

Appendix C:

Selected Foreign Experience with Aquaculture

In several Asian countries, as well as Chile, Scotland, and Norway, a number of factors have coalesced to foster the development of highly productive aquaculture industries. Industry achievements in these countries have come in the context of different natural resource endowments, resource traditions and political systems. Many of the same factors, including strong national leadership and support, have operated to create an interest in aquaculture development and to facilitate this development in each case, yet industry experience of every country has been unique.

JAPAN AND OTHER ASIAN NATIONS

The policies and structure of Japan's aquaculture industry reflect one of the most, if not the most, effectively organized systems of aquaculture anywhere. Japan has borrowed extensively from technologies developed in the United States to build a highly sophisticated, diverse and complex industry, based on a variety of species and culture systems. Japan is notable for its national commitment to aquaculture; its system of industry-driven research and education; and its well-coordinated financing of private/public activities in support of aquaculture.

Japan has a long history of marine aquaculture, reflecting the relative scarcity of arable land for traditional agriculture, and religious and cultural preference for fish over other meat. Aquaculture production increased markedly after World War II, with the intensified production of high-priced species. High market demand coupled with rising prices, decreases in Japan's distant water fisheries, and strong policy leadership by the Japanese government at various levels are among the reasons for the success of aquaculture.

Policy leadership has been expressed via government programs designed to enhance marine aquaculture, and a highly organized professional research and education system, which includes the most extensive network of fisheries high schools and universities in the world. Japan's research program in aquaculture is large, decentralized and emphasizes regional priorities. Coordination of public and private research programs, and information dissemination via extension workers has accelerated the rate of commercial innovation.

Increasingly in Japan, fish farmers are gaining control of marine resources through ownership rights, a trend which seems to be a necessary foundation for systematic future development of the industry.

Other Asian nations, including China, Indonesia, Taiwan, Thailand and the Philippines also have highly complex and successful industries, which produce a large quantity of a broad range of species using a variety of culture systems and technical practices. Like Japan, these countries have a well-established critical mass of human resources, a range of technical training available, well established research and extension systems, available capital for investment, and government departments that focus on aquaculture.

CHILE

In South America, Chile illustrates the recent and rapid development of a simpler subsector (based largely on salmon) in a country with a national commitment to aquaculture, cheap labor, low production costs, abundant marine resources, and a diversified free market economy. In addition, Chile provides a model for public/private sector collaboration in commercializing applied research in aquaculture ventures. Such collaboration was institutionalized with the establishment of Fundacion Chile (FCh), a successful joint government/private sector research venture whose mission is to incorporate new technologies into the country's economy. FCh's aquaculture related activities have been a key force in industry success.

Chile's success also rests on the fact that conditions for salmon rearing are ideal in its waters. This, along with inexpensive labor, helps to make production costs for salmon rearing the lowest in the world. Feed costs are substantially lower in Chile than in many other countries because of the ready availability of fish meal. Under Chile's ideal water temperatures, the feed conversion ratio is very high. The costs of smolts in Chile is approximately half what it would be in the United States.

The industry has been relatively free of problems in Chile, and the government offers strong support. Chile has a very predictable site-approval process, with an orderly and well-defined set of criteria for judging a site application; response is very quick. Under these conditions, marine salmon culture has increased tenfold since the 1980s.

NORWAY

Norway provides one of the best examples of major aquacultural success in the 20th century, a success secured through large national investments, incentives, and long-term development planning. Norway also provides an example of an aquaculture industry that is diversifying from a single species emphasis to new species and techniques.

A number of physical, biological, and social conditions were in place in Norway to favor the development of their salmon farming industry: the natural conditions of ideal sea temperatures and sheltered sites; the social conditions of a declining fishery and rural unemployment; a large capital base and favorable regulatory attitude; and support and positive cooperation by all levels of government were critical factors.

Norway had a 100-year tradition of fish farming before the first experiments in net pen culture began in the late 1950s. Up until the early 1970s, local citizens and communities had carried out independent, trial and error salmon culture techniques. The early farms were small, and family-built, -owned, and -operated with little or no supportive infrastructure.

The government began actively supporting aquaculture expansion to encourage coastal development in remote areas in 1973. By 1977, salmon production was doubling every two years. By the 1980s, private investment in aquaculture had expanded and support industries had grown. Government support at all levels was also increasing.

The Ministry of Fisheries increased efforts to provide scientific information to help farmers expand intensive production and improve processing and marketing. The National Veterinary Institute and the Norwegian Fish Farmers Association recognized the need for improved health care and cooperated toward this end. Trial and error treatment methods were soon replaced with veterinary diagnostics and scientific research.

