Chapter Seven

Summary - Status of the Gulf of Mexico and Southern Atlantic States Shrimp Fisheries

7.1 Introduction

Imports have severely impacted prices in the Gulf of Mexico and southern Atlantic states shrimp fisheries. Although shrimp landings have remained fairly constant, averaging 267 million pounds since 1980, prices have declined—primarily due to a growth in imports in spite of increasing consumer demand. Ex-vessel prices[1] declined 27% in the Gulf of Mexico and 24% in the southern Atlantic states shrimp fishery between 1997 and 2002 as imports increased 300%. This price decline has resulted in a significant decline in gross revenue of 41.7% in the Gulf of Mexico and 32.5% in the southern Atlantic states between 2000 and 2002. The impact of the decline in shrimp prices on gross revenue in the Gulf of Mexico would have been much greater had 2002 had not been an average year for landings.

Shrimp demand analyses indicate that imports have adversely impacted shrimp prices. First, domestic prices at the ex-vessel level decline by about 55 cents for every one dollar decline in import price.[2] As can be seen in Table 7-1, import prices have generally fallen since 1997, resulting in a corresponding decline in both ex-vessel prices and wholesale prices. Second, from 1980 to 2001 in Figure 7-1, imports of shrimp increased from under 300 million pounds to over 1.2 billion pounds (heads-off weight), while exports have remained relatively constant since 1991. This approximately 300% increase in imports resulted in a significant decline in the ex-vessel price for domestically harvested shrimp. According to Keithly, et al., (1993), ex-vessel price should decline 84 cents per pound for every hundred million pounds of shrimp imported into the U.S. Although this 300% recent increase is beyond the range of data used in the Keithly market analysis, the increase in imports in Figure 7-1 would result in a substantial decline in ex-vessel price and should be the primary cause for the long-run decline in reported prices.

The growth in imports into the United States is attributed to three factors. First, although economic conditions have declined in the three primary shrimp importing regions (U.S., Japan, and the EU), the relative strength of the U.S. economy has led to a greater rate of import growth. Second, a changing EU tariff structure has redirected shrimp from Thailand (a major producer) into U.S. markets. Third, higher detection levels for the banned substances chloramphenicol and nitrofuran under sanitary and phytosanitary measures have resulted in a redirection of shrimp products from the EU to U.S. markets. However, it is equally important to recognize that the increased trade flow reflects not just increased production in total, but also the source of the increased output; i.e., farmed production versus wild production. First, the farm-raised product has greater and more consistent quality than the wild product. Second, farmed product is less

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[1] Ex-vessel prices have been made comparable over time by converting them to constant 2001 dollars to eliminate the effect of inflation.

[2] Preliminary Inverse Demand Model for Shrimp:

Real Price (2003=100) = 0.53397 -0.0000000035284*Landings + 0.55125 * Real Import Price
(1.9947) (2.695) (5.403)

where values in parentheses are the t-statistics.

seasonal in nature and therefore more reliable in terms of steady supply than its wild counterpart. Third, species and sizes can be controlled better in a farm-based system than in a wild-based system. Finally, the current trend toward vertical integration in the farming system lends itself to better adaptation to consumer needs. These factors have led to a surge in imports into the U.S. over the last five years.

Table 7-1. Constant Dollar Wholesale, Ex-vessel, and Import Prices, 1997-2001[a]

Year	Wholesale Price	Ex-vessel Price	Import Price
1997	5.48	2.13	5.20
1998	5.02	2.03	5.03
1999	5.07	2.05	4.72
2000	5.13	2.14	5.25
2001	4.74	1.73	4.25

This import-induced price decline and the increase in diesel fuel prices that began in October, 2002 (Vondruska, 2003) reduced earnings for shrimp harvesting operators by reducing revenues and increasing operating costs. Shrimp trawling operations are particularly susceptible to increases in fuel costs, which represent a relatively large portion of their operating costs. Ward, Ozuna, and Griffin (1995) estimated that fuel costs represent approximately 25% of commercial fishermen's total cost of harvesting shrimp. Fishery management regulations to reduce gear conflicts, marine turtle mortality, and finfish bycatch levels have also increased operating costs in the shrimp fishery. These increases in operating costs and the decline in ex-vessel price reduce total revenues from fishing and significantly increase the probability that shrimpers will exit the fishery (Ward and Sutinen, 1994). Given the magnitude of the changes in ex-vessel price and costs reported for the Gulf of Mexico shrimp fishery, the economic incentive for shrimpers to leave the fishery is as significant as the financial cost to those forced to leave the fishery.

The harvest sector is not the only sector that bears the cost of a decline in shrimp prices. The number of firms engaged in Southeast shrimp processing activities has declined almost by half, from 173 to 89 during the 1980-2001 period (Figure 7-3). As indicated, the decline has been relatively steady, with a reduction of more than 50 firms in the last decade (1991 through 2001). This compares with a reduction of only about 20 firms during the decade of the 1980s. This Southeast shrimp processing sector consolidation is partially tied to the increasing import base, including increased imports of value-added products, primarily peeled raw and cooked shrimp. Overall, the deflated price of the processed product fell from well over $7.00 per pound (headless shell-on equivalent weight) during the early 1980s to less than $4.00 per pound during the late 1990s and into the next decade (Figure 7-4). The decline has been, for the most part, steady with no sign of abatement. Southeast shrimp processing establishments have coped with this decline in per unit profitability by producing, on average, a substantially higher amount of product per firm than they did during the 1980s. Overall, production averaged about 1.3 million pounds per firm during the early 1980s (Figure 7-5). By 1999-2001, this average had increased to more than 3.2 million pounds. The deflated value of output per firm averaged about $9.5 million during the 1980-82 period and advanced to over $12 million during the period 1999-

2001. Overall, the estimated marketing margin has declined substantially, with most of the decline occurring since the early 1990s. This is certainly one indication that per-unit profitability is falling and provides a rationale for the substantial exit behavior observed since the early 1990s. Overall, the number of processors in the Gulf fell by about 40%, from 124 to 72, while the reported number of South Atlantic processors fell from 49 to 17, or by almost two-thirds (Figure 7-3). This could severely impact the 73,000 jobs generating approximately $1 billion in income and $1.4 billion in added value for the U.S. economy (Centaur Associates, 1984).

However, ex-vessel price declines had some positive impacts. First, per-capita consumption of shrimp (Figure 7-1) rose from under one and a half pounds in 1980 to nearly 3 and a half pounds by 2001, while the market share for domestic harvesters declined from approximately 40% (Figure 7-2). As a result, shrimp is now the primary seafood product consumed by the U.S. public. Coupled with the growth in national population over the same time period, this increase in per capita consumption fueled the record consumption of shrimp by final consumers. As can be seen in Figure 7-1, the rate of increase in both per-capita consumption and shrimp imports increased after 1996 as prices declined.

Second, overcapacity has declined in the shrimp fishery. The decline in fleet size that can be expected with the fall in ex-vessel prices as imports and fuel costs increase, can be expected to reduce both excess and overcapacity in the regulated open access shrimp fishery. Kirkley, et al. (2002) found that purchasing the 875 vessels that would eliminate overcapacity in the shrimp fishery will require $329.9 million of the estimated $1 billion vessel buyback program needed to eliminate overcapacity in five major fisheries.[3] While the decline in total revenue and the increase in operating costs will reduce overcapacity, it will squarely place the financial burden of this capacity reduction program on those who are forced to exit the shrimp fishery.

Third, lower prices resulting from the high level of imports have led to an expansion in consumption by U.S. consumers (Figure 7-1). Shrimp consumption per capita, which is approaching 3.5 pounds, is now at its highest level, even greater than the per-capita consumption of tuna in the U.S. To capitalize on this increased demand for shrimp, processors may wish to maintain a steady and consistently high-volume, import-augmented throughput to keep average costs down. Similarly, consumers would likely favor any situation that would produce high volumes of low-priced shrimp, as long as product quality is not compromised. Murray (2003) suggests that the economic impact from imported shrimp approaches $9 billion in economic output and contributes 138,000 jobs to the national economy.

These trends in ex-vessel price, operating costs, imports, and costs of reducing overcapacity in the shrimp fishery indicate that fishermen are facing a severe financial crisis. Without some form of financial relief, the shrimp fishery could suffer a catastrophic collapse, which would severely impact the Gulf of Mexico and southern Atlantic states' economies; e.g., 73,000 jobs generating approximately $1 billion in income and $1.4 billion in added value for the U.S. economy (Centaur Associates, 1984).

[3]The other four fisheries analyzed included the New England and West Coast groundfish fishery and the East Coast swordfish and shark fisheries.

However, changes made to the shrimp fishery to increase its financial stability need to take into account the complexity of shrimp management rules and regulations as well as the dependence of the nation on high quality and low cost shrimp, most of which is now imported. The changes proposed in this report are designed to improve the financial performance of the fishery without harming the financial viability of the dealers and processors who are dependent on domestic and imported shrimp products.

