A Review of Current Conditions in The Texas Shrimp Industry, an Examination of Contributing Factors, and Suggestions for Remaining Competitive in the Global Shrimp Market

Prepared by Extension Specialists in the Departments of Agricultural Economics and Wildlife and Fisheries Sciences

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5. When this report was originally released, only preliminary data were available for calendar 2001. These preliminary data were used for aggregate landings, imports, exports, and cold storage holdings. This updated original report – completed January 9, 2003 – uses final year-end information to quantify apparent U.S. consumption (Table 7), the domestic and import market shares (Table 8), and the level of end-of-year cold storage holdings compared against total, annual supply (Table 11). Final, year-end information slightly changed some of the presented and computed values. References to and discussion of these quantitative data found within the executive summary and the body of the report have also been updated.

Acknowledgment

Many steps are necessary to prepare a report such as this. Among these are locating disparate sets of information and data that must be assembled, reviewed, and summarized. While some of the data and information used in this report were retrieved from searches across the world wide web, all of the cross-sectional time series data that details Texas shrimp landings and ex-vessel value were provided by individuals employed by the National Marine Fisheries Service.

Jim Nance and Frank Patella, both associated with the Galveston Laboratory, have demonstrated an exemplary cooperative spirit in sharing the shrimp landings data sets. The collection, validation, and management of this cross-sectional history of shrimp production are important, time-consuming tasks. Both Dr. Nance and Mr. Patella have repeatedly delivered key information on a just-in-time basis. In extraordinary times such as these, when every resignation or retirement within a public-sector organization brings additional responsibility and work to those who remain, these gentlemen have always honored our requests with expediency, and followed up to make sure what we asked for was what we received.

After weeks of preparation, a review copy of this paper was distributed to industry members, our colleagues in academia, and Mike Travis, Fisheries Economist, headquartered at the Southeast Regional Office in St. Petersburg, Florida. Reviewing other people's material is an important but thankless job that is often put off as more pertinent issues surface in the reviewer's workplace. Within five days of receiving the report, Dr. Travis had prepared a very thoughtful, comprehensive review containing numerous suggestions that have improved the quality and thoroughness of this document. We were very impressed with the level of detail in Dr. Travis' comments. He suggested better references to substantiate the points made and even included the web address where the citation could be found. Additionally, Dr. Travis pointed us to several web sites that served cross-sectional time series data pertaining to seafood imports. Conservatively, we estimate that he spent at least an entire day to complete this important, quality-improvement function.

The ability to provide the raw information resources in such a timely manner demonstrates the technical acumen of these professionals. More impressive though is their demonstrated commitment to contribute information, suggestions, and professional expertise in an expeditious, selfless manner. Without the combination of technical competence, professional interest, and personal commitment that these federal employees have exhibited, this report would have taken much longer to bring to fruition.

Successfully preparing a report of this nature also requires a bit of serendipity. In April the paper prepared by John Vondruska entitled "Southeast Shrimp Fisheries and Global Market Trends" was distributed to many within industry and academia. Shortly after a meeting of shrimp industry leaders in Aransas Pass this past April, we were tasked with developing a report that reviewed the global trade in shrimp and explained how changes in this worldwide industry have affected our domestic industry. The time series data that Dr. Vondruska presented in his paper actually guided the inclusion of topics that were covered in this report. His recent contribution was truly a fortunate find for those of us asked to make sense of how global conditions affect local shrimp fishermen and processors.

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Executive Summary

Recent changes in the global shrimp industry are having a dramatic, negative impact on domestic, wild-harvest tropical shrimp fishermen and processors. In spite of sustainable harvests and decades of economic viability, the domestic shrimp industry is currently being confronted with international economic challenges that seem beyond its immediate control. Chief among these is the recent dramatic increase in imported, pond-raised shrimp that has depressed prices to historic lows.

In 1980, the supply of tropical shrimp in the U.S. was 466 million pounds (expressed in the shell-on, headless market form), with the domestic shrimp harvest contributing 44.6 percent (208 million pounds) to total supply. By 2001, the U.S. shrimp supply had increased to 1.38 billion pounds, with U.S. shrimp fishermen supplying only 201 million pounds. Thus, production by the U.S. fleet now contributes only 14.6 percent to the domestic market. With such a market share, domestic producers clearly have lost the ability to significantly impact the price of shrimp in the U.S.

In 2001, offshore Texas shrimp fishermen experienced the lowest real ex-vessel real value for their shrimp in the past 37 years. Although production was off by 25 percent from the previous 37 year average, the historic low value was largely due to low dockside prices paid to fishermen. In fact, the previous year, 2000, saw a 25 percent *increase* over the historic average production, but the cumulative value of the landings was just shy of the real, 37-year average value. The explanation again was low dockside prices.

The availability of relatively inexpensive labor in Southeast Asian and Central American shrimp-producing countries has changed the product *form* entering the U.S. Thailand, the largest exporter of shrimp to the U.S., has greatly expanded its export of hand-peeled raw and cooked shrimp into this country. In 2001, imports of hand-peeled raw and cooked shrimp accounted for 60 percent of total imports (expressed on a shell-on, headless basis). Relatively low wages create an obvious economic advantage when adding convenience and value to the hand-peeled segment of the product line.

In addition to a more convenient product line, the count sizes of imported product are also of concern to the domestic industry. Black tiger shrimp cultured in Asia can be grown economically to sizes which compete directly with large-sized, wild shrimp. Historically these larger sizes have given U.S. shrimp fishermen an economic advantage over the smaller Pacific white shrimp which are cultured in Central and South America.

Finally, tariffs and currency exchange rates are important issues for shrimp-exporting countries. Unlike the E.U. the United States imposes no duty on shrimp imports, thus generally providing a more profitable market for foreign shrimp. Likewise, when exchange rates are factored into the pricing formula, a relatively strong U.S. dollar adds an additional important economic incentive that attracts foreign product.

The Texas shrimp industry has experienced several short term crises in its history – fuel prices, insurance, or highly variable annual production. These conditions were always met and overcome by a resourceful, resilient group of individuals. However, the current global economic conditions impacting the industry are truly beyond its control. Special industry-wide commitments to unique marketing strategies as well as short-term assistance may be needed if the domestic industry is to survive.

This report investigates current conditions in the the shrimp industry, examines factors that are impacting it, and provides suggestions for remaining competitive.

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A Review of Current Conditions in The Texas Shrimp Industry, an Examination of Contributing Factors, and Suggestions for Remaining Competitive in the Global Shrimp Market

Introduction

The year 2001 was an economically disastrous one for Texas shrimp fishermen. Production shortfalls combined with relatively low ex-vessel prices led to the worst year on record. Unwelcome as they are, poor years like 2001 are no surprise to shrimp fishermen. As 2002 began, domestic producers and processors faced an onslaught of additional shrimp imports that pushed ex-vessel and wholesale prices lower than those experienced in 2001. Some of these additional imported shrimp arrived in the American market because of political and administrative decisions that were made half a world away. To many industry members, this turn of events has signaled fundamental changes in the worldwide shrimp business. Therefore, the Gulf and South Atlantic shrimp industry – fishermen, processors, marketers, and the various supporting businesses that serve these sectors – is pondering what future operational changes will be necessary to remain active in the global shrimp industry. In addition, shrimp fishermen and processors throughout the Gulf and South Atlantic states have met with elected officials at the local, state, and federal levels to explore more immediate solutions to what many in industry see as a central threat to their survival.

This report has been prepared to meet two immediate information needs of the domestic shrimp industry. The first of these addresses the impact of the 2001 season upon producers. This segment begins with a brief review of the shrimp resource and the business of shrimp fishing. Next, the report quantifies the shortfall in both production and ex-vessel values for calendar 2001 and compares the annual production and ex-vessel value against a long-term average. The second information need is a bit more diffused. In particular, the shrimp industry has asked for assistance in formulating industry-wide ideas, plans, and strategies that will help it remain competitive in what has become an interdependent, world industry. As a first step in formulating these plans, this paper reviews what is known about the U.S. and global shrimp business; and importantly, what drives the worldwide trade in shrimp. These aggregate U.S. and global conditions reflect the *"playing field"* upon which our domestic production and processing industries compete. In the short run not much can be done to alter these conditions, but reviewing them may serve to focus on how best to help domestic producers and processors remain competitive in the global shrimp industry, which today is comprised of both fishermen and shrimp farmers.

Data Sources

Shrimp Production and Value. Shrimp landings and ex-vessel value data provided by the Galveston Laboratory of the National Marine Fisheries Service are used to quantify the 2001 harvest and compare it against the long-term expected value. Shrimp harvests are routinely tracked by National Marine Fisheries Service Port Agents who solicit information from vessel owners and processors. In addition to recording the pounds of shrimp tails landed and the dollar value of that harvest, a wide range of characterizing information is also collected. These characterizing variables include (i) the month and year of harvest, (ii) the location of harvest (i.e., a particular bay system or Gulf of Mexico subarea and water depth where the harvest occurred), (iii) the port where the product was offloaded, and (iv) the composition of the catch (i.e., species and count size).

All discussion of shrimp quantities in this report use the shell-on, headless market form. Where actual product weights (e.g., breaded, raw peeled, cooked peeled, etc.) were presented in source documents such as a review of imports or cold storage holdings, these values were converted to shell-on, headless equivalent weights by multiplying actual product weight by one of the following conversion factors: (i) breaded: 0.63, (ii) raw peeled: 1.28, (iii) canned: 2.52, (iv) other (which includes cooked peeled): 2.40 [1].

Treatment of Ex-vessel Values Through Time. Dollar values such as cumulative, annual ex-vessel value and computed ex-vessel prices per pound are expressed in real, or constant dollars which use 1982 as a base year. Constant dollar values ensure that a consistent unit of measurement is used throughout time. This removes the effect of inflation and allows consistent comparisons of landed value over the time series used in this analysis.

The effect of inflation at the producer level is estimated with a group of indices that measures the average change over time in the selling prices received by domestic producers of goods and services. This broad category of index numbers is known as the Producer Price Index (PPI). The index for "Frozen Packaged Fish and Seafood" was selected to adjust ex-vessel values to real, or constant, dollars because this index reflects the impact of inflation on prices paid by dockside buyers and processors [2]. This specific index is considered an *item* within the larger Processed Foods and Feeds *group*.[1]

All indices that measure changes in selling prices are available in two levels of specificity. The more detailed form presents monthly index numbers for the entire time span of the index. Because landings data are provided as monthly information, the more detailed version was used to deflate reported ex-vessel values into real, (or constant) dollar values. The reported (or current) ex-vessel value for each record in the shrimp landings data set is deflated with a unique PPI number that corresponds to the year and month of the harvest. For example, if the reported landed value was $25,000 for October, 1996 and the PPI for October, 1996 was 137.4, then the real landed value would be $18,195.05 as computed with the following equation:

> Real dollar value for Oct., 1996 = Reported dollar value for Oct., 1996 x (100 ÷ the PPI for that month and year)
>
> Thus;
>
> $18,195.05 = [$25,000 x (100 ÷ 137.4)]

An annual version of each index is also available and is very useful for illustrating changes in price levels through time (Table 1, Figure 1). The base year of this index is 1982, so the annual index number for 1982 would equal 100. The previous example demonstrated how current dollars are deflated into real dollar values. The following example explains the effect changing selling prices have on purchasing power from one period to another. Using the information in Table 1, shrimp landed in 1982 for $3.00 dockside would have to bring $4.93 in 2001 to maintain the same purchasing power for the fisherman.

