EXAMINATION OF TRADE SANCTIONS AND PORT STATE CONTROLS TO PROMOTE SUSTAINABLE FISHERIES

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ABSTRACT

The Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSRA) of 2006 (Public Law 109-479) amends the Moratorium Protection Act (Public Law 104_43) requiring the United States (US) to take actions to address illegal, unreported, or unregulated (IUU) fishing and bycatch of protected living marine resources on the high seas and in areas not covered by international management bodies. MSRA requires a process to certify fishing nations' ability to address these concerns and gives each nation a positive or negative certification. A nation receiving a negative certification faces denial of US port privileges and trade sanctions on fishery products. This presentation will focus on the examination of the potential ramifications of reduced supplies of imports on the U.S. economy. Two general metrics will be considered: (1) consumer benefits in the form of compensating variation and consumer surplus, and (2) impacts in terms of changes in income and employment. Metric (1) will also require an assessment of changes in prices and revenues. Assessment of the changes in compensating variation or consumer benefits involved the estimation of demand equations for shrimp, one of the species that would be likely candidates in the event of negative certifications. Impacts will be assessed by using an existing input/output (I/O) model updated to reflect more current economic activity.

Keywords: Seafood demand, fisheries trade, input-output analysis

INTRODUCTION

The United States (US) Congress has taken recent actions to address international fisheries issues. The Congress, recognizing that the US regulatory regime for fisheries management is regarded as stringent, amended the Moratorium Protection Act to strengthen the ability of international fishery management organizations, and the US, to provide tools to end illegal, unreported, and unregulated (IUU) fishing and bycatch of protected living marine resources (PLMR). These threats to sustainable fisheries worldwide have continued under existing law. The Congress has found there are few effective tools in place to ensure that international and regional management organizations can end these practices.

In a new section 207 of the Magnuson-Stevens Act, the Congress established an international compliance and monitoring program (16 U.S.C. 1829). In addition, the Congress authorized measures to help reduce IUU fishing, promote international cooperation, and strengthen the ability of regional fishery management organizations to combat harmful fishing practices in sections 608-609 of the Moratorium Protection Act. In order to protect certain vulnerable species of concern to the United States the law provides in Section 610 a parallel mechanism to encourage use in high seas fisheries of new bycatch reduction methods comparable to methods used by U.S. fishermen. NOAA Fisheries (NMFS) is promulgating regulations to implement these provisions of the Moratorium Protection Act.

Under these new provisions, the US will use a set of criteria, currently under development, to certify whether a trade partner is either in compliance or out of compliance with US laws regarding IUU fishing and PLMR bycatch. Positively certified nations will enjoy continued trade privileges with US markets while negatively certified nations will face denial of port privileges and trade sanctions against fishery products. The certification process is built on constructive engagement with nations being evaluated allowing for technology transfer, capacity building, and a level due process to avoid potentially costly sanctions.

The certification process will also require domestic capacity building to better track seafood products from the harvester to the plate. Chain of custody and origin certifications are very important components in ending any illegal fisheries activity. Depending on the final process established for certification, certification can be thought of as a type of ecolabel with trade sanction and denial of port privileges as the stick to the certification's carrot.

This work is based on a larger, forthcoming report prepared for the National Marine Fisheries Service to address the economic analysis required for the introduction of new policies. Please contact the author for the larger report (Gentner Consulting Group, forthcoming). The National Marine Fisheries Service (NMFS) uses the US Census trade data as the official record of import trade. Census data is largely based on Customs and Border Protection form 7501 (CBP 7501) as modified by additional data sources. Information regarding imports volume and value will therefore be based on Census data unless otherwise noted. CBP 7501 however data will be utilized when discussing import carriers and importers.

Due to limited space, this paper narrows the focus further to just one species, shrimp. Shrimp was selected because this product has the highest per capita consumption in the US and is the single most imported seafood product in the US. This paper begins with a brief discussion of current US market conditions and then narrows in focus to specific trade statistics for shrimp. Following the industry statistics, the seafood demand analysis methodology is introduced. The seafood demand analysis will focus on analyzing changes in domestic revenue, exporter revenue, and consumer benefits related to 5%, 25%, 50%, and 75% reductions in the imports of shrimp. Next, the economic impacts of the reduction in imports will be calculated. Finally major findings are summarized and discussed.