7.2 Alternatives

A range of alternatives has been suggested by industry, federal, state, Sea Grant, and academic representatives to improve the financial performance of the shrimp fishery in the Gulf of Mexico and southern Atlantic states. These alternatives have been analyzed using the General Bioeconomic Fishery Simulation Model (GBFSM) developed at Texas A&M University and used by the Gulf of Mexico and South Atlantic fishery management councils to develop net benefit estimates for fishery management regulations. Economic impacts were also provided based on an input-output model of the shrimp fishery developed at the Virginia Institute of Marine Science. The alternatives that were analyzed with the time and funds available include: permit or license moratorium, government buyback program, price support program, marketing program financed by a shrimp landings tax, fishermen's cooperatives, fractional license, and operating loan with payback

7.2.1 Description of Options

Permit or License Moratorium: A moratorium on permits or licenses would placed on vessels and compared to a fishery with open access. The GBFSM has an option for a moratorium on large (>60 ft) and small (<60 ft) vessels and it can also be used to analyze the option of placing the moratorium only on vessels >60 ft (those with permits in the EEZ).

Government Buyback Program: With this buyback option, the government could purchase the permit or license and vessel at a price equal to one year of revenue per vessel (for an average vessel). The model is set up where it has small vessels fish inshore and near-shore and therefore fish mostly in state controlled waters. These vessels will do very little fishing in the EEZ. Large vessels fish near-shore and offshore and must have a permit to fish in the EEZ. The buyback program has the option so that the buyback is for large and small vessels, and it will have the option to only buy back large vessels. The buyback program will be analyzed with both open access and a permit or license moratorium. Funding for the government buyback program will be analyzed from two sources of funding, which include a government grant and a loan to the shrimp fishery to be paid back with a tax on per dollar of shrimp landed over a five-year period at a 5% interest rate.

Price Support Program: This government price support program sets a target price by size class of shrimp. If the average price by size class falls below the target price, the government will pay the shrimpers the difference between the target price by size class and the average price by size class.

Increase Price through Marketing Paid for by Tax on Per Pound of Shrimp Landed: A marketing program to increase the price of shrimp would be paid for by a self-imposed tax of $0.01 on each pound of shrimp landed. Since the real effect of this marketing program is unknown, sensitivity analysis will be conducted by increasing the price by 0%, 5%, 10%, 15%, and 20% to deter the impact to shrimpers.

Cooperatives for Maximum Profit: This program assumes a cooperative will be formed, and members of the cooperative will manage it as a monopolist and use only enough vessels and effort to maximize profits to the cooperative. It will be assumed in each state there will be one cooperative for large vessels and one cooperative for small vessels. In this analysis, we vary effort from 0% to 100% in 5% increments to determine where approximate maximum profits will occur.

Fractional License Program: A fractional license (FL) program permanently reduces effort in the fishery by eliminating a portion of the licenses. This is accomplished by granting each vessel a tradable FL right (i.e., a right to a portion of a full license), yet establishing that a vessel can operate only if it obtains a full license. Fractional rights are traded among fishermen, so that a fraction of the total number of licenses is removed from the fishery.

The model assumes that vessels purchasing rights obtain government-backed, long-term loans. It is assumed that shrimpers will make a single, equal payment per year until the loan is paid off.

Operating Loan with Payback: After careful consideration, it was determined that the operating loan would not be analyzed in GBFSM for two reasons. First, such loans cannot be included in GBFSM without major revisions to the model, which is far beyond the cost of this project. Second, operating loans are designed to be paid back within a year. If shrimp prices stay at the 2002 level for more than a year, the following table is a projection of profit per vessel—given an open access fishery with no government assistance. Under these conditions and assuming that the operating loan must be paid back within a year, it would be of little use. The suggestion was made to use the capital construction fund for the operating loans. However, only a small number of vessel owners receive this source of funds, so it would not have much fishery impact and it would take legislative action to make these funds available. For all of these reasons, operating loans will not be included in this analysis.

Estimated average economic profit per vessel*

Year	Length < 60ft	Length > 60ft
2002	-2,972	-28,577
2003	-2,689	-25,446
2004	-2,338	-20,813
2005	-2,008	-16,028
2006	-1,711	-11,461

*Average economic profit goes up over time due to vessels exiting the shrimp fishery.

7.3 Models

Two models were used to evaluate the net benefits and impacts of these suggested alternatives. The General Bioeconomic Fishery Simulation Model (GBFSM) is based on a biological and an economic sub-model. The biological sub-model represents the recruitment, growth, movement, and mortality of shrimp. Shrimp mortality is due to both natural causes and fishing. When a management option is introduced in the GBFSM, the model calculates the changes in days fished, number of vessels and catch per unit of effort for shrimp. Based upon the biological effects of the management option simulated, the economic sub-model then calculates the impacts on costs, revenues, and rent for commercial vessels.[4]
The specifications of the GBFSM model as used in this analysis are provided below in the next section.

The second model is an input-output (I/O) model of the shrimp fishery. This I/O model is designed to estimate the economic impacts associated with the harvesting of shrimp by U.S. commercial fishermen. These impacts are expressed in terms of employment (full-time equivalent jobs), personal income, and output (sales by U.S. businesses).

The scope of the model includes the activities of commercial fishermen, dealers/ processors and wholesalers/distributors. For dealers/processors and wholesalers/distributors, only activities associated with domestically harvested shrimp are addressed. Excluded from the model's estimates are the activities at the retail level (food markets and restaurants) and activities associated with shrimp produced from U.S. aquaculture operations or from imports.

The model is designed to generate estimates from a single input, the value of shrimp landings in 2001. All subsequent calculations are based on this variable. The model generates estimates for employment, income, and output impacts. Each of these impacts is expressed as direct, indirect, and induced effects as well as the total of these effects.

Estimates are also disaggregated by major segments of the harvesting and seafood industries. The principal means of harvesting shrimp are by trawl and by butterfly net. Estimated impacts associated with these gear types are provided. Similarly, estimated impacts associated with dealers/processors and with wholesalers/distributors are provided. A description of the shrimp I/O model is provided here.

[4]Details of GBFSM's structure and its calibration can be found at http://GBFSM.tamu.edu.

7.3.1 GBFSM

The dimensions of the General Bioeconomic Fisheries Simulation Model (GBFSM) for this study are as follows:

Species of fish:	*Gulf of Mexico*	*South Atlantic*
	Brown shrimp (*Penaeus aztecus*) Pink shrimp (*P. duorarum*) White shrimp (*P. setiferus*)	One species (all Combined)

Sizes of shrimp

Tail count/pound:	Gulf of Mexico	South Atlantic
1	>20	<50
2	21-30	51>
3	31-50	
4	51-67	
5	68-116	
6	> 117	

Regions landings occur:	Gulf of Mexico	South Atlantic
Region 1	West Florida	North Carolina
Region 2	Alabama	South Carolina
Region 3	Mississippi	Georgia
Region 4	Louisiana	East Florida
Region 5	Texas	

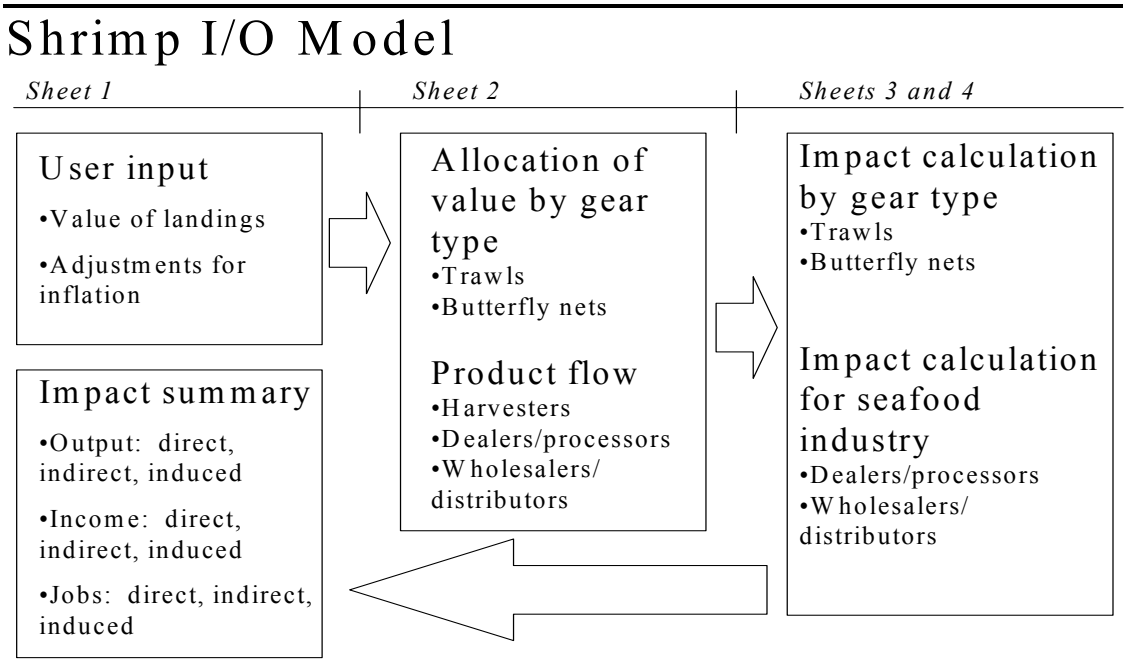
Areas fished:	Gulf of Mexico	South Atlantic
Area 1	Lower FL (Stat. grids 1-3)	North Carolina
Area 2	Upper FL (Stat. grids 4-9)	South Carolina
Area 3	AL, MS, E. LA (Stat. grids 10-12)	Georgia
Area 4	W. LA (Stat. grids 13-17)	East Florida
Area 5	Upper TX (Stat. grids 18-19)	
Area 6	Lower TX (Stat. grids 20-21)	

