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Northeast Region Commercial Fishing Input-Output Model

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Northeast Region Commercial Fishing Input-Output Model

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This issue -- No. 188 -- would normally have a publication date of either August 2004 (when Issue No. 187 came out) or September 2004 (when Issue No. 189 came out). However, due to the withdrawl of the report which had been targeted for this slot in the series, this report was slipped into the slot, even though it has a April 2006 publication date.

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Acronyms

NERIOM	=	Northeast Region Input-Output Model
NEPA	=	National Environmental Policy Act
SIA	=	Social Impact Assessment
CGEM	=	Computable General Equilibrium Model
NAICS	=	North American Industry Classification System
NMFS	=	National Marine Fisheries Service
VTR	=	NMFS' Vessel Trip Reports
URI	=	University of Rhode Island

Summary

This manuscript describes several years of work on improving input-output models for use in regulatory analyses of fisheries management actions in the Northeast U.S. Its primary intent is to provide a description of the partial multiregional input-output modeling approach we developed and to inform peers in how to make the required adaptations to the widely distributed regional input-output modeling system known as IMPLAN Pro. A hypothetical impact assessment is also conducted to illustrate the types of impacts that can be generated with the model.

1. INTRODUCTION

The economic effects of fishery management policies that alter commercial harvesting levels in a regional economy can be far-reaching. As commercial harvest levels change ancillary industries that supply the commercial fishing industry with inputs in turn adjust their production levels and expenditure patterns, initiating further rounds of backward linked repercussions in the economy. Working up the marketing chain, industries such as wholesale seafood dealers and seafood processors may be required to adjust their production levels when the availability of local seafood changes, thereby affecting input requirements from their other suppliers, and triggering a whole series of additional multiplier effects as the economy adapts to the policy action.

The National Environmental Policy Act (NEPA), Executive Order 12866, and National Standard 8 of the Sustainable Fisheries Act require federal regulators to consider the impacts on businesses that are directly and indirectly affected by proposed management actions. The scope of most economic analyses of management actions in the Northeast Region has been limited to analysis of impacts on directly affected businesses and the preparation of benefit/cost analysis which have a national perspective. While assessments of distributional effects are generally included in a Social Impact Assessment (SIA), the focus of an SIA is on the social implications of a management action on fishermen, fishing families, and social networks in a community. This means that much of the discussion of the implications of management actions on the larger fishing-related and regional economy is left for vetting in public hearings.

In an attempt to resolve this shortcoming, we have developed a partial multiregional input-output model that is capable of predicting the multiplier effects of proposed fishery management actions in the Northeast. The model is constructed at the regional level, but it has been designed so that the multiplier effects, expressed in terms of sales by businesses, average annual employment (both full and part-time), and personal income (labor income) can be determined for 24 specific sub-regions within the Northeast. While a full, disaggregated, multiregional model that explicitly measures the economic connections between all business sectors in 24 different regions is beyond possibility because of data availability, the approach developed here can be described as a partial multiregional model because it explicitly accounts for the interconnections between the fishing-related businesses (commercial harvesters, wholesale seafood dealers, bait suppliers, and seafood processors) in all 24 sub-regions in the Northeast. The intra and inter-regional seafood linkages are captured through the addition of up to 21 new fishing-related industry sectors in each of the coastal sub-regions. All of the remaining non-fishing business sectors in the model measure Northeast region-level activity, but an allocation procedure is employed that apportions the estimated region-wide effects for these businesses to the appropriate sub-regions in the model based on the relative importance of a sub-region's economy to the total Northeast region's economy.

The model was constructed using a ready-made regional input-output system called IMPLAN Pro (Minnesota IMPLAN Group, Inc.). The IMPLAN Pro system consists of software and data that may be purchased from Minnesota IMPLAN Group. The software provides the mathematical algorithms to estimate I/O models and their resulting multipliers, as well as providing a user interface that makes conducting impact assessments and organizing model outputs easier. Default data sets available for purchase include county-level data for 509 economic sectors for every county in the U.S. Data sets for each coastal state from Maine to North Carolina were acquired to construct the I/O model for the Northeast region.

The IMPLAN Pro system has considerable appeal due to its extensive use in practical applications and its readily available support literature. Further, since the conceptual basis for input-output methodology is quite intuitive, the results of impact assessments can be readily explained to fishery managers and the Public. This is important because it is our hope that the model's multiplier effects will be used by managers to compare and contrast the outcomes of proposed management strategies prior to deciding upon a preferred alternative. The ability to determine how policy-induced changes in sales, income, and employment will be distributed among businesses in 24 different sub-regions in the Northeast should provide regional decision makers with better information to make more informed policy decisions.

The primary purpose of this paper is to provide an overview of the Northeast Region input-output model's (NERIOM) operations and model outputs. This includes a comprehensive delineation of the adjustments that were made to the default IMPLAN system, a description of the underlying data, and the impact estimation approach we followed. A hypothetical impact assessment is also conducted to illustrate the types of impacts that can be generated with the model. Finally, the advantages and limitations of using the NERIOM approach for assessing the multiplier effects of fishery management actions are considered, along with a discussion of potential model improvements through additional research.

2. INPUT-OUTPUT MODELING

In addition to input-output analysis, there are a variety of other methods available for analyzing the economic impacts of fishery management actions. These range from simplistic approaches such as economic-base models to sophisticated approaches such as computable general equilibrium models (CGEM) and models that link economic and ecological or biological considerations. Although these types of models produce total impact estimates that are

similar to those generated from input-output models, they either lack the detail and complexity of those created with input-output analysis (i.e., economic-base models) or are more data intensive and generally necessitate even greater sectoral aggregation (i.e., CGEM and economic-ecological models).

In 1973, professor Wassily Leontief received the Nobel Prize in Economic Science for developing the analytical framework which came to be known as input-output analysis. Input-output analysis is generally described as a static general equilibrium approach to quantitative economic analysis. The common fabric underlying all input-output models is a comprehensive accounting system which records the sales and purchases of goods and services among industries (manufacturers), final consumers (households, government, and exports), and resource owners (land, labor, and capital) in a regional economy during a specified time period (usually one year). As such, input-output models are generally employed to predict the backward linked ripple effects (i.e., multiplier effects) of changes in the economic activity of a particular industrial sector. For example, a decrease in the output of one industry decreases the demand for output in its supplying industries, and in industries which support the suppliers, and so on. However, forward linked industries may also experience reductions in output through diminished supply of local production. If one is able to exogenously determine how these forward linked sectors might be impacted, the additional backward linked ripple effects associated with these changes could also be estimated with input-output analysis. This is discussed further in Section 6 - Impact Estimation.

Mathematically, the Leontief input-output approach derives sectoral outputs from exogenously specified final demands as

$$(1) \qquad X = (I - A)^{-1} * \hat{Y}$$

where X is a n x 1 column vector denoting output; I is a n x n identity matrix; A is a n x n direct input coefficient matrix; and $\hat{Y}$ is a n x 1 column vector denoting exogenous final demand. The elements of A (a_{ij}) are called direct input coefficients and are denoted as

$$a_{ij} = \frac{z_{ij}}{X_j}$$

where z_{ij} is the level of sales from sector i to sector j; and X_j is the total output of sector j. The $(I-A)^{-1}$ matrix is often referred to as the Leontief inverse, comprised of the interdependence coefficients (α_{ij}) alpha ij or what are commonly referred to as industry output multipliers. These multipliers indicate how much the output of each row sector would change if the final demand for sector j's output changed by one dollar. In a regional input-output model that treats household income and spending as endogenous[1], the column sum of the industry specific output multipliers measures the total direct, indirect, and induced backward linked multiplier effects from each sector of the economy required to satisfy a one dollar change in final demand for sector j's output. The direct industry multiplier measures the initial effect of sector j's one dollar final demand change on itself, which implies a multiplier value of 1. The total indirect multiplier represents the additional region-wide output changes necessitated by the one dollar change in final demand, and the total induced multiplier measures the economy-wide output effects of changes in household spending generated by the direct and indirect effects. Total output multipliers are used to estimate the economy-wide backward linked output effect associated with exogenously specified changes in final demand.[2]

The standard Leontief input-output approach must be modified before it can be applied to fishery management actions, however. From equation (1) it is clear that the model is designed to ascertain the economy-wide effects of changes in the demand for a product at the final consumption level. However, fishery management policies act by controlling gross industry output at the point of production, rather than operating to control the sale of outputs in final markets. For example, fisheries policies are generally implemented to control landings and thus directly affect the production of seafood at the harvesting level. Therefore, the basic form of equation 1 must be modified to assess the effects of management policies that induce gross changes in industry output.

To accommodate the problem of handling constraints on sectoral output within an input-output context, a procedure was developed that explicitly transforms the traditional Leontief model into one that is capable of accepting gross output changes as entries as opposed to only final demand changes (Johnson and Kulshreshtha 1982). This technique, now commonly referred to as a mixed exogenous/endogenous variables model (Miller and Blair 1985, p. 325), was used by Leung and Pooley (2002) in assessing the total economic impacts of a reduction in output of the Hawaii-based longline fishery. Unfortunately, the number of sectors contained in mixed exogenous/endogenous variables models is generally not sufficient to derive detailed estimates of indirect multiplier effects. In part, this is because all of the existing ready-made commercial regional input-output models, such as IMPLAN Pro, which provide considerable sectoral detail to trace backward linkages, are based on traditional Leontief techniques and it is not possible to incorporate the modified relationships embodied in the mixed exogenous/endogenous variables approach into these ready-made models (see Steinback 2004). As a consequence, mixed exogenous/endogenous variables models are usually derived from condensed versions of ready-made models and therefore offer rather limited evaluations of how total estimated impacts are dispersed throughout a particular region.

In an attempt to provide fishery policymakers with a higher level of sectoral detail than that contained in a mixed exogenous/endogenous variables model, another modification technique which provides the same aggregate solution as the mixed exogenous/endogenous variables model was adopted for this study. The procedure, first introduced by Tanjuakio, Hastings, and Tytus (1996), can accept gross output changes as entries within a traditional Leontief model by setting the directly impacted sectors' regional purchase coefficients (RPCs) to zero and then by modeling the changes "as if" they originated from final demand.[3] In contrast to the mixed exogenous/endogenous variables model, Tanjuakio, Hastings, and Tytus' (1996) approach is based on the traditional Leontief relationships shown in equation (1) so it can be incorporated into ready-made input-output models such as IMPLAN Pro. This is important because ready-made models reduce the cost and complexity of model formulation and the time required to generate impact estimates.[4]

The ready-made IMPLAN Pro system that was used in this study provides a user-friendly media for customizing input-output models to a specific application, and offers the capability to create custom sectors such as commercial fishing that are not well configured in the default IMPLAN Pro data base. In fact, constructing an IMPLAN Pro model capable of calculating the multiplier effects of proposed fishery management actions on businesses in 24 different sub-regions in the Northeast required creating many additional fishing-related sectors. These adjustments are explained in detail in the next section.

3. COMPONENTS OF THE NORTHEAST REGION INPUT-OUTPUT MODEL (NERIOM)

FISHING REGIONS IN THE NORTHEAST U.S.

A distinguishing feature of the NERIOM is its ability to assess the impacts of management alternatives on the entire Northeast Region's economy and on the economies of 24 specific sub-regions. The 24 sub-regions represent semi self-sufficient fishing areas that have similar economic networks and fishing-related attributes. The sub-regional designations were based on several criteria. First, data on fishing and non-fishing industrial sectors were generally only available at a county-level. Therefore, the sub-regional impact area designations represent either individual counties or groups of counties within each of the 11 Northeast Region States. Data obtained from federal Northeast vessel trip reports, Northeast dealer weigh-out slips, Northeast permit applications, and County Business Patterns were used to classify sub-regions that have similar economic networks and fishing-related attributes. These data provide an indication of regional distribution channels of seafood as it flows from harvesters through dealers and finally on to processors in the Northeast. The sub-regional designations consist mainly of a coastal county or groups of coastal counties, for these are the counties where the majority of the impacts accrue and where the employees and owners of fishing businesses, seafood dealers, and processors reside. However, if it were determined that fish are regularly being sold to dealers and processors in adjacent non-coastal counties, the sub-regional designations were expanded to account for these transactions. There are 23 coastal and one non-coastal sub-region contained in the NERIOM (see Figure 1 and Table 1).

IMPLAN PRO ADJUSTMENTS

The IMPLAN Pro sector classification system is based on the U.S. Census Bureau's North American Industry Classification System (NAICS) and contains county-level estimates of business activity for up to 509 industry sectors. Included in the coding system are four industry sectors that either directly produce seafood or are directly involved in the seafood marketing chain. These sectors are: animal production including aquaculture (sector 13), fishing (sector 16), seafood product preparation and packaging (sector 71), and wholesale trade (sector 390). These four sectors, however, are constructed from aggregate industrial sector level data which do not distinguish businesses of different types and sizes. For example, all commercial fishing harvesters, regardless of gear type or size, are included in one aggregate "catch-all" fishing sector (sector 16). This level of aggregation is too gross for conducting impact assessments of fishery management actions on specific fisheries or gear types. Furthermore, since businesses that produce similar types of products or services are generally pooled into a single IMPLAN Pro sector, the underlying data may not accurately portray the establishments of interest. For instance, businesses engaged in the wholesale distribution of seafood comprise only a small portion of the wholesale activity included in the single default "wholesale trade sector". The production functions, tradeflows, and value-added estimates associated with seafood wholesalers that deal with a perishable product may be different from those of wholesalers that distribute other durable or nondurable goods. Therefore, the fishing-related sectoral designations and underlying data must be refined before IMPLAN Pro can be used to describe the economic activity associated with fishery management actions.

To the extent that the businesses most impacted by fishery management actions are commercial fishing, wholesale distribution of seafood, and seafood processing, our refinements focused on improving on the aggregate information contained in IMPLAN Pro sectors 16 (fishing), 390, (wholesale trade), and 71 (seafood product preparation and packaging). Since the National Marine Fisheries Service (NMFS) is not directly responsible for managing the activities associated with aquaculture establishments no adjustments were made to sector 13 (animal production).

We began by deleting IMPLAN Pro's single commercial fishing sector and adding new harvesting sectors based on gear type and vessel size class. Consideration was given to classifying sectors according to primary species landed, but since management regulations often target specific gear sectors or vessels of a given size class it was necessary to incorporate these characteristics into the NERIOM. Further, the number of modifications necessary to construct a species-specific model would have been much larger than was necessary to develop gear-based sectors. Commercial fishing businesses were grouped into 18 distinct gear sectors in 22 of the 23 coastal county sub-regions. No harvesting sectors were added for the North Carolina north subregion or for inshore and offshore lobster vessels in the North Carolina central sub-region. An IMPLAN Pro model is limited to 1,000 industry sectors and this constraint would have been exceeded after adding all of the new harvesting sectors and the remaining fisheries-related sectors to be discussed below. Therefore, since there were no recording landings in the North Carolina north sub-region in 2001 (the base year of the NERIOM) nor for the North Carolina central inshore and offshore lobster harvesting sectors in 2001, these industries were excluded from the model. A total of 394 new harvesting sectors were added to the NERIOM. Table 2 delineates all of the new sectors that were added to the default IMPLAN Pro model. The data used in the construction of the fisheries-related sectors are discussed in the next section. Additional modifications included separating the wholesale seafood dealer component from the default wholesale trade sector and adding 23 new wholesale seafood dealer sectors (one for each coastal sub-region). Since seafood also passes through fish exchanges/auctions in four sub-regions in New England a fish exchange sector was created in each of these sub-regions (Lower Mid-Coast Maine, Massachusetts North Shore, Massachusetts Boston Area, and Massachusetts New Bedford Coast).[5] Purchases of bait by longline, hand gear, and lobster vessels were accounted for by assigning the purchases directly to 23 new midwater trawl bait supplying sectors and 23 medium bottom trawl bait supplying sectors (one in each coastal sub-region). In the Northeast, midwater and bottom trawls land the majority of the species used as bait by the longline, handgear, and lobster sectors. Lastly, we removed the default seafood processing sector (sector 71) and added a sub-regional processing sector in each of the 23 coastal sub-regions.

PRODUCT FLOW ASSUMPTIONS

The distribution patterns of seafood among harvesters, wholesalers, processors, and final demand establishments in the Northeast U.S. are complex. Product flow patterns are influenced by product type, market demand (both domestic and foreign), location of buyers and sellers, sales agreements/contracts between buyers and sellers, management regulations, and a host of other immeasurable factors that present challenges to modeling. In a regional input-output model each successive level of sale among seafood industry establishments adds value to the product, thereby generating additional economic impacts. Thus, it is important to account for the origin and destination of purchases and sales that will be impacted (either directly or indirectly) by management regulations.

Unfortunately, limited available data on this complicated product flow within the Northeast region called for some simplifying assumptions. In the NERIOM, harvesters are assumed to sell all of their output to wholesale dealers via direct sales or through fish exchanges/auctions (see Figure 2). Since federally permitted harvesters are required to sell to establishments that hold a valid federal dealer permit, this assumption is reasonable. For state water fisheries or where some vessels may engage in direct sales to final consumers this assumption is tenable. Wholesale dealers, in turn, are then assumed to sell their output to final consumers, intermediate demand industries (including seafood processors) and to businesses located outside of the Northeast region. However, due to the number of available seafood substitutes at the retail level, the impacts of most fishery management actions on final consumers and intermediate demand industries other than seafood processors are likely to be negligible. Therefore, impacts that may accrue beyond the processor level are not incorporated in the NERIOM (see Section 7 for more detail).

4. BACKGROUND DATA

SALES (OUTPUT)

Estimates of sales by the harvesting sectors (i.e., ex-vessel revenues) were derived from 2001 Northeast dealer weigh-out slips for each sub-region. In cases where the value of landings for a given state was not assigned to a county, sales were prorated to each sub-region within the state based on calculated revenue shares by gear sector and sub-region for data that was assignable.

Total wholesale seafood dealer sales in each sub-region were derived from 2002 Economic Census data (U.S. Census Bureau 2004), 2001 County Business Patterns data (U.S. Census Bureau 2003) and the average 2001 Fulton Market margin. The Economic Census estimates of National wholesale seafood dealer sales and employment were used to calculate a value for average sales per employee. This value was then multiplied by the County Business Patterns estimates of number of employees in each sub-region to obtain sales estimates for the sub-regions. Note that in the NERIOM the wholesale seafood dealer sectors are treated as margin sectors. That is, the value of sales excludes the "cost of goods sold." In so doing, the sales

estimate for a margin sector includes only the value added to the product being sold (i.e., total value of sales less the cost of the purchased raw material). Therefore, the sub-regional sales estimates were multiplied by the average Fulton Market mark-up (i.e., margin) in 2001 (40%).

Fish exchange/auction houses are also required to hold a valid federal dealer permit so it was possible to obtain sales estimates for seafood that passed through these establishments from the 2001 Northeast dealer weigh-out data. Fish exchange/auction houses were also treated as margin sectors in the NERIOM, however, so the weigh-out data had to be refined so that it represented only the value added by the auction houses. Value added by auction houses is generally associated with a small per-pound commission to unload, sort, ice, and display the seafood. The fees cover employee expenses and operating costs, which, in turn, generate additional economic impacts in the Northeast region. Average handling fees vary slightly across species and auction houses, but were assumed to be 11 cents per pound (7 cents paid by the boat and 4 cents by the buyer (R. Ciulla, co-manager Gloucester Seafood Display Auction, personal communication). Given handling fees, the sales estimates (i.e., the value of production) for the 4 fish exchange sectors were calculated by first dividing the average handling fee by the average annual price per pound of seafood sold at each exchange in 2001, and then multiplying the result by the total annual value of seafood sold at each exchange.

IMPLAN Pro default values for sector 17 (seafood product preparation and packaging) in each of the 23 coastal sub-regions were used to determine the value of the processing sectors' sales. These values were obtained by constructing separate default IMPLAN Pro models for each of the 23 coastal sub-regions and then incorporating the resulting 23 processor sales values into the NERIOM.

EMPLOYMENT

Employment estimates for fishermen are typically not compiled according to type of harvesting gear. In fact, because self-employed fishermen are generally not included in U.S. labor statistics, there is often a great deal of uncertainty even in aggregate estimates of commercial fishing employment. However, all federally permitted harvesters in the Northeast are required to fill out vessel trip reports in which they indicate the type of gear employed and the number of crew (including captain) that participated on each trip. This data provided the basis for calculating the majority of the harvesting sector employment estimates in each sub-region. Limited Northeast vessel trip reports were available for the hand gear trips, dive gear trips, and ocean quahog dredge gear trips, so another method for estimating employment was employed for those gear sectors. Employment calculations for both methods are shown below.

The steps used to calculate employment from vessel trip reports (VTR) were as follows:

(1) Identify a gear sector for all VTR trips in each sub-region;
(2) Calculate the average number of crew by vessel for all vessels that participated in a gear sector in each sub-region;
(3) Sum total annual value of landings by vessel for all vessels that participated in a gear sector in each sub-region;
(4) Sum total annual value by gear sector and sub-region;
(5) Sum average crew by gear sector and sub-region;
(6) Calculate the value/labor ratio by dividing the result of step 4 by the result of step 5; and
(7) Divide the value/labor ratio from step 6 into the total value of production (i.e., sales values discussed above) by gear sector and sub-region to obtain employment estimates.