CURRENT MARKET CONDITIONS

US seafood markets rely heavily on imports. Imports of seafood have risen rapidly increasing from 62% in 1997 to 86% in 2006 (FUS 2006). While the US imports 86% of the seafood consumed domestically, it exports 80% of its domestic harvest (FUS 2006). The US ranks third in total consumption of seafood, behind China and Japan, and 72nd in per capita consumption (FUS 2006). Per capita consumption has gone up since 1929 from 11.8lb to 16.5lb annually. In 2006 Americans consumed 6.5 pounds of fresh and frozen fish and 5.8 pounds of fresh or frozen shellfish. The three most popular products are shrimp, canned tuna, and salmon. Shrimp, in all product forms, is the single most popular species in American consumption. 2006 American set a record for shrimp consumption at 4.4lb per person per year, an increase of 0.3lb from 2005 and up over a pound since 2000.

Between 1979 and 2003 the real (2004 constant dollar) ex vessel price of all finfish and shellfish dropped from $.76/pound (lb) to $.35/lb (Kirkley 2006). Shrimp prices have also fallen 32% since 1997. Overall, the majority of these price reductions are driven by increased imports from wild harvest and aquaculture shrimp produced with costs much lower than those faced by US producers. Consumer prices for seafood are rising slower than other protein sources according to the Consumer Price Index. Seafood, however, is still a relatively expensive protein source. Non-price factors driving the US consumption of fish include an increasing health consciousness among US consumers. Due to these decreases in nominal prices, increases in relative income, and increasing importance of non-price factors, US demand for seafood has increased.

Worldwide, the US is the sixth largest harvester of seafood, when comparing nation’s whose primary production is from capture fisheries (Glitnir 2007). US production represents 3.6% of global seafood production with 89% from capture fisheries. By volume, the top five landed species in the US are Alaskan pollock (35%), menhaden (13%), salmon (9%), hakes (6%), and cod (6%). The most valuable species group is shellfish, however with landings of $3.9 billion in 2005. The top five most valuable species are scallops ($434 million), lobster ($414 million), crab ($413 million), shrimp ($407 million), and salmon ($331 million) in 2006.

With regards to processing, the US processes $8.8 billion in seafood (FUS 2006). Fresh and frozen product accounts for 79% of total processing value ($6 billion). The top three most valuable processed product classes include processing of fillets and steaks ($1.1 billion), sticks and portions ($397 million), and breaded shrimp ($276). 62% of the fillet and steak value comes from Alaskan pollock. Breaded shrimp is growing again in share after declines.

Two thirds of US seafood consumption occurs away from home, in restaurants or other foodservice outlets, while one thirds is consumed at home (Glitnir 2007). These proportions hold whether looking at volume or value. Independent full and limited service restaurants account for approximately 50% of sales away from home. Both independent and chain restaurants are aggressively promoting fresh seafood to drive traffic and overall sales. New species are increasingly being promoted on limited time menus.

At home consumption is currently dominated by shrimp, canned tuna, and salmon purchases. Demographic trends are expected to change consumption patterns with increasing ethnic diversity likely to increase consumption in the future, particularly across stronger tasting fish not historically consumed in the US (Glitnir 2007). New trends in value added packaging, foil pouches, ready-to-eat meals, etc., are expected to increase consumption. Finally, health, safety, and environmental concerns are increasingly important for US consumers. As a result, it is expected that eco labels will play an increasingly important role in future seafood consumption decisions.

Shrimp is the single most important import product both by volume and value with the US importing 590,299mt (product weight) of shrimp valued at $4.1 billion dollars. In 2006, the single most important product was peeled, frozen shrimp with a volume of 162,286mt. The second most imported product by volume in 2006 was shrimp, frozen other preparations with 116,645mt. This product type is precooked shrimp or prepared shrimp meals, but not breaded shrimp. Breaded shrimp was the third most imported shrimp product with a volume of 49,252mt. The last two product categories, both value added product, have grown their market share in the last five years. Shrimp, frozen other preparations imports have grown over 400% since 1997. Breaded shrimp imports have grown over 24,000% since 1997.

The ranking of imported shrimp by value tells a different story. Peeled frozen shrimp and frozen other preparations of shrimp still take the top two slots with value of $1.2 billion and $828 million respectively. Third place is overtaken by large, less than 15 count, frozen shell on shrimp with a value of $317 million. Breaded shrimp has fallen to sixth place with a value of $237 million.