Shrimp vessels length:	Gulf of Mexico	South Atlantic
Vessel class 1	< 60 ft (small vessels)	< 60 ft (small vessels)
Vessel class 2	≥ 60 ft (large vessels)	≥ 60 ft (large vessels)

Depths fished:	Gulf of Mexico	South Atlantic
Depth 1	Inshore/bay	Inshore/bay
Depth 2	1-5 fathoms	Offshore
Depth 3	6-10 fathoms	
Depth 4	11-20 fathoms	
Depth 5	> 20 fathoms	

7.3.2 I/O Model

Built in Microsoft Excel, the model comprises an interrelated set of seven worksheets. The general operation of the model is shown in the following chart.



Each worksheet addresses a distinct set of estimating issues as noted in the following table.

Model worksheets	Description
User inputs and model outputs	This is the only worksheet a user needs to access. Value of landings data is entered here. This sheet provides all inflation adjustments to input data and outputs. Output tables and print macros are on this sheet.
Species-gear types, product flow	The value of shrimp landings are allocated to the two dominant gear types—trawls and butterfly nets—that account for 97 percent of the value of all U.S. shrimp landings. All value of landings is allocated between dealers/processors and wholesalers/distributors. Products of dealers/processors are partially allocated to wholesalers/distributors.
Calculations-Harvesters	Value of landings is converted to costs and earnings for each gear type. Cost categories (e.g., fuel purchases by harvesters) are then used to estimate impacts. Wages and profits are treated as income, creating induced effects.
Calculations-Seafood Industry	Value of landings and a portion of dealers/processor sales are converted to costs and earnings for dealers/processors and wholesalers/distributors. Cost categories (e.g., insurance and utilities purchases by these businesses) are then used to estimate impacts. Wages and profits are treated as income, creating induced effects.
Harvester cost earnings	Source data on harvester costs and earnings are presented. Not all data were directly used to create the cost-earnings profiles used by the model.
Dealer processor cost earnings	Source data on costs and earnings for dealers/processor and

Model worksheets	Description
	wholesalers/distributor operations are presented. Not all data were directly used to create the cost-earnings profiles used by the model.
Product flow data	Source data on product flow between harvesters, dealers/processors and wholesalers/distributors are presented. Not all data were directly used to create the product flow estimates for the model.

7.4 Assessment

The objective of this options paper is to evaluate a series of options that the shrimp harvesting industry can pursue to reduce the presently existing financial pressure on their operation and, at the same time, result in long-term improvement in their financial condition and an economically sustainable fishery. However, in the open access shrimp fishery, assuming all other things that affect the vessels' economic profit remain unchanged, vessels will enter the fishery when economic profits are positive and exit the fishery when economic profits are negative in the long run. As a result, any option that produces economic profits when implemented will be short lived without an associated permit or license moratorium.[5]

7.4.1 Permit or License Moratorium

Gulf of Mexico: A permit or license moratorium keeps vessels from entering the fleet when economic profits are positive. At low prices, there is no incentive for vessels to enter the fishery when economic profits are negative, causing the moratorium to have little effect. With or without a permit or license moratorium, sufficient vessels leave the fishery for economic profit to approach zero over the simulation period. In year 2021, the number of small FTEV remaining in the fishery under a permit or license moratorium is 4,681, and with open access it is 4,537. The number of large FTEV remaining in the fishery under a permit or license moratorium is 1,254, and with open access it is 1,357.

With a permit or license moratorium on both small and large vessels, the present value (PV) of economic profit for large vessels improved from -$22M under open access to -$2.4M. For small vessels, the PV of economic profit improved from -$36M to -$29M with a permit or license moratorium. Apparently there is slightly more benefit for larger vessels than small vessels under a permit or license moratorium.

South Atlantic: Results for the South Atlantic region are basically the same as those for the Gulf of Mexico. No difference was found for FTEV and economic profit for the entire simulation period. Under open access, the PV of small vessels for economic profit is -$11.0M, which improved to -$7.4M with a permit or license moratorium. The PV for large vessels is -$30.0M for open access and -$27.2M for PV with a permit or license moratorium.

[5]Options without a permit or license moratorium are presented in Appendix A.

National Economic Impacts: A permit moratorium only for large vessels decreases sales by $144 million, income by $48M, and employment by 1,200 jobs nationwide. If small and large vessels are included in the permit moratorium, sales decrease by $145M, income by $49M, and employment by 1,200 jobs. These declines occur because even though net benefits remain negative, they have increased relative to the status quo.

Summary: The objective of financial stability during low shrimp prices is not achieved when the only option used is a permit or license moratorium. Although an improvement in the financial performance of the industry does occurs, net benefits for the shrimp harvesting industry remain negative. Impacts for the nation also improve more when both large and small vessels are included than if only large vessels are included in the vessel moratorium. Although net benefits increase, a permit or license moratorium alone is insufficient to improve the financial viability of the fishery if the price of shrimp is expected to remain low in the long run. A permit or license moratorium alone is insufficient to improve the financial viability of the fishery if the price of shrimp is expected to remain low in the long run. Some other option would have to be adopted to improve the financial stability of the fishing fleet.

7.4.2 Government Buyback Program

One such program is a government-sponsored vessel or permit buyback program. With this buyback option, the government will purchase the permit or license and vessel at a price equal to one year of revenue/vessel (for an average vessel). Funding for the government buyback program is analyzed from two sources of funding, which include a government grant and a loan from the government to the shrimp fishery, where repayment of the loan is made at the end of each year over a ten-year period at 5% interest. The percent of permits or licenses bought back and compared in the simulation analysis is 0, 10, 30, and 50.

7.4.2.1 Buyback with a Grant

Gulf of Mexico:

Buy back only large vessels. The simulation analysis found that with low shrimp prices, economic profits are negative and the government would need to purchase more than 30% of the large vessel permit or licenses at the end of 2004 to yield positive economic profits in 2005. Purchasing 30% of the permits or licenses is predicted to cost the government $55.5M, with a price per vessel purchased of $100,127. Purchasing 30% of the permits or licenses would cause the large vessels to have a PV of $63.9M—a change of $85.6M from open access management that more than offsets the cost to the government. A buyback of 50% of the large vessels would produce a PV of economic profit of $186.2M.

When large vessels are bought back, it reduces the fishing pressure in the near-shore waters of the Gulf of Mexico, which slightly improves the economic profit of small vessels though it still remains negative. Small vessels will continue to leave the shrimp fishery but at a slightly slower rate. For small vessels, a government buyback of 30% of the large vessels at the end of year 2004 would give them a PV of -$25.1M, compared to -$36.3M when large vessels operate under open access.

Buy back large and small vessels. Purchasing the permit or license is effective in removing large FTEV but is ineffective in removing small FTEV. In the small vessel fishery, the number of licenses exceeds the number of FTEV by a large amount, whereas this is not the case in the large vessel fishery. For example, if the government were to buy 30% (3,656) of the small vessel licenses, it would only remove 433 FTEV. Buying back 30% of the large vessels' permits or licenses would reduce licenses by 554 and FTEV by 507.

Removing 30% of the permits or licenses of both large and small vessels – versus removing only 30% of the large vessels' permits or licenses – improves the PV only slightly for small vessels (-$25.1M to -$22.5M) and large vessels ($63.9M to $69.6). Removing 30% of the permits or licenses of both large and small vessels would cost the government $79M. If the government would buy 50% of the permits or licenses, the small vessels would experience a positive PV of $6.9M and the large vessels would reap $227.7M in PV at a total cost to the government of $131.1M. It should be noted that the cost to remove the small vessel license exceeded the benefits to the small vessels. The permit or license would cost about $6,300 for small vessels and $100,000 for large vessels, regardless of the percent of vessels purchased.

South Atlantic:

Buy back only large vessels. The simulation analysis found that with low shrimp prices, economic profits are negative, and buying 50% of the large vessel permits or licenses at the end of 2004 would not yield positive economic profits for large vessels in 2005. Buying 50% of the large vessel permits or licenses would improve their PV from -$30.0M to only -$7.1M. Even after this buyout, large vessels would continue to leave the fishery.

