

Aquaculture helps meet rising demand

Already the mainstay of diets in many other countries, fish and shellfish are becoming increasingly important in American diets. U.S. per capita fish consumption increased 23%—to 14.5 pounds from 11.8 pounds—between 1970 and 1985 and is estimated to have been 15.4 pounds in 1987. U.S. per capita consumption could reach 20 pounds during 1990, according to industry spokesmen at the Aquaculture Session at USDA's Outlook 1989 conference. Annual per capita consumption in Europe and Japan averages 40–45 and 130–140 pounds, respectively.

Because traditional supplies from natural fisheries have failed to keep pace, the food industry has turned to aquaculture to help meet demand. Aquaculture development in Scandinavia, Latin America and the Far East exceeds that in the United States. Much of the fish consumed in the U.S. has been imported; thus, domestic fish farming is seen as a way to fill this gap (Table 1).

In 1980, U.S. Congress passed the National Aquaculture Act, establishing and implementing a national aquaculture development plan, and encouraging aquacultural activities and programs in both public and private sectors. USDA has designated six facilities as regional aquacultural centers; they are Southeastern Massachusetts University (east), University of Washington (west), Mississippi State University (south), the Oceanic Institute (Pacific and tropical), and Michigan State and Iowa State universities (central).

Catfish

Catfish farming is one of the fastest growing agricultural industries in the United States with consumers eating nearly 190 million pounds of catfish in 1987, a 23% increase from 1986, according to USDA.

The South remains the principal catfish-growing area due to its comparatively warm climate



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throughout the year, although catfish are raised in each of the 48 contiguous states. Commercial production, however, is limited to the channel catfish which is raised in 18 states across the South and Midwest, from North Carolina to Kansas, and in California. Mississippi leads in the commercial production of catfish. Other areas with significant production include the Carolinas, Georgia, Florida, Alabama, Louisiana, Arkansas, Texas and California.

USDA noted that the nearly 30% average annual rate of growth for catfish production between 1980 and 1986 fell to less than 14% in

1987. Demand is met mainly by a small number of large processing firms, each capable of processing at least 2,000 pounds of fish in an eight-hour shift. Some of these facilities are independently owned, some are part of larger conglomerates (such as Con Agra's Country Skillet), and others are cooperatives owned by member farmers who contract their catfish crop for processing. One such cooperative, Delta Pride Catfish Processors Inc. of Indianola, Mississippi, has more than 160 farmer members.

Salmon

Salmon farming is big business in Norway, the United Kingdom, Japan, Canada, Iceland, New Zealand and Chile. USDA reports salmon farming is the fastest-growing segment of aquaculture in the world, with 1988 production up 75% over 1987, to total more than 300 million pounds. Norway, the top producer, almost doubled output between 1987 and 1988, and overproduction during 1989 depressed world prices.

In Canada, salmon is farmed mainly in British Columbia, New Brunswick and Nova Scotia. The Puerto Montt area is the center of salmon culture in Chile. Attending an aquaculture seminar in Santiago, Chile, in April 1989, R.G. Ackman of the Canadian Institute of Fisheries Technology, Technical University of Nova Scotia, noted that Chile is in the position to sell fish meal to Canada as a base food for Canada's salmon aquaculture industry. "In exchange, they are very keen on importing salmon eggs, since the different photoperiod south of the equator accelerates the early development states of salmon, leading to early smolting and a shorter time to market. This could develop into a two-way trade of eggs if disease controls can be put in place to the mutual advantage of Chile and Canada," Ackman said.

Ackman noted that Canada does not produce enough fish meal

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for its salmon industry. "Although Newfoundland capelin is an untapped resource on the east coast, the major need may be on the west coast and favors offshore purchases. Future production depends to some extent on the roe herring industry and Japanese imports of herring roe," he said.