There has been a noticeable decline in shrimp prices in the last five years with all shrimp products, except canned shrimp, dropping in price over the last five years. The highest price product in 2006 was peeled fresh/dried/salted/brined shrimp at $16.93/kg. The second highest priced product was large, less than 15 count, shell on frozen shrimp at $12.91/kg. The third highest priced product was 15-20 count shell on frozen shrimp at $9.70/kg. Peeled frozen shrimp, the most imported product by volume and value, cost $7.45/kg.

In 2006, the US imported shrimp from 61 countries. The top 20 import partners account for 98% of the volume and value of shrimp imported into this country. Thailand, the highest volume and value importer, exported 193,764mt worth $1.3 billion to the US. Thailand's three biggest exports to the US were frozen other preparations of shrimp (70,197mt), peeled frozen shrimp (53,318mt), and frozen shell on 31-40 count shrimp. China is the second largest exporter of shrimp to the US exporting 68,150mt worth $331 million. China's three biggest export products were breaded shrimp (39,758mt), frozen other preparations of shrimp (17,588mt), and peeled frozen shrimp (4,483mt). Ecuador is the third biggest shrimp exporter to the US by volume but not by value exporting 59,363mt worth $324 million. Ecuador's biggest three export products were peeled frozen shrimp (12,249mt), 51-60 count shell on frozen shrimp (11,280mt), and 41-50 count shell on frozen shrimp (9,348mt). Indonesia actually beats Ecuador and China in terms of value, exporting less volume, 58,729mt, but more value, $430 million.

The top twenty custom districts represent 99% of all imports. The top three customs districts by volume are Los Angeles, CA, New York, NY, and Miami, FL. For Los Angeles, the three most important products are frozen other preparations (83,206mt), peeled frozen shrimp (63,392mt), and breaded shrimp (22,518mt). In New York, the most important products are peeled frozen shrimp (45,307mt), 31-40 count shell on frozen shrimp (11,793mt), and less than 15 count frozen shell on shrimp (10,838mt). For Miami, the most important products are peeled frozen shrimp (14,649mt), frozen other preparations of shrimp (11,067mt), and breaded shrimp 8,243.

METHODOLOGY

Trade policies are external stimuli that can impact prices for seafood or quantities of seafood in the market place. Changes in prices or quantities impact the decisions consumers make for seafood products which then impacts consumer benefits. Demand analysis quantifies consumer preferences for seafood allowing the examination of consumer responses to changing prices or quantities in the marketplace. Demand analysis examines the question is society better or worse off from a change in a particular policy.

In addition to demand analysis, economic impact analysis examines the distributional impacts of changes in policy. Using changes in final demand for seafood products from the demand models, changes in income and jobs can be estimated. Economic impact analysis details how the change in demand flows through the economy effecting the distribution of jobs and incomes as a result of the policy shift.

Given the growing concern over the level of global trade in seafood and resource sustainability, it is important to examine the impact a reduction in the supply of foreign seafood products would have on US seafood harvesters, importers, and consumers. In this initial examination of shrimp demand, the impact of reductions of shrimp imports on ex-vessel prices, revenues, import quantities, domestic demand quantities, and consumer benefits, as measured in terms of consumer surplus will be developed. These changes in demand will be used to then examine the economic impacts of reductions in shrimp imports.

Demand Methodology

The majority of the research in this area has used dockside or wholesale prices for two reasons; retail data is difficult to obtain and simultaneity of demand for seafood. Typically, the analytical framework used to examine food commodity includes a system of demand equations (Eales et al. 1997; Park et al. 2004; Capps and Schmitz 1991; Kirkley 2006; and Kinnucan et al. 1997). Economic theory dictates that demand for perishable commodities should use inverse, or price dependent, demand. Landings across any time period are assumed to be predetermined because a fisher does not have control over catch composition nor the process that governs the amount the fisher is allowed to harvest. Therefore, the production of seafood is fixed and price adjusts to clear the market making the system price dependent. Park et al. (2004) demonstrated that inverse demand systems are preferable to quantity dependent models for seafood products.