By the mid 1980s, it was very clear that Norway was the leader and dominant producer of farmed salmon in the world. Setbacks occurred, but biological and technical solutions were evolving so rapidly that production was outstripping all projections for industry expansion. Norway dealt effectively with environmental problems and the recent marketing crises for farmed salmon. Funds were provided for basic and applied research aimed at solving environmental problems and achieving production savings; marketing efforts were increased.

Thus, despite serious economic losses, the industry has survived. Norway will likely diversify in the future using other marine species, new farming technologies and alternative strategies. For example, after extensive research in the past few years, halibut production now is occurring on a limited basis in land-based facilities. Cod culture already provides opportunity for fish stocking and enhancement and cod farming appears to be part of the Norwegian fish farming future.

SCOTLAND

Aquaculture in Scotland provides an excellent case study of public/private collaboration to develop an industry that has successfully helped revive a depressed rural economy. Eighty-five percent of the areas with sufficient potential for fish farming in the United Kingdom are located in Scotland's Highlands and Islands. The major asset of this economically underdeveloped area was abundant, clean, and productive marine water.

Salmon farming was identified as a potential economic development tool for this area by the Highlands and Islands Development Board (HIDB), which early on provided financial assistance for research and development, and for pilot projects. The success of small farms set up in the Western Isles with the aid of HIDB provided a major breakthrough in aquaculture and economic development. A five-year program introduced by the government in the early 1980s with financial assistance from the European Community, solidified the role of salmon farming in the Scottish economy. Private growers were also investing in aquaculture with new management technology for higher production potential. As smolt and salmon production increased, indirect employment in ancillary services developed, providing added growth for the coastal regions. Without a favorable government policy, provision of public research funding, and development of needed support services, the industry would not have grown as rapidly or been as diverse.

When Scotland's salmon industry suffered from the collapse of global salmon markets in the late 1980s, substantial public investments were made in marketing research and development. Similarly, when environmental problems arose, the government worked with salmon associations to find solutions. Scottish facilities and programs for education and training in aquaculture played a critical role and have attracted worldwide attention.

Government regulatory programs have offered important assistance to the industry, particularly in the area of disease control. While regulators are not always viewed as being supportive, the industry has been allowed to expand within an established regulatory structure.

CANADA

Canadian aquaculture is in much the same position as U.S. aquaculture--successful culture sectors are emerging, but the country ranks 27th in world production. Also like the U.S., the federal strategy is to recognize that aquaculture is a private sector initiative: "The principal responsibility for commercial development will rest with the industry." To support private aquaculture development, the Canadian Federal government has established roles in research, technology transfer, and training; maintenance of

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environmental quality; product safety and inspection; market services; and advocacy services (e.g., to improve access to financing) (4).

Unlike the United States, the Canadian Department of Fisheries and Oceans (DFO) is designated the lead agency and aquaculture is considered a sector of the fishing industry. The DFO has established joint industry-government Aquaculture Implementation Committees (4). Canada's federal and provincial governments have worked together to support and plan aquaculture development through the use of memoranda of understanding (MOUs). However, these are not funding mechanisms and do not contain provisions for funding allocation.

In general, the level of government assistance is low compared with the total capital requirements of Canadian aquaculture. No federal assistance programs are targeted directly at the aquaculture industry. General programs do exist that might benefit salmon farmers, but for the most part these are small and operate either as guaranteed loan or low-interest packages. Foreign investment provides over 40 percent of capital for British Columbia's salmon industry.

OTHER COUNTRIES

In addition to these countries, established and successful aquaculture industries exist in Denmark (primarily trout), Ecuador (shrimp), and in Brazil, Egypt, Israel and Jamaica (all focusing on tilapia). Several countries in Central Europe and the Near East, as well as Bangladesh and Nepal have successful industries based mainly on carps. In all of these countries, technical, financial, and other support services are available, accessible, and well organized.

In a number of countries, aquaculture is an emergent subsector of the economy. Such countries are typically still in the research and development stage. Ventures may be backed by government or initiated by a few small-scale farmers operating with government support. Over 70 countries fall into this category, mainly in Africa, the Caribbean, Oceania, Central America and the poorest and most arid parts of the Middle East. In these countries, aquaculture may be a new interest, and there may not be traditional local markets for aquaculture products. Natural resources for aquaculture may be lacking or markets may be adequately supplied from wild sources of seafood. There are typically few support services such as educational programs, extension agents, credit systems and financial resources, or government departments designated with responsibilities to oversee aquaculture. Emergent subsectors all lack a critical mass of entrepreneurs, or primary producers, who have technical information and training.

SOURCE: Unless otherwise noted, information is derived from Andrea Katz, "International Examples of Success and Failure and Lessons for the United States," contract paper prepared for the Office of Technology Assessment, June 1994 (Springfield, VA: National Technical Information Service, 1995) as summarized by Susan J. Wunder, OTA contract writer/editor.