

# Selected Factors Affecting Seafood Markets in the United States

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The US seafood industry represents an economically important industry for the nation and an important component of the global seafood industry. The manner in which the industry has traditionally marketed the myriad of seafood products is changing. The major factors which will continue to affect the domestic seafood market include domestic resource management efforts, national and international environmental awareness, international trade policy, and a changing set of demands for seafood products and services.

The commercial seafood industry represents one of the most important natural resource-based industries in the United States. And the process by which the wide variety of seafood products moves from the deck of a trawler, or the bank of an aquaculture pond, to the consumer's plate is complex. When considering the hundreds of individual species marketed, the seasonal nature of the many domestic and foreign sources, pricing by size class for many high-valued finfish and shellfish, species-specific quality and safety attributes, and a multitude of processing methods and product forms, the obstacles confronting effective marketing of seafood products become daunting. Yet the industry has historically been able to successfully provide a consistently high-quality product to consumers, which until recently has been accomplished with traditional species, product forms long familiar to the domestic seafood consumer, and an unchallenged reputation for quality and safety.

A host of challenges (or opportunities) have recently appeared on the marketing horizon for seafoods, some of which have already begun changing the way seafood has traditionally been perceived by the consuming public and marketed by an industry accustomed to a relatively comfortable status quo. The issues confronting the industry relate to supply implications of alternative management methods for domestic fish stocks, public awareness of environmental impacts from seafood production (both wild-caught and cultured), the increasingly global nature of the seafood market, development of new product

forms and packaging to meet the changing needs of consumers, and consumer confidence in seafood safety and quality. After a brief overview of the more salient descriptive characteristics of the industry, each of these issues will be discussed in the context of the potential effect on seafood marketing in the US.

## **Descriptive Overview of the Seafood Industry**

Although seafood, both wild-caught and cultured, represents an industry of traditional importance for many communities in the nation, seafood can yet be characterized as the "red-headed stepchild" in terms of its per capita consumption ranking within the complement of all meat products. For example, of the 191 pounds (edible meat weight) of meat products consumed per capita during 1996 in the US, less than 10 percent is comprised of seafood (US Dept. of Agriculture, 1997; US Dept. of Commerce, 1997-1). And though the 14.7 pounds (edible meat weight) of seafood consumed per capita represents an increase of 20 percent over consumption amounts experienced through the mid-1980's, per capita consumption of seafood has exhibited a generally decreasing trend since 1987. This shift away from seafoods may have resulted from a flurry of media attention directed toward some notable quality and safety problems associated with seafoods during the past few years, such as viral infections linked to the consumption of raw molluscan shellfish, purported mislabeling of processed seafood, alleged contamination from polluted waters, and the absence of a mandatory, continuous federal inspection program for seafoods. In addition, the price of seafood in general has increased relative to other forms of meat products. For example, the

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consumer price index (1982-84=100) for seafood was 173.1 in 1996, compared to 134.5, 148.2, and 152.4 for red meats, pork, and poultry, respectively (US Dept. of Labor, 1997). Also, the CPI for seafood increased at an average annual rate of 4.0 percent during the 1987-1996 period, compared to 3.4 and 3.0 percent for red meats and poultry, respectively. The degree to which consumers have substituted away from seafood as a result of relative price and quality/safety perceptions is not fully understood. However, the "bottom line" is that seafood products may be losing market share to other forms of meat products and the industry is changing its traditional way of doing business in an attempt to reverse the trend.

