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Economics of Aquaculture: Special Issue Introduction

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During the last 25 years, aquaculture production has changed from a minor, relatively unimportant contributor to the world's seafood supply (about 7% in 1975) to constituting about one-third of supply in 2000 (FAO 2002). This has, of course, changed seafood consumption patterns substantially, and therefore, market structure. An implication of this development is that aquaculture production, in many cases, cannot be ignored if one is interested in the functioning of seafood markets. This is true even in the case of fishery regulations. For instance, salmon and sea bass provide prime examples of how growth in aquaculture production leads to price reduction and a very different market environment for the fishermen that target these species.

As noted by Anderson (2002, this issue), the distinction between a fishery and aquaculture depends, to a large extent, on the degree of control over the production process. This depends both on the migration of the stock in question and the degree of property rights. Hence, an ITQ system is closer to aquaculture than an open-access system. The distinction between a fishery and aquaculture then becomes very blurred for quite a few species, such as mussels, scallops, *etc*. These species, in principle, are wild and, in most cases, the breeding process is not controlled. However, when fishermen have use rights to a particular oyster bank, for example, and attempt to make the bank more productive, this is basically considered extensive aquaculture, having a number of similarities to traditional oyster aquaculture in China or France. As one gains increasing control over the production process, including breeding and feeding, aquaculture becomes more intensive and industrialized.

To what extent the production process can be controlled is important with respect to planning, and thereby influences the timing and the quality of the product sold. The increased degree of control over the production process for aquaculture products has led to interest in a number of new research topics relating to seafood products on both the production and market sides, since this control enables producers to influence more parameters than in the traditional fishery. However, as new regulatory tools give fishermen increased control over their harvest, many of these topics are or will become important in studies of traditional fisheries. Moreover, their importance is likely to increase as the competition between wild and farmed seafood intensifies, and as market requirements become similar for captured and farmed seafood (*e.g.*, in the form of ecolabels).

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Aquaculture is strongly linked to the fisheries on the market side. It is then natural that the initial contributions to the economics literature, based on its development, study the link between farmed and wild fish of similar species. Of particular interest here is a study by Anderson (1985), who formulates a model where one explicitly takes into account that the supply response of the capturing industry depends on the biology of the stock. If the stock is on the backward bending portion of the supply schedule, some surprising responses can occur if one thinks of the market interaction in terms of standard economic theory. Although there was little empirical evidence at the time, the model accurately predicted what actually occurred for several farmed species. Asche, Bremnes, and Wessells (1999) provide an example for salmon.

Much of the early research on the economics of aquaculture focused on the supply side, and this continues to be an important element in the research agenda. This includes optimal harvesting models as found in Bjørndal (1988), productivity analysis as in Salvanes (1989), and a number of other topics focusing on the farmers' optimization problem. It is also worthwhile to note that issues relating to aquaculture provide a fruitful background to extend theory in general (as is the case in relation to production risk in the work of Kumbhakar [2001, 2002]), and to introduce recently developed theory into the realm of seafood production, like agglomeration (Tveterås 2002).

The most significant impact of aquaculture on economic seafood research, however, focuses on the market. With a few notable exceptions, a reading of the fisheries economics literature gives the impression that the (lack of) regulatory regime determined supplied quantity, conditioned on the fleets' cost structure and the biology of the stocks, and this was sold at given prices. The work of Wilen and Homans (1994) focuses on the interaction between the regulatory system and the market, and therefore, prices one could obtain for the fish. For fish farmers, who maintain greater control of quality and quantity supplied, the market has been an integral part of their decision problem to a much greater extent. In an optimal harvesting model like that of Bjørndal, one needs price forecasts. Hence, aquaculture has led to a renewed interest in forecasting of seafood prices, as exemplified in Gu and Anderson (1995). High volumes with consistent availability have also led to the development of shrimp futures as a tool for hedging against supply and price risk (Martínez-Garmendia and Anderson 1999).

Interest in market and demand structure has been substantial, revealing that seafood markets often are highly segmented, as shown for salmon by Hermann, Mittelhammer, and Lin (1993). It is also no accident that salmon, which is one of the most commercially successful farmed saltwater finfish species to date, is the species for which we have the most knowledge about demand structure. Knowledge about market structure has been further expanded by consumer surveys, conjoint analysis, evoked sets, and other tools that allow us to obtain further information about consumer preferences, as in Anderson and Bettencourt (1993) and Kinnucan, Nelson, and Hiariey (1993). Control of the production process has also led fish farmers to invest in generic marketing to expand the market for their products. The effect of such programs is most closely studied for US catfish by Kinnucan and Miao (1999) and salmon by Kinnucan and Myrland (2000).

This issue contains some of the papers presented at a workshop committed to economic research on aquaculture production and markets at Utstein Monastery in Norway, May 26-27, 2001. These papers cover a range of topics of relevance not only to the aquaculture sector, but also to the seafood sector in general. We hope the selection of papers provides insight as to the diversity of the economics research on aquaculture and shows the direction of future research. In particular, we would like to mention the importance of the economics of information and labelling, as well as environmental issues. A special issue cannot, of course, cover all topics discussed at

any workshop. We would, therefore, like to conclude by mentioning two additional issues covered at the workshop that we think will be very important in the next decade. The distribution channels for food are changing, with increased concentration at the retail level focusing on information, traceability, reliability, and low distribution costs. This will certainly influence seafood markets. Moreover, it is most likely not an accident that most farmed seafood is sold in fresh product forms, as fresh product forms tend to be the most valuable. How will fishermen and fishery regulations meet these challenges? Will there be substantial market segments for seafood supplied solely by aquaculture?

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