Illinois-Indiana
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Aquaculture: A New Industry for Illinois and Indiana

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The Potential For Aquaculture In Illinois And Indiana

Stephen W. Waite

Cultivating the Land and the Waters

Since the beginnings of mankind, activities that involved the procurement of food have done much to change the face of the earth. As man progressed from a system of hunting and gathering to one of planting and harvesting, forests and meadows were transformed into villages and fields, and the wild beasts and plants were domesticated. This was the advent of agriculture. From its beginnings in about 10,000 B.C., it went through an on-going series of developments that has resulted in perhaps the greatest evolutionary change in the course of mankind.

Today, in countries rich in terrestrial resources, agriculture has become a dominant industry, using the scientific and technological innovations of the Western World to keep pace with increasing demands. Indeed, more than 96% of the total food produced in the world is grown on the land.

Like the cultivation of the earth, the controlled culture of aquatic plants and animals, or *aquaculture,* developed gradually. The early phases of aquaculture have not been as well documented as the emergence of agriculture. However, the contribution of aquaculture to society was equally important.

A daily activity of ancient Greeks and Romans was the fattening of fish in their ponds. Present-day cultures of the food fish tilapia come from stocks originally grown thousands of years ago in what is now the Middle East. At the opposite end of the world, in China, a treatise called "Fish Breeding" was written by Fan Li in 475 B.C. This document revealed an astonishing grasp of fish culture techniques, many of which are still in use today. The Chinese quickly mastered the concepts of polyculture, which emphasize the simultaneous culture of three or more species within a three-dimensional space: surface, water column, and bottom.

In some areas, such as China and Indonesia, agriculture and aquaculture were inseparably tied. Present-day descendants of the ancient Chinese, who had discovered the secrets of integrating fish farming with terrestrial production, make modern China responsible for nearly half of the total fish farmed in the world today. For countries poor in the terrestrial resources needed for farming, aquaculture has provided inexpensive protein; however, the practice has only recently begun to use modern technologies.

Now, even in societies where agriculture predominates, people are beginning to realize the importance of food production in our waters. As protein supplies begin to decline relative to an expanding human population, new sources of food and energy will be essential.

Aquaculture in the United States

Aquaculture developed in the United States in the mid-1800s when rainbow trout were produced commercially to enhance the recreational fishing industry. In the 1940s, the trout industry began to expand rapidly, and today it is the largest cold-water fish industry in the country. Trout are cultured commercially in 45 states, with the largest production occurring in Idaho.

In the 1870s, European immigrants to North America longed for a prize food fish reared in ponds in their native lands. This fish, the common carp *(Cyprinus carpio),* was not native to the United States. In 1877, in response to the demands of the immigrants, the newly-formed U.S. Fish Commission began to import the fish. Carp were imported to Washington, D.C., and transported by wagon or train to other parts of the country. Farmers who planned to produce carp needed only a letter of endorsement from their local congressional representative. By 1897, however, the carp was becoming a national pest, and the government terminated its stocking program. Now, production of common carp for food is rare in this country, despite localized attempts to renew interest, especially for research.

The culture of bait fish began in the early 1900s to satisfy demands of freshwater sports fishermen. Large-scale expansions did not occur, however, until the post-World War II era when recreational fishing became common. A large variety of bait fishes are cultured throughout the country, with the industry centered in the Southeast. In 1975, for example, 40,000 acres of inland surface waters were being used for bait fish production.

Crayfish have long been used for food in the southern states. Traditionally, these crustaceans were harvested from wild stocks, and most of the catch was used by local markets. As both local and regional demands have increased, crayfish farming has become more commercial — more than 50,000 acres in Texas and Louisiana are now devoted to commercial production.