> (1982_price x (100 ÷ 1982_PPI_value)) = (2001_price x (100 ÷ 2001_PPI_value)).
>
> Substituting the actual index numbers from Table 1 into the equation and solving for the 2001_price yields the following simplified expression:
>
> ($3.00 x (100 ÷ 100)) = (2001_price x (100 ÷ 164.2))
>
> Thus, ($3.00 ÷ 0.6090134) = 2001_price
>
> So the 2001_price equals $4.93

1. The "Frozen Packaged Fish and Seafood" index is available as both a seasonally adjusted time series and a non-seasonally adjusted data set. While the seasonally adjusted index would have been preferred, the available time span included just 15 years (1975 through 1989). On the other hand, the non-seasonally adjusted index begins in 1947 and continues to the present, so this Bureau of Labor Statistics data set was used to deflate the raw, monthly ex-vessel value information before it was summarized into annual totals or used to compute ex-vessel prices per pound.

Table 1. Non-seasonally Adjusted Annual Index Values for Frozen Packaged Fish and Seafood, an Item Within the Processed Foods and Feeds Group Which is Part of the Producer Price Index – Commodities Family

Year	Annual Index Value	Year	Annual Index Value
1965	20.0	1984	108.8
1966	22.9	1985	104.3
1967	22.2	1986	111.9
1968	23.7	1987	120.8
1969	26.1	1988	122.7
1970	26.6	1989	123.7
1971	30.2	1990	129.9
1972	35.8	1991	138.2
1973	43.4	1992	137.9
1974	42.8	1993	134.8
1975	48.6	1994	141.9
1976	63.3	1995	150.2
1977	64.9	1996	138.9
1978	67.5	1997	146.8
1979	89.3	1998	153.5
1980	84.4	1999	164.2
1981	82.5	2000	176.9
1982	100.0	2001	164.2
1983	112.4		

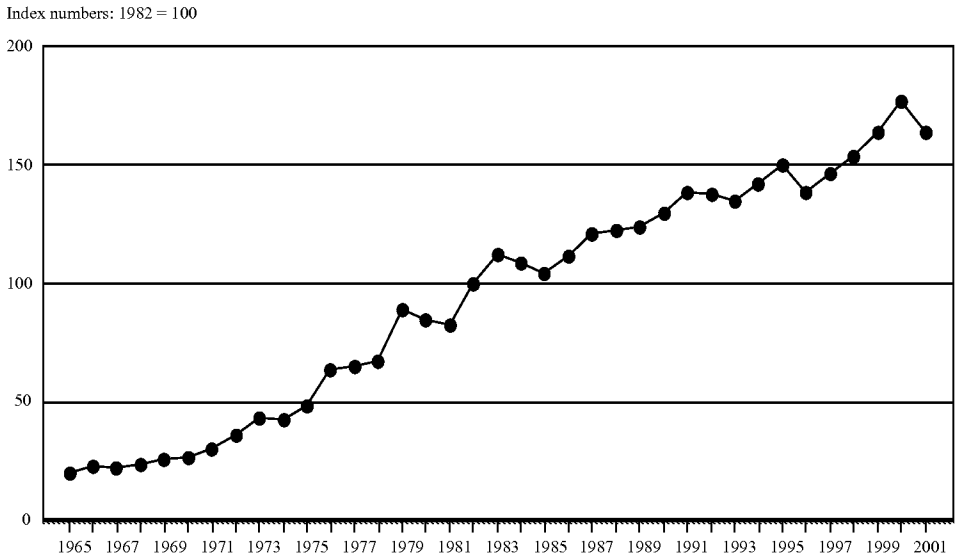


Figure 1. Non-seasonally Adjusted Annual Index Values for Frozen Packaged Fish and Seafood, an Item Within The Processed Foods and Feeds Group Which is Part of The Producer Price Index – Commodities Family

Scope of This Report

Only Texas offshore landings and ex-vessel values are used to estimate the magnitude of the 2001 production shortfall and the associated drop in cumulative ex-vessel value. It is not the authors' intention to (i) slight the contributions of inshore Texas operators by omitting production that originates from the coastal bay complex or (ii) disregard conditions in the rest of the Gulf and South Atlantic. Rather, this decision was made because a more complete picture can be created of how offshore trawlers are impacted by production and pricing issues because more cross-sectional, time series information has been collected and summarized about this segment of the industry. Also, research initiated several years ago by some of the authors has led to the creation of various standardized measures of financial position and performance that show trends in the business of offshore shrimp trawling [3]. These measurements were derived from two sources: (i) accrual-adjusted, end-of-cycle financial statements (balance sheets and income statements) prepared by Certified Public Accountants using generally accepted accounting principles and (ii) other supporting information provided by vessel owners (e.g., annual, physical measures such as days at sea, pounds of shrimp landed, gallons of diesel fuel used, etc.). All segments of the shrimp industry should benefit from this in-depth review of Texas offshore shrimp fishermen.

Background Comments on The Shrimp Resource and Shrimp Fishing

Shrimp are a short-lived species with a life span of 12 to 14 months. Nature has given the shrimp an extremely high fecundity – a single gravid female may release as many as 300,000 eggs per spawn. Once they are spawned offshore these eggs undergo several morphological changes, ultimately entering the coastal bay complex as post-larval shrimp where they grow rapidly to sub-adults. Cued by changing water temperatures as well as the lunar phase, these young shrimp migrate back offshore to mature, mate, and spawn; all in less than a year.

While the protective bay systems are an ideal nursery area, meteorological events can trigger dramatic ecological changes in these shallow water bodies. For example, late-season cold-fronts in the Spring tend to push water out of the back bays where emergent cord grasses and detrital material provide an ideal combination of protection from predators and food for juvenile shrimp. Likewise, heavy spring rains in upland watersheds impact juvenile shrimp in two ways. First, detrital material is flushed out of the back bays which reduces available food. Second, the salinity regime may be rapidly altered which stresses the shrimp.

Because the size of the annual crop is primarily determined by meteorological and resulting ecological conditions, shrimp production can dramatically fluctuate from one year to the next, making annual variation in harvests the constant companion of shrimp fishermen. From 1965 to 2001, production of shrimp from the Texas portion of the Gulf of Mexico has averaged 42.2 million pounds of shell-on, headless product. Comparing annual production with the 37-year average indicates that yearly harvests have fluctuated by approximately 14 percent about the long-term average. Importantly though, the wild shrimp resources are healthy. Recently the National Marine Fisheries Service reported that Gulf of Mexico shrimp resources are not overfished or even approaching an overfished state – a concern in many of the world's other wild-harvest fisheries [4].

In addition to fluctuations in annual harvests, the ex-vessel value of annual harvests has also varied through time. Between 1965 and 2001 annual, real, ex-vessel value fluctuated, on average, by 19 percent when compared against the 37-year average. Of course, part of the variation in cumulative ex-vessel value is due to fluctuating annual harvests, but the prices paid to fishermen for their catches have undergone quite a bit of variation as well. Importantly though, the drivers of ex-vessel price changes have, themselves, gradually changed. Forty years ago, local harvests and the quantity of a particular count size held in frozen storage

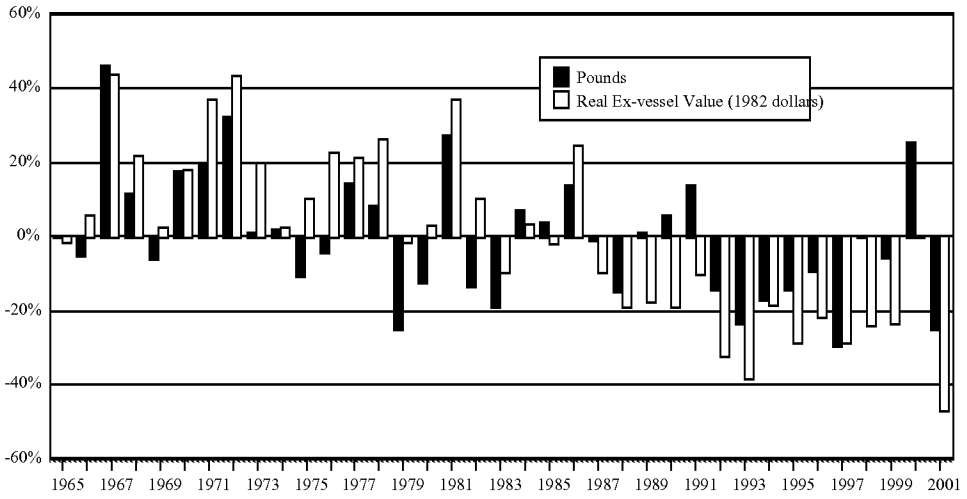
combined to determine the price fishermen would receive for their catch. At that time, domestic production accounted for well over half of U.S. consumption. With current U.S. consumption nearing 1.3 billion pounds and world shrimp production surpassing 4.3 billion pounds (shell-on, headless market form) [5], the web of (i) national economic conditions, (ii) tariffs, (iii) food safety issues, and (iv) currency exchange rates among the major shrimp-consuming regions drive the world trade in shrimp. In turn, these conditions collectively affect the price local shrimp fishermen receive for their catches.

Current Conditions at the Vessel Level

There is an old saying among commercial fishermen that *"as good as it gets is as bad as it gets."* In the recent past, as good as it has been for the offshore shrimp fisherman was calendar 2000; a year characterized by a large catch of shrimp (52.8 million shell-on, headless pounds) with a real ex-vessel value of $146.6 million (1982 dollars). From a production standpoint, calendar 2000 stands as the forth-best year on record over the 37-year history (Table 2, Figure 2). The 2000 catch of 52,807,101 pounds was surpassed only in 1967 (all-time record production of 61,658,986 pounds), 1972 (second-highest annual production of 55,663,461 pounds), and 1981 (the third-highest catch of 53,576,820 pounds). But even with a near-record catch, the real value of the 2000 catch still did not equal the 37-year average of $146.9 million (1982 dollars). In fact, when the cumulative, real, ex-vessel value of $146,558,470 (1982 dollars) is compared with the 37-year history, the fourth-best production year falls to nineteenth place out of 37 years in the landed value category. Prior to 2000, the most recent banner year was 1986 when Texas gulf shrimp fishermen produced $182.4 million (1982 dollars) worth of shrimp which amounted to a 24 percent increase above the long-term average. Between 1987 and 1999, the annual, real, ex-vessel value was consistently well below the 37-year average. Calendar 2000 astounded most producers with a bountiful catch, and the cumulative, real ex-vessel value for the Texas offshore harvest was the first year since 1986 that it rose enough to approach the long-term average; welcome relief from the previous 13 years. Calendar 2001 may well reflect the other half of the expression *"as good as it gets is as bad as it gets."* In 2001, Texas offshore shrimp fishermen produced only 31.7 million pounds of shell-on, headless shrimp (25 percent below the 37 year average). The Texas offshore shrimp harvest in calendar 2001 was ranked 35th out of 37 years. Only 1979 and 1997 experienced lower annual catches than those recorded in 2001. However, when 1979, 1997, and 2001 are evaluated by real, ex-vessel value, 1979 – with a real landed value $144,675,963 (1.5 percent below the 37-year average) – was 21st out of 37 years, and 1997 – with $104,766,834 (28.7 percent below the 37-year average) – was ranked 34th out of 37 years. The real ex-vessel value of the 2001 Texas offshore harvest was just $78.2 million (46.7 percent below the 37-year average, real ex-vessel value of $146.9 million). The cumulative, real ex-vessel value of the 2001 harvest was, by far, the lowest over the last 37 years.

