CHAPTER 11
Future Markets for Aquaculture Products

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This chapter compares the global seafood industry to other animal protein industries and examines the general trends shaping the future of the U.S. seafood industry.

The Seafood Industry

How does the seafood sector compare to other animal protein sectors? Consider the following characterization of the global seafood industry:

- The global seafood industry is the most complex and diverse animal protein sector especially in terms of the number of species and the variety of harvest technologies. There are over 800 species traded, ranging from urchin to oyster to salmon to swordfish (Anderson, 2003). The industry still uses harvesting technologies that date back thousands of years (nets, spears, and harpoons); however, it also employs some of the most advanced technologies in aquaculture and fishing systems.
- It is by far the most international of all the animal proteins. International trade in fish is valued at more than twice the trade in all other meats and poultry combined (FAO, 2004).
- It is the most fragmented industry, with tens of thousands of companies spread around the world.
- Few would argue with the claim that the seafood sector faces the most bureaucratic and inefficient regulatory environment, relative to any other food sector.
- Compared to other animal protein sectors, it is remarkably wasteful. The levels of bycatch and processing wastes are staggering. The race to find and capture fish has often resulted in excess capacity, overcapitalization, and/or regulated inefficiency, all of which waste resources.
- Seafood is definitely the most misunderstood animal protein by both consumers and chefs. The lack of knowledge regarding preparation, handling, nutritional characteristics, origin, and species is truly remarkable, especially in the U.S. The media are full of misinformation and biased content.
- Seafood trade occurs in a global marketplace which lacks transparency. There are few, well-run wholesale markets in the U.S. In general, accurate and timely information about prices and market conditions is difficult to obtain or non-existent.
- All of these factors result in a seafood sector which is highly volatile compared to the other animal protein sectors.

The factors above undermine efficiency, market planning, and market development. Growth in market share will come from the sub-sectors of the seafood industry that can change the industry from the one characterized above to one that is more like the traditional animal protein sectors (such as beef and poultry). That future belongs to aquaculture and the few well-managed wild fisheries. To understand this position more thoroughly, consider the expectations for seafood consumption in the future.

Expectations: World Supply and Demand

In a recent study, Delgado et al. (2003) projected the global demand for seafood will grow 38% from 133 million metric tons (mmt) in 1999/2000 to approximately 183 mmt in 2015. This represents an annual increase of about 2.1%, compared to an annual growth rate of 3.1% over the prior two decades. They expect 46% of this growth to come from population increases and 54% to come from economic development and other factors.

Their report also projects the source of the supply required to meet the forecasted demand. They expect that 73% will come from aquaculture, while most traditional capture fisheries are expected to stagnate. Only 27% of the growth in supply is expected to come from traditional fisheries. In particular, they expect the share of supply derived from pelagic and demersal fisheries to decline.