Employment numbers for the hand gear sectors, dive gear sectors, and ocean quahog dredge gear sectors were estimated by dividing the sectoral production values (sales values) by IMPLAN Pro's default value/labor ratios for sector 16 (Fishing) in each sub-region. The value/labor ratios were obtained by creating 23 default sub-regional IMPLAN Pro models.

Wholesale seafood dealer employment estimates were obtained from 2001 County Business Patterns Data (NAICS sector 42246; U.S. Census Bureau 2003). Employment values for counties with suppressed seafood dealer data were estimated by multiplying the average state-level employment per establishment by the total establishments contained in the county (County Business Patterns provides estimates of number of establishments even if employment data is suppressed).

Employment estimates for the four fish exchange/auction sectors were obtained by making several simplifying assumptions as follows:

(1) Average earnings per employee in each of the four sub-regions where the fish exchange/auction sectors are located were assumed to be equal to the wholesale seafood dealer average earnings values in those sub-regions.
(2) Calculate total employee earnings for each fish exchange/auction sector by multiplying the sectoral production values by the percent of total value that is used to pay employee earnings (the derivation of these employee compensation percentages is described in the next section).
(3) Divide total employee earnings for each fish exchange/auction sector by the average earnings per employee from step 1 to obtain employment estimates.

COST-EARNINGS

The validity of impact estimates generated by input-output models depends to a large degree on the underlying industry cost data, and in identifying which combination of IMPLAN Pro sectors is most likely to represent the distribution of these costs. In the development of the NERIOM, a significant effort was made to incorporate the best available cost and earnings data for harvesters, wholesale dealers, fish exchanges/auctions, and seafood processors. Cost and earnings data are the heart of an input-output model because they are used to construct production functions that link the purchasing activities of a particular sector to all other sectors in the model. This section describes the origin of these data and explains how the production functions were created.

We also extended considerable effort in developing a bridge that was used to allocate each industry expenditure item to its appropriate IMPLAN Pro sector or sectors. The description of this bridge is quite lengthy, however, so it was placed in Appendix A. Nonetheless, readers are encouraged to review the bridging process shown in Appendix A because input-output model results are particularly sensitive to how industry expenditures are distributed among sectors.

Cost and earnings estimates for harvesters were derived from Northeast Observer data, Northeast Dealer data, and surveys of specific gear sectors in the Northeast. A detailed description of these data sources by gear type is provided below and a summary is shown in Table 3.

Inshore and Offshore Lobster Trap

As part of a larger project to develop a simulation model of the lobster fishery researchers at the University of Rhode Island conducted a series of focus groups with lobster vessel owners (Anonymous, 1995). These focus groups were conducted in selected ports throughout New England and were conducted with both inshore and offshore participants. In addition to gathering data on trap management and notable changes in the fishery, the researchers collected information on operating costs, fixed costs, and crew remuneration. Since these data were originally collected in 1993-1994 the cost estimates were adjusted to 2001 dollars using IMPLAN Pro price deflators.

Linear production functions for offshore lobster, Northern inshore lobster (Maine and New Hampshire) and Southern inshore lobster (Massachusetts southward) were then developed by calculating the proportion of total costs (including payments to crew and profits) each expenditure item represented (Table 4). Before these production functions could be incorporated into the NERIOM, however, several of the proportions (i.e., absorption coefficients) had to be adjusted for wholesale and retail trade margins. Commodities and services purchased directly from manufacturers (i.e., mooring fees, repair and maintenance services, permit fees, etc.) have no transportation, wholesale, or retail markups so no adjustments were made to these absorption coefficients (Table 4). However, expenditures for commodities obtained from wholesalers or retailers (i.e., groceries, fuel, trip supplies, etc.) must be subdivided into the portion going to the retailer, wholesaler, transportation industries, and the manufacturer. The IMPLAN Pro system provides margin tables for each manufactured commodity that is purchased at the wholesale and retail level, to determine how a dollars worth of consumer expenditures is distributed among the manufacturing, wholesale, transportation, and retail industries that contribute to its production and distribution. These margin tables were used to distribute the absorption coefficients in Table 4 that pertained to commodities purchased from wholesalers or retailers, into the amount paid to the retailer, wholesaler, transportation industries, and the manufacturer. The adjusted values were then incorporated into the production functions shown in Table 4 and entered into the NERIOM. The adjusted production functions were too large to present in this document, but the margined proportions used to adjust the absorption coefficients shown in Table 4 are contained in Appendix A.

Bottom Trawl

Cost and earnings data for the small (< 50 feet), medium (50 to 70 feet), and large (> 70 feet) bottom trawl vessels were obtained from three sources. Average variable cost estimates (e.g., ice, fuel, oil, water, food, bait, and supplies) were obtained through the Northeast Fisheries Science Center's sea sampling program. These data are collected for all commercial fishing trips that carry onboard observers and represent the best available trip-level data for many fisheries. Northeast observer data from 2003 were used to estimate average trip-level expenditures because the coverage in 2003 was considerably higher than in 2001. IMPLAN Pro's deflators, which are derived from the Bureau of Labor Statistics Growth Model, were used to adjust these average values to their 2001 equivalent.

All fixed cost expenditures were derived from studies conducted by researchers at the University of Rhode Island (URI). The data for the studies were collected from mail surveys of Northeast fishing vessels whose primary gear was an otter trawl. Results of the studies were published in two reports: one for small trawlers (Lallemand et al. 1998) and one for large trawlers (Lallemand et al. 1999). Small trawlers were defined as vessels of 65 feet or less and large trawlers consisted of all vessels greater than 65 feet. These length categories are different than those contained in the NERIOM, however, so we obtained access to the raw survey data and recalculated average fixed cost estimates for the three categories of vessels contained in our model (i.e., small, medium, and large trawlers). All data were then adjusted to their 2001 equivalent using IMPLAN Pro inflators.

Average gross stock estimates were derived from 2001 Northeast dealer data and pertained only to those vessels that were surveyed in the URI reports. In combination with average crew and vessel remuneration percentages obtained from the raw URI survey data, the gross stock estimates were used to calculate the value of crew payments (employee compensation) and boat profits (proprietary income). Linear production functions for the three categories of bottom trawl vessels could then be developed by calculating the proportion of total costs (including payments to crew and profits) each expenditure item represented (Table 4). Appendix A contains the adjustments made for commodities purchased at the wholesale or retail level.

Scallop Dredge

The cost and earnings data for scallop dredge vessels were obtained from a study conducted by researchers at the University of Massachusetts Dartmouth (see Georgianna, Cass, and Amaral 1999). The study design involved a mail survey to all vessels that held a federal sea scallop permit in the Northeast in 1997. The researchers categorized the data by small (< 50 feet), medium (50 to 70 feet), and large (> 70 feet) vessels, so the average variable and fixed cost estimates published in the report were directly applicable to the vessel size classifications used for scallop vessels in the NERIOM. Average earnings estimates for crewmen, captains, and vessel owners were also determined from the survey data for each of the vessel size categories. After all of the average expenditures were obtained (including payments to crew and profits) linear production functions were created to be incorporated into the NERIOM (Table 4). Appendix A contains the adjustments made for commodities purchased at the wholesale or retail level.

Surfclam, Ocean Quahog Dredge

Cost and earnings data for this gear sector were unavailable so the production function created for the medium scallop dredge sector was used a placeholder until estimates for clam dredge vessels are obtained.

Sink Gillnet

Variable costs for sink gillnet vessels were derived from 2003 Northeast observer data and adjusted to their 2001 equivalent using IMPLAN Pro deflators. The availability of fixed costs and earnings data for these vessels was quite limited, however, so values that pertained to bottom longline vessels (described below) were used as placeholders until these data are collected. Fishing costs for bottom longline vessels are likely to be similar to vessels fishing with sink gillnets because they generally operate in the same manner. Nonetheless, the production function created for sink gillnet vessels was derived from a combination of observer data and bottom longline proxy data (see Table 4). Appendix A contains the adjustments made for commodities purchased at the wholesale or retail level.

Diving Gear

The southern inshore lobster production function was used as a proxy to describe the purchasing activities of the diving gear sectors until cost and earnings estimates for vessels fishing with this gear are obtained. Note that purchases unique to the lobster fishery such as bait and traps were excluded from the dive gear production function. Expenditures for these items were reallocated to the remaining cost categories according to the relative shares contained in the production function.

Midwater Trawl

Northeast observer coverage for this fishery is quite limited and information on fixed costs and earnings could not be found for vessels that fish with midwater trawls. Therefore, the production function created for the medium bottom trawl fishery was used as a placeholder until these data become available.

Fish Pots and Traps

The operating characteristics of inshore lobster fishing are very similar to fishing with fish pots and traps. Since specific cost and earnings data for this gear sector could not be located, the production function created for southern inshore lobster fishing was used to represent the purchasing activities associated with the fish pots and traps sectors in the NERIOM.

Bottom Longline

Average variable cost estimates were generated with data obtained from the Northeast observer program in 2003. IMPLAN Pro deflators were used to estimate 2001 equivalent values. Data collected by researchers at the University of Massachusetts Dartmouth, for a study of longline vessel owners in the Northeast in 1997, were used to calculate average fixed costs and value-added estimates (see Georgianna and Cass 1998). After these estimates were adjusted to 2001 values, they were combined with the Northeast observer variable cost data and linear production functions were created by calculating the proportion of total costs attributable to each expenditure item (Table 4). Ap-

pendix A contains the adjustments made for commodities purchased at the wholesale or retail level.

Other Mobile Gear

This gear sector includes all mobile gear except trawls and dredges. Vessels fishing with purse seines, scottish seines, danish seines, stop seines, bag nets, lift nets, shrimp beam trawls, stop nets, runaround gillnets, and trammel nets were classified as other mobile gear in the NERIOM. The production function created for medium bottom trawls was used to represent the purchasing activities of these other mobile gear sectors.

Other Fixed Gear

Landings from fixed gears such as pound nets, weirs, harpoons, fyke nets, pelagic longlines, box traps, and drift/anchor gillnets were combined into an other fixed gear sector. The sink gillnet production function was used to characterize industry purchases for these gear types.

Hand Gear

Cost and earnings data for vessels fishing with hand gear were estimated from surveys of jig and pole vessel owners that fished for groundfish in New England in 1997 (see Georgianna, Cass, and Brough 1998). IMPLAN Pro's inflators were used to adjust mean expenditure values to their 2001 equivalent. The predominant gear in this sector is hand lines, but also includes dip nets, cast nets, tongs and grabs, oyster rakes, picks, shovels, forks, hoes, and common and long seines. Linear production functions were also generated for these gears by calculating the proportion of total costs each expenditure item represented (Table 4). Appendix A contains the adjustments made for commodities purchased at the wholesale or retail level.

Small Dredge

This sector is comprised of oyster, clam, crab, conch, mussel, and urchin dredge gear. The production function created for small scallop dredges was used to represent the purchasing activities of these dredge sectors.

Wholesale Seafood Dealers

A production function developed for wholesale seafood dealers in the Mid-Atlantic region by Kirkley, Ryan, and Duberg (2004) was used to characterize the purchasing behavior of the 23 wholesale seafood sectors in the NERIOM (Table 5). As previously mentioned, the wholesale seafood dealer sectors are treated as margin sectors so the production function does not include the cost of purchasing seafood from the commercial fishing sectors. Appendix A contains the adjustments made to the production function for commodities purchased at the wholesale or retail level.

Fish Exchange/Auctions

Expenditures by the 4 fish exchange/auction sectors contained in the NERIOM were modeled with a production function developed by Kirkley, Ryan, and Duberg (2004) for Fulton Fish Market in New York (Table 5). The data utilized in their report were obtained from TechLaw, Inc. (2001) and represent the operating costs associated with the provision of services offered by the Fulton Market. These services are similar to those offered by the fish exchange/auction houses in the NERIOM. See Appendix A for the adjustments made to the production function for commodities purchased at the wholesale or retail level.

Seafood Processors

The default IMPLAN Pro production functions for Sector 71 Seafood Product Preparation and Packaging, in the 23 coastal sub-regions, were used to allocate purchases to their appropriate IMPLAN Pro sectors in the NERIOM. The default sub-regional production functions were too large to include in this document.

Exports

Foreign trade data by species and product type were obtained from the Fisheries Statistics and Economics Division of the National Marine Fisheries Service (NMFS). These data provide information on trade (value and pounds) through specific U.S. customs districts such as New England and the Mid-Atlantic regions. The procedures used to incorporate these trade data into the NERIOM are delineated in the next section.

5. MODEL CONSTRUCTION

An IMPLAN Pro model consists of more than 60 underlying Microsoft Access tables (Table 6). These tables can be grouped into four general categories. The tables in the first category contain unique code numbers for industries, commodities, margins, value-added sectors, household expenditure groups, institutions, transfer payments, and trade. Tables in the second category contain raw input data used

in the impact assessment portion of the program. Default model building information about the study area and model specs are contained in the third category of tables; and the remaining tables contain report data that are created during the model construction stage, the impact analysis stage, and for viewing final impact runs. In constructing the NERIOM, changes were made to the majority of the Access tables in the first and second categories and a few of the Access tables in the fourth category (modified Access tables are indicated with an * in Table 6).

The modification procedure generally consisted of exporting the data contained in the relevant Microsoft Access tables to Microsoft Excel, adding new data, and then importing the modified tables back into Microsoft Access. A brief summary of the modification procedure is shown in Table 7, and the detailed steps involved in building the Northeast Region input-output model are presented below. This section also includes a description of the adjustments made to each of the individual Microsoft Access tables.

MODEL CONSTRUCTION STEPS

Step 1 -- A default Northeast Region input-output model with a set of estimated multipliers was first created by opening the IMPLAN Pro software, importing the default 2001 IMPLAN data for all of the counties in Table 1, and then constructing a default IMPLAN model along with a set of estimated multipliers.

Step 2 -- The default model was then opened using Microsoft Access 2000. IMPLAN Pro data bases require this version of Access.

Step 3 -- The three US tables and the Observed RPCs table were then deleted. This step was necessary because all IMPLAN Pro models share the following five tables (as indicated by black arrows to the left of the tables when the model is opened in Access):

- US Absorption Table
- US Absorption Totals
- US Byproducts Table
- Observed RPCs
- Margin Codes

Deletion of these tables "breaks" the link so that any subsequent changes will not affect other IMPLAN models. No changes were made to the Margin Codes table so it was not necessary to remove the link to this table.

Step 4 -- The deleted tables (the three US tables and the Observed RPCs table) were then replaced with the same tables contained in the 2001 IMPLAN Pro structural matrix file 01NAT509.IMS through the import feature in Access.

Step 5 -- In Access, the default data in the 16 tables that needed to be modified were exported to Excel. Note that since the US Absorption table consisted of over 80,000 rows of data, it was necessary to create two Excel tables to house this information since Excel has a capacity of 65,536 rows.

Step 6 -- All of the default data in the 16 tables to be modified were deleted. The table layout including column and table names was not changed so that the updated data could be imported back into the original Access file structure.

Step 7 -- Data in these 16 tables were modified to better reflect the sectoral linkages among fisheries-related industries. Consistent with Step 6, the variable names and record formats were maintained so that the files were compatible with the original Access file structure.

Step 8 -- Once all 16 data files had been modified they were imported into Access. An append query in Access was used to combine the two US Absorption Excel files into one US Absorption table.

Step 9 -- The modified model was then opened in IMPLAN Pro, the model was reconstructed and multipliers were re-estimated. This step was necessary because IMPLAN Pro is not capable of recognizing the direct changes made to the underlying Access tables, so the model must be reconstructed to use the updated data.

IMPLAN PRO TABLE ADJUSTMENTS

The following provides a more detailed discussion of modifications to certain Access tables.

Industry/Commodity Codes

This table contains unique code numbers for industries and commodities. Industries and commodities share the same name and number in an IMPLAN Pro model. Modifications began by removing the default commercial fishing sector (IMPLAN sector number 16) and adding 394 new harvesting sectors to the model (sector's 510-903 in Table 2). These industry sectors designate different commercial fishing gear and vessel length categories in each of the sub-regions in the Northeast.

Additional changes included adding 23 wholesale seafood dealer sectors (sector's 904-926 in Table 2), 4 fish exchange sectors (sector's 927-930 in Table 2), 23 midwater trawl bait supplying sectors, and 23 medium bottom trawl bait supplying sectors (sectors's 931-976 in Table 2). Finally, we removed the default seafood processing sector (IMPLAN sector number 71) and added 23 sub-regional processing sectors (sector's 977 - 999 in Table 2).

Type Codes

The Type Codes table contains coding information on all transaction types in the data sets. For this table, we added the 490 industry/commodity code designations as assigned above and the associated 490 SAM Commodity codes. Transaction codes associated with Factors, Households, Institutions, Transfers, Employment, Output, and Trade remained the same.

US Absorption

This table contains the United States absorption matrix which, in input-output terminology, is the coefficient form of the use table. The default 2001 table contains 80,285 rows of data that show the proportions of commodities each industry uses in its production process (i.e., its production function). We removed the 213 rows of data contained in the production functions for the default commercial fishing sector (sector 16) and the default seafood processing sector (sector 71), and then added 55,425 rows of data that contained the production functions of each of the 490 fisheries-related sectors that were added to the model.

Sectors that purchase commodities from the default commercial fishing sector (i.e., seafood) and the default seafood processing sector required adjustments to their production functions, since these two default sectors were removed from the Northeast Region input-output model. Adjustments were made by first identifying the industries that purchase seafood from these sectors. The commodity balance sheet report option in IMPLAN Pro provides information on all industry sectors that purchase from a particular sector. Using this option, we were able to identify the 11 industry sectors that purchase seafood from the default commercial fishing sector, and the 27 industries that purchase from the default seafood processing sector in the 2001 data (Tables 8 and 9). However, in our Northeast Region model wholesale seafood dealers are assumed to purchase 100% of the commercial fishing output. Thus, it was necessary to change the assignment of seafood purchases for the 11 industry sectors that purchase commercial fishing output. We assumed that 7 of the 11 sectors would purchase seafood from seafood processors and the remaining 4 would purchase from wholesale seafood dealers (see Table 8).

This reassignment strategy, however, entailed an additional step because the Northeast Region model includes 23 sub-regional wholesale seafood dealer sectors and 23 sub-regional seafood processing sectors. A method had to be developed to determine from whom of the sub-regional dealers and processors the industries in Tables 8 and 9 would purchase their seafood. At the suggestion of the software vendor, we decided to allocate purchases according to output proportions in each sub-region. In other words, we used the sub-regional shares of total wholesale seafood dealer output and seafood processing output in the Northeast Region to allocate purchases. These shares were then multiplied by the default commercial fishing sector's and/or the default seafood processing sector's gross absorption coefficient contained in the production functions of each of the sectors shown in Tables 8 and 9. The resulting vector of absorption coefficients was then inserted into the US Absorption Table in place of the default values for each of the sectors shown in Tables 8 and 9. Note that the sum of the values contained in the vector of absorption coefficients must sum exactly to the absorption coefficient contained in the default data or the model will not build correctly.

US Absorption Totals

The US Absorption Totals table contains the sum of the absorption coefficients for each industry sector. We removed the default commercial fishing sector's total absorption coefficient and the default seafood processing sector's total absorption coefficient, and then added the appropriate absorption coefficients for the 490 new sectors in the Northeast Region model. The sum of the coefficients from each sector in the US Absorption table must match the coefficients in the US Absorption Totals table.

US Byproducts

This table contains US estimates of the proportions of each commodity an industry produces. In input-output terminology it is the coefficient form of the "make" table derived by dividing each element by the make table row totals. Industries often produce more than one commodity. Commodities other than primary commodities are called secondary commodities or byproducts. For this table, we first examined if any of the 509 default industry sectors produced commercial fishing seafood or processed seafood as a byproduct. The commodity balance sheet report option in IMPLAN Pro provides information on commodity production by all industries. From this report we found that no other industries produced commercial fishing seafood as a byproduct in the 2001 data. However, there were three industries (Frozen food manufacturing, Fruit and vegetable canning and drying, and Meat processed from carcasses) that produced processed seafood as a byproduct. If we allowed these sectors to produce processed seafood as a byproduct, the model would not construct properly because the default seafood processing sector was removed from the model. Therefore, we removed the proportion associated with processed seafood for these three sectors and added it to their primary commodity share, so that the sum of each sector's byproducts coefficients remained equal to one. The byproducts coefficients, which include the primary commodity share coefficient, must sum to one for each sector in the model in order for the model to construct properly.

We also assumed that each of the 490 new sectors that were added to the model would produce only primary commodities. Thus, we added a single record to the US Byproducts table for each of the 490 new sectors and set each sector's primary commodity share coefficient to one.