But traditions often die hard in the seafood industry. And any change in consumption patterns of the final consumer will set in motion profound effects on the derived demands for goods and services at the vessel, processor, and wholesale distribution levels. A brief overview of the seafood industry's structure may help put the nature of such potential change in perspective. Approximately 100,000 commercial boats and vessels harvested 7.5 billion pounds of edible finfish and shellfish from domestic waters in 1996, which was valued at \$3.4 billion dockside (US Department of Commerce, 1997-I). Imported seafoods further contributed to total supplies. The US is the second most important importer of seafoods in the world, with seafood being the single most valuable imported food item (3 billion pounds valued at \$6.8 billion in 1996). In addition, domestic aquacultural production of finfish and shellfish provides additional sources of supply to the US seafood market. Domestic growers produced 690 million pounds of finfish and shellfish, valued at over \$800 million farm gate in 1995. Prior to reaching the final consumer, a large portion of this seafood passes through the domestic seafood processing and wholesale sector, which is comprised of almost 5,000 plants nationwide. By the time seafoods reach the final consumer, annual sales by US harvesters, growers, processors, and wholesale distributors exceed \$40 billion, with total value-added by these various sectors estimated to exceed \$20 billion annually. This process employs an estimated 200,000 individuals nationwide, with likely an even greater number employed by the myriad of retail and food service market businesses. In addition, the rapidly growing foodfish aquaculture production and service

industries provide a further source of seafood-related employment. And it would be a mistake to suggest that the economic activities associated with the seafood industry are confined primarily to coastal communities. Although most off loading and, to a lesser extent, processing activities are necessarily located within close proximity of suitable port and transportation facilities, activities associated with the wholesale distribution, food service, and retail sectors of the seafood industry create significant economic activity within many non-coastal metropolitan areas of the nation. The non-coastal nature of the industry is becoming even more pronounced given the rapid development of inland aquaculture.

### **Changing Strategies in Domestic Resource Management**

Complementing a complex marketing system for seafoods is an equally complex resource management structure. And this management structure can have an obvious influence on seafood marketing activities. For example, current fisheries regulations determine volumes of finfish and shellfish available from domestic stocks, the sizes available within the market, and when product is available. In some cases, product quality is influenced by allowable harvesting and transportation methods. The overall goal of fisheries regulations is to maximize economic efficiency within the harvesting and processing sectors, thereby producing the highest levels of industry profits. And as this goal is sought, the constantly changing nature of fisheries management can have a profound effect on the structure, conduct, and performance of the seafood industry.

The marine resources from which wild-caught seafoods are derived, and upon which recreational enthusiasts depend, are managed at the state and federal levels. State agencies manage fisheries which are conducted primarily in state waters, while federal agencies, for example the National Marine Fisheries Service, manage fisheries found in federal waters. Within the Gulf of Mexico region, state waters extend essentially from the shore to nine nautical miles offshore (Texas and Florida) while waters for the remaining states, as well as the east coast of Florida, extend from shore to three nautical miles from shore. Federal waters extend from the seaward boundaries of state waters out to 200 miles from

shore. Individual states enforce regulations within state waters, while the US Coast Guard provides enforcement within federal waters. Over 200 individual species are commercially harvested in the Gulf of Mexico and Southeast regions, each of which may have separate sets of regulations for allowable fishing gear, harvest seasons, size limits, catch quotas, etc. In addition, regulations for individual species can vary from state to state. Most states adopt regulations for offshore species that are caught in state waters which are no less stringent than the applicable federal regulations.

The federal legislation that provides for the development of a management structure for marine fisheries resources found in the federal waters of the US is the Magnuson-Stevens Fishery Conservation and Management Act (Public Law 94-265). The Magnuson Act was initially implemented in 1977 to establish fisheries management within the US Exclusive Economic Zone, reduce foreign access to domestic fisheries resources, and enable the management structure which has regulatory authority over domestic fisheries resources (marine and Great Lakes). One of the most important features of the original Magnuson Act was the establishment of Regional Fishery Management Councils. These nine regional councils, along with the National Marine Fisheries Service, create fishery management plans (FMPs) for fishery resources found in federal waters. The original Magnuson Act was reauthorized in 1996 via the Sustainable Fisheries Act (Public Law 104-297), with numerous changes made to the goals and national standards with which the nation's marine fisheries are managed. However, the Regional Council structure has remained intact, with 36 FMPs currently in place which provide oversight for over 700 individual stocks of fish. The management process is dynamic and continuous, with over 800 regulatory actions processed in 1996 via the Federal Register to implement FMP actions and rules.

