Karlanea said the shrimp farming enterprise has been challenging but rewarding because of the learning experience. Their main activities are focused on providing an optimal growing environment for the shrimp. The main resources for shrimp production include water, salt, a little bit of baking soda, and a little bit of sugar to feed the bacteria. Labor is required for frequent water-quality testing.

One major challenge in shrimp farming is ensuring a high survival rate of the shrimp. Unless optimal water quality is maintained, survival can be very low. Another major challenge is sourcing the PLs from Florida and Texas when those states encounter natural disasters, such as hurricanes. Such a disruption can set production back for months depending on when and if the shrimp hatcheries are able to recover.

6. Rushing Waters Fisheries

Rushing Waters Fisheries (rushingwaters.net)
N301 County Road H
Palmyra, WI 53156

Owner/Operator, Peter Fritsch
Email: peter.fritsch@rushingwaters.net

Overview

Rushing Waters Fisheries started raising rainbow trout in the 1920s and began focusing on food fish farming in 1994. Today, it is the largest producer of rainbow trout in Wisconsin, operating 56 raceways and ponds across a 2-hectare farm. The farm is supplied with fresh, clear natural spring water at a consistent temperature of 50 degrees F, providing ideal conditions for trout farming.

Figure 6.1. Rushing Waters Fisheries sign.

Production process

Rushing Waters Fisheries operates an integrated system for raising rainbow trout from hatchery to market-sized fish. Fertilized eggs are sourced from commercial hatcheries and are hatched in the company's own indoor facility. The sac-fry and larval fish are initially raised in four indoor concrete raceways and then in six 6-foot tanks until they reach the fingerling stage. At that point, they are transferred to outdoor ponds where they

Figure 6.2. Fingerling culture.

Figure 6.3. Juvenile and grow-out ponds.

continue to grow to market size. To ensure efficient management of their growth, the fish are regularly graded and sorted into different ponds based on their size. It generally takes about 14 to 15 months to raise the fish from eggs to market size.

Customer and markets

The company offers end products through various sales channels: direct farm sales, retail stores and wholesale distribution to companies such as Whole Foods Market and Kroger.

In addition to selling fresh fish, the company operates an FDA/HACCP (U.S. Food and Drug Administration hazard analysis critical control point) and SQF (safe quality food) certified production facility that produces a range of

value-added products, such as smoked fish, fish spread, fish jerky, and seasonings.

The farm store offers a variety of fresh and frozen seafood, fish burgers, snacks, beverages, cooking ingredients and souvenirs. Online shopping is also available for' convenience. The farm's fishing operations are open year-round, allowing customers to catch fresh fish at any time

Figure 6.4. Products being prepared for sale in a fish processing facility.

Figure 6.5. Rainbow trout packaged with the Rushing Waters brand to be sold through various outlets.

Figure 6.6. On-farm sales of products is one successful marketing strategy that is used.

Figure 6.7. The fee-fishing operation allows customers to catch fresh fish and enjoy an outdoor experience.

Limits to production

The company faces two major challenges in production.

Regulatory issues: One of the main concerns is strict regulations that can make compliance difficult and costly, such as the excessively low limits on phosphorus discharge. Currently, the phosphorus level in the company's groundwater is 75% of the discharge limit, and they are not permitted to account for this in their discharge calculations.

High feed costs: The rising cost of feed is another significant challenge, impacting overall production expenses

Largest production costs

The largest production cost is feed, accounting for 40% of expenses, followed by labor costs at 30%

Support needed

More applied research: There is a need for more research to bridge the gap between scientific findings and practical application in the field.

Extension services: Increased support from extension staff is necessary to help disseminate research findings and implement them in practical farming operations.

Farming and extension research: Research and extension services benefit the industry by sharing valuable information and offering training that can enhance farm practices and overall productivity.