There is only a single offshore depth in the South Atlantic analysis where both small and large vessels fish; therefore, the removal of large vessels from the shrimp fishery has more effect on the small vessels' economic profit (rent) than the same situation would in the Gulf of Mexico. In the South Atlantic, large and small vessels fish together in the inshore and offshore, whereas in the Gulf of Mexico there are four depths fished offshore and large vessels fish in deeper depths where small vessels do not go. If 50% of the large vessel permits or licenses were removed, the small vessels' PV of economic profit would be $2.4M.

Buy back large and small vessels. Since purchasing one permit or license is equivalent to removing one FTEV, buying 50% of both small and large vessel permits or licenses will produce almost zero economic profits for large vessels and positive economic profits for small vessels in year 2005. Buying 30% of both large and small vessel permits or licenses will yield a positive PV of economic profit for small vessels of $4.9M. It will reduce the large vessels' negative PV to -$8.7M at a cost to the government of $14.6M. Thus, the benefit to South Atlantic shrimpers would be less than the cost to government. Buying 50% of both will yield PV for small and large vessels of $13.6M and $4.2M at a cost to the government of $24.3M. Again, it would cost the government more than it would benefit the shrimpers. The cost of the license is higher in the South Atlantic for small vessels than in the Gulf of Mexico, whereas the reverse is true for large vessels.

National Economic Impacts: A government-funded buyback program funded under a grant would for large vessels reduce sales by $133 million, income by $44 million, and employment by 1,100 nationwide for a 10% buyback, with a net loss of $82 million for the Gulf and South Atlantic. A 50% reduction in large vessels results in a reduction of sales by $255 million, income by $86 million, and employment by 2,100 nationwide, with a gain of $170 million in present value. If small vessels are included in the permit moratorium, sales decrease by $143 million, income by $48 million, and employment by 1,200 jobs for a 10% reduction in fleet size, with a net loss of $77 million. A 50% reduction in large and small vessels results in a reduction of sales by $266 million, income by $89 million, and employment by 2,200 nationwide, with a gain of $252 million in present value for the shrimp harvesting industry.

Summary: In the Gulf of Mexico, a buyback program only for large vessels is effective in producing long-term financial sustainability for the large vessel fleet, provided something greater than 10% of the large vessel permits or licenses are removed and an effective permit or license moratorium is in place. For the same program in the South Atlantic, removing up to 50% of the permits or licenses would not produce long-term financial sustainability for the large vessel fleet. This difference is probably due to a lack of data for analysis in the South Atlantic.

In the Gulf of Mexico, a buyback program for large and small vessels is effective in producing long-term financial sustainability for small vessels only when 50% of the licenses are removed from the fishery. The reason is that the number of licenses far exceeds the number of FTEV in the small vessel fishery. This same program in the South Atlantic is more effective for small vessels than it is for large vessels. However, this may be due to the lack of data.

Finally, only in the buyback program for large vessels in the Gulf of Mexico did the benefits to the shrimpers exceed the cost to the government, provided something greater than 10% of the permits or licenses were purchased.

However, impacts to the nation were negative for the large and small vessel buyback programs. In addition to the benefits generally not exceeding the buyback grant costs, the loss in sales, income, and jobs would be a serious consideration for industry and fishery managers.

7.4.2.2 Buyback with a Loan to Fishermen

In this buyback program, the fishermen remaining in the fishery will pay for the buyback. The government is assumed to provide a loan to the shrimp industry that is paid back over a 10-year period at 5% interest.

Gulf of Mexico:

Buy back only large vessels. The result of a large vessel buyback when only large vessels participate in a license buyback program and a permit or license moratorium is a downward shift in the economic profit (rent) curve by the amount of the loan payment for years 2005 through 2014. A 30% buyback reduces the PV of large vessels from $63.9M to $43.7M. The annual

payment per licensed large vessel would be $5,564 and the total annual payment by all large vessels in the Gulf of Mexico would be $7.2M. The rent per vessel increases about $20,000 in year 2005, including the loan payment.

Buy back large and small vessels. When both large and small shrimp vessels participate in a buyback program and in a permit or license moratorium, a downward shift in the economic profit (rent) curve by the amount of the loan payment occurs for years 2005 through 2014. A 30% buyback reduces the PV of large vessels from $69.6M to $58.8M. The annual payment per licensed large vessel would be $5,564 and the total annual payment by all large vessels in the Gulf of Mexico would be $7.2M. The rent per large vessel increases about $20,000 in year 2005, including the loan payment.

Up to a 50% buyback for both small and large vessels does not yield a positive PV of economic profit for small vessels. It should be noted, however, that for a 50% buyback the economic profit (rent) becomes positive in year 2015 when the loan is paid off for small vessels. The annual payment per licensed small vessel would be $819 and the total annual payment by all small vessels in the Gulf of Mexico would be $5M. The rent per small vessel increases about $5,000 in year 2005, including the loan payment; however, the rent would still be negative.

South Atlantic:

Buy back only large vessels. When only large vessels participate in a license buyback program and a permit or license moratorium, the economic profit (rent) curve is shifted down by the amount of the loan payment for years 2005 through 2014. The PV of economic profit to the large vessel is negative for all percent levels evaluated. The annual payment per licensed large vessel would be $5,386, and the total annual payment by all large vessels in the Gulf of Mexico would be $1.7M. The rent per vessel would increase less than the annual loan payment; i.e., revenue would increase less than the loan payment.

Buy back large and small vessels. When both large and small shrimp vessels participate in a buyback program with a permit or license moratorium, the economic profit (rent) curve is shifted down by the amount of the loan payment for years 2005 through 2014. For a 30% buyback of both large and small vessels, the small vessels will have a positive PV of economic profit; however, large vessels will not experience a positive PV even at a 50% buyback. The annual loan payment per small vessel would be $788 for a 30% buyback.

National Economic Impacts: A buyback program funded by a government guaranteed loan for large or small and large vessels would reduce sales, income, and employment nationwide at all levels of fleet reduction. However, net benefits are greater than or equal to zero for the 30% and 50% fleet reduction programs. If small vessels are included in the buyback program, net benefits are greater than if only large vessels are reduced. However, the greater the increases in net benefits, the more negative the impacts on the nation.

Summary: The large vessels in the Gulf of Mexico would achieve long-term economic stability if the government were to loan them money to buy back something greater than 10% of the vessels and then let the shrimpers pay off the loan over the next 10 years. The large vessels

would benefit even if the small vessel fishery in the Gulf of Mexico remained an open access fishery. The small vessel fishery in the Gulf of Mexico would not achieve long-term economic stability if the government were to loan them money to buy back at any buyback percent level evaluated.

The large vessels in the South Atlantic could not achieve long-term economic stability with this buyback program whereas the small vessels could. This suggests the need for a different management approach for the South Atlantic fishery than for the Gulf of Mexico fishery.

7.4.3 Government Price Supports

A price support government program sets a target price by size class of shrimp. If the price by size class falls below the target price, the government will pay shrimpers the difference between the target price by size class and the average price received by size class. In this simulation the target price is set at 0%, 10%, 20%, and 30% above the average price received by size of shrimp. The price support options are assumed to apply to both large and small vessels. It should be noted that the government price support was assumed to go into effect in 2004. To make the resulting estimates of PV comparable to other options, the PV was discounted for the period 2005-2021.

Gulf of Mexico: An increase in the average price received for shrimp by size class would have to be 30% for small and large vessels to achieve a positive economic profit (rent) in year 2005. The average price received for shrimp by size class would have to be 50% for small and large vessels to achieve a positive economic profit (rent) in year 2005. The PV is positive at 10% for large vessels and at 30% for small vessels. The annual cost to the government per year for a 10% increase in shrimp price would be $13.1M, and the PV of the government costs for the period 2005-2021 is $129.6M. The annual cost to the government per year for a 50% increase in price would be $61.9M, and the PV of the government costs for the period 2005-2021 is $604.4M.

South Atlantic: Large vessels could not achieve a positive economic profit (rent) in year 2005 even with a 50% target price above average price. The average price of shrimp by size class would have to be 30% for small and large vessels to achieve a positive economic profit (rent) in year 2005. The PV of economic profit is never positive for large vessels, but it is positive at 10% for small vessels. The annual cost to the government per year for a 10% increase in price would be $6.6M, and the discounted government costs for the period 2005-2021 is $64.2M. The annual cost to the government per year for a 50% increase in price would be $14.5M, and the discounted government costs for the period 2005-2021 is $142.3M.

National Economic Impacts: A government price support program has both positive economic impacts with positive net benefits above the 10% price support level. Sales, income, and jobs increase under each proposed price support program. Sales improve between $690 and $698 million, income increases between $233 and $235 million, and employment increases from 6 to 5,700 nationwide. Although the costs borne by the government are high, this is one of the

few programs analyzed in this paper that provides positive impacts for both the shrimp harvesting industry in net benefits and the nation in impacts.