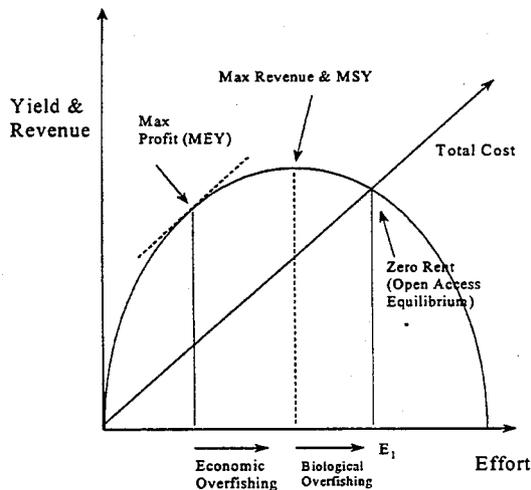
In addition to individual state management efforts and the Magnuson-Stevens Act, the Inter-jurisdictional Fisheries Act (Public Law 99-659) enables the development of management measures for fisheries resources that are found within state waters, yet are not confined within the jurisdiction of a single state. Basically, this program suggests management measures for fish stocks that move across state boundaries. The Gulf of Mexico Marine Fisheries Commission and the

South Atlantic Marine Fisheries Commission, both created by the IFA, develop data collection programs and management measures that provide information and guidance to state managers within the Gulf of Mexico and Southeast regions. Further, the National Shellfish Sanitation Program (US Food and Drug Administration) provides guidelines for which the harvest of certain near shore, molluscan shellfish (e.g., oysters) must strictly adhere. Additional regulations imposed by FDA dictate allowable handling and processing methods both onboard and shoreside. Thus, understanding the current myriad of state and federal fishery and seafood-related regulations creates an imposing challenge for harvesters, processors, and distributors of seafood products.

The common property fisheries resources in the US have traditionally been managed on an open access basis. Under open access management, anyone who is able to purchase the necessary capital and permit fees can enter the fishery. Continued use of this management strategy has encouraged an increasing number of participants to enter the commercial fisheries of the US. As a result, many of the nation's commercially important finfish stocks are currently overcapitalized and/or overfished. For example, 86 species are classified as being overfished, with an additional 10 species that are approaching an overfished condition (US Dept. of Commerce, 1997-II). Many of the nation's most valuable reefish, pelagic, and groundfish species are included in this group. Overfishing creates uncertainty in the market place for supplies derived from domestic fishery stocks. Stringent regulatory measures to correct overfishing can produce discontinuities in the availability (timing and volume) of affected finfish and shellfish species.

The process by which overfishing occurs under open access management can be briefly demonstrated in Figure 1. The curvilinear relationship represents a sustainable yield curve. Each point on this curve is a level of sustained yield that can be extracted from a given population of fish with a fixed level of effort. Note that as effort increases from the origin, sustainable yield increases to a maximum level (maximum sustainable yield, or MSY), then decreases thereafter. This is due to the recruitment, natural mortality, and cohort growth characteristics embodied within the stocks. Biological overfishing occurs at any level of effort in excess of MSY because the sustainable yield de-

**Figure 1. Sustainable Yield and Revenue for a Fishery.**



creases. Also, overcapitalization exists at any level of effort beyond that required for MSY, because the same level of yield could be produced with a smaller amount of effort. Sustainable revenue is a monotonic transformation in market price of the curvilinear sustainable yield curve. With a linear cost per unit of fishing effort emanating from the origin, maximum profits for the fishery occur at the effort level where marginal revenue equals marginal cost, or maximum economic yield (MEY). In open access, however, theory suggests that effort will continue to increase (either in the form of additional vessels or increased capacity per vessel) as long as profits exist in the fishery. In fact, effort will continue to increase well past the point of maximum economic yield to open access equilibrium,  $E_1$ , where industry profits are reduced to zero. This market failure occurs due to the absence of a full set of market signals (although effort is not costless, the individual fish are) and that the individual fishers recognize only their private operating costs, which is less than the collective social costs of the overall fishery. These social costs may take the form of congestion on the fishing grounds and/or stock size reductions. Although entities exist which attempt to control resource use, no one group claims ownership. Thus, as Gordon (1954) stated regarding the users of an open access resource, "...he who is foolhardy enough to wait for its proper time of use

will only find that it has been taken by another." As a result, many of the nation's marine fisheries are currently in this overfished and overcapitalized state.