SACommodity Sales

This table shows sales of commodities by households and institutions in the study area. There were no sales of seafood by households in the default data so no changes were made to the commodity sales rows for the nine household expenditure sectors (i.e., Type Codes 10001 - 10009). There were also no institutional sales of raw harvested seafood or processed seafood. However, zeros are entered into the commodity sales field when no sales are present so we had to remove the records that pointed to these commodity codes in the default institutional sales data. In addition, since we assumed that there are no institutional sales of commodities produced by the 490 new industries that were added to the model, rows with zeros in the commodity sales field were inserted into the table.

We also removed inventory additions (Type Code 14002) that existed in the default data for the seafood processing sector (Sector 71) because we eliminated this sector from the Northeast Region model. Sales estimates for the 23 new sub-regional seafood processing sectors in the model were estimated by first constructing 23 separate sub-regional IMPLAN Pro models to obtain the default inventory seafood processing values in each sub-region, and then assigning them to the 23 sub-regional seafood processing commodity codes in the SA Commodity Sales table.

SAEmployment

The SAEmployment table delineates average annual jobs for each industry in the study area. Jobs are measured in terms of both full-time and part-time workers combined. For this table, we removed the employment estimates for the default commercial fishing sector (Sector 16) and the default seafood processing sector (Sector 71), and then inserted our employment estimates for the 490 new sectors.

SAFinal Demands

The final demand table consists of purchases of commodities for final consumption by households and institutions. Several modifications were made to this table. The first step entailed removing final demands associated with the default commercial fishing sector and the default seafood processing sector for all nine of the household expenditure type codes and for all of the institution type codes. We then used these default values in combination with output data and the dealer transaction matrix (see Section 6) to estimate final demands by type codes for the new harvesting sectors, seafood dealer sectors, and seafood processing sectors.

Final demands for each of the 394 new harvesting sectors were estimated by first calculating the proportion of a sector's output to the total output across all 394 sectors, and then multiplying this proportion by each default commercial fishing sector's (Sector 16) final demand value contained in a Northeast Region-level model across type codes.

Final demands at the wholesale seafood dealer level were more difficult to calculate because the wholesale seafood dealer sector is lumped into in an all-encompassing wholesale trade sector in an IMPLAN Pro model. Thus, there were no default final demand values specifically for seafood purchased at the wholesale level to use as a benchmark in our new model. Therefore, we used the average 2001 wholesale seafood mark-up from Fulton fish market (40%) in combination with the dealer transaction matrix to determine final demands by type code for all 23 wholesale seafood dealers in the model. Assuming that all commercially landed seafood flows through wholesale dealers, we first divided the commercial fishing final demand sales calculated above by 0.4 to calculate the wholesale dealer final demand sales associated with each of the 394 new harvesting sectors. We then multiplied these values by the proportions contained in the dealer transaction matrix to determine final demand sales by wholesale dealer and type code associated with each new harvesting sector. Lastly, we summed the final demand sales across harvesting sectors for each wholesale dealer by type code. The resulting final demand vector contained final demand sales for all 23 wholesale seafood dealers by type code and was incorporated into the SAFinal Demands table. These final demands were also subtracted from the default wholesale trade final demand values since they were reassigned to 23 new sectors in our model.

Last, final demands for the 23 seafood processing sectors were calculated in the same manner as the harvesting sector's final demands. The proportion of a sector's output to the total output across all 23 sectors was multiplied by each default seafood processing sector's (Sector 71) final demand value contained in a Northeast Region-level model across type codes.

SAForeign Exports

The SAForeign Exports table shows demands made for goods and services by consumers and industries outside the US. For this table, we removed the foreign export estimates for the default commercial fishing sector (Sector 16), re-estimated foreign exports for raw seafood from new data (see below) and assumed that foreign exports of raw seafood occur at the wholesale level and not the harvesting level. Additionally, foreign exports for the 23 new process-

ing sectors added to the model were estimated by constructing 23 separate sub-regional IMPLAN Pro models to obtain the default inventory seafood processing export values in each sub-region.

Foreign exports of seafood produced at the wholesale-level in the Northeast Region were calculated according to the following six steps.

Step 1 -- Northeast dealer reports were used to calculate the value of landings by species for the top three to five species landed (by value) for each harvesting sector gear type in the model.

Step 2 -- The proportion of total value by species and product type that is exported out of the US was calculated. New England and Mid-Atlantic foreign trade data by species and product type is available from the Fisheries Statistics & Economics Division of the National Marine Fisheries Service (NMFS) at http://www.st.nmfs.gov/st1/trade/index.html. These data are purchased from the Foreign Trade Division of the U.S. Census Bureau and provide information on trade ($s and lbs) through specific U.S. customs districts such as the New England and the Mid-Atlantic regions. We divided the value exported by species and product type by the region-wide export value of total landings (average export price multiplied by total landings) to obtain the proportion of total sales exported out of the U.S. by product type.

Step 3 -- Fresh fillets and fresh and frozen whole fish were assumed to be exported by wholesalers. The remaining product type categories (frozen fillets, salted, dried, minced frozen, smoked, and an other product type category) were assumed to be exported by seafood processors. We summed the export proportions from Step 2 across the three wholesale product type categories to estimate total Northeast Region export proportions (in terms of value) by species.

Step 4 -- Weighted average wholesaler export proportions were calculated from the harvesting gear types. The export proportions from Step 3 were weighted by the proportions of landed value by species (for the top three to five valued species) to total landed value for each of the harvesting gear types. These species-level proportions for each gear type were then summed across species to obtain the proportions of wholesaler output that will be exported out of the U.S., originating from the 18 different gear types in the model. Note that the export rates derived from each gear type are assumed to be the same across the 23 sub-regions.

Step 5 -- The wholesale export rates from Step 4 were then multiplied by the output values contained in the dealer transaction matrix (adjusted upward assuming a margin of 40%) to obtain the wholesale dealer export values across the 23 wholesale sectors associated with each harvesting sector in the model.

Step 6 -- We then summed the wholesale export values from Step 5 across harvesting sectors for each of the 23 wholesalers and divided this value by the total sales from each wholesale sector. The resulting values show the average proportion of total seafood sales that is exported out of the U.S. by each wholesaler. The average amount exported by seafood dealers ranges from a low of 18% in the VA North sub-region to 70% in the Southern ME sub-region. These proportions were then multiplied by the margined wholesale output values contained in the SAOutput table (the wholesale sectors are treated as margin sectors in the model) to determine the value of foreign exports for each of the 23 wholesale sectors in the model.

SAOutput

The SAOutput table is a vector of output values in millions of dollars that represents an industries total production. There is a single value for each of the 997 sectors in the model. We removed the default commercial fishing sector's output value and the default seafood processing sector's output value, and then added the appropriate production values for the 490 new sectors in the Northeast Region model.

SAValue Added

This table details payments made/received by each industry to employee compensation (wage and salary payments, insurance, retirement, etc.), proprietary income (all income received), other property type income (payments from interest, rents, royalties, dividends, corporate profits, etc.) and indirect business taxes (primarily excise and sales taxes). The value added transactions associated with the default commercial fishing and seafood processing sectors were removed and the appropriate values for the 490 new sectors were added to the table.

Observed RPCs

The Observed RPCs table contains forced regional purchase coefficient values for all states in the model. We removed the values associated with the default commercial fishing and seafood processing sectors and added the appropriate RPC values by state FIPS codes for the 490 new sectors added to the model. We used the average RPC option in IMPLAN Pro so the same RPC value was applied across states for each of the 490 new sectors. However, because of the way the model calculates impacts across sectors, virtually all of the RPC values for the new sectors were set to zero: the RPCs for the bait sectors were set to one. The model-generated default RPC values were used for the other 507 sectors in the model.

RPC Methods

This table contains information for creation of the regional purchase coefficients. Similar to the modifications made for to many of the other tables, we removed the information associated with the default commercial fishing and seafood processing sectors and then added the relevant information for the 490 new sectors to the table.

Deflator1

The Deflator1 table contains deflators that account for relative price changes during different time periods. The IMPLAN Pro deflators are derived from the Bureau of Labor Statistics Growth Model. The 2001 IMPLAN Pro data base contains deflators from 1977 to 2010 for each commodity in the model. We eliminated the default commercial fishing sector deflators and applied these same values to the 394 new harvesting sectors in the table. We also removed the default seafood processing sector and applied those deflators to the 23 new sub-regional seafood processing sectors that we added to the table.

rptSAFinal Demands

This is a report table that is used by the IMPLAN Pro software to view final demand purchases of industry outputs. Report tables are not used by the IMPLAN Pro software for model construction or impact analysis; they simply provide a means to view data from within the IMPLAN Pro system. Therefore, modifications to this table are not absolutely necessary, but are required in order to use the IMPLAN Pro reporting feature.

To keep the software fully functional we modified the final demand values in this table. We removed the final demand values associated with both the default commercial fishing and seafood processing sectors, and added the appropriate data from the SAFinal Demands and SAForeign Exports table. Note that modifications in ACCESS are not acknowledged by the IMPLAN Pro software so the social accounts must be regenerated after changes are made in order for the reporting features in IMPLAN Pro to work properly.

rptSAIndustry Data

This is another report table that is used by the IMPLAN Pro software to show industry output, employment, and value added information by sector. Changes to this table will not effect model construction or impact analysis, but need to be made in order to use the reporting feature in the IMPLAN Pro software. We eliminated the industry data associated with the default commercial fishing and processing sectors, and added the appropriate data from the SAOutput table, SAEmployment table, and the SAValue Added table.

6. IMPACT ESTIMATION

The NERIOM provides analysts with a tool for assessing how the impact of fishery management decisions may be distributed across different sectors of regional and sub-regional economies. However, any impact assessment must begin with an externally derived estimate of how any such action would affect commercial fishing sales. The economy-wide backward-linked impacts of proposed fishery management actions are estimated by applying these exogenously determined gross output changes to the appropriate NERIOM multipliers. As discussed in Section 2, an IMPLAN Pro model can accept exogenous gross output (i.e., sales) changes as entries if the RPCs of the directly impacted sectors are set to zero. In addition to deriving exogenous gross output changes for the harvesting sectors, however, the NERIOM also requires exogenous estimates of how the sales will change for wholesale seafood dealers, fish exchange/auctions, and seafood processors. Thus, the RPCs for all of the fishing-related sectors in the NERIOM were set to zero. By simultaneously multiplying the estimated exogenous gross output changes for the harvesting sectors, wholesale seafood dealer sectors, fish exchange/auction sectors, and seafood processing sectors by their corresponding model-generated multipliers, the backward-linked effects associated with changes in commercial fishing sales and the additional backward-linked multiplier effects that may occur through changes in local supply to wholesalers, auction houses, and seafood processors can be measured. This modeling approach, however, requires not only an external estimate of how management actions will impact harvesting revenues, but also how the actions will impact the revenues of auction houses, wholesalers, and seafood processors.

In previous applications of this approach, we began with a mathematical programming model to estimate how ex-vessel revenues for each of the commercial harvesting gear sectors in the NERIOM might change upon implementation of the proposed regulations. Mathematical programming models are but one method that may be used to estimate potential changes in harvesting revenues. Other methods may be appropriate depending upon the management changes that may be under consideration.

Once the exogenous ex-vessel revenue changes are determined, adjustments can be made to account for the additional revenue changes that may occur to the auction houses, seafood wholesalers, and seafood processors. To estimate these changes, we first constructed a dealer transaction matrix from 2001 Northeast dealer weigh-out data. Northeast weigh-out slips record all transactions between federally permitted harvesters and wholesale dealers. Thus, it was possible to create a transaction matrix that showed the value of seafood sold by each of the 394 commercial

fishing gear sectors in the NERIOM to each of the 23 wholesale dealers and 4 fish exchange/auction houses in the model. Fish/exchange auction houses are also required to hold a federal dealer permit. The transaction matrix could then be used to determine how changes in a particular harvesting sector's ex-vessel revenues would affect the value of purchases associated with the 23 wholesale dealers and the 4 fish exchange/auction houses. Wholesale seafood dealer gross revenue changes were then calculated by assuming the mark-up on these purchases was 40% - the average Fulton Market margin in 2001. The values of the mark-ups were then entered as the change in direct sales for each wholesale dealer sector in the NERIOM since these sectors are treated as margin sectors by the model. The 4 fish exchange/auction houses are also treated as margin sectors in the model. The values of these mark-ups were calculated by dividing the average exchange fee per pound (11 cents) by the average price per pound of seafood sold at each exchange. The estimated gross revenue changes associated with the 4 fish exchange/auction houses were then multiplied by the mark-up values (approximately 9.7%) and entered as the change in direct sales for each fish exchange/auction house. Gross revenue changes for seafood processors are estimated following the steps described below.

Step 1 -- Calculate the estimated value of seafood exported by wholesale seafood dealers. Multiply the estimated gross revenue changes for each wholesaler by the average proportion of total seafood sales that is exported out of the U.S. by each wholesaler (derivation of these proportions were explained in Section 5).

Step 2 -- Calculate the value of seafood left in the Northeast that is available to be purchased by Northeast seafood processors. This step simply requires removing the estimated value of seafood exported by wholesale dealers. Thus, these values are obtained by subtracting the export estimates calculated in Step 1 for each wholesale dealer from the estimated wholesaler's gross revenue change.

Step 3 -- Calculate the estimated value of wholesale seafood that will actually be purchased by seafood processors in the Northeast. As noted earlier IMPLAN Pro data for the Northeast shows seafood processors purchasing approximately 48% of the sales produced by the commercial fishing sector in the Northeast in 2001. This value can be determined by constructing a default Northeast IMPLAN Pro model and then viewing the commodity balance sheet for the commercial fishing sector. As we have said, most of the seafood purchased by seafood processors generally flows through wholesalers before reaching the processing level and all federally permitted commercial harvesters are required to sell to establishments that hold federal dealer permits. Thus, in the NERIOM it is assumed that seafood processors will purchase product from wholesalers and not directly from commercial harvesters. As such, 48% of Northeast wholesale dealer sales – and not commercial harvester sales - are assumed to be purchased by seafood processors in the region. The value of the purchases are then calculated by multiplying the result of Step 2 by 0.48 for each wholesale dealer in the model. The other 52% of wholesale seafood sales are purchased by industries such as eating and drinking establishments, hospitals, hotels, etc. and by final demand sectors other than exports (i.e., households and government entities; see Figure 2). These purchases are assumed to remain constant in the NERIOM, however.

Step 4 -- Determine the value of purchases by seafood processors that will be derived from each wholesaler. In Step 3, the value of wholesale seafood dealer output that is purchased by seafood processors was calculated. In this step, we have to allocate the purchases to specific seafood processors. In states with more than one sub-region, seafood processors are assumed to purchase from all in-state wholesale dealers according to seafood processor output proportions contained in the NERIOM.

Step 5 -- Convert the impacts on purchases to gross revenue changes. To calculate estimated gross revenue changes, margins are applied to the values estimated in Step 4. The margins were derived from each sub-regional seafood processing sector's production function and represent the value of output less the cost of the seafood purchased. The margins varied from 62% to 67% across sub-regions, and since seafood processors are considered producing sectors in the NERIOM, the estimates calculated in Step 4 were marked-up according to the appropriate sub-regional margin values. These producer values are then entered as the change in direct sales for each seafood processing sector.

The estimated direct changes in gross revenues for harvesters, fish exchanges/auctions, wholesale seafood dealers, and seafood processors are then compiled into an impact vector and entered into a Microsoft Excel template that can be imported into IMPLAN Pro (see Appendix I in Olson and Lindall, 1999 for details about the template). The impact vector can then be applied to the multipliers in the NERIOM to arrive at the economy-wide impacts of the proposed regulation in the Northeast.[6]

Allocation of Indirect and Induced Impacts to Sub-regions

The NERIOM explicitly addresses sub-regional impacts for the seafood producing sectors that are estimated to be directly affected: the commercial harvesting gear sectors, the fish exchange/auction sectors, the wholesale seafood dealer sectors, and the seafood processing sectors. The sum of the sub-regional impact estimates for these sectors

in the NERIOM equals the regional impact. The NERIOM, however, calculates only Northeast region-level impacts for the sectors that are estimated to be indirectly affected, therefore a method had to be developed that could apportion the estimated region-wide effects on indirectly affected sectors to the sub-regions contained in the NERIOM.

The allocation method we developed is based on the relative importance of each sub-region's economy (determined to be directly affected) to the total Northeast region's economy. We assumed that the indirect impacts would be distributed according to output, personal income, and employment shares in each of the sub-regions that were directly impacted. The shares were first determined by constructing separate default IMPLAN Pro models for each of the 24 sub-regions. Then the default output, personal income, and employment estimates contained in each sub-regional model were divided by the regional totals. Using output estimates as an example, if T_{ir} is equal to the total default output for each industry sector (i) in each sub-region (r), then the shares can be represented as $S_{ir} = \frac{T_{ir}}{\sum_{r}^{R} T_{ir}}$. These shares are then adjusted three times before they are applied to the IMPLAN-generated region-wide estimates of indirect impacts.

The first adjusted share calculation maintains the unadjusted shares (S_{ir}s) for industries located in the directly impacted sub-regions and the non-maritime sub-region and sets the remaining shares to zero. If D_r indicates the sub-regions that are directly impacted (i.e., revenue changes will occur for commercial harvesters, seafood dealers, fish exchange/auction houses, or seafood processors in that sub-region) and A^1_{ir} equals the first adjusted share then for all $D_r > 0$ $A^1_{ir} = S_{ir}$. If $D_r = 0$ then $A^1_{ir} = 0$. Additionally, if the subscript r equals the non-maritime sub-region then let $r = NM$ and $A^1_{ir} = S_{iNM}$.

The shares are then adjusted a second time to capture the relative importance of industry output in each of the directly affected sub-regions to total industry output across all of the directly affected sub-regions. If B_{ir} is set equal to $\sum_{i}^{I} A^1_{ir}$ and A^2_{ir} equals the second adjusted share then

$$A^2_{ir} = \left[\frac{A^1_{ir}}{B_{ir}} + \left(\frac{S_{iNM}}{B_{ir}} - S_{iNM} \right) \right] * \frac{A^1_{ir}}{\left(B_{ir} - S_{iNM} \right)}$$

for $B_{ir} \neq S_{iNM}$, otherwise if $B_{ir} = S_{iNM}$ then $A^2_{ir} = 0$.

Finally, the non-maritime Northeast region shares for each industry i are then subdivided into non-maritime New England shares and non-maritime Mid-Atlantic shares. The adjusted shares are calculated based on the proportion of direct impacts that occur in each of the two aggregate sub-regions to the total direct impacts in the Northeast region. Mathematically, if A^3_{ir} equals the third adjusted share and the subscripts NE and MA represent New England and Mid-Atlantic sub-regions, respectively, then for $r = NM$, $A^3_{iNMNE} = \frac{\sum_{r}^{NE} D_r}{\sum_{r}^{R} D_r} * S_{iNM}$ and $A^3_{iNMMA} = \frac{\sum_{r}^{MA} D_r}{\sum_{r}^{R} D_r} * S_{iNM}$. For all $r \neq NM$, $A^3_{ir} = A^2_{ir}$.

The region-wide IMPLAN-generated impact estimates for each of the indirectly affected sectors can then be apportioned across the directly impacted sub-regions by multiplying the estimates by the third adjusted shares. The shares sum to one which ensures that the sum of the resulting sub-regional impacts will equal the model-generated region-wide impacts.

Hypothetical Impact Assessment

Hypothetical reductions in medium bottom trawl ex-vessel revenues are used to illustrate the outputs produced by the NERIOM. If it is assumed that a reduction in landings is required to meet an annual rebuilding target, and the reduction in landings is predicted to cause a $500,000 decline in total ex-vessel revenues for medium bottom trawl vessels in each of the coastal sub-regions from Maine through New York, the NERIOM can be employed to assess the multiplier effects (sales, personal income, and employment) associated with the estimated decline in revenues. Tables 10 through 15 show the results of this hypothetical impact assessment.

The total exogenously determined direct loss in ex-vessel revenues for medium bottom trawl vessels across all the sub-regions in the Northeast sums to $5.5 million ($5.0 million across the sub-regions in New England and $500 thousand in the Mid-Atlantic sub-regions; Tables 10 and 11, respectively).[7] Exogenously determined losses in wholesale dealer sales of seafood are estimated to approach $1.16 million in New England and $230 thousand in the Mid-Atlantic. Additionally, exogenously determined losses in sales by fish exchange/auction houses in New

auction houses in New England are estimated to be $196 thousand. Finally, exogenously estimated losses in seafood processing revenues are estimated to be $5.56 million in New England and $430 thousand in the Mid-Atlantic. As previously mentioned, wholesale dealers and fish exchange/auction houses are treated as margin sectors so their sales estimates in the NERIOM reflect only the value added to the seafood being sold (i.e., total gross sales less the cost of the purchased seafood). The NERIOM then uses all of the exogenously determined estimates of revenue changes to the commercial harvesters, wholesale dealers, fish exchange/auction houses, and seafood processors to calculate the indirect and induced multiplier effects of those changes. At the greatest level of detail, indirect and induced effects can be estimated for up to 507 sectors in each of the 24 sub-regions. Thus, for presentation purposes, the results have been aggregated into 15 summary categories for each sub-region. Of the total sales impact in New England, 68% is associated with direct gross revenue losses to medium bottom trawlers, seafood dealers, fish exchange/auction houses, and seafood processors. The remaining 32% of the losses in New England are the indirect and induced effects that occur among industries that provide goods and services in the production of seafood. The largest indirect revenue losses in New England are estimated for establishments classified as service industries ($1.83 million). Across the Mid-Atlantic, however, the indirect and induced effects comprise nearly 84% of the total sales impact. This seeming disproportionate effect is mainly a function of the substantial industry-level infrastructure that exists in the Mid-Atlantic sub-regions. Mid-Atlantic based businesses produce a greater percentage of the goods and services that are used in the production of seafood in the Northeast region. The largest indirect and induced revenue losses in the Mid-Atlantic are predicted to occur in service industries ($1.83 million), finance, insurance, and real estate ($947.36 thousand), and wholesale trade ($812.35 thousand).