One of the most impressive examples of industrial-scale fish farming in the United States is the catfish industry. Early farming attempts began in 1955, but the first pond constructed for the sole purpose of commercial catfish production was not built until 1965. Fifteen years later, total acreage had risen to 28,000 in Mississippi alone. Now, catfish are raised commercially in virtually all southern coastal states in addition to California, Kansas, Nebraska, Illinois, Indiana, Missouri, and Arkansas. The total combined land area devoted to catfish exceeds 100,000 acres.

Total U.S. production of aquaculture products is estimated today at almost 400 million pounds, which accounts for nearly 11 percent of the total edible production of fish and shellfish. This is roughly 300 percent greater than total yields recorded in 1975.

The expanding aquaculture industry in the U.S. has been considered a way to use marginal land or other low-value soils. The catfish industry, in particular, developed in the South because the net profit from fish exceeded that of rowcrops, even with the costs of pond construction and maintenance. In contrast, in states like Illinois and Indiana that have enjoyed productive soil and premium land values, farmers have not needed to practice aquaculture. Recently, however, farmers have begun to consider the value of integrating aquaculture with agriculture both to provide supplementary income and to reduce risk from failure of a single crop.

Government Support

Until the late 1970s, impetus for the expansion of the industry lay solely with the private sector. As aquaculture became more prominent, government involvement on the national level increased. In 1978, the Committee on Aquaculture within the National Research Council requested that the Extension Service of the U.S. Department of Agriculture be made available to aquaculturists for education, marketing, and research strategies. Several states have already announced the availability of assistance within their state Extension programs.

The National Oceanographic and Atmospheric Administration (NOAA) then proposed that the government initiate a national policy and an overall aquaculture plan to identify objectives and describe actions to be taken by federal and state governments, academia, and private industry. By the end of 1978, the Joint Subcommittee on Aquaculture, under the auspices of the Interagency Committee on Marine Science and Engineering, initiated work on a preliminary aquaculture plan. Completed two years later, the preliminary plan consisted of two parts — an overall plan and individual species plans.

Aquaculture Legislation

In 1980, the U.S. Congress passed the National Aquaculture Act (P.L. 96-362) to encourage development of the industry and expanded research programs related to the production of fish and shellfish. As a result of a memorandum of understanding signed by members of the U.S. Departments of Commerce, the Interior, and Agriculture, federal funds were allocated to the National Sea Grant College Program* for a variety of activities, including research and development of advisory programs, to be conducted during fiscal years 1983 to 1987.

In 1981, a National Plan Task Force, consisting of participants representing the U.S. Departments of Commerce, the Interior, and Agriculture, began to finalize its aquaculture development plan. The resulting document, the 1983 *National Aquaculture Development Plan*, builds on the legislative mandate of the Sea Grant Program and on more than 15 years of research experience of Sea Grant scientists and their colleagues in government and industry. It defines policy, sets goals, and establishes objectives to help guide decisions regarding the direction of research and allocation of resources.

Several states already have developed individual plans. Soon, Illinois and Indiana will begin formulating their plans through the cooperative efforts of key universities and agencies in these two states.

The need exists for a state-wide aquaculture plan that demonstrates the economic and technical viabilities of aquaculture to prospective growers, investors, bankers, marketing specialists, and consumers. The plan should provide a logical basis from which aquaculture as an industry can develop and create a foundation from which research priorities and future development will arise. In the plan, objectives and goals must be set regarding statutes and regulations to be enacted or amended. Priorities also need to be established so they can be addressed by legislators, scientists, lending institutions, and regulatory agencies. A state aquaculture plan would generally be implemented through local or regional aquaculture associations cooperating with regulatory and taxing agencies, the agriculture infrastructure, commercial and industrial arenas, and individual consumers.

*Sea Grant is a program working with industry, business, government, and the general public to promote sound economic development and the wise use of our nation's marine and coastal resources. It is administered under NOAA in the U.S. Department of the Interior.