U.S. salmon production was 15% higher in 1987 than in 1986. Although there are many state, federal and private hatcheries across the U.S., the commercial industry for this species is based in Washington, Oregon, California and Maine. Three methods for producing salmon are currently in practice. The first is to hatch eggs and grow fry to the smolt stage in tanks on land and then transfer the smolts to pens or cages in salt water. The fish then are cultured until they attain market size. The second method is to grow salmon

TABLE 1

Potential for U.S. Farm-raised Seafood (in million pounds)

Seafood	1983	1985	1986	1988	1990	
					High	Low
Total demand	5,526	5,940	6,237	6,671	9,168	7,334
Total wild catch	4,995	5,329	5,534	5,796	6,072	6,072
Farm-raised demand	531	611	703	875	3,096	1,262

Source: Wallace Stevens, president of Ocean Products Inc., Portland, Maine, in a talk presented at the Aquaculture Session of USDA's Agricultural Outlook Conference held November 1988 in Washington, D.C.

entirely in fresh water, using the same raceway techniques as trout production. The third method is called salmon ranching. The fish are hatched and grown to smolt stage and then released directly to the sea or a nearby river. After maturing (which takes one to three years), these fish return to the hatchery to spawn. The majority of the returning fish are harvested, although some are kept as broodstock.

The U.S. salmon aquaculture industry is poised for major expansion. A study by the National Marine Fisheries Service estimated domestic salmon production would more than triple between 1987 and 1990. Salmon aquaculture enterprise outside the U.S. also is expected to grow rapidly.

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aquaculture operations." It also supplies fertilized salmon eggs to other aquaculture operations around the world.

Other finfish species

Trout is another major fish farmed in the United States with an annual production totalling over 50

Crawfish (Crayfish)

About 70% of total U.S. crawfish production is grown on farms and the remainder is caught in the Atchafalaya Basin of Louisiana. Louisiana is the center of production; over 85% of total farm acreage devoted to crawfish production is in Louisiana. Texas is the sec-

U.S. aquaculture production of trout is more than 50 million pounds.

million pounds. Idaho is the primary trout-growing area in the U.S., with activity centered along the Snake River in the Twin Falls area. However, trout are raised throughout the country. California is a major area in the West; North Carolina is the leader in the East. Overseas producers include Chile and Norway.

Other finfish culture being conducted in the U.S. includes tilapia, carp, striped bass, redbfish and sturgeon. Tilapia, native to Africa, are being grown commercially in Florida, Texas, Arizona, California and Idaho. Striped bass farmed in California are marketed in the United Kingdom. Carp is grown in many southern states for food and for weed control. In some cases, they are grown with catfish (polyculture).

In 1988, the first marketing of commercially produced striped bass via pond culture was accomplished in the U.S. by a producer in North Carolina. Progress toward establishing commercial enterprises for this species is being made in Mississippi, Texas, California, Arizona and Maryland.

Redfish are grown in Texas, Louisiana and Mississippi and culture activities have begun in Florida. Sturgeon, meanwhile, are raised in California.

In Canada, research is under way in British Columbia on black cod, a favorite in Japanese and U.S. markets.

ond largest producer. Other producers are Florida, South Carolina, Arkansas, Georgia, Mississippi and North Carolina.

Shrimp

Ecuador, the largest supplier of shrimp to the U.S., was the largest producer of farmed shrimp until 1988, when China became the leader. Other major producers of cultured shrimp are Taiwan, Indonesia, India and Thailand. U.S. production is still relatively small, with farming activity in Hawaii, Texas, South Carolina and Louisiana.

Shrimp production in Southeast Asia has reached an all-time high and may be on the verge of explosive growth. However, countries such as the Philippines and Indonesia must import ingredients to feed the shrimp they raise. Because fish meal is quite costly, soybean protein's use as a supplement in feed is seen by the American Soybean Association as an economical feedstuff for the shrimp industry in Southeast Asia.

USDA funding of shrimp aquaculture research through the Aquacultural Research Service Program (ARSP) is being provided to Gulf Coast Research Laboratory in Mississippi, Oceanic Institute in Hawaii, Texas A&M Agricultural Experimental Station in Texas, Tufts University in Massachusetts and Waddell Mariculture Center in South Carolina.

Lobsters and other shellfish

Lobster culture is still in the early stages of development in the U.S. Massachusetts and Maine each have a lobster hatchery in operation. Although it is feasible to hatch lobsters from eggs and grow them, production for the near future probably will remain limited to juveniles for ocean stocking, according to USDA, noting that the goal is eventually to enhance populations in the natural fishery. Reducing the time required to produce market-size lobsters and effectively managing their aggressive behavior must be accomplished before commercial production becomes economically feasible.

Maine accounts for 75-85% of cultured mussels in the United States. Culture of clams, oysters, mussels and other shellfish is still confined to relatively small industries.

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