



Aquaculture Alternatives in Arkansas

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Aquaculture, the farming of aquatic animals and plants, is a form of agriculture. Many people are looking at various aquaculture enterprises as a way to start a new business or provide food for their families. Arkansas is a prime location for the development of aquaculture farms. Industry infrastructure, such as feed mills, aquaculture supply houses, financial institutions and equipment manufacturers, is available in Arkansas or adjacent states and supports existing producers. In considering an aquaculture business venture, there are a number of important decisions to be made. This fact sheet is intended to assist potential producers by outlining critical questions and briefly describing the various alternative species and culture systems. The Southern Regional Aquaculture Center (SRAC) provides online access to over 150 fact sheets (<https://srac.tamu.edu/>), many of which are referenced by fact sheet number throughout this publication.

Commercial aquaculture operations typically sell fish to processors, wholesalers or directly to consumers. Markets must be developed by the individual producer. In addition to commercial operations, small-scale aquaculture can produce food for family and friends. A pond, a few cages or an indoor system can be managed to provide a supply of fresh fish for the table. Information on raising fish for family food and recreation is also available through the University of Arkansas Cooperative Extension Service.

The vast majority of fish farms in Arkansas are small family businesses. Fish farming requires a high level of dedication, hard work and near-constant attention during the growing

season. Prior to entering commercial farming, consider if you have the temperament, skills, management ability, financial resources and time required to run a fish farm. If you are not interested or suited to the task and still wish to pursue fish farming, you will have to pay to hire a manager. SRAC 0441 is a fact sheet on the realities of aquaculture and is an excellent resource for people thinking of beginning an aquaculture business. It points out the potential for catastrophic disasters such as oxygen depletions and disease, emphasizes the importance of marketing and discusses the risks and benefits of fish farming.

Financing and Marketing

It is critical to develop a business plan before beginning an aquaculture operation. A business plan includes a marketing plan and a financial analysis of the proposed operation (see SRAC 0381). The University of Minnesota AgPlan web site (<https://www.agplan.umn.edu/>) provides free online assistance in developing a business plan. Marketing is the key to a successful aquaculture business. For producers planning to sell locally, Arkansas MarketMaker (<http://ar.marketmaker.uiuc.edu/>) provides an online site for buyers and sellers of agricultural and fishery products to connect. Unfortunately, USDA organic certification is not available for aquaculture products as yet.

You will likely need to contact lenders and investors to acquire the necessary capital. Commercial lenders typically are very reluctant to finance aquaculture operations. Fish farming requires large amounts of capital for pond construction and equipment, and it is not always easy to sell or

lease the business if you decide to exit. Your plan should indicate potential profits. Will the profit make your efforts worthwhile? Visits to commercial farms and with Extension personnel can help you set goals for your aquaculture operation and assist with developing budgets. SRAC 4400-4403 describe financial management considerations for aquaculture businesses.

Deciding which aquaculture species to produce is an important step. Each species has its own biological and economic potential and constraints. The principal question is, can this species be raised and sold for a profit in Arkansas? In selecting a species, it is critical to study not only the production methods but also markets available and accessible to your proposed operation as well as anticipated costs, market price and expected profits.

Production of many aquaculture species depends upon a supply of commercially available feed. Unfortunately costs of feed grains and other ingredients have increased dramatically in recent years. Much of the protein in catfish feed comes from soybean meal, and feed alone accounts for over half of the cost of catfish production.

Sources of Information

The Aquaculture/Fisheries Center of the University of Arkansas at Pine Bluff (<http://www.uaex.uada.edu/aqfi>) and the University of Arkansas Division of Agriculture, Cooperative Extension Service (<http://www.uaex.uada.edu>) work cooperatively to provide research-based information to people interested in aquaculture. Information on fish production can be obtained from any county Cooperative Extension Service office in Arkansas. Your county Extension agent can provide valuable information on local conditions. Extension materials are designed to provide an objective overview of the requirements and rewards involved. Ultimately, the decision to enter fish farming rests with the individual. Informed individuals make better decisions, reducing the chances of failures that hurt everyone in the business.

