Markets, Trade and Seafood

Frank Asche, Professor
Department of Industrial Economics
University of Stavanger
Stavanger, Norway

Cathy A. Roheim, Professor
Department of Agricultural Economics and Rural Sociology
University of Idaho
Moscow, Idaho, U.S.A.

Martin D. Smith, The Dan and Bunny Gabel Associate Professor
Nicholas School of the Environment and
Department of Economics
Duke University
Durham, N.C., U.S.A.

Abstract

This chapter describes the growth in seafood production and trade and the main factors causing these developments. We then review the leading economic research on the international seafood trade and markets with a focus on interactions of markets and the management of fisheries and aquaculture. Specific examples include the relationship between fisheries management institutions and international trade; the relationship between the value of seafood attributes and production practices; and the development of the Fish Price Index by the United Nation's Food and Agriculture Organization (FAO) to address food security concerns.

Keywords: aquaculture**,** economics, ecolabeling, fisheries management, food safety, international trade, markets, price index, seafood

Introduction

Oceans, lakes, rivers and other waterways provide about 16% of animal protein consumed globally. The fishing and aquaculture operations that produce this protein also support livelihoods for 8% of the world's population. Fully 39% of total seafood production (in live weight) enters into international trade, valued at US$102 billion per year in 2008 [1]. Seafood from developing countries, in particular, constitutes the most valuable category of agricultural exports, totaling US$20 billion per year. By comparison coffee exports are US$6 billion per year, and rubber, cocoa, bananas, meat and tea, are each less than US$5 billion per year [2].

The amount of seafood traded internationally has grown significantly during the past decades. The technologies and logistics associated with globalization of food markets in general have influenced the seafood trade by creating access to new markets, lessening the importance of distance, and ultimately allowing producers to exploit new comparatives advantages. These trends have greatly expanded aquaculture production, which accounts for much of the growth in the international seafood trade. Large wholesalers and retailers can now source fish from all over the world, providing new opportunities for some producers and new challenges for others. For instance, substitutes for Atlantic cod are no longer limited to regional substitutes from capture fisheries such as haddock and saithe, but now include distant capture fisheries such as Alaskan pollock and New Zealand hoki as well as farmed species such as pangasius and tilapia.

Seafood is distinguished from most other food industries because much of seafood production involves a close connection to an otherwise uncontrolled environment, and often institutions are insufficient to allow markets to organize production efficiently [3]. As the world´s last significant hunting-based industry, fisheries are limited by the supporting ecosystem are subject to the tragedy of the commons when poorly managed. There is little doubt that many of the world's fish stocks are degraded [1]. However, overfishing is just one of many issues that influence the size of fish stocks and the amount of seafood that enters international seafood trade. Habitat destruction from some types of fishing gear, bycatch (incidental catches of no-target species), and fishing that affects the size

distributions of fish populations all influence the balance of ecosystems and indirectly the future availability of fishery resources. Similarly, most aquaculture production occurs in the open ocean or in ponds, and may lead to surrounding ecosystem effects. But aquaculture overall is more similar to livestock production in agriculture than to fishing; it relies on the ecosystem for inputs but not for the product itself [4]. Aquaculture also is less exposed to commons problems. Hence, aquaculture faces weaker environmental and institutional barriers to further growth. Still, the continued growth of aquaculture production has implications for environmental health in producing countries if institutional safeguards are not embedded into the production systems. Aquaculture may have fewer commons problems than fisheries but still must resolve environmental externalities such that products are priced to reflect the true costs of production [3].

Interactions among domestic fisheries management, the international retail market and a wide array of environmental concerns about aquaculture and fisheries could all affect the international seafood trade. In this chapter we first provide background on the growth in seafood production and trade and the main factors causing these developments. We then briefly review the economic literature on the international seafood trade and markets. Because space limitations preclude a complete review, we focus on state-of-the-art analysis of seafood markets with implications for management of fisheries and aquaculture that aim to reduce market inefficiencies.