Early Development in Illinois and Indiana

A rapidly growing technology will augment the potential of an aquaculture industry in Illinois and Indiana. In these two states, aquaculture is in the earliest stages of comprehensive production, processing, and marketing. Aquaculture's development into a major industry and its contribution to the economy of these two states depends on economic and natural resources, adaptability of existing methods and technologies, sufficient research and marketing support, and relaxation of regulations and statutes that currently hamper the growth of aquaculture.

Several institutions have begun research into production systems, capital equipment, feed formulations, and feeding strategies. At Southern Illinois University, researchers are investigating the culture of sportfishes and are instrumental in developing international aquaculture programs for developing countries. Aquatic biologists at the Illinois Natural History Survey are conducting multidisciplinary programs. These programs are directed toward the polycultures (the culturing of several species simultaneously) of non-sportfishes and shellfish in ponds that receive agricultural wastes. These wastes are substituted for commercial feeds.

Freshwater Shrimp grown in polyculture with Chinese Carp

Unfortunately, little research has been directed toward the economic feasibility of system designs (i.e., the engineering aspects of growing a particular species) for this region — a consideration that is important for growth of this industry. At Purdue University in Indiana, however, research is being conducted on simulating "fish barn" production. This involves the use of high density, water recirculation systems. When completed, a facility for growing fish, similar to swine confinement or poultry barns can be analyzed for management options and economic viability.

Administrative Agency Involvement

State agencies that will play an important role in the development of aquaculture in Illinois include the Departments of Energy and Natural Resources, Conservation, Commerce and Community Affairs, Public Health and the Illinois Environmental Protection Agency; in Indiana these agencies include the Department of Natural Resources, the Commerce Department — Energy and Agriculture Divisions, and the Board of Health.

Federal agencies that assist in the development of aquaculture or have a regulatory function in this area include the U.S. Department of Agriculture — the Extension Service and the Soil Conservation Service, the U.S. Environmental Protection Agency, the U.S. Department of Commerce — NOAA, National Sea Grant College Program, and the U.S. Army Corps of Engineers.

The Benefits of Aquaculture

In addition to providing food for human consumption, aquaculture in Illinois and Indiana will be valuable in many ways. It will add to the natural stocks of sportfishes, provide bait for commercial and sportfishing, produce by-products for industrial and agricultural uses, and recycle organic wastes into edible protein. Aquaculture can also help meet the demand for premium-quality fish and shellfish products, provide second incomes and spread risks for farmers, generate employment in fish farms and supporting industries, and contribute to the overall economic growth of these two states (see Table 1).

Israeli Carp grown in polyculture with Chinese Carp

The large-scale development of the aquaculture industry will depend on an adequate economic return for the investment. Cultivation of fish, shellfish, and other aquatic organisms offers certain advantages over that of domestic terrestrial livestock. A primary advantage is the ability of fish to convert food nutrients into weight gains more efficiently than traditional livestock (see Table 2). Because

they are cold-blooded, fish require little energy to maintain body temperature. Also, they do not use as many nutrients to maintain a skeleton because the water provides much of the structural support needed. Furthermore, many agricultural wastes and by-products could be used to stimulate the growth of natural fish-food organisms, such as zooplankton, algae, and bacteria. This would further reduce production costs.

Table 1
Aquatic Species with Good Culture and Market Potential in Illinois and Indiana

Catfish	Freshwater prawns
Trout	Crayfish
Largemouth bass	Aquatic plants
Striped bass	Frogs
Yellow perch	Mussels
Tilapia	Bullhead
Carp	Walleye
Bait fish — fathead minnow, golden shiner, goldfish	