Use reasonable caution when obtaining information from the Internet or other sources. Be wary of offers that are “too good to be true,” such as free fish. Unfortunately, some new producers have been taken advantage of by “aquashysters” who promote novel culture systems or improved breeds. It is important to thoroughly investigate such claims and to seek unbiased information from Cooperative Extension. While many commercial sites provide useful information and links, the potential exists for information to be biased toward a particular company’s product or service. Even government or educational sites may be unintentionally misleading. For example, it is possible to access publications developed for one region of the country that offer recommendations unsuited to other locations. Reliable, research-based information can be obtained from the University of Arkansas Cooperative Extension Service, the Southern Regional Aquaculture Center and from eXtension (<http://www.extension.org/>), the national web site for Extension information.

Aquaculture Species Regulations

To commercially culture fish or other aquatic animals in Arkansas, a Fish Farming Permit from the Arkansas Game and Fish Commission (AGFC) should be obtained. To buy or sell paddlefish or sturgeon, a Roe Taker/Seller Permit is also required. Fish farmers also must supply a bill of sale or lading when they sell fish (see Section 42 of the AGFC code of regulations for details). The AGFC also maintains a list of approved aquaculture species, those species that can be legally cultured in Arkansas without a special permit. A number of additional species can be raised if a farm meets AGFC requirements and obtains a “restricted species possession permit.” Species that are not on either list cannot be legally cultured. However, the AGFC does have a process where producers may apply for permission to culture certain species under an “unlisted aquaculture species permit.” For example, marine shrimp culture requires this permit. It is essential not to introduce new species into Arkansas unless and until AGFC approval has been obtained. Exotic species can cause tremendous economic and ecological damage to the state and the region as well as to the state’s aquaculture industry.

Aquaculture Species

A large variety of different aquaculture species is cultured in Arkansas. The major species raised are channel catfish and baitfish (golden shiners, fathead minnows and goldfish). Information on culture methods for these crops is readily available from the Cooperative Extension Service. Additional species currently or historically raised in Arkansas include hybrid striped bass, grass carp, largemouth bass (food fish), fancy goldfish, koi, common carp, ornamental fish, crawfish, trout, black carp, tilapia, freshwater prawns, marine shrimp and turtles. Sportfish, fish for stocking recreational ponds, such as largemouth bass, bluegill, black crappie, hybrid bream and redear sunfish, are also farmed. However, there is limited information available on the production and/or marketing of many of these species. Existing producers have spent much time and effort developing their own production methods and markets. A potential producer should gain experience before attempting to produce these species commercially and must expect to devote a large portion of his or her time to marketing efforts.

Every year a number of people “discover” new aquaculture species that are not being raised in Arkansas and see great profit potential in these new ideas. If a species is not presently cultured, usually it means that there are technical problems in its culture or that it cannot be raised profitably.

Catfish and Hybrid Catfish – Arkansas is third in the nation in channel catfish production, with approximately 9,000 acres of ponds (Figure 1). Catfish production is capital-intensive, with investment costs of approximately \$4,000 per acre. It is also a demanding business that requires hard work and skilled management. There are economies of scale in catfish farming, meaning that production costs per pound of fish produced are higher for small farms



FIGURE 1. Arkansas is the third largest producer of farmed-raised channel catfish. Most catfish production in Arkansas is in earthen ponds.

(see SRAC 1800) and lower for larger farms, at least 320 acres or more. Large farms typically sell fish to catfish processors while farms of less than 20 acres should consider marketing fish locally through direct sales (see SRAC 0350). Fee fishing operations (pay lakes) and fishing leases provide additional income opportunities (see SRAC 0479a, 0480-0482). Catfish is a high-quality, desirable product (see SRAC 0501), but sales have been hurt by imports of competing fish species from countries with few environmental and regulatory controls.

Over the past decade, many producers have switched to hybrid catfish production. The hybrid is a cross between the channel catfish female and the blue catfish male (see SRAC 0190). Hatchery production of the hybrid is more labor-intensive than that of channel catfish because the two species are extremely difficult to produce in ponds and must be manually crossed by stripping eggs and sperm in the hatchery. Hybrids grow faster than channel catfish. Although current hatchery production methods have been improved, production of adequate numbers of fingerling hybrids to meet demand for stocking in grow-out ponds has yet to be achieved.

Channel catfish and hybrid catfish can be raised in farm ponds on a part-time basis, primarily as a hobby or for home food production. At this level of production, profits from the sale of fish are not enough to pay for the construction of new ponds. Harvesting can be a major problem with existing farm ponds if they are deep, without drains or filled with stumps and other debris.

