Gulf of Mexico Menhaden Economic Impact and Management Uncertainty

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Introduction

The Gulf Menhaden reduction fishery is one of the largest fisheries by volume in the United States and has been successfully managed under a regional Fishery Management Plan since 1978. The fishery continues to be classified by the National Marine Fisheries Service (NMFS) as 'not overfished' with 'no overfishing occurring', and a population that is sustainable based on the most recent stock assessment. Through the partnerships, which have been developed among NMFS Beaufort Laboratory, the state marine agencies, the menhaden industry, and the Gulf States Marine Fisheries Commission (GSMFC), the Gulf Menhaden fishery-dependent data set is one of the most detailed and data-rich of the fisheries currently operating in the Gulf of Mexico. [1]

The NMFS personnel have had access to the catch at each of the processing plants for biostatistical and stock assessment purposes since 1964, and the menhaden companies report daily vessel unloads to the NMFS on a daily or weekly basis throughout the fishing season. Additionally, vessel captains complete daily logs of each vessel's activities called Captain's Daily Fishing Reports (CDFRs). They include an at- sea catch estimate, fishing location, set duration, and weather conditions for each and every set; compliance is 100% and they are provided to NMFS on a weekly or bi-weekly basis throughout the fishing season.

According to NMFS, the most recent accounting is for 2019 during which U.S. menhaden Landings along the Atlantic coast were 433.8 million pounds valued at $53.9 million. Gulf region landings were 1.1 billion pounds valued at $102.4 million.

Pressure mainly from environmental groups and recreational fishing interests has led to ongoing discussions of curtailing commercial harvests using among other methods, "distance from shore" restrictions. Industry believes that consideration of any such curtailments requires a complete knowledge of the fisheries operation to fairly assess expected negative regulatory impacts.

[1] SEDAR 63 Stock Assessment Report. Gulf Menhaden, December 2018.

Changing available fishing grounds likely would create harvest displacements leading to economic losses and related economic impacts to firms and the communities in which they operate. This analysis concerns itself with quantifying the relative economic importance of the fishery at varying locations as defined by "distance-from-shore" measures.

Objectives

Objective 1. Complete a menhaden fishery economic impact model for the Northern Gulf of Mexico.[2] Findings include traditional measures of impacts including total, sales, incomes, value added, employment and taxes generated. The harvest value estimates and associated statistics completed generating the values imported to an economic impact input-output model (IMPLAN). The model will estimate associated direct, indirect and induced impacts such as output, incomes, value added, employment and taxes generated.

Objective 2. Developed estimates of the economic activity generated by discreet fishing zones as determined by distance from shore. Distance-from-shore catch evaluations were completed based upon CDFR data for 2015-2019.[3] Harvest and harvest variability from four zones (0-0.5 miles, 0.5-1mile, 1-3 miles, 3+ miles from shore) was evaluated and mid-point estimates used to assess the discreet economic impacts of harvests from those areas. The selection of distance from shore intervals was finalized with industry.

Utilizing the overall impact assessment from Objective 1 further refinement in impact estimates was made in conjunction with harvest changes arising from pro-forma changes in specific distance from shore harvest regulations.

Objective 3. Additional market distribution and value-added assessments were completed for the processed and marketed meal and oil products. At each market level, associated (discreet)

[2] Gulf region herein includes LA and MS, where processing facilities aggregate and process the landings.

[3] 2019 is the most recent year with complete Captains Daily Fishing Reports (CDFR) data compiled by NOAA fisheries. The confidential data was provided in format suitable to exporting into SAS for further analysis The menhaden data relates only to the industrial fishery and does not include the relatively minor catches sent to the bait industry.

economic impacts were quantified building upon the initial harvest level impact measures developed in Objective 1. Combining the economic impacts from harvest to processed products market provided a more complete vertically integrated assessment of economic impacts for the industry which may be used to further evaluate harvest regulatory impacts. More recent annual data was not available from NMFS to be utilized to make proposed, more contemporary, estimates.

Methods and Analysis[4]

Methods for Managing CDFR Raw Data

Fishery dependent data used to estimate the economic impacts of Gulf menhaden fisheries and processing was evaluated using confidential information from two private companies for three plant locations in Louisiana and Mississippi. Raw catch data based upon Captain's Daily Fishing Reports submitted to National Marine Fisheries Service were evaluated, reviewed for quality and aggregated in support of subsequent input into economic impact (IMPLAN) analysis. Raw data consisted of haul level information for fishing activity during the years 2015-2019.