Summary: Target prices would be an expensive proposition for the government. To increase the average price 10% to the shrimpers, the discounted costs borne by government for the period 2005-2021 in the Gulf of Mexico and South Atlantic would be $193.8M. It would cost $426.6M for a 20% increase in average price and $746.7M for a 30% increase.

7.4.4 Marketing Program to Increase Shrimp Prices

A marketing program to increase the price of shrimp could be paid for by a self-imposed tax of $0.01 on each pound of shrimp landed. Since the real effect of this marketing program is unknown, sensitivity analysis is conducted by increasing the price by 0, 5, 10, 15, and 20% to deter the effect on shrimpers. It should be noted that the government price support was assumed to go into effect in 2004. To make the resulting estimates of PV comparable to other options, the PV was discounted for the period 2005-2021.

Gulf of Mexico: For positive economic profits (rents) to occur in the Gulf of Mexico marketing program by 2005 – for both large and small vessels – the marketing program would have to raise the price of shrimp at least 20%. A marketing program that would raise the price of shrimp 15% would achieve near zero positive economic profit (rent) by 2007. The more successful the marketing program, the fewer vessels will leave the fishery. Each 5% increase in the average price of shrimp due to the marketing program will allow an additional 5% of both large and small vessels to remain in the shrimp fishery. The marketing program would cost approximately $1.5M per year.

South Atlantic: For the South Atlantic marketing program, a 20% increase in price will not achieve positive economic profit (rent) by 2021 for large vessels, whereas small vessels will achieve a positive economic profit (rent) by 2005. Large vessels continue to leave the fishery for the entire simulation period. At lower percentage increases in the shrimp price, small vessels will continue to leave the fishery. Large vessels never have a positive PV from the marketing program. The small vessels do achieve a positive PV provided the marketing program is successful in increasing the shrimp price at least by 10%. The cost of the marketing program in the South Atlantic is about $150,000 based on $0.01 per pound of shrimp harvested.

National Economic Impacts: Like a price support system, a marketing program that raises prices received by shrimpers above 10% will have positive impacts on sales, income, and job levels nationwide. Sales increase $16 million for a 10% increase and to $188 million for a 20% increase. Income increases $6 to $64 million, and employment increases from 100 to 1,500 jobs. These positive impacts on the nation are accompanied by a $3 to $91 million increase in net benefits.

Summary: The marketing program for shrimpers is uncertain. It takes a 5% increase in price for large vessels in the Gulf of Mexico and small vessels in the south Atlantic to achieve a positive PV. A marketing program would have to achieve a 15% increase in the price of shrimp

to cause positive PV for small vessels in the Gulf of Mexico. Large vessels in the South Atlantic never achieve a positive PV.

7.4.5 Cooperatives for Maximum Profit (Collective Group Action)

To analyze this alternative, it is assumed that the members of a cooperative would manage their cooperative like a monopolist and use only enough vessels to maximize cooperative profits. The derived maximum economic profit for the period 2005-2021 is then combined with the open access simulation for the period 2002-2004. Thus, from 2002 to 2004 the fisheries would operate under open access, and in 2005, they are assumed to have formed cooperatives that are operated from 2005 to 2021 with just enough FTEV to maximize profit. Shrimp prices are assumed not to change because of collective action.

Gulf of Mexico: Large FTEV are reduced by 70% beginning in 2005, as compared to the end of 2004, as a result of forming a cooperative and operating it for maximum profit. Economic profit jumps to just less than $50M per year, and its PV for the period 2005-2021 is $489.4M. Small FTEV are reduced by 65% beginning in 2005, as compared to the end of 2004. Economic profit jumps to $10M per year, and its PV for the period 2005-2021 is $102.3M. Large vessel CPUE increased from 515 pounds in 2004 to 1,087 pounds in 2005 (an increase of 110%). Small vessel CPUE increased from 373 pounds in 2004 to 584 pounds in 2005 (an increase of 57%).

South Atlantic: Large FTEV are reduced by 77% beginning in 2005, as compared to the end of 2004 as the result of forming a cooperative and operating it for maximum profit. Economic profit jumps to $2M per year, and its PV for the period 2005-2021 is $18.4M. Small FTEV are reduced by 73% beginning in 2005, as compared to the end of 2004. Economic profit jumps to $2M per year and its PV for the period 2005-2021 is $19.5M. Large vessel CPUE increased from 310 pounds in 2004 to 1,307 pounds in 2005, an increase of 320%. Small vessel CPUE increased from 310 pounds in 2004 to 522 pounds in 2005, an increase of 68%.

National Economic Impacts: The impacts from establishing a cooperative are negative. Sales decline by $528 million, income decreases by $178 million, and employment falls by 4,400 jobs nationwide, with the overall increase in PV to $630 million for the shrimp harvesting industry.

Summary: It is unrealistic to believe that all shrimpers will join a single cooperative in the Gulf of Mexico and South Atlantic. But, these results illustrate that the shrimp fisheries in the Gulf of Mexico and South Atlantic are overcapitalized. Small cooperatives, however, could be formed and a certain amount of catch could be assigned to each cooperative. Then, the cooperative could manage its vessels so that economic profit could be maximized.

7.4.6 Fractional License Program

A fractional license (FL) is a program that permanently reduces effort in the fishery by eliminating a portion of the licenses. This is accomplished by granting each vessel a tradable FL right, i.e., a right to a portion of a full license. A vessel can operate only if it obtains a full

license. Fractional rights are traded among fishermen, so that a fraction of the total number of licenses is removed from the fishery.

The GBFSM calculates the potential profits of the individual vessels in the Gulf of Mexico for the current FL program. These potential profits will determine the vessel's willingness to pay (WTP) to complete their license and the willingness to accept (WTA) to sell their license. It is assumed that trading leads to a permanent transfer of the right from one vessel to another. Each vessel's WTP to complete its license is set equal to the PV of future annual economic profits.

The results assume that vessels purchasing licenses use government-backed, long-term loans to obtain them. Shrimpers are assumed to make a single, equal payment per year until the loan is paid off. The loan is for 10 years at 5% interest.

Buy back only large vessels. When only large vessels participate in a FL program in conjunction with a permit or license moratorium, the simulation analysis found that with low shrimp prices, economic profits are negative. There would need to be a reduction in permits or licenses of 30% of the large vessels at the end of 2004 to yield positive economic profits in 2005. This would give a PV of $103.4M.

A 30% reduction in permits or licenses means that every vessel would be issued 70% of a license. Any vessel wanting to stay in the shrimp fishery would have to buy an additional 30% of a permit or license to complete their license from those who are willing to sell their permit or license. An additional 30% of a license could be obtained for an average price of $200. This means that those selling their 70% of a permit or license would receive an average price of $467. This seems like an extremely low amount; however, it must be remembered that by the end of 2004 there have been three years with large negative rents. Many marginal vessels would be willing to leave the fishery with or without selling their part of a permit or license. Notice that when the FL is 10%, the average price to complete a permit or license is zero; yet, there is a reduction in permits or licenses of 223. If there is a 50% FL, the average price to complete a permit or license is $28,607.

It is interesting to compare the FL prices when shrimp prices are low to FL prices when shrimp prices are high. For high shrimp prices (which means economic profits are positive), the average price to complete a permit or license is $13,695 for a 10% FL, $60,371 for a 30% FL, and $130,762 for a 50% FL. With large vessels, it is possible that fleet owners may retire a part of their fleet and combine the license for the remainder of their fleet.

Even though small vessels are not participating in the FL program, they do benefit from it. This is because both small and large vessels fish in the near-shore. A 50% FL will cause small vessels to have near zero economic profit in year 2005.

Buy back large and small vessels. There is little difference for a large vessel buyback when both large and small vessels participate in a FL program and a permit or license moratorium, except that small vessels' economic profit is positive for a 50% FL program. The reason there is little difference between the two analyses is that there are considerably more

licenses than FTEV for the small vessels. Therefore, removing 50% of small vessel licenses removes very few small FTEV.

National Economic Impacts: Fractional licenses reduce sales, income, and jobs for all options considered by GBFSM for the Gulf of Mexico shrimp fishery. Sales decline between $81 to $261 million, income declines between $27 and $88 million, and employment declines between 600 and 2,100 jobs depending upon which fractional license option is chosen. However, net benefits to the shrimp fishing fleet are positive for any option where more than 10% of the fleet is eliminated by trading licenses.

Summary: A fractional license (FL) program[6] reduces the number of licenses held by shrimpers. The program initially sets each license as a fixed percentage of a complete permit or license. Under low prices and negative economic profits, large vessel economic profits become positive as long as 30% or more of the licenses are retired. The loans per remaining large vessel are predicted to be negligible for a 10% program, about $200 for a 30% program, to $31,000 for a 50% program. For small vessels, positive economic profits can be achieved only for the 50% FL scenario. For lower reductions, the vessels continue to lose money and exit the fishery voluntarily.