Baitfish – Arkansas leads the nation in the production of fish for bait and as feeders (live food for ornamental fish and invertebrates). Approximately 20,000 acres of ponds are used to raise over six billion baitfish each year. The main species raised are the golden shiner (Figure 2), the fathead minnow and the goldfish. While there have been improvements in hatchery and production methods in recent years, marketing remains the most difficult part of the baitfish business. Baitfish species are not particularly difficult to culture, but it is a very risky



FIGURE 2. Golden shiners are baitfish that are farm-raised in Arkansas. (Photo by Troy Clemment)

business, as the retail demand for baitfish is highly variable due to factors such as the weather that are entirely out of the control of the producer. Newcomers are unlikely to capture a significant share of the market without developing a thorough understanding of baitfish marketing. SRAC 0120-0124 provide information on production of baitfish.

Crawfish – Capital requirements and operating expenses for crawfish culture are less than those for catfish production, as only low (3-foot) levees are needed and forage is used instead of feed (see SRAC 0240, 0241). However, harvesting crawfish by trapping requires considerable labor in the spring, when row crop farmers are busy planting (see SRAC 2400, 2404). Production of quality crawfish (cleaned and purged) is one way to promote sales of Arkansas pond-raised crawfish and to differentiate farmed product from the wild catch. Careful handling and purging of crawfish can help with marketing (see SRAC 2402); local markets are willing to pay a good price for large, quality crawfish.

Sportfish – Sportfish are fish produced for stocking recreational ponds. These include largemouth bass, bluegill (see SRAC 0724), black crappie, hybrid bream (bluegill and green sunfish cross is common) (see SRAC 7205) and redear sunfish. The successful producer should be able to offer a variety of healthy, quality fish species to give the customer “one-stop shopping” for their pond-stocking needs. Sportfish suppliers may also offer other products to their customers for their ponds, such as feed, aerators and chemicals.

Tilapia – A hardy tropical fish that is widely cultured around the world, tilapia can be raised in indoor systems or outdoors during the summer months in Arkansas (Figure 3) (see SRAC 0280-0283). Tilapia are particularly suited to culture in recirculating systems as they tolerate high stocking densities and poor water quality. High over-wintering costs and the fact that market-sized fish would be available for only a short time in the fall limit the potential for pond culture of this species. Production

costs in indoor tank systems are relatively high. While there has been a growing market for tilapia fillets, foreign farms are able to produce, process and ship fish to the United States at a lower cost than can be achieved by domestic tilapia producers. Producers in the U.S. are limited primarily to supplying live tilapia to niche markets, such as ethnic grocery stores. Tilapia are an excellent fish for hobby or home food production and are widely used in high school aquaculture programs.



FIGURE 3. Tilapia are a popular culture species particularly in aquaponic systems. They are tropical animals and must have water temperatures above 48°-52°F to survive.

Trout – Requirements for trout culture are well established. Trout are typically grown in raceways and require large amounts of clean, cold water (less than 70°F). Winter culture of trout in ponds is possible, but its feasibility has not been established and markets would have to be developed. It would require a relatively large fish to start with, as the growing season is short. Trout are raised in government hatcheries within Arkansas, but at present there are no commercial operations. SRAC 0220-0223 provide information on trout production.

Other Food Fish Species – Hybrid striped bass are an excellent food fish and are raised in several other states and countries for the food fish market. Arkansas is a leader in the production of hybrid striped bass fingerlings, but there is very limited production of hybrid striped bass as a food fish in the state. Information is available on culture methods (see SRAC 0301, 0302 and 0303), but marketing is likely to be a challenge. Typically, hybrid striped bass are sold whole, on ice, to restaurants. No processing is available, and this limits production. Another food fish species is the largemouth bass. Largemouth bass (Figure 4) as small fingerlings can be brought into tanks and trained to eat pelleted feeds (see SRAC 0201). This is a demanding process, but once the fish learn to accept feed pellets, they can be raised for the live food fish market. Largemouth bass diets are different from those for catfish, and in general, culture methods are relatively demanding. Hybrid bream are also a potential food fish species, but grow relatively slowly compared to catfish and will likely require at least two growing seasons to reach a minimally acceptable market size (see SRAC 7205). There are no commercial hybrid bream food fish producers in the state, and the economics and marketing have



FIGURE 4. Largemouth bass are the most sought-after sportfish in America.

not been studied. Crappie (black or white, or the hybrid) are species that have been proposed as a potential food fish, primarily because they are considered “good eating.” While there has been some research on crappie culture, much remains to be learned before commercial culture of this relatively delicate and demanding species becomes a reality. Paddlefish (Figure 5) (see SRAC 437), buffalo (see SRAC 723) and grass carp are examples of species that can be raised in polyculture with catfish or in extensive culture (fertile reservoirs).