There is an extensive literature on examining the relationship between the demand for domestic product and foreign imports. For examples, see Houthhakker and Magee (1969), Kreinin (1967), Leamer (1973), Price and Thornblade (1972), Neimi (2003), Raxafimahefa et al. (2005), Lee et al. (2003), Gorman (1961), Costello and McAusland (2003), and Muti (1977). One of the more widely used trade models in these examples has been the Armington (1969) trade model. This model seeks to estimate demand from different sources by treating the good from each source as a unique product (e.g., the demand for shrimp from China would be one demand and the demand for shrimp from Thailand would be another demand). The Armington specification is as follows:

$$\ln M_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln \frac{P_j}{P^*} + \beta_i \ln \frac{M}{P^*} \tag{1}$$

where M_i is the quantity imported from source i; P_j is the price of imports from source j, M is total expenditures on imports of the good from all sources; and P* is Stone's geometric price index for imports of this good. Similar models have been developed using price as the endogenous or left-hand side variable. Other specifications include the Almost Idea Demand System specification (AIDS) of Deaton and Muellbauer (1980), the source differentiated AIDS model of Yang and Koo (1994), and purely ad-hoc specifications (e.g., Tang, 2005).

For unknown reasons, there appears to have been little empirical work on the interrelationships between the demand for foreign imports and the demand for domestic product other than some relatively limited analyses (Murray and Ginman 1976). Most of this work, however, assumes a quantity dependent specification in which the demand for imports is a function of domestic prices, imported prices, and either gross national product or disposable income. The basic model of Murray and Ginman is as follows:

$$\ln (Q) = \beta_0 + \beta_1 \ln (y) + \beta_2 \ln (P_m) + \beta_3 \ln (P_d) + \varepsilon \tag{2}$$

where Q is the quantity of imports demanded; y is real gross national product; P_m is the import price; P_d is the domestic price, and , is a normally distributed error with zero mean and constant variance. In such specifications, one-way independence is often assumed. That is, demand for imports is influenced by domestic and foreign prices while the demand for domestic product is influenced only by the domestic price.

Demand models include equations (1) and (2) as well as numerous other specifications including the AIDS model of Deaton and Muellbauer (1980) and the synthetic inverse demand model of Park et al. (2004). Unfortunately, many of the more current specifications, such as the AIDS model, require a large number of observations because these models are based on flexible functional forms or second-order approximations, typically containing a large number of parameters.

In actuality, the demand for imports is likely to be but one equation in a large system of equations. This large system would include both the demand and supply of all products, substitutes, and complements at all market levels. For example, in the case of fish, the model would likely have demand models for beef, pork, poultry, and the various species and product forms of seafood at the retail, wholesale/processor, domestic producer, and import level. Moreover, the retail level would be broken down into at home and away from home consumption.

Unfortunately, data necessary for estimating a large system of equations to assess the demand for seafood imports are not available. The data on demand patterns, other than the quantity and prices of imports and domestic landings, is extremely limited. Thus the analysis is forced to use more simple specifications such as Eq. (1) or Eq. (2), where the suitability of model (1) over model (2) is testable using conventional statistical procedures.

Annual models were determined to be the most appropriate because of the need to examine changes in economic metrics as a result of annual restrictions on trade. Data were available for imports, landings, and ex-vessel price for shrimp for the period between 1989 and 2006. Both quantity dependent and price dependent models were considered, but a decision to use price dependent models was made due to the nature of fishery markets and due to concerns about estimating consumer surplus.

The general specifications were as follows:

$$P_m = f(Q_m, L_d, Y) \tag{3a}$$
$$P_d = g(Q_m, L_d, Y) \tag{3b}$$

where Pm indicates the import price: P_d is the ex-vessel domestic price; Q_m represents quantity of imports; L_d is the quantity of domestic landings; and Y is year, which serves as a proxy for food expenditures, trends, and income. Food expenditures or total expenditures on imports and domestic product would be preferred, but such data are not available.

