

*Suggested Approach
to Estimate
Economic Impacts of
Mississippi-
Alabama
Sea Grant
Research,
Education,
and Outreach
Programs*



Abstract

This publication demonstrates how standard economic impact analysis can be used to estimate the marginal economic impacts of Sea Grant projects in Mississippi and Alabama. The sales and jobs multipliers of various economic sectors were computed using economic impact analysis data and software. Two levels of marginal economic impacts of Sea Grant projects were estimated in 2012 for selected projects. The initial marginal economic impacts estimation template consisted of a scenario where Sea Grant projects received \$70,000 in federal funding for 2012. Initial marginal economic impacts refer to the creation of additional economic output, jobs, and incomes arising from expenditures on goods and services needed to successfully complete each project. The final marginal economic impacts template consisted of various scenarios where annual gross sales or annual labor income was increased by \$1 million in 2012 due to new technology developed by Sea Grant projects. Final marginal economic impacts consist of the creation of new output, more jobs, and additional income associated with the adoption of the results of Sea Grant projects by producers and households. Specific examples from Sea Grant activities were used in estimating the two levels of economic impacts.

This publication was funded by the Mississippi State University Extension Service and the Mississippi-Alabama Sea Grant Consortium through the U.S. Department of Commerce's National Oceanic and Atmospheric Administration under award NA10OAR4170078. It is MSU Extension Publication 2883 and Mississippi-Alabama Sea Grant Publication MASGP-14-035.

<http://www.coastal.msstate.edu/msalsgpimpacts.html>

Suggested Approach to Estimate Economic Impacts of Mississippi-Alabama Sea Grant Research, Education, and Outreach Programs

Introduction

There is a pressing need to adequately measure the significant contributions of Sea Grant projects to the intended U.S economic sectors or industries. U.S. industries initially targeted by the research, education, and outreach (REO) efforts of the Mississippi-Alabama Sea Grant Consortium (MASGC) during the past decade were identified in an earlier publication (Posadas 2014). The initial U.S. industries targeted by the MASGC-REO projects during the past decade were grouped under the four focus areas currently being promoted by the MASGC (2014):

- (1) Sustainable fisheries and aquaculture
 - Commercial fishing
 - Seafood processing
 - Seafood wholesaling
 - Seafood retailing
 - Marine aquaculture
 - Live-bait dealers
- (2) Healthy coastal ecosystems
 - Research and development in biotechnology
 - Research and development in the physical, engineering, and life sciences
 - Research and development in the social sciences and humanities
- (3) Resilient communities and economies
 - Working waterfronts
 - Commercial marinas
 - Charter boats for hire
 - Saltwater recreational fishing
 - Wildlife watching
 - Coastal restoration
 - Ship building and repair

- (4) Environmental literacy and workforce development
 - Other justice, public order, and safety activities
 - Administration of air and water resource and solid-waste management programs
 - Administration of general economic programs
 - Regulation of agricultural marketing and commodities
 - Household sector

Individual households, specific communities, and the entire region accrue economic benefits associated with the MASGC-REO projects that are not captured by economic impact analysis as defined in this publication. Benefit-cost (B/C) analysis, however, compares the present values of the expected future benefits to the costs of these projects (Evenson 2001). The discounted economic indicators used in B/C analysis include B/C ratio, net present value (NPV), and internal rate of return (IRR).

In this publication, however, I attempted to estimate the marginal economic impacts of selected MASGC-REO projects by using standard economic multiplier analysis. The initial marginal economic impacts refer to the creation of additional economic output, jobs, and incomes arising from expenditures on goods and services needed to successfully complete each project. Final marginal economic impacts consist of the creation of new output, more jobs, and additional income associated with the adoption of the results of Sea Grant projects by producers and households.

