HAS THE SHRIMPING INDUSTRY BOUNCED BACK SINCE DEEPWATER HORIZON?

by

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ABSTRACT

JONATHAN BROWNSTEIN. Has the Shrimping Industry Bounced Back Since Deepwater Horizon? (Under the direction of DR. CRAIG A. DEPKEN, II)

Nearly fifteen months after the British Petroleum (BP) oil spill of April 20, 2010, later characterized as one of the largest accidental oil spills in United States history, BP submitted findings showing that the Gulf economy reached pre-spill activity and declared that the local economies had recovered. BP's post incident statistics illustrated a vison of a thriving future in the Gulf economy, and subsequently established that there was no longer a need for BP's continuation of payments to mitigate future risk to the Gulf economy (Supplemental Comments of BP Exploration & Production Inc., 2011). However, can this claim be substantiated?

This study divides the state of Florida's coastline into two zones. With the western portion of the state (Gulf coast) and the eastern portion of the state (Non-Gulf coast) data separated, we can effectively model a valid control and treatment group. These two regions, sharing similar demographics and geography, allow us to implement this approach. By comparing the two Floridian coasts, we look for a common trend pre-spill in pounds harvested, value, and average value, in both magnitude and direction. If similar, this approach allows us to imply the economic impact, if any, post-spill.

This analysis finds that when considering National Oceanic and Atmospheric Administration (NOAA) data, results substantiate BP claim showing that average value increased in the Post BP Claim Period for every shrimp species, including in aggregate. Pounds harvested also increased for almost every shrimp species.

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CHAPTER 1 – INTRODUCTION

On April 20, 2010, the shrimping industry experienced a catastrophic environmental change; the Deepwater Horizon spill became the largest oil spill in United States history. An explosion caused oil to seep into the Gulf of Mexico for 87 days leaking approximately 134 million gallons of oil originating from an oil rig situated on Mississippi Canyon Block 252, located offshore of Louisiana's Gulf coast (Macondo Prospect, Gulf of Mexico).

Over 10 years later, evidence is still emerging that highlights the severity of the spill. As recently as this year (2020), a paper peer-reviewed by Science Advances journal suggested that previous estimates of oil leaked into the gulf, determined by satellite imagery of the Texas shore, Florida Keys, and coast of Tampa, could have been underestimated by as much as 30% (Berenshtein, 2020).

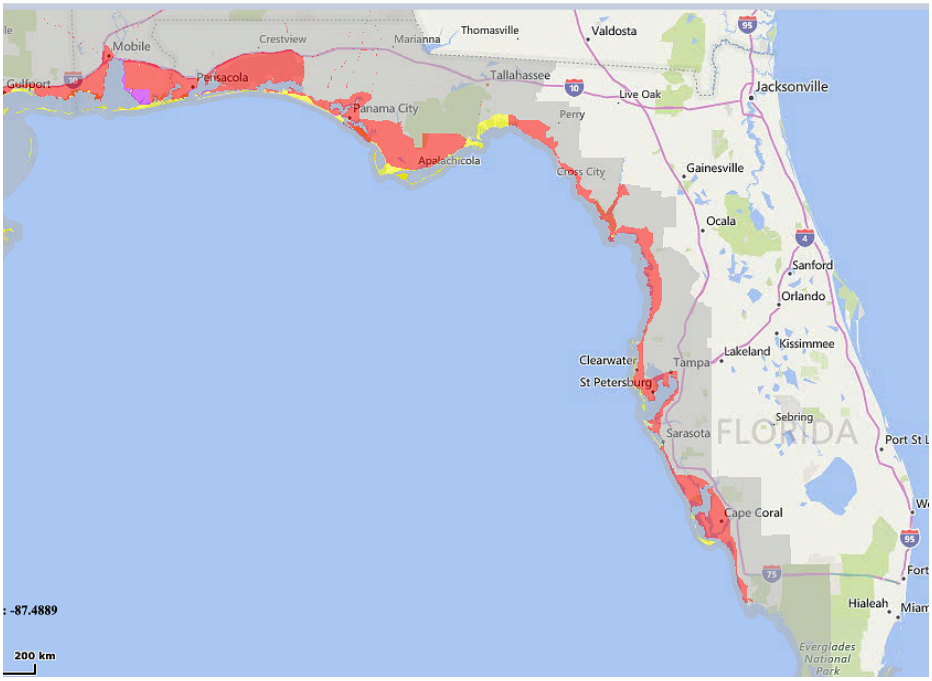
Given the impact of the oil spill on the Gulf coast economy, almost immediately after the spill, litigation was brought against BP from individuals and businesses which relied on the Gulf and claimed to be negatively impacted from the spill. On May 27, 2010, Transocean, which owned the Deepwater Horizon and was contracted by BP, said in a statement before the United States House Judiciary Committee that the company was a defendant in nearly 120 lawsuits, over half being class action lawsuits (Deep Water Horizon Gulf Coast Oil Spill Lawsuits, 2019). The claimants ranged from fishermen, restaurant owners, and seafood processing facilities that claimed to be affected by the spill. Class action *Wilkerson v. Transocean* primarily covered these fishermen and shrimpers, among other groups, who relied on the Gulf of Mexico for income and profit and claimed financial damages caused by the spill (Clingman, 2010).

Following litigation, BP agreed by June 16, 2010 to designate $20 billion to settle claims filed by businesses and individuals. A court-appointed settlement program named the Gulf Coast Claims Facility (GCCF) was established as a program to administer funds allocated in a court-established trust fund to compensate for actual loss incurred as well as a "future factor" which was intended to account for future losses (BP Gulf of Mexico Oil Spill Settlement, 2020).

On July 7, 2011, approximately one year after the settlement, BP submitted findings to the GCCF stating that "multiple lines of evidence demonstrate that, to the extent portions of the Gulf economy [that] were impacted by the spill, the Gulf economy [had] recovered, and there [was] not a basis for continuing to pay for future factor to account for the risk of future loss" (Supplemental Comments of BP Exploration & Production Inc., 2011).

With the evidence provided, BP sought to reduce the company's long-term liability due to the spill. Considering the states impacted by the spill (Alabama, Florida, Louisiana and Mississippi), the western coast of Florida was determined to be within the "Economic Loss Zone" designated by the GCCF while the Eastern coast of the state was not included in the zone (DARRP, 2010). Since the state of Florida could be easily divided into two sections (as shown in Figure 1 below), east and west, a difference-in-difference technique is an effective tool in determining the oil spills' impact, if any, on Florida's shrimping industry. Using this approach, I test whether there is any correlation between the spill and performance in the Floridian shrimping industry, with focus on pounds harvested, value, and average value of shrimp.

Figure 1: Economic Loss Zone on Gulf Coast of Florida



Economic Loss Impact Zone Highlighted in Red Providing a Visual of Coastal Communities Impacted in Gulf Coast of Florida

As seafood from the Gulf is the focus, shrimp is selected in this analysis since it is a highly valued commercial species harvested from the Gulf of Mexico which has significant importance with local coastal communities (Ropicki, 2016). This paper looks into BP's July 2011 claim submitted to the GCCF stating that the shrimping industry had returned to pre-spill levels in Florida. For this analysis, five species of shrimp common to Florida's Gulf and Atlantic regions were selected: Brown, Pink, Rock, Royal Red and White Shrimp.

CHAPTER 2 – LITERATURE

The Gulf states, including Florida, supply 73% of all wild shrimp for the United States (Warner 2010). The BP oil spill caused a major disruption in domestic consumption due to various factors including closed waters for shrimping activity and a fluctuation of the amount of shrimp available for harvest due to a lack of demand of shrimp sourced from the Gulf. Additionally, loss of market share from wild-caught to farm-raised shrimp was a concern for the industry as Americans shifted purchasing to imported shrimp from large exporting countries including Thailand, Ecuador, Indonesia, China, Mexico and Vietnam (Warner, 2010).

The oil spill wasn't the first instance of adversities that have affected the Gulf coastal communities. Prior to the spill, several hurricanes have devastated local economies, including in 2005, when Congress appropriated $260 million in aid due to hurricane Katrina and Rita, "for the direct needs of fishermen and related businesses, and supported related fisheries programs such as oyster bed and fishery habitat restoration, cooperative research, product marketing, fishing gear studies, and seafood testing" (Congressional Research Service 2019).

There is a considerable amount of research that has examined the impact of the BP oil spill and other events on the Gulf coast economy. Newly published research has examined the economic impact to costal employment and provides evidence that the state of Florida faced a larger loss in employment than other Gulf states; it is estimated that roughly 80,000 people lost employment due specifically to the accident. These jobs have since been restored, and along with $2.314 billion dollars distributed to claimants in

Florida, it is argued that the economic impact of the spill has been remediated (Norman, 2017).

What makes this paper unique is that this is the first time, from review of previous literature, that a difference-in-difference approach has been implemented to study specifically how shrimp species (in aggerate and individually) were affected by the spill, to which we can further imply an effect on the coastal shrimping communities. The difference-in-difference approach used in this analysis has been used in other applications to measure the effect of a change, holding all else constant.

An example of a difference-in-difference approach utilizing regression analysis can be cited from Kiel and McClain who used the approach to measure the selling price of homes before and after a garbage incinerator was built in the surrounding area. Factors including age of the home, distance to central business districts, number of rooms and bathrooms, and proximity of the home to the incinerator were used in their econometric model to determine the impact the garbage incinerator had on home prices post-build. A similar neighboring town unaffected by the garbage incinerator was used as a control group in order to observe evidence of any impact (Depken, 2018).

Another practical example of this approach, and perhaps one of the most recognized studies, was by Card and Krueger who had studied the impact of minimum wage in the fast food industry (Burger King, KFC, Roy Rogers and Wendy's) in eastern Pennsylvania and New Jersey. The study examined the impact of a minimum wage increase from $4.25 to $5.05 that took effect on April 1, 1992. Their study found that the rise in minimum wage did not reduce employment in New Jersey, using eastern

Pennsylvania, which did not implement a minimum wage increase, as a control in their model (Card & Krueger, 2004).

Similar to these previous studies, this analysis uses eastern Florida as a control since it was not impacted by the BP oil spill (as determined by the "economic loss zones"). In Kiel and McClain's research on incinerator proximity, home prices pre-spill were used as a control group. I use this same approach to estimate the impact of the oil spill on shrimp and from this information we can imply the economic impact on the shrimping community due to the oil spill.

CHAPTER 3 – DATA AND METHODOLOGY

In this analysis, data from NOAA and FFWLC shrimp landings were used. BP had used NOAA data in their analysis, and the FFWLC data provides a robustness check for the NOAA data. This paper examines both datasets to determine how pounds harvested, value, and average value were influenced by the BP oil spill. For each dataset pounds harvested is measured as live weight and value is measured in nominal US dollars without adjustment for inflation.

NOAA commercial landing data comprises a monthly panel from years 2004 – 2016 that is grouped into two regions, Gulf and Non-Gulf. The data describe pounds harvested and value for Brown, Pink, Rock, Royal Red and White Shrimp.

FFWLC commercial landing data comprises a quarterly panel from years 2000 – 2016 that is grouped into Gulf and non-Gulf regions. Florida regulation prohibits the disclosure of individual fishery data from being disclosed. Therefore, to comply with Florida regulation, FFWLC provides the data in quarterly segments. By providing the data by regions (Gulf/Non-Gulf) rather than by county, it maintains the privacy of the fisheries. The FFWLC data includes pounds harvested, value, and a derived field for average value for all shrimp considered in the NOAA dataset, in addition to bait and other shrimp types, which to keep consistent with the NOAA dataset bait and other shrimp types are not considered in this study. Fishery product is credited to the shore on which it is landed.

The statistical approach of this analysis includes a difference-in-difference technique which allows for a statistical model, referred to as a quasi-natural experiment by economists, where panel data is used to mimic an experimental research design to

study the resulting effect of the natural experiment on the treatment group against a control group. This technique was first used by Obenauer and Von Der Nienburg (1915) to study the effects of minimum wage for the US Bureau of Labor Statistics. The technique has also been extended to other natural experiments such as testing the effect a New Jersey minimum wage increase had on employment in the fast food restaurant industry in New Jersey using Pennsylvania as a control (Angrist & Pischke, 2009).

By using the difference-in-difference technique in this analysis, we compare the unaffected Eastern (Gulf) side of the state with the affected Western (Non-Gulf) side of the state. If shrimping is comparable prior to the spill, referred to as the common trends assumption, we can utilize a difference-in-difference technique with this data to analyze the impact of the spill on the shrimping industry.

Since this analysis focuses on two periods of time, Spill period and Post BP Claim period, two OLS regression models are utilized:

Model 1: Spill Period

$$y_{it} = \beta_0 + \beta_1 SPILL_t + \beta_2 GULF_i + \beta_3 SPILL_t * GULF_i + \varepsilon_{it}$$

SPILL is a dummy variable that represents the period of time oil leaked into the Gulf (between 2010 Q2 – 2011 Q3 for NOAA data and FFWLC data). GULF is a dummy variable for the Gulf coast; this dummy variable captures differences between the Gulf coast and Eastern coast of Florida. The coefficient B_3 is the interaction term of significance, which represents the difference between the Gulf and Non-Gulf coast for pounds harvested, value, and average value during the spill period.

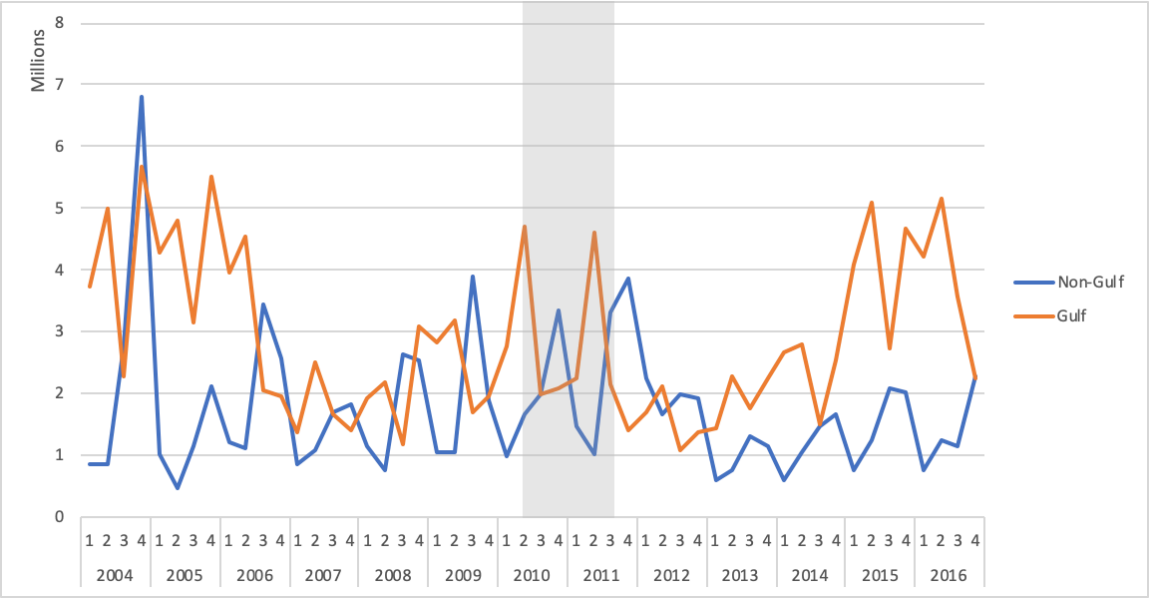
Model 2: Post BP Claim Period

$$y_{it} = \beta_0 + \beta_1 POSTBPCLAIM_t + \beta_2 GULF_i + \beta_3 POSTBPCLAIM_t * GULF_i + \varepsilon_{it}$$

POSTBPCLAIM is a dummy variable that represents the period after BP made the claim that there was no longer a basis for continuing to make payments to account for future loss to claimants. GULF is a dummy variable for the Gulf coast; this dummy variable captures differences between the Gulf and Non-Gulf coast of Florida. The coefficient B_3 is the interaction term of significance, which represents the difference between the Gulf and Non-Gulf coast for pounds harvested, value, and average value after BP's claim.