Information in the data set included fields describing date, time, location, vessel, set within day, haul characteristics, catch and a suite of environmental data. Variables in the data set were examined for anomalous records and in a small number of cases, with subsequent follow up with the fishing companies and NMFS to resolve hauls that were thought to contain errors. Given the subsequent economic analysis was centered upon catch as a function of distance from shore, records that contained missing catch and/or location data were excluded from the analysis. Overall, the final data set used in the economic impact analysis contained 80,090 records. Catch data were aggregated into four different zones with respect to distance from shore (0-0.5 miles, 0.5-1.0 miles, 1-3 miles, and greater than 3 miles). The final data set also included the variables year and company. This information was available to enter the economic impact analysis.

[4] CDFR data assimilation and analysis was completed for Murray & Associates by Dr. David B. Rudders. Economic impact I(MPLAN) modelling was completed by Dr. Alan W. Hodges.

Methodology for Economic Impact Analysis of Gulf Menhaden Fisheries and Processing

The economic impacts of Gulf menhaden fisheries and processing were evaluated using confidential data from two private companies representing three plant locations in Louisiana and Mississippi. The data included information on processed meal and oil product volumes and values, in addition to processing plant and harvest vessel employment. Utilized in conjunction with regional economic models constructed with the IMPLAN software and associated region model data for 2019 (Implan Group, LLC). The most recent landings data for the Gulf of Mexico Menhaden Fishery (NMFS) was 2019.

The processing plants are located in Plaquemines Parish, LA, Abbeville, LA (Vermillion Parish) and Moss Point, MS (Jackson County). Five separate IMPLAN models were created for these three counties or parishes as well as the states of Louisiana and Mississippi, in order to analyze economic impacts at the local and state levels. Information on average catch and ultimate sales of fish meal and oil was provided for the three-year period 2018-20. Industry activity was analyzed in IMPLAN industry sector 17-Commercial fishing for fish harvesting, and 92-Seafood product preparation and packaging for fish processing and product manufacturing. The share of total output value of processed product was allocated to the two sectors based on the share of total employment reported. Output and employment were entered into the IMPLAN models for the year 2019, representing the midpoint of the period 2018-20. Employee compensation was also entered into the model for one location in which this data was provided, rather than allowing the model to impute this information based on industry averages.

Economic impacts compiled for each local and state region were reported for the measures of employment (fulltime and part-time jobs), labor income (employee wages, salaries, benefits, proprietor income), value added (total personal and business income, equivalent to GDP), output (business revenues), business taxes on production and imports, and all state-local and federal government taxes. Results were broken down by direct, indirect, and induced multiplier effects, representing the activity by the companies, supply chain purchases, and employee household consumer spending, respectively. Results were also reported for 21 major economic sectors defined under the North American Industry Classification System (NAICS) at the two-digit level.

Economic impacts of the menhaden fishery were allocated to four different zones defined by distance from shore (0-0.5 miles, 0.5-1.0 miles, 1-3 miles, and greater than 3 miles), based on reported catch by distance from shore in data compiled from the Captain's Daily Fishing Reports submitted to National Marine Fisheries Service. The reported catch in each zone was 19.1%, 13.3%, 35.3% and 32.3%, respectively. In view of potential disclosure matters results are presented here as overall for the States of Louisiana and Mississippi.

Table 1. Menhaden Catch by Distance Zone from Shore (CDFR 2015-2019)

Distance from shore (miles)	Zone	Observations (number sets)	Total catch (000s fish)	Average catch per set	Percent of Total Catch
0-0.5	1	14,208	1,526,647	107.45	19.1%
0.5-1.0	2	11,331	1,058,119	93.38	13.3%
1.0-3.0	3	29,005	2,813,229	96.99	35.3%
>3.0	4	25,546	2,577,916	100.91	32.3%
Total		80,091	7,975,911	1,526,647	100%

Economic Impacts

Economic impact analysis begins with introducing a change in the output of goods and services using the multiplier model to analyze the effects on a region's economic base. Most regional input-output studies attempt to characterize either, the economic impacts of specified changes in final demand for a given set of products, services, and industries, or, the economic significance of specific industries in a regional and national economy. The research described herein accomplishes the latter task. It assesses the economic significance of commercial menhaden fishing and Processing activity in the States of Louisiana and Mississippi. For this assessment that initial change in output arises from menhaden landings of $102.4 million in the Gulf of Mexico during 2019.