Although the equations are jointly related, both can be estimated by ordinary least squares, because the right-hand side variables were the same (Maddala, 1978). The potential issue of the need for a system of equations based estimation, such as two stage least squares, arises but unfortunately, there is not sufficient data on pre-determined variables to use such an approach. As a result, either ordinary least squares or least squares corrected for first-order serial correlation was used. Equations (3a) and (3b) are specified in terms of natural logarithms:

$$\ln P_{mt} = \beta_0 + \beta_1 \ln Q_{mt} + \beta_2 \ln L_{dt} + \beta_3 \ln year_t + u_{mt} \tag{4a}$$
$$\ln P_{dt} = \beta_0 + \beta_1 \ln Q_{mt} + \beta_2 \ln L_{dt} + \beta_3 \ln year_t + u_{dt} \tag{4b}$$

To be sure, the two equations (4a) and (4b) are strictly empirical specifications, and at best offer limited analytical capabilities. Nevertheless, they are consistent with other specifications presented and used in the literature to assess the economic ramifications of import policies.

Numerous estimation methods were used to estimate the import and ex-vessel demand equations. These methods include ordinary least squares, generalized least squares, seemingly unrelated regression, two-stage least squares, three-stage least squares, and non-stochastic parametric method. The latter method is based on the linear and quadratic programming methods of Aigner and Chu (1968). Bootstrapping is used to estimate the variance-covariance matrix. Overall, ordinary least squares, corrected for first-order autocorrelation, provided the best results given the limited number of observations.

Retail level demand data on any specific species are nearly impossible to obtain. The most significant problem is the absence of seafood product tracking once it leaves the dock of first purchase. Compounding this problem at the retail level is the potential mislabeling of fish. Even if retail transaction data could be obtained, it would difficult to verify the species sold as being the same species that was landed. Foulke's (1993) FDA white paper about US Customs inspections of mislabeled seafood points to three reasons for this problem. Shrimp includes all species of shrimp landed in the United States. Due to data limitations, it was not possible to estimate these models by product type. Instead all product types for each species were aggregated into a single category.

All weights were converted to live weight equivalent measures based on conversion factors provided by NMFS, and prices were calculated as the value of the product divided by the live weight equivalent. All import prices and revenues were converted to 2006 constant dollar values by dividing the nominal value and price by the gross national product implicit price deflator. Domestic ex-vessel prices and revenues were converted to 2006 constant dollars using the producer price deflator for fish and seafood. Data on both imports and domestic production were obtained from NMFS. The implicit price deflator was obtained from the US Department of Commerce, Bureau of Economic Analysis. The producer price deflator for fish and seafood was obtained from the US Bureau of Labor Statistics.

Impact Methodology

Imported and domestic seafood passes through multiple industrial sectors on the way to the consumer and tracing those flows through the income and jobs generated is the point of economic impact analysis. For instance, imports start their journey to the consumer through a port. From the port, products may face additional processing domestically before heading to a wholesaler or distributor and then on to the consumer. Domestic seafood is only slightly different. Catch is landed at a dealer who may also be a processor and, if not, the catch moves on to additional processing, a wholesaler or directly to a market. Various methods were employed to trace these flows.

Imported seafood is transported into this country in a variety of modes including air, truck, rail, and waterborne transport modes. Overall, the most used mode, particularly for high value fresh product is air transportation with 37.7% of the volume. That is followed by truck transportation with 33.4% of the volume imported. Across all species of fish, the waterborne mode is the third most used transportation mode transporting 28.7% of seafood imports. Finally all other modes, including hand carried, mail, and rail, account for less than a percent of all imports (0.2%).

The vast majority of shrimp product, 95.4% by volume, is coming into this country via the waterborne mode followed by the Truck mode at 4.6%. Because this proposed policy action deals with denying port privileges to vessels and because the waterborne mode dominates the other transport mode across these five groups, the remainder of this discussion will focus on the waterborne mode. Within waterborne transportation, there are two transportation options; container ships and general cargo vessels. The bulk of the seafood traffic into the US is in the containerized mode at 99.5% by volume. The remaining 0.5% is transported in the general cargo mode. Over 16 million containers arrive in US ports each year, and, when ranked by value, fish and crustaceans rank 18th containerized imported product value (CBO 2006). Much of this value is shrimp. As a result, the remaining impact calculations will focus on containerized shrimp imports.

Port activity generates economic activity across many sectors including surface transportation, maritime services, cargo handling federal/state/local governments, port authorities, importers/consignees, and the banking and insurance sectors. Maritime services include the revenues to the cargo vessel, pilots, chandlers (food and other supplies), towing, bunkering (fuel), marine surveyors, and shipyard/marine construction. Cargo handling services include longshoremen, stevedoring, terminal operators, warehouse operators, and container leasing and repair.