Table 2. Annual Percentage Deviation in Production and Real Ex-vessel Value (1982 dollars) from the Thirty-seven Year Average for Texas Shrimp Harvested from the Gulf of Mexico

	Shell-on, Headless Pounds			Real Ex-vessel Value (1982 dollars)		
Year	Pounds	Difference	Pct. Change	Value	Difference	Pct. Change
1965	42,167,129	(6,860)	-0.0%	144,845,983	(2,036,752)	-1.4%
1966	40,109,549	(2,064,440)	-4.9%	155,037,942	8,155,207	5.6%
1967	61,658,986	19,484,997	46.2%	211,252,366	64,369,631	43.8%
1968	46,998,928	4,824,939	11.4%	178,494,373	31,611,638	21.5%
1969	39,600,879	(2,573,110)	-6.1%	150,469,607	3,586,872	2.4%
1970	49,548,942	7,374,953	17.5%	173,408,606	26,525,871	18.1%
1971	50,463,535	8,289,546	19.7%	200,602,256	53,719,521	36.6%
1972	55,663,461	13,489,472	32.0%	210,475,509	63,592,774	43.3%
1973	42,549,096	375,107	0.9%	176,099,408	29,216,673	19.9%
1974	42,968,758	794,769	1.9%	150,330,226	3,447,491	2.4%
1975	37,672,797	(4,501,192)	-10.7%	161,998,620	15,115,885	10.3%
1976	40,374,418	(1,799,571)	-4.3%	179,917,604	33,034,869	22.5%
1977	48,145,273	5,971,284	14.2%	178,253,914	31,371,179	21.4%
1978	45,656,705	3,482,716	8.3%	185,353,181	38,470,446	26.2%
1979	31,665,290	(10,508,699)	-24.9%	144,675,963	(2,206,772)	-1.5%
1980	36,859,048	(5,314,941)	-12.6%	150,967,596	4,084,861	2.8%
1981	53,576,820	11,402,831	27.0%	201,049,759	54,167,024	36.9%
1982	36,525,896	(5,648,093)	-13.4%	161,842,930	14,960,195	10.2%
1983	34,235,309	(7,938,680)	-18.8%	132,438,568	(14,444,167)	-9.8%
1984	45,061,698	2,887,709	6.9%	151,437,417	4,554,682	3.1%
1985	43,781,206	1,607,217	3.8%	144,364,835	(2,517,900)	-1.7%
1986	47,909,345	5,735,356	13.6%	182,401,275	35,518,540	24.2%
1987	41,840,498	(333,491)	-0.8%	132,539,566	(14,343,169)	-9.8%
1988	36,012,355	(6,161,634)	-14.6%	118,924,845	(27,957,890)	-19.0%
1989	42,648,702	474,713	1.1%	121,518,107	(25,364,628)	-17.3%
1990	44,576,492	2,402,503	5.7%	118,922,586	(27,960,149)	-19.0%
1991	47,976,677	5,802,688	13.8%	131,755,088	(15,127,647)	-10.3%
1992	36,167,977	(6,006,012)	-14.2%	99,629,157	(47,253,578)	-32.2%
1993	32,343,333	(9,830,656)	-23.3%	91,005,821	(55,876,914)	-38.0%
1994	34,958,672	(7,215,317)	-17.1%	120,174,398	(26,708,337)	-18.2%
1995	36,085,447	(6,088,542)	-14.4%	105,341,591	(41,541,144)	-28.3%
1996	38,226,650	(3,947,339)	-9.4%	115,256,077	(31,626,658)	-21.5%
1997	29,784,076	(12,389,913)	-29.4%	104,766,834	(42,115,901)	-28.7%
1998	42,216,986	42,997	0.1%	111,823,927	(35,058,808)	-23.9%
1999	39,884,764	(2,289,225)	-5.4%	112,460,246	(34,422,489)	-23.4%
2000	52,807,101	10,633,112	25.2%	146,558,470	(324,265)	-0.2%
2001	31,714,805	(10,459,184)	-24.8%	78,266,529	(68,616,206)	-46.7%
Avg.	42,173,989			146,882,735		
Average, annual, absolute percent change			13.5%			19.0%



The 37-year average offshore harvest is 42.2 million shell-on, headless pounds
The 37-year average value of the offshore harvest is $146.9 million real (1982) dollars

Figure 2. Annual Percentage Deviation in Production and Real Ex-vessel Value from the Thirty-seven Year Average for Texas Shrimp Harvested from the Gulf of Mexico

Reconciling the disparities of a near-record catch with a real landed value that almost equaled the 37-year average (i.e., the 2000 situation) or a disastrous harvest with a real landed value that fell just short of the 37-year average by 1.5 percent (i.e., the 1979 situation) is best explained by the ex-vessel prices fishermen were paid for their catches in those years.[2] In 2000, the annual, real, ex-vessel price per pound was $2.78 while the real, ex-vessel price per pound paid in 1979 was $4.57 (Table 3, Figure 3). Last year, the third-poorest catch in the last 37 years was priced at the lowest level in the 37-year time series, making 2001 the worst year on record. As Figure 3 illustrates, annual, real, ex-vessel prices per-pound have mostly increased between 1965 and 1982, but since 1982 annual, real, per-pound prices have declined. When these two time intervals were tested for trend, with time (year) being the only explanatory variable, the period 1965 to 1982 reflected an *increase* of 4.1¢ per pound each year while the time frame 1982 to 2001 demonstrated a 5.7¢ per pound *decrease* each year. A visual review of these data suggest that other issues besides trend were responsible for annual price changes. However, from a statistical perspective trend was a significant component in the two time frames under investigation.

2. For this discussion, the annual, real, ex-vessel prices per pound are the quotients found by dividing the annual, real ex-vessel value by the pounds harvested. This is a fairly gross measure of price changes through time because specific count sizes and the contribution each count size makes to the annual harvest are ignored.

Table 3. Computed, Annual, Real, Ex-vessel Prices per Pound for Texas Shrimp Harvested from the Gulf of Mexico

Year	Annual price per pound (1982 dollars)	Year	Annual price per pound (1982 dollars)	Year	Annual price per pound (1982 dollars)
1965	3.44	1978	4.06	1991	2.75
1966	3.87	1979	4.57	1992	2.75
1967	3.43	1980	4.10	1993	2.81
1968	3.80	1981	3.75	1994	3.44
1969	3.80	1982	4.43	1995	2.92
1970	3.50	1983	3.87	1996	3.02
1971	3.98	1984	3.36	1997	3.52
1972	3.78	1985	3.30	1998	2.65
1973	4.14	1986	3.81	1999	2.82
1974	3.50	1987	3.17	2000	2.78
1975	4.30	1988	3.30	2001	2.47
1976	4.46	1989	2.85		
1977	3.70	1990	2.67		

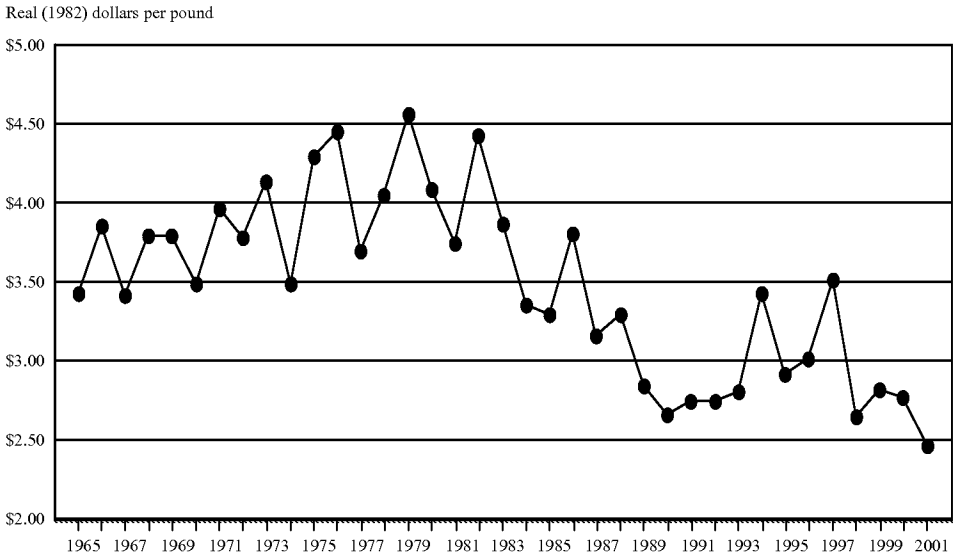


Figure 3. Computed, Annual Real Ex-vessel Prices per Pound for Texas Shrimp Harvested from the Gulf of Mexico

For some industries such as manufacturing, the ability to weather a year characterized by sharp reductions in revenue requires that managers reduce or defer certain expenses. In addition to aggressive cost control measures, managers will also opt to utilize productive assets as intensively as possible (i.e., 24-hour per day operations) so long as the difference between unit selling prices and unit variable costs is positive. In so doing, some contribution to fixed expenses can be made.

Unfortunately, there is not much opportunity for fishermen to improve the bottom line by reducing expenses. Cooperative research with offshore producers that collected and summarized various measures of financial position and performance revealed that between 1986 and 1997, total annual trawler expense necessary to generate one dollar of gross revenue (i.e., the production expense ratio) ranged from 83¢ to 119¢ (Table 4, Figure 4) [3].[3] Over the twelve-year time frame used in this study, the production expense ratio averaged 98¢ for the median trawler. In other words, it cost the median trawler 98¢ to generate each dollar's worth of revenue. This high ratio suggests two things. First, although shrimp fishermen land a high-valued product, offshore shrimp fishing was not a high-margin enterprise between 1986 and 1997. Second, operating expenses such as crew shares, fuel, repairs, and gear comprise virtually all of the expenses a trawler incurs. Thus, there are few expenses which are unnecessary and can therefore be eliminated or deferred and still operate the vessel.

Table 4. Total Trawler Expense Per dollar of Gross Revenue for Cooperating Offshore Shrimp Trawlers

	Cents of each gross revenue dollar required to cover all trawler expenses		
Year	75th Percentile	Median Vessel	25th Percentile
1986	109.0	100.0	92.1
1987	107.8	101.8	98.8
1988	119.0	107.9	105.5
1989	118.4	104.7	96.3
1990	105.1	97.8	90.6
1991	99.3	90.8	84.6
1992	104.7	97.9	95.4
1993	102.3	95.6	83.1
1994	101.3	92.7	88.3
1995	98.8	94.3	91.3
1996	101.8	97.2	92.4
1997	99.0	96.2	93.6

3. Summarizing annual performance measures and ratios can be done in several ways. The approach used in reporting research findings follows the methodology pioneered by RMA-The Risk Management Association (formerly known as Robert Morris Associates) a professional association that supplies lenders with baseline information about the financial position and performance of various industries. Rather than using the arithmetic mean to describe particular measurements or ratios, the studies compiled by RMA present ranges of financial ratios for particular industries that reflect the values realized by middle 50 percent of the industry. Values falling above or below the middle 50 percent are considered to be "unusual" values. For any distribution, this middle 50 percent is comprised of those data falling between the 25th and 75th percentile values. There are two reasons for following the convention of RMA. The first is consistency in reporting financial information to lenders. Loan officers are accustomed to industry summaries being expressed in terms of ranges. The second is accuracy in reporting the expected value of a distribution of specific ratios or measures. When the data are normally distributed, all measures of central tendency – the mean, median, and mode – return the same value. However, if the data are not normally distributed, then using the mean to communicate the summary value of a data stream will not be an accurate estimate of the expected value of the distribution. When the data are skewed, the median provides a more accurate measure of the expected value of a particular distribution [6]. In other words, when the distribution of a measure or ratio is described with the median, one does not have to assume that the distribution of that particular measure or ratio is normal.