Expectations: U.S. Market

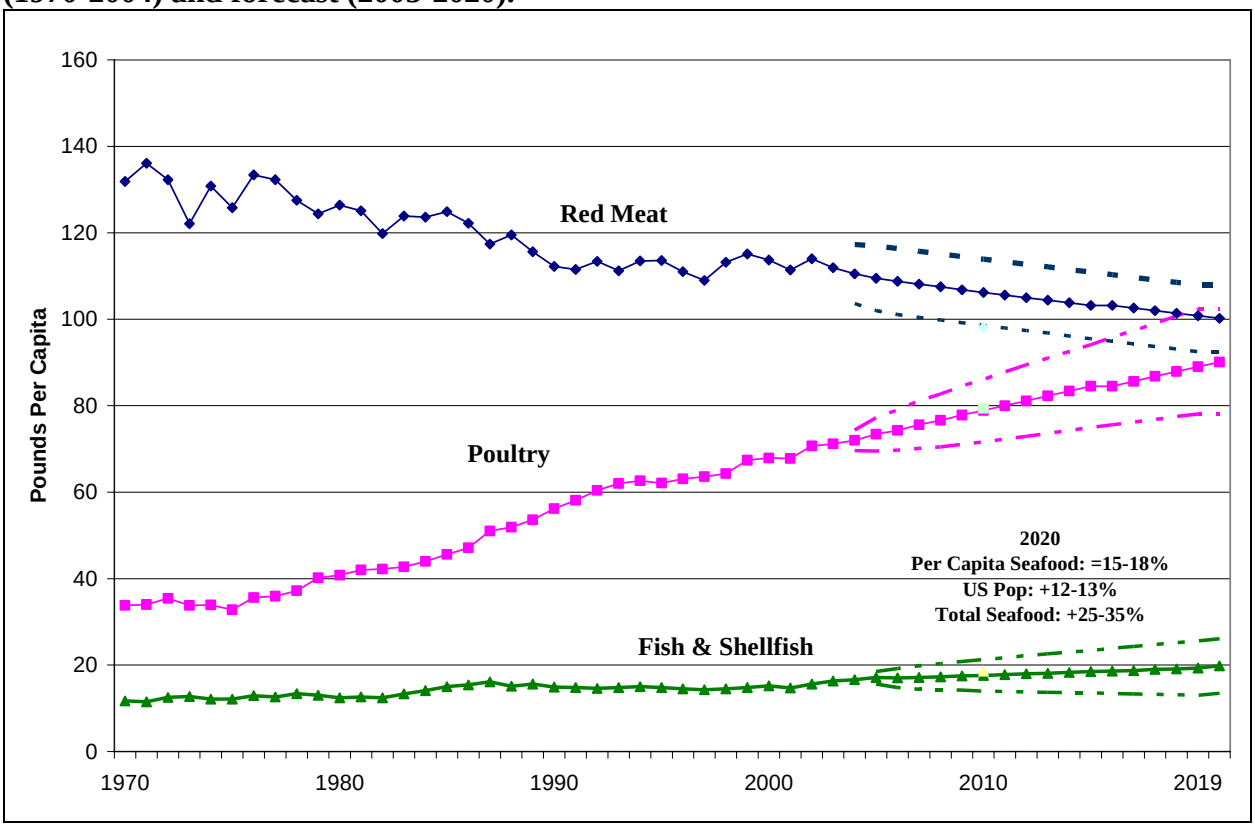
Figure 11.1 illustrates U.S. per-capita consumption of red meat, poultry and seafood. Expected per-capita consumption for the three categories was forecasted out to 2020 using a basic state-space time series model. Red meat per-capita consumption is expected to decline by about 9% over the next 15 years, and poultry per-capita consumption is expected to increase nearly 40% (barring an outbreak of Avian flu). Growth in seafood consumption is expected to increase 14-17%, from 16.6 pounds per capita to over 19 pounds per capita by 2020. Given that the U.S. population is expected to grow 12-13%, additional seafood requirements are likely to range between 25 to 35% more than are currently available. These expectations are in line with the forecasts by Delgado et al. (2003) for global demand. Demand could also expand as consumers seek out seafood products due to their associated health benefits. Demand could also expand as consumers seek out seafood products due to their health benefits. Seafood is an excellent source of high quality proteins and long chain omega-3 fatty acids, including EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid). Both DHA and EPA provide essential health benefits, including cardiovascular health, improved cellular function, and overall brain and nervous system function. The consumption of omega-3 fatty acids is beneficial especially with regard to cardiovascular health (Seierstad et al., 2005; Kris-Etherton et al., 2002; Eliseo et al., 2002; Connor, 2000; Kromhout et al., 1985). Advances in aquaculture production will be required to meet this expected demand. With improved marketing and advances in technology, these forecasts may be conservative.

Current Market Trends

Consider how the market has been changing over the past decade or so. Table 11.1 shows two significant changes in the U.S. seafood market. The first startling observation is that growth in per-capita consumption is occurring almost exclusively among aquaculture-based species. Since 1987, salmon is up 403%, shrimp is up 74%, catfish is up 91%; and tilapia wasn't even measured in 1987. In contrast, many traditional fisheries are stable or declining: cod is down 62%; clams are down 21%; flatfish are off the top ten list; and tuna and scallops remain essentially unchanged.

A second observation is that the market for seafood is becoming more concentrated. Note that the top five species account for 76% of total consumption in 2003, compared to 56% in 1987. Furthermore, the top ten species now account for 93% of total seafood per-capita consumption. This concentration is coming from consolidation in the seafood business, which is driven in large part by the presence of the aquaculture sector. The aquaculture sector is not just increasing global seafood supply, it is also reducing supply uncertainty and providing a more consistent, high-quality product. This leads to better marketing and new product development.

Figure 11.1. U.S. per capita consumption of red meat, poultry, and fish/shellfish actual (1970-2004) and forecast (2005-2020).



Source: USDA, 2004; NMFS, 2004

Seafood product diversity in the future will not necessarily come from the next "new" species; rather, it will come from the same species with a new preparation, sauce, product form, or image (such as organic). The U.S. catfish industry, for example, has expanded its market share by making catfish appear different with sauces, flavors, and coatings. Producers within the tilapia industry will likely do the same to increase market share and expand product lines.

The trend toward aquacultured species is further substantiated by the data collected in the annual retail survey conducted by *Seafood Business.* As can be seen in Table 11.2, top selling species (salmon, tilapia, shrimp, and catfish) are now dominated by aquaculture. Ten years ago pollock, cod, haddock, and flounder were the top sellers.