In an attempt to achieve MEY, traditional, open access, fishery management efforts have included regulatory tools such as bag limits, gear restrictions, seasonal closures, harvest quotas, trip limits, and size limits, with no explicit measures to restrict entry into the fishery. In many respects, fishery management in the US is experiencing a paradigm shift in the strategies being adopted for future management. Many of the commercial fisheries in the Gulf of Mexico and South Atlantic region have begun managing with restricted access methods. In most federal fisheries, a permit is required to enter the fishery. A moratorium exists on the issuance of new permits for most of these fisheries. In Florida, for example, entrance into most fisheries in state waters is restricted by a required threshold level of income derived from commercial fishing. This essentially limits access to most species by full-time, experienced commercial fishermen. These restricted access fisheries do not, however, restrict effort, thereby providing the opportunity for continued overcapitalization and overfishing. In fact, a restricted access program implemented under a catch quota often leads to what is known as a "derby" fishery, which results in a rush by participants to gain a share of the quota before the closure occurs. This derby fishery leads to supply gluts, dockside price depression, quality loss, and unsafe fishing practices. Such conditions are now being seen in the red snapper fishery in the Gulf of Mexico, which reached the quota of 4.7 million pounds in only 74 days of fishing during 1997 (Gulf of Mexico Regional Fishery Management Council, 1997).

A more progressive approach to restricted access is the use of individual quotas (IQ), which predetermines the number of participants in the fishery and allocates each participant a share of the overall allowable catch. Thus, each participant is allowed an individual quota which is based on their past catch history and any changes in allowable catch. There is more flexibility in how and when the quota is produced by the fishery. And the program may allow a participant to lease or sell a share, thereby creating a market for shares that will theoretically equilibrate at the most economically efficient number of participants and, thus, effort. Such a program has been imple-

mented for several species in the past decade. Most notably, ocean quahogs, halibut, surf clams, and wreckfish are now managed under individual quota programs.

IQ programs provide positive benefits to the business of marketing seafoods. IQ-managed fisheries are now less subject to the effects of derbies, thereby reducing the inherent variabilities in dockside prices, supplies, and product quality. Seafood processors and wholesalers can be less concerned about unanticipated excesses in supply. Seafood purveyors can now better predict the supply and price of these IQ-managed species given that the harvest may be more influenced by market signals and less by availability via a regulatory window. Consumers may benefit by being provided a higher quality product that has been harvested and handled under less stressful conditions. Unfortunately, the potential market benefits resulting from an IQ program for red snapper and other species will be postponed until a Magnuson-Stevens Act moratorium on such programs expires. Concerns about the community impacts of IQ programs (i.e., quota share concentration in the harvesting and/or processing sectors) must be addressed before additional programs will be implemented.

### **Environmental Concerns Associated with Commercial Fisheries Harvest**

The most notable concept with which marine resource utilization is currently concerned is *sustainability*. The term is ubiquitous within resource management agency objectives, academic research agenda, the mantras of environmental activists, and the popular environmental press. And as well it should be, for the current overutilized condition of many US fisheries simply mirrors the current status of many of the fisheries around the globe. World catch of marine fisheries increased from 18.7 million metric tons in 1950 to 94.8 million metric tons in 1995 (Food and Agricultural Organization, 1995). Concerns over whether this trend can be sustained continues to fuel debate regarding the need to control fishing effort worldwide. For example, the decadal average annual rate of increase has decreased markedly since the 1950's (e.g., 6.8 % during the 1950's to 3.6% during the 1980s). Also, world catch exhibited a sustained decline for the first time in history during 1990-92, with the exception

