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Data Needs for Economic Analysis of Fishery Management Regulations

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Acronyms

CBA	=	cost-benefit analysis
FMP	=	fishery management plan
IOA	=	input-output analysis
NMFS	=	National Marine Fisheries Service
RIR	=	regulatory impact review

INTRODUCTION

JUSTIFICATION

Executive Order 12866 signed by President Clinton on September 30, 1993, directs regulatory agencies to evaluate, among other things, economic consequences of proposed fishery management regulations and to choose regulatory measures that maximize *net national benefits*¹:

In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. Further, in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach (President 1993).

The Fishery Conservation and Management Act of 1976 (also referred to as the Magnuson Act) also calls for managers to “promote efficiency in the utilization of fishery resources” (Fishery Conservation and Management Act of 1976), where efficiency is viewed by economists to mean *economic efficiency*, *i.e.*, maximizing the net national benefits or *net economic value* from a fish resource². At a minimum, the National Marine Fisheries Service’s (NMFS) “Guidelines on Regulatory Analysis of Fishery Management Actions” (NMFS 1995), which guides the regulatory impact review (RIR) process of fishery management plans (FMP), calls for “a full qualitative analysis of expected incremental benefits and costs” from a management alternative.

While all of these regulatory actions focus on evaluating economic consequences of fishery management alternatives, specific economic data needed to meet national efficiency goals have not been identified³. This document identifies and delineates the overall economic data needed for management of living marine resources; it is intended to help achieve an understanding and coordination of the economic data necessary to capture immediate and long-term consequences of management actions. This document does not suggest an implementation strategy for data collection, prioritize data needs, or account for the cost of data collection. While these are topics worthy of discussion, our efforts focus exclusively on identifying economic data needs.

GOALS

Collection of the data items illustrated in this document are required to achieve three fundamental goals:

1. *To understand the value of the resource and to recognize its importance to the economy and users.* This involves describing and enumerating ways in which benefits are derived from the resource, measuring capital and labor devoted to those uses, determining the importance of resource use to various users, and describing institutions surrounding those uses.
2. *To measure the flow of net benefits derived from various uses and to understand how those benefits are generated.* This entails technically describing productive activities (*i.e.*, inputs, processes, outputs) in their temporal and spatial setting, measuring costs and benefits (*e.g.*, consumer benefits, industry income) in each transformation, and determining the decision processes of producers.
3. *To preserve, conserve, enhance, and improve the flow of net benefits from the endowment.* This requires utilizing information derived from the above efforts and other information to seek ways to improve the flow of net benefits by reducing costs, defining constraints on use, evaluating tradeoffs among uses, designing improved allocations (or establishing systems that will, *e.g.*, markets), defining minimal acceptable conditions, and exploring and enhancing demand through trade.

ANALYTICAL TOOLS

To achieve these goals, economists rely on economic tools such as cost-benefit, input-output, financial, and trade analyses, as well as descriptive statistics on various economic facets of the resource and those who use it. *Cost-benefit analysis* (CBA) is the comparison of gains and losses in net economic value from a regulatory action, where net economic value is the sum of *consumer surplus* and *producer surplus*. These surpluses are measured by estimating demand and supply functions for various users of the resource.

Demand functions are estimated using information such as prices and quantities⁴ of the good under examination, as well as factors that influence demand for a good such as the price of substitutes and available incomes. *Supply functions* require information on quantities supplied (again using the appropriate units, *e.g.*, pounds of fish or number of recreational trips), output prices, and factor prices and quantities, or on production costs. Once market models are esti-

mated, net economic values can be measured by summing the surpluses. Regulatory alternatives are evaluated by comparing the expected net economic value under existing conditions with that expected under a new regulatory framework.

The majority of data elements listed in this document are used in CBA. However, we also include information useful for descriptive purposes and for input-output, financial, and trade analyses.

Input-output analysis (IOA) is used to assess changes in income, revenues, expenditures, and employment, usually on a regional basis rather than at the national perspective of CBA. IOA is most often used by manufacturers and industries, and by local and state governments, to determine changes in their market share or tax base, respectively (Edwards 1990). IOA is not used to address issues of net economic value. For instance, changes in employment predicted from an IOA are sometimes mistakenly used to argue for changes in net economic value, when, in fact, there may be no relationship. The kinds of data required for IOA are incomes and expenditures of various economic sectors. Although some of the data illustrated in this document, such as information concerning dependent industries, could be used to estimate economic impact, IOA and related analyses require substantially more information than is listed herein to describe the technical interactions among the industry, households, and export markets.

Financial analysis takes a closer look at individual players to determine how their behavior is shaped by financial constraints. **Cash flow analysis** is one kind of financial analysis that looks at the ability of firms to meet obligations given the amount and timing of cash inflows. **Financial ratios** are used to evaluate the financial performance of firms. In order to facilitate these kinds of analyses, some financial data, such as amounts of assets and liabilities, are needed.

Trade analysis is concerned with how the structure of international markets affects the utilization of domestic resources. Aspects of trade such as imports and exports can be part of CBA and IOA. Therefore, trade activity is listed as a data requirement in this document. To do a complete trade analysis, however, detailed information on tariffs and trade sanctions is required.

DATA COLLECTION DEFICIENCIES

At present, many of the economic data needed to analyze economic effects of fishery management regulations are not being collected by government agencies with fisheries responsibilities. Most data collection systems are almost completely lacking in economic considerations beyond landings and prices. As a result, economic analyses in RIRs, environmental impact statements, and environmental assessments are generally limited. Quite often, economists are forced to analyze critical aspects of fishery man-

agement decisions with insufficient data or to apply fairly specialized private-sector data and analyses developed under disparate viewpoints and guidelines.

For instance, the sole source of cost data on otter trawl vessels used in the analysis of Amendment 5 of the Northeast Multispecies FMP was tax returns of 51 trawl vessels out of 2,049 vessels holding multispecies permits (Groundfish Plan Development Team 1993). This small and non-random sample provided the basis for examining fleetwide differences in profits, **variable costs**, and labor and **fixed costs** associated with alternative regulatory actions. Similarly, limited industry data were used to estimate product mixes, prices, and input costs for evaluation of the inshore/offshore allocation decision in the Alaskan Groundfish FMP. A CBA was required despite limited availability of public-sector industry data. All offshore cost data were obtained from the American Factory Trawlers Association, a trade group representing the offshore sector (Milon 1993; Herrick *et al.* 1994).

Another result of insufficient data is that economists are often forced to choose methods that use the available data rather than use a preferred method, because the requisite data have not been collected. The data needs identified in this document should permit most foreseeable economic analyses. However, there are methods that require fewer data. Some of these methods include duality theory⁵, general equilibrium welfare analysis⁶, almost ideal demand systems⁷, and benefits transfer⁸. In certain cases, these methods are apropos, and a subset of the listed data could be collected to perform these analyses. But, in order to establish a long-term, comprehensive system for economically evaluating fisheries, the collection of all data listed herein is essential.

DATA COLLECTION PROSPECTS

Imminent changes in the way the NMFS collects fisheries statistics have prompted a reevaluation of economic data requirements. Events such as the shift from voluntary to mandatory reporting systems, and national initiatives such as the National Fisheries Statistics Strategic Planning Process, offer an opportunity to assess what information is required by economists to evaluate regulatory alternatives correctly.

Fisheries regulations are continually in a state of flux. Therefore, it is important to establish baseline economic statistics to evaluate fully the economic effects of management changes.

DATA IDENTIFICATION METHODS

Renewable marine resources (*i.e.*, wild finfish and shellfish resources, marine mammals, and other aquatic life) are used in different ways and by various user groups. Figure

1 depicts the utilization of living marine resources by various resource uses and the interactions among user groups. The first level in the figure divides resource use into five use categories: 1) seafood production from commercial harvesting, 2) seafood production from aquaculture, 3) recreation, 4) non-consumptive uses of living marine resources, and 5) subsistence and traditional uses of living marine resources.

Below each resource use category in Figure 1 are various user groups. User groups classified under seafood production from commercial harvesting are commercial harvesters (including at-sea processors), processors and wholesalers, retailers, and consumers. The seafood-production-from-aquaculture user groups are identical to those delineated under seafood production from commercial harvesting, except that commercial harvesters are replaced by aquacultural producers⁹. Recreation user groups are the provider (e.g., party or charter boat operator) and angler. Under non-consumptive uses, user groups are the provider (e.g., whale-watching boat operator or diving-boat operator) and *ecotourist*. Lastly, subsistence and traditional uses include groups of commercial-type and recreational-type harvesters, including entities with treaty rights.

This section of the document is organized by resource use, user group, and entities of interest. Each resource use is introduced with a brief discussion of the *benefits* derived from the resource. User groups are similarly introduced. The term “benefits” is defined here as the gross benefits that user groups derive from the resource, not the net benefits that are determined from a CBA in which *opportunity costs* are considered.

Within each user group there are particular entities for which information needs to be obtained. For example, in the anglers user group of the recreation use category, there are two kinds of entities: 1) party and charter boat anglers, and 2) “other” anglers (i.e., private boat anglers and on-shore anglers). In addition, for each entity, certain data are needed that represent annual or other periods, such as a trip or a month (i.e., the data period). Data can be collected every such period, every other period, or within some other interval of periods (i.e., the collection frequency). For each entity, data can be censused or sampled (i.e., the data coverage). For example, a sample (data coverage) of economic and related data on individual anglers gathered from daily trip (data period) surveys is needed every 3-5 yr (collection frequency). Table 1 shows how the data are organized and presented in the “Data Categories, Elements, and Collection Schedules” section by resource use, user groups, and entities of interest.

Data elements are specific pieces of information needed to answer economic questions. Table 2 lists and defines data elements within the annual data and other-period data subsections. In general, annual and other-period data elements are presented similarly across user groups. In some cases, this strict categorization does not make sense; some deletions and/or additions have been made based on what is sensible for an entity within a particular user group. Some

data elements, mostly identification data, are repeated in an entity’s annual and other-period data because these sets of data need to be linked together.

DATA CATEGORIES, ELEMENTS, AND COLLECTION SCHEDULES

SEAFOOD PRODUCTION FROM COMMERCIAL HARVESTING¹⁰

Economic benefits derived from seafood production from commercial harvesting are: 1) harvest-sector employee incomes and vessel revenues; 2) **value added** and employee incomes realized in processing, wholesaling, transport, and retailing; 3) consumer surplus¹¹ realized by consumers; and 4) support and supply industry incomes and revenues derived from seafood production from commercial harvesting. These benefits are augmented at various points by exporting and importing activities. Additional vessel profits and crew incomes are earned by providing harvesting services in joint venture arrangements and by adding value through on-board processing.

Commercial Harvesters

Benefits derived from commercial fisheries consist of vessel revenues and crew incomes derived from commercial harvesting of living marine resources (including incomes and profits derived from joint venture arrangements), and of support and supply industry revenues and incomes derived from such harvesting.