Table 11.1. United States seafood consumption changes from 1987 to 2003.

Edible kg per Capita

	1987			2003			% Change
	Tuna	1.59		Shrimp	1.81		+74
	Shrimp	1.04	56%	Tuna	1.54	76%	-3
	Cod	0.76		Salmon	1.01		+403
	AK Pollock	0.40		AK Pollock	0.77		+93
	Flatfish	0.33		Catfish	0.52		+91
71%	Clams	0.30	93%	Cod	0.29		-62
	Catfish	0.27		Crab	0.28		+84
	Salmon	0.20		Clams	0.25		-21
	Crab	0.15		Tilapia	0.24		NA
	Scallops	0.15		Scallops	0.15		0
	Other	2.16		Other	0.55		-75
	Total	7.35		Total	7.40		+1

Source: NMFS(2004) and NFI (1988, 2005)

Expectations: Global Supply

Globally, supplies from traditional fisheries will either remain flat or decline over time. Figures 11.2 & 11.3 demonstrate the trend in traditional capture fisheries production, where harvests have been stable or declining over the past 20 years. Increases in global seafood supply will not come from traditional fisheries. Many fisheries are already fully exploited and any increases in harvest levels will only reduce the stock and ultimately decrease, rather than increase, harvest levels. Instead, any increases in total global fisheries production will come from the aquaculture sector.

In contrast to Figures 11.2 and 11.3, which represent stagnant or declining global supply in traditional fisheries over the past 20 years, Figures 11.4 & 11.5 demonstrate the extraordinary expansion in production that occurred and will continue to occur in the aquaculture sector.

Global production of salmon and trout, as well as tilapia, has exhibited remarkable growth over the past two decades. Production by these sectors has steadily increased, unlike the situation for traditionally harvested flatfish and cods. Interestingly, tilapia imports in the U.S. are likely to surpass salmon imports within the next 15 years (Figure 11.6). One reason for the rapid growth in tilapia, in addition to technological and genetic advances, is the substitution of tilapia for traditional whitefish, as supply from traditional capture fisheries remains static or declines.

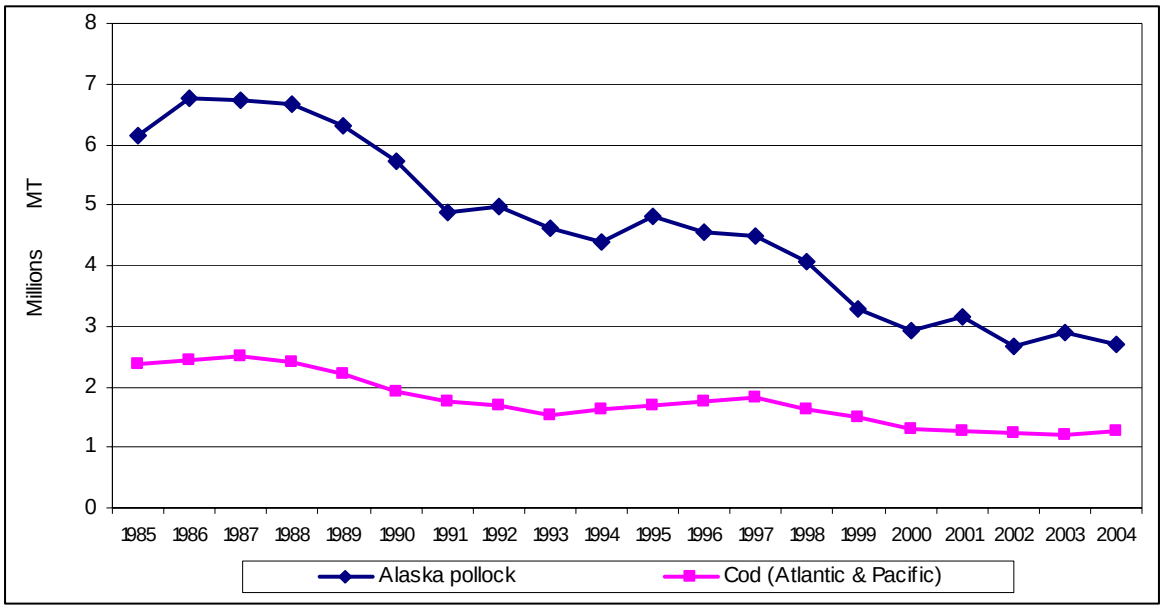
The emergence of offshore aquaculture could alter this scenario, especially if species such as cod and haddock are raised in offshore aquaculture operations. Even if these species are not raised domestically, the importation of these and other aquaculture species will continue, and most likely increase, as the forecasted gap between domestic demand and supply for seafood widens.

Table 11.2. *Seafood Business* Retail Survey: U.S. Retail Sales, 1994 vs. 2004.