Economic Impact Models

Weisbrod and Weisbrod (2014) defined an economic-impact analysis as an attempt to estimate the change in economic activity in a specified region caused by a specific business, organization, policy, program, project, activity, or other economic event. The study region includes the areas of Alabama and Mississippi covered by MASGC programs. Total economic impact is the sum of direct, indirect, and induced impacts. Direct effects express the economic impacts in the sector where the expenditure was initially made. Indirect impacts result from changes in economic activity of other industrial sectors that supply goods or services to the sector being evaluated. Induced impacts are the result of personal consumption expenditures by industry employees.

In order to measure the marginal sales or output impacts (MSI) of the MASGC project in the i^{th} economic sector or industry, the following computational procedure is suggested:

$$MSI_i = EXP_i \times K_{si} \quad \text{Eqn. 1}$$

where EXP_i = annual expenditures of the MASGC project in year t (\$/yr), and K_{si} = sales multiplier of the i^{th} economic sector in year t . The sales or output multipliers relate the changes in sales to final demand by one organization or industry to total changes in output or gross sales by all industries within the local area. The values of the output or sales multipliers provide a quick view of the interactions between the initial changes in sales measured by the annual expenditures of MASGC projects to the total changes in annual output or gross sales in the industry served by Sea Grant projects.

The suggested formula involved in estimating the total employment or jobs impacts (MEI) associated with the MASGC project to the i^{th} economic sector or industry is as follows:

$$MEI_i = EXP_i \div K_{ji} \quad \text{Eqn. 2}$$

Sustainable Fisheries and Aquaculture

The MASGC focus area on “sustainable fisheries and aquaculture” initially targeted the following U.S. industries during the past decade (Posadas 2014): (1) commercial fishing, (2) seafood processing, (3) seafood wholesaling, (4) seafood retailing, (5) marine aquaculture, and (6) live-bait dealers. The IMPLAN (MIG 2014) sales or output multipliers for the U.S. industries listed under the focus area on sustainable seafood and aquaculture are shown in Figure 1.

IMPLAN computes the total output multiplier for commercial fishing as 1.47. This multiplier indicates that a \$1.00 increase in sales by the industry would have an economic impact of \$1.47 in Mississippi and Alabama. The

where EXP_i is as defined in Eqn. 1, and K_{ji} = jobs multiplier of the i^{th} economic sector in year t per \$1 million increase in annual gross sales. Employment or jobs multipliers relate the total change in the number of jobs resulting from an initial \$1 million increase in annual gross sales of an organization or industry within the local economy. The values of the jobs or employment multiplier provide a quick view of the interactions between the initial changes in sales measured by the annual expenditures of MASGC projects to the total change in the number of jobs in the industry served by Sea Grant projects.

The marginal economic impacts of recently funded MASGC-REO projects were estimated by using standard economic-impact analysis. The equivalent U.S. industries identified through the North American Industry Classification System (NAICS 2014) were selected from the list of U.S. industries used by the IMPLAN software. The marginal economic impacts of expenditures on projects serving the same U.S. industries were estimated by using IMPLAN (MIG 2014). This publication presents the results of the economic-impact analysis without attempting to explain differences among different economic sectors.

The IMPLAN economic model generates economic-impact estimates in terms of output or sales, employment or jobs, labor income, value added, and tax revenues. The income, value-added, and output impacts are expressed in dollars for the year specified by the user. Output or sales is the gross sales by businesses within the economic region affected by an activity. Labor income includes personal income from wages and salaries and proprietors’ income or income from self-employment. Employment impacts are expressed as a mix of full- and part-time jobs. Value-added is the contribution made to the value of products at each stage of harvesting, processing, and distribution.

direct effect—the economic impact in the sector where the expenditure was initially made—was assumed to be \$1.00. The indirect impact—money spent by the businesses that supply goods or services to the commercial fishing sector—was \$0.17. Induced impacts—personal consumption expenditures by commercial fishing employees—totaled \$0.30.

The IMPLAN employment multipliers for the U.S. industries listed under the MASGC (2014) focus area on sustainable seafood and aquaculture are shown in Figure 2.