While seafood is an important product in containerized imports when ranked by value, the volume of seafood on any one container ship is relatively low. The US Maritime Administration (MARAD) publishes annual volume estimates and the average volume of imports brought in during a port call in 2005 was 44,590mt (MARAD 2007). Using the 2006 CBP data, the average volume of seafood per container ship call was 61mt, or 0.14% seafood by volume for each port call. The minimum amount of seafood brought in on a container ship in 2006 was one kg and the maximum was 7,308mt. Additionally, each containerized call hauls 5.9 different seafood products on average to slightly over two importers.

MARAD has also developed a US national average economic impact model for waterborne shipping modes called the MARAD Port Kit (MARAD 2000). Numerous other individual port studies were examined looking for containerized shipping multipliers based on metric tons of imported cargo (Martin Associates 2005; CBO 2006; Port of Long Beach 2002), but the MARAD estimates were determined to be the most flexible and complete, although they were older than the other studies. The MARAD Port Kit estimates were inflated using the producer price index to 2006 dollars and converted to metric tons. From the MARAD Port Kit, each metric ton of containerized cargo generates \$78.37 in revenue, \$81.71 in employee income, and generates 0.0023 in employment.

Once the seafood arrives in the US, some goes directly to retail while some portion enters the processing chain. Overall, seafood processing plants in the US process 2.6 billion mt and generate about \$8.8 billion in revenue. Unfortunately, there is no existing source of data that details how much of the import trade in seafood goes through additional processing once it reaches US shores. Instead, several methods were examined to estimate the proportion of imports undergoing additional processing in the US (Gentner Consulting Group forthcoming).

The method used for this paper divides total processed product from FUS (FUS 2006) by the total seafood supply in 2006. Total seafood supply for this purpose is landings minus exports plus imports in product weight minus re-exports. This method assumes that imports are processed at the same rate as the rate for landings and imports combined. There is no way to currently separate US processed product into domestically sourced product and imported product. Some landings are processed domestically and some are exported to be processed overseas. Similarly some imports are processed overseas while some are processed domestically. Using this method, 26.3% of all imported shrimp is processed in the US. While this method may overstate/understate this proportion for some categories, it is much less subjective than the other methods examined, doesn't exceed the domestic harvesting capacity, and produces a proportion for shrimp, whereas the other methods could not (Gentner Consulting Group forthcoming).

Domestic seafood industry impacts were derived using the model developed by Kirkley, Gentner, and Duberg (2004). The seafood industry includes harvesters, primary dealer/processors, and secondary dealers/wholesalers. This model was developed using IMPLAN (MIG 2000) base data and creating additional fishery sectors using additional fisheries cost and earnings data. Steinback's (2004) methodology was used in this model to develop the forward linkages to the sectors forward of the commercial harvesting sector. Domestic revenue increases were modeled by applying the increases in revenue calculated from the demand models. The impact of additional processing and distribution of imports was calculated by taking the change in imported quantity from the demand model, applying the predicted import price, and applying the percentage of imported shrimp that is processed domestically that was developed above. Retail level impacts were not calculated for this analysis.

RESULTS

Linear specifications were used to estimate import and domestic product demands for shrimp. The adjusted R^2 values for the estimates corresponding to the import and domestic demand models equaled, respectively, 0.90 and 0.78. The Durbin-Watson (DW) test statistic indicates that both regressions do not suffer from autocorrelation. The estimates are as follows with standard errors in parentheses:

$$\text{Shrimp } IM_P = \underset{(41.50)}{-165.03} + \underset{(0.02)}{0.09}\text{ year} - \underset{(0.20*10^{-9})}{0.16*10^{-8}}\text{ Shrimp } IM_Q;\ DW = 2.06$$

$$\text{Shrimp } D_P = \underset{(50.14)}{-127.77} + \underset{(0.02)}{0.07}\text{ year} - \underset{(0.11*10^{-8})}{0.24*10^{-8}}\text{ Shrimp } D_Q - \underset{(0.25*10^{-9})}{0.12*10^{-8}}\text{ Shrimp } IM_Q;\ DW = 2.23$$