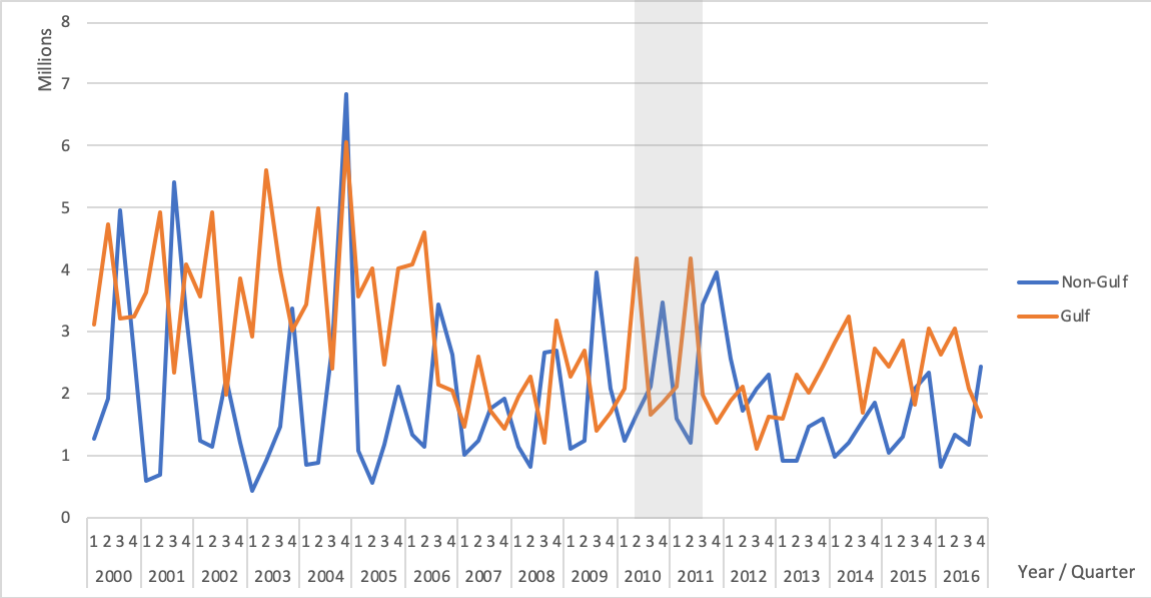
Using this model, the interaction term helps aid in understanding whether BP's claim to end payments could be substantiated based on conditions of shrimp landings, value, and average value returning to pre-spill levels. With the model defined, we compare the two Floridian coasts (Gulf and Non-Gulf), and look for a common trend in pre-spill in, pounds harvested, value, and average value, in both magnitude and direction. If similar, this approach will allow us to imply the economic impact, if any, post-spill. The below six graphs shown in figure 2 through 7 show aggregated data, with NOAA data rolled up from monthly to quarterly data for all shrimp species selected for this analysis. The figures sections include graphs for each species individually, as well.

Figure 2: All Shrimp – NOAA Data – Pounds harvested



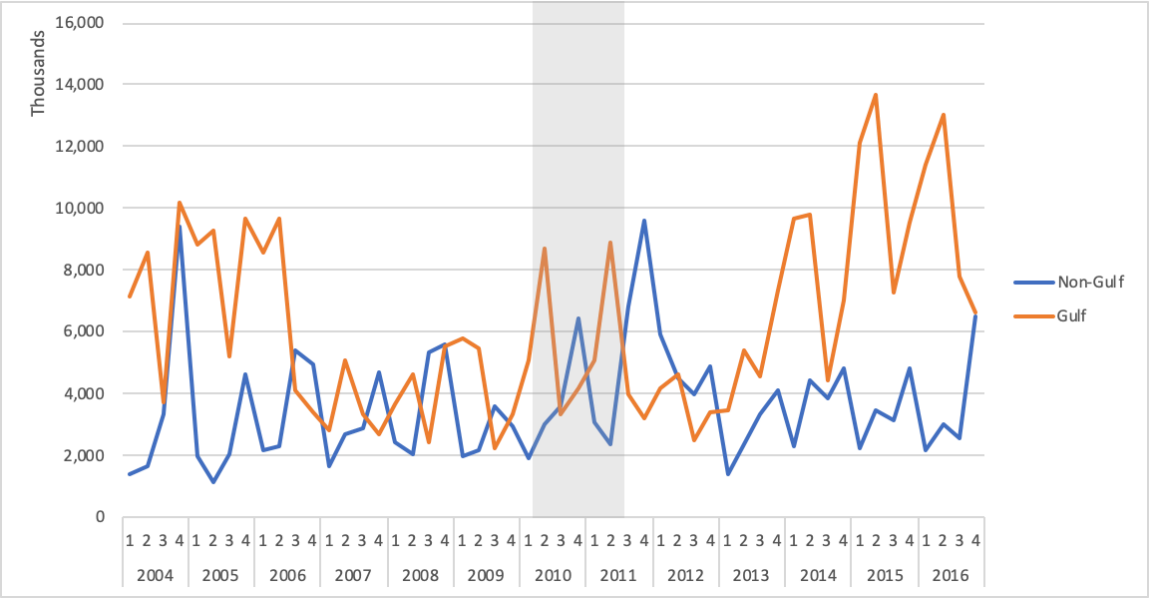
Pounds Harvested by Year/Quarter, Spill Period Highlighted in Gray

Figure 3: All Shrimp – FLFWC Data – Pounds Harvested



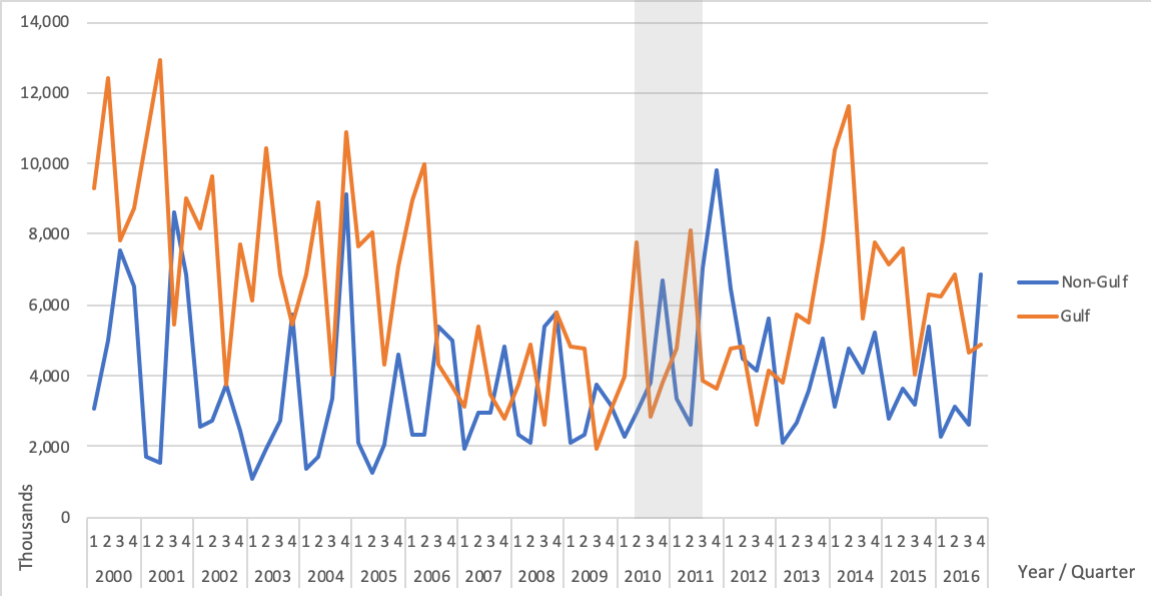
Pounds Harvested by Year/Quarter, Spill Period Highlighted in Gray

Figure 4: All Shrimp – NOAA Data – Value



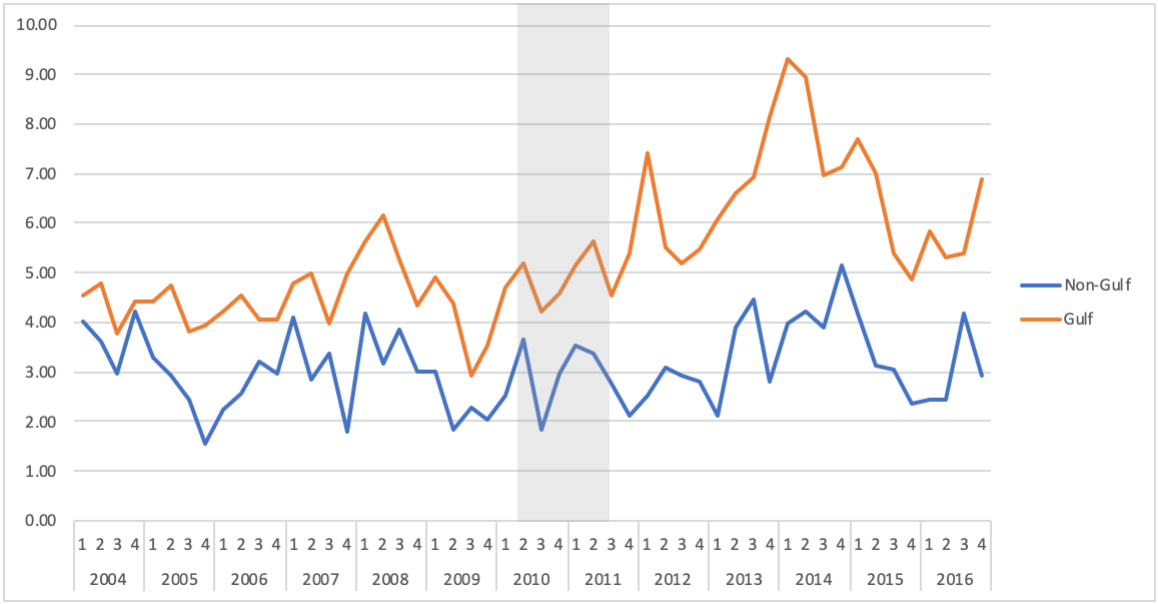
Value by Year/Quarter, Spill Period Highlighted in Gray

Figure 5: All Shrimp – FLFWC Data – Value



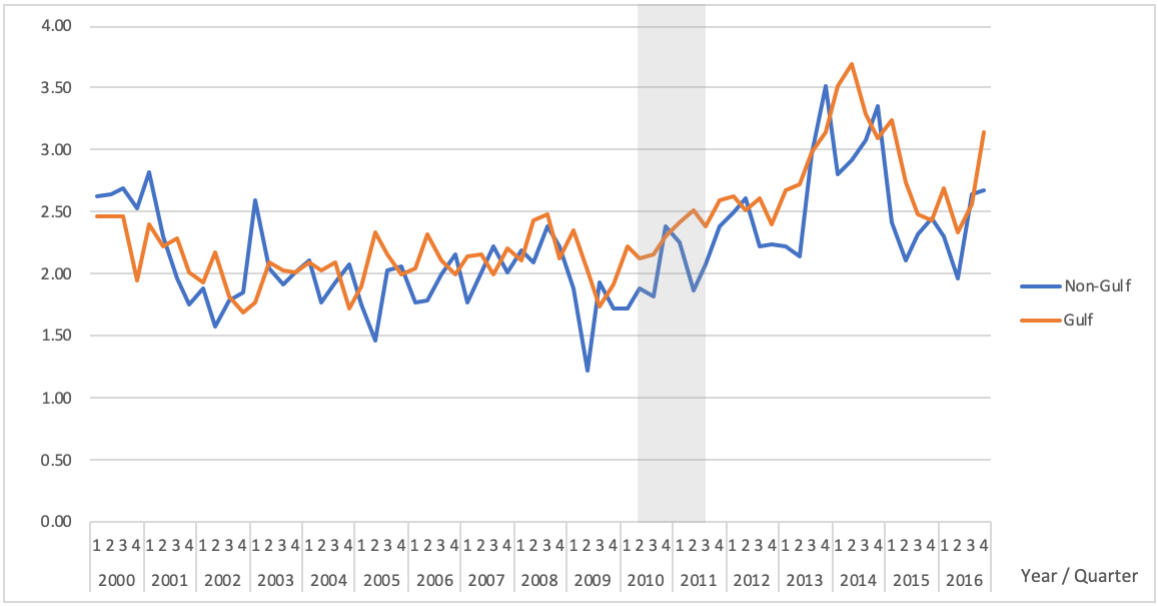
Value by Year/Quarter, Spill Period Highlighted in Gray

Figure 6: All Shrimp – NOAA Data – Average Value



Average Value by Year/Quarter, Spill Period Highlighted in Gray

Figure 7: All Shrimp – FLFWC Data – Average Value



Average Value by Year/Quarter, Spill Period Highlighted in Gray

In review of the graphs found in figure 2 through 7, in aggregate, the common trends appear to be relative in both magnitude and direction pre-spill. Individually, as found in the appendix section, Pink and White shrimp appear to differ in common trend pre-spill in both datasets. Given this, the results for Pink and White shrimp may be invalid.

CHAPTER 4 – RESULTS

Using the difference-in-difference approach from both NOAA and FFWLC, results are compared in aggregate and by species, between the two datasets. The results of two periods are analyzed, Post BP Claim and the Spill Period, using the two models specified previously. The interaction term B_3 is compared for both datasets and both time periods, in aggregate as well as by each species type for pounds harvested, value, and average value in each of the tables presented below.

In aggregate, as shown in table 1 and 2 shown below, during the Spill period, NOAA data showed that average value was negatively statistically significant at the 10% level; pounds harvested and value showed to be negative, although not statistically significant. FFWLC data did not show any statistically significant coefficients for the interaction term; pounds harvested and average value were calculated with a negative coefficient.

Although the results were not statistically significant, a negative coefficient in pounds harvested and average value makes sense. During this time, waters used for shrimping were closed. In addition, a decrease in demand is expected due to a negative stigma of seafood from the Gulf (Greiner, 2013).

In aggregate, during the Post BP Claim period, NOAA data showed that average value was positively statistically significant at the 1% level; pounds harvested and value showed to be positive, although not statistically significant. FFWLC data did not show any statistically significant coefficients for the interaction term; pounds harvested and value were calculated with a negative coefficient while average value carried a positive coefficient.

