COLLABORATIVE RESEARCH NEEDS IN AQUACULTURE ECONOMICS

Yung C. Shang*

In this brief discussion paper, I will address the collaborative research needs in aquaculture, primarily in the area of production economics.

Aquaculture has a rich history of several thousand years. Present day technology has been developed largely by "trial and error" rather than scientific research. Presumably, productivity of resources used in traditional practices can be increased through systematic research with a consequent increase in profitability. In much the same way that the dynamic element of constant production innovation provided the key to the development of agriculture, aquaculture can similarly benefit from well planned research thrusts. Since aquaculture is a multidisciplinary science that includes biology, engineering, nutrition and feed technology, genetics, and economics, a wide spectrum of collaborative research is needed to develop new and more efficient operating systems, as well as to improve existing management practices. In addition, the lack of sufficient data for economic analysis in aquaculture is always a major problem, but this shortage may be overcome by cooperative efforts, locally or internationally, among relevant specialists.

Collaborative research in the economics of aquaculture can be broadly grouped into two categories: (1) collaboration among economists, and (2) collaboration among economists and other aquaculture specialists, either in the same country or in different regions of the world. In each category, there are several

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*/ Department of Agricultural and Resource Economics, University of Hawaii.
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collaborative research needs that can be identified. The following are my observations:

1. The potential of aquaculture for development in an economy is determined by factors that are both internal and external to the sector and to the economy. There are five major areas which influence aquaculture development in a specific location: (1) the relative economics of rearing and marketing various aquaculture species; (2) the comparative advantages of rearing and marketing aquaculture species which compete with those raised in other regions in either domestic or foreign markets; (3) the relative economics of aquaculture versus other economic activities that either require the same inputs or compete in the same product markets; (4) the expansion of other economic activities that produce positive or negative externalities for aquaculture; and (5) the existing regulations and institutions related to aquaculture development. Technical, economic, and institutional factors in all five of these areas play an important role in determining the future of aquaculture. Collaborative research among economists is essential in evaluating the economic feasibility of local, regional and national aquaculture development programs. In addition, economists should be members of multidisciplinary teams in planning for aquaculture development.

2. In improving the existing aquaculture production efficiency, many alternative strategies are often encountered such as extensive vs. intensive; monoculture vs. polyculture; homogeneous vs. multi-size stocking; single vs. multi-stage rearing; and running water vs. aeration. Evaluation of the efficiency and the economics of different management strategies by multidisciplinary research teams is needed before any can be recommended for wider application.

For new species or new culture technologies such as cage, pen, raceway, or enclosed system, economic feasibility studies should be conducted based on experimental data first and then modified when new information becomes available from commercial operations. Experimental designs as well as economic feasibility studies would require the collaborative support of economists and biologists.

3. Feed is probably the most important cost item for intensive type of aquaculture. In many cases, it accounts for more than 50 percent of the total cost of production. Research on cost-effective feed has a high priority and formulation of cost-effective feed rations requires the collaborative efforts of economists and fish nutritionists.

4. The success of aquaculture in many Asian countries and in Israel is due principally to the development of intensive polyculture and integrated aquaculture-agriculture systems. Polyculture, the rearing of several compatible species together, usually makes more efficient use of the growing space and total pond productive capacity. The species, size, and number of fish to be stocked depends on many bio-economic elements such as the quantity and quality of each type of potential food available in the pond, their rate of growth and replenishment, the feeding rate of fish at different stages, the availability and relative price of fry, and the market demand and relative price of marketable fish. Obviously, development of an efficient management practice for such a system would require the collaborative input of aquaculture economists and non-economist in the regions of the world where the practice of polyculture is state-of-the-art.

Integrated aquaculture with livestock farming have been practiced for centuries in Asia. This system apparently offers greater efficiency in resource utilization, reduces risk by diversification, and reduces the cost of pro-

duction, especially the cost of fertilizer and feed. The importance of integrated farming system has recently begun to be more fully appreciated by Western countries due to the rapid increase in the price of fertilizer and high protein feed. National and international organizations are now taking a fresh look at the traditional integrated farming system practiced mainly in Asia and Eastern European countries to obtain a better understanding of how these systems have sustained the small farmers. In addition, research is being conducted to find ways and means of making them more viable. A successful integrated system depends on many bio-economic elements. The selection and combination of species, stocking ratio, feed and fertilizer input mix, water quality, and market demand, are all relevant factors to consider. Again collaborative efforts of interested specialists are needed to develop efficient management practices for systems where aquaculture exists alongside agriculture.

5. Like many other biological production systems, fish rearing is a dynamic and probabilistic process. It is dynamic in the sense that production follows a sequential and interrelated process. The fish (or shellfish) being cultured are usually placed in several distinct physical facilities (i.e., nursery, transition, and rearing), each of which is specifically designed to provide for efficient growth during a given age or physiological stage. During the process, survival rates, growth rates and food conversion rations, among others, are stochastic in nature. These parameters depend not only on genetic traits of the species and on natural environmental conditions, but also on management inputs into the production process. Successful operation can only be achieved through better understanding of all the relevant biological, physical, and economic elements, as well as their interrelationships throughout the entire production process. Systems analysis, while taking into account all

relavant factors and their relationships, may be one of the approaches to be used in improving farm management efficiency. However, if the analysis is to be realistic, it would require the collaborative efforts of the economists and related specialists.