The employment multiplier for commercial fishing is 26.49 jobs per \$1 million in gross sales. In other words, a \$1 million increase in commercial fishing sales would cre-

ate a total of 26.49 jobs in Mississippi and Alabama. The direct employment impact on the commercial fishing sector would be 22.81 new jobs per \$1 million in gross sales. Other businesses that supply goods or services to the

commercial-fishing sector would gain one additional job. The induced impacts, which result from personal consumption expenditures by commercial fishing employees, would add 2.68 new jobs.

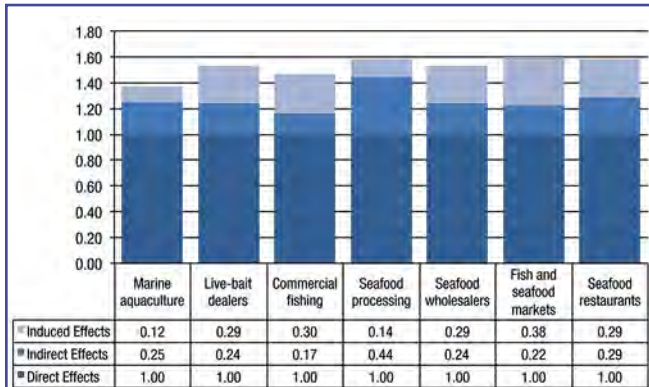


Figure 1. Sales or output multipliers of U.S. industries initially served by MASGC-REO projects under focus area on sustainable fisheries and aquaculture in 2012. Source: MIG (2014).

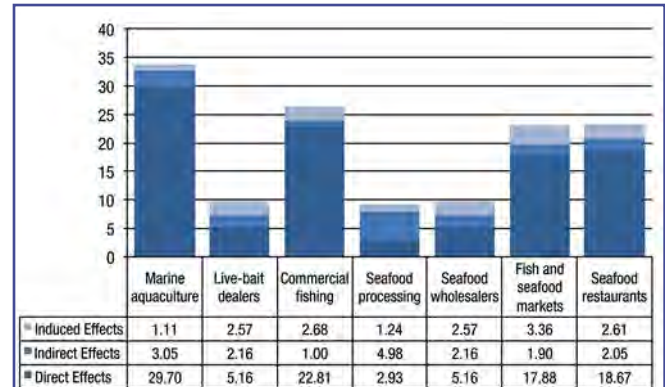


Figure 2. Employment multipliers of U.S. industries initially served by MASGC-REO projects under focus area on sustainable fisheries and aquaculture in 2012. Source: MIG (2014).

Healthy Coastal Ecosystems

Under the focus area on “healthy coastal ecosystems,” the following industries were identified as the target beneficiaries of REO projects conducted or funded by the MASGC: (1) research and development in biotechnology; (2) research and development in the physical, engineering, and life sciences; and (3) research and development in the social sciences and humanities (Posadas 2014). The IMPLAN (MIG 2014) output and employment multipliers for the U.S. industries listed under the focus area on healthy coastal ecosystems are shown in Figures 3 and 4.

For R&D in any of the sciences, IMPLAN estimates the total output multiplier to be 1.72, which suggests that a \$1.00 increase in sales would generate an economic impact of \$1.72 in Mississippi and Alabama. The direct effect was assumed to be \$1.00 in the R&D sector, where

the expenditure was initially made. The indirect impact on industries that supply goods or services to this sector was \$0.30. The induced impact resulting from personal consumption expenditures by industry employees amounted to \$0.42.

The employment multiplier for scientific R&D is 12.13 jobs per \$1 million in gross sales, which implies that an increase of \$1 million would result in 12.13 jobs new jobs in Mississippi and Alabama. The direct effect on the R&D sector would be 5.56 new jobs per \$1 million. The indirect impact on other industrial sectors that supply goods or services to this sector would be 2.87 new jobs. The induced impacts that result from personal consumption expenditures by industry employees would create 3.70 jobs.