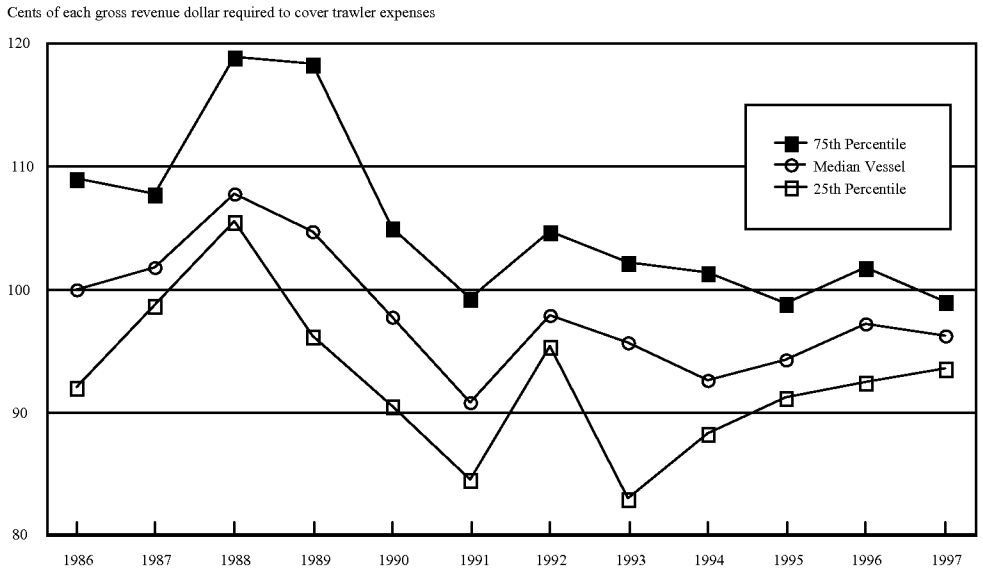


Figure 4. Total Trawler Expense Per Dollar of Gross Revenue for Cooperating Offshore Shrimp Trawlers

This cooperative research project with offshore producers also measured the number of days a trawler fished each year. These data were accumulated into annual totals from settlement sheets maintained by the vessel owner. Over the same twelve-year time frame, median days-at-sea ranged from 227 (i.e., the vessel fished 62 percent of the year) to 264 (i.e., the vessel fished 72 percent of the year). These values suggest that the offshore trawler fleet is operating at or very near to a maximum annual level. Therefore, the two survival avenues open to firms like manufacturers – reducing or deferring certain expenses and, if feasible, boosting throughput that can make a contribution to fixed expenses – are not available to the offshore trawler fleet.

It is against this backdrop of stunning declines in ex-vessel value – a 46.7 percent reduction in real ex-vessel value earned in 2001 compared against the 37-year average of $146.9 million – and the lack of normal *"belt-tightening"* options available to producers that has the domestic shrimp industry pondering its next step. Part of knowing the next move to make revolves around understanding what is occurring in the world shrimp trade.

Current Conditions Driving Global Shrimp Trade

Of the seafood commodities, shrimp typifies a worldwide supply chain required to satisfy demand in the three major shrimp-consuming regions: the United States, the European Union, and Japan. This section begins with a brief history of changes in worldwide shrimp supplies and a review of consumption trends in the major shrimp markets. Next, the U.S. market is addressed. This segment of the report emphasizes the sources of supply required to meet market needs and the effects of market growth upon traditional inventory management practices of processors. Following the section on the U.S. market, trading policies, currency exchange rates, and food safety concerns are reviewed because these issues are the primary criteria that determine where shrimp produced in one country are ultimately sold.

Trends in World Shrimp Supplies, and the Increasing Importance of Aquaculture

Shrimp are available from practically every tropical and subtropical coastal country in the world. Historically, the source of supply has been wild harvests from the worldwide band of nearshore tropical waters. Between 1979 and 1999, world production of tropical shrimp grew from 1.86 billion pounds of shell-on, headless product to 4.3 billion pounds [5].

With many wild sources being harvested close to their maximum sustainable levels, new supplies have come from coastal shrimp farms, most located in developing countries within Asia, the Indian sub-continent, and Central America. In 1979, pond-raised shrimp contributed just 88 million shell-on, headless pounds to world production (4.7 percent) while wild sources supplied 1.78 billion pounds [5]. Twenty-one years later wild harvests stand at 2.74 billion pounds worldwide, while cultured shrimp contribute 1.57 billion pounds (36.5 percent) to the world production base of tropical shrimp (Table 5, Figure 5). Over this 21-year time frame, wild harvests grew about 41 million pounds a year while pond production grew by about 84 million pounds each year. Closer examination of worldwide growth in cultured shrimp reveals that between 1979 and 1990, production grew by 962 percent (almost a ten-fold increase). On an annual basis therefore, farmed shrimp output increased by 87 percent each year between 1979 and 1990. However, between 1991 and 1999, aquaculture production grew by 36 percent, with average annual growth amounting to 4.5 percent. Of course, additional quantities of cultured shrimp were still entering the market each year, but the average annual growth rate from 1991 to 1999 was sharply lower than the rapid growth experienced between 1979 and 1990.

Table 5. Worldwide Production of Tropical Shrimp
from Capture Fisheries and Aquaculture

	Shell-on, Headless Pounds			
Year	Capture	Aquaculture	Total Supplies	Percent Cultured
1979	1,773,416,673	88,072,110	1,861,488,783	4.7%
1980	1,804,307,202	99,875,718	1,904,182,919	5.2%
1981	1,702,061,594	123,080,079	1,825,141,673	6.7%
1982	1,794,246,977	155,604,248	1,949,851,225	8.0%
1983	1,787,352,626	197,509,347	1,984,861,973	10.0%
1984	1,841,473,910	239,339,432	2,080,813,342	11.5%
1985	2,050,588,216	296,782,173	2,347,370,389	12.6%
1986	2,157,141,578	444,073,748	2,601,215,325	17.1%
1987	2,102,309,049	686,417,911	2,788,726,960	24.6%
1988	2,135,543,073	801,477,038	2,937,020,112	27.3%
1989	2,006,452,142	863,014,994	2,869,467,136	30.1%
1990	2,034,144,847	935,179,947	2,969,324,795	31.5%
1991	2,145,651,918	1,157,905,145	3,303,557,063	35.1%
1992	2,139,891,113	1,237,293,679	3,377,184,791	36.6%
1993	2,063,872,657	1,178,313,148	3,242,185,805	36.3%
1994	2,278,169,882	1,237,160,320	3,515,330,202	35.2%
1995	2,237,239,967	1,323,777,990	3,561,017,957	37.2%
1996	2,356,067,858	1,335,178,744	3,691,246,602	36.2%
1997	2,508,452,056	1,390,439,131	3,898,891,187	35.7%
1998	2,548,422,069	1,493,166,774	4,041,588,843	36.9%
1999	2,735,697,548	1,570,763,304	4,306,460,851	36.5%

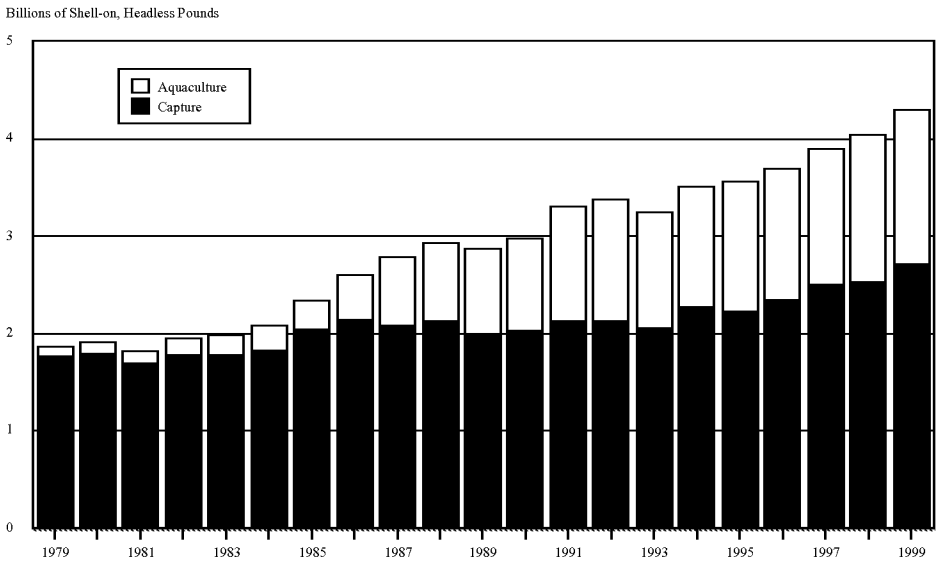


Figure 5. Annual Changes in World Production of Tropical Shrimp From Capture Fisheries and Aquaculture

A Review of Market Growth in the Major Shrimp-consuming Countries

Time series data that detail apparent consumption of shrimp for Japan and the European Union (E.U.) are somewhat fragmented.[4] With respect to the time series that describes shrimp consumption in the E.U., data were only available for the time frame between 1988 and 1999. Apparent consumption data for the E.U. were originally expressed on a product weight basis, then converted to a heads-on or round weight basis by the author of the original report [5].These data were converted again into the shell-on, headless market form for this report so a consistent classification could be used to present the 12 years of information.

The U.S. began the 12-year time series as the largest single market of the three, and has consistently remained so (Table 6, Figure 6) [5]. While an upward trend is visually evident from both the table and accompanying figure, the computed annual growth in apparent consumption of shrimp in the U.S. is 27.3 million pounds a year. By comparison, the E.U. is the second largest major market for shrimp, with consumption increasing by an average of roughly 25 million pounds per year between 1988 and 1999. In contrast to both the U.S. and the E.U., shrimp consumption in Japan grew between 1988 and 1994 but then began to decline in response to slower economic growth that affected consumer demand for shrimp [5].

4. Market size is generally measured by apparent consumption of the product. Apparent consumption is computed by the following algorithm: Apparent consumption = [landings + imports + (Dec. 31 cold storage holdings in the previous year – Dec. 31 cold storage holdings in the current year) – exports]. End-of-year cold storage adjustments reflect the amount of product withheld from the market or entered into the market as determined by changes from one year to the next.

