

AFS Policy Statement # 22:
Commercial Aquaculture
(Full Statement)

Policy

Commercial aquaculture is an important industry in North America. Continuing expansion results from increased demand for fishery products and reduced yields from harvest of wild foodfish stocks. Per capita consumption of edible fishery products in the United States reached an all time high of 15.4 lbs in 1987. The annual commercial aquacultural production in the U.S. is over 700 million pounds round weight with a value to producers of nearly \$600 million, while Canada's rapidly expanding aquaculture industry is valued over \$50 million.

Aquaculture offers alternative sources of income to many farmers and opportunities for capital investment, by others. Aquacultural production can reduce national trade imbalances in edible fisheries products; in the USA, this imbalance now stands at over \$4.1 billion. Aquaculture and its support industries, such as feed mills, processing plants, and equipment dealers, create jobs in rural communities. Proper aquacultural practices are consistent with sound soil and water conservation measures. Aquaculture produces increasing numbers of fish to augment natural stocks and support recreational fisheries.

Much recent expansion of aquaculture has been in the catfish and crayfish industries in the southeastern USA. It is estimated that the annual production of farm-raised catfish is over 350 million pounds representing more than a 400% increase in the industry since 1980. Similar expansion has occurred in crayfish culture since 1980 with over 150,000 acres in production in an industry valued at over \$90 million. Trout production, now at over 55 million pounds, has potential for expansion as does culture of numerous other aquatic animals including shrimp, salmon, red drum, hybrid striped bass, mussels, clams, and oysters. Canadian aquaculture is best known for its salmon, trout, oysters, and mussels.

The American Fisheries Society supports the continued development of commercial aquaculture as an important source of food, potential fisheries enhancement, and business opportunity. To protect both the viability of the aquaculture industry and the integrity of native aquatic communities, the Society advocates the following principles.

(1) Federal, state and provincial agencies should cooperatively promulgate and enforce regulations to ensure both the health of aquatic organisms and the quality of food products. Animals that are to be moved from one biogeographic area to another or to natural waters should be quarantined to prevent disease transmission. Processing plants and fresh and processed food products should be inspected regularly to safeguard human health.

(2) To prevent disruption of natural aquatic communities should cultured organisms escape confinement, the use of organisms native to each facility's region is strongly encouraged.

(3) When commercially cultured fish are considered for stocking in natural waters, every consideration should be given to protecting the genetic integrity of native fishes.

(4) Aquaculture facilities should meet prevailing environmental standards for wastewater treatment and sludge control.

In support of the industry and of the principles outlined above, the Society advocates:

(1) Interagency cooperation and coordination of state, provincial, and federal fisheries and aquaculture programs;

(2) Aquaculture legislation to create coherent federal, state, and provincial aquaculture programs and appropriation of funds to implement the legislation;

(3) Food safety legislation to establish fish inspection programs to ensure the safety and quality of aquacultural products;

(4) Continued development of regional and provincial aquaculture research and extension centers;

(5) Development of federal, state, and provincial centers to compile and disseminate aquaculture information;

(6) Improved joint programs of the federal, provincial, state, and private sectors to facilitate the use of commercially grown fish with proper safeguards for fisheries enhancement and mitigation; and

(7) College and university programs to train students for future employment in all aspects of aquaculture.

Background

Recent successful commercial culture of channel catfish, salmonids, and crayfish has led researchers and entrepreneurs to investigate and invest in a wide array of potential finfish, crustacean, and molluscan candidates for commercial rearing. This rapid explosion of aquaculture has raised many concerns and opportunities for American Fisheries Society (AFS) members. Thus, the timing is appropriate to examine the aquaculture issues potentially affecting the AFS and to develop an AFS Position Statement. Although aquaculture includes the husbandry of aquatic animals and plants, this paper is primarily concerned with the food production aspect of the industry. Bait and aquarium fish are important components of the industry and many of the constraints and environmental concerns discussed in this paper are shared by culturists of those groups. This paper does not specifically address non-commercial aquaculture such as fish produced by state,

provincial, federal, or private agencies for fisheries management, public recreational fisheries, mitigation, or for endangered species programs.