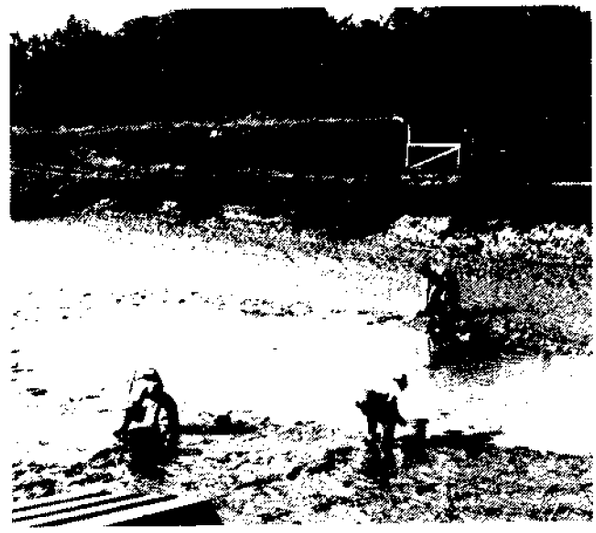
Source:
Survey conducted by Stephen Waite for the Illinois Natural History Survey, February 1984.

Production Systems Used in Aquaculture

Freshwater culture systems that will be used in Illinois and Indiana fit into two primary categories, extensive and intensive. Many operations in the United States use extensive techniques, in which culture organisms (e.g., fish, shellfish, and aquatic plants) are grown in relatively low densities but are cultured in a large number of ponds or other water bodies. Other characteristics of extensive systems include: (1) naturally spawning brood stock, (2) the low use of supplemental feeds, (3) the use of minimum amounts of fertilizer to stimulate production of natural food base organisms, and (4) production levels of target culture species ranging from 1,000 to 2,000 pounds per acre, as compared to 100 to 500 pounds in natural sportfishing ponds.

Intensive culture systems require that brood stock be held in separate systems and be spawned artificially. Also, the young must be placed in special rearing ponds or other containment systems. Cultured aquatic plants and animals generally will be stocked in high densities and fed commercially processed feeds. Annual production in these systems can range from 2,000 to 10,000 pounds per acre per year.

Whether in ponds or artificial containers, intensive culture systems traditionally have required large amounts of water. Increasing power and water costs, however, will stimulate the use of closed systems that emphasize recycled waters and waste resources. Raceways, silos, and circular pools (constructed of cement, fiberglass, or metal)



Harvesting Chinese Carp and Freshwater Shrimp

have a number of advantages as containment units: they are relatively easy to clean; they can be sited virtually anywhere; they do not require large tracts of land; and they are less prone to noxious growths of aquatic vegetation. In these systems, temperate or tropical organisms can be grown indoors under stringent environmental controls. Therefore, several crops can be grown on a year-round basis.

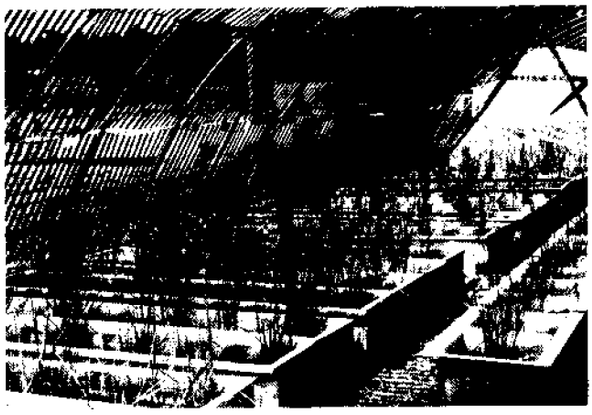
Enclosed culture systems are a substantial departure from traditional fish farming techniques. Facilities are housed in buildings and use temperature controlled water, artificial feeds, and constant water filtration. Controlled production conditions enhance growth and allow for multiple harvests. These facilities are less land intensive, but more capital and energy intensive than open culture methods.

Table 2
Ratios of Feed to Body Weight Gain (conversion efficiencies) and Body Weight Gain per Pound of Food Eaten

Animal	Conversion efficiency	Body weight gain/lb eaten
Channel catfish	1.4 to 1	0.716 lb
Brown trout	1.7 to 1	0.576
Chicken	2.8 to 1	0.356
Swine	3.4 to 1	0.292
Cattle	6.1 to 1	0.163

(Representative aquatic and terrestrial livestock are listed.)