The standard input-output model estimates the direct, indirect, and induced economic implications of this basic economic activity. The secondary effects (the indirect and induced

impacts), along with the basic economic activity estimates, provide a cumulative estimate of the "multiplier" effects from the basic activity (direct impact).[5]

At each market level described above, the value-added activity in itself not only has a discreet markup value, but it also generates discreet additional direct and indirect economic impacts associated with that function.

Table 2 reflects these cumulative direct economic impacts associated with the gross sales from harvest through processing explained above.

In the standard input-output model, measures of aggregate economic activity are used as a basis for estimating the total economic impact of the subject activity. For example, measures of direct employment or total sales in an industry are obtained, and these are then used as a basis for evaluating the total impact. In this report, estimates of the primary commercial fishery sales were obtained and used as the base measure of the "direct impact" of the industry reflected below.

As shown in Table 2, the direct impacts of the fishery and marketplace were $259.5 million in output (sales), 884 associated jobs, which required $135.3 million in labor income. Further, $219.2 in wages and salaries, interest, rent, profits, and indirect taxes paid by businesses, ("total value added") was associated with this overall level of direct activity.

Table 2. Direct Economic Impacts of the Commercial Menhaden Fishery (M$ 2019)

Impact Type	Louisiana & Mississippi
Output (M$)	$259.5
Employment (FTES)	884
Labor Income (M$)	$135.3
Total Value-Added (M$)	$219.2

This measure of the market flow and associated direct impacts, allows estimation of the indirect impacts. IMPLAN uses information on the interactions between these direct industry sectors and

[5] A Glossary of economic impact definitions is contained in Appendix 2. Herein "output" for wholesale and retail industries represents their markup margin only; it does not represent gross revenues (sales).

other economic sectors which are, to varying extent, dependent upon menhaden harvesting and marketing related industries.

Table 3 shows the cumulative indirect economic impacts across all harvest and marketing functions from boat to consumer.

Table 3. Indirect Economic Impacts of the Commercial Menhaden Fishery (2019) (M$)	
Impact Type	Louisiana & Mississippi
Output (M$)	$45.2
Employment (FTES)	380
Labor Income (M$)	$15.5
Total Value-Added (M$)	$26.3

Ultimately, the direct sales activity, and the resulting indirect activity, generate increases in the general level of employment and income in households within the study area. The extra income generated in this way leads to a third "wave" of economic impact through greater household expenditures on goods and services. Much of this additional re-spending will also occur within the broader region, further expanding economic activity. These effects are referred to as the "induced impacts" of the industry and are summarized in Table 4.

Table 4. Induced Economic Impacts of the Commercial Menhaden Fishery (2019) (M$)	
Impact Type	Louisiana & Mississippi
Output (M$)	$114.7
Employment (FTES)	795
Labor Income (M$)	$34.0
Total Value-Added (M$)	$64.1

Conclusion – Total Economic Impact of Gulf of Mexico Menhaden Harvest and Processing

To summarize, because of the interrelationships among the many sectors involved from fishery harvest to marketing, new sales of goods and services required by those sectors generate additional waves of economic impact. Expenditures by non-local marketers and consumers are in fact "exports" from local economic bases and these transactions initiate the multiple rounds of economic impacts among businesses and households detailed above and summarized in Table 5.

Table 5. Total Economic Impacts of the Commercial Menhaden Fishery (2019) (M$)	
Impact Type	Louisiana & Mississippi
Output (M$)	$419.3
Employment (FTES)	2,059
Labor Income (M$)	$184.8
Total Value-Added (M$)	$309.6