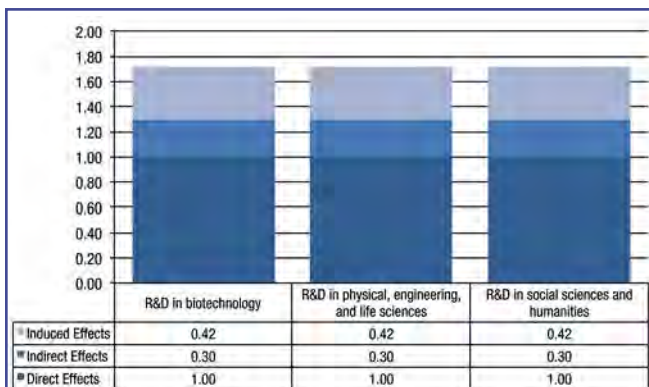


Figure 3. Sales or output multipliers of U.S. industries initially served by MASGC-REO projects under focus area on healthy coastal ecosystems in 2012. Source: MIG (2014).

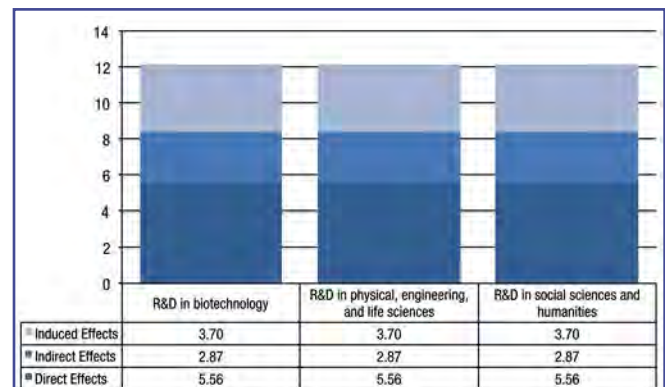
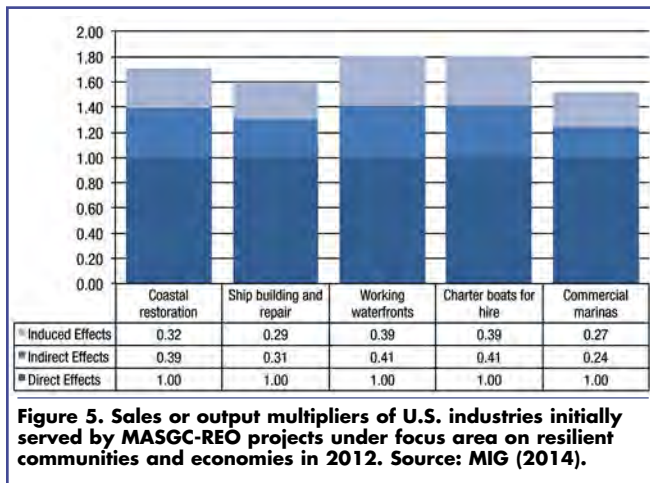


Figure 4. Employment multipliers of U.S. industries initially served by MASGC-REO projects under focus area on healthy coastal ecosystems in 2012. Source: MIG (2014).

Resilient Communities and Economies

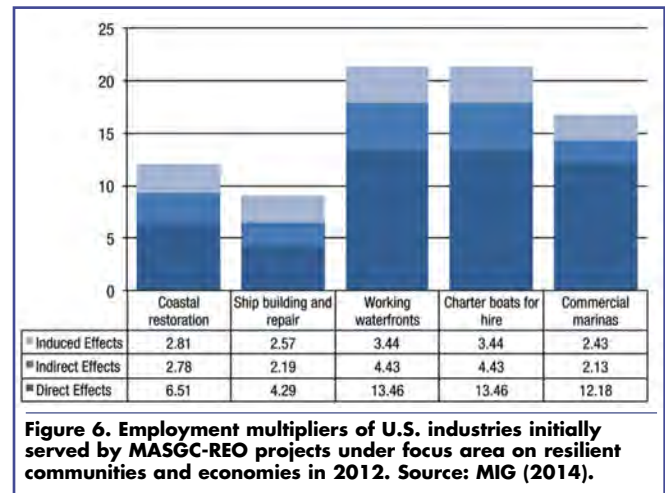
Under the focus area on “resilient communities and economies,” the following industries were identified as preliminary target beneficiaries of the REO projects conducted or funded by the MASGC: (1) working waterfronts, (2) commercial marinas, (3) charter boats for hire, (4) saltwater recreational fishing, (5) wildlife watching, (6) coastal restoration, and (6) ship building and repair. The IMPLAN (MIG 2014) output and employment multipliers for the U.S. industries listed under the focus area on resilient communities and economies are shown in Figures 5 and 6.