Figure 2 illustrates the composition of data elements for commercial harvesters.

Vessel and Related Onshore Facilities

Annual Data

Annual data elements enumerated in Table 3 provide a picture of the financial status of fishing firms and are critical in evaluating how regulations affect investments and fixed costs. Specifically, this information is needed to: 1) identify producing units and inventory capital, 2) describe benefits, 3) establish financial condition of firms, and 4) identify and describe the support industries related to the productive activity. The completeness of the description of each firm, the degree to which all firms and vessels involved in the industry are included, and the ability to distinguish vessels in a given fishery are fundamental for evaluating regulations effectively.

There is no substitute for a census of this information every year. A series of tailored questionnaires could elicit the required degree of detail without unnecessarily burden-

ing any of the firms. Sufficient information should be obtained to develop representative groups of vessels whose performance can be used in assessing regulatory change. Cooperative panels (*i.e.*, a representative group of vessel owners willing to provide information) could be developed on the basis of the census data.

Trip Data

Table 4 lists the detailed trip-level data which provide information needed for: 1) measuring major costs of regulations, and 2) describing technical interactions and production relationships. In addition, the trip-level data provide important daily and set (tow) information (*e.g.*, catch/bycatch by gear, area(s) fished, disposition of landings) required for quota and effort monitoring and in **bioeconomic modeling** to link catch/bycatch levels to supply-and-demand relationships.

Initially, it is crucial to census fishing activity for every trip in order to design reasonable strata (by time and vessel type) from which subsequent detailed sampling can be conducted.

Processors and Wholesalers

Ideally, one would like to trace the flow of product from the harvest sector to the point of final sale. Fish are imported or sold from vessels to processors and wholesalers (including truckers) who then process or deliver the product in final form to restaurants, retail outlets, other institutions, and international markets. Processors and wholesalers are heterogeneous, ranging from large multinational corporations to small cottage-industry firms (such as crab picking). Information currently available on some of these user groups is sparse.

Processor and wholesaler benefits include plant (firm) revenues and employee incomes derived from transforming the raw product into final form, and revenues and incomes derived from delivery of product (in raw form, processed form, and final product) to retail institutions (both domestic and foreign). To the extent that support and supply industries are variously related to the supply of specialized inputs to the processing and wholesaling sector (including transportation of product), then revenues and incomes of these industries are appropriately counted in the benefits of resource use.

Figure 3 illustrates the composition of data elements for processors and wholesalers.

Plants (Firms)

Annual Data

The annual data elements presented in Table 5 provide information to characterize the industry and to examine how

its structure and organization change through time. In particular, these data are needed to: 1) identify firms in the industry, their investments, and their capacities; 2) examine benefits; 3) assess the financial impact of harvest-sector management measures; and 4) assess the importance of international trade.

A complete census of firms, using processor and wholesaler permit applications, is desirable every year in order to identify the population of firms. Then, the annual data needs could be achieved by either: 1) adding appropriate questions to the applications, or 2) conducting a follow-up survey of the identified population.

Monthly Data

Table 6 presents monthly production and variable cost data which provide the basis for evaluating how costs, profits, employment, and production are affected by management regulations. This information is used in value-added studies, CBA, and for assessing the financial health of firms. Production and variable cost information are also important for tracing the flow of product between ports to assess port dependencies and transportation industries.

A census should be conducted every month until a sampling scheme is designed.

Retailers

Retail markets are a final point of sale for fishery products. Data on seafood purchased from restaurants are difficult to characterize because prices are often for a whole meal, not just a fish product. Additionally, there is usually no choice of quantity, and a visit to a restaurant is made for many reasons unrelated to the price or quantity of fish. Notwithstanding, benefits consist of revenues and employee incomes derived from the purchase of seafood (in raw, processed, or final form) by consumers, and of revenues and incomes of the support and supply industries providing specialized inputs used in the production of seafood to restaurants and retail markets.

Figure 4 shows the composition of data elements for restaurants and retail markets.

Annual Data

The annual data elements illustrated in Table 7 characterize the retail market in terms of number and type of firms, fixed costs, and investments. These data are needed to assess the financial impact of changes in: 1) supply-and-demand relationships caused by management regulations, including trade policies; and 2) final demand (consumer demand) resulting from changes in seafood preferences.

Initially, a complete census of the retail market is important to identify subgroups for sampling. Thereafter, sampling should be conducted every 3-5 yr.

Monthly Data

Table 8 illustrates monthly production and cost data which provide the basis for evaluating how changes in supply-and-demand relationships affect the number of customers served, employment, and prices and quantities of transactions by seafood species (including imports). This information is used in CBA to examine production relationships, and in value-added studies and IOA to trace the quantity and value of fish sales by product form.

A monthly data census should be conducted for 1 yr, followed by sampling every 3-5 yr.

Seafood Consumers

Benefits derived from consumption of U.S. seafood consist of consumer surplus realized by consumers in both the United States and in key foreign countries which import substantial quantities of U.S. harvests (*e.g.*, Japan, although Japan's consumer surplus would not be counted in a CBA of U.S. fisheries). When total benefits of seafood production from commercial harvesting are measured (*i.e.*, the summed benefits of harvesting, processing & wholesaling, retailing, and consumption) it is important to include consumer benefits because these constitute an essential component of the value that consumers receive from fishery resources.

Figure 5 shows the composition of data elements for seafood consumers.

Households

Annual Data

Table 9 presents the annual data items needed to identify consumers of seafood, their household characteristics, and their consumer preferences. This information is useful to: 1) estimate demand models for marketing studies, 2) examine economic effects of seafood contamination on consumers, 3) estimate consumer surplus (consumer benefits) derived from seafood consumption, 4) estimate economic effects of regulations on consumer demand, and 5) estimate economic effects of trade policies.

Stratified sampling, based on census data, at the national level would provide the requisite data. Surveys should then be conducted every 3-5 yr to capture changes in preferences and international demand.

Daily Data

Table 10 presents daily consumption data which enable researchers to understand the factors that influence the household consumption mix. These data provide the basis for analyzing how demand relationships are affected by regu-

lations, seafood contamination, trade policies, and tastes and preferences. Additionally, daily data provide information on direct effects used in IOAs of local or regional income and employment.

To understand daily choices made by seafood consumers, logbook-based studies should be undertaken every 3-5 yr. Such studies ask participants to record on a daily basis their eating and shopping habits.

SEAFOOD PRODUCTION FROM AQUACULTURE

Economic benefits derived from the aquacultural industry are: 1) employee incomes and producer revenues derived from the sale of aquacultural products; 2) value added and employee incomes realized in processing, wholesaling, transporting, and retailing; and 3) consumer surplus realized by consumers. These benefits are augmented by international trade, through either exporting final products or importing inputs to production. Additionally, aquacultural products provide benefits to the processing, wholesaling, and retail sectors.

Since processors, wholesalers, retailers, and consumers all utilize aquacultural products, data on the use of these products by each of these user groups need to be collected. Data elements for the user groups in the seafood-production-from-commercial-harvesting resource use category also apply here, but are not repeated.

Aquacultural Producers

This group covers all types of marine aquacultural operations, irrespective of the production method used or the items cultivated (*i.e.*, fish food, finfish, shellfish, aquatic plants). It also includes operations such as egg production, smolt production, and fish feed production.

Benefits derived from aquacultural production are revenues and employee incomes from growing, storing, and harvesting finfish or shellfish grown in a controlled environment, and the revenues and incomes of support and supply industries derived from aquacultural production.

Figure 6 illustrates the composition of data elements for aquacultural producers.

Production Facilities

Annual Data

Table 11 illustrates the annual descriptive, fixed-cost, and financial status information needed to develop aquacultural industry profiles, to perform financial analyses of firms, and to conduct CBA and IOA.

Since aquaculture is becoming increasingly important, a census each year of all aquacultural facilities is required.

Monthly Data

Table 12 illustrates monthly production activity and variable-cost data needs. This information contributes to the description of the aquacultural industry, helps in financial analysis of firms, is useful in CBA, and provides information on direct effects for use in IOA.

Initially, a monthly census should be undertaken; thereafter, representative firms might be sampled every 3-5 yr.

Processors and Wholesalers

See data elements for “Seafood Production from Commercial Harvesting - Processors and Wholesalers.”

Retailers

See data elements for “Seafood Production from Commercial Harvesting - Retailers.”

Seafood Consumers

See data elements for “Seafood Production from Commercial Harvesting - Seafood Consumers.”

RECREATION

Benefits derived from marine recreational fishing are: 1) crew incomes and producer revenues earned from **party boat** and **charter boat** activities; 2) consumer surplus realized by fishermen (anglers); and 3) income, employment, and production by support and supply industries generated from party and charter boat companies (recreational fishing providers), and from boat-owning, boat-renting, or onshore anglers.

Providers

Benefits derived from recreational providers (party boat and charter boat companies) consist of vessel revenues and captain and crew incomes earned from providing recreational fishing trips, including revenues earned from sale of fish and consumer goods (food, drink, tackle, T-shirts, etc.) while on board. These providers comprise part of the demand for goods and services produced by support and supply industries, thereby generating incomes and revenues in local and regional economies.

Figure 7 illustrates the composition of data elements for recreational providers.

Vessel and Related Onshore Facilities

Annual Data

The annual data elements in Table 13 represent the types of information needed to characterize the industry and to examine how regulations of fishing gear or fishing practices affect the economic value of production. In particular, data are needed to: 1) examine industry profiles to understand the constituency and organization of economic activity, 2) identify fleet size and inventory capital, 3) conduct financial analyses of firms to predict effects of regulations on solvency, and 4) assess the direct effects of regulations for use in IOAs of local or regional income and employment.

A one-time annual census of charter and party boats is needed. Subsequently, sampling should be conducted every 3-5 yr to capture entry/exit behavior.

Trip Data

Table 14 presents trip-level data needed in describing and evaluating the effects of management regulations on revenues, variable costs, and angler participation. Trip-level harvest data are essential in quota and effort monitoring, and in bioeconomic modeling to link harvest levels to supply-and-demand relationships (*i.e.*, supply of trips by providers and demand for trips by anglers). This information is used in CBA to examine changes in production relationships, and in input-output models to estimate changes in income and employment.

Initially, a 1-yr census of each vessel’s trip activity should be conducted to gain baseline knowledge on the fleet of vessels. Thereafter, annual sampling of homogeneous subgroups of vessels (e.g., by type of operation, target species, and geographic area) would be adequate.

Anglers

Angler benefits consist of consumer surplus derived from the marine recreational fishing experience. Anglers patronize support and supply industries, thereby generating incomes and revenues in local and regional economies.

Figure 8 shows the composition of data elements for marine recreational anglers.