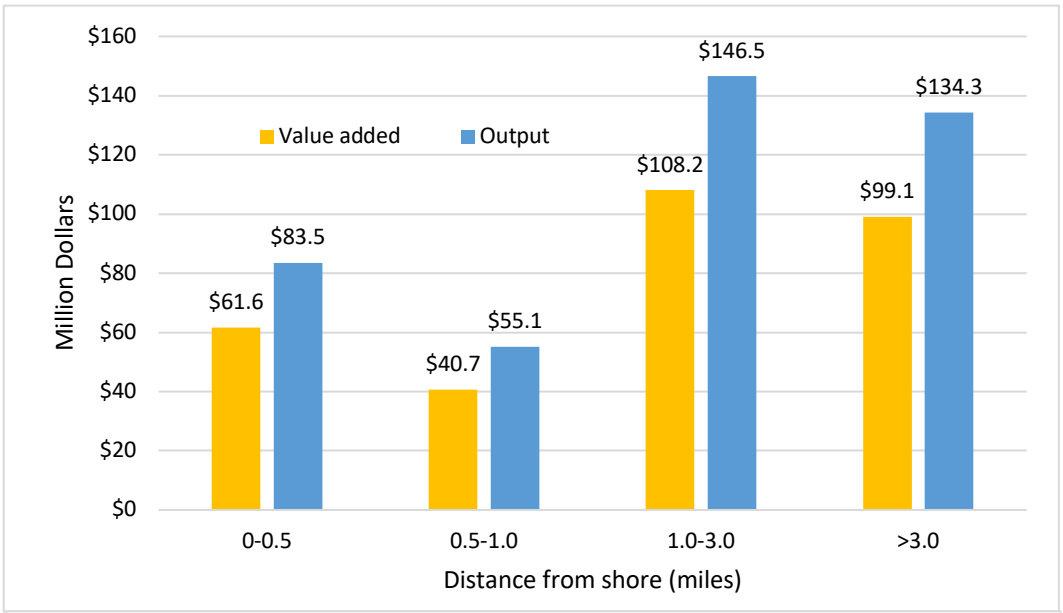
As shown in Table 5 the cumulative impacts of the fishery and marketplace on the States of Louisiana and Mississippi were $419.3 million in output (sales), 2,059 associated jobs, which required $184.8 million in labor income. Further, $309.6 million in wages and salaries, interest, rent, profits, and indirect taxes paid by businesses, ("total value added") was associated with the menhaden commercial harvest and processing in 2019.

By virtue of the fact that the hierarchy of transactions entail the payment of various taxes at each level, another impact of the menhaden industry can be measured in local, state and federal taxes generated. Table 6 below summarizes the taxes generated as a result of the provision of Gulf of Mexico Menhaden on Louisiana and Mississippi in 2019. In total $25.3 millions of "indirect business taxes" arose from the menhaden fishery in localities and States.

Table 6. Total State and Local Business Taxes Generated in Louisiana & Mississippi by Commercial Menhaden Industry (2019)	
State & Local Business Taxes (M$)	$25.3

The economic activity associated with the various distance-from-shore zones are summarized as well in the chart below. The measures of output and value added appear together and employment is viewed in the second chart.

Figure 1. Economic Impacts by Distance from Shore Zones.



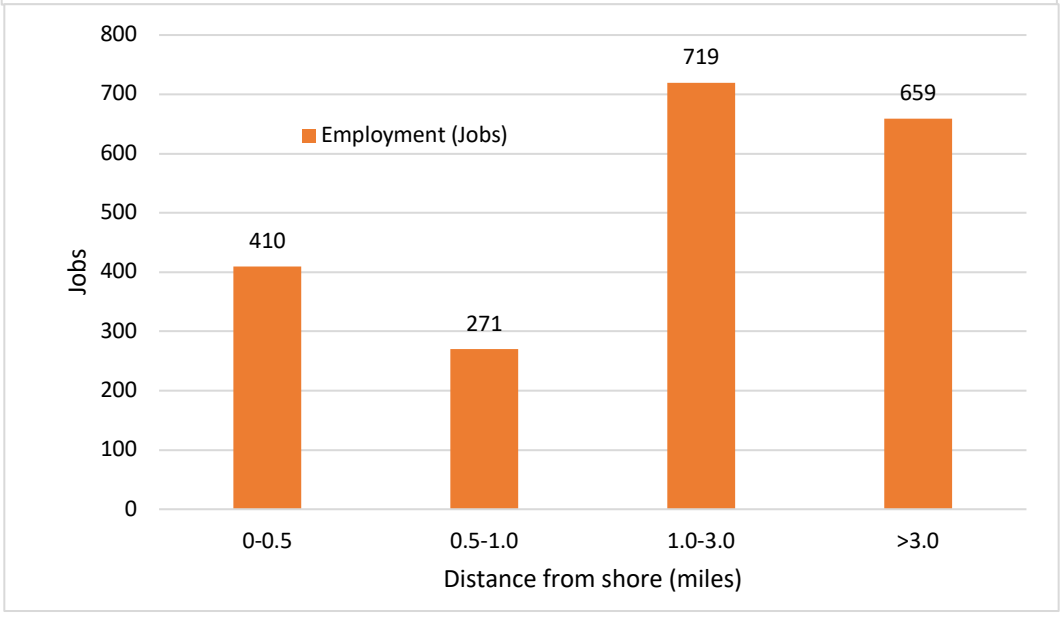


Table 7. Economic impacts of menhaden industry in Louisiana and Mississippi by catch distance zone from shore