Production and trade

The total supply of seafood increased from 71.7 million tonnes in 1976 to 145.1 million tonnes in 2009 [1]. Seafood comes from two main modes of production – harvest from capture fisheries and aquaculture. Until the 1970s, aquaculture was unimportant. However, since then a virtual revolution has taken place. Figure 1 shows the changing production from wild fisheries and aquaculture. Aquaculture production has grown from approximately 3.5 million tonnes in 1970, or 5.1% of total seafood supply, to 60.5 million tonnes, or 40% of total seafood supply in 2011 [5]. The combined effect of increased productivity, increased market access and demand growth has made aquaculture the world's fastest growing animal-based food sector [1]. Capture fisheries production, on the other hand, has fluctuated between 90 and 100 million tonnes in annual landings with no particular trend.

Fisheries supply is not expected to increase in the future, as the majority of fish stocks are either fully or over exploited [1].

Seafood has long been traded internationally, but trade in seafood has increased dramatically in recent decades. The increase in seafood trade is largely attributable to growth in aquaculture productivity and increased exports from developing countries. International trade has increased much faster than total seafood production. From 1976 to 2008 the export volume of seafood increased from 7.9 million tonnes to 33.5 million tonnes, or almost fourfold. Adjusted for inflation, the export value during this period increased threefold. [1]

A number of factors have caused the increased trade in seafood. Transportation and logistics have improved significantly. Lower transportation costs have also given new producers access to the global market. Coastal nations also imposed the 200-mile exclusive economic zones (EEZs) in the 1970s and 1980s that increased incentives for international trade.[2] Countries with considerable distant-water fishing fleets, such as Spain and Japan, were negatively affected, as other coastal nations expanded their domestic fleets to exploit the fisheries within their 200-mile EEZs. As a result, countries that relied on harvesting within the 200-mile EEZ of foreign nations had to increase their imports to maintain domestic consumption at the same levels.

When seafood export quantity increases fourfold and export value only threefold, the unit value decreases. Lower unit values suggest seafood's competitiveness as a food source has increased and are key factors explaining increased trade. Successful aquaculture species such as salmon and shrimp illustrate this phenomenon. Real prices for each are less than one-third of what they were 25 years ago, and internationally-traded quantities have grown at an annual rate of 16.8% and 13.6%,

[1] Export quantities are not directly comparable to the production quantities because exports are measured in product weight. This can lead to dramatic differences. The fillet weight of tilapia, for instance, is only between 30% and 40% of the harvest weight.

[2] Peru, Ecuador, and Chile implemented EEZs as early as 1952. By the time the US declared its 200-mile EEZ in 1976, 37 nations had already extended their jurisdiction, and by the mid-1980s, nearly all coastal nations had imposed EEZs [6].

respectively, during the period from 1985 to 2008 [5]. Total growth in quantities traded in salmon and shrimp for the period were 3014% and 1491%, respectively. The profitable expansion in the production of these species, despite decreasing prices, is due to a combination of lower production costs, improved production technologies, and lower distribution and logistics costs.

The trade patterns are widely different between exports and imports. The source of seafood exports were split almost equally between developing and developed countries in 2008, as shown in Figure 2. The value share of exports going from developing countries has increased from 37% in 1976, to 50% in 2008 [5]. Alternatively developed countries comprised 78% of all imports in 2008. Even though that share has declined from 86% in 1976, most of the increased trade pattern in seafood is to developed countries, and a considerable share is exported from developing countries. Japan and the U.S. are the two largest importers. However, if the EU countries are aggregated, the EU is clearly the largest market.

It is certainly not arbitrary that developed countries account for most of the imports and that the EU, Japan, and the U.S. are the largest seafood importers. These regions are the world's wealthiest customers with the best ability to pay. Economic growth in China and Southeast Asia has led to substantial growth in seafood imports, with prospects for even further growth in demand [7].

Economics of Seafood Markets and Trade

This section reviews the state-of-the-art in the economic literature about markets, trade and seafood. It covers the relationship between fisheries management and trade; the relationship between the value of seafood attributes and production practices value of seafood attributes; and the development of the Fish Price Index by the United Nation's Food and Agriculture Organization (FAO) to address food security concerns.

The relationship between fisheries management and trade

The impacts of trade liberalization will differ depending on several factors, including production method (capture or aquaculture) and domestic fisheries management policies. Modern theories of open access (and of fisheries management in general) are dynamic and account for the inseparable link between harvest now and the stock of fish in future periods. Economists began to grapple with

the dynamic nature of fishery resources in the 1950s [8] and developed a fully dynamic theory of open access came in the late 1960s [9,10]. These results have important implications for conventional models of international trade. Trade policies that decrease (or increase) prices or costs may have the opposite effect of what one might see in other resource or agricultural sectors depending on the level of exploitation of the fishery resource [11]. The basic intuition is that any short-run increase in harvest of the renewable resource sparked by trade liberalization will lead to long-run decreases in harvest when the resource is governed by open access.