Table 6. Apparent Annual Consumption of Shrimp Among Major Markets

	Shell-on, headless pounds			
Year	USA	European Union	Japan	Total
1988	788,280,000	513,810,467	618,465,015	1,920,555,482
1989	738,633,000	554,359,756	670,020,120	1,963,012,876
1990	719,225,000	611,884,457	683,426,520	2,014,535,977
1991	777,954,000	662,350,887	688,806,720	2,129,111,607
1992	840,958,000	716,991,714	685,373,535	2,243,323,249
1993	817,042,000	694,483,316	713,890,800	2,225,416,116
1994	870,247,000	727,996,560	725,755,905	2,323,999,465
1995	846,644,000	695,055,646	695,648,835	2,237,348,481
1996	864,468,000	743,123,014	689,604,930	2,297,195,944
1997	930,642,000	722,002,378	641,037,600	2,293,681,978
1998	1,000,792,000	848,346,959	571,333,140	2,420,472,099
1999	1,102,047,000	816,296,490	596,265,075	2,514,608,565

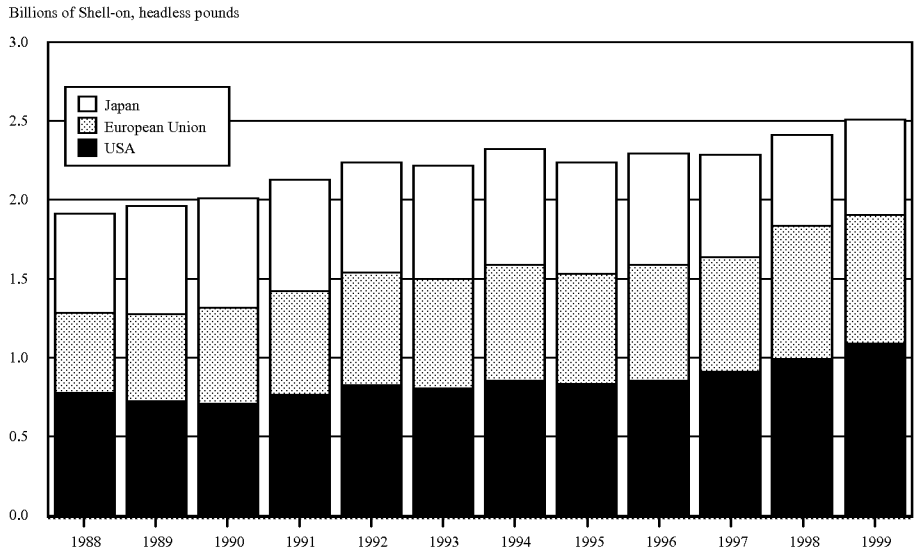


Figure 6. Apparent Consumption of Shrimp Across the Major World Markets

When worldwide supplies (Table 5, Figure 5) are compared with total apparent consumption from the three major markets (Table 6, Figure 6), it is clear that shrimp consumption across the rest of the world is also increasing. In 1988, approximately two-thirds of worldwide supplies (1.9 billion shell-on, headless pounds) were consumed in the U.S., the E.U. and Japan, with 1 billion pounds consumed in the rest of the world. In 1999 however, the U.S., the E.U. and Japan consumed 58 percent (2.5 billion pounds) of the 4.3 billion pound worldwide supply that year, with the rest of the world using approximately 1.8 billion pounds. Increasing worldwide consumption outside the major shrimp markets is a positive signal for the domestic shrimp industry because it suggests that more of the growing supply base is being consumed outside the U.S., the E.U., and Japan.

Growth in The U.S. Market

Apparent consumption data across the major shrimp-consuming regions in the world was limited to just 12 years. A longer time series – 1980 through 2001 – is available to assess growth in U.S. shrimp consumption [1]. Apparent consumption of shrimp in the U.S. has virtually tripled since 1980, growing from around 423 million pounds to approximately 1.3 billion pounds in 2001 (Table 7, Figure 7). Statistically, an upward-sloping linear trend accounts for about 90 percent of total variation in apparent consumption between 1980 and 2001.[5] The remaining 10 percent of variation in apparent annual consumption is accounted for by cyclical and random variation. Since 1980, apparent consumption has grown by an average of 33 million pounds each year.[6]

Table 7. The U.S. Market for Shrimp

	Thousands of Pounds of Shell-on, Headless Product						
Year	Landings	Imports	Dec. 31 Cold Storage Holdings	Cold Storage Adjustments	Exports	Apparent Consumption[a]	Computed Trend in Consumption
1979	205,587	267,119	109,634		53,058	NA	NA
1980	207,869	255,957	109,509	125	41,054	422,897	436,048
1981	218,900	256,920	89,886	19,623	43,721	451,722	469,000
1982	175,613	319,596	76,645	13,241	37,198	471,252	501,953
1983	155,591	421,179	101,357	(24,712)	35,937	516,121	534,906
1984	188,132	422,340	81,596	19,761	26,591	603,642	567,858
1985	207,239	452,232	79,379	2,217	26,940	634,748	600,811
1986	244,409	492,005	75,633	3,746	30,450	709,710	633,764
1987	223,514	583,030	92,319	(16,686)	33,813	756,045	666,716
1988	203,350	598,210	70,816	21,503	34,784	788,279	699,669
1989	215,825	563,523	67,770	3,046	36,056	746,338	732,622
1990	213,899	579,427	78,035	(10,265)	59,682	723,379	765,574
1991	198,115	632,775	71,655	6,380	87,186	750,084	798,527
1992	207,086	694,252	69,105	2,550	81,604	822,284	831,480
1993	180,687	708,683	76,751	(7,646)	81,447	800,277	864,433
1994	174,969	749,993	70,789	5,962	77,755	853,169	897,385
1995	190,208	719,463	71,528	(739)	77,677	831,255	930,338
1996	195,902	720,852	61,857	9,671	75,130	851,295	963,291
1997	179,084	810,696	67,926	(6,069)	66,674	917,037	996,243
1998	173,304	893,578	83,891	(15,965)	65,302	985,615	1,029,196
1999	189,112	959,915	79,893	3,998	65,427	1,087,598	1,062,149
2000	218,542	1,024,476	66,633	13,260	70,383	1,185,895	1,095,101
2001	201,428	1,178,232	81,842	(15,209)	67,975	1,296,476	1,128,054

a. Apparent consumption = [landings + imports + (Dec. 31 cold storage holdings in the previous year – Dec. 31 cold storage holdings in the current year) – exports]. End-of-year cold storage adjustments reflect the amount of product withheld from the market or entered into the market as determined by changes in subsequent years. For example, end-of-year inventories between 1999 and 2000 dropped from 79,893,000 lb. to 66,633,000 lb., so an additional 13,260,000 lb. entered the market in calendar 2000.

5. Trend is one component of a time series that underlies growth, decline, or both elements. The trend component can be described by a straight line, a parabola (which embodies both growth and subsequent decline), an exponential curve(i.e., growth with a constant percentage increase over time) or a Gompertz curve where initial growth is rapid, but slows after a certain point [7].

6. Importantly, the expected annual growth rate in consumption will be different when a 22-year data stream is used versus a 12-year time series in the previous section.

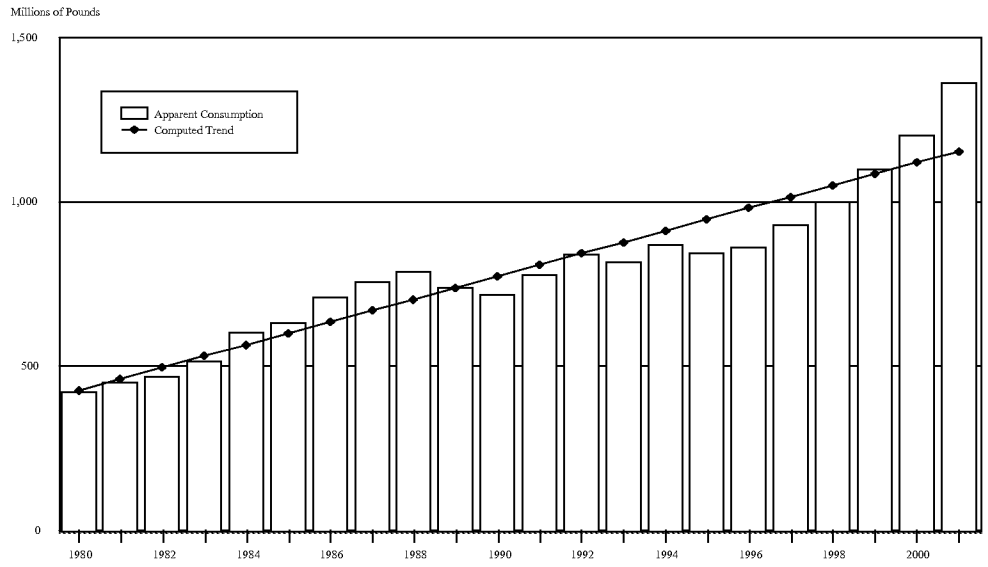


Figure 7. The U.S. Market for Shrimp (shell-on, headless basis)

Since 1980, domestic landings of tropical shrimp have remained relatively steady.[7] Therefore, with consumption increasing by an average of 33 million pounds each year, virtually all of the growth has been fueled by imports. Because of significant growth in the total domestic shrimp market, the market share of domestic producers has gradually slipped from 44.6 percent in 1980 to 14.6 percent in 2001 (Table 8, Figure 8). It is important to realize that the domestic market share has dropped because of market growth, not declining production levels in the domestic shrimp fishery.

Table 8. Domestic and Import Market Shares of the U.S. Shrimp Market

	Thousands of Pounds			Market Share			Thousands of Pounds			Market Share	
Year	Landings	Imports	Total	Domestic	Import	Year	Landings	Imports	Total	Domestic	Import
1979	205,587	267,119	472,706	43.5%	56.5%	1991	198,115	632,775	830,890	23.8%	76.2%
1980	207,869	255,957	463,826	44.8%	55.2%	1992	207,086	694,252	901,338	23.0%	77.0%
1981	218,900	256,920	475,820	46.0%	54.0%	1993	180,687	708,683	889,370	20.3%	79.7%
1982	175,613	319,596	495,209	35.5%	64.5%	1994	174,969	749,993	924,962	18.9%	81.1%
1983	155,591	421,179	576,770	27.0%	73.0%	1995	190,208	719,463	909,671	20.9%	79.1%
1984	188,132	422,340	610,472	30.8%	69.2%	1996	195,902	720,852	916,754	21.4%	78.6%
1985	207,239	452,232	659,471	31.4%	68.6%	1997	179,084	810,696	989,780	18.1%	81.9%
1986	244,409	492,005	736,414	33.2%	66.8%	1998	173,304	893,578	1,066,882	16.2%	83.8%
1987	223,514	583,030	806,544	27.7%	72.3%	1999	189,112	959,915	1,149,027	16.5%	83.5%
1988	203,350	598,210	801,560	25.4%	74.6%	2000	218,542	1,024,476	1,243,018	17.6%	82.4%
1989	215,825	563,523	779,348	27.7%	72.3%	2001	201,428	1,178,232	1,379,660	14.6%	85.4%
1990	213,899	579,427	793,326	27.0%	73.0%						

7. Of course, annual harvests have continuously fluctuated as expected with any organism whose abundance is determined by meteorological events that trigger short-term habitat changes. Testing for the presence of trend (i.e., a long term change either up or down) in annual harvest of shrimp off the Texas coast using landings data from 1960 through 2000 revealed statistically, that no trend existed in these data. This does not mean that there is no variation in the time series. Rather, annual production is not systematically increasing or decreasing through time.

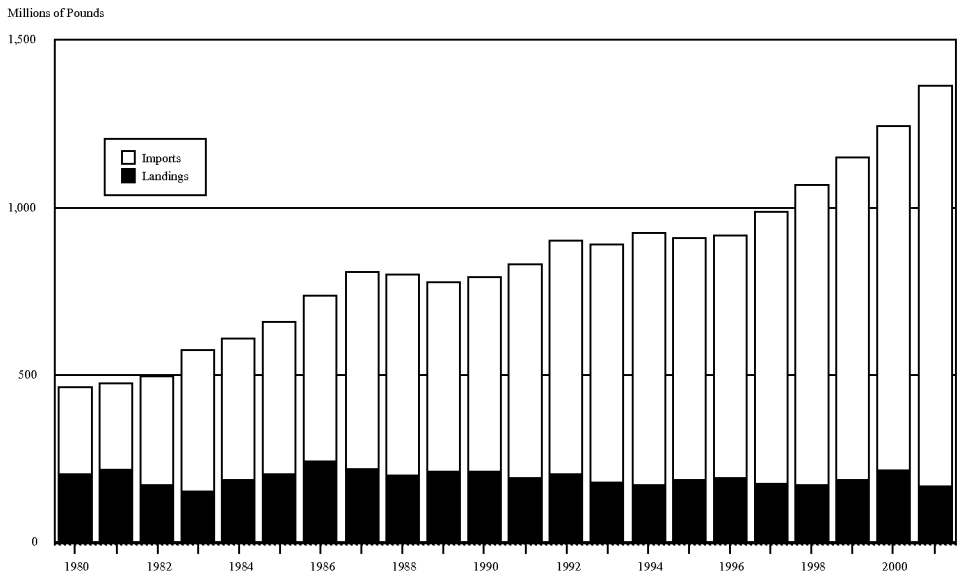


Figure 8. The Contribution Domestic Landings and Imports Make to The U.S. Shrimp Market (shell-on, headless market form).