Best Sellers		
	1994	**2004**
1	Shrimp	Shrimp
2	Salmon	Salmon
3	Pollock, Cod, Haddock	Tilapia
4	Catfish	Tuna
5	Flounder	Catfish
Fastest Growing Items		
	1994	**2004**
1	Salmon	Salmon
2	Shrimp	Tilapia
3	Tilapia	Shrimp
4	Catfish	Tuna
5	Orange Roughy	Crab

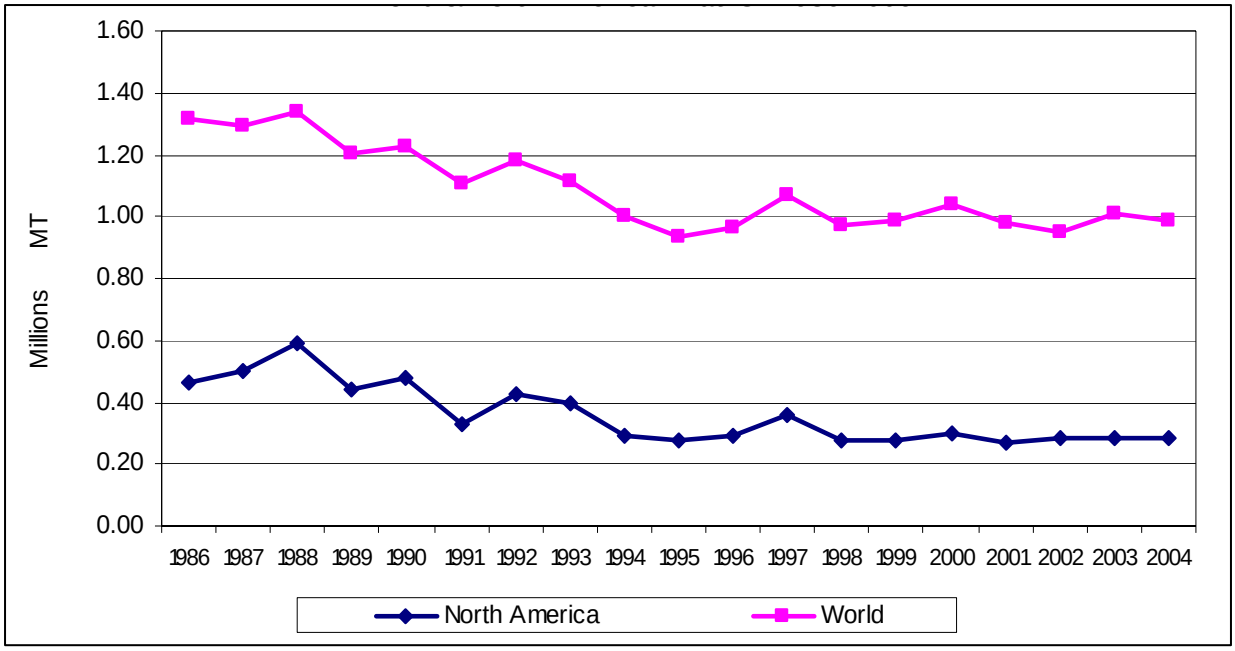
Source: Perkins, 1994; and Robinson, 2004

Figure 11.2. World harvest of Alaskan pollock and cod 1985-2004.