FIGURE 5. Paddlefish are not a common culture species, but they can be raised at low densities in reservoirs.

Ornamentals – Some producers raise fish that are strictly ornamental. These include fancy goldfish, koi (see SRAC 7201), and tropical fish species such as angelfish. Ornamental fish can be sold directly to retail customers or wholesale to dealers. The producer receives a higher price per fish for ornamental species, but a great deal of effort must be exerted to produce quality fish with the body conformation, fins and colors that the customer demands. As an example, if a producer has high-quality brood fish and has the ability to select out valuable fingerlings from ordinary ones, the results could be rare koi with color patterns that are worth several thousand dollars. However, without the investment and acquired knowledge from years of fish breeding, it is likely that the fish produced will be worth just pennies.

Marine Shrimp – Marine shrimp, typically the Pacific white shrimp (*Litopenaeus vannamei*), can be raised in low-salinity inland waters in the southern United States during the summer (Figure 6) (see SRAC 2601). Once past the larval stages, marine shrimp can tolerate water with low salt levels. Shrimp are tropical animals, and they cannot survive the winters in Arkansas. Young shrimp (post-larvae) are stocked in late May, and the resulting product must be harvested by fall (early October) before the onset of cold weather (water temperatures

below 59°F). Because of competition from wild-caught and imported shrimp, and seasonal production, marketing is a major concern for inland shrimp farmers. It is essential that the post-larval shrimp be obtained from a reputable hatchery, that they be specific pathogen free (SPF) and inspected to ensure they are free of viral diseases. While post-larval shrimp are widely available, there is limited availability of quality product.



FIGURE 6. Marine shrimp raised in freshwater ponds, Pine Bluff, Arkansas.

Freshwater Prawns – The scientific name for the freshwater prawn (also called freshwater shrimp) is *Macrobrachium rosenbergii*, and it is a tropical species native to Asia. In Arkansas, freshwater prawns are an approved aquaculture species, but the stocks must be certified disease-free and the certificate posted on-site. Prawns can be raised during the summer months only, as they die when the temperature drops below 59°F (see SRAC 484). Prawns are best raised in small ponds, 0.5 to 2.5 acres in size, which are constructed specially for prawn culture. As prawns live on the bottom, deep ponds are not recommended as bottom waters often have little oxygen in the summer months. The growing season in Arkansas is limited to 110-130 days from mid- to late May through the first week of October. For this reason, producers must stock a relatively large “baby” prawn, called a juvenile, which is already about 90 days old. Juvenile prawns are stocked at 8,000 to 12,000 per acre. The current price is 7 to 9 cents per juvenile, so at a stocking density of 10,000 per acre, seed stock alone costs about \$800 per acre, excluding delivery charges. As producers in the South follow a similar stocking and harvest schedule, resulting production is placed onto the market during a 2- to 4-week period in early fall. This highly seasonal abundance in supply will become an increasingly important factor as the quantity of prawns produced increases. Post-harvest handling of prawns requires special care to maintain product quality (see SRAC 4831). Processed freshwater prawns can be imported into the U.S. for a fraction of what it costs to produce shrimp domestically, so it is unlikely that American producers will be able to expand beyond existing live and fresh niche markets. In general, freshwater prawn production is an expensive business (see SRAC 4830). Potential producers need to carefully consider the costs and risks involved.

Turtles – Several species of aquatic turtles are produced in Arkansas (Figure 7). Only a limited amount of research has been done on turtle culture, and current operations have developed many of their own techniques. Small hatchlings are sold as pets (see SRAC 0439), but due to regulations and health



FIGURE 7. Arkansas has several turtle farms, but little research-based information is available on culture and marketing.

concerns, these must all be sold to overseas customers, typically in China. Turtles that are one pound and larger are sold as food, domestically and overseas. Anyone considering turtle culture should check with the Arkansas Game and Fish Commission to obtain current information on regulations.