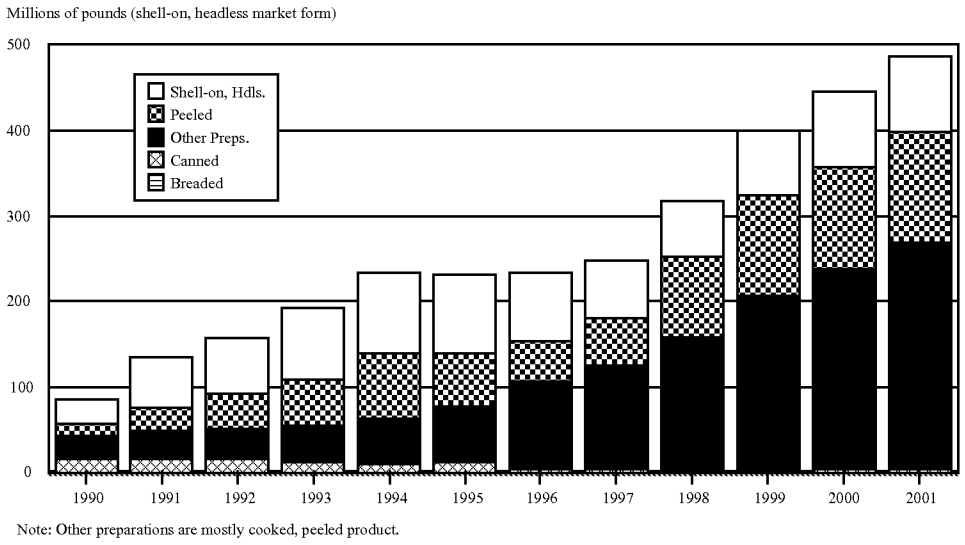
In addition to obvious growth in the U.S. shrimp market, a review of import data suggests that the imported product mix is also changing. Thailand, the largest single importer of shrimp into the American market, demonstrates unmistakably that many countries are exporting the *"fruits"* of relatively inexpensive labor as much as their home-grown products (Table 9, Figure 9) [8].[8] In 1990, Thai exports to the U.S. were 85.4 million pounds (shell-on, headless market form equivalent), with canned shrimp accounting for approximately 20 percent of the total poundage [9]. Shell-on, headless product and cooked, peeled shrimp each accounted for approximately 32 percent of total exports, with raw, peeled shrimp comprising the remaining 16 percent of total exports to the U.S. In 2001, total Thai exports to the U.S. had increased to roughly 486 million pounds, but the composition of these shrimp exports drastically changed. Canned product had dropped from about 17 million pounds (shell-on, headless market form equivalent) in 1990 to 5.4 million pounds in 2001, and accounted for just 1 percent of total shrimp imports from Thailand. The ultimate in convenience – hand-peeled, cooked, ready-to-eat, shrimp – represented roughly 55 percent of the 486 million pounds shipped to the U.S. in 2001. Raw hand-peeled product, a great labor-saving market form for food service establishments, accounted for about 27 percent of total shrimp imports from Thailand. Shell-on, headless shrimp, the product with the least amount of convenience added by Thai workers, accounted for approximately 18 percent of all Thai shrimp that was exported to the U.S.

8. The Bureau of Statistics, an office of the International Labor Organization, collects various statistics on wages, hours worked, number of employees for some 200 countries. These data are categorized according to the International Standard Industrial Classification system. For Thai enterprises that manufacture food, beverages, and tobacco, the average monthly wage in 1999 (the most recent data available) was 5,243 Baht. Expressed in U.S. dollars, these Thai workers earned $124.87 per month. An hourly wage rate was calculated assuming four 40-hour work weeks per month. Thus, in 1999, the hourly wage rate was 78¢. Using this same website to compare the hourly wage rates of production employees in food and beverage manufacturing firms in the U.S. revealed that the average wage per hour in 1999 was $12.11.

Table 9. Growth in Shrimp Imports from Thailand and Changes in the Thai Shrimp Product Mix: 1990 – 2001

	Shell-on, headless pounds					
Year	Breaded	Canned	Other Preps.[a]	Peeled	Shell-on, Hdls.	Total Imports
1990	0	17,098,843	27,296,756	13,715,646	27,239,219	85,350,464
1991	573,570	17,035,097	32,528,613	27,399,492	57,677,429	135,214,201
1992	765,577	16,855,562	35,442,206	39,633,110	65,241,729	157,938,184
1993	200,412	13,072,467	43,326,376	53,775,689	81,916,011	192,290,955
1994	211,726	10,697,095	53,016,271	77,796,429	90,921,396	232,642,917
1995	244,010	12,243,402	66,347,429	62,545,054	90,023,946	231,403,841
1996	252,942	4,057,946	103,624,932	47,036,414	78,671,320	233,643,554
1997	222,761	3,939,952	123,194,835	55,646,005	65,315,333	248,318,886
1998	236,689	3,750,917	155,847,398	93,593,877	63,883,226	317,312,107
1999	169,561	3,396,839	205,320,149	116,599,278	74,318,407	399,804,234
2000	353,133	4,791,573	234,866,402	119,455,672	85,301,217	444,767,997
2001	586,447	5,410,334	264,655,639	129,969,301	85,336,435	485,958,156

a.Other preparations are mostly cooked, peeled products.



Note: Other preparations are mostly cooked, peeled product.

Figure 9. Growth in Shrimp Imports from Thailand and Changes in the Thai Shrimp Product Mix: 1990 – 2001

Historic Inventory Management Practices of Domestic Processors Compared with Current Market Conditions

Domestic production peaks in July, August, and September off Texas, but the prime market windows for shrimp have traditionally been the fourth and first quarters of each year. Historically, cold storage was the bridge between wild harvests and sales. Buying shrimp in the late summer and early fall when it was plentiful, and gradually selling it during the holiday season and in the first half of the subsequent year when production abated was a standard practice in the fifties, sixties, seventies, and eighties. Realizing that dockside prices generally moved inversely to production peaks allowed processors to buy shrimp, and then sell it later when prices were generally higher. Not surprisingly, earnings from inventory held for subsequent sale became a significant revenue stream for many processors.

However, the risks associated with holding shrimp began to increase as the growing shrimp market was supplied with a greater fraction of imported product. In general, the market risk of holding shrimp for subsequent sale (i.e., declines in wholesale market prices) increased because processors had less knowledge about the quantity of shrimp moving into the domestic market. For example, between 1990 and 2000 the annual imports of all count sizes of shell-on, headless product ranged from 314 million pounds to 352 million pounds. Within this time frame, the average annual percent deviation from the 11-year average of 334.9 million pounds was 3.8 percent. Between 2000 and 2001 though, the imports of all count sizes of shell-on, headless shrimp jumped by 102.9 million pounds; a 30 percent increase (Table 10, Figure 10) [9].

Table 10. Total, Annual U.S. Imports of Shell-on Headless Shrimp (all count sizes)

Year	Pounds imported	Difference	Pct. Difference
1990	327,181,128		
1991	313,553,734	(13,627,394)	-4.2%
1992	351,823,986	38,270,252	12.2%
1993	341,206,203	(10,617,783)	-3.0%
1994	335,438,026	(5,768,177)	-1.7%
1995	327,353,891	(8,084,135)	-2.4%
1996	318,057,833	(9,296,058)	-2.8%
1997	343,704,529	25,646,696	8.1%
1998	341,956,621	(1,747,908)	-0.5%
1999	344,962,900	3,006,279	0.9%
2000	338,798,439	(6,164,461)	-1.8%
2001	441,658,040	102,859,601	30.4%
Average annual percent change: (1990 - 2000)			3.8%
Average annual percent change: (1990 - 2001)			6.2%

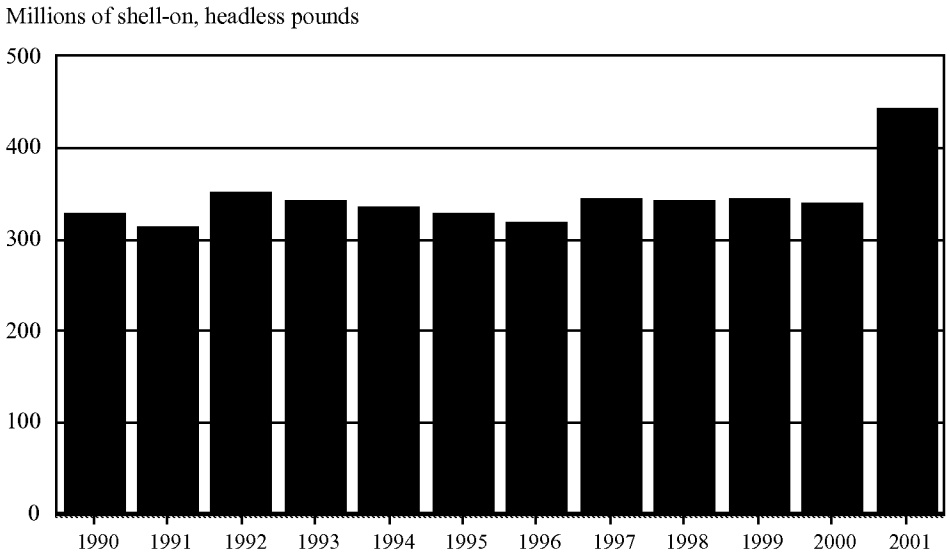


Figure 10. Annual U.S. Imports of Shell-on, Headless Shrimp (all count sizes)

Certain count sizes have become more prevalent in the market, and this growing supply of specific count sizes changes the prices processors expect. With respect to large shrimp, the black tiger shrimp (*Penaeus monodon*) – generally cultured in Southeast Asia – has changed the traditional contribution large-count shrimp (e.g., 16 to 20, 21 to 25, and 26 to 30 tails per pound) make to the total supply of shrimp on the domestic market. Thus,

the bellwether of the Texas offshore industry, large-sized shrimp, is losing some of its prominence in response to greater supplies of black tiger shrimp [10]. In 2001, 5.4 million pounds of 1 to 20 count shrimp were produced off Texas, but imports of 1 to 20 count shrimp amounted to 96.6 million pounds that year. That 96.6 million pounds represented 22 percent of all shell-on, headless shrimp imported in 2001. In the western hemisphere, the most economic culture regimen for Pacific white shrimp (*Litopenaeus vannamei*) has centered on producing three crops per year with the most common size count falling within the size count classification of 41 to 50 tails per pound. In the wild domestic shrimp fishery, this size count is most abundant in early summer as the shrimp migrate offshore and become available for harvest. In 2000, imports of 31 to 40 and 41 to 50 count tails were respectively 63.9 million pounds and 36.3 million pounds. Between 2000 and 2001, imports of 31 to 40 count tails increased by 23 percent above 2000 imports to 78.7 million pounds, and imports of 41-50 count tails increased by 26 percent above the 2000 level to 45.6 million pounds.