Evidence of a statistically significant increase in average value during the Post BP Claim period could be related the BP's claim that the shrimping industry in the Gulf had returned to pre-spill levels.

Table 1: Interaction Term Comparison – Spill Period – All Shrimp

Interaction Term Results	Pounds	Value	Avg Value
FFWLC Data	-632,828	-1.924e+06	-0.0730
	(627,768)	(1.210e+06)	(0.680)
NOAA Data	-112,278	-428,353	-0.752*
	(155,562)	(280,900)	(0.407)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2: Interaction Term Comparison – Post BP Claim Period – All Shrimp

Interaction Term Results	Pounds	Value	Avg Value
FFWLC Data	-566,093*	-1.053e+06	0.687
	(326,153)	(725,528)	(0.752)
NOAA Data	30,577	327,608	2.825***
	(93,779)	(210,976)	(0.383)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3, found below, provides a comparison of results for aggregated species, as well as individually. The complete results for each individual species can be found in the appendix. The non-shaded regions indicate that the result was statistically significant. The positive/negative sign indicates whether the results of the interaction term is positive or negative.

In review of this table, it is most interesting that the average value for all species is positive and statistically significant in the Post BP Claim Period. Additionally, pounds

harvested for all species except White and Pink shrimp showed as positive. White and Pink shrimp, after a review of the common trend assumptions, are not similar pre-spill (found in appendix) and therefore the results could be misleading.

Table 3: Overall Interaction Term Comparison

Spill Period	Pounds Harvested		Value		Average Value	
	NOAA	FFWLC	NOAA	FFWLC	NOAA	FFWLC
All Shrimp	+	-	+	-	-	-
Brown Shrimp	-	-	-	-	-	-
White Shrimp	-	-	+	-	+	+
Pink Shrimp	-	-	-	-	-	-
Rock Shrimp	+	+	+	+	+	+
Royal Red Shrimp	-	+	-	+	-	+

Post BP Claim Period	Pounds Harvested		Value		Average Value	
	NOAA	FFWLC	NOAA	FFWLC	NOAA	FFWLC
All Shrimp	+	-	+	-	+	+
Brown Shrimp	+	-	+	-	+	+
White Shrimp	-	-	-	-	+	+
Pink Shrimp	-	-	+	-	+	+
Rock Shrimp	+	+	+	+	+	-
Royal Red Shrimp	+	-	+	-	+	+

CHAPTER 5 – CONCLUSION

In summary, five species of shrimp were examined using a difference-in-difference model to determine the impact the Deep-Water Horizon oil spill had during Spill and Post BP Claim periods for five different species of shrimp, each with data grouped by pounds harvested, value, and average value.

Utilizing the technique of differences-in differences to establish a comparison of both regions, the west coast of Florida (within the Economic Loss Zone) and the east coast of Florida (outside the Economic Loss Zone), as established by the GCCF (Claims Center, 2020), I analyzed whether economic impacts were sustained by the shrimping community post spill.

In dividing the state's coastlines into two zones, the western portion of the state (Gulf coast) and the eastern portion of the state (Non-Gulf coast), I modeled a valid control and treatment group which share similar shrimping output prior to the spill. These two regions, sharing similar demographics and geography, allow us to implement this approach. By comparing the two Floridian coasts, I looked for a common trend pre-spill in pounds harvested, value, and average value in both magnitude and direction. This approach allowed me to imply the economic impact post-spill.

Evidence suggests that average value increased in the Post BP Claim Period for every shrimp species, including in aggregate. Also, value increased in the Post BP Claim Period for every shrimp species, including in aggregate except for White Shrimp. Pounds harvested increased in the Post BP Claim Period except for white and pink shrimp. Having increases in pounds harvested, value and average value in the Post BP Claim period provides evidence that the shrimping industry in the Gulf of Florida has bounced back since Deepwater Horizon.

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APPENDIX A

TABLES

FFWLC - All Shrimp - (PostBpClaim x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg_Price
PostBPClaim	37,040	1.223e+06	0.991
	(1.254e+06)	(3.215e+06)	(0.878)
Gulf	1.084e+06***	2.719e+06***	-0.369
	(249,822)	(449,031)	(0.278)
PostBPClaimGulf	-566,093*	-1.053e+06	0.687
	(326,153)	(725,528)	(0.752)
Constant	2.135e+06***	5.640e+06***	15.36***
	(454,682)	(790,825)	(0.538)
Observations	136	136	136
R-squared	0.382	0.472	0.671

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

FFWLC - All Shrimp - (Spill x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg Value
PostSpill	601,216	1.089e+06	0.193
	(782,864)	(2.001e+06)	(0.907)
Gulf	1.043e+06***	2.716e+06***	-0.250
	(183,290)	(356,883)	(0.287)
PostSpillGulf	-632,828	-1.924e+06	-0.0730
	(627,768)	(1.210e+06)	(0.680)
Constant	2.227e+06***	5.758e+06***	15.27***
	(451,816)	(791,679)	(0.563)
Observations	152	152	152
R-squared	0.380	0.482	0.658

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

FFWLC – Brown Shrimp (PostBpClaim x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg_Price
PostBPClaim	-161,989	-389,672	-0.251**
	(160,737)	(348,125)	(0.124)
Gulf	208,691***	499,808***	0.0630
	(46,136)	(97,533)	(0.0695)
PostBPClaimGulf	-91,131	-43,484	0.386**
	(61,597)	(141,805)	(0.163)
Constant	88,713	476,356*	3.363***
	(107,527)	(270,529)	(0.169)
Observations	135	135	135
R-squared	0.624	0.620	0.710

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

FFWLC - White Shrimp (PostBpClaim x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg_Price
PostBPClaim	803,310	2.470e+06	-0.0285
	(940,694)	(2.383e+06)	(0.228)
Gulf	-694,761***	-1.752e+06***	-0.463***
	(73,877)	(177,220)	(0.0717)
PostBPClaimGulf	-268,622*	-1.064e+06***	0.332*
	(152,034)	(389,218)	(0.170)
Constant	518,599***	1.707e+06***	3.453***
	(107,059)	(293,727)	(0.146)
Observations	136	136	136
R-squared	0.676	0.705	0.774

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

FFWLC - Pink Shrimp (PostBpClaim x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg_Price
PostBPClaim	-116,102	-394,564	0.257
	(267,050)	(813,808)	(0.247)
Gulf	2.061e+06***	4.469e+06***	0.325***
	(124,438)	(274,228)	(0.0988)
PostBPClaimGulf	-594,289***	-438,569	0.165
	(163,766)	(452,711)	(0.208)
Constant	345,190**	1.700e+06***	2.495***
	(139,479)	(421,555)	(0.225)
Observations	136	136	136
R-squared	0.820	0.810	0.531

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

FFWLC - Rock Shrimp (PostBpClaim x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg_Price
PostBPClaim	-457,287	-472,965	0.133
	(306,022)	(367,420)	(0.220)
Gulf	-477,868***	-532,388***	-0.162**
	(155,195)	(179,194)	(0.0668)
PostBPClaimGulf	417,259**	409,563*	-0.340*
	(172,243)	(207,404)	(0.176)
Constant	1.013e+06**	1.461e+06***	1.888***
	(430,273)	(540,556)	(0.127)
Observations	135	135	135
R-squared	0.369	0.396	0.660

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

FFWLC - Royal Red Shrimp (PostBpClaim x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg_Price
PostBPClaim	-180,116**	-248,960***	0.692***
	(69,355)	(92,667)	(0.180)
Gulf	-50,990***	-98,715***	-0.256**
	(19,077)	(35,251)	(0.124)
PostBPClaimGulf	-128,380***	-271,270***	0.506**
	(37,251)	(75,488)	(0.249)
Constant	179,637***	367,108***	2.258***
	(29,539)	(66,042)	(0.171)
Observations	96	96	96
R-squared	0.588	0.613	0.471

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

FFWLC – Brown Shrimp (Spill x Gulf)

Brown Shrimp

VARIABLES	(1) Pounds	(2) Value	(3) Avg Value
PostSpill	284,639**	613,224**	0.177*
	(143,241)	(303,484)	(0.105)
Gulf	191,861***	505,293***	0.176**
	(31,837)	(68,095)	(0.0704)
PostSpillGulf	-360,822**	-765,614**	-0.0859
	(156,517)	(341,745)	(0.142)
Constant	116,864	515,757*	3.300***
	(109,484)	(271,961)	(0.180)
Observations	151	151	151
R-squared	0.626	0.628	0.670

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

FFWLC - White Shrimp (Spill x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg Value
PostSpill	-241,809	-943,321	0.0862
	(566,250)	(1.460e+06)	(0.204)
Gulf	-766,446***	-2.106e+06***	-0.344***
	(64,846)	(168,040)	(0.0688)
PostSpillGulf	-156,972	-42,874	0.149
	(239,563)	(549,136)	(0.252)
Constant	539,913***	1.829e+06***	3.412***
	(113,976)	(306,308)	(0.158)
Observations	152	152	152
R-squared	0.661	0.677	0.756

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

FFWLC - Pink Shrimp (Spill x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg Value
PostSpill	574,666**	1.463e+06**	-0.125
	(264,883)	(674,570)	(0.204)
Gulf	2.014e+06***	4.715e+06***	0.406***
	(105,330)	(242,715)	(0.0877)
PostSpillGulf	-360,637	-1.354e+06**	-0.0406
	(338,199)	(569,247)	(0.241)
Constant	424,572***	1.705e+06***	2.454***
	(131,996)	(388,152)	(0.218)
Observations	152	152	152
R-squared	0.790	0.802	0.513

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

FFWLC - Rock Shrimp (Spill x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg Value
PostSpill	-93,089	-122,267	0.0573
	(259,729)	(369,914)	(0.0925)
Gulf	-385,040***	-470,716***	-0.245***
	(106,686)	(125,964)	(0.0714)
PostSpillGulf	337,867	409,071	0.116
	(305,700)	(440,161)	(0.111)
Constant	982,884**	1.443e+06***	1.950***
	(425,473)	(531,946)	(0.125)
Observations	151	151	151
R-squared	0.362	0.391	0.643

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

FFWLC - Royal Red Shrimp (Spill x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg Value
PostSpill	71,591	119,412	-0.128
	(73,726)	(91,244)	(0.334)
Gulf	-89,933***	-180,231***	-0.0596
	(19,377)	(38,390)	(0.117)
PostSpillGulf	-7,620	-26,527	-0.899***
	(48,207)	(79,822)	(0.214)
Constant	201,682***	412,881***	2.120***
	(32,009)	(70,007)	(0.182)
Observations	104	104	104
R-squared	0.500	0.523	0.536

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

NOAA - All Shrimp (PostBpClaim x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg Value
PostBPClaim	-149,867	-54,177	-1.665***
	(300,355)	(736,436)	(0.418)
Gulf	363,824***	744,854***	2.642***
	(70,099)	(114,140)	(0.192)
PostBPClaimGulf	30,577	327,608	2.825***
	(93,779)	(210,976)	(0.383)
Constant	963,922***	1.630e+06***	5.409***
	(194,480)	(292,258)	(0.487)
Observations	312	312	312
R-squared	0.338	0.381	0.731

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

NOAA - All Shrimp (Spill x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg Value
PostSpill	172,158	310,047	0.923*
	(171,668)	(405,955)	(0.475)
Gulf	389,128***	926,583***	3.870***
	(51,644)	(106,580)	(0.214)
PostSpillGulf	-112,278	-428,353	-0.752*
	(155,562)	(280,900)	(0.407)
Constant	958,320***	1.540e+06***	4.821***
	(191,102)	(293,673)	(0.586)
Observations	312	312	312
R-squared	0.340	0.380	0.675

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

NOAA - Brown Shrimp (PostBpClaim x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg Value
PostBPClaim	-79,126*	-192,036**	-0.790**
	(43,507)	(94,805)	(0.345)
Gulf	36,953***	89,813***	1.091***
	(14,056)	(26,214)	(0.120)
PostBPClaimGulf	22,058	94,498**	0.735***
	(19,547)	(40,411)	(0.221)
Constant	-37,915**	-95,000***	1.022***
	(17,147)	(33,930)	(0.271)
Observations	312	312	312
R-squared	0.559	0.516	0.468

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

NOAA - White Shrimp (PostBpClaim x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg Value
PostBPClaim	226,073	749,844	-0.130
	(184,975)	(467,962)	(0.164)
Gulf	-253,703***	-628,514***	-0.440***
	(22,297)	(52,192)	(0.0743)
PostBPClaimGulf	-51,922	-282,852***	0.405***
	(40,247)	(107,411)	(0.128)
Constant	401,469***	979,015***	2.269***
	(62,358)	(169,355)	(0.122)
Observations	312	312	312
R-squared	0.592	0.597	0.663

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

NOAA - Pink Shrimp (PostBpClaim x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg Value
PostBPClaim	-122,405	-409,978	-0.367**
	(94,219)	(259,200)	(0.153)
Gulf	715,373***	1.425e+06***	1.284***
	(37,883)	(74,500)	(0.0648)
PostBPClaimGulf	-64,072	388,079***	0.736***
	(54,412)	(143,492)	(0.120)
Constant	302,130***	524,945***	1.175***
	(83,099)	(166,332)	(0.187)
Observations	312	312	312
R-squared	0.739	0.723	0.787

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

NOAA - Rock Shrimp (PostBpClaim x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg Value
PostBPClaim	-156,177*	-173,124*	-0.238
	(90,480)	(103,140)	(0.303)
Gulf	-127,538***	-129,322***	0.657***
	(42,932)	(40,991)	(0.0796)
PostBPClaimGulf	114,928**	109,982**	0.656***
	(45,012)	(47,861)	(0.156)
Constant	284,068**	194,994**	0.301*
	(131,838)	(85,300)	(0.164)
Observations	312	312	312
R-squared	0.207	0.221	0.531

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

NOAA - Royal Red Shrimp (PostBpClaim x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg Value
PostBPClaim	-18,231	-28,883	-0.140
	(12,342)	(19,155)	(0.167)
Gulf	-7,260**	-12,596**	0.0506
	(3,614)	(6,381)	(0.0750)
PostBPClaimGulf	9,583**	17,900**	0.293**
	(3,860)	(6,992)	(0.141)
Constant	14,170**	25,628**	0.641***
	(5,995)	(10,982)	(0.232)
Observations	312	312	312
R-squared	0.142	0.133	0.157

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

NOAA - Brown Shrimp (Spill x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg Value
PostSpill	86,660**	197,352**	0.537
	(38,959)	(85,865)	(0.358)
Gulf	58,661***	155,258***	1.413***
	(9,511)	(18,310)	(0.113)
PostSpillGulf	-110,928**	-236,448**	-0.224
	(45,216)	(98,669)	(0.305)
Constant	-46,259**	-121,895***	0.885***
	(17,971)	(37,656)	(0.291)
Observations	312	312	312
R-squared	0.574	0.530	0.448

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

NOAA - White Shrimp (Spill x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg Value
PostSpill	-80,380	-323,009	-0.0127
	(110,981)	(285,012)	(0.150)
Gulf	-270,837***	-747,135***	-0.283***
	(20,304)	(53,886)	(0.0673)
PostSpillGulf	-33,232	38,073	0.0596
	(60,309)	(143,082)	(0.169)
Constant	402,457***	1.015e+06***	2.190***
	(63,872)	(178,065)	(0.122)
Observations	312	312	312
R-squared	0.586	0.581	0.651