A well-known theoretical analysis considers trade between two countries with equal natural resource endowments but that differ based on their resource management institutions: one country with open access management and another with a conservationist approach [12]. By allowing for excess exploitation, open access can be a source of comparative advantage and lead to exporting the resource to the conservationist country. Society benefits for the conservationist country but declines for the open access country in the long run. However, it is also possible that the well-managed resource in the conservationist country can lead to this country having a lower price. The result is that the conservationist country exports the resource, and both countries gain from trade. Brander and Taylor aptly summarize, "when a renewable resource is subject to open access, or something approaching it, then free trade may not be the tide that raises all boats. Improved management of renewable resources may be a necessary precondition for gains from trade." [13]

The effects of trade liberalization have also been considered under other fisheries management scenarios. Trade liberalization may negatively affect the resource under open access or even under limited access fisheries management regimes [14]. For the society at large, trade will always be beneficial if the resources are well managed, although there will be redistribution effects within each society.

International Markets: Seafood Safety

There are many food safety issues involved in the seafood markets and trade. Some stem from the food system and others arise from the natural environment from which the products are raised or

captured. Health risks from seafood consumption are varied and include the potential for a wide range of episodic events—including bacterial and parasitic illnesses and histamine poisoning—as well as concerns about repeated exposure to high levels of mercury and PCBs.[3] Some health issues stem from water quality problems, e.g. shellfish contamination from algal blooms or local waste water treatment difficulties. Other seafood-borne illnesses result from processing, handling, inadequate refrigeration, and spoilage. The public is concerned about the health benefits and risks involved in seafood consumption [15]. However, consumers have difficulty estimating health risks in the food they consumed even when given seafood advisories [16]. Consumers are flooded with information and misinformation related to the health risks of farmed seafood consumption, affecting both purchase decisions and consumer welfare [15; 16; 17; 18]. Evidence is almost universal that information widely available to consumers is inadequate to promote informed consumption of farmed seafood [18]. Government agencies and non-profit organizations often provide conflicting guidance, and research repeatedly demonstrates sub-optimal consideration of long-term health risks and benefits related to farmed seafood [18; 19]. Indeed, a recent National Academies study concludes that "research is needed to develop and evaluate more effective communication tools for use when conveying the health benefits and risks of seafood consumption" [18]. And there is some experimental evidence that public communication programs could reduce the uncertainty by providing the accurate health benefit and risk information [20].

International Seafood Markets: Ecolabeling

Seafood ecolabeling programs that certify fisheries based on sustainability allow consumers to signal preferences for healthier global oceans each time they purchase labeled seafood. Ecolabels can thus create an economic incentive for environmental improvements [3; 21; 22]. Ecolabeling is an increasingly important tool used in the promotion of sustainable fishery products around the world. Whether the consumer is actually paying a price premium for ecolabeled products is of fundamental importance as it indicates a return on the investment of sustainable practices, providing an incentive

[3] See [23] for an overview of the economic issues related to seafood safety.

for producers to undertake such practices. A portion of consumers in the U.S. and select European countries have a statistically significant preference for seafood with ecolabels relative to unlabeled seafood [24; 25; 26; 27]. In a study of consumers' non-economic motivations to purchase ecolabeled seafood in Europe, there is a relationship between consumers' preference for ecolabeled fish and stated beliefs about the level of fisheries regulation and fish stocks [28]. Moreover, French consumers' taste for ecolabeled seafood is a function of perceptions of the fishing industry [29]. And most notably, there is a statistically significant premium of 14.2% for ecolabeled frozen processed pollock in the U.K. market [30]. Altogether, these studies jointly imply the potential for successful market differentiation for ecolabeling programs and possible incentives for sustainable fisheries practices. Whether these modest price premiums translate into actual changes in fishing practices is still being debated and researched.