Shrimp farming has changed much more than the quantity and distribution of count sizes on the market. With its just-in-time processing and delivery capability, shrimp farming works against the customary approaches domestic processors of wild-harvested shrimp have used over the years because once the shrimp are purchased, the processor is immediately susceptible to market risk. This is a pivotal concern to all domestic processors since their cost of goods sold (i.e., purchases of shrimp) is relatively high. Historically, adding convenience and value to shell-on, headless shrimp by peeling, breading, and cooking provided domestic processors with a competitive advantage. However with roughly 60 percent of total imports falling into the hand-peeled raw and cooked categories in 2001 (724 million pounds of peeled and cooked, peeled products expressed on a shell-on, headless basis), domestic processors must compete head-to-head across the entire shrimp product line.

Perhaps the best quantitative example of the fundamental impact imported shrimp is having on the domestic processing industry is the amount of shrimp held in cold storage as a fraction of current year shrimp supplies.[9] This relationship, expressed as a percentage value, reflects the number of weeks of the annual supply that is held in frozen storage. With imports increasing each year to support growth in the domestic market (Table 8, Figure 8 above), the percentage of annual supplies held in cold storage at year end has steadily dropped. In 1980, almost three months of shrimp supplies were held in frozen storage while in 2001 just three weeks of shrimp supplies were held in frozen storage (Table 11, Figure 11). The reason why cold storage holdings as a percent of annual supplies have trended downward is clear. Shrimp are literally available from worldwide producing regions with a phone call, so bridging the gap between peak production periods and prime marketing windows with frozen inventory is not as important as in previous times. This does not mean that domestic processors have altered their approach of accumulating shrimp in the third quarter of each year and subsequently marketing it into the following year. Processors that rely on the wild harvest have little choice in when shrimp are available, and the customary cycle of inventory accumulation follows the tempo of the wild harvest.[10]

9. Cold storage holdings as a percent of annual shrimp supplies is found by dividing the reported cold storage holdings on December 31 by the annual supply of shrimp (the annual supply of shrimp is found by summing landings and imports and subtracting exports). One month of a year's supply held in cold storage holdings equals 8.3 percent while one week of a year's supply held in cold storage holdings equals 1.9 percent.

10. If year-end cold storage data were available for just the **domestic** processing segment, the amount of shrimp held in cold storage as a fraction of current-year domestic landings would be stable over the same time series (1980 through 2001). However with the domestic industry supplying just 14.6 percent of the market, the collective impact of domestic processors on year-end cold storage holdings is muted in deference to the national market that is dominated by the import sector.

Table 11. End-of-year Cold Storage Holdings as a Percent of Annual Shrimp Supplies

	All categories expressed as thousands of shell-on, headless pounds					
Year	Landings	Imports	Exports	Annual Supply	Dec. 31 Cold Storage Holdings (CSH)	CSH as Pct. of Annual Supply
1979	205,587	267,119	53,058	419,648	109,634	26.1%
1980	207,869	255,957	41,054	422,772	109,509	25.9%
1981	218,900	256,920	43,721	432,099	89,886	20.8%
1982	175,613	319,596	37,198	458,011	76,645	16.7%
1983	155,591	421,179	35,937	540,833	101,357	18.7%
1984	188,132	422,340	26,591	583,881	81,596	14.0%
1985	207,239	452,232	26,940	632,531	79,379	12.5%
1986	244,409	492,005	30,450	705,964	75,633	10.7%
1987	223,514	583,030	33,813	772,731	92,319	11.9%
1988	203,350	598,210	34,784	766,776	70,816	9.2%
1989	215,825	563,523	36,056	743,292	67,770	9.1%
1990	213,899	579,427	59,682	733,644	78,035	10.6%
1991	198,115	632,775	87,186	743,704	71,655	9.6%
1992	207,086	694,252	81,604	819,734	69,105	8.4%
1993	180,687	708,683	81,447	807,923	76,751	9.5%
1994	174,969	749,993	77,755	847,207	70,789	8.4%
1995	190,208	719,463	77,677	831,994	71,528	8.6%
1996	195,902	720,852	75,130	841,624	61,857	7.3%
1997	179,084	810,696	66,674	923,106	67,926	7.4%
1998	173,304	893,578	65,302	1,001,580	83,891	8.4%
1999	189,112	959,915	65,427	1,083,600	79,893	7.4%
2000	218,542	1,024,476	70,383	1,172,635	66,633	5.7%
2001	201,428	1,178,232	67,975	1,311,685	81,842	6.2%

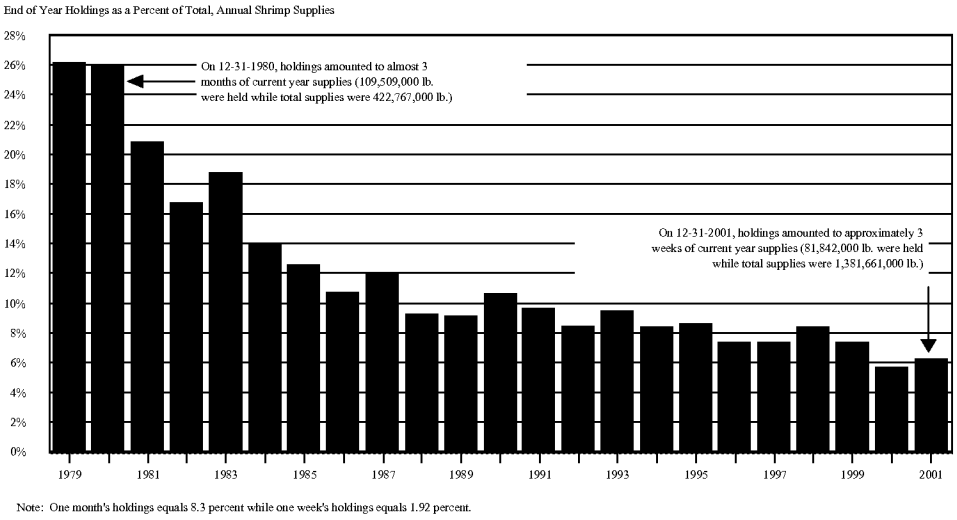


Figure 11. End-of-year Cold Storage Holdings as a Percent of Annual Shrimp Supplies

The Effects of Tariffs, Currency Exchange Rates, and Food Safety Considerations in Directing Shrimp Trade

Tariff Issues. Shrimp are routinely traded on the world market, but individual countries have differing approaches in taxing imported shrimp. Furthermore, in some countries the tariff rates can change almost overnight, or can be applied differently to various market forms of the same product. Other things being equal, tariffs result in the exporter netting less money on the transaction than if those shrimp were sold in countries with low or, in some cases, no tariffs. Of course if the price offer takes the tariff into account, then other factors like currency exchange rates and differences in transportation costs direct the flow of shrimp from producing country to consuming country.

All market forms of shrimp enter the U.S. market duty-free [11]. On the other hand, the E.U. exemplifies a trading block of nations where tariffs for certain products are in a state of flux. Specifically, certain nations that export shrimp to the E.U. experienced tariff treatment different from that accorded to other shrimp-producing countries. Earlier this year Thai shrimp marketers were surprised to learn that the lower tariffs the E.U. had imposed under the generalized system of preferences had ended, and the tariff on Thai shrimp would be 12 percent on frozen, raw products and 20 percent on cooked shrimp [12]. E.U. duties on processed shrimp (e.g., peeled or cooked, peeled varieties) from other countries such as Peru, Indonesia, India and Vietnam were taxed at between 3.6 percent and 7 percent, while a tariff rate of 4.2 percent was applied to frozen (e.g., shell-on, headless) shrimp. Importantly, such tariff increases make shrimp from countries affected by these higher tariffs appear less expensive in competing markets.

Currency Exchange Rates. Exchange rates for currency are important issues for most shrimp-exporting countries because the revenues earned from the sale of shrimp in many developing countries are used to fund improvements in national infrastructure. Generally speaking, national infrastructure such as aircraft, road-building services, petroleum development, electrical power and its distribution, etc. is priced in U.S. Dollars, Euros, or Yen [12].

When the exchange rates are factored into the pricing formula along with tariffs, the final destination of shrimp exported from a producing country can clearly be seen. Tables 12 through 14 illustrate three scenarios of tariffs and currency exchange rates. In Table 12, a hypothetical Thai marketer offers shrimp to an E.U. buyer under the provisions of a 4.2 percent tariff and a Dollar/Euro exchange rate of 1.0823 [13]. As shown in Table 12, after accounting for the tariff and the exchange rate, the price of 5 Euros per pound offered by the E.U. buyer nets the marketer $4.426 per pound.

Table 12. Computing a U.S. Dollar Equivalent Price for Thai Shrimp Offered for Sale in the E.U. with a 4.2 Percent Tariff and an Exchange Rate where One U.S. Dollar Equals 1.0823 Euros

Conditions: Current E.U. tariff is 4.2 percent ▪ Exchange rate: 1 Euro = $0.924 ▪ Exchange rate: $1.00 = 1.0823 Euro	
A firm in the E.U. bids 5.00 Euros/lb.	A bid is also solicited from a U.S. firm.
Determine E.U. bid price in U.S. dollars after accounting for tariff and exchange rate issues: = (5.00 Euro / lb. * (1 - % tariff)) * ($1.00 / 1.0823 Euro) = (5.00 Euro / lb. * (0.958)) * ($1.00 / 1.0823 Euro) = 4.79 Euro / lb. * $0.924 / Euro = 4.79 ~~Euro~~ / lb. * $0.924 / ~~Euro~~ = $4.426 / lb. **After paying the tariff and accounting for the exchange rate, that bid of 5.00 Euros/lb. is worth $4.426 U.S.**	If the U.S. bid price is at least equal to $4.426 / lb. then the Thai processor would sell his shrimp in the U.S. assuming that transportation costs are equal.

In Table 13 only the tariff rate has changed; this time to 12 percent. After the tariff increase, the Thai marketer would net $4.065 per pound on the same bid of 5 Euros per pound. If the freight cost from Bangkok, Thailand to either the U.S. or Europe is the same, then should a U.S. buyer offer a price just above the $4.065 the seller would net in the E.U., then those shrimp would likely be shipped to the U.S.

Table 13. Computing a U.S. Dollar Equivalent Price for Thai Shrimp Offered for Sale in the E.U. with a 12 Percent Tariff and an Exchange Rate where One U.S. Dollar Equals 1.0823 Euros

Conditions: Current E.U. tariff is 12 percent ▪ Exchange rate: 1 Euro = $0.924 ▪ Exchange rate: $1.00 = 1.0823 Euro	
A firm in the E.U. bids 5.00 Euros/lb.	A bid is also solicited from a U.S. firm.
Determine E.U. bid price in dollars after accounting for tariff and exchange rate issues: = (5.00 Euro / lb. * (1 - % tariff)) * ($1.00 / 1.0823 Euro) = (5.00 Euro / lb. * (0.88)) * ($1.00 / 1.0823 Euro) = 4.40 Euro / lb. * $0.924 / Euro = 4.40 ~~Euro~~ / lb. * $0.924 / ~~Euro~~ = $4.065 / lb. **After paying the tariff and accounting for the exchange rate, that bid of 5.00 Euros/lb. is worth $4.065 U.S.**	If the U.S. bid price is at least equal to $4.065 / lb. then the Thai processor would sell his shrimp in the U.S. assuming that transportation costs are equal.

Table 14 presents conditions where one U.S. Dollar is worth less than one Euro. In this situation, the 5 Euro per pound bid would actually be worth $5.72 per pound. In this scenario, the American shrimp buyer would have to offer something at least equal to $5.72 for shrimp to be delivered to the United States.