Other Species – A large variety of other aquaculture species currently have limited potential in Arkansas. This list includes animals such as bullfrogs, salamanders, eels, redfish (red drum), bigmouth or smallmouth buffalo, various algae and alligators. The technology to rear these species may exist, but the demonstrated economic feasibility is lacking. For example, alligators survive year-round in the southern portions of the state, so alligator farming for the meat and skin trade is biologically possible (see SRAC 0230-0232). However, the market for these products is comparatively small and is presently supplied by wild harvest and the few existing farms. Similarly, there is a market for frog legs, but culture of frogs is labor-intensive and relatively expensive (see SRAC 0436). Competition from imported frog legs (from frogs that are wild-caught in foreign countries) has made domestic frog culture uneconomical. Buffalo (fish) were cultured and sold in the past. While there is demand for buffalo ribs (steaks), markets would have to be developed.

Culture Systems

Various systems are used in raising aquaculture crops. The vast majority of species are best grown outdoors in earthen ponds. Cage culture provides a means to raise fish in ponds that cannot be harvested. Indoor recirculating tank systems have experienced a high failure rate among commercial operations but are well suited to home use or select niche markets. Raceway culture requires a reliable supply of flowing water, and while feasible in select locations, design and management measures are necessary to minimize the environmental impact from the constant effluent stream.

Ponds – Pond culture is a known and proven technology. Ponds naturally process fish waste products, and successive crops of fish can be raised in the same water without draining or water exchange. Compared to other culture systems, fish densities are relatively low. Worldwide and in the United States, most of the fish and shrimp produced through aquaculture are cultured in ponds (Figure 8). Arkansas has large areas of flat land with soils suitable for levee ponds. For information on commercial levee pond site selection and construction, see SRAC 0100 and 0101. Several catfish producers have installed split-pond production systems, where fish are raised in a smaller section of the pond (15-20 percent of pond area) and water is circulated daily through the remaining pond area. Preliminary results indicate that split-pond systems may double yields, although total costs are also higher.



FIGURE 8. Earthen ponds are the most common culture system.

Groundwater is the best source of water for levee pond fish farming. While groundwater remains abundant in some areas of the Delta, there are regions where groundwater levels are becoming critically low. Prospective producers should consult with well drilling companies or the Arkansas Natural Resources Commission to determine local conditions. Proper pond construction and management can limit water use in fish culture to 15 to 24 inches per year after the initial pond filling. Fish can also be raised in watershed ponds that are supplied with water by rain and associated runoff. Management of watershed ponds is more difficult, and these ponds are susceptible to drought. Nevertheless, watershed ponds are used successfully for fish culture in other areas of the South. Information on site selection and construction of watershed ponds is available in SRAC 0102. Arkansas also has over 100,000 farm ponds. Many were built for cattle watering or recreational fishing, but they can also be used for family food fish production. A typical farm pond supports 100 to 400 pounds of fish per acre.

Recirculating Systems – Indoor recirculating aquaculture systems seemingly provide a great many advantages. Fish can be grown year-round in virtually any location with a modest water supply. Raising fish in indoor tanks facilitates stocking, feeding and harvesting. In some cases, water from fish culture

units is used for aquaponic systems that grow vegetables or herbs. Relatively simple, low-technology units are widely used for small-scale production and for educational purposes. Dozens of high schools in Arkansas and hundreds of schools across the nation maintain recirculating aquaculture systems to provide “hands-on” experience to students and to demonstrate the real life importance of mathematics, chemistry and other subjects. SRAC 4501 provides instructions for making a simple recirculating system for classrooms.

A recirculating system typically consists of a culture tank, where the organisms are held and fed; a solids collection device; and a biofilter, where a film of bacteria growing on a substrate (selected for its large surface area to volume ratio) breaks down nitrogenous wastes into relatively non-toxic forms (Figure 9). A small pump is used to circulate water through the various components, and an air blower is used to add oxygen to the water. The simplest form of a recirculating system is the home aquarium – the gravel on the tank bottom as well as substrate in the filter serves as a biofilter. Commercial recirculating systems are more intensive and produce a greater weight of fish per unit volume. Additional components such as protein skimmers, micro-screens (to remove small particles) and liquid oxygen systems may be used.