7. Tippco Fish Inc.

Tippco Fish Inc.
10867 U.S. Highway 231 S.
Romney, IN 47981

Owner-operator, Phillip Shambach
Email: philshambach@tds.net

Background

Tippco Fish Inc. is located in Romney, Indiana, just south of Lafayette. It is owned by Phillip Shambach, who has a bachelor's degree in biology from Ball State University in Indiana and a master's degree in aquaculture from Auburn University in Alabama. Phil said that when he was trying to figure out what he wanted to do after his biology degree, he worked at a biology lab in Covington, Indiana. There, he got experience working with freshwater shrimp just for the fun of it and became excited about aquaculture. So, he decided to go back to school, ending up at Auburn University where he earned a master's in aquaculture. He then worked on the east coast for an agriculture cooperative raising tilapia in recirculating systems. He had opportunities to move up in management at the company but instead decided to start a fish farm on his own so he could stay in the fish business.

Phil heard of a tilapia producer in the Midwest who had quit raising tilapia. With Phil's experience in growing tilapia and having grown up the Midwest, he saw the situation as a prime opportunity for him to return to Indiana and start a tilapia farm to fill the gap left in the market. Tippco Fish Inc. started operations in 2012.

Figure 7.1. Tippco Fish Inc.

Farm infrastructure

Tippco Fish Inc. uses an indoor recirculating aquaculture system to produce fish. The system comprises 12 nursery tanks, each with a capacity of 700 gallons, and 12 grow-out tanks, each with a capacity of 6,000 gallons. The production system has biofilters and microscreen drum filters for biofiltration of waste. Biofiltration is done via a moving bed biofilter where the water from the grow-out tanks comes in through a microscreen drum filter to remove the solids and then flows through three separate chambers of

Figure 7.2. Moving bed media.

moving bed media to remove the ammonia or convert ammonia to nitrate. The water is then pumped back through a low-head oxygenator, and the oxygenated water is returned to the production tanks.

The farm uses liquid oxygen to support the fish. Indoor temperatures are maintained at about 80 degrees F, which is accomplished with a building design where the combustion heating units and all the exhaust heat come into the building. According to Phil, the farm building is well insulated, and his highest heating costs are during the winter months at an average of $300 a month. The building is ventilated to allow for air exchange along with heat to maintain the room temperature. The building design also helps to keep some of the humidity out of the building even during the winter months.

Production practices

The farm receives tilapia fingerlings about every four weeks from a supplier. The fingerlings are about ⅓ to 1 gram and are placed in the nursery tanks for three to three-and-a-half months. They grow to about 100 grams after the nursery phase and then are moved to the grow-out phase, where they are for another three to three-and-a-half months, growing to the market size of about 1½ pounds. In the nursery, fish are fed four to five times a day, and in the grow-out tanks, three times a day. The fish are usually sorted into four size groups between the nursery and the grow-out phases so that by the time they go into the grow-out phase, there will be about one group of fish graded into each of the four different sizes.

Marketing

Tilapia raised at the farm is for the live food fish market, mostly Asian grocery stores in the Chicago area, Illinois and other Midwestern cities. However, tilapia is a staple for Asian, Hispanic and Middle Eastern grocers in North America. Major market outlets for live tilapia are ethnic grocers in Toronto, New York and Chicago, which are very competitive; they take large volumes, but the price they offer is a bit on the lower side. Since Phil started Tippco Fish Inc. 12 years ago, he has had loyal customers in smaller niche markets who offer a decent price for his fish. His customers are more driven by quality and service, and he doesn't

Figure 7.3. Nursery tanks.

Figure 7.4. Grow-out tanks.

even talk to them about an order; they have a standing order every week, and that's what he delivers to them unless they tell him something different.

Opportunities

A potential marketing outlet for live tilapia is recreational stocking of tilapia, which some farms are using, but Tippco Fish Inc. is not yet selling through that outlet. During the summer months, recreational pond stockers demand tilapia for stocking water bodies such as community ponds and farm ponds to clean up algae. Currently, recreational stockers are not competing with the food-size tilapia fish, according to Phil, because the fish is worth much more to grow out to market size than to sell as stockers.