Important differences in impacts across the 23 sub-regions are also predicted to occur. Revenue losses are estimated to range from a high of $4.35 million in the New York Seacoast sub-region to no estimated losses in the 9 sub-regions south of New Jersey (excluding the non-maritime Mid-Atlantic sub-region). The comparatively large losses shown for the New York Seacoast sub-region can generally be traced to a greater reliance on goods and services produced from within the New York Seacoast sub-region than from any of the other sub-regions in the NERIOM. In the 9 sub-regions south of New Jersey, there are no predicted direct revenue losses for any of the seafood producing sectors (i.e., medium bottom trawlers, seafood dealers, fish exchange/auctions, or seafood processors). It is assumed, therefore, that there will also be no indirect or induced effects in these sub-regions. In the Downeast Maine sub-region and in the New Jersey North and New Jersey South sub-regions there are no predicted direct revenue losses associated with medium bottom trawlers, but there are direct losses associated with one or more of the other seafood producing sectors. Indirect and induced effects are, therefore, predicted to occur as supporting businesses supply fewer goods and services to seafood dealers, fish exchanges/auctions, and seafood processors. It is also worth noting that supporting businesses in the non-maritime sub-regions in New England and the Mid-Atlantic are predicted to incur substantial revenue losses even though there are no direct revenue losses associated with any of the seafood producing sectors in these sub-regions. These losses result because as the revenues of businesses located in the coastal sub-regions decline, they, in turn, purchase smaller quantities of goods and services from non-maritime businesses (i.e., indirect effects). In addition, as employee earnings decline, household spending falls, initiating further rounds of revenue repercussions in the non-maritime sub-regions (i.e., induced effects).

Although losses in sales represent a loss in output, losses in personal income and jobs are a more telling indicator of economic impact. The total loss in personal income is estimated to range up to $1.67 million in the New York Seacoast sub-region (Tables 12 and 13). In terms of jobs, the are no estimated impacts in the 9 sub-regions south of New Jersey while the New York Seacoast sub-region is predicted to incur the largest job impact (35; Tables 14 and 15). As was the case for changes in sales, a much larger proportion of the total income and employment impacts fall on the seafood producing sectors in New England than in the Mid-Atlantic. Nearly 70% of the total income impact and total employment impact in New England can be traced to medium bottom trawlers, seafood dealers, fish exchange/auctions, and seafood processors. In the Mid-Atlantic, however, only 18% of the total estimated income changes and 23% of the total employment changes can be traced to the seafood producing businesses. As previously indicated, the disparity is generally due to the substantial industry-level infrastructure that supplies seafood establishments in the Mid-Atlantic region.

7. DISCUSSION

The NERIOM has been designed to calculate the backward linked multiplier effects induced by exogenous changes in gross revenues for commercial harvesters, fish exchange/auction houses, seafood dealers, and seafood processors. Assessments such as this are essential to fishery management agencies that want to know how management actions will impact regional economies.

One of the more useful features of the modeling approach presented here is that it is based on traditional Leontief input-output relationships, so it can be incorporated into ready-made input-output systems such as IMPLAN Pro. Ready-made models reduce the cost and complexity of model formulation and the time required to

generate impact estimates. This is important, because the primary reason for building the NERIOM is for use in relative policy appraisals of alternative fishery management actions. The ability to be able to predict the multiplier effects of policy-induced changes in a timely manner, will allow regional decision makers in the Northeast to compare and contrast the outcomes of alternative management strategies prior to choosing the final measures.

Ready-made regional input-output models also offer considerable industry detail to trace backward linkages and to generate disaggregated estimates of indirect and induced multiplier effects. In contrast, the multiplier effects generated from other types of input-output models (e.g., mixed exogenous/endogenous variables models and spreadsheet-type models based on limited input-output multipliers) are usually derived from aggregated or condensed versions of these same ready-made models. As a consequence, the models lack the sectoral detail contained in the NERIOM and generally do not provide the multiplier effects necessary for fully informed decision making.

The multiplier effects generated by the NERIOM, however, are static and should be viewed as the immediate/short-term impacts of the change being analyzed. There are several technological assumptions built into the model, such as fixity of prices and zero-substitution elasticities in consumption and production that make it difficult to assess how the seafood producing sectors will adjust over time. For example, vessels may be able to offset initial ex-vessel revenue losses due to a cutback in a landings quota by switching to other fisheries. In addition, direct revenue losses to seafood dealers, auction houses, and seafood processors may also decline over time as seafood flows from other fisheries increase. The reduction in local supply may also cause prices and/or imports to increase lowering the estimated direct revenue losses even further. Unfortunately, these types of longer run adjustments are generally not captured in input-output models. As harvesters, seafood dealers, and seafood processors adapt to policy-induced reductions in supply over time, it is likely that at least some of the losses estimated with the NERIOM will be avoided through shifts to other fisheries, price increases, and additional imports.

The impacts estimated by the NERIOM also exclude the retail level. Although it is possible that restaurants and food service establishments in the Northeast could experience a reduction in local supply because of a restrictive fishery management action, we have assumed that consumers would simply choose from among the many other close substitutes (e.g., other fish species, chicken, turkey, etc.) such that retail level gross revenues would remain unchanged.

At present, the NERIOM can accept input data for the years 2001 through 2010. Although the data contained in IMPLAN Pro are based on economic relationships in 2001, the impacts of management actions in succeeding years are determined by converting the estimated changes in gross revenues to year 2001 dollars before the impacts are estimated. The NERIOM then automatically converts the impact estimates back to the year of the input data (through 2010). This process accounts for the effects of inflation on the impact estimates. However, the economic relationships that existed in 2001 are only approximations of the ones that may exist in subsequent years. Technological change and price variability may alter an industry's production process over time, and hence the businesses that are impacted by changes in fishery management actions. Technology and prices tend to change rather slowly, however, so the mismatch between the economic relationships in 2001 and near subsequent years is likely to be minimal. Nonetheless, since the NERIOM assumes these economic relationships remain constant, an element of uncertainty is introduced into the model's estimates.

Product flow assumptions are another source of possible uncertainty. The federal Northeast dealer data base tracks the flow of seafood from harvesters to seafood dealers and most fish exchange/auction houses (e.g., the flow of seafood to Fulton Market in New York is unknown), but documentation of successive levels of sales among seafood industry establishments in the Northeast region are not available. In particular, virtually no data is available to measure transactions between and among fish exchange/auction houses, seafood dealers, and seafood processors. Thus, the NERIOM assumes a linear flow of product sales from harvesters to fish exchange/auction houses and wholesale seafood dealers, and then finally onto seafood processors. To the extent that these simplifying assumptions underestimate the number of transactions between the seafood producing establishments in the Northeast region, the value added by each successive level of sale will be underestimated. If this is the case, the impacts generated by the NERIOM are also underestimated.

The allocation method used to translate region-wide indirect impacts into sub-regional impacts ensures that that the sum of the sub-regional impacts will equal the model-generated region-wide impacts, but the method is based on weighted ratios that may only approximate true economic relationships in the Northeast region. For example, the total Northeast region ice manufacturing sales impact in the hypothetical impact assessment shown above was $40.69 thousand (Tables 10 and 11). This model-generated indirect impact was then distributed across sub-regions that were predicted to be directly impacted based on the relative importance of ice manufacturing across each of the directly impacted subregions and the non-maritime sub-regions. Since ice manufacturing output (i.e., sales) in the Boston Massachusetts sub-region comprises 6.48% of the regional total, 6.48% ($6,283) of model-generated regional total is allocated to the Boston Massachusetts sub-region. While the proportional allocation method is computationally efficient and concise, it only distributes the model-generated region-wide indirect and induced impacts to sub-regions where direct impacts are predicted to occur. If businesses

located in sub-regions that are not predicted to be directly impacted are affected the weighting method may misrepresent the distribution of impacts.

Consideration was given to allocating indirect and induced impacts across all 24 sub-regions according to the default fixed output, income, and employment shares in each sub-region. This method would result in estimates of indirect and induced impacts in all 24 sub-regions, but it is insensitive to the location of the direct impacts. The allocation method we followed places more weight on indirectly affected businesses located in the sub-regions where the direct effects take place. Construction of a full multi-regional model that explicitly measures the linkages between indirectly affected sectors in each of the sub-regions would likely provide more accurate sub-regional estimates of indirect impacts. However, a model of this kind in the Northeast region is computationally unworkable since it would require over 12 thousand sectors to measure the economic relationships that exist between the indirectly affected sectors in each of the 24 sub-regions (i.e., 507 possible indirectly affected sectors * 24 sub-regions = 12,168 sectors).

ENDNOTES

1. This is known as closing the model with respect to households. In a closed input-output model, the household sector is moved from the final-demand column and placed inside the A matrix, making it one of the endogenous sectors.

2. Employment and personal income multipliers can also be derived from input-output models by multiplying the model-generated output changes by an industry's employment to output ratio, and an industry's personal income (employee compensation plus proprietor's income) to output ratio, respectively.

3. An RPC measures the portion of the total regional demand for a particular industry sector's output that is supplied by local producers.

4. For a derivation of the equivalence between the total aggregate impact estimates generated from a mixed exogenous/endogenous variables model and the approach described in Tanjuakio, Hastings, and Tytus (1996) see Steinback 2004.

5. The addition of fish exchanges/auctions could not be extended to the New York sub-region where the largest wholesale market in the Northeast operates – the Fulton Market, because specific data on the flow of seafood through this market, though formerly available is not now so.

6. Although the effects on the economy of direct changes in gross revenues for harvesters, fish exchanges/auctions, wholesale seafood dealers, and seafood processors are estimated simultaneously in the NERIOM, the model avoids double counting because the RPC's for these sectors have been set to zero. Setting the RPCs of the outputs produced by the directly impacted sectors to zero prior to constructing the direct input coefficient matrix (A matrix) effectively prevents other local industries from buying these outputs and, thus, removes the possibility of double counting impacts. In other words, the impacts associated with changes in seafood dealer revenues and fish exchange revenues exclude the impacts associated with changes in commercial harvesting revenues, and revenue changes associated with seafood processors exclude those changes attributable to seafood dealers, fish exchanges, and commercial harvesters. Thus, the impacts associated with revenue changes to these sectors can be summed to obtain the total effect on sales, income, and employment without double counting impacts.

7. In 2001, there were no reported landings for medium bottom trawl vessels in the Downeast Maine sub-region. Thus, there are no losses in ex-vessel revenues reported for the medium bottom trawl sector in this sub-region in Table 10.

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Figure 1. Fishing Regions in the Northeast U.S.

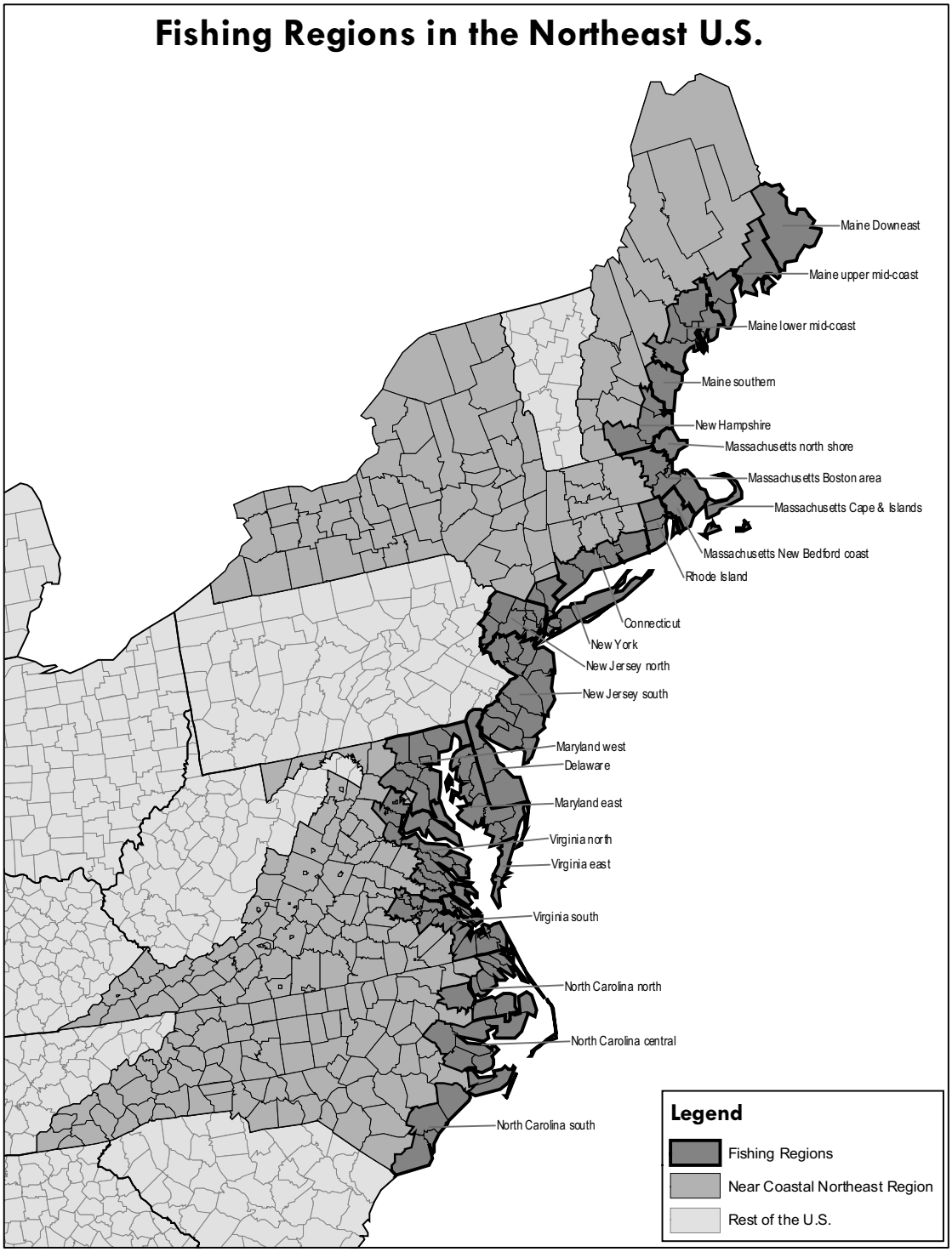
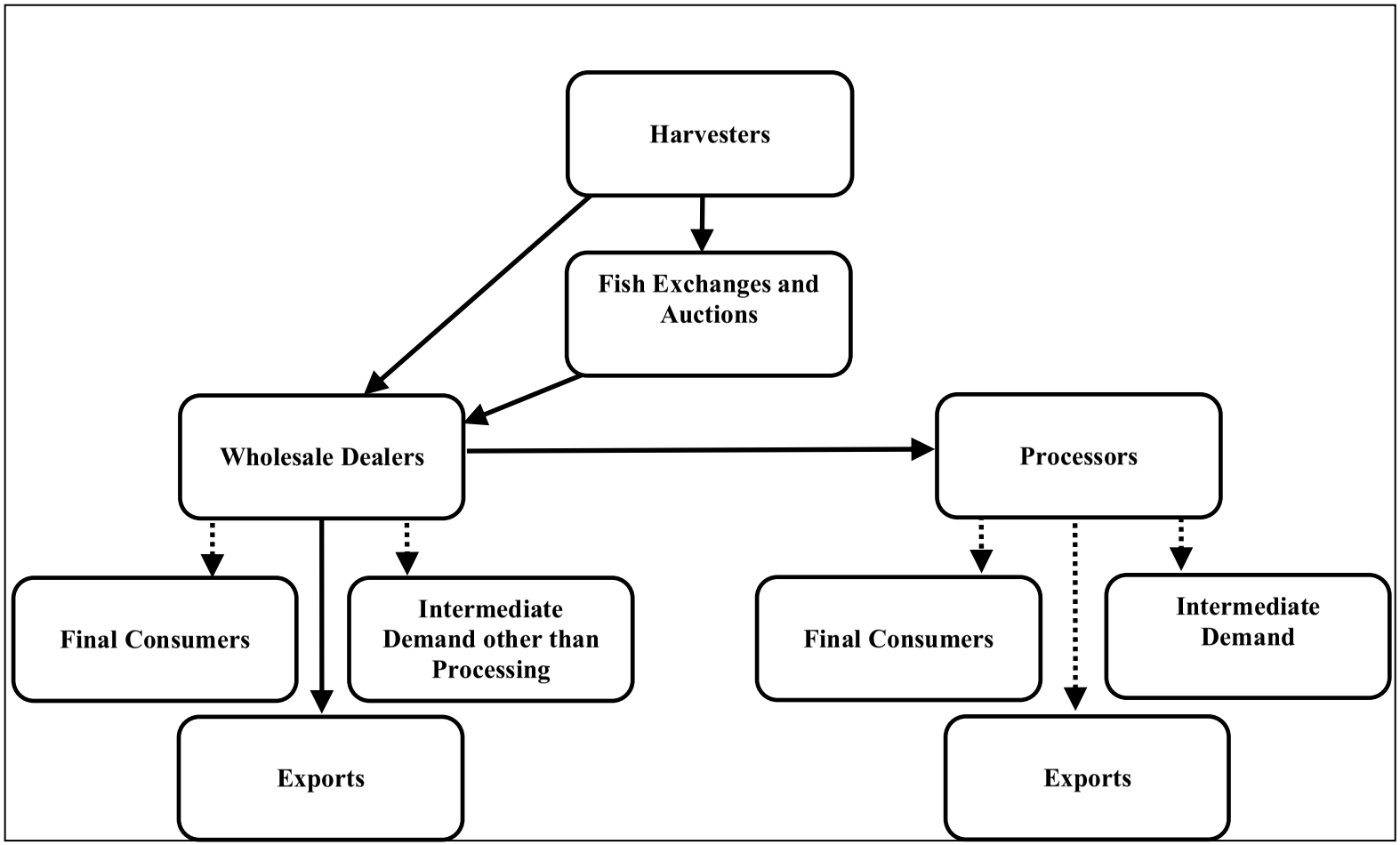


Figure 2. NERIOM Product Flows*



* Product flows illustrated by solid lines are captured in the NERIOM. Product flows illustrated with the dashed lines are excluded in the NERIOM.

Table 1. Fishing Regions in the Northeast U.S.