7.5 Proposed Approach to Developing a Financially Sustainable Shrimp Fishery

The goal considered here is to make long-term improvements in the shrimp vessel's financial condition and in an economically sustainable fishery. At low shrimp prices, this means putting in place regulations that produce positive economic profits in the long run. This would require:

1) Some type of permit or license moratorium that also limits capital stuffing;
2) A reduction in the number of vessels in the fishery; and
3) The prevention of capital stuffing.

Any option that fails to reduce the number of vessels would fail to achieve a financially sustainable fishery. In the options examined in this options paper, the price support program and the increased price through marketing do not have a vessel reduction component; rather, they encourage vessels to remain in the fishery that would otherwise exit the fishery. The price support program would be very expensive for taxpayers and the price response achievable through a marketing program is highly uncertain. The permit or license moratorium by itself does not reduce the number of vessels in the shrimp fishery and would do nothing to elevate the current financial situation. However, it would keep vessels from entering the fishery if and when shrimp prices increase, so that economic profits become positive.

If cooperatives could be formed and managed for maximum profit, it would result in the greatest reduction in the number of vessels and the greatest increase in economic profits of all the programs considered. According to Kitts and Edwards, cooperatives would allow fishermen to jointly harvest, market, and price their product without being in violation of antitrust laws.

[6]The FL program was only considered for the Gulf of Mexico since data were not available to analyze this program for the South Atlantic.

Capital could be organized by the cooperatives to maximize profit and their capital stuffing could potentially be controlled. However, there are more than 16,000 licensed vessels in the Gulf of Mexico and over 2,200 in the South Atlantic. It is doubtful that everyone will want to join a cooperative. If more than one cooperative is formed, which would probably be the case, there would be competition between cooperatives just as currently exists between individual fishermen. Competition could be reduced if everyone was required to join a cooperative and cooperatives were assigned an allocation of the total catch or assigned a territory to fish. Cooperatives work best when there are small, rather homogeneous groups with common goals.

The two requirements mentioned above could be met with a buyback program or a FL program, and these two programs appear to be the most likely means of improving the fisheries' financial condition. We will first discuss the implementation of a buyback program and then, implementation of a FL. First, however, we need to discuss the number of governments that have jurisdiction over the shrimp resource and its implication on these programs.

In the Gulf of Mexico, there are five state governments who have jurisdiction inshore and shoreline to the EEZ. In the South Atlantic, there are four state governments who have jurisdiction inshore and shoreline to the EEZ. The federal government has jurisdiction in the EEZ. This presents a challenge for management of the shrimp fishery, since to be fully successful the program must be implemented in both state waters and the EEZ. According to the simulation analysis, in the Gulf of Mexico the federal government could successfully implement either of these programs in the EEZ and increase fleet profitability. However, if the states also implement the same option in conjunction with that in the EEZ, then the increase in profitability would be even greater. In the South Atlantic, the simulation results found that implementing a buyback program in the EEZ without the states cooperating would not be successful in the long run. However, the simulation model in the South Atlantic was highly aggregated due to lack of data and the quality of the data was very poor; therefore, this may influence the results.

7.5.1 Government Buyback Program

If a government agency wanted to implement a buyback program, what type of program would it implement? Texas has implemented a buyback program where revenue to purchase licenses is generated by putting a surcharge on all users of coastal water resources and they also have acquired grants to use for vessel buyback. Each year bay and bait shrimpers can submit a bid to the Texas Parks and Wildlife Department (TPWD) for the amount they are willing to sell their license. This plan is on a volunteer basis, and it will take several years to reduce the excess license from these fisheries.

In this study, we evaluated government buyback programs that retire 10, 30, or 50% of the permit or license in a single year. We assumed that each vessel owner would be paid one year's revenue for their permit or license. However, it is unknown whether 50% of the fleet would volunteer to sell their permit or license at that price. A number of other practical questions arise. If a fleet owner has two vessels that fish in the EEZ, would the owner be allowed to dispose of one of the vessels and allowed to keep the other one? And who should finance the buyout: the taxpayers or the vessels remaining in the fishery that reap the economic profits from

the shrimp resource? Given these difficulties, we believe a FL program or a variation thereof may be the most practical approach.

7.5.2 Fractional License Program

If the federal government decided to implement a 50% FL program in the EEZ of the Gulf of Mexico, each vessel would be issued 50% of a tradable permit and could not go fishing unless the owner had purchased rights from other vessel owners to complete 100% of a permit. Fractional permits can be traded among the fishermen, so that 50% of the total number of licenses is removed from the EEZ shrimp fishery. Each vessel's owner would have to determine how much he is willing to pay (WTP) for the other 50% of a license he needs, and he will have to determine how much he is willing to accept (WTA) for his 50% of the permit that he owns. The government would need to play a role in facilitating transactions in this market and facilitate the program using government-backed, long-term loans. When owners have more than one vessel, they would be allowed to transfer the fractional rights internally, avoiding the need for loans. The FL approach has the advantages of allowing market forces to identify those vessels that are retired from the fishery and does not place a significant long-term monetary burden on governments.

7.5.3 The Control of Capital Stuffing

Fishing effort is a function of both the number of vessels operating and the fishing capacity of those vessels. Even if a limit is imposed on the number of licenses, effort can continue to expand if vessels are allowed to grow in length, increase their net size, or augment their power. As is true in virtually all economic activities, shrimpers are profit maximizers and are very resourceful when it comes to improving their profits. The tendency for vessels to increase their fishing capacity is referred to as "capital stuffing" or "effort creep."

Due to data limitations, capital stuffing is only partially represented and is imperfectly modeled in the simulation analysis. In most of the analysis, capital stuffing is not assumed to occur. In the FL analysis, limited capital stuffing is represented. The problem of capital stuffing must be addressed for any of the effort limitation options to be fully effective. One way to do this is to tie rights to some characteristic of the vessels or their gear. For example, in the TPWD buyback program, a vessel may be replaced, but it cannot be replaced with a vessel that is more than 15% greater in length. A program in Australia ties licenses directly to gear. The challenge for any such approach is to ensure that effort is controlled without inhibiting technological innovations or locking in inefficient technology.

It is recommended that the permit be tied to the length of headrope of the trawl that has been historically used with a given length of vessel. Data on historical headrope[7] used is available in the NMFS vessels operating units' files. This would allow a vessel owner to optimize the vessel length and engine to the length of the total headrope of its nets. This would not completely remove all capital stuffing, but it should be more effective than either horsepower or length of vessel.

[7]Actually, footrope is recorded in the vessel's operating units' files. It would have to be converted to headrope.

7.6 Summary

Based on Table 7-3, a number of options are available to the industry to improve their financial viability. For example, a marketing program that raised market prices by at least 10% could increase both the fleet's profitability and provide positive economic impacts to the nation in terms of sales, income, and employment. While expensive for the government, government price supports would result in significant increases in jobs, income, and sales as well as increased fish harvester profitability.

Potential programs exist that would increase industry efficiency and reduce impacts on the nation. A buyback of vessels, permits, and licenses with a government grant or an industry-financed loan could result in increased profitability for the fishing fleet even though sales, income, and jobs decline. Cooperatives could increase fleet profitability. Fractional licenses could also improve the shrimp fishing fleet's financial viability if fleet size were reduced by at least 30%.

None of these options would provide the estimated improvement in present value or profitability for the fishing fleet if some form of limited entry is not adopted. As a result, some form of a license moratorium is assumed for each option presented. Also, it is important to note that some options provide an improvement to the fishing fleet's profitability even if action is only taken for large vessels that operate primarily in the EEZ. For example, a government grant to buy back 30 to 50 percent of the large fishing vessels will provide positive profits for the fishing fleet even if small vessels are allowed to remain in an open access fishery. This result depends on a license moratorium for large vessels in the offshore fishery. Similarly, the fractional license system only for large vessels will provide positive profits for the fishing fleet if it is only applied to the large vessel component of the fleet.

Options that are useful in improving profitability in the fishery in the aggregate may not work in both regions of the fishery. That is, an overall improvement in Table 7-3 may be the combination of a decline in the Gulf of Mexico (Table 7-2) and a larger increase in the South Atlantic (Table 7-1). The 30 percent fleet reduction, industry-financed, vessel buyback is an example of where an improvement in one fishery was offset by a loss in the other region. The point is that care needs to be taken when crafting a solution to improve financial performance of the fishing fleet. Each region needs to be considered separately, and a solution to its unique set of circumstances needs to be developed.

Finally, combinations of options should be considered. If two options have positive present values for the fishing industry, then combinations of two positive options will further increase the profitability of the fleet. A permit moratorium coupled with a marketing program and fractional licenses or a cooperative could generate substantially greater profitability than for any single option reported in Table 7-3.