International Seafood Markets: Attributes

Consumers value a wide array of seafood attributes, ranging from species, taste, texture, color, freshness, nutritional content, and product form to less tangible attributes such as country-of-origin or the presence of an ecolabel [25; 27; 31]. Moreover, attributes of fish also have value for the producer [32 – 40]. Some individual attributes may be more highly valued than others, and particular combinations of attributes lead to higher or lower valued fish at the producer level. For example, quality (resulting from handling during catch) or size of fish may segment fish within a particular fishery into different fresh or processed product forms [40]. Results of several of these studies have shown that quality matters; in particular, that there is a higher return for the raw fish product that is of sufficiently high quality to be put into a higher valued market segment. Quality issues can thus be an additional source of economic inefficiency in fisheries if poor fish quality results from management systems that provide incentives for long trips and poor treatment of fish. Under regulated open access, a larger share of the raw fish product can flow toward the inferior low-value market rather than the high-value fresh market [41]. An alternative is for processors to add value by breading into fish sticks to cover poor fish quality and create some direct employment in fish processing [40]. However, this

strategy may reduce the overall value of the fishery for coastal communities and the fishermen when the fish is relegated to lower-valued product forms.

Overall, globalization and the expansion of the international seafood trade has often led to market integration. Competition from aquaculture, in particular, has tended to decrease prices, an undeniably good outcome for consumers but a challenge to capture fisheries [42]. This competition creates an even greater sense of urgency for wild fisheries to adopt effective management institutions that organize production efficiently and produce sustainable profits. Market integration also reduces opportunities for price compensation from ecological and technological disasters. Hypoxia (low dissolved oxygen), for example, has decreased profits for the shrimp fishery in North Carolina, which makes up a small portion of the U.S. total domestic shrimp production [43] . In the much larger Gulf of Mexico shrimp fishery, which also experiences hypoxia and was affected by the recent Deepwater Horizon oil spill, price data indicate that the market is integrated with imports; producer losses from recent supply disruptions likely have not been offset even partially by price increases [44]. Pushing back against market integration are attempts to segment the seafood market through country-of-origin labeling, ecolabeling, differentiating wild from farmed fish, and promotion of local seafood.

FAO Fish Price Index

Seafood is a critical contributor to livelihoods and food security [3]. As world food prices hit an all-time high in February 2011 and are still almost two and a half times those in 2000, there is an increased awareness that prices are an important indicator of food scarcity. The FAO, which has for a long time compiled prices for other major food categories, recently began tracking seafood prices, working together with a team of researchers to develop a Fish Price Index (FPI) [45]. The FPI can facilitate understanding of seafood crises and may assist in averting them. The index uses a similar format as price indices for other foodstuffs, all of which are published in the FAO Food Outlook (www.fao.org/giews/english/fo/index.htm).

The FPI relies on trade statistics because seafood is a highly traded commodity, these data are easily updated, and trade data can provide a timely proxy for domestic seafood prices that are difficult to observe in many regions and costly to update with global coverage. Calculations of the extent of

price competition in different countries support the plausibility of reliance on trade data. The FPI can also be separated into sub-indices according to production technology, fish species, or region, providing a valuable tool for understanding and tracking development in different segments of the seafood market. In Figure 3 we show the FPI, as well as separate indices for capture fisheries and aquaculture. Figure 3 suggests increased scarcity of capture fishery resources in recent years but growth in aquaculture that is keeping pace with demand.

Conclusions

The international seafood trade will likely continue to grow. As aquaculture production expands in developing countries, it will continue to be exported to developed countries and will likely experience growth in exports to consumers in developing countries. Production from capture fisheries is unlikely to grow overall, although improvements in fisheries management in some countries (and continued degradation in fisheries stocks in other countries) may change the relative mix of seafood from capture fisheries available on the international market. Increasing affluence of consumers in emerging markets and increasing populations will lead to continued demand growth. Thus, to promote a future in which the international markets maintain access to seafood and developing countries have seafood as a source of food security, a challenge will be to create economic incentives for sustainability. In other words, institutions are required that allow the market to operate efficiently such that natural resource prices reflect the costs of sustainability.

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Figures

Figure 1. Global Production from Capture Fisheries and Aquaculture: 1970 – 2008. Source: FAO FishStat.

Figure 2. Nominal Value of Seafood Exports from Developing and Developed Countries: 1976 – 2008. Source: FAO FishStat

Figure 3. FAO Fish Price Index, Monthly 1990-2011, Aquaculture v. Capture. Source: Tverterås, et al. 2012.