Source:
W.H. Hasting and L.M. Dickie, 1972. Feed formulation and evaluation. In **Fish Nutrition**, ed. J.E. Halver, pp. 327-374. New York and London: Academic Press.



Chinese Water Chestnuts used as a filter which removes nutrients from wastewater

The culture of fish or shellfish in floating net cages or netted enclosures is a relatively new development in Illinois and Indiana. This technique, called cage culture, presents numerous advantages that allow considerable increases in fish production. Cages are often used in undrainable ponds or in waters that are not easily seined. They can also be used in raceways where soils are inappropriate for pond construction. Both the location of the cages within a pond and the mesh size of cage walls are important factors for optimum production of the target species. Anchorage of cages must allow sufficient space between the bottom of the container and the pond bottom to allow wastes to settle out of cages and to prevent positioning of fish in water strata where low levels of oxygen can prevent or retard growth. Species that can be reared in cages include catfish, trout, salmon, and prawns. In some areas, cages are appropriate for double cropping — catfish during spring and summer, and trout in fall and winter. Cage culture may play an increasing role in aquaculture in Illinois and Indiana.

Epilogue

Although surface waters available for food production are plentiful in most areas, simple economics have been a primary limiting factor against the aquaculture industry in the western world. Whereas newly developed technologies allow the culture of virtually any kind of aquatic animal or plant, inexpensive energy and plentiful natural resources have, until recently, made the controlled culture of aquatic organisms more expensive than the gathering or the hunting and fishing of wild stock. Yet we must begin to recognize that fishing requires increasingly sophisticated and "energy-hungry" equipment to capture aquatic life that is becoming more scarce due to overfishing and industrial pollution.

For science and technology to be incorporated fully into aquaculture, as it has been in land-based agriculture, we must learn to be productive rather than extractive; food and fiber should be produced through farming activities rather than extracted from the available supply through fishing activities. As we perfect these techniques, aquaculture will come of age.

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The Legal Environment For Aquaculture In Illinois

Margaret R. Grossman

The aquaculture industry, like other types of agriculture, faces a number of legal issues. Because aquaculture is not particularly well developed in the midwest, few efforts have been made to describe the legal climate for aquaculture and to analyze the laws that apply to aquaculture operations. Moreover, legislatures and regulatory agencies have not given special attention to the unique needs of aquaculture. Thus, the legal climate is not hospitable to aquaculture, which is governed by a wide variety of laws and regulations.

The material that follows centers on four general areas: 1) recognition of aquaculture as a specific branch of agriculture and several laws that apply to aquaculturists; 2) potential sources of financing for aquaculture facilities and operations; 3) laws and regulations concerning water use; and 4) environmental protection laws. Issues concerning taxation and business organizations are not included.

Much of the focus in this chapter is directed towards the law in Illinois, with some reference to federal law. Some of the general principles that apply in Illinois may also apply in Indiana, but the discussion does not consider Indiana law specifically. The legal environment of aquaculture in Indiana is a research topic to be investigated by the Illinois-Indiana Sea Grant Program in the future. Upon completion of this research, results will be published in an updated report.

The information that follows is intended to provide a general overview of the legal climate for aquaculture. Anyone who is considering an aquaculture operation should consult an attorney for specific legal advice.

Legislative Recognition of Aquaculture

In a number of states, where aquaculture is well-established, laws have been enacted to recognize and foster the industry. Among these laws are special licensing provisions for fish farmers; fish marketing laws; recognition of security interests in farm-raised fish; and authorization of cooperatives for marketing fish and purchasing supplies. In addition, several states have enacted statutes to indicate clearly that the term "agriculture" includes aquaculture; this provision ensures that fish farmers will share any special legal protections available to other agricultural operations. Arkansas, Alabama, California, Louisiana, and Mississippi, for example, have enacted one or more of these special provisions.