Party or Charter Boat Anglers

Annual Data

Table 15 presents the annual data elements needed to examine profiles of marine anglers. This information is nec-

essary to: 1) identify the population of anglers, 2) identify subsistence fishermen for sociocultural studies, and 3) enumerate and describe the support and supply industries directly related to party or charter boat angler activities.

A census of charter boat and party boat anglers is impractical; instead, a census every 3-5 yr of vessels and trips could be used to estimate relevant economic relationships.

Trip Data

Table 16 presents angler trip data needed to understand the effects of regulations (*e.g.*, participation and access limits, creel limits, size limits) on the net economic value of recreational fishing. Data on harvest, preferences, and variable costs of fishing are used in demand analyses and in CBA to assess how catch rates, fish size, etc., affect demand for charter boat and party boat services.

Economic and related trip data on individual anglers should be acquired every 3-5 yr to determine structural changes or changes in preferences and demand. Daily intercepts of anglers' trips on charter boats and party boats would have to be accomplished to obtain trip-level data.

Onshore, Boat-Renting, or Boat-Owning Anglers

Annual Data

Table 17 presents the annual data elements necessary to examine profiles of marine anglers. This information is needed to: 1) identify the population of anglers, 2) identify subsistence fishermen for sociocultural studies, and 3) enumerate and describe the support and supply industries directly related to fishing from shore or boats (private/rental).

Data should be sampled every 3-5 yr using intercept surveys to examine changes in angler profiles and to estimate relevant economic relationships.

Trip Data

Table 18 presents angler trip data needed to understand the effects of management regulations (*e.g.*, participation and access limits, creel limits, size limits) on the net economic value of recreational fishing. Data on harvest, preferences, and costs of fishing (including boat operating costs) are used in demand analyses and in CBA to assess how catch rates, fish size, etc., affect demand for marine recreational fishing.

Economic and related data on individual anglers could be sampled every 3-5 yr using intercept surveys. Intercept surveys of anglers' trips would also allow estimation of total catch and effort, and an evaluation of structural changes or changes in preferences and demand.

NON-CONSUMPTIVE USES OF LIVING MARINE RESOURCES¹²

Benefits derived from non-consumptive use are: 1) crew incomes and provider revenues earned from providing non-consumptive activities, 2) ecotourist surplus (*i.e.*, benefits received in excess of viewing costs), 3) support and supply industry incomes and revenues derived from non-consumptive activities, and 4) existence values that may arise independent of use.

Providers

Benefits derived from non-consumptive providers (*e.g.*, whale-watching boats, sightseeing boats, diving boats) consist of vessel revenues and captain and crew incomes earned from providing non-consumptive trips, including revenues earned from sale of consumer goods (*e.g.*, food, drink, binoculars, T-shirts) while on board. Non-consumptive providers comprise part of the demand for goods and services produced by support and supply industries, thereby generating income and employment in local and regional economies.

Vessel and Related Onshore Facilities

The annual and trip data required for economic analysis of non-consumptive providers and related activities--both supply and demand--would be identical to those already listed for charter and party boat operations, with the obvious omission of fishing gear and harvest information, and a change in emphasis from fishing trips to wildlife observation trips.

An annual census of non-consumptive providers would initially be necessary to enumerate the population of providers and to form a basis for subsequent sampling every 3-5 yr.

Ecotourists

Individuals who receive benefits from their non-consumptive use of ocean resources are defined to be ecotourists in this document. Ecotourists either rent services of non-consumptive providers, or engage in non-consumptive activities by themselves (*i.e.*, view or enjoy some aspect(s) of the ocean environment from private boats, personal rental boats, or from shore).

Benefits consist of ecotourist surplus (*i.e.*, non-consumptive consumer surplus) derived from non-consumptive trips, and the incomes and revenues of support and supply industries generated from ecotourist activities.

Figure 9 illustrates the composition of data elements for ecotourists.

Annual Data

Table 19 presents the annual data elements needed to examine profiles of ecotourists. Individual and household information is needed to: 1) identify the ecotourist population, 2) provide descriptive data for CBA to estimate effects of regulations on net economic value of ecotourism, and 3) enumerate the support and supply industries for use in IOAs of local or regional income and employment.

Total aggregate participation should be estimated each year from a survey of non-consumptive vessels. A census of non-consumptive vessel ecotourists is impractical; instead, the census of vessels and trips could be used to conduct a stratified sampling program of ecotourists every 3-5 yr.

Trip Data

Table 20 presents trip data needed to develop a basic understanding of ecotourism. Data on ecotourists' sightings, costs, and preferences can be used in demand analyses to determine how marine animal abundance may affect demand for non-consumptive vessel services, and in CBA to estimate effects of regulations on the economic value of ecotourism.

Economic and related data on individual ecotourists might be acquired every 3-5 yr to evaluate possible structural changes or changes in preferences and demand. Economic data could be collected from add-on questionnaires or from follow-up telephone contacts of surveyed ecotourists.

Existence Values for U.S. Citizens

Ecotourists, anglers, and even *non-users* might value the mere existence of living ocean resources and be willing to pay to protect, preserve, or restore them. In economic circles, natural resource values of this kind are known as *existence values*, and are wholly independent of use of the resource, whether current or future, potential or actual. Users of the ocean environment may hold both use and existence values, but non-users by definition can only hold existence values, if any (M.A. Freeman 1993).

Existence value benefits consist of the maximum willingness to pay to protect, preserve, restore, or prevent losses of living ocean resources (*e.g.*, takings of harbor porpoises in gillnet fisheries). There are no markets for existence values, so valuation techniques such as *contingent valuation* are typically employed to simulate market bids for preservation, protection, and restoration.

Figure 10 illustrates the composition of data elements for estimating existence values of U.S. citizens.

U.S. Citizens

Table 21 identifies the annual data elements needed to estimate U.S. existence values associated with preservation, protection, and restoration. Estimating existence values is typically based on attitudinal and preference surveys.

On a need-to-know basis, households would have to be surveyed randomly by mail or telephone to collect information on existence values.

SUBSISTENCE AND TRADITIONAL USES OF LIVING MARINE RESOURCES¹³

Economic benefits derived from this user group are: 1) employee incomes and vessel revenues from occasional sales of marine finfish and shellfish, 2) value of the resources consumed by the harvester, and 3) consumer surplus realized by consumers who buy from subsistence and traditional users.

Subsistence, as used by social scientists, can have two meanings: 1) activities by which people acquire the food (and other culturally defined necessities) needed to sustain themselves whether through growing, gathering, catching, bartering, or purchasing (Howard 1989); and 2) a system in which people grow, gather, or catch all food (and obtain all other necessities) solely for their own use and never for sale (Beals *et al.* 1977; Schultz and Lavenda 1990; Stearman and Redford 1992). By the first definition, we are all engaged in subsistence; by the second definition, few are.

In general, individuals or households are engaged in subsistence if: 1) they cannot afford to buy equivalent protein and other nutritional needs in the market, or 2) the taking of certain organisms is vital to their spiritual or cultural life. Primarily, subsistence fishing consists of catching fish as part of a pattern of resource exploitation that includes fishing, hunting, and the gathering of wild plants. All of these activities are used to obtain household protein, and/or to acquire species not commonly found at the retail level, but which may be important to traditional meals or holidays of a particular culture.

In this document, subsistence harvesters are defined as those people who either: 1) rely on fishing to supply directly at least part of their dietary needs, and who may or may not also sell small amounts of finfish or shellfish as a vital supplement to their income; or 2) conduct traditional practices under treaty rights.

Those attempting initially to locate and identify subsistence harvesters have a variety of possible sources of information, presumably from the group itself. Those who

fish from party or charter boats can be identified through port surveys of party/charter boat captains, and through questions added to surveys regarding size of catch, species, disposition of catch, income levels, and frequency of outings. Local conservation law officers can provide additional information, as can federal and state personnel from fisheries agencies and social science researchers familiar with different sections of the coastline.

Commercial-Type Harvesters with Treaty Rights

Technically, those who fish commercially under treaty rights are defined as engaging in a subsistence use, and therefore are discussed in this section.

All of the data elements associated with the commercial harvesters user group of the seafood-production-from-commercial-harvesting use category apply to commercial-type harvesters with treaty rights. In addition, the questions in Table 22 are germane in order to assess benefits derived from resources not sold.

Recreational-Type Harvesters with Treaty Rights

While some treaty rights involve commercial fisheries, others involve low harvest levels and non-intensive harvesting techniques. These harvesters may fall under the small-scale, food-oriented definition.

All of the data elements associated with the anglers user group of the recreation use category apply to recreational-type harvesters with treaty rights, as do the incremental questions listed in Table 22.

Non-Treaty-Right Harvesters

A third group of subsistence harvesters, which overlaps to some degree the recreational fishery, is composed of those people who catch some fish for recreation, but also some for food and/or income. Some of this third group may fish from party boats. Many will fish only from shore. Some may be children or the elderly. Others will be low-income single adults or heads of low-income households. Some subsistence harvesters will be members of established ethnic/cultural enclaves, recent immigrants, or minorities. As noted above, these latter two groups (low-income and ethnic/cultural groups) may include crew members of commercial vessels and their families. Often, even when they constitute important populations, these non-treaty-right subsistence harvesters are not recognized by policy and regulatory bodies (Fortmann 1990; M. Freeman 1993).

All of the data elements associated with the anglers user group of the recreation use category, as well as the incremental questions listed in Table 22, apply to non-treaty-right subsistence harvesters.

Members of ethnic/cultural groups who are commercial harvesters without treaty rights are generally indistinguishable from other commercial harvesters, and are therefore not discussed here. They are not subsistence harvesters by our definitions. However, some may still consider themselves to be following a traditional lifestyle. The questions listed in Table 22 are thus applicable to this group as well.

ENDNOTES

1. The glossary serves as a reference for all key economic concepts, principles, and analyses identified in *bold italics*.
2. See Edwards (1990) for a thorough discussion of economic efficiency, cost-benefit analysis, and input-output analysis as they relate to fisheries resources.
3. Guides have been developed to assist policymakers in designing and executing economic data collection programs, but most of these efforts describe needs based on only a portion of the entire fishery system -- the harvest sector -- and are generally geared towards small-scale fishery administrators. See Stevenson *et al.* (1982), Sutinen and Pollnac (1980), Smith (1979), and Smith (1975).
4. Prices and quantities should be measured in units appropriate for the particular user group (*i.e.*, fishing trips for recreational fishers, pounds of fish for seafood production, or sightseeing trips for *non-consumptive users*), or, if measuring derived demand, in units appropriate for the inputs being measured.
5. For a discussion of duality theory, see Beattie and Taylor (1985) or Chambers (1988). For examples of duality theory applied to fisheries, see Ward (1991) or Kirkley (1986).
6. See Thurman and Easley (1992).
7. See Cheng and Capps (1987).
8. See USEPA (1993) and Krupnick (1993).
9. To limit redundancy, the processors and wholesalers, retailers, and consumers user groups are only depicted under the seafood-production-from-commercial-harvesting use category; as shown in Figure 1, these user groups are associated with seafood production from aquaculture as well.
10. Includes at-sea processors, joint ventures, and directed foreign fishing.