FIGURE 9. Recirculating systems require careful attention. (Photo by Paul Willis)

Unfortunately, there are a number of disadvantages to recirculating systems as culture units. Commercial systems are capital- and energy-intensive and require skilled labor and management. In general, production costs are higher in recirculating tanks than in other culture systems. Commercial systems require alarm systems with automatic dialers, emergency back-up generators, lighting and duplication of important mechanical components, such as pumps. Fish are typically crowded at high densities, and diseases can be problematic. There have been many financial failures of aquaculture businesses using only recirculating systems. The economics of recirculation systems for many species demonstrates that costs of production are higher than

current market values. While many of these failures were due to factors other than the culture system itself, it is important for the potential commercial producer to examine carefully and thoroughly all aspects of the proposed operation. Information on various aspects of recirculating systems is available in SRAC 0451, 0452, 0453, 0456 and 4502.

Converting Hog or Poultry Facilities – Farmers with unused hog parlors or poultry houses seek alternative uses for these vacant facilities. While recirculating systems can be installed in such buildings, economic and market considerations can be problematic. The economics of recirculating systems remains risky even when an existing building is available (given high capital and operating costs), and marketing will still be a critical challenge. Hog or poultry farms are often located in rural areas, increasing transportation costs. In addition, a plentiful supply of water is essential. Although tank systems recirculate water and use less than do other systems, a large volume of water must be available at times to fill tanks and to clean and purge fish for market.

Farm buildings will require renovations to make them suitable for fish culture. A vapor barrier must be installed given the large volume of water that evaporates from indoor tanks. Without a barrier, humid air typically condenses on the cooler ceiling and roof and creates rain inside the building. Heating systems typically are needed for both air and water. Air heat exchangers will retain some heat while removing moisture. Most buildings will require additional insulation. Floors should slope toward a drain, and large-capacity drains are needed. Doors must be large enough for culture tanks to be installed and to allow access by trucks and forklifts. An emergency generator is essential as well.

Aquaponics – Aquaponics is the integration of hydroponic plant production and fish culture within the same recirculating system (Figure 10). Hydroponics is the growing of plants in water containing nutrients. When fish culture is added, the majority of



FIGURE 10. Aquaponic systems can provide both fresh fish and vegetables. Year-round production requires a heated greenhouse.

the nutrients then come from fish wastes. Interest in aquaponics in Arkansas has grown in recent years. Small backyard or home aquaponic systems can be found throughout the state. Plants that can be raised include plants that do not require acidic soil. Fish species successfully raised include tilapia, catfish, hybrid striped bass and bream. Freshwater prawn have also been grown in home aquaponic systems. A few commercial systems exist in Arkansas, but profitability is still unproven. Although improvements in production practices have been made, the majority of commercial operations are not profitable, and many have gone out of business. SRAC 0454 provides information on commercial aquaponics systems.

Cages – Cage culture is an option where existing ponds have irregular bottoms and stumps or trees that prevent harvesting fish with a seine, as in commercial ponds (Figure 11). In general, costs of production (per pound) are higher for raising fish in cages than in open ponds. However, cages provide an excellent way to raise small quantities of fish and to keep them readily accessible for harvest. In fact, fish can perhaps be too accessible in some cases because poaching is a major problem in cage culture. SRAC 0160 through 0170 provide detailed information on various aspects of cage culture, including suitable species, cage design and construction, siting, management and problems.



FIGURE 11. Cages are a great way to raise fish for home consumption.

Raceways – Raceways consist of concrete, plastic or earthen channels with constantly flowing water and are typically used to culture coldwater species such as trout. Most existing operations are federal or state hatcheries that produce fish for stocking public waters. Outdoor raceways require a constant flow of good-quality water. Suitable water sources are few and are often located in pristine and ecologically sensitive ecoregions. Nutrients added to these waters through fish wastes and excess feed may be considered especially damaging. SRAC 0220-0224 provide information on trout culture in raceways.

Summary

Investigate carefully the production, economics and marketing potential of a species and culture system before investing. While many opportunities are available, such opportunities can also entail high risk. Information on production methods and markets for many aquaculture species is limited. Existing producers have spent much time and effort developing markets and perfecting culture techniques to be profitable.