For coastal restoration projects, IMPLAN calculates the total output multiplier to be 1.71, which means a \$1.00 sales increase in this sector would change total annual gross sales by \$1.71 in Mississippi and Alabama. The direct effect, which expresses the economic impact in the sector where the expenditure



was initially made, was assumed to be \$1.00. The indirect impact, which results from changes in economic activity of industrial sectors that supply goods or services to coastal restoration projects, was \$0.39. The induced impact resulting from personal consumption expenditures by industry workers amounted to \$0.32.

The employment multiplier of coastal restoration projects is 12.1 jobs per \$1 million in gross sales. This multiplier indicates that a \$1 million sales increase in this sector would increase Mississippi and Alabama employment by 12.1 jobs. The direct effect in the coastal restoration industry would be 6.51 new jobs. The indirect impact in industries that supply goods or services to this sector would be 2.78 additional jobs. The induced impact resulting from personal consumption expenditures by industry employees would be 2.81 new positions.



Environmental Literacy and Workforce Development

Under the focus area on “environmental literacy and workforce development,” five industries were identified as the target beneficiaries of the REO projects conducted or funded by the MASGC: (1) other justice, public order, and safety activities; (2) administration of management programs for solid waste and air and water resources; (3) administration of general economic programs; (4) regulation of agricultural marketing and commodities; and (5) household sector.

Due to limitations in the availability of data, this publication presents the output and employment multipliers only for the private household sector. For private households, the total output multiplier is 1.67, suggesting that an increase in sales of \$1.00 by this sector would result in total annual gross sales of \$1.67 in Mississippi and Alabama. The direct effect on the private household sector was assumed to be \$1.00. The

indirect impact resulting from economic activity in industries that supply goods or services to this sector was zero. The induced impact resulting from personal consumption expenditures by industry workers amounted to \$0.67.

The employment multiplier for the private household sector is 284.8 jobs per \$1 million in gross sales. In other words, a \$1 million increase in sales would create 284.8 new jobs in Mississippi and Alabama. The direct employment impact in the private household sector would be 278.9 new jobs. The indirect impact from changes in economic activity of other industries that supply goods or services to this sector would be zero. The induced impact resulting from personal consumption expenditures by industry employees would generate 5.92 new positions.

Economic Impact Estimation

The estimation of the initial marginal economic impacts of MASGC-REO projects included the creation of additional economic output, jobs, and incomes arising from its expenditures on goods and services needed to successfully complete each initiative. After the initial economic impacts of projects were estimated, they were compared to the most relevant economic impacts associated with each targeted U.S. industry compiled by Posadas (2014). The ratios between the projects' initial economic impacts and the relevant U.S. industries represent the initial impact coefficients of Sea Grant projects under consideration. The sum of the annual values of the initial impact coefficients over the project lifetime ranged from zero to one, but was expected to be mostly close to zero.

The final economic impacts consist of the creation of new output, more jobs, and additional income associated with benefits of MASGC-REO projects to producers and households. Final impacts are extremely difficult to measure due to the confidentiality of private

business or household decisions and the indefinite time lags between project completion and decision-making. Theoretically, after the final economic impacts of projects are estimated, they would be compared to the total costs of the projects. For a project to be considered to have generated significant economic impacts, its benefit-cost ratio must be positive.