11. In contrast to other gross benefits illustrated in this document, consumer surplus (defined in the glossary) is a measure of net economic value (*i.e.*, a benefit in excess of costs). Due to the confusion often associated with the total economic value of consumer benefits (*i.e.*, gross benefits measured by **maximum willingness to pay**) and the importance of consumer surplus in CBA, we have chosen to use consumer surplus when referring to consumer benefits from consumption or use of a good or service.
12. See the glossary for definition.
13. For detailed case studies on managing subsistence fisheries in an industrial context, see Feldman (1981), Hanna and Smith (1993), and Pinkerton and Keitlah (1990).

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REFERENCES CITED

Beals, R.L.; Hoiyer, H.; Beals, A.R. 1977. An introduction to anthropology. 5th ed. New York, NY: Macmillan.

Beattie, B.R.; Taylor, C.R. 1985. The economics of production. New York, NY: John Wiley and Sons.

Chambers, R.G. 1988. Applied production analysis: a dual approach. Cambridge, England: Cambridge University Press.

Cheng, H.-T.; Capps, O. 1987. Demand for disaggregate fish and shellfish species in the United States. *Va. Agric. Exp. Stn. Bull.* 87-2.

Edwards, S.F. 1990. An economics guide to allocation of fish stocks between commercial and recreational fisheries. *NOAA Tech. Rep. NMFS* 94.

Feldman, K.D. 1981. Anthropology and public policy in Alaska: recent policy related to legal systems, Native subsistence, and commercial fisheries. *Policy Stud. Rev.* 1(1):87-110.

Fishery Conservation and Management Act of 1976. 1976. *U.S. Code*. Vol. 16, secs. 1801-82.

Fortmann, L. 1990. Locality and custom: non-aboriginal claims to customary usufructuary rights as a source of rural protest. *J. Rural Stud.* 6(2):195-208.

Freeman, M. 1993. The International Whaling Commission, small-type whaling, and coming to terms with subsistence. *Hum. Organ.* 52(3):243-251.

Freeman, M.A. 1993. The measurement of environmental and resource values: theory and methods. Washington, DC: Resources for the Future.

Groundfish Plan Development Team. 1993. Bioeconomic evaluations of the impacts of Amendment #5 alternatives. Saugus, MA: New England Fishery Management Council.

Hanna, S.; Smith, C. 1993. Resolving allocation conflicts in fishery management. *Soc. Nat. Resour.* 6:55-69.

Herrick, S.F., Jr.; Strand, I.; Squires, D.; Miller, M.; Lipton, D.; Walden, J.; Freese, S. 1994. Application of benefit-cost analysis to fisheries allocation decisions: the case of Alaska walleye pollock and Pacific cod. *N. Am. J. Fish. Manage.* 14:726-741.

Howard, M.C. 1989. Contemporary cultural anthropology. 3rd ed. Glenview, IL: Scott, Foresman & Co.

Kirkley, J.E. 1986. The relationship between management and the technology in a multi-species fishery: the New England, Georges Bank, multi-species fishery. College Park, MD: Univ. of Maryland. Ph.D. Dissertation.

Krupnick, A.J. 1993. Benefit transfers and valuation of environmental improvements. *Resources* 110:1-7.

Milon, J.W. 1993. U.S. fisheries management and economic analysis: implications of the Alaskan groundfish controversy. *Am. J. Agric. Econ.* 75:1177-1182.

NMFS [National Marine Fisheries Service]. 1995. Guidelines on regulatory analysis of fishery management actions. App. 2.d. *In: Operational guidelines for the fishery management plan process.* Silver Spring, MD: National Marine Fisheries Service.

Pinkerton, E.; Keitlah, N. 1990. The Point No Point Treaty Council: innovations by an inter-tribal fisheries management cooperative. *Univ. Br. Colum. Plan. Pap.* DP #26. Vancouver, BC: Univ. of British Columbia, School of Community and Regional Planning.

President. 1993. Executive Order 12866 of September 30, 1993. *Fed. Regist.* 58, no. 2. (4 October 1993).

Schultz, E.A.; Lavenda, R.H. 1990. Cultural anthropology: a perspective on the human condition. 2nd ed. St. Paul, MN: West.

Smith, F.J. 1975. The fisherman's business guide. Camden, ME: International Marine Publishing Co.

Smith, I.R. 1979. A research framework for traditional fisheries. *Int. Cent. Living Aquat. Resour. Manage. Stud. Rev.* 2.

Stearman, A.M.; Redford, K. 1992. Commercial hunting by subsistence hunters: Sirionó Indians and Paraguayan Caiman in lowland Bolivia. *Hum. Organ.* 51(3):235-244.

Stevenson, D.; Pollnac, R.; Logan, P. 1982. A guide for the small-scale fishery administrator: information from the

- harvest sector. Kingston, RI: Univ. of Rhode Island, International Center for Marine Resource Development.
- Sutinen, J.; Pollnac, R.; Logan, P., editors. 1982. Small-scale fisheries in Central America: acquiring information for decision making. Kingston, RI: Univ. of Rhode Island, International Center for Marine Resource Development.
- Thurman, W.N.; Easley, J.E., Jr. 1992. Valuing changes in commercial fishery harvests: a general equilibrium derived demand analysis. *J. Environ. Econ. Manage.* 22:226-240.
- USEPA [U. S. Environmental Protection Agency]. 1993. Benefits transfer: procedures, problems, and research needs. *In: Proceedings of the 1992 Association of Environmental and Resource Economists Workshop*, Snowbird, Utah. Available from: U. S. Environmental Protection Agency, Washington, DC (EPA 230-R-93-018).
- Ward, J.M. 1991. Modelling vessel mobility: The Gulf of Mexico shrimp fleet. Kingston, RI: Univ. of Rhode Island. Ph.D. Dissertation.

GLOSSARY

- benefits** -- here defined as gross economic benefits derived from use of a resource. Not to be confused with net benefits where opportunity costs are subtracted from gross benefits.
- bioeconomic modeling** -- mathematical formulae that simulate the interaction between biological behavior of fish stocks and human behavior of users of the resource as it is shaped by economic factors.
- cash flow analysis** -- a type of financial analysis that compares the timing and amount of cash inflows with the timing and amount of cash outflows. A firm's cash flow position can greatly affect its ability to remain in business. These effects may not be apparent from a cost-benefit analysis.
- charter boat** -- any vessel-for-hire engaged in recreational fishing and hired for a charter fee by an individual or a group of individuals (for the exclusive use of that individual or group of individuals), which results in that vessel being unavailable for hire to any other individual or group of individuals during the period of the charter.
- consumer surplus** -- net economic value from consumption or use of a good or service. It is the difference between the maximum that a person is willing to pay for the good or service rather than do without it, and what he/she actually spends. The adjective, "consumer" is misleading because this category of value also applies to non-consumptive uses (*e.g.*, observing salmon runs) and to non-use benefits (*e.g.*, protecting marine mammals from exploitation).
- contingent valuation** -- a method which uses survey questions to elicit people's preferences for public goods by asking what they would be willing to pay or receive for specified increments or decrements in the public good.
- cost-benefit analysis** -- a comparison of the economic value of using a productive resource with the opportunity cost of using the resource. Projects or regulations are evaluated based on how they change net economic value.
- demand function** -- a behavioral relationship between quantity consumed and a person's maximum willingness to pay for incremental increases in quantity. It is usually an inverse relationship where at higher (lower) prices, less (more) quantity is consumed. Other factors which influence willingness-to-pay are income, tastes and preferences, and price of substitutes.
- economic efficiency** -- a measure of the size of consumer surplus and producer surplus. An increase in the combined surpluses is an increase in economic efficiency.
- ecotourists** -- individuals who rent services of non-consumptive providers or produce non-consumptive trips themselves.
- existence value** -- value that individuals place on the existence of living ocean resources.
- financial analysis** -- cost accounting based on market prices as opposed to opportunity costs.
- financial ratio** -- a method of evaluating a firm's financial position. An example is the "current ratio" which is equal to current assets divided by current liabilities.
- fixed costs** -- costs that do not vary with the level of output.
- input-output analysis** -- a systematic method that both describes the financial linkages and network of input supplies and production which connect industries in a regional economy (however defined), and predicts the changes in regional output, income, and employment. Input-output analysis generally focuses on economic activity and the self-sufficiency of an economy, unlike cost-benefit analysis which focuses on changes in net national benefits from use of a productive resource.
- maximum willingness to pay** -- maximum valuation placed by an individual on a good or service in terms of money. The summation of individuals' maximum willingness to pay is tantamount to the total economic value of consumer benefits (*i.e.*, gross benefits).
- net economic value** (alternate term for net national benefits) -- sum of consumer surplus and producer surplus.
- net national benefits** (alternate term for net economic value) -- sum of consumer surplus and producer surplus.

non-consumptive users -- individuals may use (*i.e.*, observe), yet not consume, certain living ocean resources, like whale watching, sightseeing, or scuba diving. Additionally, individuals might value the mere existence of living ocean resources without actually observing them. In this document, uses of this kind are defined as non-consumptive. Some argue that certain non-consumptive uses disrupt habitats, breeding patterns, or feeding patterns and should therefore not be considered non-consumptive. Our use of the term is for classification purposes only and not for descriptive purposes.

non-users -- individuals who obtain value from a resource, but do not use the resource.

opportunity cost -- generally intended to refer to foregone economic value when a productive resource, such as labor, capital, land, or fish, is used to produce one good or service instead of something else.

party boat (also called a head boat) -- any vessel-for-hire engaged in recreational fishing and hired (or leased, in whole or part) for a per-capita fee on a first-come, first-served basis.

producer surplus -- the total revenue obtained from using a productive resource minus all opportunity costs of production (opportunity costs of entrepreneurs' skills, labor, capital, and ownership of natural resources).

supply function -- shows the quantities of goods and services a producer would provide at various prices.

trade analysis -- economic analysis of the trade of goods and services between countries.

value added -- the dollar value of a firm's output (*i.e.*, harvest) minus the dollar value of the inputs it purchases from other firms.

variable costs -- cost that vary with the level of output.