Constraints on Aquaculture

Expansion of aquaculture will most likely be limited more by availability of suitable sites than by saturation of the market. Water of suitable quality is the primary limiting factor. For example, the bountiful supply of good quality ground water in the Mississippi delta catfish farming region is now beginning to show signs of drawdown, and expansion of the industry may be hampered as a result. If good quality water in sufficient quantity can be found, land costs become the second most significant limiting factor. Farmland, such as that used for the production of channel catfish, and leased subtidal or intertidal lands used for shellfish production, may be available at relatively low cost, but coastal lands that might be suitable for the production of shrimp and certain marine fishes in ponds can be extraordinarily expensive. Commercial aquaculture generally cannot compete for land that can be utilized for condominiums, resorts, planned private communities, or even industrial development.

Successful aquaculture ventures are largely restricted to ponds, net-pens, and raceways. Raceways, employed primarily by trout producers, require large volumes of high quality, virtually free water such as that available in the Thousand Springs area in the Hagerman Valley of Idaho. A considerable amount of research has been focused on the development of closed or semi-closed water systems for use in commercial aquaculture, but because of large demands for energy by such systems, they have not proved economically feasible for grow-out in most instances. However, high intensity water systems are frequently used for larval fish and shellfish production.

Use conflicts in both inland and coastal waters can be expected to intensify as aquaculturists, recreationalists of all types, developers, environmentalists, and commercial fishermen contend for use of the same bodies of water. The challenge to local, state, provincial, and federal governments will be to accommodate all interest groups in a fair and equitable manner.

Currently, most states and provinces with emerging aquaculture interests are writing regulations to provide safeguards for their wild fisheries resources. Because of lack of experience and a zeal for not erring, most agencies are taking conservative approaches to regulations which are often viewed by aquaculturists as one primary hurdle impeding development of an aquaculture industry. Obviously, agencies charged with the responsibility of natural resource stewardship owe their primary allegiance to protection of the natural resources, and rightly so. Because many proponents of aquaculture believe that aquaculture is best served under the auspices of agriculture departments, there is a natural tendency to view natural resource, agencies and agriculture agencies supporting aquaculture in adversarial roles. This must not be allowed to happen because the resource will be the ultimate loser.

A good example of the interdependency of the interests of the various agencies is illustrated by the crisis in health inspection programs currently being experienced by the trout industry in the western United States. Traditionally, the U.S. Fish and Wildlife Service has provided health inspection and disease certification services to private growers as well as to state and federal hatcheries. However, the Service has had to limit their support to the private sector due to a shortage of funding *in* the fish health program. The Service prioritizes fish health assistance requests in the following order: 1) Fish and Wildlife Service, 2) State and Tribal, and 3) private sector. Obviously, it is in the natural resource agencies' best interests for private growers to have access to competent diagnostic services. Private diagnostic services can only be a partial solution since many foreign countries and some states recognize disease certifications only from a government agency. Thus, the lack of certification services poses a direct threat to ongoing marketing efforts and in some cases poses a direct threat to the continued viability of these businesses. The Departments of Interior and Agriculture should explore ways to provide needed disease diagnostic and certification programs 'Co address the agencies, mutual interest in protecting our natural resources, while allowing and promoting aquaculture.

Aquaculturists also have' a host of biological problems that often must be addressed on a daily basis in addition to disease recognition and control. These include maintenance of desirable water quality characteristics, product quality and safety control, and availability of efficient feeds specifically formulated for the cultured organism. From an economic standpoint, most aquaculture operations are capital intensive, and cash-flow problems can occur because it often takes 18-24 months to grow a product to market size. In many instances, markets and distribution channels for lesser known species have not been developed.