In contrast to these other states, Illinois has tended to ignore the needs of aquaculture as a specialized branch of agriculture. Only recently has the legislature begun to address the needs of the aquaculture industry. The Farm Development Act, for example, authorizes issuance of notes and bonds to finance loans for acquiring and developing facilities to be used for producing agricultural commodities. That law provides that agricultural commodities include aquaculture products. Also, the Illinois Agricultural Areas Conservation and Protection Act, designed to protect land in voluntarily established agricultural areas for agricultural production, names fish farms among the activities that constitute agricultural production.

Most Illinois statutes that regulate or protect the agriculture industry, however, do not mention aquaculture. Laws affecting agricultural labor, for example, do not expressly include aquaculture. The Illinois Pesticide Act refers to agricultural commodities, but does not define fish as a type of agricultural commodity. These definitional lapses, which seem to indicate ignorance of aquaculture rather than legislative antagonism, could be corrected rather easily.

The Illinois Fish Code does not expressly address the legal status of the fish farmer in Illinois. That Code, administered by the Illinois Department of Conservation, defines and specifies licensing requirements for commercial fishermen, wholesale and retail fish dealers, and fish breeders. The fish farmer often engages in activities characteristic of several of these licensing categories. In prac-

tice, the Department of Conservation has required the fish farmer to secure a fish breeder's permit, rather than a commercial fishing license. Some fish farmers may also be subject to the licensing requirements for fish dealers.

The Fish Code also regulates the release of fish into Illinois waters. Permission from the Department of Conservation is required before fish can be released into Illinois waters. If a privately-owned body of water is involved, however, native fish can be released; permission is necessary for release of fish not native to Illinois. Some varieties of fish cannot be imported or possessed lawfully. The Code contains other provisions that may affect the fish farmer. Persons with questions about the applicability and administration of the Code should consult the Illinois Department of Conservation.

As the discussion above indicates, Illinois law does not particularly encourage fish farming. Legislative recognition of aquaculture as a legitimate form of agricultural production could help foster the development of fish farming. For example, a provision that the use of the term "agriculture" in any statute or regulation includes aquaculture would make it clear that the fish producer qualifies for special legal protections available to other farmers. A comprehensive fish farming statute, amendments to the Fish Code, and other legislative changes are also desirable. These changes would help to eliminate needless legal uncertainties and burdens on a developing aquaculture industry in Illinois.

Financing for Aquaculture

Aquaculturists, like other farmers, need reliable sources of financing. Many of the institutions that lend money to farmers are also possible sources of capital for fish farmers. Traditional agricultural enterprises have relied on three major sources of credit: the farm credit system, the Farmers Home Administration, and country banks. Other federal programs, as well as private sources of capital, are sometimes available.

The federal laws that govern the farm credit system make loans available to fish farmers who are eligible for credit under other criteria. Federal Land Banks can make long-term real estate mortgage loans available to producers or harvesters of aquatic products. Farm Credit Administration regulations specify how aquaculture enterprises can qualify for these loans, which are secured by a first lien on the real estate comprising the aquaculture property. Fish farmers can also borrow from Production Credit Associations, which make secured, short- and intermediate-term loans for operating capital and equipment purchases. Banks for Cooperatives may finance aquaculture cooperatives that meet the Farm Credit Administration's eligibility requirements.

Farmers Home Administration (FmHA) loans are available, often at favorable interest rates, to farmers who cannot get credit from traditional sources. The FmHA makes farm ownership, operating, and emergency loans. Fish farmers whose operation is not larger than a family farm and who cannot obtain credit elsewhere at reasonable rates and terms are eligible for FmHA financing.

FmHA farm ownership loans are made to finance purchases and improvements of farms and to refinance existing debt. They are subject to limitations in amount and are secured by real estate or real estate and other assets. FmHA operating loans are available to fish farmers for annual operating expenses and other purposes. These loans are generally secured, and have a maximum duration of seven years. FmHA emergency loans are also available, under certain conditions, to aquaculture operators who have sustained losses because of a natural disaster.