Table 14. Computing a U.S. Dollar Equivalent Price for Shrimp Offered for Sale in the E.U. with a 12 Percent Tariff and an Exchange Rate where One U.S. Dollar Equals 0.769 Euros

Conditions: Current E.U. tariff is 12 percent ▪ Exchange rate: 1 Euro = $1.30 ▪ Exchange rate: $1.00 = 0.769 Euro	
A firm in the E.U. bids 5.00 Euros/lb.	A bid is also solicited from a U.S. firm.
Determine E.U. bid price in dollars after accounting for tariff and exchange rate issues: = (5.00 Euro / lb. * (1 - % tariff)) * ($1.00 / 0.769 Euro) = (5.00 Euro / lb. * (0.88)) * ($1.00 / 0.769 Euro) = 4.40 Euro / lb. * $1.30 / Euro = 4.40 ~~Euro~~ / lb. * $1.30 / ~~Euro~~ = $5.72 / lb. **After paying the tariff and accounting for the exchange rate, that bid of 5.00 Euros/lb. is worth $5.72 U.S.**	If the U.S. bid price is at least equal to $5.72 / lb. then the Thai processor would sell his shrimp in the U.S. assuming that transportation costs are equal.

Thus, when the dollar is valued higher than the native currency in the country (or trading block) where the shrimp are sold, the shrimp appear less expensive in the American market, and product would be expected to flow to the U.S. Conversely, when the native currency in the country (or trading block) where the shrimp are sold is valued higher than the dollar, the shrimp would have to command a relatively high price in the U.S. to remain competitive with the bid offered in another country. In this situation, the exporter may find it easier to sell his shrimp in the E.U. because to equal the bid of 5 Euros per pound, a U.S. firm would have to offer at least $5.72 per pound.

Food Safety Issues. All national public health agencies have standards and specifications for domestically produced and imported products. Recently chloramphenicol, the broad-spectrum antibiotic, was detected in shrimp offered for sale in the E.U. With a zero tolerance for this compound, public health authorities in the E.U. blocked importation of shrimp. Faced with a zero tolerance for this compound in the E.U., shrimp exporters redirected their shrimp shipments to the U.S. When this issue first surfaced, the U.S. action level for chloramphenicol was 5 parts per billion [14]. Recently, officials in several Gulf states have initiated a sampling plan to determine the presence and level of chloramphenicol in imported product. Early sampling has shown the presence of the compound in farm-raised shrimp and crawfish. This issue has now become a concern of the Food and Drug Administration, and the federal action level has been lowered to 1 part per billion. Determining an allowable limit of therapeutic drug residues is a matter of public health that regulatory authorities address. History suggests that issues such as these are aggressively managed by regulatory authorities, and chloramphenicol is no exception. In time, the action levels for therapeutic aquaculture drugs in all major seafood-importing countries will be consistent.[11] In practice, most importing countries adopt virtually identical food safety criteria because a country maintaining a less stringent action level would suggest that the consuming public in that country does not have the same public health assurances provided by other countries.

Competing in The Global Shrimp Business: A Proposed Action Plan for The Domestic Industry

What are the options for the U.S. tropical shrimp industry, which currently contributes 14.6 percent to the domestic market, to compete in a world market where it takes Texas gulf shrimp fishermen more than 90¢ to land a dollar's worth of shrimp? Fishing longer (i.e., more days at sea) is probably not a viable option for the Texas offshore shrimp fleet because, as a recent survey showed, vessels are currently fishing between 60 and 70 percent of the year. Considering issues like months when production is historically minimal or the crews' family commitments, Texas vessels are currently fishing at or near a maximum level. Reducing expenses is difficult since the major expenses are operational in nature (e.g., fuel, crew shares, gear, and repairs and maintenance). Due to the distribution of shrimp as they move into deeper Gulf waters with age, reducing the *number* of vessels in the fleet will *not necessarily* increase the efficiency of the remaining fleet (i.e., increase the Catch Per Unit Effort thereby boosting revenues). This same fact (coupled with a relatively high natural mortality for tropical shrimp) argues against Individual Transferable Quotas as a solution to the problem. On the other hand, the simplest way to improve the economic condition of the domestic shrimp industry would be to position wild-harvested shrimp in a niche market as a premium product, commanding a premium dockside price over comparably sized pond-raised imports. How might this be accomplished?

Published scientific data as well as anecdotal observations by individuals historically associated with the domestic shrimp industry indicate that wild-harvested shrimp which are *properly handled on board and in the processing plant*, have a discernibly improved flavor over their pond-raised counterparts [15]. This is thought to be due primarily to the increased abundance of free amino acids which the animals utilize to counteract the large osmotic gradient which exists in salty offshore waters. Conversely, pond-raised shrimp are most efficiently raised in tropical countries during the rainy season when pond salinities may drop to one-tenth that of open ocean water. There is also speculation that the unique flavor of wild-harvested shrimp is due in part to their diet of high-protein natural foods (i.e., other crustaceans, polychaete worms, etc.) versus the cereal grain-based feeds required to grow shrimp at high densities in ponds. The suggested stepwise action plan would be to:

11. When two countries' food safety standards (i.e., differing standards for the therapeutic drugs, pathogens, etc.) are inconsistent, this difference becomes the driving force in determining the destination for some imports. For example, if Country A has a zero tolerance but Country B has a more relaxed standard, not surprisingly the products that cannot meet the zero tolerance criteria in Country A would be destined for Country B where the standards are less stringent.

- Carry out sensory and chemical laboratory analyses to determine the chemical components contributing to the unique flavor of wild-harvested shrimp.

- Determine the optimal trawl tow time, on-board handling procedures, and processing plant operations which will assure a consistent, high-quality and uniquely flavorful product.

- Establish a statistically valid sampling procedure to verify that shrimp receiving the *"wild harvest"* quality label meet the established standards.

- Promote these shrimp as a product which should be used in simply-prepared specialty dishes such as boiled shrimp cocktails where the natural flavor of the shrimp can be appreciated.

- Pursue a relationship with those food distributors and grocery chains that emphasize organic products. The recent promotion of wild Alaska salmon certified under the Marine Stewardship Council's eco-labeling program by Whole Foods Market is an excellent example of public/private promotional efforts. Whole Foods Market is the world's largest natural and organic foods supermarket chain [16].

Summary and Conclusions

Calendar 2001 was the worst year, dollar-wise, for offshore producers in 37 years (Table 2, Figure 2). Collectively, Texas gulf operators generated but $78.3 million (1982) dollars, just 53 percent of the 37-year average, real, ex-vessel value. Beginning in 1987, Texas gulf operators have faced 13 sequential years when real, ex-vessel values were below the long-term average. Recovering from a year like 2001 is challenging since cooperative research with offshore vessel owners reveals a production expense ratio in excess of 90¢ (Table 4, Figure 4). This means that it costs offshore shrimp fishermen more than 90¢ to generate one dollar of revenue.

Looking forward, the first half of 2002 suggested to vessel owners and processors alike that fundamental changes were occurring in the global shrimp business that appeared to be leaving the domestic industry sidelined. In particular, political events occurring half a world away had a dramatic impact on worldwide shrimp trade which ultimately affected local dock-side prices. Specifically, a tariff increase by the E.U. for Thai shrimp immediately reduced the net price Thai firms would realize when selling to E.U. companies (Tables 11 and 12). This single event then placed downward pressure on prices offered by U.S. shrimp marketers, and additional product flowed into the U.S. Likewise, short-term differences in food safety standards among the major shrimp-consuming regions also pushed more product into the American market as some exporting nations with chloramphenicol levels above specified action levels were prohibited from selling in the E.U. The composition of shrimp imports are of particular concern to our domestic processing industry. Black tiger shrimp cultured in Asia grow to a larger size, and these compete directly with domestic 1 to 20, 21 to 25, and 26 to 30 count products. As well, additional supplies of hand-peeled raw and cooked product entered the market, further depressing wholesale prices and forcing processors to reconsider how best to add convenience and value to shrimp products when domestic wage rates are several times higher than rates paid in some shrimp-producing countries.

The domestic industry has two primary concerns. First, there is much fretting about the upcoming 2002 season that begins off Texas in mid-July. With liquid assets stretched, vessel owners are scrambling to ready their vessels for the upcoming season. Yet, many are questioning what this season will hold. A series of late-season cold-snaps pushed water out of the back bays along the Texas coast, and generally this suggests a delay in offshore harvests once the Texas offshore season opens. With downward pressure on prices, many operators are wondering whether even an above-average catch will improve their bottom line. The second primary concern of many in the industry is that domestic production levels, processing strategies, and inventory management approaches have become irrelevant in determining domestic prices.

Importantly, some of the recent issues that caused abrupt changes in the global shrimp business this year – like the short-term differences in action levels for drugs used in aquaculture – may ultimately have a *"silver lining"* for the domestic industry. Regarding chloramphenicol residues in shrimp tissue, all of the major shrimp-importing regions will ultimately employ the same standard, so differences in action levels will no longer be a determinant in where shrimp are ultimately sold. As these action levels drop to the lower limits of detection, output from some farming regions may decline. It should also be recalled that while shrimp from farming systems grew by 87 percent a year between 1979 and 1990, the growth rate between 1991 and 1999 has been just 4.5 percent a year (Table 5, Figure 5). Furthermore, when annual world shrimp supplies are compared with consumption in Japan, the E.U. and the U.S. (Table 6, Figure 6) it is clear that the rest of the world is consuming an increasing fraction of growing world shrimp supplies.

Addressing the impacts of greater sophistication in marketing and the competitive advantage of relatively inexpensive labor in most shrimp-producing regions of the world is a more difficult undertaking. In eleven years, processors of cultured shrimp went from exporting roughly two-thirds of total production as the shell-on, headless market form to converting a significant fraction of their annual harvests into value-added products like hand-peeled raw and cooked product (Table 9, Figure 9). Using domestic production in head-to-head competition with these value-added products will be difficult because of sharply lower wages paid to processing plant workers in developing countries.

Importantly however, wild-caught shrimp have a flavor profile that results from two factors that cannot be duplicated in pond systems: (I) the native diet of shrimp that includes other crustaceans, worms, etc., and (ii) the increased abundance of free amino acids which the animals utilize to counteract the large osmotic gradient which exists in salty offshore waters. Capitalizing on these distinguishing attributes will require a host of steps. These include (I) designing and implementing a comprehensive quality assurance system involving production and processing interests, (ii) positioning the product as one best used in simple preparations like boiling or steaming so the natural flavor intensity is highlighted, and (iii) working cooperatively with those segments of the food industry that have already carved out a niche for *"natural, additive-free"* foods.

Finally, it is incumbent upon all in the domestic industry to remember that today they are victims of their own innovation and creativity. Pioneering fishermen developed the gear and know-how necessary to fish for the nocturnal brown shrimp in the Gulf of Mexico that today comprises 80 percent of Texas shrimp landings. Once the shrimp were off-loaded, sorting shrimp by size presented processors with monumental materials handling challenges. High speed shrimp sorting equipment was developed in South Texas, and some fifty-five years later the family business still sells shrimp sorting equipment across the globe. Hand in hand with extended offshore fishing trips came the need to preserve shrimp quality. Innovative producers designed and installed immersion brine freezing systems aboard shrimp trawlers that solidly freeze shrimp in minutes, thereby preserving their fresh-caught quality. This industry has led in innovation and creativity, and the *"fruits"* of this work have been implemented around the globe in shrimp-producing countries. That same spirit of innovation is needed today, but the industry needs to focus on the combination of procedures and processes at the production and processing levels necessary to supply an increasingly sophisticated market with consistent quality products that have superior flavor and can thus command premium prices.

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