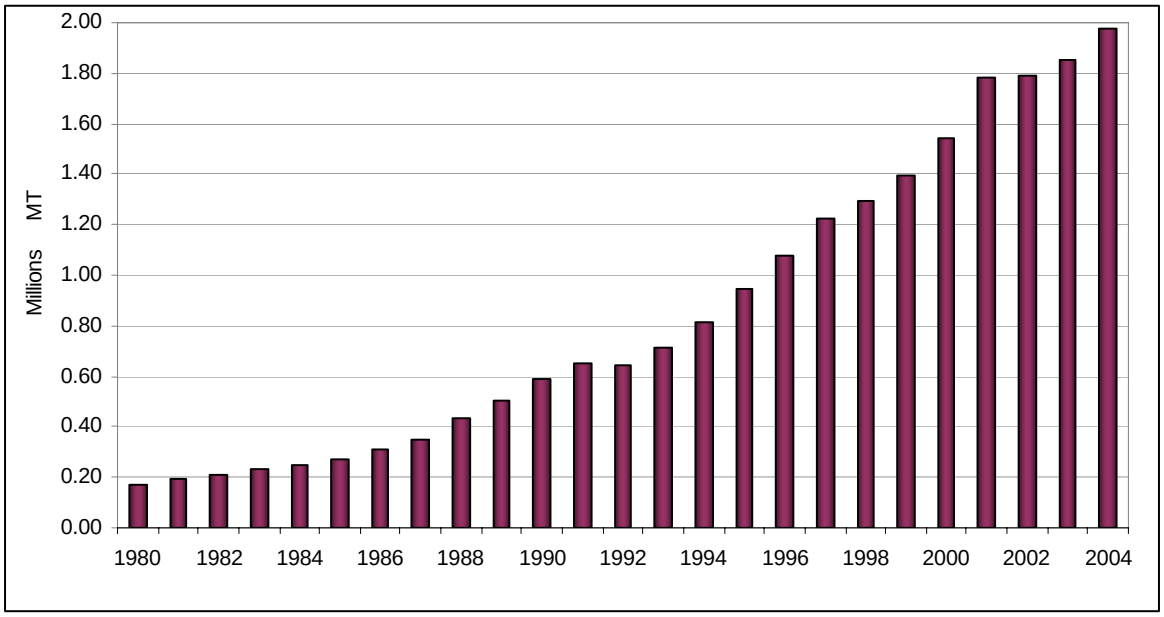
Source: FAO, 2006

Figure 11.3. World and North American flatfish 1986-2006.



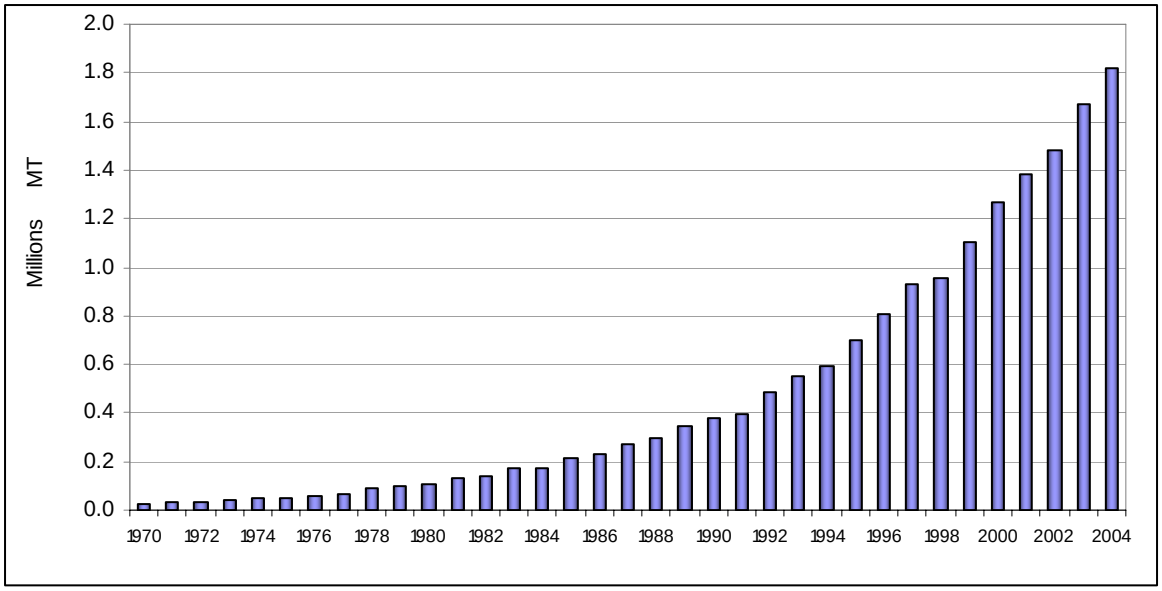
Source: FAO, 2006

Figure 11.4. World salmon and trout aquaculture.