Table 1. Organization of the data elements needed to analyze economic effects of fishery management regulations

Resource Use	User Group	Entity of Interest	Data Coverage & Collection Frequency by Data Period	
			Annual Period	Other Period
Seafood production from commercial harvesting	Commercial harvesters	Vessel and related onshore facilities	Census every year	Census every trip
	Processors & wholesalers	Plants	Census every year	Census then design sampling scheme
	Retailers	Retailers	Census then sample every 3-5 yr	Census then sample every 3-5 yr
	Seafood consumers	Households	Sample every 3-5 yr	Sample every 3-5 yr
Seafood production from aquaculture	Producers	Production facilities	Census every year	Census then sample every month
Recreation	Providers	Vessel and related onshore facilities	Census then sample every 3-5 yr	Census every trip then stratified sampling
	Anglers	Party or charter boat anglers	Stratified samples every year	Stratified samples every 3-5 yr
		Onshore, boat-renting, or boat-owning anglers	Stratified samples every year	Stratified samples every 3-5 yr
Non-consumptive use of living marine resources	Providers	Vessel and related onshore facilities	Census then sample every 3-5 yr	Census then sample every 3-5 yr
	Ecotourists	Ecotourists	Stratified samples every 3-5 yr	Stratified samples every 3-5 yr
	All U.S. citizens	U.S. citizens	Periodic samples	No data collected
Subsistence & traditional uses of living marine resources	Commercial-type harvesters with treaty rights	Vessel and related onshore facilities	Census every year	Census every trip
	Recreational-type harvesters with treaty rights	Party or charter boat harvesters	Stratified samples every year	Stratified samples every 3-5 yr
		Onshore, boat-renting, or boat-owning harvesters	Stratified samples every year	Stratified samples every 3-5 yr
	Non-treaty-right harvesters	Party or charter boat harvesters	Stratified samples every year	Stratified samples every 3-5 yr
		On-shore, boat-renting, or boat-owning harvesters	Stratified samples every year	Stratified samples every 3-5 yr

Table 2. Definition of data categories to be used to analyze economic effects of fishery management regulations

Category	Definition
Annual Data	
Identification and ownership	Information that allows one to identify and classify vessels, firms, and individuals within a user group
Descriptive	Information that describes and delineates a firm's and/or vessel's activities, inventories, and capacities
Fixed (or indivisible) cost	Vessel, firm, or plant costs that do not vary with production
Financial position	Asset and liability information that allows one to enumerate and assess a firm's financial status
Other	Generally, information that portrays income sources and other information not directly associated with the user group, <i>e.g.</i> , profits from use of a commercial fishing vessel for whale watching
Dependent industry	Identifying and descriptive information pertaining to industries or firms that depend on the user group, <i>e.g.</i> , marine bait-and-tackle shops depend on recreational anglers
Other-Period Data	
Descriptive and identification	Information that describes and identifies the type of commercial or recreational trip and delineates a firm's or market's/restaurant's activities, inventories, and capacities
Activity	Data at the daily, trip, or tow level that allow one to enumerate and quantify activities of a user group
Variable cost	Vessel, firm, or market/restaurant costs which vary with level of output

Table 3. Annual data needed on commercial harvesters

Identification and ownership

- Vessel identification (name, Coast Guard number, or state registration number)
- Owner(s) (name, address, telephone, social security number)
- Ownership type (sole proprietor, partnership, owner-operator, etc.)
- Corporation name (if incorporated)
- Names and numbers of other vessels in organization (if partnership)
- Permits held
- Port of registry

Description of vessel and equipment

- Type of vessel (principal gear)
- Length
- Gross tons
- Net tons
- Hull construction material
- Hold capacity
- Engine(s) descriptors (brand, age, horsepower, fuel type)
- Harvest gear (number and description)
- Deck gear (number and description)
- Wheelhouse electronics (number and description)
- Gear-mounted electronics (number and description)
- On-board processing/refrigeration (equipment list, descriptions, capacities)
- Year built
- Purchase year and price
- Estimated market value fully equipped
- Market value of permits owned

Onshore facilities

- Facilities (list, descriptors, capacities)
- Equipment (list, descriptors, capacities)
- Estimated market value of onshore investment
- Names and numbers of other vessels within organization that also use same onshore facilities

Fixed costs

- Annual insurance costs (hull, health, protection and indemnity, mortgage, etc.)
- Annual haulout/overhaul
- Dockage
- Professional fees (accounting, legal, bookkeeping, tax filing, etc.)
- Loan payments (principal and interest)
- Vessel depreciation
- All other gear depreciation (fishing gear, electronics, etc.)
- New gear acquired list, cost (for replacement or addition)
- Repairs
- Maintenance
- Crew salary (for those crew not paid on a trip basis)
- Crew benefits (all crew)
- Taxes (income, property, etc.)
- Vessel improvement cost
- Value of catch in storage
- Vessel permit fees
- Auto/trailer
- Office

Table 3. Cont.

- Association(s) fees
- Onshore permits/export/import/license/etc. fees
- Cold storage rental
- Onshore (non-owned) processing/holding costs, leases
- Advertising
- Lease or mortgage of onshore facilities
- Onshore employee salaries and benefits

Firm financial status

- Current assets (list and value)
- Long-term assets (list and estimated market value)
- Current liabilities (list and amount)
- Long-term liabilities (list and amount)
- Monthly income all sources
- Monthly cash outflow all destinations

Other

- Total other annual revenue from use of vessel (*e.g.*, recreational fishing trips, sightseeing, whale watching, fire-works, transport of goods and people, SCUBA)
- Vessel-owner-owned onshore business revenue
- Amount and value of quota bought or sold

Dependent industries

- Firm identifiers (name, address, telephone number, owner, other)
 - Product list (quantities and prices by product type)
 - Net income derived from commercial harvesters
 - Number of employees per firm
-

Table 4. Trip data needed on commercial harvesters

Vessel identification and trip descriptors

- Vessel identification (name, Coast Guard number, or state registration number)
- Port of departure
- Departure date and time
- Return date and time
- Hours fished
- Fishing/hauling time lost (by cause, by day)

Crew status

- Captain and crew identifiers
- Captain's experience as captain in target fishery

Daily activities (within trip)**Mobile-gear tow activities (repeat for each tow type)**

- Date
- Tow number or other demarcation of effort
- Gear electronics in operation (Y/N)
- Location (statistical area and Loran bearings)
- Gear type
- Target species
- Time tow started
- Time tow ended
- Pounds of catch kept (by species and market category)
- Pounds of catch discarded (by species and market category)

Mobile-gear mammal incidents

- Location (statistical area and Loran bearings)
- Gear deployment specifics
- Species and numbers encountered
- Disposition by code by animal

Fixed gear

- Gear type
- Location (statistical area and Loran bearings)
- Gear hauled (number of units by statistical area) this day
- Gear deployment descriptors
- Average soak time of hauled gear
- Pounds of catch kept (by species and market category)
- Pounds of catch discarded (by species and market category)

Fixed-gear mammal incidents

- Location (statistical area and Loran bearings)
- Gear deployment specifics
- Species and numbers encountered
- Disposition by code by animal

Table 4. Cont.

At-sea transfer

- Pounds and price per pound of fish off-loaded (unprocessed) (by species and market category)
- Pounds and price per pound of fish on-loaded (unprocessed) (by species and market category)
- Pounds and price per pound of fish off-loaded (processed) (by species and processing code)
- Pounds and price per pound of fish on-loaded (processed) (by species and processing code)

Disposition of (unprocessed) landings

- Port(s) landed
- Buyer(s)
- Pounds sold and price per pound (by port, buyer, species, and market category)

Disposition of processed landings

- Port(s) landed
- Buyer(s)
- Pounds sold and price per pound (by port, buyer, species, and processing code)

Variable costs**Trip costs**

- Replacement or repair cost of gear and equipment lost or damaged
- Fuel
 - Quantity
 - Cost
- Oil
 - Quantity
 - Cost
- Bait (repeat for each type)
 - Description
 - Quantity
 - Cost
- Ice
 - Quantity
 - Cost
- Water
 - Quantity
 - Cost
- Total food cost
- Trip grading/handling/unloading
- On-board processing costs
- Local transport costs
- Supplies

Labor costs

- Crew
 - Number
 - Crew share formula
 - Total crew cost
 - Total captain cost
- Shack estimated value
- Shack distribution formula
- Captain and crew bonuses

Table 5. Annual data needed on processors and wholesalers

Descriptive and firm identification

- Plant identification
- Plant activities (processing, wholesaling, packing, etc.)
- Primary markets (restaurants, institutions, retail outlets, export)
- Ownership type (sole proprietorship, partnership, etc.)
- Plant capacity (metric tons of fish per year which the plant could process)
- Degree of vertical integration (this should include vessels and aquacultural facilities)
- Degree of horizontal integration
- Plant identifications of other plants owned by same firm
- Equipment inventory

Fixed costs

- Insurance (property and casualty, business interruption, workers compensation, other)
- Professional fees (accounting, legal, bookkeeping, tax filing, etc.)
- Loan payments (principal and interest)
- Finance/service charge
- Depreciation
- Administrative salaries and benefits
- Taxes (income, property, etc.)
- Plant improvement costs
- Advertising
- Permits, licenses, and fees
- Bad debt allowance
- Storage
- Leases
- Repairs
- Maintenance
- Office
- Miscellaneous/other

Financial status

- Current assets (list and value)
- Long-term assets (list and estimated market value)
- Current liabilities (list and amount)
- Long-term liabilities (list and amount)
- Monthly income all sources
- Monthly cash outflow all destinations
- Market value of plant, land, and equipment

Other

- Other income sources not related to commercial fishing

Dependent industries

- Firm identifiers (name, address, telephone number, owner, etc.)
 - Product list (quantities and prices by product type)
 - Net income derived from commercial harvesters
 - Number of employees per firm
-

Table 6. Monthly data needed on processors and wholesalers

Production and plant identification

- Plant identification
- Total number of production workers
- Total number of support staff
- Domestic fish purchased: pounds and price per pound (by seller, species, and market category)
- Imports: pounds and price per pound (by country, species, and market category)
- Inventories (species/pounds/market category)
- Production hours
- Quantity and value by product form and by customer

Variable costs

- Income taxes (state and federal)
- Labor (number of full- and part- time employees and cost)
- Utilities
- Transportation
- Raw product cost
- Packaging material
- Additives used in the production process
- Waste amelioration
- Other

International trade activities

- Quantity and value of exports by product form by country to which exported; for those countries to which exported, the quantity and value of imports by product form from non-U.S. sources
 - Quantity and value of imports by product form and country of import
 - Exchange rates
-

Table 7. Annual data needed on retailers

Descriptive and market/restaurant identification

- Market or restaurant identification
- Retail market type (fish market, supermarket, restaurant, etc.)
- Ownership type (sole proprietorship, partnership, etc.)
- Seafood retail space if market
- Seating capacity if restaurant
- Degree of vertical integration (fish market owner also owns fish farm or vessel)
- Identification of other markets/restaurants owned by same firm

Fixed costs

- Insurance (property and casualty, business interruption, workers' compensation, etc.)
- Professional fees (accounting, bookkeeping, tax filing, etc.)
- Loan payments (principal and interest)
- Finance or service charge
- Depreciation
- Administrative salaries and benefits
- Taxes (income, property, etc.)
- Improvement costs
- Advertising
- Permits, licenses, and fees
- Bad debt allowance
- Miscellaneous/other