where Shrimp IM_P and IM_Q indicate the price and quantity of imported shrimp; Shrimp D_P and D_Q indicate the ex-vessel price and quantity of domestically landed shrimp; and year equals a year between 1989 and 2006. Any reductions in the imports of this highly popular seafood product will have substantial ramifications for consumer benefits. While the results were statistically valid, a conflicting result was found. There is an asymmetry in the substitutability of domestic shrimp for imported shrimp. The results suggest that imported shrimp are substitutes for domestically landed shrimp but domestically landed shrimp are not substitutes for imported shrimp. The value of the chi-squared test of restriction that the coefficient for domestic landings equaled zero in the import demand equation was 1.01, which is well below the critical chi-squared value. There are two possible explanations for this result: two separate markets for shrimp occur in the US; and import quantities (590,299 mt) dwarf domestic production (152,632 mt). Given the data limitations, it was impossible to explore the two market hypothesis.

As a baseline for the policy examination, import revenue in 2006 was $4.1 billion, domestic revenue was $465.9 million, and consumer surplus was $5 billion. It is possible that the statistical models estimated for shrimp provide limited analytical capabilities as it is highly unlikely that consumer surplus would exceed total expenditures, but it is possible.

Overall, small reductions in imports actually generate higher foreign revenues or dollars leaving the United States (Table 1). This is due to prices increasing enough to offset losses in quantity imported. Import quantities are actually falling dramatically, but prices are rising even more dramatically. At the same time, even small reductions in imports enhance domestic ex-vessel prices and revenues, but consumer benefits substantially decline. For example, a five percent reduction in imports in 2006 generates a loss of $547 million in consumer surplus in 2006. Larger reductions in imports, however, generate substantial reductions in US expenditures on foreign imports, generating increases in domestic prices and revenues and generating very large reductions in consumer benefits. If imports were to be reduced by 75% and no substantial changes occurred in the US producing sector, consumers would lose nearly $5.0 billion in benefits. That is, consumer surplus drops to approximately zero when imports are reduced by 75 percent.

Table 1. Demand Model Results.

Percent Reduction	Delta Import Quantity (mt)	Predicted Price	Import Revenue*	Delta Domestic Quantity (mt)	Predicted Price	Domestic Revenue*	Total Revenue*	Consumer Surplus Loss*
5%	173,970	$1.82	$4,478	1,304,705	$1.55	$521	$4,999	$547
25%	409,228	$2.71	$5,275	1,077,052	$2.21	$742	$6,017	$2,416
50%	703,300	$3.83	$4,966	738,450	$3.03	$1,019	$5,985	$4,040
75%	997,372	$4.94	$3,208	261,402	$5.48	$1,845	$5,053	$5,008

*Millions of US $

Table 2 contains the economic impact results of these demand changes. Overall, US jobs are higher for all levels of reduction and incomes are higher for all but the 5% reduction as domestic harvest has not risen to a level high enough to offset the reductions in income from losses of import processing. There are substantial income losses from re-processing of imported product. This result is driven in large part by the assumption that 26.3% of all imported shrimp are reprocessed in the US. It was impossible to ascertain the validity of this assumption within this project. However, the rising cost of labor in the US relative to the rest of the world means that more and more processing is occurring overseas. Also, the countervailing duties put in place for shrimp in January 2005 included only fresh shrimp and not breaded shrimp or other value added shrimp products. As a result, foreign producers have begun breading shrimp and otherwise adding value overseas and the US has been importing more of these value added products. Breaded shrimp imports were up 12.9% in 2006 and look to increase in 2007. These facts suggest that this assumption should be explored further.

Table 2. Economic Impact Results

Percent Reduction	Import Processing		Shipping Transportation		Domestic Seafood Industry		Net Change	
	Income*	Jobs	Income*	Jobs	Income*	Jobs	Income*	Jobs
5%	-$118.6	-975	-$14.2	-400	$56.4	1,352	-$73.15	16
25%	-$234.5	-2,294	-$33.4	-941	$297.8	4,616	$47.48	4,059
50%	-$554.8	-3,942	-$57.5	-1,618	$599.5	14,257	$22.83	9,115
75%	-$1,070.0	-5,590	-$81.5	-2,294	$1,502.0	35,703	$439.83	27,865