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

NOAA - Pink Shrimp (Spill x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg Value
PostSpill	135,037*	374,563**	0.0986
	(71,521)	(151,323)	(0.173)
Gulf	694,990***	1.617e+06***	1.596***
	(29,468)	(74,055)	(0.0666)
PostSpillGulf	-47,599	-305,190**	-0.126
	(83,685)	(147,697)	(0.128)
Constant	319,569***	441,666***	1.021***
	(85,368)	(165,013)	(0.205)
Observations	312	312	312
R-squared	0.738	0.718	0.757

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

NOAA - Rock Shrimp (Spill x Gulf)

VARIABLES	(1) Pounds	(2) Value	(3) Avg Value
PostSpill	-349.0	8,658	-0.224
	(72,200)	(99,324)	(0.219)
Gulf	-93,302***	-98,784***	0.911***
	(27,879)	(26,138)	(0.0817)
PostSpillGulf	105,532	120,271	0.0971
	(84,440)	(115,311)	(0.178)
Constant	270,864**	184,642**	0.166
	(128,503)	(82,600)	(0.182)
Observations	312	312	312
R-squared	0.198	0.215	0.500

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

NOAA - Royal Red Shrimp (Spill x Gulf)

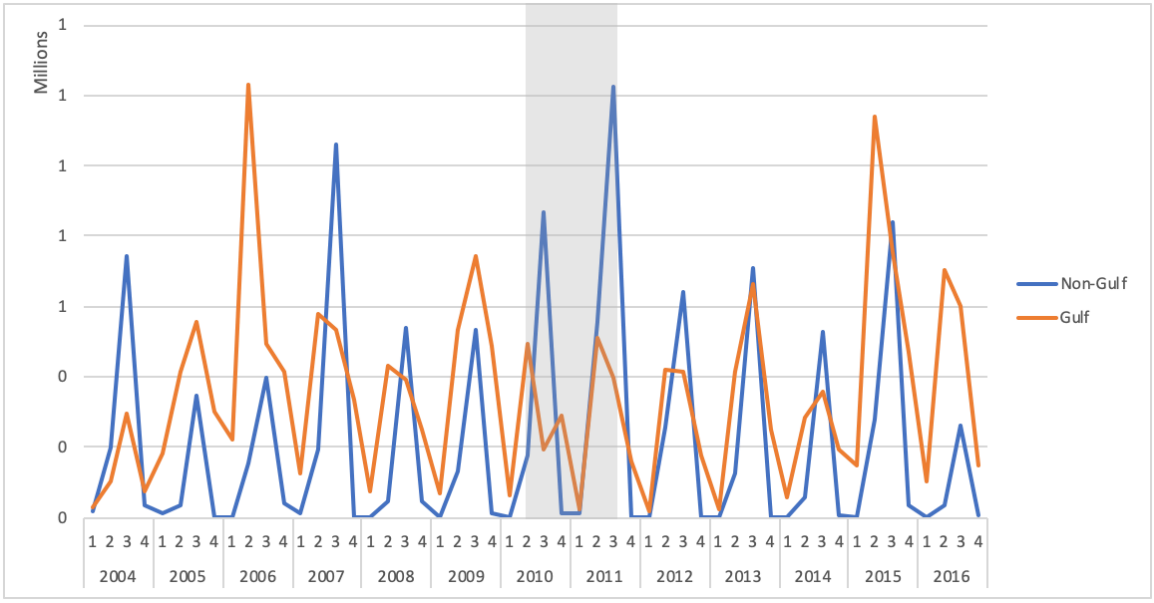
VARIABLES	(1) Pounds	(2) Value	(3) Avg Value
PostSpill	31,189**	52,484**	0.524***
	(13,277)	(21,533)	(0.178)
Gulf	-383.5	-167.9	0.233***
	(1,801)	(3,470)	(0.0709)
PostSpillGulf	-26,052**	-45,059**	-0.558***
	(12,822)	(20,896)	(0.177)
Constant	11,689**	20,950*	0.559**
	(5,859)	(10,765)	(0.226)
Observations	312	312	312
R-squared	0.187	0.173	0.169

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

APPENDIX B

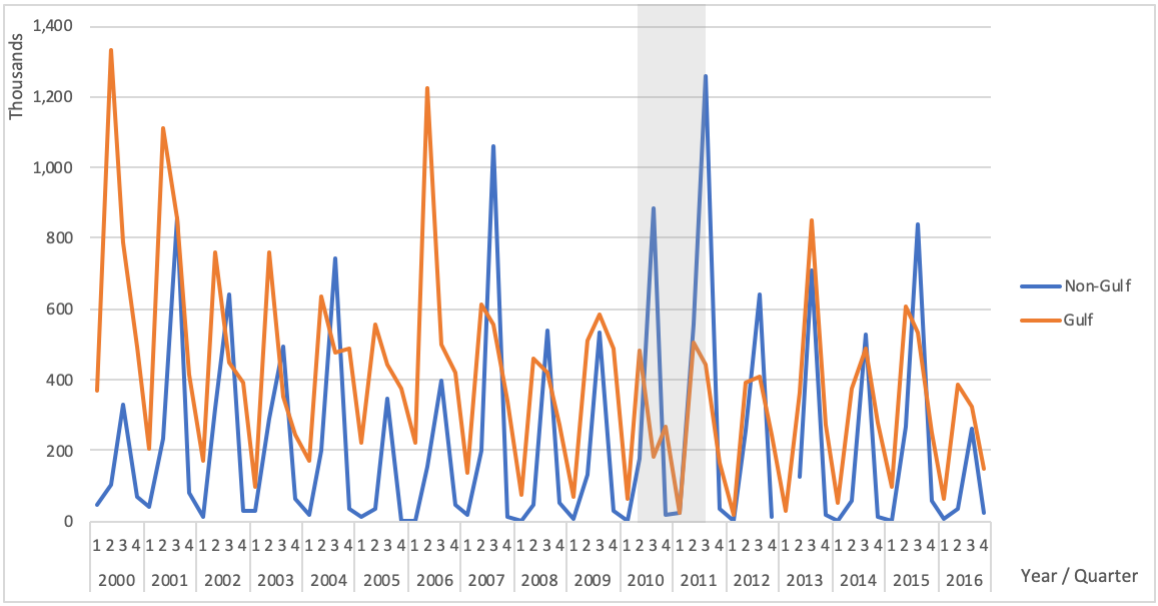
FIGURES

Brown Shrimp – NOAA Data – Pounds Harvested



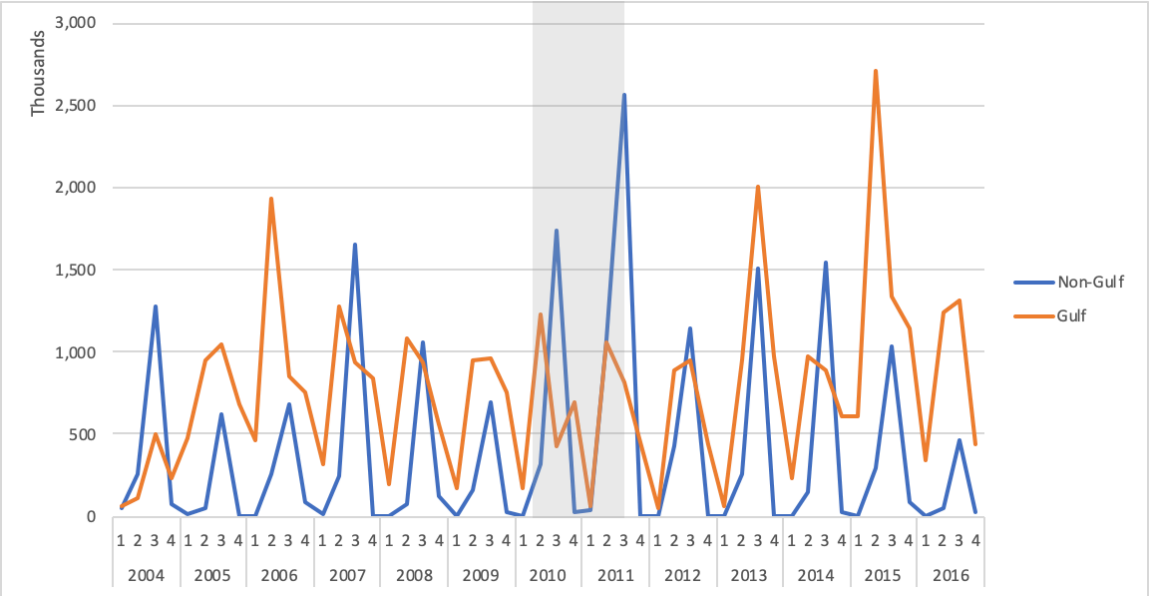
Pounds Harvested by Year/Quarter, Spill Period Highlighted in Gray

Brown Shrimp – FLFWC Data – Pounds Harvested



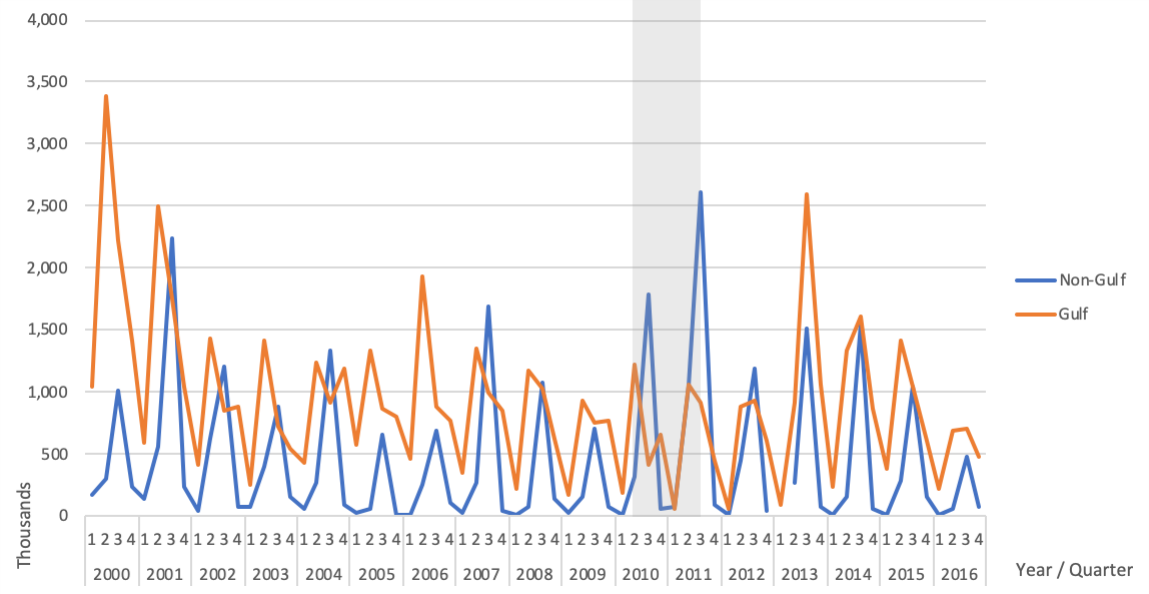
Pounds Harvested by Year/Quarter, Spill Period Highlighted in Gray

Brown Shrimp – NOAA Data – Value



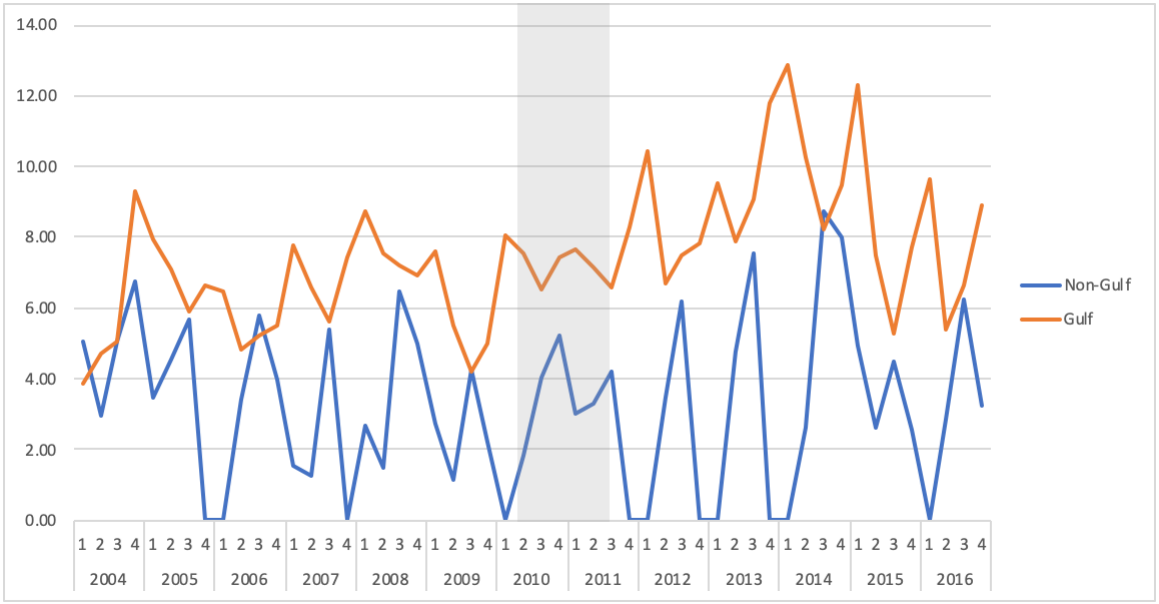
Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

Brown Shrimp – FLFWC Data – Value



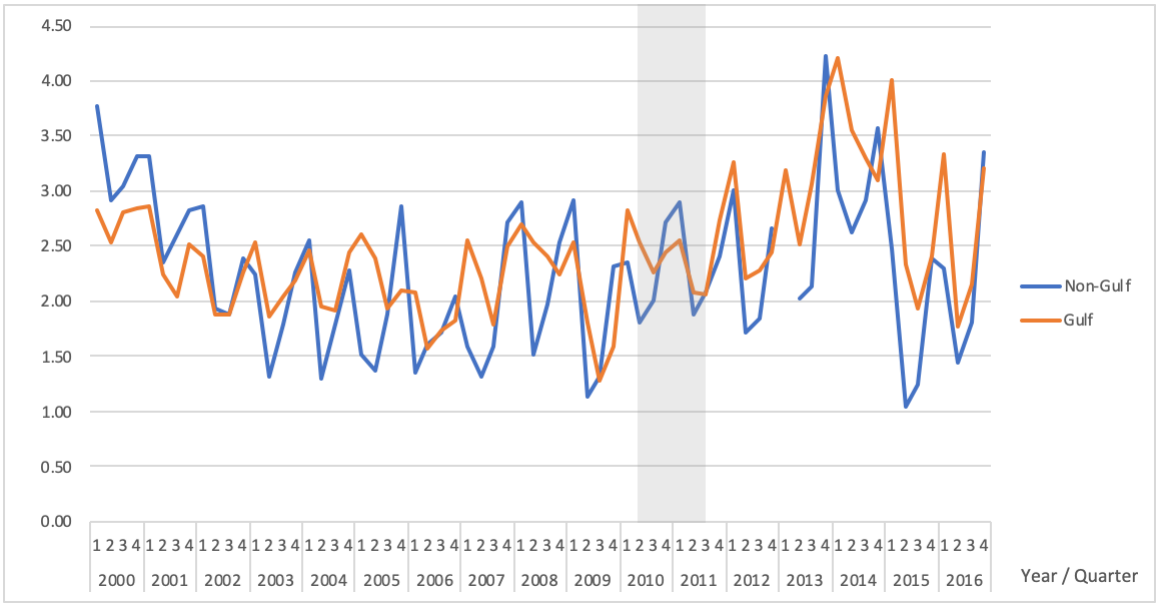
Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