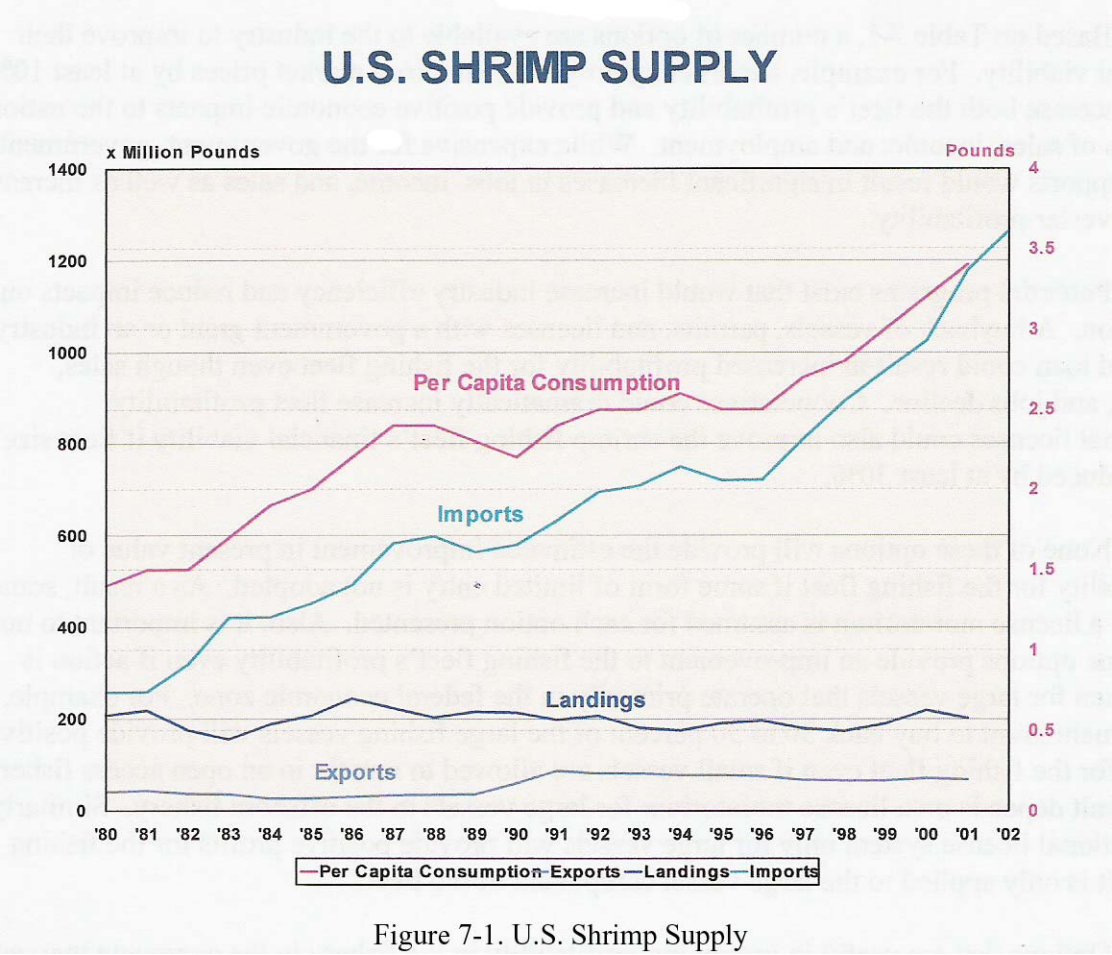


Figure 7-1. U.S. Shrimp Supply

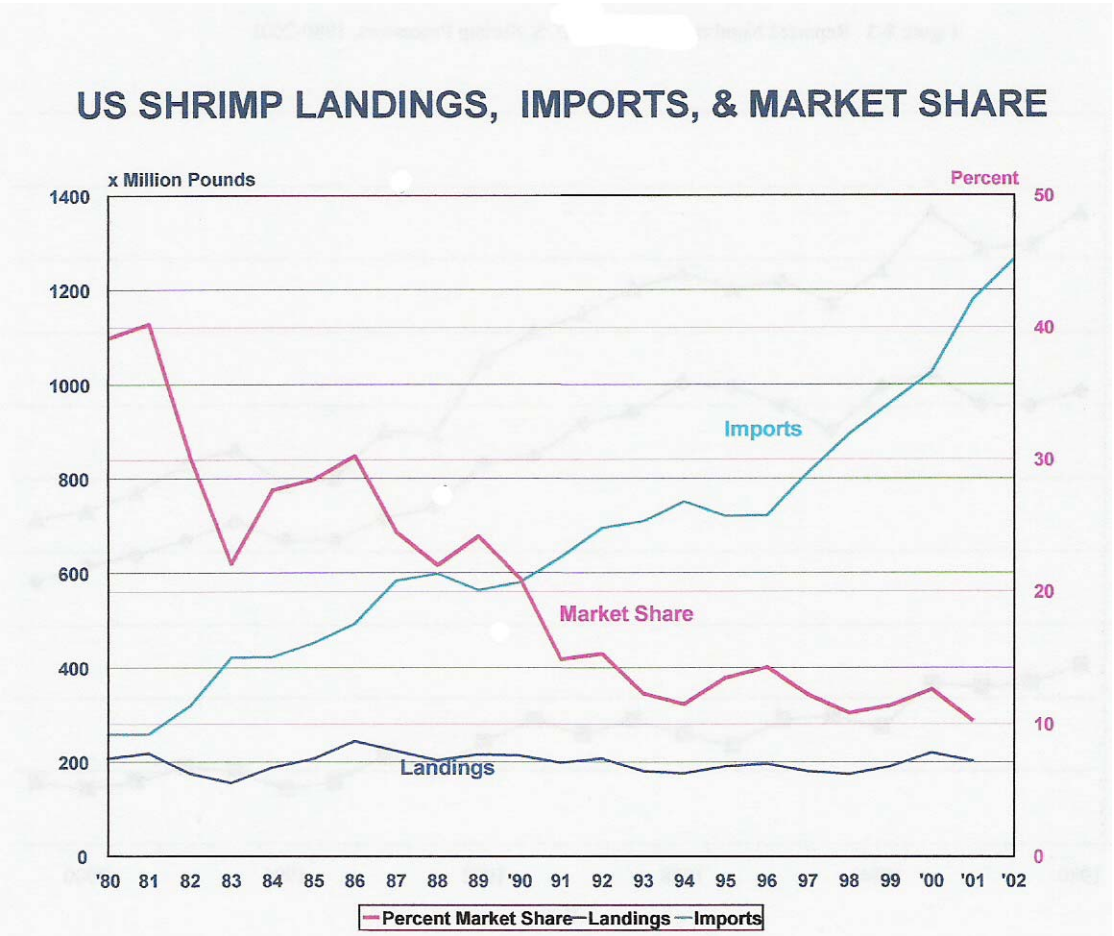


Figure 7-2. U.S. Shrimp Landings, Imports, & Market Share

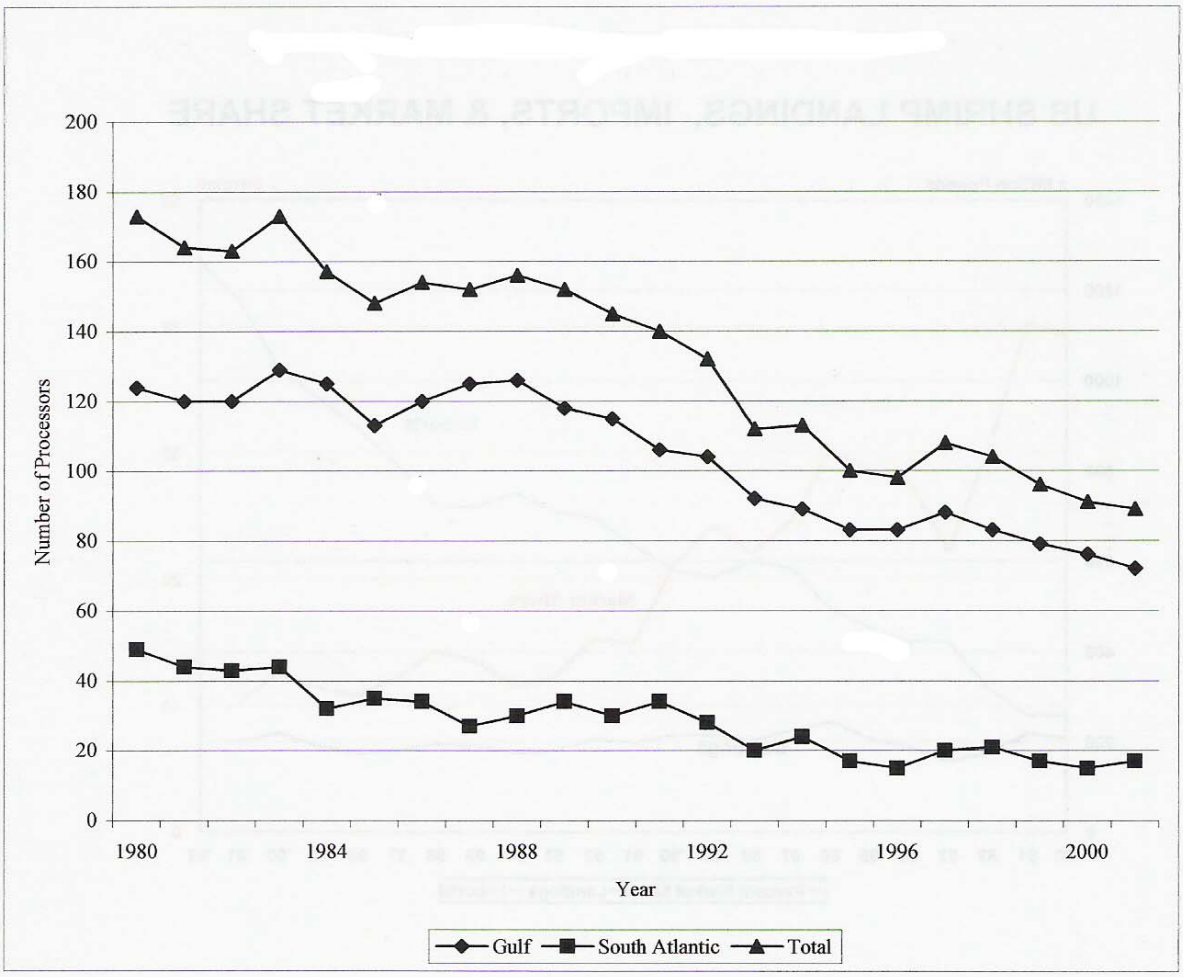


Figure 7-3. Reported Number of Southeast U.S. Shrimp Processors, 1980-2001