Other federal programs may be available to fish farmers. For example, the Federal Crop Insurance Act authorizes coverage of agricultural commodities, including finfish propagated in a controlled or selected environment. But insurance is not available unless income from the commodity is an important part of the total agricultural income in the county where the operation is located. The limited scope of aquaculture in Illinois makes it unlikely that aquaculture crop insurance will be available in Illinois in the near future.

Country banks are a private sector financing source for fish farmers. These banks traditionally lend money for short-term operating loans, intermediate-term equipment loans, and long-term real estate mortgages. Once bankers are aware of the potential of the aquaculture industry, fish farmers should have no special difficulty in obtaining country bank financing, when the money is needed and the fish farmer is eligible for credit. Until the industry gains commercial acceptance, however, some country banks may be reluctant to lend to fish farmers.

Water for Aquaculture

Another crucial consideration for the fish farmer is the availability of water for the aquaculture operation. Both Illinois water use law and public regulation of bodies of water are relevant here. The various types of aquaculture facilities and the different sources of water available make these issues particularly complex. The discussion that follows presents information about the law that governs the use of water in Illinois, as well as laws and regulations that limit the alterations a fish farmer may make in a body of water.

Water Use Law

A fish farmer who propagates fish on private land faces legal restrictions on the use of water. Legal principles determine who may use water, how much may be used, and for what purposes it may be used. The law that applies depends on the source of water used for the fish farm.

The use of water in natural watercourses (rivers, streams, lakes) in Illinois is governed by the law of "riparian rights." This means that the owner of land bordering on

the watercourse (riparian land) has the right to use water from that watercourse. Thus, an aquaculture operation located on riparian land would have the right to use water from the adjoining watercourse. But that right is subject to some restrictions.

The riparian right is a property right; it allows the riparian owner to enjoy the water and use it without altering its substance. Each riparian owner has this right, and no owner may use water in a way that prevents other riparian owners from using water. The amount of water that each riparian owner may take is determined in Illinois by the principle of "reasonable use".

Under the principle of reasonable use, the owner may use as much as necessary for natural or domestic uses, such as drinking, household needs, and the needs of a limited number of livestock. The owner is more restricted in the use of water for artificial uses, which increase the owner's prosperity and comfort. Aquaculture is likely to be considered an artificial use. Once all domestic uses are satisfied, each riparian owner is entitled to a proportionate share of the remaining water for artificial uses. Thus, the fish farmer's access to water through riparian rights will depend in part on the needs and uses of other riparian owners. Because these needs may change, the fish farmer's water supply may be uncertain.

It is not clear in Illinois whether water from a natural watercourse can be used for a fish farming operation located on nonriparian land. A fish farmer should be cautious if the only source of water is based on a riparian right, secured from a riparian property owner for use on land that does not adjoin a natural watercourse.

Other issues concerning natural watercourses also are important. If the watercourse is navigable, the public has the right to use the water for navigation. The fish farmer cannot interfere with this public easement of navigation. This limitation may be especially important to the fish farmer who hopes to use anchored fish cages floated in a river or lake.

Groundwater is another possible source of water for an aquaculture operation. Underground streams, which flow within well-defined channels, probably follow the riparian rights principles explained above. The Illinois Water Use Act of 1983 regulates the use of percolating water found below the surface of the earth. That law states that the rule of reasonable use applies to groundwater withdrawals in Illinois. Reasonable use, for purposes of this law, means the use of water to meet natural wants and a fair share for artificial wants. Reasonable use does not include the wasteful or malicious use of water. Thus, the fish farmer who relies on percolating groundwater must realize that his right to that water may depend in part on the needs of other landowners. The Illinois Water Use Act also imposes a reporting requirement if new points of groundwater withdrawal are proposed and withdrawals are reasonably expected to exceed 100,000 gallons on any day.