Using 2012 IMPLAN (MIG 2014) data and software in Mississippi and Alabama, illustrative examples of economic impact estimation were conducted for some notable MASGC-REO projects. The initial and final economic impacts of each of the selected projects were estimated for 2012. For this analysis, I created an initial economic impact template consisting of a scenario where projects received \$70,000 in federal funding for 2012. The final economic impact template consisted of scenarios where annual gross sales or annual labor income was increased by \$1 million in 2012 because of new technology developed by MASGC-REO projects.

Sustainable Fisheries and Aquaculture

Under this focus area, a notable outreach program that produced readily measurable economic impacts was Technical Adjustment Assistance for Farmers (TAAF). Kemper and Rainey (2014) reported that between 2010 and 2013, a total of 5,409 commercial shrimp fishermen participated in this program. About 99.7% developed and submitted approved initial business plans (Phase 2), while 93% successfully completed approved long-term business plans (Phase 3). In Mississippi and Alabama, faculty and staff of MASGC and the Auburn University Extension Service provided technical and marketing assistance to 848 commercial fishermen who successfully completed the program.

Each commercial fisherman received \$4,000 after successfully completing Phase 1 of TAAF. Fishermen who successfully completed Phase 2 and Phase 3 received additional subsidies of \$8,000 and \$12,000, respectively. For Phase 1 alone, qualifying commercial

shrimp fishermen in Mississippi and Alabama received \$3.392 million in TAAF subsidies. MASGC faculty and staff did not have significant involvement in the implementation of Phases 2 and 3 of the TAAF program in the two states.

Using the 2012 IMPLAN (MIG 2014) data and software for the two states, I created two economic scenarios. The first scenario involved the Mississippi Alabama Sea Grant Extension Program (MASGEP) receiving \$70,000 in TAAF funding for the implementation of the program in Mississippi and Alabama in 2012. The second scenario consisted of commercial shrimping vessel owners receiving TAAF subsidies amounting to \$1 million in 2012.

The initial marginal economic impacts of the \$70,000 in TAAF funding are shown in Table 1. Project expenditures on goods and services produced total sales impacts of \$102,718, created an additional 1.9 jobs, and generated additional labor income of \$38,781

Table 1. Initial marginal economic impacts of \$70,000 in MASGC funding on commercial fishing projects in Mississippi and Alabama in 2012.

Impact type	Employment	Labor income	Value added	Output
Direct effect	1.6	\$28,866	\$34,964	\$70,000
Indirect effect	0.1	\$3,176	\$4,896	\$11,694
Induced effect	0.2	\$6,740	\$12,880	\$21,024
Total effect	1.9	\$38,781	\$52,739	\$102,718

in the two states. The initial marginal economic impacts for the other years when MASGC faculty and staff were actively engaged in the TAAF program can be measured using the same procedure.

The final marginal economic impacts of a \$1 million increase in labor income for Mississippi and Alabama commercial fishermen associated with the federal TAAF funds are shown in Table 2. This income increase generated total induced effects of \$0.627 mil-

lion in sales and 5.6 jobs. The total sales impact of commercial fishing in the two states in 2012 was \$155.9 million. Therefore, the simulated 1-year sales impact due to the TAAF program was about 0.40%. This value represents the final impact coefficient of a \$1 million TAAF program conducted by MASGC. Similar final marginal impacts can be estimated for the other years when MASGC faculty and staff were actively engaged in the TAAF program.

Table 2. Final marginal economic impacts of a \$1 million increase in labor income of owners of Mississippi and Alabama commercial fishing vessels due to TAAF in 2012.