Northeast Region	
Sub-region	**Counties**
1. Maine Downeast	Washington
2. Maine upper mid-coast	Hancock, Knox, Waldo
3. Maine lower mid-coast	Androscoggin, Cumberland, Kennebec, Lincoln, Sagadahoc
4. Maine southern	York
5. New Hampshire	Hillsborough, Rockingham, Strafford
6. Massachusetts north shore	Essex
7. Massachusetts Boston area	Norfolk, Middlesex, Plymouth, Suffolk
8. Massachusetts Cape & Islands	Barnstable, Dukes, Nantucket
9. Massachusetts New Bedford coast	Bristol
10. Rhode Island	Bristol, Kent, Newport, Providence, Washington
11. Connecticut	Fairfield, Middlesex, New Haven, New London
12. New York	Bronx, Kings, Nassau, New York, Queens, Richmond, Rockland, Suffolk, Westchester
13. New Jersey north	Bergen, Essex, Hudson, Morris, Passaic, Sussex, Union, Warren
14. New Jersey south	Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Hunterdon, Mercer, Middlesex, Monmouth, Ocean, Salem, Somerset
15. Delaware	Kent, New Castle, Sussex
16. Maryland west	Anne Arundel, Baltimore, Baltimore City, Carroll, Cecil, Harford, Howard, Montgomery, Prince Georges
17. Maryland east	Calvert, Caroline, Charles, Dorchester, Kent, Queen Anne's, St. Mary's, Somerset, Talbot, Wicomico, Worcester
18. Virginia north	Essex, Fairfax, King and Queen, King George, King Williams, Lancaster, Middlesex, Monassas, Monassas Park, New Kent, Northumberland, Prince William, Richmond, Stafford, Westmoreland
19. Virginia east	Accomack, Northampton
20. Virginia south	Charles City, Chesapeake, Chesterfield, Colonial Heights, Gloucester, Hampton, Henrico, Hopewell, Isle of Wight, James City, Mathews, Newport News, Norfolk, Poquoson, Portsmouth, Prince George, Richmond City, Suffolk, Surry, Virginia Beach, Williamsburg, York
21. North Carolina north	Bertie, Camden, Chowan, Currituck, Pasquotank, Perquimans, Tyrell, Washington
22. North Carolina central	Beaufort, Carteret, Craven, Dare, Hyde, Pamlico, Pitt
23. North Carolina south	Brunswick, New Hanover, Onslow, Pender
24. Near Coastal Northeast	Remaining counties in the 11 coastal Northeast states

Table 2. Industry/Commodity Codes

Industry Code	Description
510	Downeast ME Inshore Lobster
511	Downeast ME Offshore Lobster
512	Downeast ME Large Bottom Trawl
513	Downeast ME Medium Bottom Trawl
514	Downeast ME Small Bottom Trawl
515	Downeast ME Large Scallop Dredge
516	Downeast ME Medium Scallop Dredge
517	Downeast ME Small Scallop Dredge
518	Downeast ME Surfclam, Ocean Quahog
519	Downeast ME Small Dredge
520	Downeast ME Sink Gillnet
521	Downeast ME Diving Gear
522	Downeast ME Midwater Trawl
523	Downeast ME Pots and Traps
524	Downeast ME Bottom Longline
525	Downeast ME Other Mobile Gear
526	Downeast ME Other Fixed Gear
527	Downeast ME Hand Gears
528	Upper Mid-Coast ME Inshore Lobster
529	Upper Mid-Coast ME Offshore Lobster
530	Upper Mid-Coast ME Large Bottom Trawl
531	Upper Mid-Coast ME Medium Bottom Trawl
532	Upper Mid-Coast ME Small Bottom Trawl
533	Upper Mid-Coast ME Large Scallop Dredge
534	Upper Mid-Coast ME Medium Scallop Dredge
535	Upper Mid-Coast ME Small Scallop Dredge
536	Upper Mid-Coast ME Surfclam, Ocean Quahog
537	Upper Mid-Coast ME Small Dredge
538	Upper Mid-Coast ME Sink Gillnet
539	Upper Mid-Coast ME Diving Gear
540	Upper Mid-Coast ME Midwater Trawl
541	Upper Mid-Coast ME Pots and Traps
542	Upper Mid-Coast ME Bottom Longline
543	Upper Mid-Coast ME Other Mobile Gear
544	Upper Mid-Coast ME Other Fixed Gear
545	Upper Mid-Coast ME Hand Gears
546	Lower Mid-Coast ME Inshore Lobster
547	Lower Mid-Coast ME Offshore Lobster
548	Lower Mid-Coast ME Large Bottom Trawl
549	Lower Mid-Coast ME Medium Bottom Trawl
550	Lower Mid-Coast ME Small Bottom Trawl
551	Lower Mid-Coast ME Large Scallop Dredge
552	Lower Mid-Coast ME Medium Scallop Dredge
553	Lower Mid-Coast ME Small Scallop Dredge
554	Lower Mid-Coast ME Surfclam, Ocean Quahog
555	Lower Mid-Coast ME Small Dredge
556	Lower Mid-Coast ME Sink Gillnet
557	Lower Mid-Coast ME Diving Gear
558	Lower Mid-Coast ME Midwater Trawl
559	Lower Mid-Coast ME Pots and Traps
560	Lower Mid-Coast ME Bottom Longline
561	Lower Mid-Coast ME Other Mobile Gear
562	Lower Mid-Coast ME Other Fixed Gear
563	Lower Mid-Coast ME Hand Gears
564	Southern ME Inshore Lobster
565	Southern ME Offshore Lobster
566	Southern ME Large Bottom Trawl
567	Southern ME Medium Bottom Trawl
568	Southern ME Small Bottom Trawl
569	Southern ME Large Scallop Dredge
570	Southern ME Medium Scallop Dredge
571	Southern ME Small Scallop Dredge
572	Southern ME Surfclam, Ocean Quahog
573	Southern ME Small Dredge
574	Southern ME Sink Gillnet
575	Southern ME Diving Gear
576	Southern ME Midwater Trawl
577	Southern ME Pots and Traps
578	Southern ME Bottom Longline
579	Southern ME Other Mobile Gear
580	Southern ME Other Fixed Gear
581	Southern ME Hand Gears
582	NH Seacoast Inshore Lobster
583	NH Seacoast Offshore Lobster
584	NH Seacoast Large Bottom Trawl
585	NH Seacoast Medium Bottom Trawl
586	NH Seacoast Small Bottom Trawl
587	NH Seacoast Large Scallop Dredge
588	NH Seacoast Medium Scallop Dredge
589	NH Seacoast Small Scallop Dredge
590	NH Seacoast Surfclam, Ocean Quahog
591	NH Seacoast Small Dredge
592	NH Seacoast Sink Gillnet
593	NH Seacoast Diving Gear
594	NH Seacoast Midwater Trawl
595	NH Seacoast Pots and Traps
596	NH Seacoast Bottom Longline
597	NH Seacoast Other Mobile Gear
598	NH Seacoast Other Fixed Gear
599	NH Seacoast Hand Gears
600	Gloucester, North Shore Inshore Lobster
601	Gloucester, North Shore Offshore Lobster
602	Gloucester, North Shore Large Bottom Trawl
603	Gloucester, North Shore Medium Bottom Trawl
604	Gloucester, North Shore Small Bottom Trawl
605	Gloucester, North Shore Large Scallop Dredge

Table 2. Industry/Commodity Codes - Continued

Industry Code	Description
606	Gloucester, North Shore Medium Scallop Dredge
607	Gloucester, North Shore Small Scallop Dredge
608	Gloucester, North Shore Surfclam, Ocean Quahog
609	Gloucester, North Shore Small Dredge
610	Gloucester, North Shore Sink Gillnet
611	Gloucester, North Shore Diving Gear
612	Gloucester, North Shore Midwater Trawl
613	Gloucester, North Shore Pots and Traps
614	Gloucester, North Shore Bottom Longline
615	Gloucester, North Shore Other Mobile Gear
616	Gloucester, North Shore Other Fixed Gear
617	Gloucester, North Shore Hand Gears
618	Boston Area Inshore Lobster
619	Boston Area Offshore Lobster
620	Boston Area Large Bottom Trawl
621	Boston Area Medium Bottom Trawl
622	Boston Area Small Bottom Trawl
623	Boston Area Large Scallop Dredge
624	Boston Area Medium Scallop Dredge
625	Boston Area Small Scallop Dredge
626	Boston Area Surfclam, Ocean Quahog
627	Boston Area Small Dredge
628	Boston Area Sink Gillnet
629	Boston Area Diving Gear
630	Boston Area Midwater Trawl
631	Boston Area Pots and Traps
632	Boston Area Bottom Longline
633	Boston Area Other Mobile Gear
634	Boston Area Other Fixed Gear
635	Boston Area Hand Gears
636	Cape and Islands Inshore Lobster
637	Cape and Islands Offshore Lobster
638	Cape and Islands Large Bottom Trawl
639	Cape and Islands Medium Bottom Trawl
640	Cape and Islands Small Bottom Trawl
641	Cape and Islands Large Scallop Dredge
642	Cape and Islands Medium Scallop Dredge
643	Cape and Islands Small Scallop Dredge
644	Cape and Islands Surfclam, Ocean Quahog
645	Cape and Islands Small Dredge
646	Cape and Islands Sink Gillnet
647	Cape and Islands Diving Gear
648	Cape and Islands Midwater Trawl
649	Cape and Islands Pots and Traps
650	Cape and Islands Bottom Longline
651	Cape and Islands Other Mobile Gear
652	Cape and Islands Other Fixed Gear
653	Cape and Islands Hand Gears
654	New Bedford, South Shore Inshore Lobster
655	New Bedford, South Shore Offshore Lobster
656	New Bedford, South Shore Large Bottom Trawl
657	New Bedford, South Shore Medium Bottom Trawl
658	New Bedford, South Shore Small Bottom Trawl
659	New Bedford, South Shore Large Scallop Dredge
660	New Bedford, South Shore Medium Scallop Dredge
661	New Bedford, South Shore Small Scallop Dredge
662	New Bedford, South Shore Surfclam, Ocean Quahog
663	New Bedford, South Shore Small Dredge
664	New Bedford, South Shore Sink Gillnet
665	New Bedford, South Shore Diving Gear
666	New Bedford, South Shore Midwater Trawl
667	New Bedford, South Shore Pots and Traps
668	New Bedford, South Shore Bottom Longline
669	New Bedford, South Shore Other Mobile Gear
670	New Bedford, South Shore Other Fixed Gear
671	New Bedford, South Shore Hand Gears
672	Rhode lsland Inshore Lobster
673	Rhode lsland Offshore Lobster
674	Rhode lsland Large Bottom Trawl
675	Rhode lsland Medium Bottom Trawl
676	Rhode lsland Small Bottom Trawl
677	Rhode lsland Large Scallop Dredge
678	Rhode lsland Medium Scallop Dredge
679	Rhode lsland Small Scallop Dredge
680	Rhode lsland Surfclam, Ocean Quahog
681	Rhode lsland Small Dredge
682	Rhode lsland Sink Gillnet
683	Rhode lsland Diving Gear
684	Rhode lsland Midwater Trawl
685	Rhode lsland Pots and Traps
686	Rhode lsland Bottom Longline
687	Rhode lsland Other Mobile Gear
688	Rhode lsland Other Fixed Gear
689	Rhode lsland Hand Gears
690	CT Sea Coast Inshore Lobster
691	CT Sea Coast Offshore Lobster
692	CT Sea Coast Large Bottom Trawl
693	CT Sea Coast Medium Bottom Trawl
694	CT Sea Coast Small Bottom Trawl
695	CT Sea Coast Large Scallop Dredge
696	CT Sea Coast Medium Scallop Dredge
697	CT Sea Coast Small Scallop Dredge
698	CT Sea Coast Surfclam, Ocean Quahog
699	CT Sea Coast Small Dredge
700	CT Sea Coast Sink Gillnet
701	CT Sea Coast Diving Gear

Table 2. Industry/Commodity Codes - Continued

Industry Code	Description
701	CT Sea Coast Diving Gear
702	CT Sea Coast Midwater Trawl
703	CT Sea Coast Pots and Traps
704	CT Sea Coast Bottom Longline
705	CT Sea Coast Other Mobile Gear
706	CT Sea Coast Other Fixed Gear
707	CT Sea Coast Hand Gears
708	NY Inshore Lobster
709	NY Offshore Lobster
710	NY Large Bottom Trawl
711	NY Medium Bottom Trawl
712	NY Small Bottom Trawl
713	NY Large Scallop Dredge
714	NY Medium Scallop Dredge
715	NY Small Scallop Dredge
716	NY Surfclam, Ocean Quahog
717	NY Small Dredge
718	NY Sink Gillnet
719	NY Diving Gear
720	NY Midwater Trawl
721	NY Pots and Traps
722	NY Bottom Longline
723	NY Other Mobile Gear
724	NY Other Fixed Gear
725	NY Hand Gears
726	NJ North Inshore Lobster
727	NJ North Offshore Lobster
728	NJ North Large Bottom Trawl
729	NJ North Medium Bottom Trawl
730	NJ North Small Bottom Trawl
731	NJ North Large Scallop Dredge
732	NJ North Medium Scallop Dredge
733	NJ North Small Scallop Dredge
734	NJ North Surfclam, Ocean Quahog
735	NJ North Small Dredge
736	NJ North Sink Gillnet
737	NJ North Diving Gear
738	NJ North Midwater Trawl
739	NJ North Pots and Traps
740	NJ North Bottom Longline
741	NJ North Other Mobile Gear
742	NJ North Other Fixed Gear
743	NJ North Hand Gears
744	NJ South Inshore Lobster
745	NJ South Offshore Lobster
746	NJ South Large Bottom Trawl
747	NJ South Medium Bottom Trawl
748	NJ South Small Bottom Trawl
749	NJ South Large Scallop Dredge
750	NJ South Medium Scallop Dredge
751	NJ South Small Scallop Dredge
752	NJ South Surfclam, Ocean Quahog
753	NJ South Small Dredge
754	NJ South Sink Gillnet
755	NJ South Diving Gear
756	NJ South Midwater Trawl
757	NJ South Pots and Traps
758	NJ South Bottom Longline
759	NJ South Other Mobile Gear
760	NJ South Other Fixed Gear
761	NJ South Hand Gears
762	DE Inshore Lobster
763	DE Offshore Lobster
764	DE Large Bottom Trawl
765	DE Medium Bottom Trawl
766	DE Small Bottom Trawl
767	DE Large Scallop Dredge
768	DE Medium Scallop Dredge
769	DE Small Scallop Dredge
770	DE Surfclam, Ocean Quahog
771	DE Small Dredge
772	DE Sink Gillnet
773	DE Diving Gear
774	DE Midwater Trawl
775	DE Pots and Traps
776	DE Bottom Longline
777	DE Other Mobile Gear
778	DE Other Fixed Gear
779	DE Hand Gears
780	MD West Inshore Lobster
781	MD West Offshore Lobster
782	MD West Large Bottom Trawl
783	MD West Medium Bottom Trawl
784	MD West Small Bottom Trawl
785	MD West Large Scallop Dredge
786	MD West Medium Scallop Dredge
787	MD West Small Scallop Dredge
788	MD West Surfclam, Ocean Quahog
789	MD West Small Dredge
790	MD West Sink Gillnet
791	MD West Diving Gear
792	MD West Midwater Trawl
793	MD West Pots and Traps
794	MD West Bottom Longline
795	MD West Other Mobile Gear
796	MD West Other Fixed Gear

Table 2. Industry/Commodity Codes - Continued

Industry Code	Description
797	MD West Hand Gears
798	MD East Inshore Lobster
799	MD East Offshore Lobster
800	MD East Large Bottom Trawl
801	MD East Medium Bottom Trawl
802	MD East Small Bottom Trawl
803	MD East Large Scallop Dredge
804	MD East Medium Scallop Dredge
805	MD East Small Scallop Dredge
806	MD East Surfclam, Ocean Quahog
807	MD East Small Dredge
808	MD East Sink Gillnet
809	MD East Diving Gear
810	MD East Midwater Trawl
811	MD East Pots and Traps
812	MD East Bottom Longline
813	MD East Other Mobile Gear
814	MD East Other Fixed Gear
815	MD East Hand Gears
816	VA North Inshore Lobster
817	VA North Offshore Lobster
818	VA North Large Bottom Trawl
819	VA North Medium Bottom Trawl
820	VA North Small Bottom Trawl
821	VA North Large Scallop Dredge
822	VA North Medium Scallop Dredge
823	VA North Small Scallop Dredge
824	VA North Surfclam, Ocean Quahog
825	VA North Small Dredge
826	VA North Sink Gillnet
827	VA North Diving Gear
828	VA North Midwater Trawl
829	VA North Pots and Traps
830	VA North Bottom Longline
831	VA North Other Mobile Gear
832	VA North Other Fixed Gear
833	VA North Hand Gears
834	VA South Inshore Lobster
835	VA South Offshore Lobster
836	VA South Large Bottom Trawl
837	VA South Medium Bottom Trawl
838	VA South Small Bottom Trawl
839	VA South Large Scallop Dredge
840	VA South Medium Scallop Dredge
841	VA South Small Scallop Dredge
842	VA South Surfclam, Ocean Quahog
843	VA South Small Dredge
844	VA South Sink Gillnet
845	VA South Diving Gear
846	VA South Midwater Trawl
847	VA South Pots and Traps
848	VA South Bottom Longline
849	VA South Other Mobile Gear
850	VA South Other Fixed Gear
851	VA South Hand Gears
852	VA East Inshore Lobster
853	VA East Offshore Lobster
854	VA East Large Bottom Trawl
855	VA East Medium Bottom Trawl
856	VA East Small Bottom Trawl
857	VA East Large Scallop Dredge
858	VA East Medium Scallop Dredge
859	VA East Small Scallop Dredge
860	VA East Surfclam, Ocean Quahog
861	VA East Small Dredge
862	VA East Sink Gillnet
863	VA East Diving Gear
864	VA East Midwater Trawl
865	VA East Pots and Traps
866	VA East Bottom Longline
867	VA East Other Mobile Gear
868	VA East Other Fixed Gear
869	VA East Hand Gears
870	NC Central Large Bottom Trawl
871	NC Central Medium Bottom Trawl
872	NC Cental Small Bottom Trawl
873	NC Cental Large Scallop Dredge
874	NC Central Medium Scallop Dredge
875	NC Central Small Scallop Dredge
876	NC Central Surfclam, Ocean Quahog
877	NC Central Small Dredge
878	NC Central Sink Gillnet
879	NC Central Diving Gear
880	NC Central Midwater Trawl
881	NC Central Pots and Traps
882	NC Central Bottom Longline
883	NC Central Other Mobile Gear
884	NC Central Other Fixed Gear
885	NC Central Hand Gears
886	NC South Inshore Lobster
887	NC South Offshore Lobster
888	NC South Large Bottom Trawl
889	NC South Medium Bottom Trawl
890	NC South Small Bottom Trawl
891	NC South Large Scallop Dredge
892	NC South Medium Scallop Dredge

Table 2. Industry/Commodity Codes - Continued

Industry Code	Description
893	NC South Small Scallop Dredge
894	NC South Surfclam, Ocean Quahog
895	NC South Small Dredge
896	NC South Sink Gillnet
897	NC South Diving Gear
898	NC South Midwater Trawl
899	NC South Pots and Traps
900	NC South Bottom Longline
901	NC South Other Mobile Gear
902	NC South Other Fixed Gear
903	NC South Hand Gears
904	Downeast ME Seafood Dealer
905	Upper Mid-Coast ME Seafood Dealer
906	Lower Mid-Coast ME Seafood Dealer
907	Southern ME Seafood Dealer
908	NH Seacoast Seafood Dealer
909	Gloucester, North Shore Seafood Dealer
910	Boston Seafood Dealer
911	Cape and Islands Seafood Dealer
912	New Beford, South Shore Seafood Dealer
913	Rhode Island Seafood Dealer
914	CT Sea Coast Seafood Dealer
915	NY Seafood Dealer
916	NJ North Seafood Dealer
917	NJ South Seafood Dealer
918	DE Seafood Dealer
919	MD West Seafood Dealer
920	MD East Seafood Dealer
921	VA North Seafood Dealer
922	VA South Seafood Dealer
923	VA East Seafood Dealer
924	NC North Seafood Dealer
925	NC Central Seafood Dealer
926	NC South Seafood Dealer
927	Lower Mid-Coast ME Fish Exchange (Portland)
928	Gloucester Fish Exchange
929	Boston Fish Exchange
930	New Bedford Fish Exchange
931	Downeast ME Midwater Trawl, Bait
932	Upper Mid-Coast ME Midwater Trawl, Bait
933	Lower Mid-Coast ME Midwater Trawl, Bait
934	Southern ME Midwater Trawl, Bait
935	NH Seacoast Midwater Trawl, Bait
936	Gloucester, North Shore Midwater Trawl, Bait
937	Boston Midwater Trawl, Bait
938	Cape and Islands Midwater Trawl, Bait
939	New Beford, South Shore Midwater Trawl, Bait
940	Rhode Island Midwater Trawl, Bait
941	CT Sea Coast Midwater Trawl, Bait
942	NY Midwater Trawl, Bait
943	NJ North Midwater Trawl, Bait
944	NJ South Midwater Trawl, Bait
945	DE Midwater Trawl, Bait
946	MD West Midwater Trawl, Bait
947	MD East Midwater Trawl, Bait
948	VA North Midwater Trawl, Bait
949	VA South Midwater Trawl, Bait
950	VA East Midwater Trawl, Bait
951	NC North Midwater Trawl, Bait
952	NC Central Midwater Trawl, Bait
953	NC South Midwater Trawl, Bait
954	Downeast ME Medium Bottom Trawl, Bait
955	Upper Mid-Coast ME Medium Bottom Trawl, Bait
956	Lower Mid-Coast ME Medium Bottom Trawl, Bait
957	Southern ME Medium Bottom Trawl, Bait
958	NH Seacoast Medium Bottom Trawl, Bait
959	Gloucester, North Shore Medium Bottom Trawl, Bait
960	Boston Medium Bottom Trawl, Bait
961	Cape and Islands Medium Bottom Trawl, Bait
962	New Beford, South Shore Medium Bottom Trawl, Bait
963	Rhode Island Medium Bottom Trawl, Bait
964	CT Sea Coast Medium Bottom Trawl, Bait
965	NY Medium Bottom Trawl, Bait
966	NJ North Medium Bottom Trawl, Bait
967	NJ South Medium Bottom Trawl, Bait
968	DE Medium Bottom Trawl, Bait
969	MD West Medium Bottom Trawl, Bait
970	MD East Medium Bottom Trawl, Bait
971	VA North Medium Bottom Trawl, Bait
972	VA South Medium Bottom Trawl, Bait
973	VA East Medium Bottom Trawl, Bait
974	NC North Medium Bottom Trawl, Bait
975	NC Central Medium Bottom Trawl, Bait
976	NC South Medium Bottom Trawl, Bait
977	Downeast ME Seafood Processing
978	Upper Mid-Coast ME Seafood Processing
979	Lower Mid-Coast ME Seafood Processing
980	Southern ME Seafood Processing
981	NH Seacoast Seafood Processing
982	Gloucester, North Shore Seafood Processing
983	Boston Seafood Processing
984	Cape and Islands Seafood Processing
985	New Beford, South Shore Seafood Processing
986	Rhode Island Seafood Processing
987	CT Sea Coast Seafood Processing
988	NY Seafood Processing