Recent Governmental Actions

National Aquaculture Act and the National Aquaculture Development, Plan in the United States

In September 1980, the National Aquaculture Act (P.L. 96362) was signed into law. The Act states that it is national policy "to encourage the development of aquaculture in the United States." It further states that "the principal responsibility for the development of aquaculture in the United States 'must rest with the private sector.'" The purpose of the Act was to establish a national aquaculture plan, and encourage aquaculture activities and programs. Although funding was authorized, no appropriation has been made.

The Act established within the Executive Branch, the Joint Subcommittee on Aquaculture (JSA), a subcommittee of the Federal Coordinating Council on Science, Engineering, and Technology, to increase effectiveness and productivity of Federal aquaculture programs by improving coordination and communication among Federal agencies involved in these efforts. The Act assigned various responsibilities to the JSA, including development of a national aquaculture plan.

The National Aquaculture Development Plan (NADP) was published in September 1983 by the JSA. The NADP consists of two volumes. Volume I describes technologies, problems, and opportunities associated with aquaculture in the U.S. and its territories. It recommends actions to solve problems and analyzes the social, environmental and economic impacts of growth in the aquaculture industry. Volume II contains an in-depth discussion of important, selected, aquacultural species and an extensive bibliography.

In 1985 the National Aquaculture Act was amended and reauthorized as the National Aquaculture Improvement Act of 1985. The new Act was included as part of the Food Security Act of 1985 (The Farm Bill). The new Act established the Department of Agriculture as a lead agency responsible for coordinating federal activities and for the dissemination of aquaculture information. The Act also established the Secretary of Agriculture as the permanent chairman of the JSA and charges the Secretary of Agriculture with the lead responsibility for coordinating the revisions and implementation of the National Aquaculture Plan. The National Aquaculture Information Center was also established within the USDA under the ACT. The message sent by Congress in this Act is that aquaculture is a form of agriculture.

The Food Security Act of 1985 contained additional significant provisions relative to aquaculture of particular significance was Title XIV; subtitle L, which reauthorized the establishment of regional aquaculture centers by USDA. In FY 1987, Congress appropriated \$3 million for the establishment of four regional aquaculture centers. In FY 1989, Congress appropriated \$3.75 million for the four centers and established a fifth center. These appropriations were the first federal dollars appropriated to implement parts of the NADP.

Federal Aquaculture Activities in Canada

The Department of Fisheries and oceans (DFO) has assumed the lead federal agency role for aquaculture in Canada and has been primarily responsible for the development of the following papers:

1983--National Aquaculture Conference-Strategies for Aquaculture Development in Canada,

1984--Aquaculture: A Development Plan for Canada-Industry Task Force for the Science Council of Canada,

1986--Developing Aquaculture in Canada-A Discussion Paper

--National Policy Goals for Canadian Aquaculture

--Private Sector Aquaculture Production and Value in Canada: An Overview,

1987--Report of Activities-Bilateral Scientific Working Group on Salmonid Introductions and Transfer, and

1988--Commercial Aquaculture in Canada

A Proposed Strategy for Aquaculture was prepared in draft form in 1989.

The DFO has generally defined aquaculture as a fishery, but several provincial governments have given the lead aquaculture role to agricultural agencies. Most Canadian jurisdictions recognize the potential adverse impacts of aquaculture on wild fisheries, but believe that government should be making efforts to reduce unnecessary constraints on the aquaculture industry, to support aquaculture through research and development, but not with capital, and to coordinate the involvement of diverse government departments so that aquaculture is not continually embroiled in red tape. The prevailing Canadian view recognizes risks in supporting aquaculture development while maintaining conservation of wild fisheries, but also recognizes that risk management implies regulation, not prohibition.

Accomplishments

Arguments can be presented for or against the impact that governmental actions have had on the development of the industry. There is no doubt that strong research and extension educational programs supported by the federal and provincial governments have had a major impact. The industry has grown at a rapid rate in the past 5 years, and the opportunity for continued expansion is excellent.

Although regional center programs are just underway, it is clear that research, extension, and industry linkages have been strengthened. Recent testimony presented before government committees indicated strong industry support for these programs.