of periods during the two world wars. Most troubling, however, is that almost 70% of fisheries resources for which data are currently available are reportedly either heavily or fully exploited, overexploited, overfished, depleted, or recovering from depletion (Garcia and Newton, 1997). Such conditions appear to be the case around the globe, but are most prevalent with groundfish species (i.e. cod, hake). Thus, the question arises about the sustainability of these wild-catch fisheries given the current levels and rates of utilization. The recent passage of the Sustainable Fisheries Act, as discussed above, confirms the same set of concerns exist specifically for US fisheries.

Efforts to draw attention to the general overutilized conditions of the world's fisheries is being led by a number of environmental awareness groups. These groups include Greenpeace, Earth Island Institute, World Wildlife Fund, Marine Stewardship Council, National Audubon Society, Ocean Wildlife Campaign, and International Game Fish Association, to name a few. Although each individual agenda may focus on a different set of issues, the common theme is a concern over the reported overutilization of the world's marine resources. These groups, in conjunction with established resource management agencies, have been able to successfully flex their muscle over a number of important issues, including the virtual elimination of commercial whale fisheries, reduction of dolphin bycatch by tuna seiners in the Eastern Tropical Pacific, the elimination of the use of high-seas driftnets in certain regions of the world and, more recently, the inclusion of Turtle Excluder Devices in shrimp trawls around the world, and Bycatch Reduction Devices in US shrimp trawls. The latter issue, bycatch reduction, has developed into the most contentious issue to confront fishery participants, managers, and activists. FAO (1994) estimates that about one quarter of the world's fisheries catch (27 million metric tons) are discarded each year.

But what effect, direct or otherwise, will such environmental activism have on seafood markets in the US? The failure to comply with the provisions of the dolphin bycatch regulations led to an US embargo of tuna canned in Mexico. Elimination of high seas driftnets reportedly increased the availability of sea-run salmon to Alaskan producers that would otherwise have been intercepted at sea. Failure to comply with US turtle excluder device regulations resulted in a threatened em-

bargo of shrimp imported from 29 countries, some of which are major suppliers of shrimp to the US market. And the effective and widespread use of bycatch reduction devices in shrimp trawls in the Gulf of Mexico will purportedly result in a greater availability of several important species of finfish in US markets, including red snapper, which currently is severely overfished.

Thus, participants in the marketing of seafoods would be well advised to stay abreast of the agendas held by environmental groups. These groups have grown to yield considerable political power and have been successful in influencing the development of marine resource policies that can have a direct effect on product availability and trading patterns. It is extremely difficult to scan the pages of any fisheries or seafood related popular journal without finding some direct reference to the these groups. In fact, some of the more powerful seafood trade associations have recognized the common ground held among some environmental groups is growing. For example, the National Fisheries Institute, the largest seafood trade association in the US, recently urged the National Marine Fisheries Service to be more proactive in addressing the sustainability of the North Pacific region fisheries, and began assisting shrimp-exporting nations in becoming certified by the US State Department as having "turtle safe" shrimp. It has supported the ratification of the InterAmerican Convention for the Protection and Conservation of Sea Turtles, and adopted the FAO Code for Responsible Fishing to ensure "environmentally sensitive, sustainable use of fishery resources... throughout the world" (*Seafood Leader*, 1997).

### International Trade

The US is one of the most important nations in terms of the international trade in seafood products. In fact, the total import value associated with seafoods is higher than for any other single category of foods (US Dept. of Commerce, 1996). The value of edible seafoods imported into the US in 1996 totaled \$6.7 billion. The US ranks second (Japan is first) among all nations in terms of value of imported seafoods (US Dept. of Commerce, 1997-I). During the 1987-96 period, the nominal value of imported seafoods has increased by 18%, while import volumes remained virtually constant. Shrimp, lobster, tuna, and groundfish represent

the most important single species groups, with Asia, South America, and Canada being the most important sources of product. The US also is a major source of seafood for the world market. The value of US edible seafood exported during 1996 totaled \$3 billion. The US also ranks second (Thailand is first) among all nations in terms of value of exported seafoods. And during the 1987-96 period, the nominal value of exported seafoods increased by 88%, while export volumes increased by over 160%. Salmon, surimi, lobsters and fish roe are the most important forms of exported seafoods, with Japan and Canada being the most important trading partners.