Financial status

- Current assets (list and value)
- Long-term assets (list and estimated market value)
- Current liabilities (list and amount)
- Long-term liabilities (list and amount)
- Monthly income all sources
- Monthly cash outflow all destinations
- Market value of buildings, land, and equipment

Dependent industries

- Firm identifiers (name, address, telephone number, owner, etc.)
 - Product list (quantities and prices by product type)
 - Net income derived from seafood products
 - Number of employees per firm
-

Table 8. Monthly data needed on retailers

Retail activity

- Market/restaurant identification
- Employment by outlet by month
- Customers (volume) per month
- Prices, quantities of transactions from retail markets by species, by product type (fresh/frozen/canned/smoked, dressed/fillets, prepared/unprepared, cooked/uncooked), by type of outlet, by month
- Prices, quantities of imports to retail markets by species, by product type (fresh/frozen/canned/smoked, dressed/fillets, prepared/unprepared, cooked/uncooked), by type of outlet, by month
- Percent of total revenue earned from fish products

Operating costs

- Utilities
 - Labor
 - Rent or mortgage
 - Transportation
 - Cost of goods sold by product
-

Table 9. Annual data needed on seafood consumers

Identification

- Identification (name, address, telephone, social security number)

Tastes and preferences

- Household experience with seafood poisoning or other illnesses
- General knowledge of seafood poisoning or other illnesses
- Preference scale by type of seafood
- Strength of preferences
- Other indicators of preferences (health consciousness, exercise, etc.)
- List of substitutes

Households

- Number adults and children in household
 - Employment status of adults (*e.g.*, employed, unemployed, retired, student, full-time, part-time, self-employed, any combination)
 - Occupation
 - Education
 - Marital/cohabitational status
 - Age
 - Sex
 - Race/ethnic identity
 - General health
 - Annual household income (or total food budget)
-

Table 10. Daily data needed on seafood consumers

Identification

- Identification (name, address, telephone, social security number)

Daily consumption by product type and outlet

- Quantity
 - Cost
-

Table 11. Annual data needed on aquacultural producers

Descriptive and firm identification

- Facility identification
- Type of facility (technique used, *e.g.*, net pen, sea ranching, hatcheries)
- Location
- Primary outlet (wholesaler, processor, retailer, etc.)
- Ownership type (joint venture, corporation, sole owner, etc)
- Owner name
- Species type (*e.g.*, salmon, shrimp, mussels, aquatic plants)
- Growth stage (*e.g.*, egg, smolt, post-larvae)
- Production capacity
- Degree of vertical integration
- Degree of horizontal integration
- Facility identifications of other aquacultural operations owned by same firm
- Equipment inventory

Fixed costs

- Insurance (property and casualty, business interruption, workers' compensation, other)
- Professional fees (accounting, legal, bookkeeping, tax filing, etc.)
- Loan payments (principal and interest)
- Finance/service charges
- Depreciation
- Administrative salaries and benefits
- Taxes (income, property, etc.)
- Facility improvement costs
- Advertising
- Permits, licenses, and fees
- Bad debt allowance
- Storage
- Leases
- Repairs
- Maintenance
- Office
- Waste amelioration
- Dock fees
- Miscellaneous/other

Financial status

- Current assets (list and value)
- Long-term assets (list and estimated market value)
- Current liabilities (list and amount)
- Long-term liabilities (list and amount)
- Monthly income all sources
- Monthly cash outflow all destinations
- Market value of facility

Dependent industries

- Firm identifiers (name, address, telephone number, owner, etc.)
 - Product list (quantities and prices by product type)
 - Net income derived from aquacultural industry
 - Number of employees per firm
-

Table 12. Monthly data needed on aquacultural producers

Production information

- Facility identification
- Total number of production workers
- Total number of support staff
- Type of input product (eggs, larvae, fry, juveniles, smolts, seed, etc.) and origin
- Description of products
- Quantity, value, and destination of output product sold per month by product type
- Quantity, value, and final product type inventoried (kept in its aquacultural site) per month by product type
- Quantity and value of product exported per month by product type
- Capacity measurement per month (percent utilization of facility)
- Pounds of feed used per month
- Quantity and value of product lost in mortality per month by product type by type of loss (*e.g.*, poaching, weather, disease, predation)

Variable costs

- Income taxes (state and federal)
 - Labor (number of full- and part-time employees and cost)
 - Utilities
 - Transportation
 - Input to production (egg, smolt, seed, post-larvae, etc.)
 - Feed (quantity and costs)
 - Heating
 - Disease prevention and control
 - Fuel
 - Handling expenses (ice, refrigeration, etc.)
 - Customs if export
 - Equipment rental
-

Table 13. Annual data needed on recreation providers

Identification and ownership

- Vessel identification (name, Coast Guard number, or state registration number)
- Owner(s) (name, address, telephone, social security number)
- Ownership type (sole proprietorship, partnership, owner operator, etc.)
- Corporation name (if incorporated)
- Names and numbers of other vessels in organization (if partnership)
- Permits held
- Port of registry

Description of vessel and equipment

- Type of vessel (party or charter)
- Length
- Gross tons
- Net tons
- Hull construction material
- Passenger capacity
- Engine(s) descriptors (brand, age, horsepower, fuel type)
- Harvest gear (number and description)
- Wheelhouse electronics (number and description)
- On-board processing/refrigeration (equipment list, descriptions, capacities)
- Year built
- Purchase year and price
- Estimated market value fully equipped

Onshore facilities

- Facility type (restaurant, tackle shop, etc.)
- Estimated market value of onshore investment
- Names and numbers of other vessels within organization that also use same onshore facilities

Fixed costs

- Annual insurance (hull, health, protection and indemnity, mortgage, etc.)
- Annual haulout/overhaul
- Dockage
- Professional fees (accounting, legal, bookkeeping, tax filing, etc.)
- Loan payments (principal and interest)
- Vessel depreciation
- All other depreciation (fishing gear, electronics, etc.)
- New gear acquired list, cost (for replacement or addition)
- Repairs
- Maintenance
- Crew salary (for those not paid on a trip basis)
- Crew benefits (all crew)
- Taxes (income, property, etc.)
- Vessel improvement cost
- Vessel permit fees
- Auto/trailer
- Office
- Association(s) fees
- Onshore permit fees
- Cold storage rental
- Advertising
- Lease or mortgage of onshore facilities
- Onshore employee salaries and benefits

Table 13. Cont.

Firm financial status

- Current assets (list and value)
- Long-term assets (list and estimated market value)
- Current liabilities (list and amount)
- Long-term liabilities (list and amount)
- Monthly income all sources
- Monthly cash outflow all destinations

Other

- Total other annual revenue from use of vessel (*e.g.*, sightseeing, whale watching, fireworks, transport of goods and people, SCUBA).
- Owner-owned onshore business revenue (restaurant, tackle shop, etc.)

Dependent industries

- Firm identifiers (name, address, telephone number, owner, etc.)
 - Product list (quantities and prices by product type)
 - Net income derived from charter and party boats
 - Number of employees per firm
-

Table 14. Trip data needed on recreation providers

Vessel identification and trip descriptors

- Vessel identification (name, Coast Guard number, or state registration number)
- Port of departure
- Departure date and time
- Return date and time
- Gear(s) used
- Hours fished
- Area(s) fished
- Target species

Crew status

- Captain and crew identifiers (social security numbers)
- Captain, number of years in business (experience)

Catch by species

- Number and size and total weight of catch
- Number and size and total weight returned
- Number and size and total weight taken by captain
- Number and size and total weight taken by mates
- Number and size and total weight taken by anglers

Revenues

- Number of customers
- Fee schedule
- Total revenues from fees
- Gear rental
- Tackle
- Sale by species by captain (number, size, and total weight)
- Sale by species by mate (number, size, and total weight)
- Revenue from filleting (captain and mate)
- Tips (captain and mate)
- Consumer goods (food, drink, tackle, T-shirts, etc.)

Variable costs**Trip costs**

- Replacement or repair cost of gear and equipment lost or damaged
- Fuel
 - Quantity
 - Cost
- Oil
 - Quantity
 - Cost
- Bait (repeat for each type)
 - Description
 - Quantity
 - Cost
- Tackle and gear (repeat for each type)
 - Description
 - Quantity
 - Cost

Table 14. Cont.

- Ice
 - Quantity
 - Cost
- Rental equipment (repeat for each type)
 - Description
 - Quantity
 - Cost
- Total consumer goods (*e.g.*, food, drink)

Labor costs

- Crew
 - Number
 - Crew share formula
 - Total crew cost
 - Total captain cost (if not salaried)
 - Captain and crew bonuses
-

Table 15. Annual data needed on party or charter boat anglers

Identification

- Identification (name, address, telephone, social security number)
- Age
- Gender
- Race/ethnic identity
- Employment status (*e.g.*, employed, unemployed, retired, student, full-time, part-time, self-employed, any combination)
- Annual household income (or total leisure budget)
- Hourly wage (if not salaried)
- Days worked per week
- Hours worked per week
- Annual number of vacation days
- Annual number of holidays
- Marital status
- Education
- Household size (number of children)

Dependent industries

- Firm identifiers (name, address, telephone number, owner, etc.)
 - Product list (quantities by product type)
 - Net income from sale to anglers
 - Number of employees
-

Table 16. Trip data needed on party or charter boat anglers

Identification

- Name and social security number
- Number in party and relationship to them
- Vessel identification (name, Coast Guard number, or state registration number)
- Port of departure
- Departure date and time
- Return date and time

Harvest

- Target species
- Catch by species (number and possibly weight)
- Number released by species
- Number given to friends, relatives, mate, or captain
- Number and cash from sale and identity of purchaser

Preferences

- Reason(s) for fishing (*e.g.*, enjoyment, food, income) and relative importance
- Satisfaction with trip
- Maximum willingness to pay for this trip (fee) (*e.g.*, if your costs for fishing on this day had increased by \$X, would you still have gone fishing on that day?)
- Experience (number of years)
- Subscription to fishing periodicals?
- Own motor boat?
- Part of a vacation? Fishing vacation?
- Alternative use of this time (*e.g.*, how much money could you have earned if you hadn't taken this trip?)