Table 2. Industry/Commodity Codes - Continued

Industry Code	Description	Industry Code	Description
989	NJ North Seafood Processing		
990	NJ South Seafood Processing		
991	DE Seafood Processing		
992	MD West Seafood Processing		
993	MD East Seafood Processing		
994	VA North Seafood Processing		
995	VA South Seafood Processing		
996	VA East Seafood Processing		
997	NC North Seafood Processing		
998	NC Central Seafood Processing		
999	NC South Seafood Processing		

Table 3. Cost-Earnings Data Sources

Harvesting Sectors	**Data Sources**
1. Inshore Lobster	Variable costs, fixed costs, and crew payments from focus group surveys conducted by URI study (see Anonymous, 1995).
2. Offshore Lobster	Variable costs, fixed costs, and crew payments from focus group surveys conducted by URI study (see Anonymous, 1995).
3. Large Bottom Trawl	Variable costs from Northeast observer data, 2001 adjusted fixed costs from raw URI CMER study data (see Lallemand et. al. 1998 and Lallemand et. al. 1999), and gross stock estimates from Northeast dealer data that pertained only to those vessels that were surveyed by the CMER study
4. Medium Bottom Trawl	
5. Small Bottom Trawl	
6. Large Scallop Dredge	All cost and earnings data obtained from UMASS Dartmouth study (see Georgianna, Cass, and Amaral 1999).
7. Medium Scallop Dredge	
8. Small Scallop Dredge	
9. Surfclam, Ocean Quahog Dredge	Medium scallop dredge cost-earnings data as proxy
10. Sink Gillnet	Variable costs from Northeast observer data, fixed costs and value-added proportions from bottom longline data
11. Diving Gear	Southern inshore lobster as proxy
12. Midwater Trawl	Medium bottom trawl as proxy
13. Fish Pots and Traps	Southern inshore lobster as proxy
14. Bottom Longline	Variable costs from Northeast observer data, 2001 adjusted fixed costs from raw UMASS CMER study data (see Georgianna et. al. 1998), and gross stock estimates from Northeast dealer data that pertained only to those vessels that were surveyed by the CMER study
15. Other Mobile Gear	Medium bottom trawl as proxy
16. Other Fixed Gear	Sink gillnet as proxy
17. Hand Gear	All cost and earnings data obtained from raw UMASS CMER study data (see Georgianna et. al. 1998)
18. Small Dredge	Small scallop dredge as proxy
Wholesale Seafood Dealers	Production function obtained from VIMS CMER study (see Kirkley, Ryan, and Duberg 2004)
Fish Exchanges/Auctions	2001 adjusted variable costs, fixed costs, and value-added proportions estimated for Fulton Market in the VIMS CMER study (see Kirkley, Ryan, and Duberg 2004)
Seafood Processors	2001 sub-regional defaults for IMPLAN sector 71 (seafood product preparation and packaging)

Table 4. Commercial Fishing Production Functions

Expenditure Categories	Northern Inshore Lobster	Southern Inshore Lobster	Offshore Lobster	Large Bottom Trawl	Medium Bottom Trawl	Small Bottom Trawl	Large Scallop Dredge	Medium Scallop Dredge	Small Scallop Dredge	Surfclam Ocean Quahog Dredge[b]
	Percentage Distribution									
Miscellaneous trip supplies	1.72%	3.95%	1.26%	0.95%	2.02%	1.57%	0.70%	0.52%	0.52%	0.52%
Repair & maintenance: fishing gear	5.66%	4.34%	4.41%	3.03%	2.27%	3.93%	8.41%	5.76%	4.91%	5.76%
Repair & maintenance: vessel & engine										
By Yard	1.69%	0.40%	4.20%	3.17%	4.06%	3.50%	3.43%	3.35%	3.14%	3.35%
By Owner	3.04%	4.17%	2.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Repair & maintenance: electronics	0.00%	0.00%	0.00%	0.56%	0.61%	1.13%	1.04%	0.72%	0.79%	0.72%
Groceries	0.21%	0.41%	3.78%	2.12%	2.69%	2.52%	2.64%	1.56%	0.84%	1.56%
Fuel & lubricants	4.87%	6.44%	7.35%	11.32%	10.16%	9.84%	15.57%	27.74%	6.12%	27.74%
Ice	0.00%	0.00%	0.00%	2.48%	2.29%	3.29%	1.90%	8.32%	1.36%	8.32%
Loading, unloading	0.00%	0.00%	0.00%	1.11%	0.72%	1.39%	1.81%	0.78%	1.99%	0.78%
Moorage, dockage, haulout	1.03%	2.48%	0.53%	3.00%	3.12%	4.41%	2.60%	1.24%	1.70%	1.24%
Licenses, permits	0.29%	0.35%	0.11%	0.26%	0.27%	0.60%	0.30%	0.18%	1.26%	0.18%
Business associations	0.00%	0.00%	0.00%	0.19%	0.22%	0.69%	0.21%	0.14%	1.41%	0.14%
Consignment	0.00%	0.00%	0.00%	0.27%	0.86%	0.72%	0.45%	0.95%	1.02%	0.95%
Professional fees	0.00%	0.00%	0.00%	0.76%	0.73%	1.20%	1.08%	0.67%	0.00%	0.67%
Boat insurance	2.29%	2.09%	3.15%	4.29%	3.77%	1.59%	6.32%	5.50%	2.53%	5.50%
Crew insurance (lobster vessels)	0.49%	0.28%	4.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Interest payment: short term loan	0.09%	2.15%	0.11%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Interest payment: vessel	1.81%	0.37%	2.84%	1.03%	1.92%	1.13%	2.09%	0.42%	0.77%	0.42%
Shorefront property expenses										
Rent (40%)	0.35%	0.79%	0.00%	0.18%	0.33%	0.54%	0.11%	0.30%	0.24%	0.30%
Utilities (20%)	0.18%	0.40%	0.00%	0.09%	0.17%	0.27%	0.05%	0.15%	0.12%	0.15%
Supplies (30%)	0.26%	0.60%	0.00%	0.13%	0.25%	0.41%	0.08%	0.23%	0.18%	0.23%
Advertising (10%)	0.09%	0.20%	0.00%	0.04%	0.08%	0.14%	0.03%	0.08%	0.06%	0.08%
Vehicle	3.28%	3.41%	1.26%	0.73%	1.02%	2.23%	0.82%	0.68%	4.75%	0.68%
Boat principal payment	5.43%	1.26%	3.66%	2.48%	2.81%	3.56%	5.12%	1.02%	1.35%	1.02%
Short term loan principal payment	0.28%	7.53%	0.13%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bank service charge	0.11%	0.33%	0.07%	0.07%	0.09%	0.09%	0.10%	0.02%	0.03%	0.02%
Gear replacement (lobster vessels)	7.93%	7.95%	3.85%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bait	12.11%	11.96%	10.54%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Miscellaneous expenses	0.00%	0.00%	0.00%	0.52%	1.76%	3.16%	0.00%	0.00%	0.00%	0.00%
Taxes	0.59%	0.04%	0.09%	0.25%	0.26%	0.47%	0.88%	0.97%	5.05%	0.97%
Employee compensation[a]	14.00%	16.00%	37.87%	54.88%	46.79%	35.87%	38.91%	32.28%	38.33%	32.28%
Proprietary income	32.21%	22.11%	8.59%	6.09%	10.71%	15.76%	5.34%	6.40%	21.53%	6.40%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

[a] Includes captain and crew insurance payments made by all vessel owners except lobster vessel owners. Crew insurance paid by lobster vessel owners is included in the category crew insurance (lobster vessels).

[b] The percentage distribution of expenditures for the medium scallop dredge sector was used to represent the purchasing activities of the surfclam, ocean quahog dredge sector.

Table 4. Commercial Fishing Production Functions - Continued

Expenditure Categories	Sink Gillnet	Diving Gear[c]	Midwater Trawl[d]	Fish Pots and Traps[e]	Bottom Longline	Other Mobile Gear[f]	Other Fixed Gear[g]	Hand Gear	Small Dredge[h]
	Percentage Distribution								
Miscellaneous trip supplies	0.82%	5.85%	2.02%	3.95%	1.65%	2.02%	0.82%	0.98%	0.52%
Repair & maintenance: fishing gear	8.44%	4.86%	2.27%	4.34%	7.30%	2.27%	8.44%	3.87%	4.91%
Repair & maintenance: vessel & engine		0.00%							
By Yard	8.47%	0.44%	4.06%	0.40%	6.02%	4.06%	8.47%	11.13%	3.14%
By Owner	0.00%	4.66%	0.00%	4.17%	0.00%	0.00%	0.00%	0.00%	0.00%
Repair & maintenance: electronics	1.49%	0.00%	0.61%	0.00%	1.69%	0.61%	1.49%	2.34%	0.79%
Groceries	0.94%	0.46%	2.69%	0.41%	0.56%	2.69%	0.94%	2.04%	0.84%
Fuel & lubricants	2.59%	7.21%	10.16%	6.44%	3.39%	10.16%	2.59%	8.07%	6.12%
Ice	1.21%	0.00%	2.29%	0.00%	1.21%	2.29%	1.21%	0.98%	1.36%
Loading, unloading	0.39%	0.00%	0.72%	0.00%	0.17%	0.72%	0.39%	0.71%	1.99%
Moorage, dockage, haulout	5.36%	2.77%	3.12%	2.48%	5.53%	3.12%	5.36%	6.88%	1.70%
Licenses, permits	0.60%	0.39%	0.27%	0.35%	0.62%	0.27%	0.60%	2.11%	1.26%
Business associations	0.33%	0.00%	0.22%	0.00%	0.34%	0.22%	0.33%	0.50%	1.41%
Consignment	0.00%	0.00%	0.86%	0.00%	0.14%	0.86%	0.00%	0.00%	1.02%
Professional fees	0.95%	0.00%	0.73%	0.00%	0.98%	0.73%	0.95%	1.38%	0.00%
Boat insurance	5.61%	2.34%	3.77%	2.09%	4.06%	3.77%	5.61%	5.12%	2.53%
Crew insurance (lobster vessels)	0.00%	0.32%	0.00%	0.28%	0.00%	0.00%	0.00%	0.00%	0.00%
Interest payment: short term loan	0.00%	2.40%	0.00%	2.15%	0.00%	0.00%	0.00%	0.00%	0.00%
Interest payment: vessel	3.58%	0.42%	1.92%	0.37%	2.82%	1.92%	3.58%	5.13%	0.77%
Shorefront property expenses		0.00%							
Rent (40%)	0.32%	0.89%	0.33%	0.79%	0.33%	0.33%	0.32%	0.56%	0.24%
Utilities (20%)	0.16%	0.44%	0.17%	0.40%	0.16%	0.17%	0.16%	0.28%	0.12%
Supplies (30%)	0.24%	0.67%	0.25%	0.60%	0.25%	0.25%	0.24%	0.42%	0.18%
Advertising (10%)	0.08%	0.22%	0.08%	0.20%	0.08%	0.08%	0.08%	0.14%	0.06%
Vehicle	3.14%	3.82%	1.02%	3.41%	3.23%	1.02%	3.14%	6.42%	4.75%
Boat principal payment	9.12%	1.41%	2.81%	1.26%	6.57%	2.81%	9.12%	11.97%	1.35%
Short term loan principal payment	0.00%	8.43%	0.00%	7.53%	0.00%	0.00%	0.00%	0.00%	0.00%
Bank service charge	0.18%	0.37%	0.09%	0.33%	0.13%	0.09%	0.18%	0.24%	0.03%
Gear replacement (lobster vessels)	0.00%	8.90%	0.00%	7.95%	0.00%	0.00%	0.00%	0.00%	0.00%
Bait	0.00%	0.00%	0.00%	11.96%	4.86%	0.00%	0.00%	2.22%	0.00%
Miscellaneous expenses	0.00%	0.00%	1.76%	0.00%	1.46%	1.76%	0.00%	0.00%	0.00%
Taxes	9.58%	0.05%	0.26%	0.04%	9.86%	0.26%	9.58%	4.47%	5.05%
Employee compensation	30.01%	17.91%	46.79%	16.00%	30.47%	46.79%	30.01%	18.22%	38.33%
Proprietary income	6.38%	24.76%	10.71%	22.11%	6.11%	10.71%	6.38%	3.83%	21.53%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

[c] The distribution of expenditures for the southern inshore lobster sector were used as proxy values for the diving gear sector.
[d] The percentage distribution of expenditures for medium bottom trawls was used to represent the purchasing activities of the midwater trawl sector.
[e] The distribution of expenditures associated with the southern inshore lobster sector was used to represent the expenditures of the fish pots and traps sector.
[f] The percentage distribution of expenditures for medium bottom trawls was used to represent the purchasing activities of the other mobile gear sector.
[g] The distribution of expenditures for the sink gillnet sector was used to characterize the industry purchases for the other fixed gear sector.
[h] The percentage distribution of expenditures for the small scallop dredge sector was used to represent the expenditures of the small dredge sector.

Table 5. Seafood Wholesale and Fish Exchange/Auction House Production Functions

Expenditure Categories	Seafood Wholesale Dealer	Fish Exchange/ Auction
	Percentage Distribution	
Ice	2.80%	3.00%
Packaging: boxes	2.70%	2.94%
Shipping	4.10%	0.00%
Storage	14.70%	22.88%
Advertising	4.00%	4.40%
Rent	6.80%	0.00%
Repair & Maintenance: building	6.90%	5.30%
Vehicle	4.10%	0.00%
Utilities: electric	1.37%	1.49%
Utilities: gas	1.37%	1.49%
Utilities: telephone	1.37%	1.49%
Insurance	4.10%	6.64%
Professional fees	0.70%	0.76%
Building principal payment	4.00%	7.41%
Interest payment: building	1.40%	1.20%
Bank service charge	0.08%	0.30%
Taxes	2.12%	0.00%
Employee compensation	33.35%	40.70%
Proprietary income	4.05%	0.00%
Total	100.00%	100.00%

Table 6. IMPLAN Pro Tables

Table Name	Description	Category
*Industry/Commodity Codes	Codes (Modified)	1
*Type Codes	Codes (Modified)	
Margins Codes	Codes	
*US Absorption Table *US Absorption Totals *US Byproducts Table	Raw input data (Modified)	2
*SACommodity Sales *SAEmployment *SAFinal Demands *SAForeign Exports *SAOutput *SAValue Added	Raw input study area data (Modified)	
SATransfers	Raw input study area data	
*Observed RPCs	Raw input data (Modified)	
*RPC Methods	Raw input data (Modified)	
Margins	Raw input data	
*Deflators	Raw input data (Modified)	
General Information	Model-building information	3
Model Specs Multiplier Specs	Model-building information	
SARatios	Ratios for impact and multiplier calculations	
IMCommodity Transactions IMEvents IMFactor Transactions IMGroups IMIndustry Transactions IMInstitutions Transactions IMMargins IMProjects	Impact report data (Empty before impact analysis)	4
Regional Absorption Regional Byproducts Regional Commodity Balances Regional Direct Institutional Requirements Regional Factor Balances Regional Industry Balances Regional Institution Balances Regional Institution Demand Regional IxI Regional Market Shares Regional Multipliers Induced Regional Multipliers Type I Regional SAM Balances Regional SAM Balances Aggregated Regional SAM Balances Industry Detail Regional SAM Balances IxI Regional SAM Balances IxI Industry Detail Regional Sam Distribution Regional Value Added Coefficients	Output/report data for regional I-O model (Empty before 'Construct Model')	
rptEC Multipliers rptEmployment Multipliers rptIBT Multipliers rptOPTI Multipliers rptOutput Multipliers rptPersonal Income Multipliers rptPropInc Multipliers rptTotal VA Multipliers	Output reports	
*rptSAFinal Demands	Data from SAFinal Demands and SAForeign Exports (Modified)	
*rptSAIndustry Data	Data from SAOutput, SAEmployment & SAValue Added (Modified)	
SAM Rollup	SAM report data	
Tax Impacts	Tax report data	
Type Code Rollup	Type code report data	
CGE Account	Output data for computable general equilibrium models	

Table 7. Summary of IMPLAN Modification Procedure

General Steps for Model Construction	General Instruction
1	In IMPLAN, select new model, name the new model, locate the relevant regional data, build study area
2	Open the new model in ACCESS
3	Delete the three US tables and the Observed RPCs table
4	Import the three US tables and the Observed RPCs table from 01NAT509
5	Export the default data in the 16 ACCESS tables that will be modified to EXCEL
6	Delete all default data in the 16 ACCESS tables
7	Create 16 new tables with modified data in Excel
8	Import the 16 updated tables from EXCEL into ACCESS
9	In IMPLAN, reconstruct the model and multipliers

Table 8. Industry Sectors Purchasing from the Default Commercial Fishing Sector (Sector 16)

Industry Sector Description	IMPLAN Sector	Purchases Reassigned to
Rendering and meat byproduct processing	69	Seafood processing
Seafood product preparation and packaging	71	Wholesale seafood dealers
Water Transportation	393	Wholesale seafood dealers
Hospitals	467	Seafood processing
Nursing and residential care facilities	468	Seafood processing
Other amusement- gambling- and recreation industries	478	Seafood processing
Hotels and motels- including casinos	479	Wholesale seafood dealers
Other accommodations	480	Seafood processing
Food services and drinking places	481	Wholesale seafood dealers
Civic- social- professional and similar organizations	493	Seafood processing
Other Federal government enterprises	496	Seafood processing

Table 9. Industry Sectors Purchasing from the Default Seafood Processing Sector (Sector 71)

Industry Sector Description	IMPLAN Sector
Dog and cat food manufacturing	46
Other animal food manufacturing	47
Fats and oils refining and blending	54
Frozen food manufacturing	60
Meat processed from carcasses	68
Frozen cakes and other pastries manufacturing	72
Bread and bakery product- except frozen- manufacturing	73
Cookie and cracker manufacturing	74
Soft drink and ice manufacturing	85
Leather and hide tanning and finishing	109
Petroleum refineries	142
Petroleum lubricating oil and grease manufacturing	145
Water transportation	393
Scenic and sightseeing transportation and support	397
Advertising and related services	447
Hospitals	467
Nursing and residential care facilities	468
Social assistance- except child day care services	470
Museums- historical sites- zoos- and parks	475
Fitness and recreational sports centers	476
Other amusement- gambling- and recreation industries	478
Hotels and motels- including casinos	479
Other accommodations	480
Food services and drinking places	481
Civic- social- professional and similar organizations	493
Other Federal government enterprises	496

Table 10. Total New England Coastal Region Sales Impacts (2003 $'s)