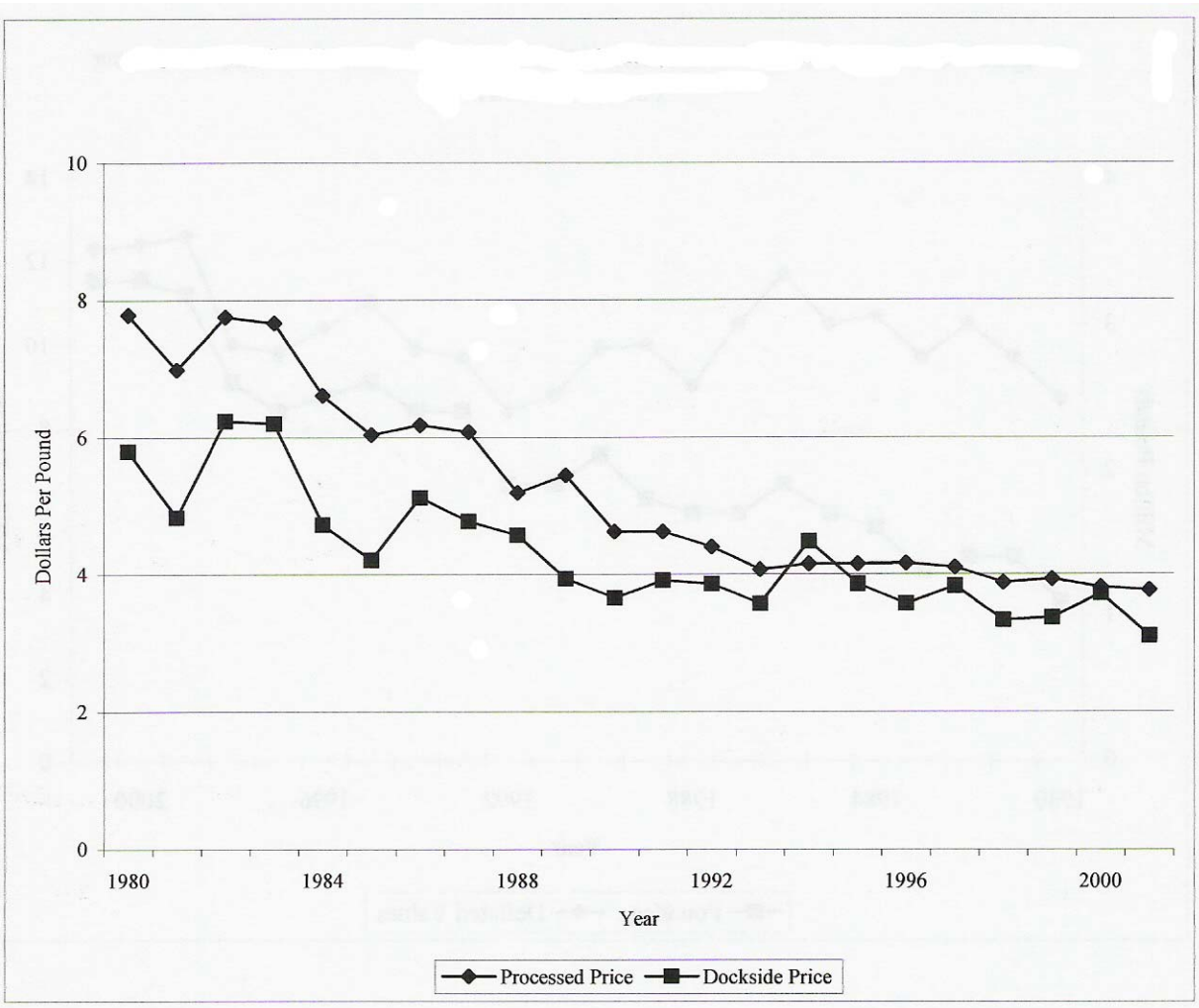


Figure 7-4. Deflated Southeast U.S. Shrimp Processed Price (Headless Shell-on Weight) and Dockside Price (Headless Weight), 1980-2001

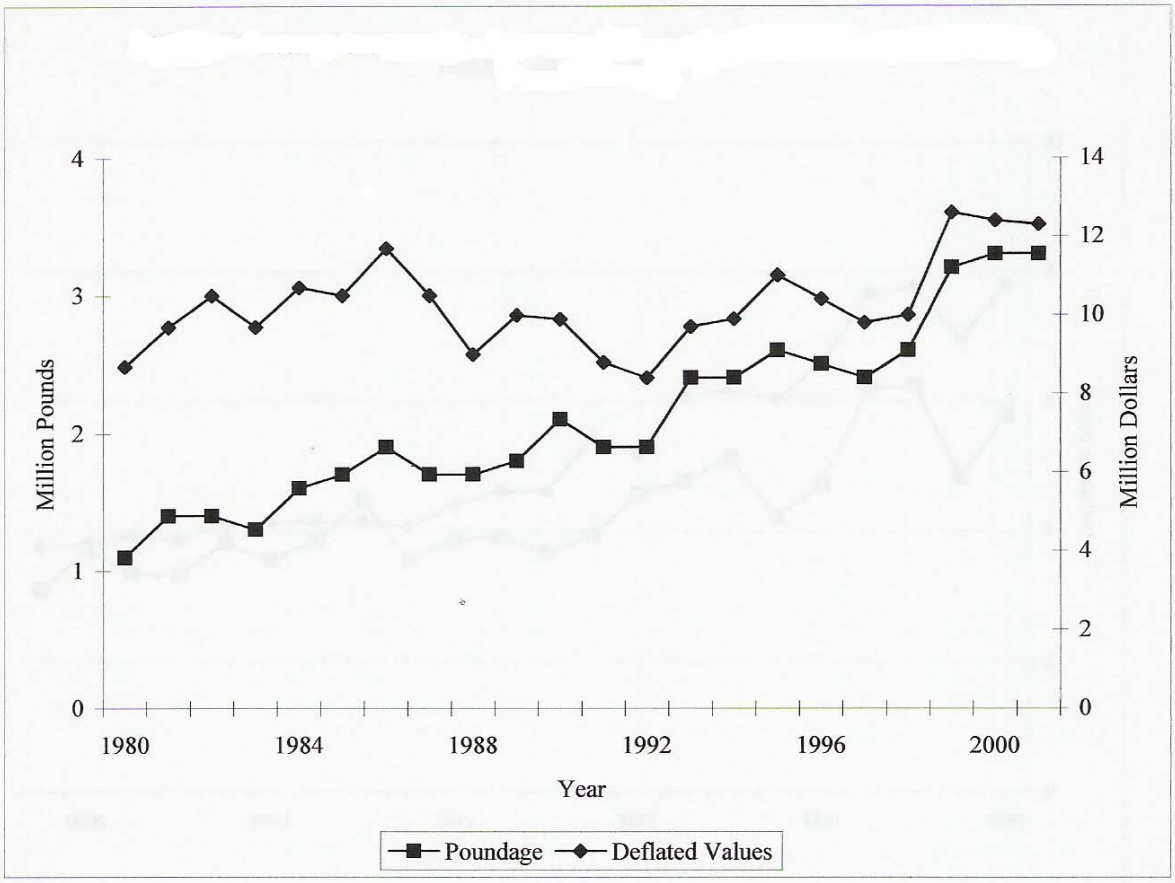


Figure 7-5. Average Production and Deflated Value per Southeast U.S. Shrimp Processing Firms, 1980-2001