Brown Shrimp – NOAA Data – Average Value



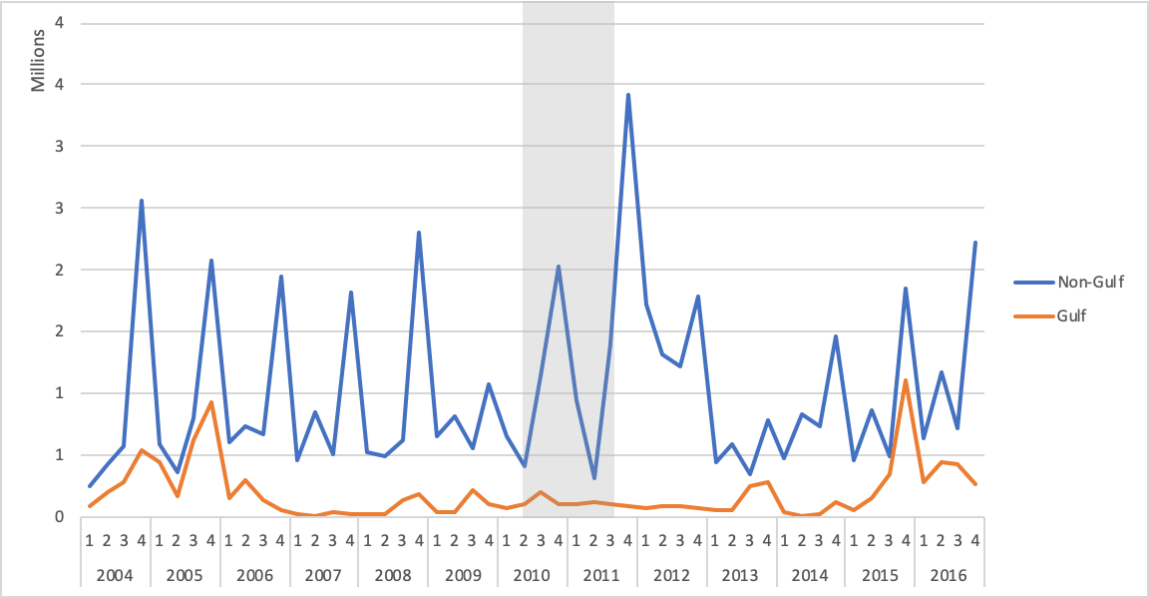
Average Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

Brown Shrimp – FLFWC Data – Average Value



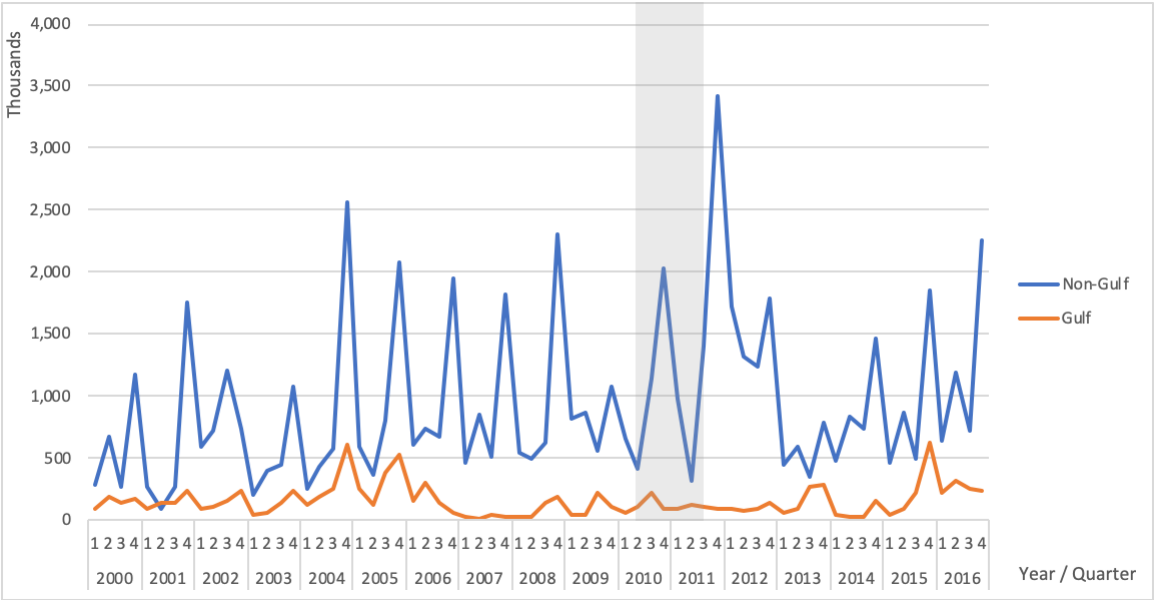
Average Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

White Shrimp – NOAA Data – Pounds Harvested



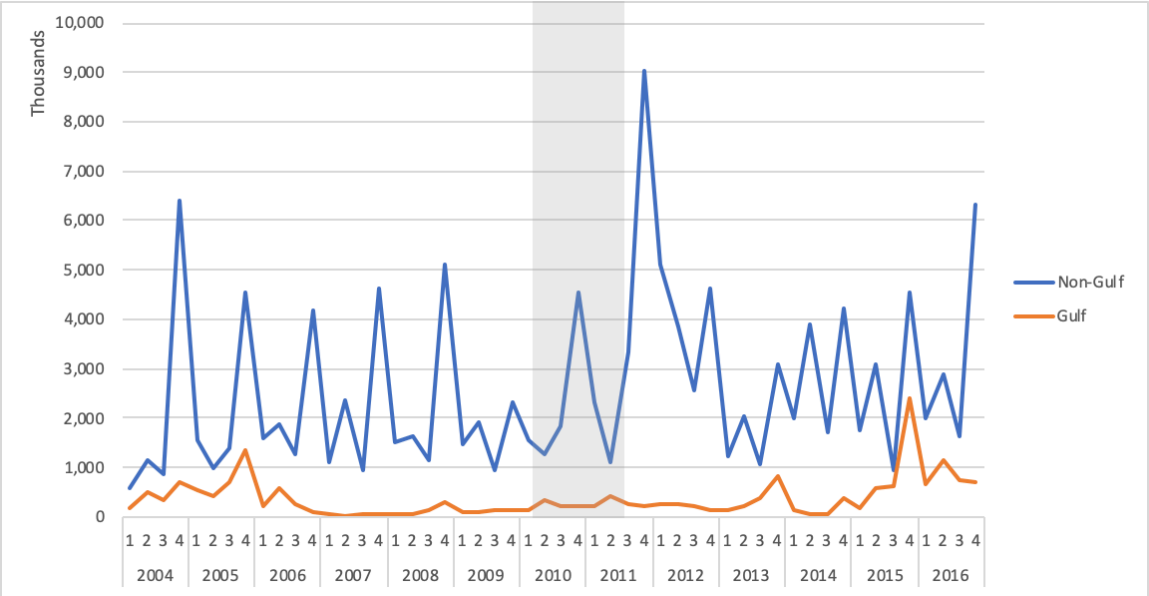
Pounds Harvested by Year/Quarter, Spill Period Highlighted in Gray

White Shrimp – FLFWC Data – Pounds Harvested



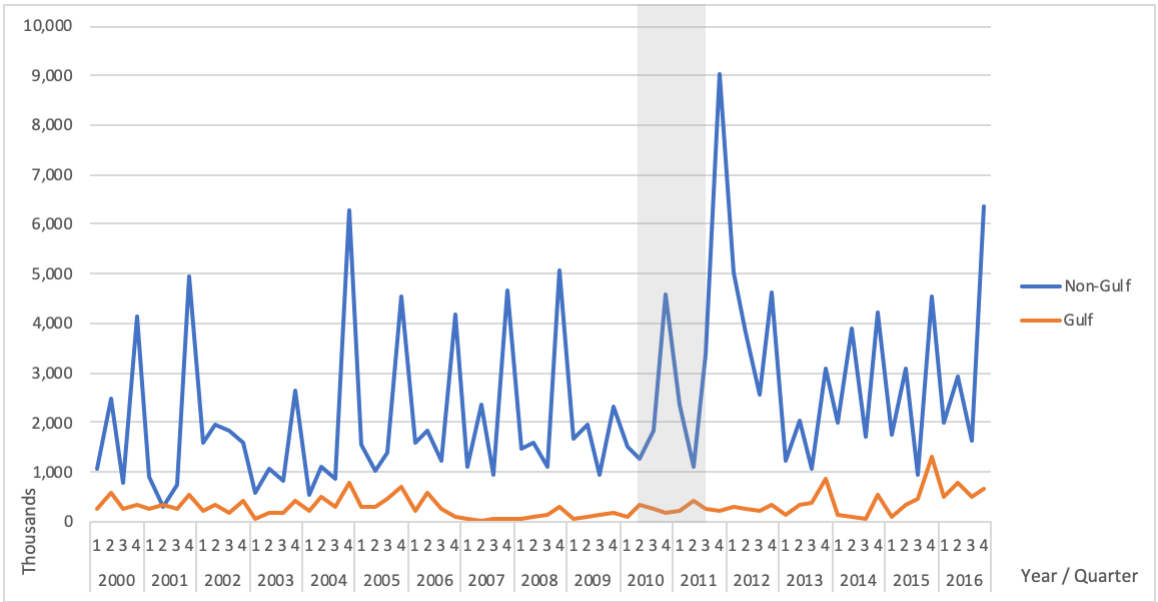
Pounds Harvested by Year/Quarter, Spill Period Highlighted in Gray

White Shrimp – NOAA Data – Value



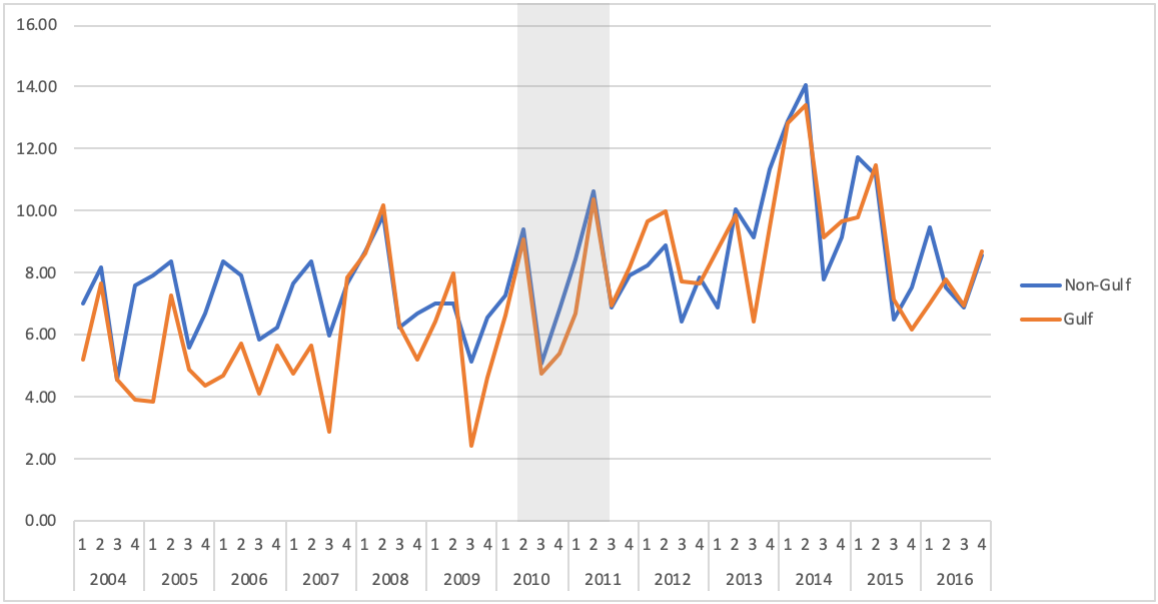
Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

White Shrimp – FLFWC Data – Value



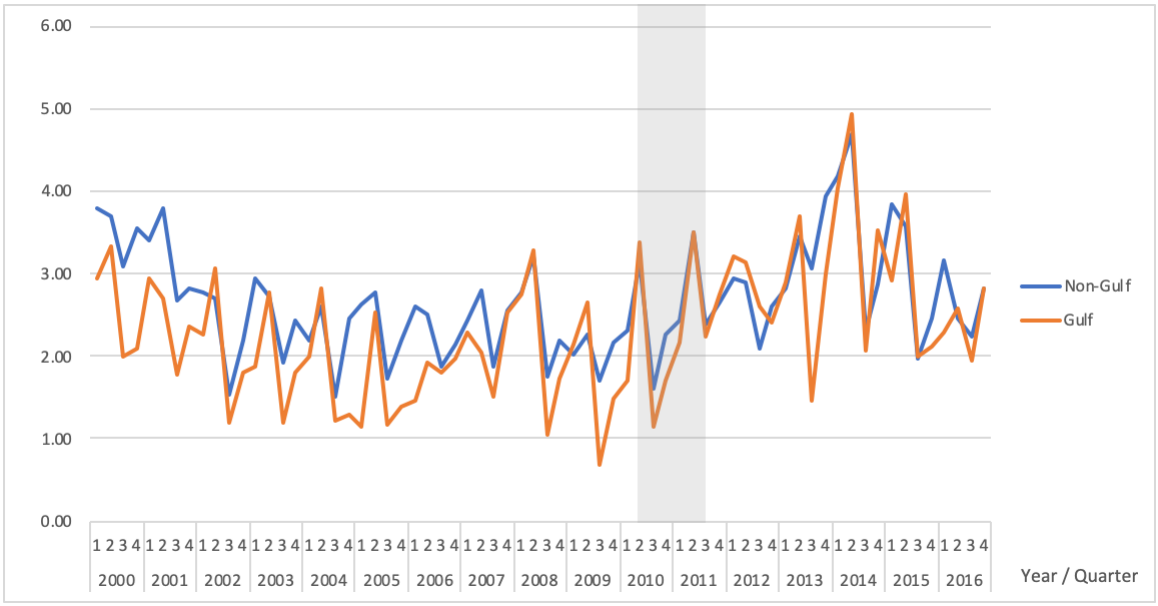
Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