Benefits of Aquaculture Expansion

Meeting Increasing Food Fish Demand

Demands for fish and fishery products throughout the world are expected to continue expanding faster than products can be supplied. Data from the Food and Agricultural Organization of the United Nations indicate the global supply of fish the catch from the ocean, inland waters, and all farm-reared aquatic products- increased 11% from 1982 through projections for 1988. During that period, the volume of fish traded among 162 nations increased 16% indicating the more rapid increase in demand than in supply.

Imports of fish and fishery products into the United States were valued at \$365 million in 1960 and \$8.9 billion in 1988, when the imports consisted of \$3.4 billion worth of non-edible products (animal feeds, industrial products, etc.) and \$5.5 billion for edible fishery products. Imports have expanded at an average rate of \$860 million per year from 1982 to 1987 while exports increased at only \$120 million per year. The annual per capita consumption of fish increased over 20% from 1975 to 1988, when the per capita rate reached 7.0 kg (15.0 lbs); it is expected to be 13.6 kg (29.9 lb) by the year 2020. Based on data from the Food and Agricultural Organization, the world's catch of fish (millions of metric tons) was 27 in 1954, 57 in 1966, 74 in 1976, 83 in 1984, and 90 in 1986. The

catch has increased with the demand only because previously unused resources--those formerly classified as trash fish--are now being captured and processed into consumer-acceptable forms such as imitation crab, lobster, shrimp, and scallops (surimi analog products). The ocean's resources are recognized as finite, having an estimated maximum sustainable yield of about 100 to 120 million metric tons. The expansion of demand *in a* market with limited supply is expected to continue to drive prices up and make fish farming even more lucrative than it is today, when more than 11% of *global* fish landings are produced by aquaculture. The forecast is for the *global yield* from aquaculture to increase to 22 million metric tons *by* the year 2000 representing 25% of the world's harvest of aquatic organisms.

Meeting Increased Sport Fishing Demand

According to a survey conducted by the U.S. Fish and Wildlife Service *in* 1985, 58 million anglers spent \$28.2 billion in 987 million angler days. Sport fishing is projected to double by the year 2030. The fishing pressure on *public* waters is expected to increase much more rapidly than the ability of the resource to produce. Even today some anglers have abandoned public waters to fish in more productive private waters. Many U.S. citizens are willing to buy catchable fish for stocking in private ponds for recreational purposes. Others are willing to pay sizable fees to enjoy quality fishing in private waters.

Aquaculturists are producing hybrids of striped bass and white bass, Florida strain largemouth bass, and other warmwater species for food and sport. Some anglers have paid \$900 per day for the opportunity to catch 3kg trophy-sized bass in private waters and other fishermen routinely pay \$90 in the off-season and \$165 per day in the peak season to fish for 1-to 2-kg fish. Adoption of the user-pay philosophy has long been evident in private hunting clubs and on game management areas requiring special licenses and fees. The growing popularity of fee-fishing operations offers expanded opportunities for selling farm-raised fish for recreational purposes.

The catch from privately owned fee-fishing operations is frequently so high that it resembles a supermarket activity. In a single day, anglers have harvested over 500 kg of channel catfish from a 0.1-ha pond. Activities such as these may relieve the fishing pressure and certainly provide recreational opportunities in excess of those available on public waters. In many locations, public waters are already being managed as catch and release fisheries. If fishing pressure increases as projected, a greater percentage of the commercially captured fish will be redirected to recreational fisheries, i.e. some fisheries will become more valuable as recreational than as commercial species. Farm-raised fish are expected to become increasingly important for food and recreational purposes.

Reducing the U.S. Trade Deficit

In 1987, the trade deficit for fish and fishery products (\$7.2 billion) was 4.1% of the total U.S. trade deficit (\$171.2 billion) and, excluding manufactured goods, was second only to the deficit for petroleum and petroleum products (\$16.2 billion)-9.5% of the total. By comparison, the top five agricultural products imported, listed by actual value and as a

percent of the total deficit, were vegetables and fruits \$4.3 billion, 2.5%; coffee \$2.8 billion, 1.6%; crude rubber \$1.2 billion, 0.7%; cocoa \$1.1 billion, 0.6%; and sugar \$0.4 billion, 0.2%.