Approximately one-half of the seafood consumed in the US is imported. As a result, the seafood industry created a trade deficit of \$3.7 billion in 1996. Recent trade policy actions may provide a means by which to increase the export market for US seafoods. For example, the Uruguay Round of the General Agreement on Tariffs and Trade provided for reduced tariffs barriers to several established foreign seafood markets for the US (Table 1). Several Asian markets allowed major reductions in import duties that should provide for increased market opportunities for US exporters. Thailand, for example, reduced its fishery tariffs from 30% to 5%. Tariff reductions in the European community will likely continue to encourage growth in the European market for US seafood products, which has increased by 50 percent since 1987. During this same period, exports to Asia have doubled and exports to Africa have quadrupled. The largest percentage growth for US seafood exports, however, has been to the Latin America region. Exports of edible seafood products to South America increased from 0.3 million pounds to 12.4 million pounds during the last 10 years.

**Table 1. Selected Tariff Changes Resulting from UR-GATT on Fisheries Products.**

| Country or Region   | Pre-GATT<br>Tariff | Post-GATT<br>Tariff |
|---------------------|--------------------|---------------------|
| United States       | 1.37 %             | 1.16 %              |
| European Community  | 6.79 %             | 6.22 %              |
| Japan               | 5.54 %             | 4.18 %              |
| South Korea         | 20.06 %            | 13.11 %             |
| Brazil              | 60.56 %            | 25.56 %             |
| Other Major Markets | 6.63 %             | 4.99 %              |

Source: Unpublished UR-GATT summary document. Trade and Industry Service Office, National Marine Fisheries Service, NOAA, US DOC.

Other non-tariff barriers have also been relaxed as a result of GATT. The Uruguay Round generated more restrictive policies on import licensing and license application procedures. This was especially true for the allocation of fishery product import quotas in Japan and import licenses in South Korea. Improved product sanitation rules should reduce the unjustified use of arbitrary sanitation tolerance levels and inspection requirements for seafood products imported from the US. Interestingly, the Uruguay round also strengthened the requirements for setting product standards; thereby helping to reduce the likelihood that such standards will be used as an indirect barrier to products of US origin. This latter issue is interesting in that the recently implemented FDA Hazard Analysis and Critical Control Point (HACCP) program requires that foreign suppliers of seafood to the US implement a HACCP program and adhere to quality and safety standards as dictated by FDA. Failure by a foreign seafood export firm to do so, beginning in 1998, will result in a US embargo of product originating from that firm's facility. When and to what extent FDA will enforce this new regulation on foreign importers is yet to be determined. However, the potential impact on product availability to the US seafood market is of interest if widespread noncompliance by foreign processors occurs.

A growing dependence on foreign sources of product and markets leaves domestic processors and distributors vulnerable to rapid changes in the world market conditions, regulations and policy. For example, concerns regarding the coastal ecosystem of India has prompted the Indian Supreme Court in late 1996 to order all shrimp farms within 500 meters of shore to cease operations. These operations account for 65% of Indian cultured shrimp production. India is the fourth most important single source of shrimp to the US market, of which cultured shrimp represents a large share. And although Thailand has become the most important foreign source of shrimp to the US market, the development of the shrimp culture industry has not come without cost. Environmental degradation and disease have prompted calls for a moratorium on further industry development. In addition, the EU has reduced tariffs breaks for Thai shrimp because of the tremendous success of the industry. The resulting changes in trading patterns for shrimp could have both positive and negative impacts on the US market. The US Inter-

national Trade Commission (ITC) ruled in 1997 that the Chinese have been dumping freshwater crawfish tails on the US market, prompting a countervailing duty in excess of 100%. The price effects of resulting supply reductions may be good news for domestic harvesters and growers, but potentially bad news for consumers and processors. In addition, the US ITC is currently investigating the alleged dumping of fresh, cultured salmon on the US market by Chile. The ITC has preliminarily determined that evidence exists that these imports are materially injuring the US industry. These events represent only a small subset of the issues developing within the global seafood market that can significantly influence import supplies and the manner in which the US seafood industry conducts business, thereby impacting all market levels from harvester to consumer.