White Shrimp – NOAA Data – Average Value



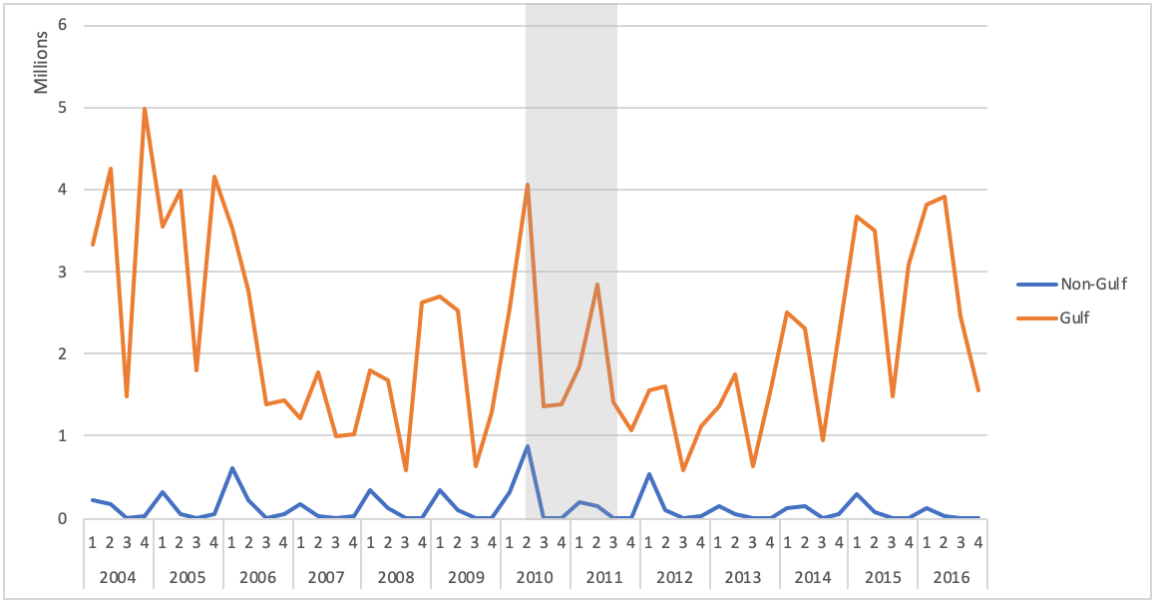
Average Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

White Shrimp – FLFWC Data – Average Value



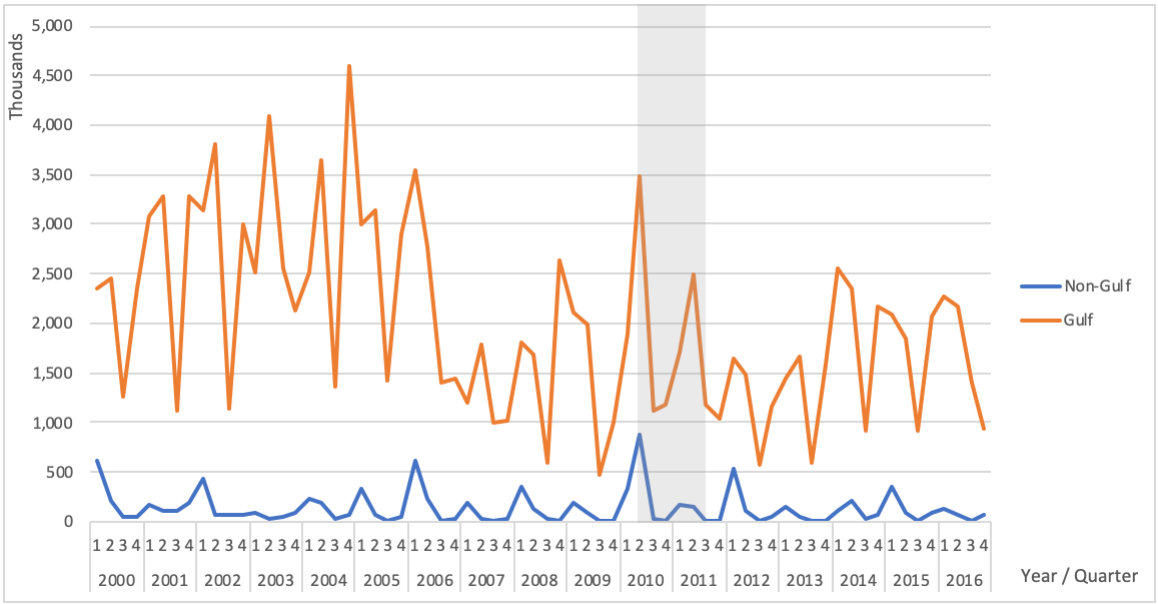
Average Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

Pink Shrimp – NOAA Data – Pounds Harvested



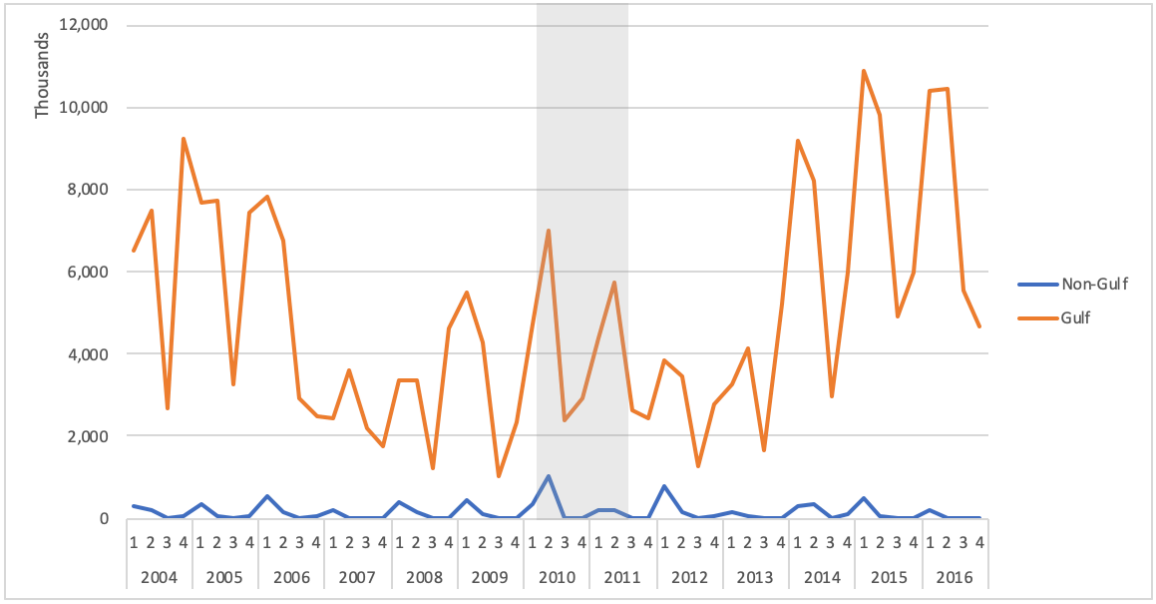
Pounds Harvested by Year/Quarter, Spill Period Highlighted in Gray

Pink Shrimp – FLFWC Data – Pounds Harvested



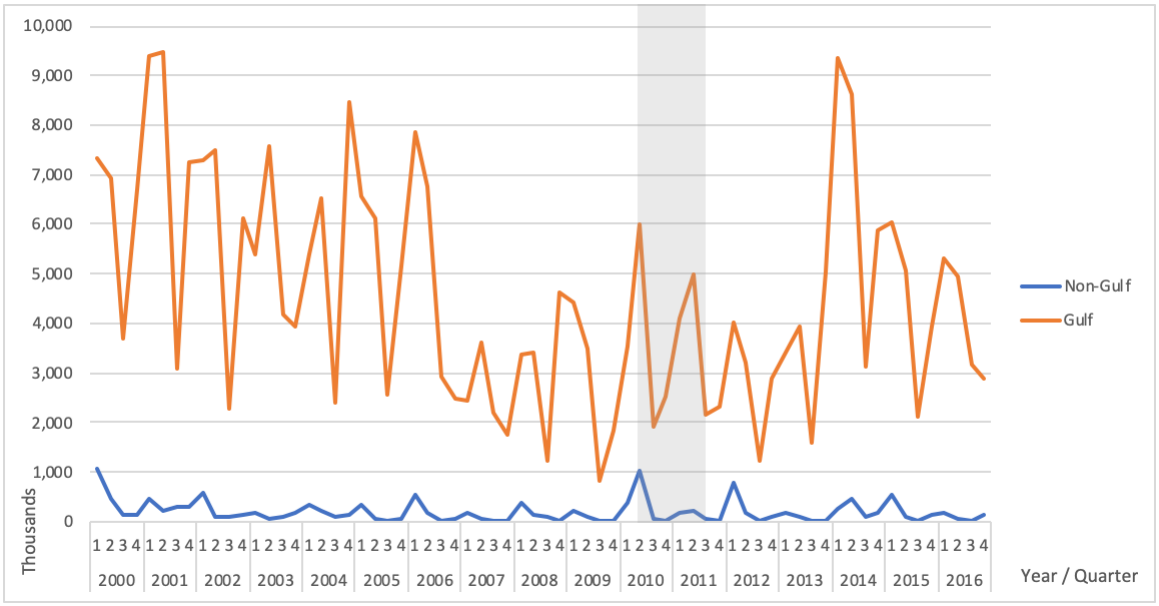
Pounds Harvested by Year/Quarter, Spill Period Highlighted in Gray

Pink Shrimp – NOAA Data – Value



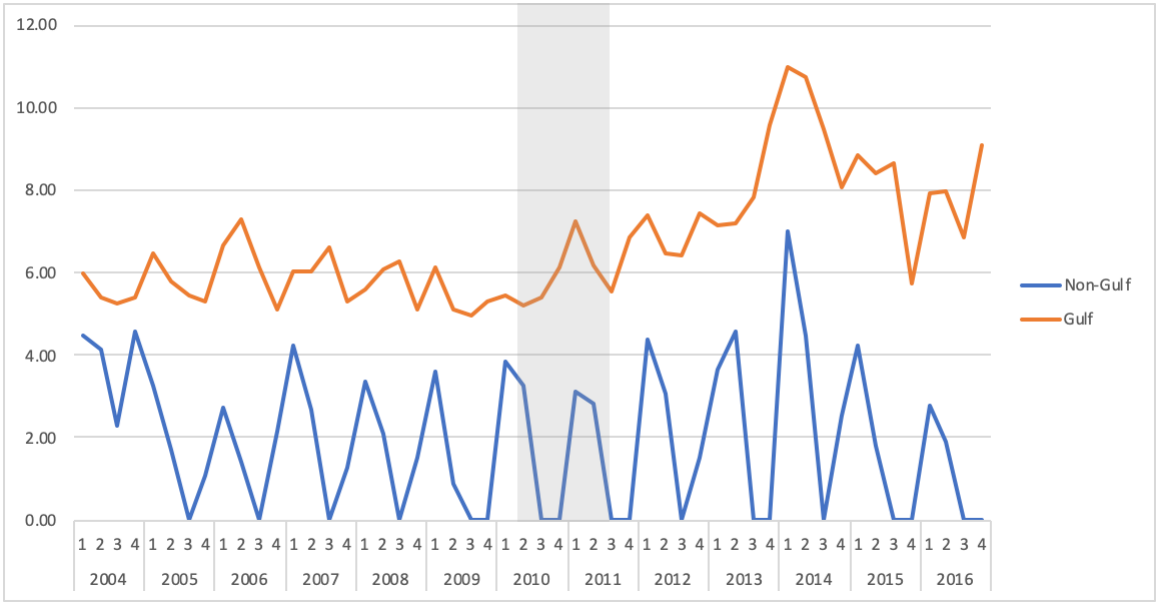
Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

Pink Shrimp – FLFWC Data – Value



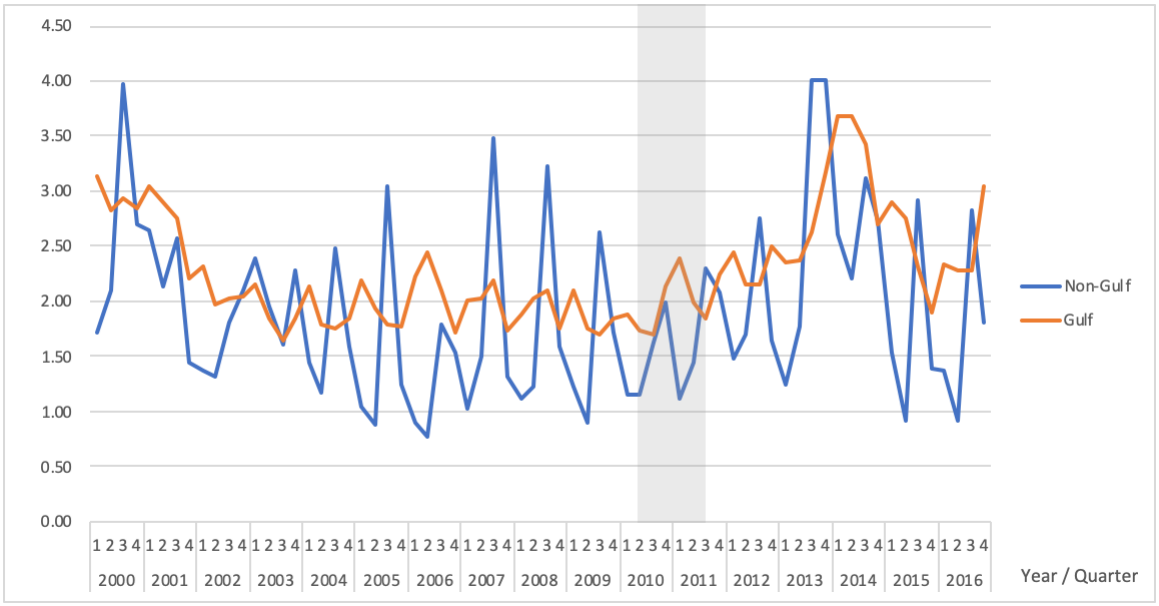
Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

Pink Shrimp – NOAA Data – Average Value



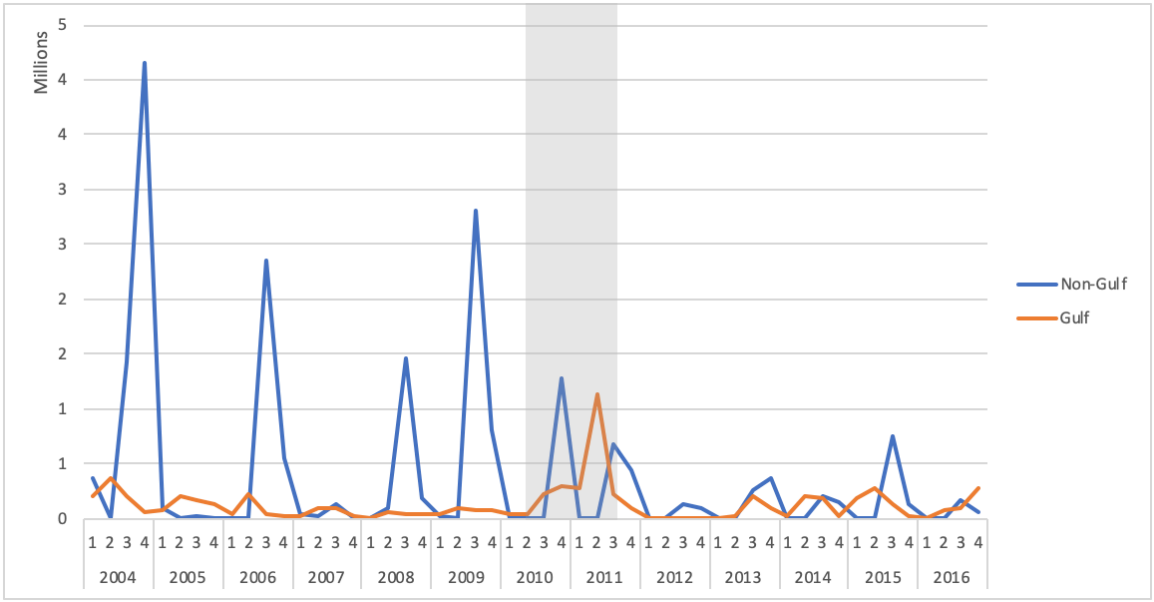
Average Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