*Millions of US $

Part of the losses in the processing sector will be directly offset by increases in processing of domestic product. Also, the commercial fisheries impact model used has higher income multipliers for processing than harvesting and higher employment multipliers for harvesting than processing, which partially explains why the job impacts rise faster than the income impacts. It is also worth noting that the US shrimp processing sector currently only employs 8,156 workers and processes $1.4 billion in product (FUS 2006). At the 75% reduction, processor revenue falls by $927 million. It is also worth noting that the domestic shrimp harvest has been relatively flat since 1989 with the trend being a slight decline in production. Domestic shrimp landings in 2006 were 152,632mt. Domestic harvests, under these scenarios, vary from 261,402mt to 1.3 million mt under the 75% reduction and 5% reduction policy respectively. It is also worth noting that the current 2006 level of shrimp landings supports roughly 14,000 jobs in the economy, including harvesters, processors, dealers, and wholesalers. Without significant changes in shrimp harvest policies or increased aquaculture development it would be difficult to meet these increased domestic production levels

DISCUSSION

In the past 20 or so years, the United States has increasingly relied on imports for its supply of seafood and related products. In 1980, imports accounted for 62% of the total supply available for U.S. consumption of edible seafood, and in 2006, imports' share of the total supply available for U.S. consumption had increased to 86% percent. A large dependency on foreign supplies of any product often worries U.S. consumers and policy makers. The concerns are related to dollars and jobs leaving the United States, and the potential for some nations to manipulate the U.S. economy. More recent concerns relating to the importation of seafood include the use of harmful chemicals in producing aquaculture products, the impacts of destructive fishing practices on PLMR, and potential differences in comparative advantage when other harvesting nations are not subject to as stringent harvesting policies as US harvesters face.

In this report, a limited economic assessment of the potential ramifications of import restrictions is provided for shrimp. The demand model here is very simplistic and is limited largely due to the type of and quality of data available. No data exists on retail prices or retail consumption making it impossible to estimate how consumer benefits at the retail level would change. Changes in benefits at the retail level are likely to be much higher than at the ex-vessel and import sector levels as examined here.

Another major limitation of this study is that restricting imports of shrimp would likely affect the demand for other imports, other domestically harvested or produced fish, and quite likely the demand for other forms of protein. Unfortunately, data sufficient for such a comprehensive task was not available for this project. Therefore the results presented here are best viewed as qualitative indicators of change rather than precise quantitative indicators of the economic ramifications of restricting imports. Much further work can be done to hone these estimates and this work should be considered a first pass.

The results are not surprising. Restricting shrimp imports increases U.S. expenditures on foreign products for low levels of restrictions, but revenues decrease as the reductions are increased. Reducing imports increases US jobs and US income, but reduces consumer benefits very substantially. For example, a 50% reduction in the importation of shrimp could cause a reduction of $4 billion per year in consumer benefits but increase seafood industry jobs over 9,000 and increase incomes nearly $23 million.

Of further interest to nations that export shrimp would be models that incorporate country of shrimp origin. The data contains origin data; however, origin is actually only the country of last significant processing. The top three exporters of shrimp in this report were Thailand (32.8%), China (11.5%), and Ecuador (10.1%), by volume. Additionally, impacts detailed here are national level impacts, which might hide regional impact issues. For example 46.4% of all shrimp arrives in Los Angeles, California customs district, 20.9% in New York, New York, and 10.3% in Miami, Florida.

In this era of challenges the question arises: can the US industry increase production to offset a loss in imports? Domestic landings have been on the decline and the domestic industry has been in decline. Harvests have been flat and declining since 1989. Shrimp prices are falling and regulations are increasing. The stocks in the US are heavily regulated because harvests are at their limit. Increasingly restrictive management policies increase cost and further drive the wedge between domestic harvest and imports harvested under less restrictive regimes. Energy prices have risen, driving processing costs up and driving fuel dependent harvesting costs up as well. Along the same lines, labor costs are higher in the US than in most of the import trade partners' countries. Infrastructure is being lost as coastal development pressure and a shrinking commercial harvesting sector have led to the conversion of the seafood infrastructure into other types of development. In addition to the rising competition from wild caught imports, the US faces strong competition from foreign aquaculture, which is much more prevalent outside of the US. It would be difficult for the industry to ramp up production even if harvests could be increased, at least in the short term. It might be possible to increase aquaculture production, but not without another set of regulatory and infrastructure hurdles. Additionally, to increase production, it would likely be necessary to make tradeoffs for less conservation and more bycatch. If production cannot be increased, consumer benefits will fall even farther

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