### **Market Development and Enhancement**

Current trends indicate that seafood is losing market share among competing meat products. As discussed earlier, seafoods represent less than 10 % of the total meat products consumed per capita in the US on an annual basis. In addition, the per capita consumption of seafoods has been declining since reaching an all-time high of 16.2 pounds in 1987. Reasons for the relatively small market share may include traditional red meat/poultry oriented consumption habits, lack of familiarity with seafoods and preparation methods, limited availability of seafoods, and the relative price of seafoods compared to other meat products. In addition, recent concerns regarding the perceived quality and safety of seafoods may have placed additional barriers to industry efforts aimed at increasing the general demand for seafoods. Most likely, all of these issues play some role in constraining the growth in the market for seafoods in the US. As a result, the seafood industry has adopted an aggressive approach to enhancing the domestic market for seafoods. Included in this mix of proactive strategies are efforts to introduce new species, develop markets for live seafood, create an array of more convenient packaging, establish full-service retail counters in major grocery outlets, utilize new processing and packaging technologies to enhance product quality, develop foreign markets, and regain consumer confidence by assisting in the implementation of FDA's HACCP program.

The most popular species and product of seafood consumed in the US is canned tuna (US Dept. of Commerce, 1997-I). Processed groundfish products (i.e., fish sticks, breaded fillets) are also a traditionally popular item for domestic consumers. In an attempt to increase consumer awareness of the diversity that exists for seafood and add to the limited list of traditional favorites, a variety of new species have been introduced that most consumers probably would not have been aware of a decade ago. Examples of such species include golden crab, opah, monkfish, Chilean Sea Bass, Escolar, Cape Haddie, pomfrets, corvina, and orange roughy, just to name a few. These species are being harvested from fisheries all around the world, with the availability of some being the product of fishing effort displaced from overfished regions and being redirected into new fishing areas with new gear. In addition to these new wild-caught species, a host of cultured species are becoming increasingly available on the domestic market. These species include Mediterranean Sea Bream, tilapia, black tiger shrimp, Norwegian and Chilean salmon, blue and green-shell mussels, freshwater crawfish, hybrid striped bass and bay scallops. Aquacultured product represents less than 10 percent of the total domestically produced supply of seafoods, but this percentage has doubled in the last decade. Aquacultured seafood products, both freshwater and marine species, will become increasingly important as a source of supply to the domestic seafood market, particularly given the stringent harvest restrictions in place for domestic stocks and if sustainability of world harvests is not achievable with current effort levels.

In addition to fresh, frozen, and further processed seafoods, an interesting product form that is becoming increasingly popular is live finfish and shellfish. A variety of live finfish are finding a growing demand in primarily ethnic markets within major metropolitan areas. Although live American lobster have long been available to customers in retail and restaurant settings, live snapper, carp, trout, tilapia, and other finfish species are becoming more available. In addition, live shrimp harvested by bait vessels in Florida are currently being shipped to growing markets in the northeast and midwest metropolitan areas. These live products pose a different set of shipping, handling and storage considerations by seafood mar-

eters as they strive to ensure a high quality product reaches the final consumer.