Pink Shrimp – FLFWC Data – Average Value



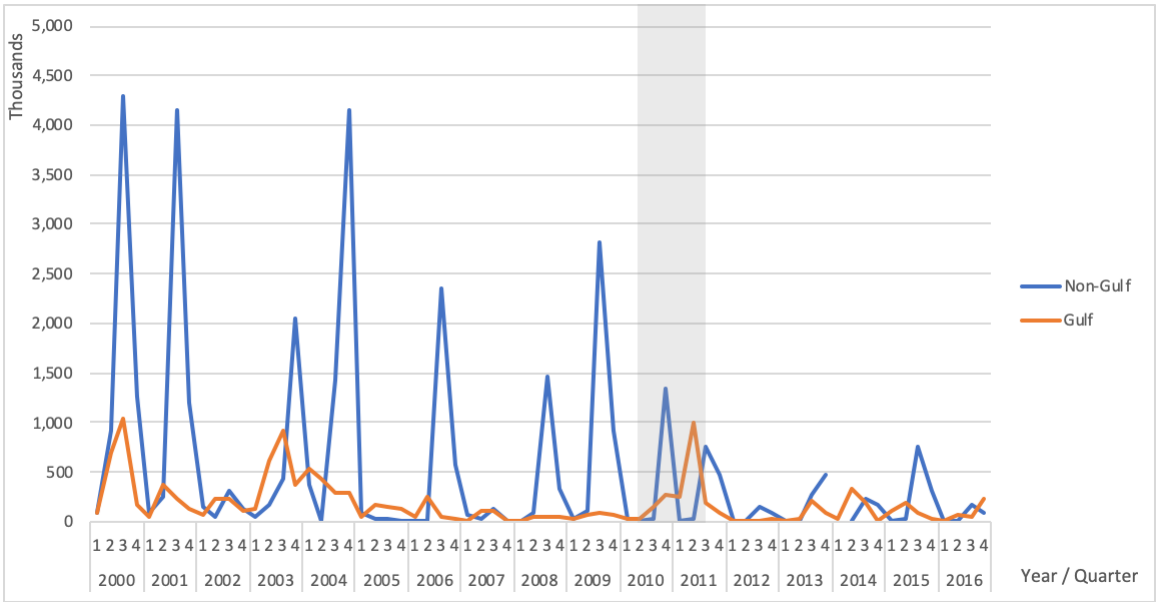
Average Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

Rock Shrimp – NOAA Data – Pounds Harvested



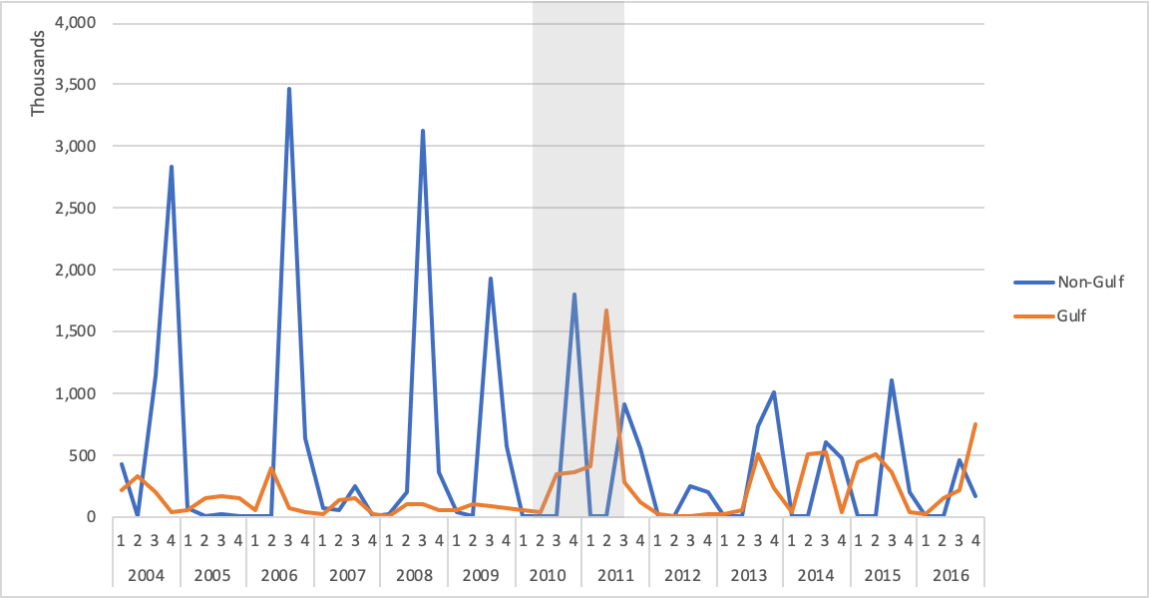
Pounds Harvested by Year/Quarter, Spill Period Highlighted in Gray

Rock Shrimp – FLFWC Data – Pounds Harvested



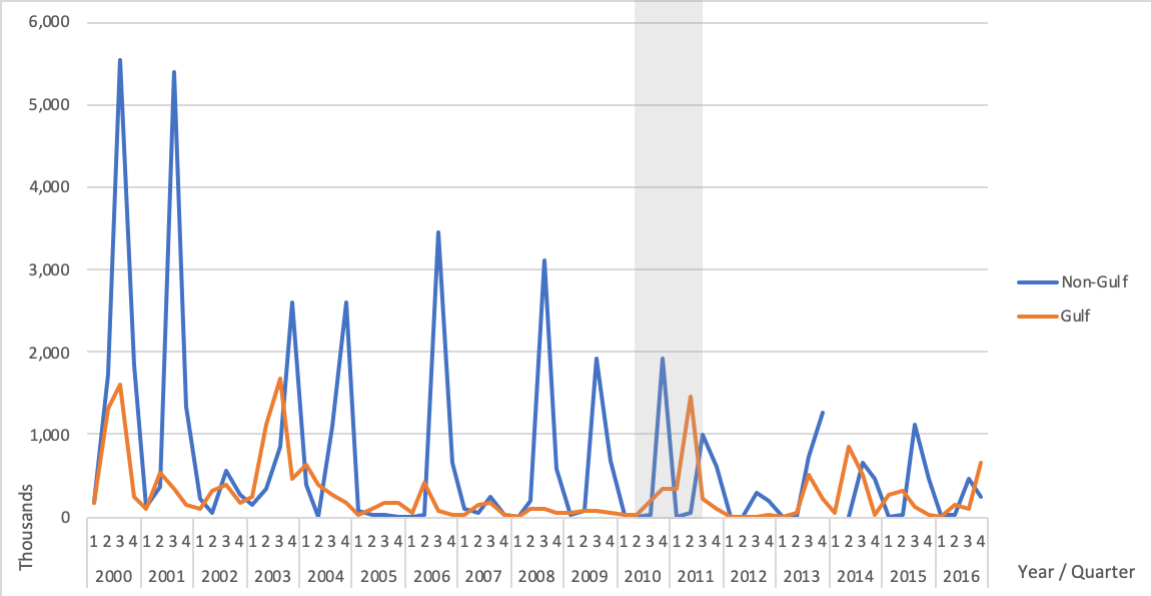
Pounds Harvested by Year/Quarter, Spill Period Highlighted in Gray

Rock Shrimp – NOAA Data – Value



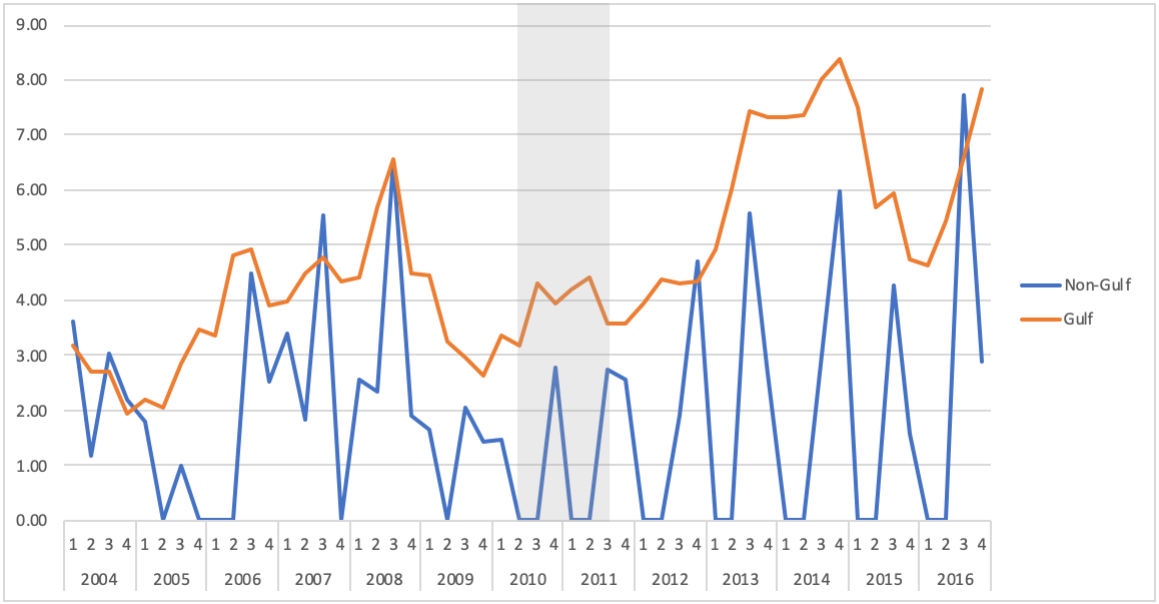
Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

Rock Shrimp – FLFWC Data – Value



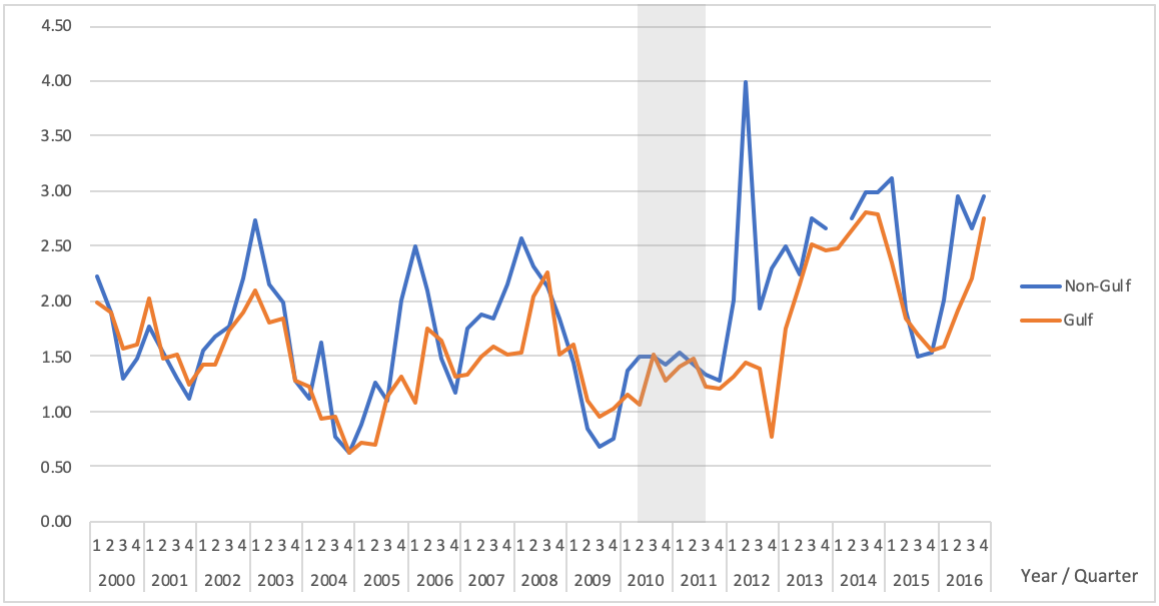
Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

Rock Shrimp – NOAA Data – Average Value



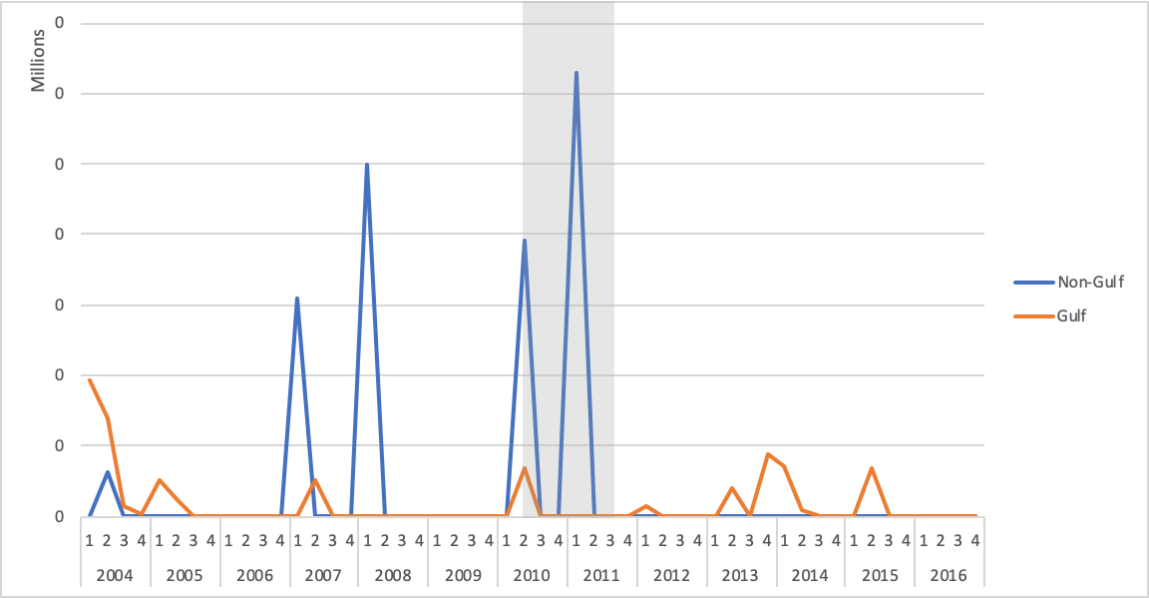
Average Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