Challenges

Input costs: Challenges for aquaculture, particularly recirculating systems, include the prices of inputs. The price of liquid oxygen has gone up about 30% since 2022, according to Phil. The prices of feed and fingerlings have also gone up. The market price of the fish has gone up a bit to keep up with the upward trend in the price of inputs. However, the increase in fish market prices has incentivized a lot of competition for whole live tilapia. Phil said his business has experienced some rough times the past couple of years with COVID-19 and a fire outbreak at the farm, but he has endured and the farm is doing a lot better now.

Environmental control: Phil said that tilapia are very hardy and disease resistant if they are kept warm — at a minimum water temperature of 80 degrees F to have a decent production — and that to maintain the temperature that high costs money.

Disease management: There are limited treatment options for recirculating aquaculture systems because of the bacteria needed in the biofiltration process. The main challenge for a small fish farmer is securing medicated feed from feed suppliers because suppliers require larger orders, and it can take a while to receive those supplies. Tippco Fish Inc. works with a local veterinarian when there are disease and health issues. The common drug they use is Romet TC for top-coating of feed, and that treatment works decently for tilapia.

Advice for aspiring aquaculturists

Phil's advice for aspiring fish farmers is that they should not get into aquaculture just wanting to make money but should also have a passion for raising fish because aquaculture is farming. He said there are lots ways other than fish farming to invest and make money. An aspiring aquaculturist should also have diverse skills and knowledge in biological and mechanical issues. For Phil, he does a little bit of everything himself.

Fish processing

There is currently no processing of tilapia in the Midwest, except an aquaponics farm in Illinois that does on-farm processing of its tilapia for farmers markets and on-farm sales. According to Phil, the challenge for processed tilapia fillet is import price competition, and that is the reason almost all tilapia produced in the U.S. are sold to ethnic fish markets.

8. Superior Aquaculture LLC

Superior Aquaculture LLC
(superiorraceways.com)
Stevens Point, Wisconsin

Owner-operator: Jay Warecki
Email: info@superiorraceways.com

Jay Warecki of Superior Aquaculture LLC was interviewed via Zoom in lieu of a site visit.

Jay Warecki, Ph.D., said that his first aquaculture experiences involved processing and distribution of fish bycatch obtained from fishermen operating in the Great Lakes region. That bycatch consisted of whitefish and chubs associated with fishing of yellow perch. When the yellow perch fisheries went into decline, he lost tax subsidies supporting bycatch processing, which bycatch consisted primarily of Menominee whitefish and burbot associated with fishing for yellow perch and lake whitefish. At that point, he directed his efforts at designing and producing in-pond raceways to improve the efficiency of aquaculture production systems, as opposed to indoor RAS systems.

Jay's company, Superior Aquaculture LLC, markets and sells self-contained in-pond raceways to companies in the U.S., Africa and Canada. His raceways are typically 90 feet long, containing 48,000 gallons of water. Raceway water flow is provided via air-lift pumps powered by 2.5-horsepower regenerative blowers serving two raceways. According to Jay, his raceways are typically placed in 2-to-4-acre ponds.

Jay suggests that a promising aquaculture candidate to replace yellow perch, as a declining U.S. wild fisheries product, is the native bluegill sunfish. He said that when prepared, bluegill taste and texture is similar to yellow perch, and that bluegill are easier to breed and grow because they are much less susceptible to stress-related disease and mortality. Jay said that producers in Florida are using his raceways to grow bluegill in warm and brackish water, emphasizing the broad temperature and water-quality tolerance of bluegill. However, he suggested the optimal temperature for maximum bluegill growth is 75 degrees F. According to

Figure 8.1. Floating raceways can be used in many different pond and lake systems for producing fish.

Figure 8.2. Floating in-pond raceways that can be used in smaller ponds for raising fish.