Links

•Over 150 online fact sheets on aquaculture crops and topics appropriate for the South are available through the **Southern Regional Aquaculture Center (SRAC)**. These fact sheets were developed at land-grant universities to provide a source of research-based information – <https://srac.tamu.edu/>. SRAC is one of five regional aquaculture centers established by Congress, and it coordinates regional research and Extension programs. For information on projects within the southern region, visit the SRAC web page at <http://www.msstate.edu/dept/srac/>.

•**Fish disease diagnosis and pond water quality analysis services** are provided by the Aquaculture/Fisheries Center of the University of Arkansas at Pine Bluff – <https://www.uaex.uada.edu/aqfi/extension/fishhealth/>.

•**Farm pond management information** is available online through the Aquaculture/Fisheries Center site at <https://www.uaex.uada.edu/aqfi/extension/farmponds/>.

•**Aquatic vegetation** can be a problem in ponds. The Texas Cooperative Extension Service web site Aquaplant provides online information on aquatic plant identification and control, <http://aquaplant.tamu.edu/>. The University of Florida Center for Aquatic and Invasive Plants maintains a premier aquatic plant web site at <http://plants.ifas.ufl.edu/>.

•The State Aquaculture Coordinator (Vice President Agri/Aqua) and Assistant Aquaculture Coordinator, **Arkansas Department of Agriculture**, provide overall coordination of assistance to Arkansas aquaculture producers and information on financial programs – <http://aad.arkansas.gov/aquaculture/Pages/default.aspx>.

•To obtain a Fish Farming Permit and information on permissible aquaculture species in Arkansas, contact the **Arkansas Game and Fish Commission** at <http://www.agfc.com/>; for specific license information, see http://www.agfc.com/fishing/Documents/regs_mussel_baitfish_fishfarmer.pdf.

•The **Natural Resources Conservation Service**, Arkansas office, provides information on soils, watersheds and wetlands, as well as pond construction information and specifications – <http://www.ar.nrcs.usda.gov/>.

•Considering culturing fish in cages, a recirculating system or a raceway? Large facilities may need to obtain a National Pollutant Discharge Elimination System (NPDES) Permit. For more information, see the **U.S. Environmental Protection Agency** web site on aquatic animal production industry effluent guidelines at <http://epa.gov/guide/aquaculture/index.html> and contact the **Arkansas Department of Environmental Quality** at <http://www.adeq.state.ar.us/>.

•The **Arkansas Agricultural Statistics Service** provides information on aquacultural crops in Arkansas – <http://www.nass.usda.gov/ar/>.

•Statistical information on aquaculture, including catfish production and processing, is available through the **Economic Research Service** at <http://www.ers.usda.gov/data-products/aquaculture-data/documentation.aspx>.

•The **Arkansas Small Business Development Center** provides a wealth of information to individuals thinking of starting their own business – <https://www.asbtcd.org/>.

•The **Arkansas Farm Bureau Federation** provides representation for fish farmers on issues that affect their livelihood – <http://www.arfb.com/>.

•Statewide producer organizations include the **Catfish Farmers of Arkansas** (www.cfarkansas.com) and the **Arkansas Bait and Ornamental Fish Growers Association**.

There are several national associations that represent aquaculture producers:

•The **National Aquaculture Association** – <http://thenaa.net/>

•**Catfish Farmers of America** – <http://www.catfishfarmersofamerica.com/>

•**United States Trout Farmers Association** – <http://www.ustfa.org/>

•The **Catfish Institute** provides catfish recipes, nutritional information and other news about catfish production and processing – <http://www.uscatfish.com/>.

•Are **birds** a problem on your fish farm? **USDA APHIS Wildlife Services** provides assistance to producers with bird depredation problems – http://www.aphis.usda.gov/wildlife_damage/state_office/arkansas_info.shtml.

•For assistance with **fish kills** suspected to be caused by pesticides, fish processor bond information, approved special needs aquatic pesticides and fish feed analysis, contact the **Arkansas State Plant Board** – <http://www.plantboard.org/>.

•For information on a national level, the USDA **eXtension** freshwater aquaculture web site provides research-based information – http://www.extension.org/freshwater_aquaculture.

•For social networking and a gateway to aquaculture information, the University of Hawaii **Aquaculture Hub** is a community of people interested in aquaculture – <http://www.aquaculturehub.org/>.

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