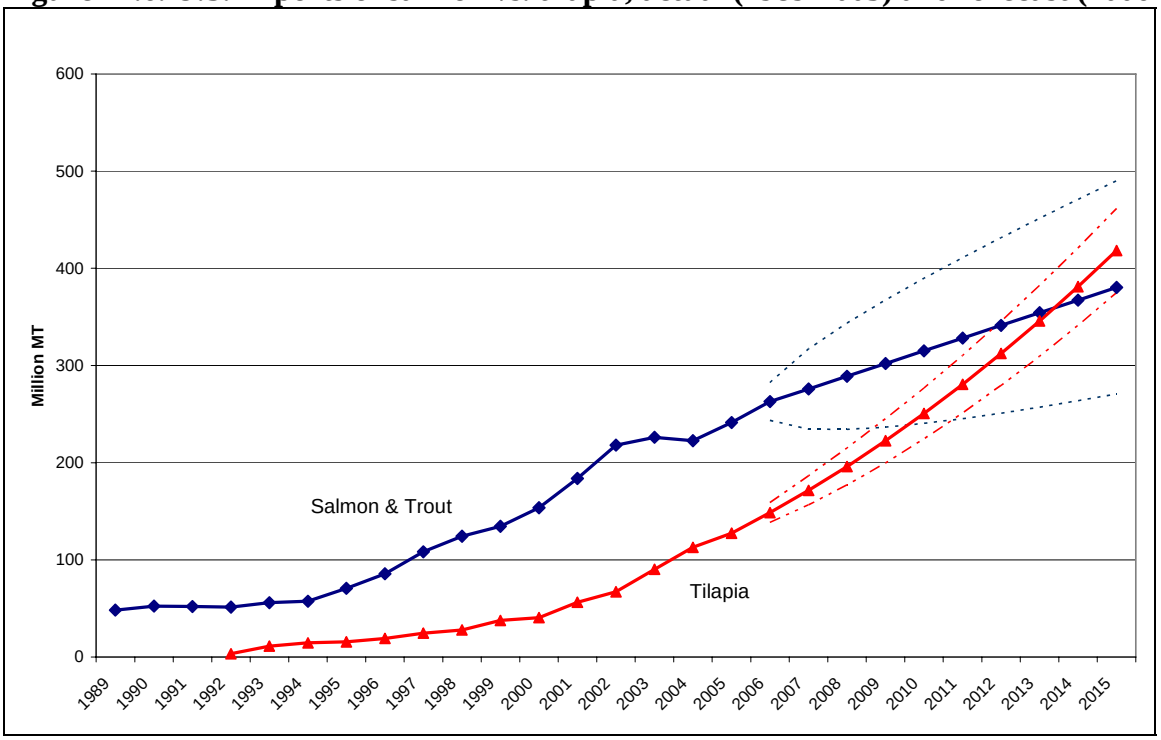
Source: FAO, 2006

Figure 11.5. World tilapia aquaculture.



Source: FAO, 2006

Figure 11.6. U.S. imports of salmon vs. tilapia, actual (1989-2005) and forecast (2006-2015).



Source: USDC, 2005

Aquaculture vs. Traditional Fisheries

In addition to increasing global seafood supplies, the aquaculture sector also provides seafood markets with characteristics that traditional fisheries are often unable to provide. Aquaculture species are often not as influenced by seasonal and environmental fluctuations in supply, unlike wild fisheries (such as wild-caught salmon) which have season-specific supply spikes, followed by periods of no availability. This consistency in the supply of a species is preferable to processors and distributors, who can make production and marketing decisions throughout the year instead of over a concentrated period of time. Consumers also benefit from year-round availability of a species, allowing demand to grow as consumption becomes more frequent. In aquaculture, product forms do not have to be limited to frozen, as is often the case for many wild fisheries. Furthermore, year-round trade in fresh or live species is also possible for several species.