Money costs (expenses of only the person interviewed)

- Fee paid for self plus others in party (number and relationship of others paid for)
 - Gear rental
 - Tackle
 - Bait
 - License
 - Filleting service
 - Goods on board (food, drink, tackle, T-shirts, etc.)
 - Travel activities
 - Miles (one way)
 - Time (one way)
 - Travel expenses by category (gas, oil, lodging, food, etc.)
-

Table 17. Annual data needed on onshore, boat-renting, or boat-owning anglers

Identification

- Identification (name, address, telephone, social security number)
- Age
- Gender
- Race/ethnic identity
- Employment status (*e.g.*, employed, unemployed, retired, student, full-time, part-time, self-employed, any combination)
- Annual household income (or total leisure budget)
- Hourly wage (if not salaried)
- Days worked per week
- Hours worked per week
- Annual number of vacation days
- Annual number of holidays
- Marital status
- Education
- Household size (number of children)

Dependent industries

- Firm identifiers (name, address, telephone number, owner, etc.)
 - Product list (quantities by product type)
 - Net income from sale to anglers
 - Number of employees
-

Table 18. Trip data needed on onshore, boat-renting, or boat owning anglers

Trip identification

- Identification (name, address, telephone, social security number)
- Number in party and relationship to them
- Departure date and time
- Port of departure
- Location(s) fished
- Hours fished (time gear is in water)
- Fishing mode(s) (boat, pier, jetty, shore)
- If boat:
 - Owned or leased
 - Registration number
 - If owned:
 - Type
 - Length
 - Engine horsepower

Harvest

- Target species
- Catch by species (number and weight)
- Number released by species
- Number given to friends or relatives
- Number and cash from sale, and identity of purchaser

Preferences

- Reason(s) for fishing (*e.g.*, enjoyment, food, income) and relative importance
- Satisfaction with trip
- Maximum willingness to pay for this trip (fee) (*e.g.*, if your costs for fishing on this day had increased by \$X, would you still have gone fishing on that day?)
- Experience (number of years)
- Subscription to fishing periodicals?
- Part of a vacation? Fishing vacation?
- Alternative use of this time (*e.g.*, how much money could you have earned if you hadn't taken this trip?)

Money costs (expenses of only the person interviewed)

- Fuel cost
- Oil cost
- Bait (repeat for each type)
 - Description
 - Cost
- Tackle and gear (repeat for each type)
 - Description
 - Quantity
 - Cost
- Ice cost
- Rental equipment (repeat for each type)
 - Description
 - Quantity
 - Cost
- Mooring/dockage fees
- License
- Travel activities
 - Miles (one way)
 - Time (one way)
 - Travel expenses by category (gas, oil, lodging, food, etc.)

Table 19. Annual data needed on ecotourists

Identification

- Identification (name, address, telephone, social security number)
- Age
- Gender
- Race/ethnic identity
- Employment status (*e.g.*, employed, unemployed, retired, student, full-time, part-time, self-employed, any combination)
- Annual household income (or total leisure budget)
- Hourly wage (if not salaried)
- Days worked per week
- Hours worked per week
- Annual number of vacation days
- Annual number of holidays
- Marital status
- Education
- Household size (number of children)

Dependent industries

- Firm identifiers (name, address, telephone number, owner, etc.)
 - Product list (quantities by product type)
 - Net income from sale to anglers
 - Number of employees
-

Table 20. Trip data needed on ecotourists

Trip identification

- Name and social security number
- Number in party and relationship to them
- Vessel identification (name, Coast Guard number, or state registration number)
- If boat owned or leased:
 - Registration number
 - Type
 - Length
 - Engine horsepower
- Port of departure
- Departure date and time
- Return date and time

Sightings

- Species sought
- Species sighted and quantities

Preferences

- Reason(s) for viewing and relative importance
- Satisfaction with trip
- Maximum willingness to pay for this trip (fee) (*e.g.*, if your costs for this day had increased by \$X, would you still have gone viewing on that day?)
- Experience (number of years)
- Subscription to related periodicals?
- Own motor boat?
- Part of a vacation? Fishing vacation?
- Alternative use of this time (*e.g.*, how much money could you have earned if you hadn't taken this trip?)

Money costs (expenses of only the person interviewed)

- Fee paid for self plus others in party (number and relationship of others paid for)
 - Goods on board (food, drink, T-shirts, etc.)
 - Travel activities
 - Miles (one way)
 - Time (one way)
 - Travel expenses by category (gas, oil, lodging, food, etc.)
-

Table 21. Annual data needed on U.S. citizens

Identification

- Identification (name, address, telephone, social security number)
- Age
- Gender
- Race/ethnic identity
- Employment status (*e.g.*, employed, unemployed, retired, student, full-time, part-time, self-employed, any combination)
- Annual household income (or total leisure budget)
- Hourly wage (if not salaried)
- Days worked per week
- Hours worked per week
- Annual number of vacation days
- Annual number of holidays
- Marital status
- Education
- Household size (number of children)

Valuation

- Annual willingness to pay to protect/restore/prevent losses from a species' population (*e.g.*, takings of harbor porpoises in Gulf of Maine gillnet fishery); requires discrete-choice format and careful experimental design to control treatments and sources of bias
- Reasons for \$0 bids

Preferences

- Awareness of species
 - Number of encounters with species
 - Memberships in conservation organizations
 - Donations to protect species
 - Preference-scale evaluation of strength of feelings regarding protection
-

Table 22. Additional questions to be asked of subsistence and traditional users

-
- Besides finfish, what other marine resources (*e.g.*, shellfish, seaweed, kelp) do you harvest or another member of your household catch or gather?
 - How often do you eat marine resources (including finfish, shellfish, squid, seaweed or kelp) that you or another member of your household catch or gather?
 - Does your household ever give finfish, shellfish, or other marine resources (such as seaweed or kelp, octopus or squid) that it harvested to members of other households?
 - If so, to whom do you give them (*e.g.*, affinal relatives, consanguineal relatives, fictive kin, friends, neighbors, elderly, infirm, unemployed)?
 - To what extent would you characterize your household's fishing and gathering of marine resources as recreation or subsistence?
 - Have you ever fished or gathered marine resources from a location with a posted health advisory or that you suspected to be polluted?
 - If so, why did you fish there?
 - Approximately what percent of all the food (domestic meat and wild game, fish and shellfish, fowl, garden vegetables or other plants including domestic or wild fruits, nuts, berries, mushrooms, etc.), that is eaten by members of your household comes from resources harvested by your own household?
 - What is the significance of the resource harvested to your cultural/spiritual life?
 - What is the significance of your methods/styles of fishing to your cultural/spiritual life?
 - To what extent and in what way are the distribution network or the specific resources distributed defined by cultural/religious tenets or traditions?
 - To what extent are resources and profits communal versus individual?
-

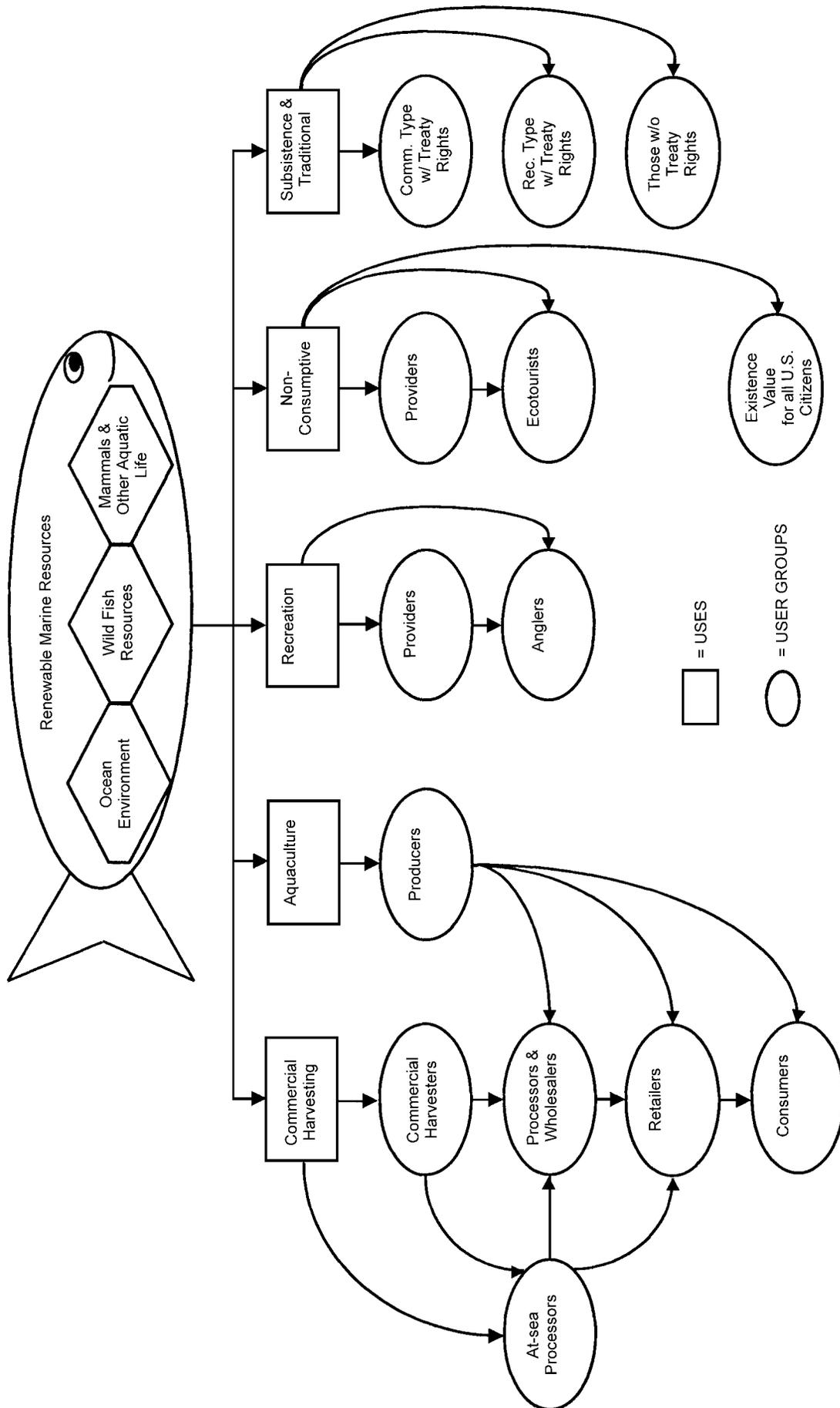


Figure 1. Flow of renewable marine resources through various uses.