Sector	Downeast ME	Upper Mid-Coast ME	Lower Mid-Coast ME	Southern ME	NH Seacoast NH	Gloucester MA	Boston MA	Cape & Islands MA	New Bedford MA	Rhode Island RI	CT Seacoast CT	Non-Maritime New England	Total New England
Commercial Fishing							Sales ($'s)						
Inshore Lobster Traps	0	0	0	0	0	0	0	0	0	0	0	0	0
Offshore Lobster Traps	0	0	0	0	0	0	0	0	0	0	0	0	0
Large Bottom Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Bottom Trawl	0	-500,000	-500,000	-500,000	-500,000	-500,000	-500,000	-500,000	-500,000	-500,000	-500,000	0	-5,000,000
Small Bottom Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0
Large Scallop Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Scallop Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0
Small Scallop Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0
Surf Clam, Ocean Quahog Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0
Small Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0
Sink Gillnet	0	0	0	0	0	0	0	0	0	0	0	0	0
Diving Gear	0	0	0	0	0	0	0	0	0	0	0	0	0
Midwater Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0
Fish Pots and Traps	0	0	0	0	0	0	0	0	0	0	0	0	0
Bottom Longline	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Mobile Gear	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Fixed Gear	0	0	0	0	0	0	0	0	0	0	0	0	0
Hand Gears	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	-8,649	-1,665	-3,384	-1,070	-1,290	-660	-1,658	-538	-605	-1,818	-5,162	-197,059	-223,557
Mining	0	-1	-2	-1	-2	-129	-597	-41	-95	-4	-1,185	-14,226	-16,285
Transportation, Communications and Public Utilities	-708	-1,475	-12,365	-1,403	-15,203	-10,009	-89,562	-3,876	-9,413	-21,875	-55,706	-354,369	-575,964
Water Transportation	0	-2,756	-1,859	-1,692	-1,136	-433	-20,688	-9,018	-1,473	-4,390	-37,587	-28,738	-109,770
Warehousing and storage	-8	-13	-1,666	-152	-2,027	-714	-6,066	-10	-1,116	-869	-2,220	-24,331	-39,190
Construction	-117	-808	-2,996	-808	-3,046	-2,266	-15,615	-1,456	-1,524	-2,901	-8,578	-47,512	-87,627
Manufacturing	-235	-1,009	-11,646	-3,500	-17,517	-15,736	-52,163	-1,207	-8,214	-16,211	-47,971	-363,503	-538,911
Seafood Processing	-115,966	-497,779	-193,363	-77,484	-707,740	-1,483,438	-997,031	-2,586	-725,666	-408,514	-346,827	0	-5,556,395
Ice	0	-73	-952	-12	-961	-323	-6,283	-277	-1,081	-2,747	-824	-13,564	-27,098
Boat Building	-67	-2,295	-909	-28	-194	-64	-1,298	-77	-151	-13,343	-479	-5,466	-24,370
Paperboard Containers	0	0	-131	-25	-212	-493	-1,120	0	-440	-591	-1,148	-9,009	-13,170
Trade	-491	-2,641	-13,129	-3,115	-19,857	-12,749	-60,751	-6,413	-10,399	-15,259	-44,757	-237,818	-427,381
Seafood Dealers	0	-22,718	-27,442	-527	-260,131	-38,104	-181,636	-85,784	-143,017	-198,803	-200,000	0	-1,158,161
Fish Exchanges / Auctions	0	0	-116,768	0	0	-35,591	-8,496	0	-35,218	0	0	0	-196,072
Wholesale Trade	-239	-1,876	-14,223	-1,440	-31,376	-20,737	-158,932	-2,657	-12,457	-20,344	-76,007	-335,632	-675,919
Finance, Insurance and Real Estate	-129	-1,561	-17,491	-1,164	-19,360	-11,383	-167,205	-4,523	-4,719	-25,443	-85,495	-323,129	-661,602
Services	-1,462	-8,073	-48,618	-9,950	-61,762	-48,751	-383,148	-20,049	-29,623	-72,712	-199,551	-944,607	-1,828,306
Government	-347	-1,654	-7,407	-4,588	-12,236	-11,233	-61,990	-4,259	-6,949	-13,788	-37,747	-192,325	-354,523
Total	-128,418	-1,046,397	-974,350	-606,959	-1,654,050	-2,192,812	-2,714,238	-642,772	-1,492,161	-1,319,611	-1,651,245	-3,091,288	-17,514,301

Table 11. Total Mid-Atlantic Coastal Region Sales Impacts (2003 $'s)

Sector	NY Seacoast NY	NJ North NJ	NJ South NJ	DE State DE	MD West MD	MD East MD	VA North VA	VA South VA	VA East VA	NC North NC	NC Central NC	NC South NC	Non-Maritime Mid-Atlantic	Total Mid-Atlantic
Commercial Fishing							Sales ($'s)							
Inshore Lobster Traps	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Offshore Lobster Traps	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large Bottom Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Bottom Trawl	-500,000	0	0	0	0	0	0	0	0	0	0	0	0	-500,000
Small Bottom Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large Scallop Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Scallop Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Small Scallop Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Surf Clam, Ocean Quahog Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Small Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sink Gillnet	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diving Gea r	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Midwater Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fish Pots and Traps	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bottom Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Mobile Gear	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Fixed Gear	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hand Gears	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	-2,997	-2,930	-20,829	0	0	0	0	0	0	0	0	0	-19,177	-45,933
Mining	-9,610	-1,639	-211	0	0	0	0	0	0	0	0	0	-1,384	-12,844
Transportation, Communications and Public Utilities	-392,866	-167,951	-129,829	0	0	0	0	0	0	0	0	0	-34,486	-725,131
Water Transportation	-96,893	-49,461	-18,195	0	0	0	0	0	0	0	0	0	-2,797	-167,346
Warehousing and storage	-9,286	-18,793	-10,878	0	0	0	0	0	0	0	0	0	-2,368	-41,324
Construction	-38,615	-12,555	-15,388	0	0	0	0	0	0	0	0	0	-4,624	-71,181
Manufacturing	-130,488	-170,294	-149,217	0	0	0	0	0	0	0	0	0	-35,375	-485,374
Seafood Processing	-422,859	-2,868	-4,160	0	0	0	0	0	0	0	0	0	0	-429,886
Ice	-7,613	-1,381	-3,278	0	0	0	0	0	0	0	0	0	-1,320	-13,592
Boat Building	-55	-15	-9,345	0	0	0	0	0	0	0	0	0	-532	-9,948
Paperboard Containers	-2,019	-2,963	-1,649	0	0	0	0	0	0	0	0	0	-877	-7,508
Trade	-165,415	-75,631	-86,909	0	0	0	0	0	0	0	0	0	-23,143	-351,098
Seafood Dealers	-225,697	-3,256	-252	0	0	0	0	0	0	0	0	0	0	-229,204
Fish Exchanges / Auctions	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wholesale Trade	-407,085	-206,230	-166,371	0	0	0	0	0	0	0	0	0	-32,662	-812,348
Finance, Insurance and Real Estate	-652,462	-161,766	-101,684	0	0	0	0	0	0	0	0	0	-31,446	-947,358
Services	-1,061,522	-335,526	-344,964	0	0	0	0	0	0	0	0	0	-91,925	-1,833,938
Government	-219,939	-69,440	-68,126	0	0	0	0	0	0	0	0	0	-18,716	-376,222
Total	-4,345,419	-1,282,701	-1,131,286	0	0	0	0	0	0	0	0	0	-300,831	-7,060,237

Table 12. Total New England Coastal Region Income Impacts (2003 $'s)

Sector	Downeast ME	Upper Mid-Coast ME	Lower Mid-Coast ME	Southern ME	NH Seacoast NH	Gloucester MA	Boston MA	Cape & Islands MA	New Bedford MA	Rhode Island RI	CT Seacoast CT	Non-Maritime New England	Total New England
Commercial Fishing							Income ($'s)						
Inshore Lobster Traps	0	0	0	0	0	0	0	0	0	0	0	0	0
Offshore Lobster Traps	0	0	0	0	0	0	0	0	0	0	0	0	0
Large Bottom Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Bottom Trawl	0	-275,947	-275,947	-269,846	-287,497	-281,396	-270,297	-283,047	-283,047	-287,497	-287,496	0	-2,802,015
Small Bottom Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0
Large Scallop Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Scallop Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0
Small Scallop Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0
Surf Clam, Ocean Quahog Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0
Small Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0
Sink Gillnet	0	0	0	0	0	0	0	0	0	0	0	0	0
Diving Gear	0	0	0	0	0	0	0	0	0	0	0	0	0
Midwater Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0
Fish Pots and Traps	0	0	0	0	0	0	0	0	0	0	0	0	0
Bottom Longline	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Mobile Gear	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Fixed Gear	0	0	0	0	0	0	0	0	0	0	0	0	0
Hand Gears	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	-2,673	-412	-833	-159	-144	-83	-358	-69	-101	-245	-1,290	-43,596	-49,963
Mining	0	0	-1	-1	-1	0	-8	0	0	-1	-5	-2,995	-3,014
Transportation, Communications and Public Utilities	-194	-435	-4,049	-435	-4,747	-2,957	-30,133	-1,075	-2,693	-6,777	-18,046	-112,922	-184,464
Water Transportation	0	-154	-125	-88	-262	-111	-2,420	-545	-169	-315	-5,999	-3,781	-13,969
Warehousing and storage	-5	-7	-966	-86	-1,186	-419	-3,557	-6	-636	-500	-1,394	-14,370	-23,132
Construction	-40	-306	-1,314	-336	-1,574	-1,189	-9,388	-698	-739	-1,477	-4,748	-22,626	-44,433
Manufacturing	-42	-188	-2,546	-745	-4,435	-3,301	-13,752	-254	-1,858	-3,514	-11,004	-77,117	-118,758
Seafood Processing	-11,641	-66,123	-31,118	-8,817	-122,106	-385,807	-246,882	-306	-121,505	-76,908	-79,358	0	-1,150,570
Ice	0	-22	-182	-1	-136	-44	-1,084	-42	-187	-464	-143	-1,988	-4,292
Boat Building	-14	-593	-217	-7	-50	-16	-431	-21	-22	-4,166	-170	-1,493	-7,199
Paperboard Containers	0	0	-25	-6	-38	-82	-251	0	-91	-108	-255	-1,951	-2,807
Trade	-200	-1,095	-5,669	-1,331	-9,348	-5,863	-28,895	-2,871	-4,734	-6,925	-21,271	-106,521	-194,724
Seafood Dealers	0	-8,497	-10,263	-197	-97,289	-14,251	-67,932	-32,083	-53,488	-74,352	-74,800	0	-433,152
Fish Exchanges / Auctions	0	0	-47,527	0	0	-14,486	-3,458	0	-14,334	0	0	0	-79,805
Wholesale Trade	-88	-709	-5,434	-547	-12,132	-8,010	-61,612	-1,011	-4,742	-7,792	-29,467	-129,163	-260,706
Finance, Insurance and Real Estate	-26	-404	-4,617	-269	-5,145	-2,542	-46,945	-972	-1,149	-6,308	-26,069	-85,563	-180,008
Services	-507	-3,112	-20,689	-3,919	-27,543	-22,247	-195,283	-8,423	-12,479	-32,204	-99,285	-423,963	-849,655
Government	-17	-143	-467	-2,408	-1,043	-560	-6,263	-548	-431	-753	-1,515	-12,115	-26,263
Total	-15,447	-358,146	-411,988	-289,198	-574,675	-743,366	-988,949	-331,972	-502,407	-510,307	-662,314	-1,040,162	-6,428,930

Table 13. Total Mid-Atlantic Coastal Region Income Impacts (2003 $'s)

Sector	NY Seacoast NY	NJ North NJ	NJ South NJ	DE State DE	MD West MD	MD East MD	VA North VA	VA South VA	VA East VA	NC North NC	NC Central NC	NC South NC	Non-Maritime Mid-Atlantic	Total Mid-Atlantic
Commercial Fishing							Income ($'s)							
Inshore Lobster Traps	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Offshore Lobster Traps	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large Bottom Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Bottom Trawl	-283,046	0	0	0	0	0	0	0	0	0	0	0	0	-283,046
Small Bottom Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large Scallop Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Scallop Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Small Scallop Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Surf Clam, Ocean Quahog Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Small Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sink Gillnet	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diving Gear	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Midwater Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fish Pots and Traps	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bottom Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Mobile Gear	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Fixed Gear	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hand Gears	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	-613	-376	-3,723	0	0	0	0	0	0	0	0	0	-4,243	-8,955
Mining	-2,231	-261	-18	0	0	0	0	0	0	0	0	0	-291	-2,802
Transportation, Communications and Public Utilities	-130,824	-59,437	-42,630	0	0	0	0	0	0	0	0	0	-10,989	-243,880
Water Transportation	-10,871	-6,487	-2,718	0	0	0	0	0	0	0	0	0	-368	-20,444
Warehousing and storage	-5,727	-11,805	-6,776	0	0	0	0	0	0	0	0	0	-1,398	-25,706
Construction	-21,951	-7,194	-8,514	0	0	0	0	0	0	0	0	0	-2,202	-39,860
Manufacturing	-26,436	-29,289	-22,748	0	0	0	0	0	0	0	0	0	-7,505	-85,978
Seafood Processing	-103,641	-504	-683	0	0	0	0	0	0	0	0	0	0	-104,828
Ice	-1,386	-241	-541	0	0	0	0	0	0	0	0	0	-193	-2,362
Boat Building	-7	-3	-2,825	0	0	0	0	0	0	0	0	0	-145	-2,980
Paperboard Containers	-483	-680	-362	0	0	0	0	0	0	0	0	0	-190	-1,714
Trade	-79,241	-36,859	-41,000	0	0	0	0	0	0	0	0	0	-10,366	-167,466
Seafood Dealers	-84,411	-1,218	-94	0	0	0	0	0	0	0	0	0	0	-85,722
Fish Exchanges / Auctions	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wholesale Trade	-156,921	-79,680	-64,215	0	0	0	0	0	0	0	0	0	-12,570	-313,386
Finance, Insurance and Real Estate	-193,467	-41,994	-28,334	0	0	0	0	0	0	0	0	0	-8,327	-272,121
Services	-550,348	-162,366	-161,934	0	0	0	0	0	0	0	0	0	-41,258	-915,906
Government	-21,088	-5,781	-4,603	0	0	0	0	0	0	0	0	0	-1,179	-32,651
Total	-1,672,693	-444,174	-391,719	0	0	0	0	0	0	0	0	0	-101,224	-2,609,810

Table 14. Total New England Coastal Region Employment Impacts (2003)

Sector	Downeast ME	Upper Mid-Coast ME	Lower Mid-Coast ME	Southern ME	NH Seacoast NH	Gloucester MA	Boston MA	Cape & Islands MA	New Bedford MA	Rhode Island RI	CT Seacoast CT	Non-Maritime New England	Total New England
Commercial Fishing							Employment (Jobs)						
Inshore Lobster Traps	0	0	0	0	0	0	0	0	0	0	0	0	0
Offshore Lobster Traps	0	0	0	0	0	0	0	0	0	0	0	0	0
Large Bottom Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Bottom Trawl	0	-8	-8	-8	-8	-8	-8	-8	-8	-8	-8	0	-80
Small Bottom Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0
Large Scallop Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Scallop Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0
Small Scallop Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0
Surf Clam, Ocean Quahog Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0
Small Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0
Sink Gillnet	0	0	0	0	0	0	0	0	0	0	0	0	0
Diving Gear	0	0	0	0	0	0	0	0	0	0	0	0	0
Midwater Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0
Fish Pots and Traps	0	0	0	0	0	0	0	0	0	0	0	0	0
Bottom Longline	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Mobile Gear	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Fixed Gear	0	0	0	0	0	0	0	0	0	0	0	0	0
Hand Gears	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	-3	-3
Mining	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation, Communications and Public Utilities	0	0	0	0	0	0	-1	0	0	0	0	-2	-4
Water Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0
Warehousing and storage	0	0	0	0	0	0	0	0	0	0	0	0	-1
Construction	0	0	0	0	0	0	0	0	0	0	0	-1	-1
Manufacturing	0	0	0	0	0	0	0	0	0	0	0	-2	-2
Seafood Processing	-1	-3	-1	0	-4	-7	-5	0	-4	-2	-2	0	-27
Ice	0	0	0	0	0	0	0	0	0	0	0	0	0
Boat Building	0	0	0	0	0	0	0	0	0	0	0	0	0
Paperboard Containers	0	0	0	0	0	0	0	0	0	0	0	0	0
Trade	0	0	0	0	0	0	-1	0	0	0	-1	-5	-8
Seafood Dealers	0	0	0	0	-1	0	-1	0	-1	-1	-1	0	-6
Fish Exchanges / Auctions	0	0	-2	0	0	0	0	0	0	0	0	0	-3
Wholesale Trade	0	0	0	0	0	0	-1	0	0	0	0	-3	-4
Finance, Insurance and Real Estate	0	0	0	0	0	0	-1	0	0	0	0	-2	-4
Services	0	0	-1	0	-1	-1	-4	0	0	-1	-2	-14	-25
Government	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	-1	-11	-12	-9	-15	-17	-22	-9	-14	-13	-15	-31	-168

Table 15. Total Mid-Atlantic Coastal Region Employment Impacts (2003)

Sector	NY Seacoast NY	NJ North NJ	NJ South NJ	DE State DE	MD West MD	MD East MD	VA North VA	VA South VA	VA East VA	NC North NC	NC Central NC	NC South NC	Non-Maritime Mid-Atlantic	Total Mid-Atlantic
Commercial Fishing							Employment (Jobs)							
Inshore Lobster Traps	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Offshore Lobster Traps	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large Bottom Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Bottom Trawl	-9	0	0	0	0	0	0	0	0	0	0	0	0	-9
Small Bottom Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Large Scallop Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Medium Scallop Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Small Scallop Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Surf Clam, Ocean Quahog Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Small Dredge	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sink Gillnet	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diving Gear	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Midwater Trawl	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fish Pots and Traps	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bottom Longline	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Mobile Gear	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Fixed Gear	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hand Gears	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	-1
Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation, Communications and Public Utilities	-2	-1	-1	0	0	0	0	0	0	0	0	0	0	-4
Water Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Warehousing and storage	0	0	0	0	0	0	0	0	0	0	0	0	0	-1
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	-1
Manufacturing	-1	0	0	0	0	0	0	0	0	0	0	0	0	-2
Seafood Processing	-2	0	0	0	0	0	0	0	0	0	0	0	0	-2
Ice	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boat Building	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Paperboard Containers	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trade	-3	-1	-2	0	0	0	0	0	0	0	0	0	0	-6
Seafood Dealers	-1	0	0	0	0	0	0	0	0	0	0	0	0	-1
Fish Exchanges / Auctions	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wholesale Trade	-2	-1	-1	0	0	0	0	0	0	0	0	0	0	-5
Finance, Insurance and Real Estate	-2	-1	-1	0	0	0	0	0	0	0	0	0	0	-4
Services	-12	-4	-4	0	0	0	0	0	0	0	0	0	-1	-21
Government	0	0	0	0	0	0	0	0	0	0	0	0	0	-1
Total	-35	-9	-9	0	0	0	0	0	0	0	0	0	-3	-56

APPENDIX A
Bridge between Expenditures and IMPLAN Pro Sectors

The expenditures by harvesters, seafood wholesalers, fish exchanges/auctions, and seafood processors were allocated across a number of industry sectors contained in the NERIOM. If an expense was assumed to occur at the retail level, transportation, wholesale, and retail margins were also included. This Appendix shows the bridge that we created to allocate each industry expenditure item to its appropriate IMPLAN Pro sector or sectors.

Harvester Expenditures

Association Fees

IMPLAN Sector	Sector Title	Proportion
493	Civic, Social, Professional and Similar Organizations	1
	Total	1

Association fees were allocated to establishments primarily engaged in promoting the business interests of their members. These establishments conduct research on new products and services, develop market statistics, lobby public officials, or publish newsletters, books, or periodicals for distribution to their members.

Bait: Hand Gear Vessels

IMPLAN Sector	Sector Title	Proportion
394	Truck Transportation	.0012
400	Warehousing and Storage	.0002
390	Wholesale Trade	.1641
393	Water Transportation	.0190
954-976	Medium Bottom Trawl, Bait	.8155
	Total	1

For the most part, a large portion of the bait used by hand gear vessels in the Northeast is locally landed squid. Since the bulk of squid landings in the Northeast generally occur aboard otter trawl vessels, bait purchases were allocated to medium bottom trawl bait sectors. However, it was assumed that the purchases occurred at the wholesale level so transportation and storage margins were included. Squid purchases by hand gear vessels in a particular sub-region were allocated across medium bottom trawl bait sectors in the state where the sub-region was located. The relative importance of each sub-region's medium bottom trawl bait sector's output value to total state-level output was used to allocate bait purchases across sub-regions within a state.

Bait: Lobster Vessels

IMPLAN Sector	Sector Title	Proportion
394	Truck Transportation	.0012
400	Warehousing and Storage	.0002
390	Wholesale Trade	.1641
393	Water Transportation	.0190
931-953	Mid-Water Trawl, Bait	.8155
	Total	1

In the NERIOM it was assumed that the bait used by lobster vessels is locally landed herring or mackerel. Since the bulk of herring and mackerel landings generally occur aboard midwater trawl vessels, bait purchases were allocated to midwater trawl bait sectors. However, it was assumed that the purchases occurred at the wholesale level so transportation and storage margins were included. Herring and mackerel purchases by hand gear vessels in a particular sub-region were allocated across midwater trawl bait sectors in the state where the sub-region was located. The relative importance of each sub-region's midwater trawl bait sector's output value to total state-level output was used to allocate bait purchases across sub-regions within a state.

Bait: Longline Vessels

IMPLAN Sector	Sector Title	Proportion
394	Truck Transportation	.0012
400	Warehousing and Storage	.0002
390	Wholesale Trade	.1641
393	Water Transportation	.0190
931-976	Mid-Water Trawl, Bait and Medium Bottom Trawl, Bait	.8155
	Total	1

Commonly used bait in the Northeast longline industry is frozen squid, mackerel, and herring. Since the bulk of these landings in the Northeast occur aboard otter trawl vessels and midwater trawl vessels, bait purchases were allocated to both medium bottom trawl bait sectors and midwater trawl bait sectors. However, it was assumed that the purchases occurred at the wholesale level so transportation and storage margins were included. Bait purchases by longline vessels in a particular sub-region were allocated across medium bottom trawl bait sectors and midwater trawl bait sectors in the state where the sub-region was located. The relative importance of each sub-region's medium bottom trawl bait sector's output value and midwater trawl bait sector to total state-level output was used to allocate bait purchases across sub-regions within a state.

Bank Service Charge

IMPLAN Sector	Sector Title	Proportion
430	Monetary Authorities and Depository Credit Institutions	1
	Total	1

Bank service charges, both real (fees, points) and imputed (services for which no fee is charged), occur every time a loan is dispersed. These charges make up the output of financial institutions. The annual fee for these services in 2001 was calculated by assuming the average charge was 2% of the principle divided by the average life of the loan.