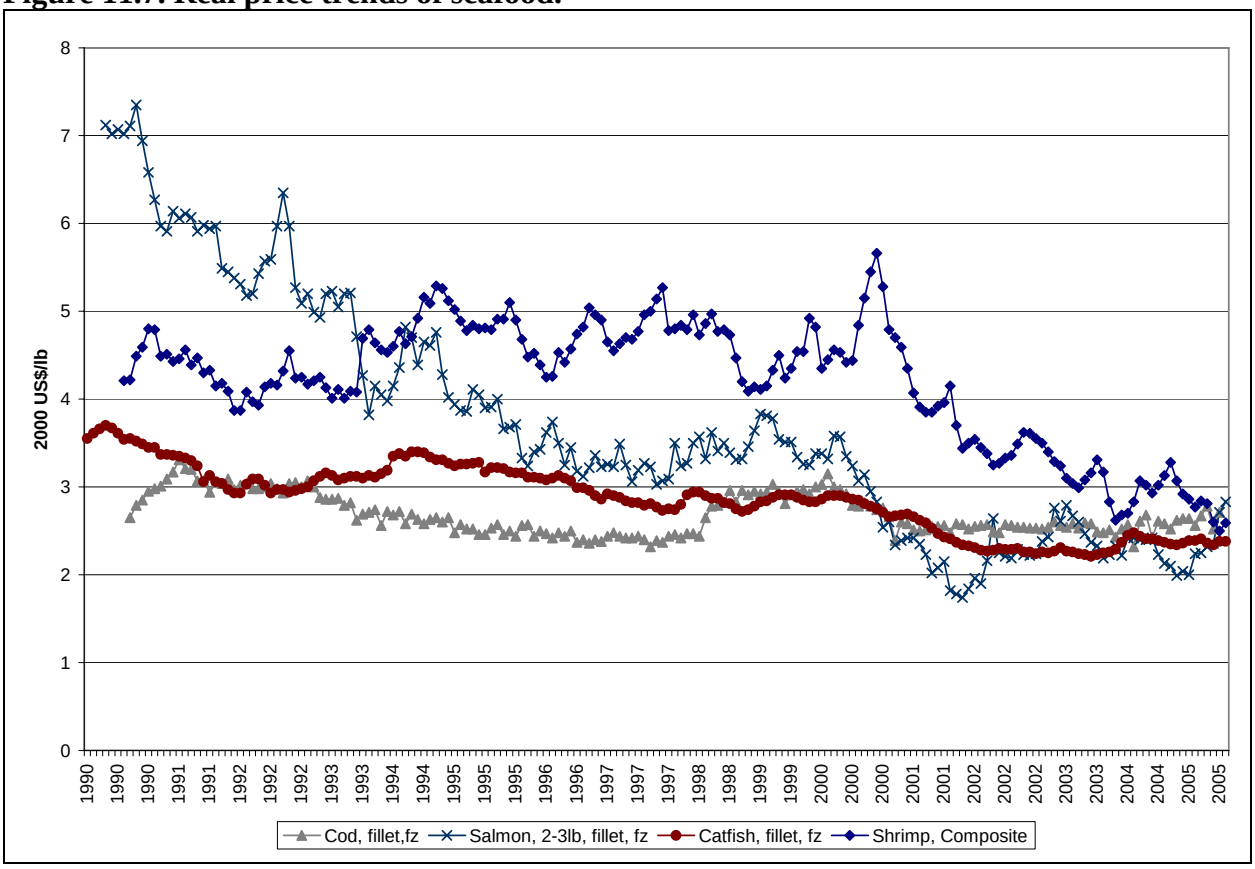
Given the standardized production of aquaculture species, producers are able to supply a homogeneous product of similar size, quality, and consistency throughout the year. For example, a catfish fillet harvested and sold in March is essentially identical in size and quality to a catfish fillet sold in December, owing to consistency in the production process. Processors, distributors, consumers, and the market all benefit from this reliability in supply, quality, and form. Another important feature of aquaculture is the ability to predict supply with a much lower variance than is the case in wild, traditional fisheries.

The consistency in supply and quality of aquacultured products are essential features for market development, especially with regard to new and value-added products. Investors and marketers will seek out species that exhibit increasing production trends, where, as demand grows so too can supply—further increasing market demand.

Real Price Trends in Seafood

The real price trends of various aquaculture species have been declining over time in contrast to traditional wild-caught species, which have remained essentially flat or increased (Figure 11.7). Over the past 15 years, the real price of frozen cod has remained relatively unchanged. During 1990, the average price of frozen cod was $2.84 per pound, while in 2005 the average price was $2.65 per pound, a 7% difference. In contrast, the real prices for salmon, shrimp, and catfish all fell considerably over that same time period. Salmon prices declined 66%, falling from an average price of $6.94 per pound in 1990 to an average price of $2.39 per pound in 2005. The price of shrimp declined from an average price of $4.52 per pound in 1990, to an average price of $2.71 per pound in 2005, representing a decline of 40 percent. Similarly, the price of frozen catfish fillets declined 33%, from an average price of $3.57 per pound in 1990 to an average price of $2.38 per pound in 2005. It is also interesting to note that, currently, catfish, shrimp, salmon, and cod are all trading at very similar prices. Relatively consistent declines in the price of aquacultured products are important, because they create opportunities for market development and increased market share.

Figure 11.7. Real price trends of seafood.



Source: USDA, 1990-2005; Urner Barry Publications, 1990-2005

Product Diversification and the Role of Eco-labeling

Relating back to Table 11.1, as the number of species consumed becomes fewer and the market becomes more concentrated, diversity in product attributes will fuel additional market growth. As stated earlier, this can come in the form of new preparations, sauces, flavorings, and other value-added consumer conveniences. Another important source of product differentiation will come from eco-labeling and other types of certification programs that differentiate products according to set standards that relate back to environmental, health, or other relevant production methods.

There are two major marine certification programs: one administered by the General Aquaculture Alliance (GAA), and one administered by the Marine Stewardship Council (MSC). The GAA strictly deals with aquacultured species. According to its website, the GAA is "an international, nonprofit trade association dedicated to advancing environmentally and socially responsible aquaculture" (GAA, 2006). The GAA established the Responsible Aquaculture Program (RAP), which led to the establishment of quantitative, "Best Aquaculture Practices" standards for shrimp farming. These standards address environmental and social issues in addition to food safety and traceability issues (GAA, 2006).