Jay, another advantage of bluegill is that they grow well on low-protein feeds, such as 32% protein catfish feed. Bluegill fry are produced in inorganic fertilized ponds providing zooplankton populations as initial feed. He suggests that bluegill fry are easy to convert to pelleted floating feed and that there are ready markets for bluegill fingerlings for pond stocking yielding prices of $6 per pound live weight. Jay said that prices for bluegill fillets in the 5/8-to-1-pound total fish weight size range from $16 to $26 per pound, whereas yellow perch fillets range from $15 to $17 per pound. Warecki values the research conducted at the University of Missouri and Lincoln University, which demonstrated the potential for bluegill food fish production (see MU Extension publication G9473, Bluegill Sunfish Production in Missouri, extension.missouri.edu/publications/g9473).

Jay said that he spent several years researching soybean derived omega-6 lipids versus fish-derived omega-3 lipids. He said that omega-6 lipids are considered oxidants and omega-3 lipids are classified as antioxidants. He feels that the human health advantage of fish oils is a strong selling point for fisheries and aquaculture products in general.

9. Freshwater Farms of Ohio

Freshwater Farms of Ohio
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Figure 9.1. Freshwater Farms of Ohio.

History

Dave Smith, Ph.D., established Freshwater Farms of Ohio in 1983 with his father, Dick Smith. His son, Ben Smith, is the farm manager and designer for WaterSmith fountains. Freshwater Farms operates a rainbow trout hatchery and growing operations in various tanks and ponds for different growth stages of trout. It has been raising fish in indoor facilities using recirculating aquaculture systems (RAS) since 1986. The farm started with 5 acres of land and an abandoned chicken farm that Dick found while Dave was a student at the University of Wisconsin. Dave's experience working in an indoor water circulation aquaculture facility at the university motivated him to experiment with RAS when he started the farm.

Figure 9.2. Dave Smith.

The farm is vertically integrated and adopts sustainable practices. It produces rainbow trout fillets and smoked trout from fish raised from egg to adult in solar-heated barns using clean water and feeds.

The farm also offers tours and family and community activities. Dave said that one of the goals of Freshwater Farms of Ohio is to educate the public and counteract the negative portrayal of fish farming in the media. Freshwater Farms has 10 employees year-round and an additional 10 seasonal workers in the summer.

Farm infrastructure

Freshwater Farms of Ohio is considered Ohio's largest indoor fish hatchery. For biosecurity reasons, the hatchery has limited public access. The farm sits on land that has ground cold-water levels at about 6 feet down, and as a result, it operates a well with an 8-inch casing with a 5 horsepower pump

because the ground abounds in water. The well is operated continuously, and the water is used in every aspect of the farm operations. The water flow is about 70 gallons per minute although the pump is rated at 3,000 gallons per minute. The farm can be said to be conveniently situated at an appropriate spot for good cold water that is very suitable for a rainbow trout hatchery and production.

Dave indicates that the relatively lower cost associated with the farm's cold water supply is a contributing factor to using RAS compared to raising warm-water fish for which heated water needs to be recycled. He believes that many fish farms fail because they use too much energy, which is a major cost item for indoor fish production systems.

Freshwater Farms powers the farm buildings with 100% solar-generated electricity to keep the energy costs very low. It also uses equipment that doesn't require large energy consumption.

The solar collectors and photovoltaic systems have provided all the energy for heating and electricity, 200 kilowatts total energy output. The panels are installed on the roofing of the fish barns and provide heat to keep the inside temperature at 50 to 60 degrees F even in the winter.

Figure 9.3. Solar panels installed on farm barn.

The farm also has an alarm system that monitors air pressure and power supply and alerts them if there is loss of power, a pipe breaks or something goes wrong with the system.

Figure 9.4. Attached greenhouse.

Some sections of the barn have a functional greenhouse behind the solar heater that allows the capture of carbon dioxide (CO_2) that the fish give off. The barn is kept airtight in the winter to capture and keep the heat. The greenhouse has several garden water plants, grown from the seedling stage, which help with carbon dioxide stripping and provide some heat in the barn. The concrete and cement block structures used in the barns also store some heat energy overnight and help keep a stable indoor temperature even when there are a couple of weeks of cloudy weather in the winter.