Consignment

IMPLAN Sector	Sector Title	Proportion
459	Other Support Services	1
	Total	1

Consignment costs are fees paid to an independent agent or broker that sells harvesters' seafood. These services may also include bartering, packaging, and labeling. Sales of seafood by harvesters through actual fish exchanges/auctions, however, were not classified as consignment expenditures. As previously indicated, 23 fish exchange/auction sectors were added to the model to account for those types of transactions.

Fish Exchange/Auction

IMPLAN Sector	Sector Title	Proportion
927-930	Fish Exchange/Auction	1
	Total	1

Commercial harvesters that use fish exchange/auction houses to sell their landings are generally charged about 7 cents per pound. Thus, fees for utilizing this service were allocated to the 4 fish exchange sectors in the NERIOM. The relative ex-vessel value of landings that was sold through a fish exchange sector, by each harvesting sector in the NERIOM, was used to allocate expenditures across the four fish exchange sectors. The 2001 Northeast Dealer data base provided this information.

Fuel and Lubricants

IMPLAN Sector	Sector Title	Proportion
142	Petroleum Refineries	0.393794
390	Wholesale Trade	0.361077
392	Rail Transportation	0.006754
393	Water Transportation	0.005192
394	Truck Transportation	0.008658
396	Pipeline Transportation	0.004953
407	Gasoline Stations	0.219571
	Total	1

The default margin table for Sector 142 in IMPLAN Pro was used to allocate purchases of fuel and lubricants.

Gear Replacement: Lobster Vessels

IMPLAN Sector	Sector Title	Proportion
103	Other Miscellaneous textile product mills	0.09669
242	Spring and wire product manufacturing	0.406902
390	Wholesale Trade	0.019952
391	Air Transportation	0.007183
392	Rail Transportation	0.007981
394	Truck Transportation	0.034318
404	Building material and garden supply stores	0.426975
	Total	1

Gear replacement expenditures were assumed to be for replacement of pots and lines. Replacement of pots was allocated to Sector 242 which encompasses the construction of fabricated wire products. Replacement of lines was allocated to sector 103 which includes the production of cordage and twine. It was assumed that 80% of purchase price was for replacement of pots and 20% for replacement of lines. These items are usually purchased at the wholesale level so the default IMPLAN Pro margins associated with Sector 242 were also included.

Groceries

IMPLAN Sector	Sector Title	Proportion
1	Oilseed farming	6.36E-05
2	Grain farming	0.000379
3	Vegetable and melon farming	0.022642
4	Tree nut farming	0.000749
5	Fruit farming	0.014302
6	Greenhouse and nursery production	0.000652
10	All other crop farming	0.000203
12	Poultry and egg production	0.006205
15	Forest nurseries, forest products, and timber	0.000137
26	Other nonmetallic mineral mining	1E-05
46	Dog and cat food manufacturing	0.016556
47	Other animal food manufacturing	0.002251
48	Flour milling	0.00234
49	Rice milling	0.001427
51	Wet corn milling	0.002738
52	Soybean processing	7.65E-05
54	Fats and oils refining and blending	0.004478
55	Breakfast cereal manufacturing	0.016116
56	Sugar manufacturing	0.005154
57	Confectionery manufacturing from cacao beans	0.003429
58	Confectionery manufacturing from purchased chocolate	0.015461

59	Nonchocolate confectionery manufacturing	0.01315
60	Frozen food manufacturing	0.035386
61	Fruit and vegetable canning and drying	0.051314
62	Fluid milk manufacturing	0.040036
63	Creamery butter manufacturing	0.002148
64	Cheese manufacturing	0.014711
65	Dry, condensed, and evaporated dairy products	0.008433
66	Ice cream and frozen dessert manufacturing	0.005012
67	Animal, except poultry, slaughtering	0.057514
68	Meat processed from carcasses	0.054934
70	Poultry processing	0.027721
72	Frozen cakes and other pastries manufacturing	0.005509
73	Bread and bakery product, except frozen, manufacturing	0.046437
74	Cookie and cracker manufacturing	0.016265
75	Mixes and dough made from purchased flour	0.009065
76	Dry pasta manufacturing	0.003576
77	Tortilla manufacturing	0.002269
78	Roasted nuts and peanut butter manufacturing	0.004765
79	Other snack food manufacturing	0.01767
80	Coffee and tea manufacturing	0.012974
81	Flavoring syrup and concentrate manufacturing	0.005455
82	Mayonnaise, dressing, and sauce manufacturing	0.00848
83	Spice and extract manufacturing	0.007112
84	All other food manufacturing	0.018899
85	Soft drink and ice manufacturing	0.06019
171	Other miscellaneous chemical product manufacturing	0.000167
390	Wholesale trade	0.098877
391	Air transportation	0.000487
392	Rail transportation	0.002832
393	Water transportation	0.001729
394	Truck transportation	0.013268
399	Couriers and messengers	0.001554
400	Warehousing and storage	0.000889
402	Furniture and home furnishings stores	9.66E-05
404	Building material and garden supply stores	0.001584
405	Food and beverage stores	0.196583
407	Gasoline stations	0.016591
410	General merchandise stores	0.006296
411	Miscellaneous store retailers	0.00834
500	Noncomparable imports	0.006314
	Total	1

IMPLAN Pro's Personal Consumption Expenditure (PCE) vector 1111 was chosen to approximate the industries involved in the manufacturing of groceries purchased by commercial fishermen. The Bureau of Economic Analysis creates this expenditure vector for their work on national average benchmark input-output tables. The PCE vector represents the national average expenditure pattern for groceries. At the time of this writing, IMPLAN Pro's PCE vector 1111 was developed from SIC coded sectors. The NERIOM, however, is based on IMPLAN Pro's new NAICS coding system that was implemented in conjunction with the release of the 2001 data. Thus, it was necessary to convert the old SIC-based IMPLAN Pro codes into the new NAICS-based IMPLAN Pro codes. The developers of the IMPLAN Pro system provided the bridge from which these conversions were made. The majority of the default conversions were maintained in the NERIOM. However, purchases associated with the two default seafood sectors (i.e., commercial fishing and seafood product preparation and packaging) were reallocated to Sector 60 (frozen food manufacturing) to better reflect likely consumption habits aboard commercial fishing vessels.

Ice

IMPLAN Sector	Sector Title	Proportion
85	Soft drink and ice manufacturing	0.628331
390	Wholesale trade	0.10275
392	Rail transportation	0.000222
393	Water transportation	3.14E-05
394	Truck transportation	0.006453
405	Food and beverage stores	0.193154
407	Gasoline stations	0.069058
	Total	1

The default margin table for Sector 85 (Soft drink and ice manufacturing) in IMPLAN Pro was used to allocate purchases of ice.

Insurance: Boat

IMPLAN Sector	Sector Title	Proportion
427	Insurance Carriers	1
	Total	1

Fees for insurance were applied to IMPLAN Pro sector 427 (Insurance carriers). This sector includes establishments primarily engaged in underwriting and assuming the risk of insurance policies. Another insurance sector is included in IMPLAN Pro that contains businesses that act as agents or brokers in selling insurance policies, but this sector is similar to a margin sector and its production function does not account for the actual cost of the insurance policy. Sector 427 accounts for the underwriting cost and includes reimbursement to agents and brokers for their fees.

Insurance: Captain and Sternman

IMPLAN Sector	Sector Title	Proportion
Value-Added	Employee Compensation	1
	Total	1

Employee compensation in IMPLAN Pro includes all payroll costs, including benefits such as health and life insurance.

Interest Payment: Short term Operating Loans

IMPLAN Sector	Sector Title	Proportion
Value-Added	Other Property Type Income	1
	Total	1

In most input-output models, such as IMPLAN Pro, interest payments are not paid directly to an industry, they are included in the value-added sector Other Property Type Income.

Interest Payment: Vessel

IMPLAN Sector	Sector Title	Proportion
Value-Added	Other Property Type Income	1
	Total	1

Interest payments were allocated to the value-added sector Other Property Type Income.

Miscellaneous Expenses: Gear, Hotel, Telephone, (excludes lobster vessels)

IMPLAN Sector	Sector Title	Proportion
103	Other Miscellaneous Textile Product Mills	0.35619931
390	Wholesale Trade	0.08591825
391	Air Transportation	0.00402798
392	Rail Transportation	0.00026973
394	Truck Transportation	0.01381022
408	Clothing and Clothing Accessories Stores	0.10850381
410	General Merchandise Stores	0.16925327
412	Nonstore Retailers	0.10936058
422	Telecommunications	0.05088562
479	Hotels and Motels	0.10177125
	Total	1

A miscellaneous expense category was included in both the UMASS and URI CMER studies. The preceding allocation of expenditures is based on the responses that were filled in for this question on the surveys. Responses generally included additional gear purchases (70%), hotel expenditures (20%), and expenses for phone services while at sea (10%). Gear purchases were allocated to Sector 103 for ropes and twines; hotel expenses to Sector 479; and phone fees to Sector 422. Also included were the default margins for Sector 103 since rope and twine are usually purchased at the wholesale and retail level.

Mooring, Dockage, Haulout

IMPLAN Sector	Sector Title	Proportion
478	Other Amusement, Gambling, and Recreation Industries	1
	Total	1

IMPLAN Pro Sector 478 includes the activities of marinas. Marinas usually offer mooring, dockage, and haulout services for a fee.

Loading, Unloading

IMPLAN Sector	Sector Title	Proportion
478	Other Amusement, Gambling, and Recreation Industries	1
	Total	1

Lumpers fees were assumed to be paid to marina employees. The activities of marinas are included in IMPLAN Pro Sector 478.

Permits and License Fees

IMPLAN Sector	Sector Title	Proportion
Value-Added	Indirect Business Taxes	1
	Total	1

Permit and license fees in an IMPLAN Pro model are allocated to value-added in indirect business taxes. These are fees that are paid during the normal operation of a business.

Principal Payment: Short term Operating Loans for Lobster Vessels

IMPLAN Sector	Sector Title	Proportion
103	Other Miscellaneous textile product mills	0.09669
242	Spring and wire product manufacturing	0.406902
390	Wholesale Trade	0.019952
391	Air Transportation	0.007183
392	Rail Transportation	0.007981
394	Truck Transportation	0.034318
404	Building material and garden supply stores	0.426975
	Total	1

Short term operating loans for lobster vessels were assumed to cover gear replacement costs for pots and lines. Following the same expenditure pattern delineated above for gear replacement costs, replacement of pots was allocated to Sector 242 and replacement of lines to sector 103. It was assumed that 80% of the purchase price was for replacement of pots and 20% for replacement of lines. These items are usually purchased at the wholesale level so the default IMPLAN Pro margins associated with Sector 242 were also included.

Principal Payment: Vessel

IMPLAN Sector	Sector Title	Proportion
357	Ship Building and Repairing	1
	Total	1

Principal payments for vessels were allocated to Sector 357 Ship Building and Repairing. This sector includes establishments engaged in the construction and repair of fishing boats.

Professional Fees

IMPLAN Sector	Sector Title	Proportion
438	Accounting and Bookkeeping Services	1
	Total	1

Businesses engaged in accounting and bookkeeping services are classified in IMPLAN Pro Sector 438 Accounting and Bookkeeping Services.

Profits: Owner

IMPLAN Sector	Sector Title	Proportion
Value-Added	Proprietary Income	1
	Total	1

Payments received by vessel owners as income are known as value-added payments and are classified as proprietary income in an IMPLAN Pro model.

Repair & Maintenance: Electronics

IMPLAN Sector	Sector Title	Proportion
484	Electronic Equipment Repair and Maintenance	1
	Total	1

Expenditures for electronic repairs aboard commercial fishing vessels were allocated to Sector 484 Electronic Equipment Repair and Maintenance.

Repair & Maintenance: Fishing Gear, Equipment

IMPLAN Sector	Sector Title	Proportion
485	Commercial Machinery Repair and Maintenance	1
	Total	1

Establishments engaged in commercial equipment repair, including hydraulic equipment repair and freezer repair are classified in IMPLAN Pro Sector 485 Commercial Machinery Repair and Maintenance.

Repair & Maintenance: Vessel and Engine at Boat Yard

IMPLAN Sector	Sector Title	Proportion
357	Ship Building and Repairing	1
	Total	1

Vessel and engine repairs conducted at the boat yard were allocated to IMPLAN Pro Sector 357 Ship Building and Repairing.

Repair & Maintenance: Vessel and Engine by Owner

IMPLAN Sector	Sector Title	Proportion
244	Turned Product and Screw, Nut, and Bolt Manufacturing	0.451699
390	Wholesale Trade	0.160032
391	Air Transportation	0.00345
394	Truck Transportation	0.011146
404	Building Material and Garden Supply Stores	0.373673
	Total	1

Vessel and engine repairs conducted by the owner were allocated to establishments primarily engaged in manufacturing metal bolts, nuts, screws, rivets, and washers, and other industrial fasteners. These establishments are classified in IMPLAN Pro Sector 244.

Shorefront Expenses: Rent, Utilities, Supplies, Advertising

IMPLAN Sector	Sector Title	Proportion
30	Power Generation and Supply	0.2
133	Stationery and Related Product Manufacturing	0.3
431	Real Estate	0.4
447	Advertising and Related Services	0.1
	Total	1

Onshore expenses, generally due to the ownership of storage facilities or office space, were allocated to four IMPLAN Pro sectors. Average rents comprised 40% of the shorefront expenses and were allocated to the Real Estate Sector. Utilities were assumed to be for electricity and were allocated to IMPLAN Pro Sector 30 Power Generation and Supply (20%). Supplies averaged 30% of onshore expenses and were assumed to be for stationery and related products (Sector 133). Finally, advertising expenses comprised 10%, on average, of onshore expenses and were allocated to IMPLAN Pro Sector 447.

Taxes

IMPLAN Sector	Sector Title	Proportion
Value-Added	Indirect Business Taxes	1
	Total	1

Tax expenditures included in this sector consist of excise taxes, property taxes, and sales taxes, but exclude income taxes paid by businesses. These fees were allocated to IMPLAN Pro's Value-Added Sector Indirect Business Taxes.

Miscellaneous Trip Supplies

IMPLAN Sector	Sector Title	Proportion
100	Curtain and Linen Mills	0.00856
103	Other Miscellaneous Textiles	0.007716
125	Paper and Paperboard Mills	0.040025
126	Paperboard Container Manufacturing	0.180838
130	Coated and Uncoated Paper Bag Manufacturing	0.02375
163	Soap and Other Detergent Manufacturing	0.047259
164	Polish and other Sanitation Good Manufacturing	0.040146
172	Plastics Packaging Materials	0.054372
177	Plastic Plumbing Fixtures and all other Plastics	0.008319
179	Tire Manufacturing	0.006631
278	Ac, Refrigeration	0.007234
286	Other Engine Equipment Manufacturing	0.074987
289	Air and Gas Compressor Manufacturing	0.004581
321	Watch, Clock, and Other Measuring and Controlling Devices	0.007475
325	Electric Lamp Bulb and Part Manufacturing	0.012176
333	Electric Power and Specialty Transformer Manufacturing	0.005184
338	Primary Battery Manufacturing	0.010247
350	Motor Vehicle Parts Manufacturing	0.0475
392	Rail Transportation	0.001
390	Wholesale Trade	0.161
404	Building Material & Gardening Supplies	0.001
405	Food and Beverage Stores	0.185
407	Gasoline Stations	0.013
410	General Merchandise Stores	0.014
411	Miscellaneous Store Retail	0.038
	Total	1

Trip supplies consist of expenditures for chemical cleaning products, brooms, mops, soaps and detergents, boxes, plastic packaging materials, bulbs, furnishings, plumbing accessories, and miscellaneous machine parts. Expenditures for these items were allocated to manufacturing sectors according to proportions contained the default IMPLAN Pro commercial fishing sector's production function. Specifically, we summed the absorption coefficients associated with the manufacturing sectors that produce the aforementioned items and then determined the proportion that each sector represented. These proportions were used to allocate miscellaneous trip expenditure estimates to the correct IMPLAN Pro manufacturing sector. Average wholesale, transportation, and retail margins across all of the manufacturing sectors were calculated and included in the expenditure estimates since the majority of these purchases occur at the retail level.

Vehicles (20% Repair, 80% Fuel and Lubricants)

IMPLAN Sector	Sector Title	Proportion
483	Automotive Repair and Maintenance	0.2
142	Petroleum Refineries	0.315036
390	Wholesale Trade	0.288862
392	Rail Transportation	0.005403
393	Water Transportation	0.004154
394	Truck Transportation	0.006926
396	Pipeline Transportation	0.003962
407	Gasoline Stations	0.175657
	Total	1

Vehicle expenses were assumed to cover repair (20%) and fuel (80%) costs. Automotive repair services were allocated to IMPLAN Pro Sector Automotive Repair and Maintenance, and the default margin table for Petroleum Refineries was used to allocate expenses for fuel and lubricants.

Wages: Captain and Crew

IMPLAN Sector	Sector Title	Proportion
Value-Added	Employee Compensation	1
	Total	1

The wages and salaries of employees were allocated to the Value-Added Sector Employee Compensation.

Seafood Wholesale Dealer Expenditures

Many of the commodities and services purchased by commercial harvesters are also purchased by wholesale seafood dealers. Therefore, to avoid duplication, detailed descriptions of wholesale dealer expenditures are only provided for products and services that were not purchased by commercial harvesters. Please see the Commercial Harvester Expenditure section for descriptions of the following expenses that were also incurred by wholesale seafood dealers: bank service charges, ice, insurance, interest expense, professional fees, profits, vehicles, taxes, and wages.

Advertising

IMPLAN Sector	Sector Title	Proportion
447	Advertising and Related Services	1
	Total	1

Advertising fees were allocated to IMPLAN Pro Sector 447 Advertising and Related Services.

Packaging: Boxes

IMPLAN Sector	Sector Title	Proportion
126	Paperboard Container Manufacturing	0.581083
390	Wholesale Trade	0.016356
391	Air Transportation	0.000463
392	Rail Transportation	0.026539
394	Truck Transportation	0.130381
411	Miscellaneous Store Retailers	0.245178
	Total	1

The default IMPLAN Pro margin table for Sector 126 Paperboard Container Manufacturing was used to allocate packaging expenses.

Rent

IMPLAN Sector	Sector Title	Proportion
431	Real Estate	1
	Total	1

Industries in the Real Estate Sector include establishments that are primarily engaged in the renting or leasing real estate to others, including the leasing of mini warehouses and storage buildings.

Repair & Maintenance: Building

IMPLAN Sector	Sector Title	Proportion
458	Services to Buildings and Dwellings	1
	Total	1

Establishments contained in Sector 458 Services to Buildings and Dwellings are primarily engaged in cleaning and maintaining building interiors, and providing landscape care and maintenance.

Shipping

IMPLAN Sector	Sector Title	Proportion
394	Truck Transportation	1
	Total	1

The majority of seafood landings in the Northeast are shipped by truck to Northeast wholesale dealers. Therefore, IMPLAN Pro Sector 394 Truck Transportation was chosen to represent the costs associated with shipping. The Truck Transportation Sector comprises establishments primarily engaged in providing general freight trucking.

Storage

IMPLAN Sector	Sector Title	Proportion
400	Warehousing and Storage	1
	Total	1

Industries in IMPLAN Pro's Warehousing and Storage Sector are primarily engaged in operating warehousing and storage facilities for general merchandise.

Utilities: Electric

IMPLAN Sector	Sector Title	Proportion
30	Power Generation and Supply	1
	Total	1

IMPLAN Pro's Power Generation and Supply Sector comprises establishments primarily engaged in generating, transmitting, and/or distributing electric power.

Utilities: Gas

IMPLAN Sector	Sector Title	Proportion
31	Natural Gas Distribution	1
	Total	1

Establishments in IMPLAN Pro's Natural Gas Distribution Sector are primarily engaged in transmitting and distributing gas to final consumers.

Utilities: Telephone

IMPLAN Sector	Sector Title	Proportion
422	Telecommunications	1
	Total	1

The Telecommunications Sector in IMPLAN Pro contains businesses that are primarily engaged in operating, maintaining, and/or providing access to facilities for the transmission of voice, data, text, sound, and video.

Fish Exchange/Auction Expenditures

Commodities and services purchased by fish exchange/auction establishments in the NERIOM were assumed to be identical to those purchased by wholesale seafood dealers, with the exception of shipping fees, profits, and truck maintenance. Harvesters who sell their product through auction houses are assumed to pay for the transportation fees in the NERIOM, and owner profits were assumed to be zero since these establishments generally operate as nonprofit entities.

Expenditures included in the fish exchange/auction production function consisted of fees for advertising, bank service charges, ice, insurance, interest, mortgage payments, packaging supplies, professional fees, rent, building maintenance, storage, taxes, utilities, and employee wages. The IMPLAN Pro sectors associated with these expenses were discussed in the preceding two sections.

Seafood Processor Expenditures

The IMPLAN Pro default production function for Sector 71 Seafood Product Preparation and Packaging was used to allocate purchases by seafood processors in all 23 coastal sub-regions in the NERIOM to their appropriate IMPLAN Pro sector. This production function includes over 140 industry sectors that sell commodities and services to the 23 seafood processing sectors in the NERIOM.

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