Another important certification program, the MSC, deals strictly with traditional capture fisheries. Established through a partnership between Unilever and the World Wildlife Fund (WWF), the MSC was developed to create standards for certifying fisheries as sustainable and well-managed (MSC, 2006). There are three main principles of the MSC standard: 1) the condition of the fish stock is evaluated, ensuring harvest levels are sustainable; 2) the impact of the fishery on the surrounding marine environment is examined (including the potential impact on non-targeted species, marine mammals, and sea birds); and finally, 3) the fishery management system is evaluated to assess the success of its rules and procedures in ensuring the sustainable use of the resource (MSC, 2006). Currently, the MSC does not certify aquacultured fish; however, it is reasonable to envision the MSC expanding to include both traditional fisheries and aquaculture in the future.

Both certification programs provide another form of value-added product differentiation to consumers by providing information on the production and harvest practices and, also, the overall environmental and social impacts of a given fishery. Consumers are becoming increasingly interested in where and how their seafood was produced or harvested, and the value of this information has not been lost on retailers and restaurants. Both Wal-Mart and Darden restaurants have recently committed to providing MSC- and GAA-labeled products to its consumers. In early 2006, Wal-Mart announced its commitment "to source all of its wild-caught fresh and frozen fish for the North American market from MSC certified fisheries over the next three to five years" (Wal-Mart, 2006). This commitment will apply to Wal-Mart's own branded products, not other branded products, although the company hopes "to influence that also" (McGovern, 2006). Darden Restaurants Inc., the parent company of Red Lobster, recently committed to requiring its farmed shrimp suppliers to adhere to GAA "Best Aquaculture Practices" certification standards. Both companies are major players, and their actions speak volumes about the growing importance of environmental certification programs. Other retailers and restaurants will most likely follow the lead of Wal-Mart and Darden, increasing both the availability and popularity of this new form of value-added seafood product in the market.

Roheim (2003) identifies four major beneficiaries of successful eco-labeling programs. First, marine fisheries and surrounding ecosystems benefit from the establishment of sustainable management practices. Second, consumers benefit from receiving more information on the seafood products which they consume, allowing them to make more informed purchasing decisions. Third, producers of eco-labeled seafood products benefit from potentially higher prices, due to the ability to differentiate their products. And finally, the fishing industry itself benefits from operating in a sustainable and well-managed framework designed to preserve both the resource and the industry.

Conclusions

The general trends shaping the future of the U.S. seafood industry are increasing imports predominantly from the aquaculture sector: moderately increasing per capita seafood consumption, and growth in value-added seafood products. The U.S. demand for seafood is forecasted to expand by 25-35% over the next 15 years, with no foreseeable increases in domestic production, especially from domestic capture fisheries. The situation is similar for global capture fisheries, many of which are already fully exploited. Therefore, any further

increases in total global fisheries production will come from the aquaculture sector, as has been the case to date.

Per-capita consumption of seafood will continue to increase; however, it will likely be concentrated on fewer species produced primarily through aquaculture. Product diversity will come from variations in preparation, including sauces, portions, and other value-added and convenience-driven modifications. Additionally, eco-labeling and other certification programs will provide further opportunities for value addition and product differentiation.

Technological innovations and better nutritional and disease management practices will continue to reduce costs in aquaculture production. In turn, lower production costs and increased supplies from aquaculture will hold prices down, another attractive outcome for investors and marketers. However, the trend toward value-added products has the potential to drive processing to countries where labor costs are lower.

Retail outlets will continue to be increasingly important to the seafood industry. Supply stability and product standardization are important attributes for large retailers and chain restaurants, especially those focused on growth in revenue and market share. They will seek out new product forms that have the potential to expand both on the supply and the demand sides. Furthermore, they will seek out supply sources where consistency and low prices allow them to engage in long-term planning. Given these requirements, aquaculture is in a better position to satisfy these demands than traditional capture fisheries.

Open-ocean aquaculture has the potential to contribute in two major ways. First, it would increase the global supply of seafood by providing an additional source of production. Recall that global demand for seafood is expected to grow 38 percent between 1999/2000 and 2015. Additionally, open-ocean aquaculture can provide a product that meets the needs of consumers and processors: a consistent, high-quality product with a relatively stable and/or declining price.

With regard to the United States, seafood imports will remain vital in bridging the gap between domestic supply and demand. While the emergence of a domestic, open-ocean aquaculture industry has the potential to increase domestic seafood production, it will not eliminate seafood imports. However, without any increases in domestic aquaculture production, offshore or otherwise, the level of seafood imports will have to increase to meet an ever-growing domestic demand for seafood products. In 2004, the U.S. seafood deficit was $7.6 billion, an all-time high (NMFS, 2004). Without substantial increases in domestic production, the seafood trade deficit will certainly increase. In the future, aquaculture will be the primary source of growth in seafood supply for the U.S. market. U.S. regulatory policy over the aquaculture sector will largely determine whether that source is from domestic or foreign production.

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