The export value of several other agricultural commodities exceeded their import value resulting in a positive trade balance for these few items. These agricultural trade surpluses in billions were as follows: soybeans \$4.3, corn \$3.3, wheat \$3.0, cotton \$1.6, rice \$0.5, and tobacco \$0.5. Each of these commodities produced in surplus have benefited from strong government support programs including research, extension and loans. Similar positive action programs for aquaculture, if funded at just a small percentage of the trade deficit for fish and fishery products, would produce almost immediate benefits. The trade deficit would shrink, new jobs would be created, additional food fish would be provided for consumers and sport fish for anglers, and fish farmers would be better prepared to compete in international markets. Without this positive action the trade deficit in fish and fishery products is expected to continue its upward spiral as demand grows and supply shrinks.

Potential Adverse Impacts of Aquaculture

Disease problems, genetic pollution, escape of exotic and introduced species, and eutrophication *are* the areas of greatest concern associated with an expanding aquaculture industry. The recent spread of whirling disease and bacterial kidney disease in the Western United States underscores the need for adequate health inspection programs and regulations both in the private, state, and federal sectors. There is the possibility of amplifying pathogenic organisms in an intensive culture system which might be released with or without fish into a wild population. All states and provinces should have a fish health program, but because of the diverse nature of these programs, only the federal government may be able to consistently apply equal standards throughout the country. This is particularly important when fish are transported from one biogeographical area to another and a quarantine of such fish until approved for distribution is justified.

Biotechnologies are now providing the mechanisms to genetically manipulate organisms to promote economic advantages through increased growth rates, sex reversal, etc. However, the effect of the escape of these genetically altered organisms into the natural environment is not known. It is possible that these fish, as well as the release of "domesticated stocks" that have a less diverse genetic background, could have an adverse impact on wild populations. It is imperative that aquaculturists understand the need for and that governmental agencies enforce regulations to safeguard wild populations from escaped aquaculture species. The same can be said for exotic and introduced species. These species may be good citizens in their native areas, but their escape outside their endemic areas may result in a restructuring of aquatic ecosystems.

Successful commercial aquaculture usually implies a highly intensive management system that often results in nutrient-rich effluent. Since many factors (ratio of volume of receiving water to effluent, frequency of discharge, nutrient load, geographic location,

etc.) are involved in each aquaculture operation, it is difficult to be specific, but in general, eutrophication of receiving waters should be avoided or acceptable standards should be set and enforced by regulatory agencies. For example, the eutrophication of bays and sounds is one of the principal drawbacks to net-pen culture.

Other concerns are less frequently cited, but which, nevertheless, may have potential negative impacts include the following. The approval of selected game fish to become commercial aquaculture species may encourage a black market for these fish illegally captured from wild populations. However, techniques for identifying stocks of fish are available to regulatory agencies, but the cost of such programs may have to be partially or wholly borne by the aquaculture industry. Mariculture operations in coastal wetlands may have a detrimental effect on aquatic resources and the marsh itself. Some feel that the use of low-head dams, weirs or other obstructions used to retain cultured organisms will certainly impede the natural movement of estuarine species. There is also some evidence that standing water may actually increase the amount of erosion in the marsh.

Development of aquaculture may pressure governmental agencies to divert high quality water needed for wild populations, and the economics of aquaculture may detract agencies from efforts to protect natural water resources. Expanded aquaculture interests may also negatively impact certain piscivorous birds and migratory waterfowl that congregate on aquaculture sites. Because this problem will only become more serious as the industry expands, increased attention at the state, provincial, and federal level to develop non-lethal methods to control predation from wild birds is merited. Development of certain marine species into viable aquaculture species may also result in the loss of some jobs of those employed in traditional capture fisheries. However, the decrease in harvest pressure on the involved stocks and a move from commercial to recreational status is viewed as a positive longterm trend.