Impact type	Employment	Labor income	Value added	Output
Direct effect	0.0	\$0	\$0	\$0
Indirect effect	0.0	\$0	\$0	\$0
Induced effect	5.6	\$201,059	\$384,178	\$627,106
Total effect	5.6	\$201,059	\$384,178	\$627,106

Resilient Communities and Economies

In this MASGC focus area, the selected projects involved coastal restoration efforts along the coastlines and riverbanks in communities threatened by recent natural and technological disasters. Using the 2012 IMPLAN (MIG 2014) data and software for the two states, I created two basic economic scenarios. The first scenario involved the MASGEP receiving \$70,000 in external funding for the implementation of the living shorelines program in Mississippi and Alabama in

2012. The second scenario consisted of owners of coastal restoration businesses receiving federal contracts amounting to \$1 million in 2012.

The initial marginal economic impacts of the \$70,000 in external funding for the living shorelines program are shown in Table 3. The final marginal economic impacts of a \$1 million increase in federal contracts to Mississippi and Alabama coastal restoration businesses are shown in Table 4.

Table 3. Initial marginal economic impacts of \$70,000 in MASGC funding on living shorelines projects in Mississippi and Alabama in 2012.

Impact type	Employment	Labor income	Value added	Output
Direct effect	0.4	\$23,900	\$27,490	\$70,000
Indirect effect	0.2	\$10,010	\$14,986	\$27,899
Induced effect	0.2	\$7,220	\$13,803	\$22,597
Total effect	0.8	\$41,130	\$56,279	\$120,496

Table 4. Final marginal economic impacts of a \$1 million increase in annual construction projects in the coastal restoration industry in Mississippi and Alabama in 2012.

Impact type	Employment	Labor income	Value added	Output
Direct effect	6.3	\$341,423	\$392,717	\$1,000,000
Indirect effect	2.7	\$143,000	\$214,082	\$398,558
Induced effect	2.7	\$103,148	\$197,192	\$322,810
Total effect	11.8	\$587,571	\$803,990	\$1,721,368

Healthy Coastal Ecosystems

In this Sea Grant focus area, the projects chosen covered scientific research and development efforts in coastal communities damaged by recent natural and technological disasters. Using the 2012 IMPLAN (MIG 2014) data and software for the two states, I created two preliminary economic scenarios. The first scenario involved the MASGEP receiving \$70,000 in scientific R&D federal funding for the implementation of these projects in Mississippi and Alabama in 2012. The sec-

ond scenario consisted of owners of scientific R&D consulting businesses receiving federal contracts amounting to \$1 million in 2012.

The initial marginal economic impacts of the \$70,000 in external funding for the scientific R&D program in Mississippi and Alabama are shown in Table 5. The final marginal economic impacts of a \$1 million increase in federal contracts to R&D consulting businesses are shown in Table 6.

Table 5. Initial marginal economic impacts of \$70,000 in MASGC funding on scientific research and development projects in Mississippi and Alabama in 2012.

Impact type	Employment	Labor income	Value added	Output
Direct effect	0.4	\$35,680	\$39,879	\$70,000
Indirect effect	0.2	\$7,669	\$11,970	\$20,714
Induced effect	0.2	\$9,258	\$17,700	\$28,975
Total effect	0.8	\$52,607	\$69,549	\$119,689

Table 6. Final economic impacts of a \$1 million increase in expenditures in annual R&D scientific projects in Mississippi and Alabama in 2012.

Impact type	Employment	Labor income	Value added	Output
Direct effect	5.3	\$509,710	\$569,707	\$1,000,000
Indirect effect	2.7	\$109,558	\$170,996	\$295,913
Induced effect	3.5	\$132,257	\$252,853	\$413,927
Total effect	11.5	\$751,526	\$993,556	\$1,709,840

Environmental Literacy and Workforce Development

In this Sea Grant focus area, the designated projects involved developing new evacuation practices in communities threatened or damaged by recent natural and technological disasters. Using the 2012 IMPLAN (MIG 2014) data and software for the two states, I created two basic economic scenarios. The first scenario involved the MASGEP receiving simulated \$70,000 in federal disaster evacuation funding for the implementation of the program in Mississippi and Alabama in

2012. The second scenario consisted of coastal households saving \$1 million during simulated massive disaster evacuations in 2012.