Sustainability production practices

Fish from the hatchery are grown to various sizes: advanced fingerlings for stocking, market size of about a 1½-to-2-pound size for processing into fillets, and 5 to 6 pounds

for processing into smoked trout. In addition to having grow-out tanks indoors, the farm has five large tanks outside with shade covers to keep the water cool. Freshwater Farms also has a ranching operation in a half-acre pond that is spring fed. The outdoor tanks can hold up to 5,000 rainbow trout to get them up to final market size. Leftover water used in the hatchery is transferred to the grow-out tanks, and new water is used in the hatchery. The tanks are essentially intermediaries for grow-out, and shade cloth helps keep the outdoor water temperature below 70 degrees F. During winter months, the trout mostly keep the water open unless the temperature gets down to minus 20 degrees F; then the thin skin of ice is removed. But, generally, the trout are so active that they keep the water open.

Figure 9.5. Outdoor grow-out tanks.

The nutrient-rich water from the grow-out tanks is reused in outdoor gardens for raising produce, wildflowers, native trees and plants, known as the RAINBOW project — Reutilizing and Integrating Nutrient Byproducts of Wastewater. RAINBOW is a nutrient and water recovery project to reenforce the sustainability practices on the farm.

According to Dave, one thing they've learned is that management is key: addressing mortalities and disease problems. They mainly use salt to treat disease on the farm, buy sometimes formalin. The farm does not use antibiotics, hormones or anything that is medicated. They use clean feeds and water, ensuring contaminant-free fish. Dave indicates that their practices are not only educational but also demonstrate sustainable practices and promote environmental awareness.

Marketing

The Freshwater Farms facility is VHS (viral hemorrhagic septicemia) certified and sells retail live advanced fingerlings for stocking to individuals and some community organizations, and market-sized fish to a few local restaurants. The farm used to do wholesaling when they opened the farm store, selling to restaurants and markets

Figure 9.6. Packaging for trout stockers.

twice a week in Dayton and Columbus, Ohio. They also used to deliver advanced fingerlings for stocking to facilities in Tennessee, Wisconsin, and Michigan. However, they do not do any wholesaling now. They keep most of the market-sized fish in-house for value-added processing into fillets and smoked trout. Most of their customers are individuals who are passionate about local foods and environmental issues. Dave said the retailing approach is helping to fight some of the continuing local misinformation about what fish farming is about.

Figure 9.7. Trout fillets.

Figure 9.8. Smoked trout.

Processing and value-added products

Freshwater Farms has a federally inspected kitchen for processing smoked trout and other fish products. The facility was set up in 1993 with some assistance from U.S. Department of Agriculture (USDA). They sell various trout products, including boneless marinated and preseasoned fillets, smoked trout, trout burgers, spreads, seasoning made in-house, marinated and preseasoned fillets, and dog treats. All processed products are sold in the front farm store, which was converted from an old barn. Their products are made with all-natural ingredients and contain no artificial preservatives. The dog treats are made from processed fish waste, or scraps, thus the farm uses much of the harvested fish.

The trout processed in the store is harvested twice a week from the production tanks. The trout fillets are skin-on to hold the fillet together. They are boneless fillets that are ready to cook. The smoked trout is cooked in a smoke environment and is guaranteed to be safe to eat. There are no added preservatives, but they add a bit of salt and a very low-brining step to produce a flavorful product ready to eat from the package or to be used for salads.

The farm store also sells various condiments prepared in the inspected kitchen; seafood from other sources; and souvenirs, including stuffed animals and fish. According to Dave, the store has been a very good addition to the fish farm business because of agritourism.

Agritourism and community engagement

The farm offers various kinds of public activities, including self-guided and group tours and family and community activities. Families come out to the farm and spend two to three hours with their kids, just to have fun. There is a fee for large group tours. People visiting the farm get the opportunity to feed the trout by buying feed from a dispenser installed near the outdoor tanks. Children also get to experience a petting zoo with native fishes, sturgeons, reptiles and frogs.