Rock Shrimp – FLFWC Data – Average Value



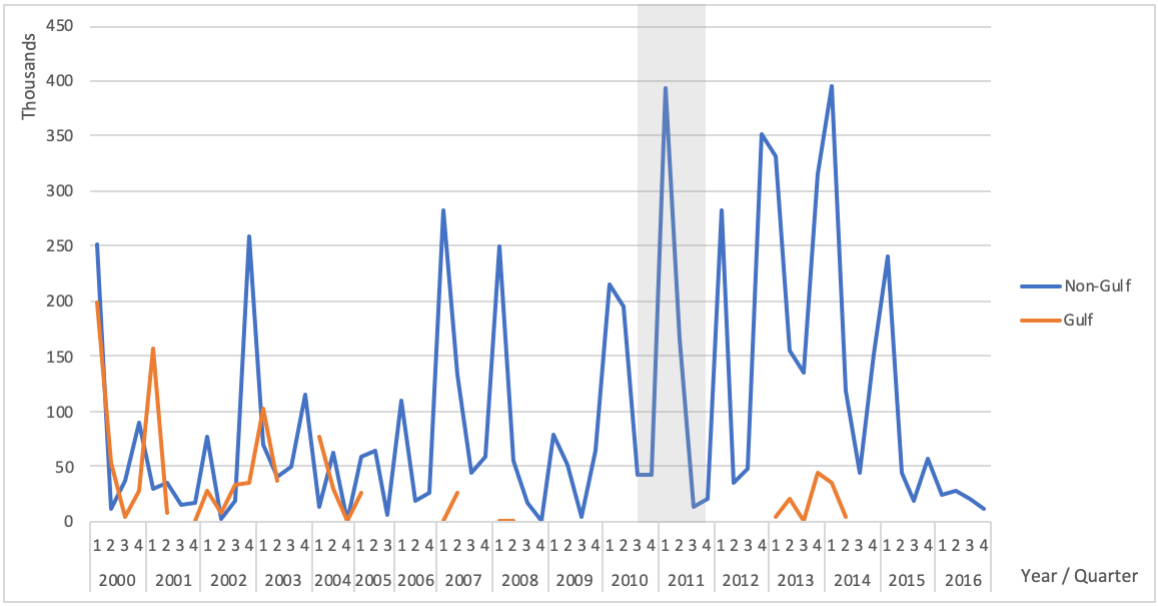
Average Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

Royal Red – NOAA Data – Pounds Harvested



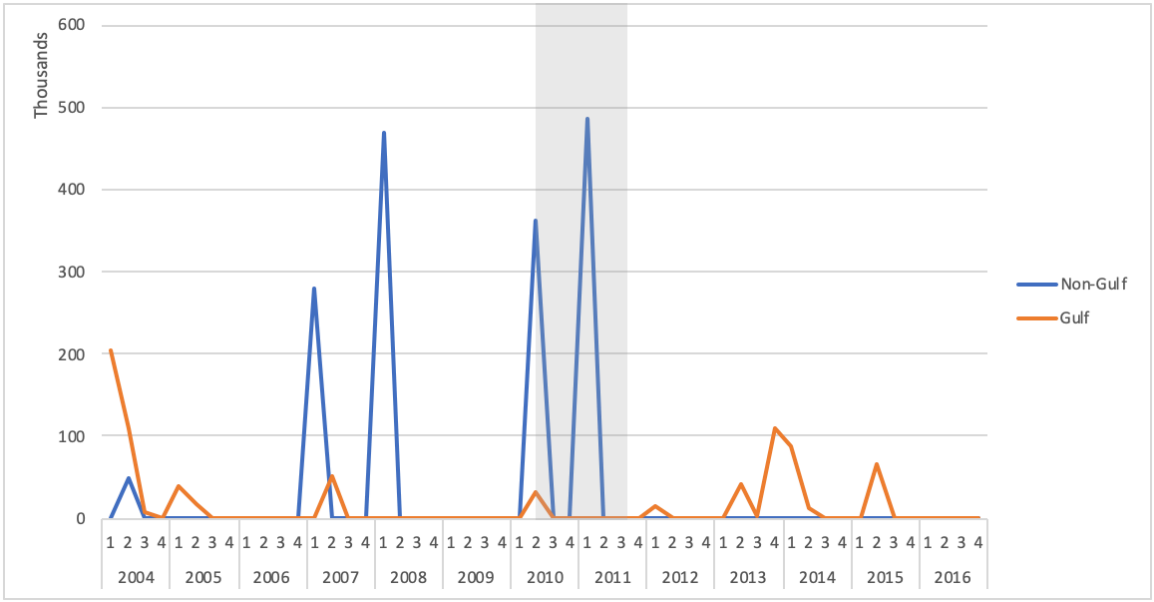
Pounds Harvested by Year/Quarter, Spill Period Highlighted in Gray

Royal Red – FLFWC Data – Pounds Harvested



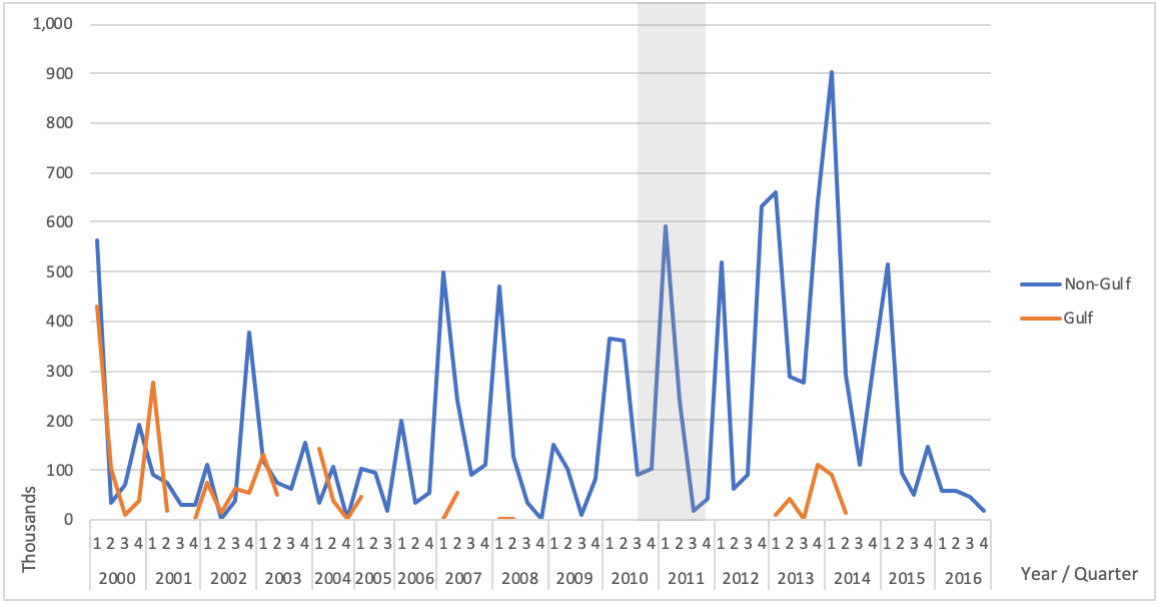
Pounds Harvested by Year/Quarter, Spill Period Highlighted in Gray

Royal Red – NOAA Data – Value



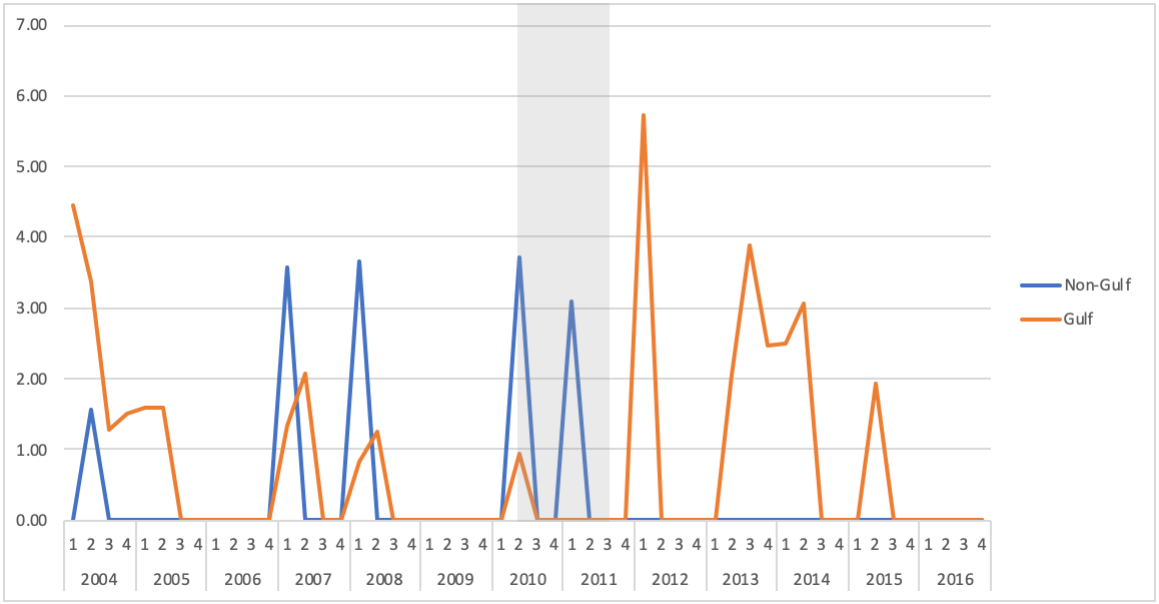
Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

Royal Red – FLFWC Data – Value



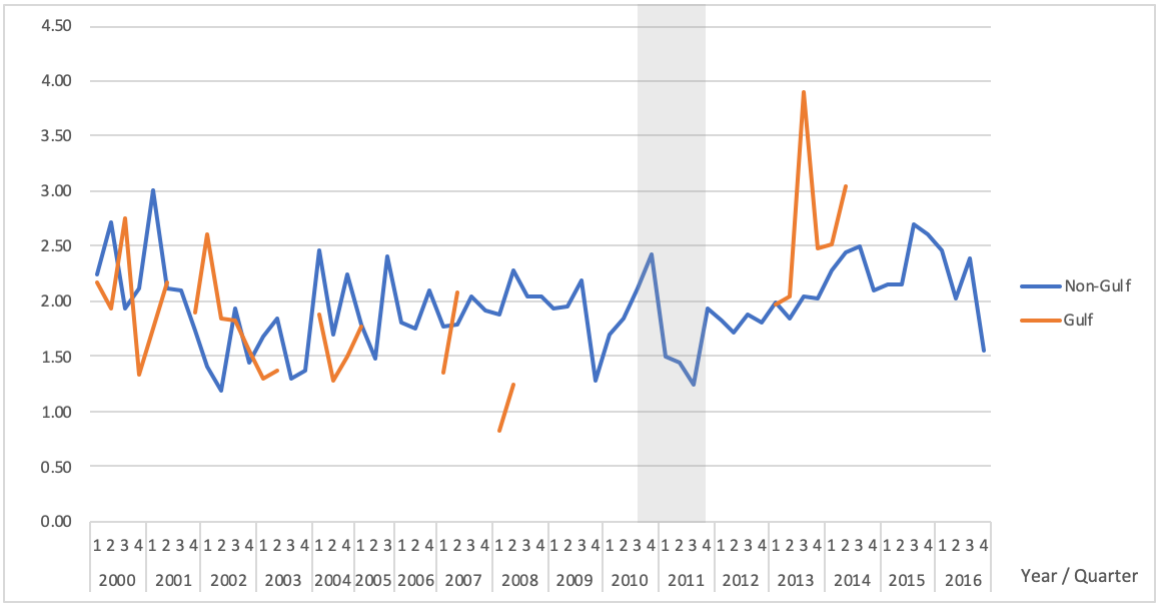
Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

Royal Red – NOAA Data – Average Value



Average Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

Royal Red – FLFWC Data – Average Value



Average Value Harvested by Year/Quarter, Spill Period Highlighted in Gray

APPENDIX C

TABLES

Interaction Term Comparison – Spill Period – Brown Shrimp

Interaction Term Results	Pounds	Value	Avg Value
FFWLC Data	-360,822**	-765,614**	-0.0859
	(156,517)	(341,745)	(0.142)
NOAA Data	-110,928**	-236,448**	-0.224
	(45,216)	(98,669)	(0.305)

Interaction Term Comparison – Post BP Claim Period – Brown Shrimp

Interaction Term Results	Pounds	Value	Avg Value
FFWLC Data	-91,131	-43,484	0.386**
	(61,597)	(141,805)	(0.163)
NOAA Data	22,058	94,498**	0.735***
	(19,547)	(40,411)	(0.221)

Interaction Term Comparison - Spill Period – White Shrimp

Interaction Term Results	Pounds	Value	Avg Value
FFWLC Data	-156,972	-42,874	0.149
	(239,563)	(549,136)	(0.252)
NOAA Data	-33,232	38,073	0.0596
	(60,309)	(143,082)	(0.169)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Interaction Term Comparison - Post BP Claim Period – White Shrimp

Interaction Term Results	Pounds	Value	Avg Value
FFWLC Data	-268,622*	-1.064e+06***	0.332*
	(152,034)	(389,218)	(0.170)
NOAA Data	-51,922	-282,852***	0.405***
	(40,247)	(107,411)	(0.128)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Interaction Term Comparison - Spill Period – Pink Shrimp

Interaction Term Results	Pounds	Value	Avg Value
FFWLC Data	-360,637	-1.354e+06**	-0.0406
	(338,199)	(569,247)	(0.241)
NOAA Data	-47,599	-305,190**	-0.126
	(83,685)	(147,697)	(0.128)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Interaction Term Comparison – Post BP Claim Period – Pink Shrimp

Interaction Term Results	Pounds	Value	Avg Value
FFWLC Data	-594,289***	-438,569	0.165
	(163,766)	(452,711)	(0.208)
NOAA Data	-64,072	388,079***	0.736***
	(54,412)	(143,492)	(0.120)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Interaction Term Comparison – Spill Period – Rock Shrimp

Interaction Term Results	Pounds	Value	Avg Value
FFWLC Data	337,867	409,071	0.116
	(305,700)	(440,161)	(0.111)
NOAA Data	105,532	120,271	0.0971
	(84,440)	(115,311)	(0.178)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Interaction Term Comparison – Post BP Claim Period – Rock Shrimp

Interaction Term Results	Pounds	Value	Avg Value
FFWLC Data	417,259**	409,563*	-0.340*
	(172,243)	(207,404)	(0.176)
NOAA Data	114,928**	109,982**	0.656***
	(45,012)	(47,861)	(0.156)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Interaction Term Comparison – Spill Period – Royal Red

Interaction Term Results	Pounds	Value	Avg Value
FFWLC Data	-7,620	-26,527	-0.899***
	(48,207)	(79,822)	(0.214)
NOAA Data	-26,052**	-45,059**	-0.558***
	(12,822)	(20,896)	(0.177)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Interaction Term Comparison – Post BP Claim Period – Royal Red

Interaction Term Results	Pounds	Value	Avg Value
FFWLC Data	-128,380***	-271,270***	0.506**
	(37,251)	(75,488)	(0.249)
NOAA Data	9,583**	17,900**	0.293**
	(3,860)	(6,992)	(0.141)

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1