Public Regulation of Waters

The fish farmer must be aware of the large number of statutory and regulatory restrictions concerning the use of bodies of water. Both federal and state regulatory agencies have rules designed to protect streams, rivers, and lakes. These regulations often affect aquaculture operations. The fish farmer must comply with applicable regulations and sometimes must obtain a permit before engaging in regulated activity.

The Illinois Department of Transportation has regulatory authority over certain rivers and lakes in which the state or the people have an interest. The Department of Conservation supervises some bodies of water. Both Departments have expressed reluctance to permit bodies of water under their jurisdiction to be used for private enterprises, such as cage culture of fish. The fish farmer who wants to use a publicly-regulated body of water must comply with the rules and guidelines of these Departments.

Some aquaculture operations (for example, those using raceways) may involve construction, dredging and filling, or alteration of beds or banks of bodies of water. These procedures usually require permits from state and federal agencies. Federal agencies have authority over navigable waters of the United States. The U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency are normally the regulating agencies.

Illinois laws and regulations require permits for a wide range of activities. For example, a fish farmer who wishes to construct intakes or conduits to obtain use of water from streams or other bodies of water that are subject to state regulation must obtain a permit. The Illinois Department of Transportation has authority in this area; the Illinois Environmental Protection Agency and Department of Conservation may also be involved.

The fish farmer should recognize that the process of obtaining permits may be costly and time-consuming. It is to be hoped that the process can be simplified as aquaculture becomes more developed in Illinois.

Environmental and Health Requirements

A large number of environmental laws and regulations may apply to aquaculture operations. These help to ensure clean water, but they also may cause time delays and increase costs for the aquaculturist. Among the relevant laws are those that regulate discharges from fish farms, the use of pesticides and drugs, and the disposal of fish wastes. Because the regulations in these areas change occasionally, only an overview is presented here.

Aquaculture operations may be subject to the requirements of the National Pollutant Discharge Elimination System (NPDES). This system, established in federal law and

administered in Illinois by the Environmental Protection Agency, requires a permit when pollutants are discharged into a waterway from point sources, including fish farms of a certain size. Some relatively small aquaculture facilities in Illinois are exempt from the permit requirements. Specific permit requirements for fish farms are included in the Illinois Pollution Control Board Livestock Waste and Water Pollution regulations.

Fish farmers who use herbicides and pesticides in their facilities may be subject to other regulations. Both federal and state laws control the registration of pesticides. In Illinois, the Department of Agriculture and the Environmental Protection Agency have applicable regulations. Activities regulated by one of these agencies include the registration and use of pesticides and the certification of pesticide applicators.

Animal drugs are also subject to significant regulation, primarily through federal law. Food and Drug Administration regulations require drugs to be registered for particular uses. Because few drugs have been certified for use by aquaculturists, the fish farmer may face the dilemma of not using unregistered chemicals and losing fish to disease, or using the unregistered chemical in violation of federal regulations.

Illinois law regulates the disposal of dead fish. The Dead Animal Disposal Act requires the fish farmer to dispose of dead fish within 24 hours of death. On-farm disposal is by burying or burning. Illinois Department of Agriculture regulations prescribe specific methods of disposal, both on the farm and when a rendering service is used.

Although many environmental protection laws impose burdens on fish farmers, these laws may also protect aquaculture operations. For example, a fish farmer whose water source has been polluted by the actions of others may contact the Illinois Environmental Protection Agency, which can investigate the problem. In addition, the fish farmer whose operation has been damaged through pollution may have the right to sue the polluter and recover damages. The fish farmer's attorney can provide specific information and advice.

Summary

As this discussion has indicated, the aquaculturist is subject to many laws and regulations. The applicability of some of these may depend on the type of aquaculture facility that will be developed. A person who plans to begin fish farming should consider these requirements well in advance of the time when the fish farm will open. The fish farmer should consult an attorney who can explain the legal requirements and help the fish farmer follow the correct legal procedures.

Recommended Readings in Aquaculture

Books

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