Community activities include the annual Ohio Fish and Shrimp Festival on the farm, which

attracts hundreds of visitors. Because of the popularity of the festival, it is now held on two Saturdays in late September. The festival features an outdoor stage with live music, an outdoor bar and kitchen, and multiple vendors. Because of the success of the festival over the years, the farm has improved infrastructure to accommodate the visitors by installing outdoor electrical hookups, water hookups, and electric charging stations for electric vehicles (EVs).

The RAINBOW project has a wildflower maze, and people can wander and see the wildlife, butterflies and biodiversity on the farm as part of the self-guided tours. The area is a monarch habitat registered as an official Monarch Waystation. The farm setup has attracted other activities, such as music events, weddings and receptions, and family reunions.

Challenges and opportunities

Dave said the main challenges he faces are addressing misinformation about fish farming and maintaining energy efficiency. He said there is much confusion and misinformation about seafood and where it comes from and how it has been raised, so Freshwater Farms is trying to help customers make informed choices about buying farm-raised seafood. The farm is also looking to organize day camps for kids to teach them about nature and environmental sustainability. The farm plans some expansion that will involve using additional land surrounding the farm to grow plants and to expand fish production in some gravel quarries in southwest Ohio.

10. Gollon Brothers Wholesale Live Bait Inc.

Gollon Brothers Wholesale Live Bait Inc.
(gollonbait.com)
2450 Torun Road
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Owner-operator: Ben Gollon
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Overview

Figure 10.1. Gollon Brothers Wholesale Live Bait Inc. sign.

Gollon Brothers Wholesale Live Bait Inc. is a family-owned business with a legacy spanning over 100 years. Ben Gollon, current owner and president, has led the company's baitfish operations since 1995. Today, Gollon Brothers is the largest baitfish farm in Wisconsin, producing high-quality minnows, leeches, worms and larvae for distribution regionally, nationally and internationally.

Figure 10.2. Gollon Brothers Wholesale Live Bait Inc. buidling.

Production systems

The farm integrates both pond and tank systems for fish production. It operates about 20 quarter-acre ponds and more than 100 ponds averaging 20 acres each. Fish larvae are produced using either natural or artificial spawning methods. Initially raised in small ponds, the fish are later transferred to larger ponds as they grow.

Figure 10.3. Outdoor ponds.

Figure 10.4. Indoor tanks.

Products and market

The company exclusively supplies its products to wholesale markets. It produces a wide variety of live species, including fathead minnow, emerald shiner, golden shiner, rosy red fathead, white sucker minnow, creek chub, common shiner, redtail chub, water

Figure 10.5. Minnows.

Figure 10.6. Leeches and worms.

or ribbon leeches, night crawlers, panfish worms or red worms, wax worms, and spikes or maggots

Figure 10.7. Baitfish harvest.

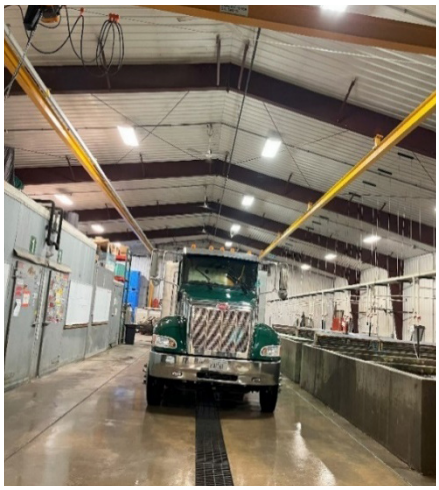

Figure 10.8. Transport.

Limitations to expansion

The primary limitations to expanding production are access to land and to water. State regulations prohibit pond construction in wetlands, although exceptions exist for industries such as cranberry farming. Additionally, water discharge regulations further constrain operational capacity.

Major production costs

Labor, transportation, land and equipment represent the major production costs for the company operation.

Support needed

The baitfish industry would benefit from stronger leadership to help influence regulatory policy. Current funding from the North Central Regional Aquaculture Center (NCRAC) should focus more on solving real-world industry challenges and aligning support with practical, on-the-ground needs.

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University of Missouri

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