Distance from shore (miles)	Zone	Employment (Jobs)	Labor Income (million $)	Value Added (million $)	Output (million $)	Business Tax (million $)
0-0.5	1	410	$36.8	$61.6	$83.5	$5.0
0.5-1.0	2	271	$24.3	$40.7	$55.1	$3.3
1.0-3.0	3	719	$64.6	$108.2	$146.5	$8.8
>3.0	4	659	$59.2	$99.1	$134.3	$8.1
Total		2,059	$184.8	$309.6	$419.3	$25.3

Table 8 summarizes the initial economic activity at the local industry sites in Louisiana and Mississippi which initiate the Statewide impacts discussed above. Within each State the fishery impacts are perhaps most significant to the local economies of Plaquemines and Vermillion Parishes as well as Jackson County Mississippi. These more local impacts include generating $332.8 million in local regional economic impacts 1,425 local jobs, $157.8 million in labor income and $13.7 million in business taxes.

Table 8. Local Economic Impacts of the Commercial Menhaden Fishery in Three Parish/County Locations (2019) (M$)

Impact Type	Plaquemines & Vermillion Parishes and Jackson County
Output (M$)	$332.8
Employment (FTES)	1,425
Labor Income (M$)	$157.8
Total Value-Added (M$)	$240.7
Business Taxes	$13.7

Viewing these impacts at the single parish or regional and state levels illustrates the hierarchy of economic dependence of fishing access to the near shore fishing zones detailed here. According to the extensive data base utilized herein nearly 20% of the economic impacts arise from catches within .5 miles from shore. One third of the overall economic impacts detailed above depend upon harvest within 1.0 mile from shore; and two thirds of the harvests occur within State waters out to three miles.

APPENDIX II.

Glossary of Input-Output Terms

Direct effects/impacts: Direct impacts represent the revenues, value-added, income, or jobs that result directly from an economic activity within the study area or a regional economy.

Employment or Jobs: Represents the total numbers of wage and salaried employees as well as self-employed jobs. This includes full-time, part-time and seasonal workers measured in annual average jobs.

Indirect Business Taxes: Include sales, excise, and property taxes as well as fees and licenses paid by businesses during normal operations. It does not include taxes on profits or income.

Indirect effects/impacts: Indirect effects occur when businesses use revenues originating from outside the region or study area to purchase inputs (goods and services) from local suppliers. This secondary, or indirect business, generates additional revenues, income, jobs, and taxes for the area economy.

Induced effects/impacts: Induced effects or impacts occur when new dollars originating from outside the study area are introduced into the local economy. Induced economic impacts occur as the households of business owners and employees spend their earnings from these enterprises to purchase consumer goods and services from other businesses within the region. This induced effect generates additional revenues, income, jobs, and taxes for the area economy.

Input-Output Analysis: The use of input-output models to estimate how revenues or employment for one or more particular industry, business or activity in a local economy impacts other businesses and institutions in that region as a whole.

Input-Output Models: A mathematical representation of economic activity within a defined region using inter-industry transaction tables or matrices where the outputs of various industries are used as inputs by those same industries and other industries as well.

Labor Income: All forms of employment compensation, including employee wages and salaries, and proprietor income or profits.

Local revenues/expenditures: Local revenues or spending represent simple transfers between individuals or businesses within a regional economy. These transactions do not generate economic spin-off or multiplier (indirect and induced) effects.

Margins: Represent the differences between retail, wholesale, distributor, and producer's prices.

Non-local revenues/expenditures: When outside or new revenues flow into a local economy, either from the sale of locally produced goods and services to points outside the study area or from expenditures by non-local visitors to the study area, additional economic repercussions occur through indirect and induced (multiplier) effects.

Other Property Type Income: Income in the form of rents, royalties, interest, dividends, and corporate profits.

Output: Revenues or sales associated with an industry or economic activity.

Total Impacts: The sum of direct, indirect, and induced effects or economic impacts.

Total Value-added: Includes wages and salaries, interest, rent, profits, and indirect taxes paid by businesses. In the IMPLAN results tables, value-added equals the sum of Labor Income, Other Property Type Income, and Indirect Business Taxes.