Historically, total seafood consumption has been characterized by an equal volume distribution between at-home and away-from-home markets (US Dept. of Commerce, 1997-I). However, almost two-thirds of the expenditures associated with seafood consumption occurs away-from-home. In an attempt to increase the overall consumption of seafood, while enhancing the at-home market, a variety of new, convenience-oriented product forms have recently been introduced. These include microwavable portions and entrees that will hopefully have an appeal to the two-wage earner households, whose schedule allows minimal time for meal preparation. In addition, frozen, individual servings have been introduced to appeal to the same market, as have individually bagged IQF fillets, frozen pouches, and pre-cooked tray-packs. Pre-shaped surimi products have continued to increase in popularity. Also, ready-to-eat, value-added products, such as vacuum-packed salmon fillets, have become popular choices. These individual, portion-controlled products are intended to not only introduce convenience, but also to make consumers more aware of the growing variety provided by seafood. Technological advancement in packaging, however, is going well beyond the need simply for more convenience. As with many foods that are marketed in the fresh form, decomposition is a key problem with fresh seafoods. Modified Atmosphere Packaging, a processing technique that seals foods in carbon dioxide and nitrogen gases to reduce spoilage, may gain acceptance as a means by which to extend shelflife and reduce losses in the retail seafood setting.

In a further attempt to expand the at-home market for seafoods, the development of full-service seafood counters in major grocery stores increased dramatically during the 1980s. A recent study indicated that of 25,000 major supermarkets surveyed, approximately 16,000 offered fresh seafood (*Seafood Leader*, 1997). Over half of those offered seafood through a full-service seafood counter. These counters provide advice on choice, preparation methods, and other "unknowns" of new or infrequent consumers. Some counters will actually prepare the seafood on the spot. However, a similar study has shown that the number of full-service counters has actually declined in recent years. The number of grocery stores with

full-service counters declined from 78% in 1991 to 61% in 1995. For some retailers the expected profit associated with these full-service counters has not been fully realized. The perceived need to have a dedicated staff of trained, seafood "specialists" may simply be too costly relative to the margins realized on fresh seafood within a retail setting. For some retailers, a return to cross-trained staff able to sell both red meats and seafoods appears a more cost-effective option. Thus, the experiment in full-service seafood sales has come full-circle for some retail operations.

Assurance of quality and safety to consumers has long been an issue of primary interest to the seafood industry. However, recent attention has been drawn to several areas of concern, which may have contributed to the reductions in per capita consumption. Alleged forms of economic fraud (i.e., mislabeling, short weight packing, etc.), the association of seafoods with site specific incidents of water pollution, illnesses associated with the consumption of raw, molluscan shellfish and thermally abused seafoods, and the absence of a continuous, mandatory inspection program have generated interest not only in the media, but also the regulatory agencies responsible for assuring consumers are provided consistently safe and high-quality food products. Interestingly, 1 in 250 servings of raw or partially cooked molluscan shellfish results in illness, while only 1 in 5,000,000 servings of cooked seafood result in illnesses — compared to 1 in 25,000 servings of cooked chicken (Lin, et. al., 1995). And although both state and federal agencies have long inspected seafood products and seafood processing activities, seafood represents the only meat industry that does not have a mandatory and continuous federal inspection program. As an alternative to the inspections programs that exist for red meats and poultry, a self-inspection program has recently been implemented for the seafood industry. Given the diversity of species, processing methods, product forms, scale of processing facilities, and dependence on foreign product, the form of inspection historically utilized for red meats and poultry likely would not be effective. Thus, FDA has designed a Hazard Analysis at Critical Control Point (HACCP) program for seafoods that focuses on identifying where potential compromises to safety may exist in the handling, processing, storage, and shipping of seafoods (*Federal Register*, 1994). Each seafood purveyor must develop a

HACCP plan utilizing the guidelines provided by FDA. The responsibility is on the individual firm to ensure that such a plan exists and is adhered to on a continuous basis. FDA inspectors will visit these firms to verify compliance and that the individual firm has maintained the required records with which compliance can be demonstrated. If the firm is not in compliance, FDA has the authority to declare the firm's product adulterated. In addition, any foreign suppliers must also have a HACCP plan in place. FDA has the authority to inspect these foreign facilities and implement an embargo on that firm's product in the case of non-compliance. The FDA HACCP program became effective as of December 1997.

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