The initial marginal economic impacts of the \$70,000 in external funding for the disaster evacuation program are shown in Table 7. The final marginal economic impacts of a \$1 million increase in coastal household savings during simulated massive disaster evacuations in 2012 are shown in Table 8.

Table 7. Initial marginal economic impacts of \$70,000 in MASGC funding for natural disaster evacuation practices in Mississippi and Alabama in 2012.

Impact type	Employment	Labor income	Value added	Output
Direct effect	18.6	\$69,599	\$69,599	\$70,000
Indirect effect	0.0	\$0	\$0	\$0
Induced effect	0.4	\$14,888	\$28,467	\$46,601
Total effect	19.0	\$84,488	\$98,067	\$116,601

Table 8. Final economic impacts of a \$1 million increase in savings among Mississippi and Alabama households that adopted new disaster evacuation practices in 2012.

Impact type	Employment	Labor income	Value added	Output
Direct effect	0.0	\$0	\$0	\$0
Indirect effect	0.0	\$0	\$0	\$0
Induced effect	8.1	\$290,397	\$574,196	\$933,721
Total effect	8.1	\$290,397	\$574,196	\$933,721

Summary and Implications

This publication attempted to estimate the initial marginal economic impacts of selected Sea Grant projects through the use of standard economic multiplier analysis. The sales or output, employment or jobs, labor income, and value-added multipliers for the U.S. industries listed under each of the Sea Grant focus areas were generated by using the economic-impact analysis data and software in Mississippi and Alabama for 2012. However, only the sales and jobs multipliers were reported in this publication.

Under the sustainable fisheries and aquaculture focus area, the sales and jobs multipliers were generated for the following economic sectors: commercial fishing, seafood processing, seafood wholesaling, seafood retailing, marine aquaculture, and live-bait dealers. The same set of sales and jobs multipliers were compiled for the focus area on healthy coastal ecosystems dealing with research and development on biotechnology, engineering, physical sciences, life sciences, social sciences, and humanities. Five sets of sales and jobs multipliers were developed under the focus area on resilient communities and economies involving working waterfronts, commercial marinas, charter boats for hire, coastal restoration, and shipbuilding and repair. Under the focus area on environmental literacy and workforce development, only the sales and jobs multipliers for the household sector were available.

The initial marginal economic impacts of Sea Grant projects included the creation of additional economic output, jobs, and incomes arising from expenditures on goods and services needed to successfully

complete each project. The final marginal economic impacts consisted of the creation of new output, more jobs, and additional income associated with the adoption of the results of Sea Grant projects by producers and households. For example, under sustainable fisheries and aquaculture, the initial marginal economic impacts of \$70,000 in federal funding received by Sea Grant for the implementation of the technical adjustment assistance program for commercial shrimp fishermen in Mississippi and Alabama in 2012 consisted of total sales impacts of \$102,718, an additional 1.9 jobs, and increased labor income of \$38,781. The final marginal economic impacts of a \$1 million increase in labor income received by participating Mississippi and Alabama commercial fishermen associated with the federal technical assistance consisted of \$0.627 million in sales impacts and 5.6 new jobs.

There are economic benefits that accrue to individual households, specific communities, and the entire region that are not captured by standard economic-impact analysis. Principal investigators and project managers are hereby urged to consider developing robust theoretical frameworks and primary survey procedures when they design and evaluate the long-term economic impacts associated with proposed projects. Secondary data that link business decisions associated with the adoption of technology developed by Sea Grant projects are virtually nonexistent. Primary surveys will be needed to tease out any possible linkages between project results and associated economic benefits of decisions made by private businesses or coastal households.

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Publication 2883

Extension Service of Mississippi State University, cooperating with U.S. Department of Agriculture. Published in furtherance of Acts of Congress, May 8 and June 30, 1914. GARY B. JACKSON, Director