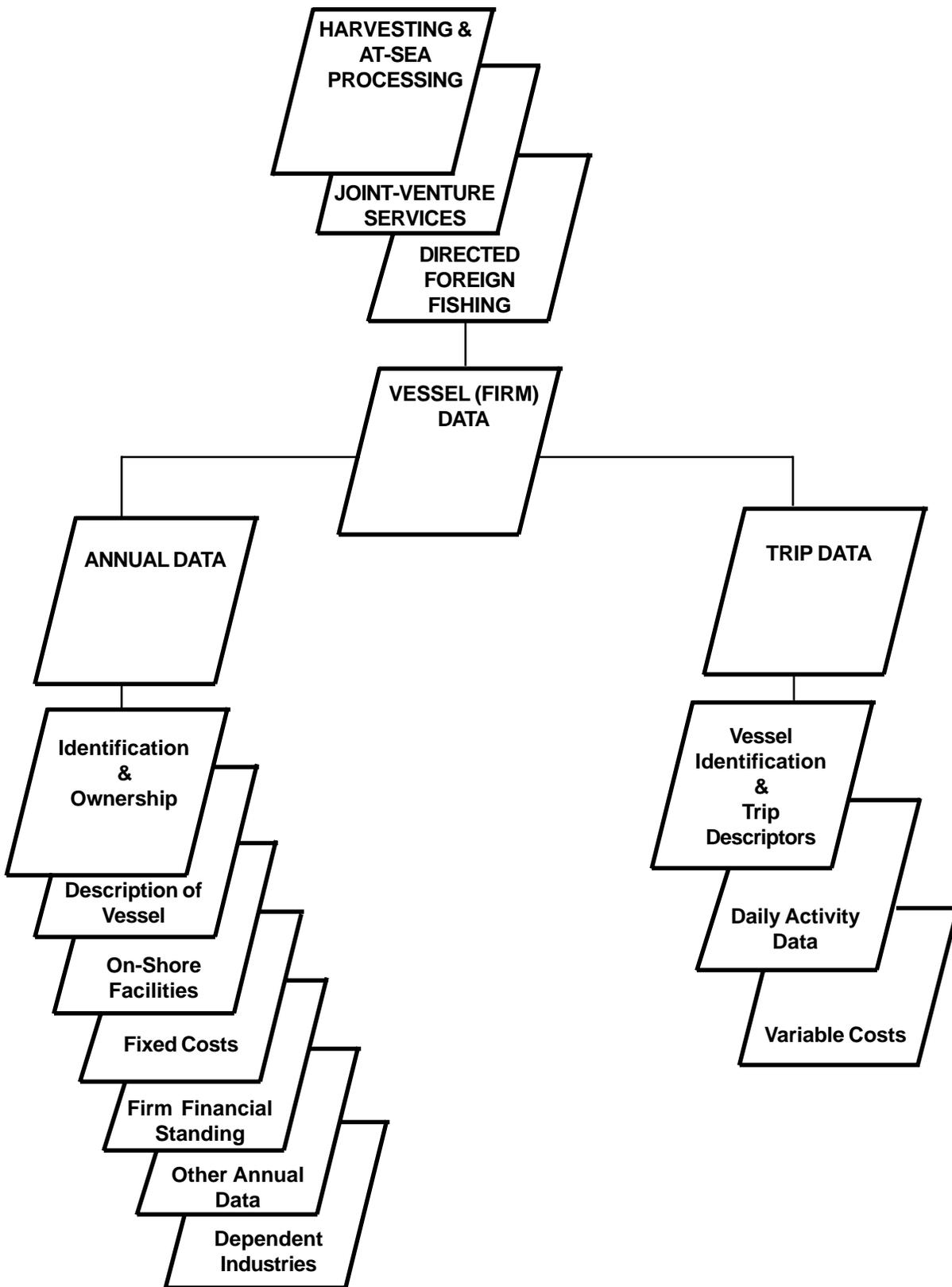


Figure 2. Composition of data elements associated with commercial harvesters.

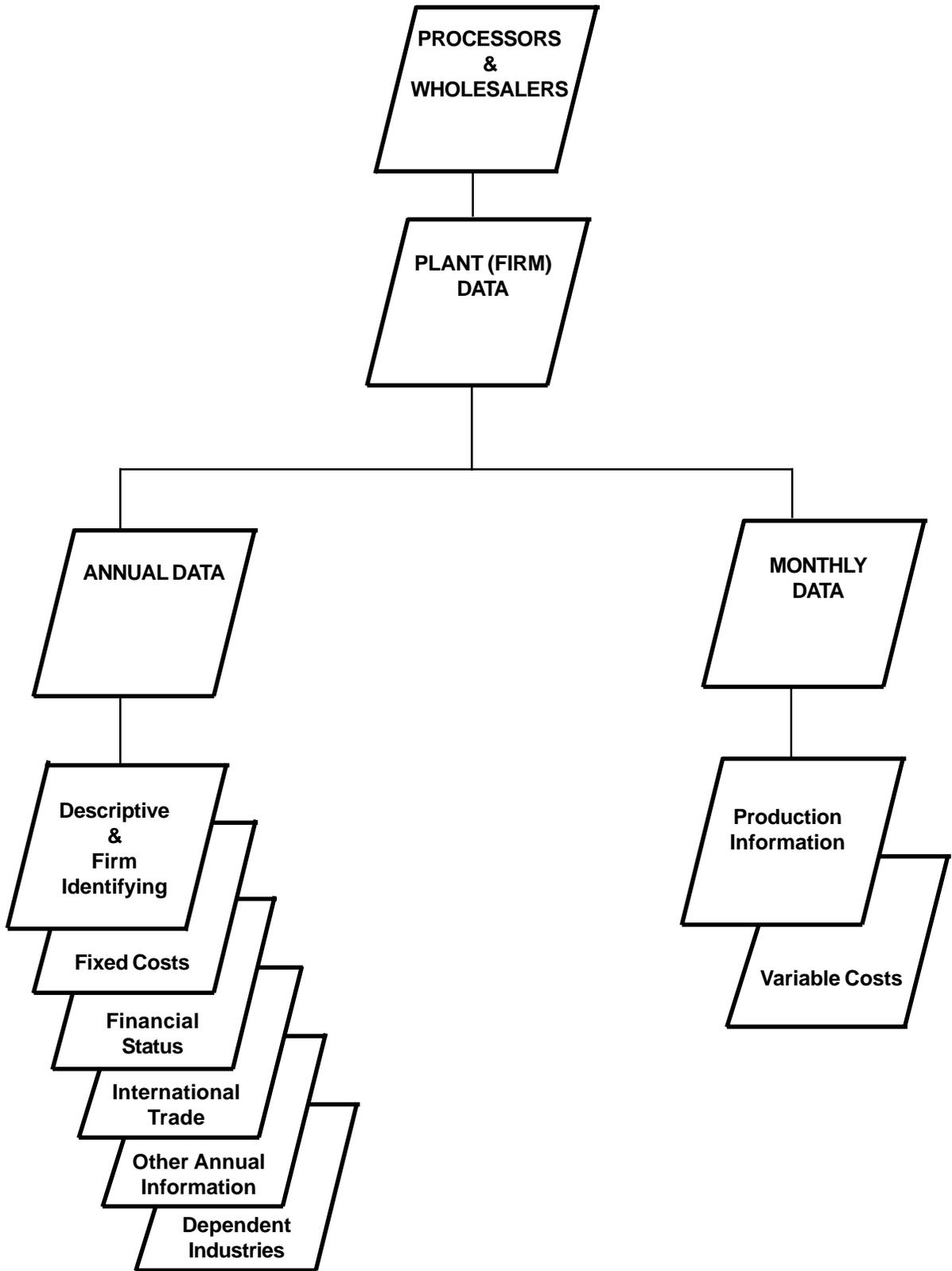


Figure 3. Composition of data elements associated with processors and wholesalers.

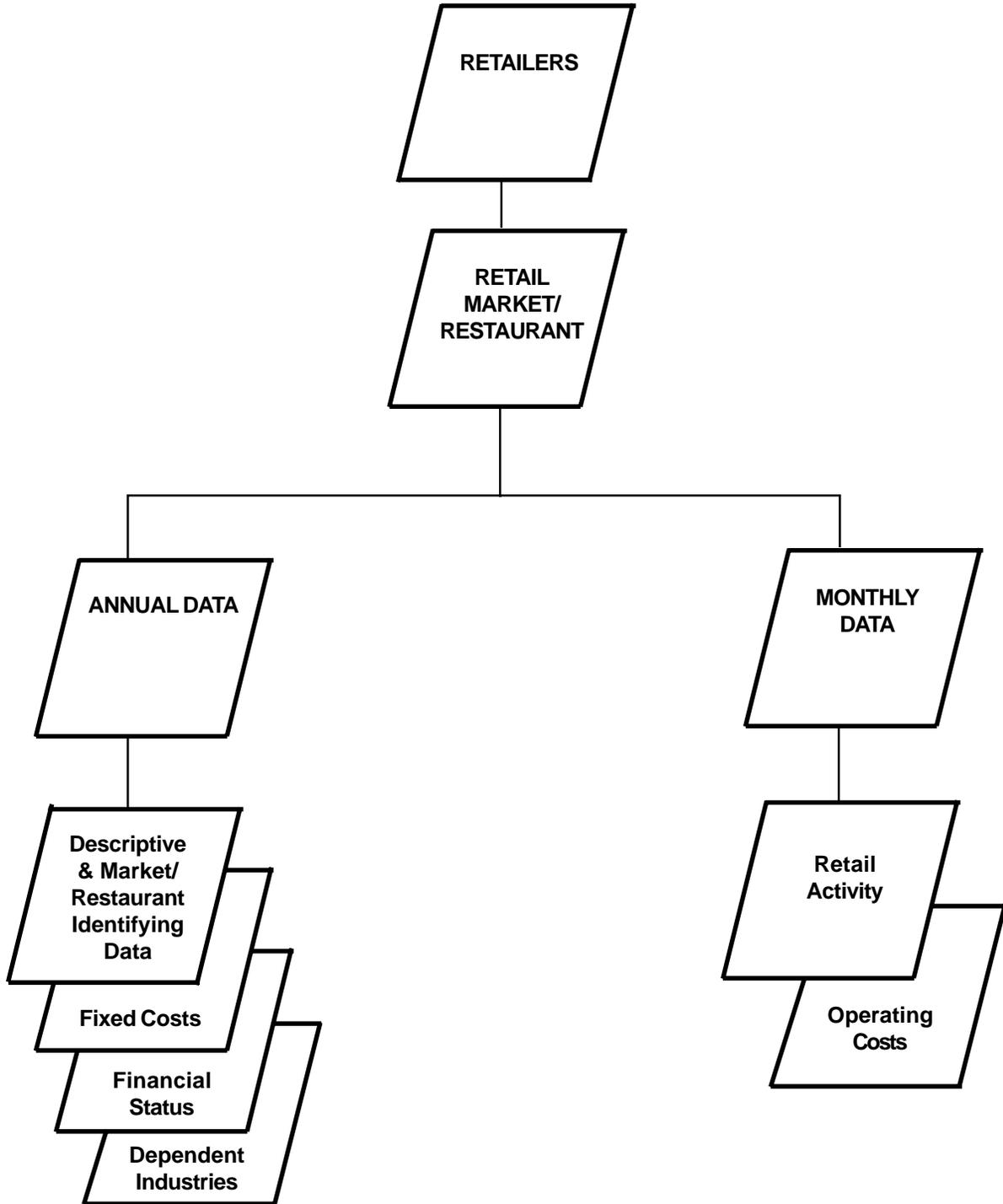


Figure 4. Composition of data elements associated with retail markets.

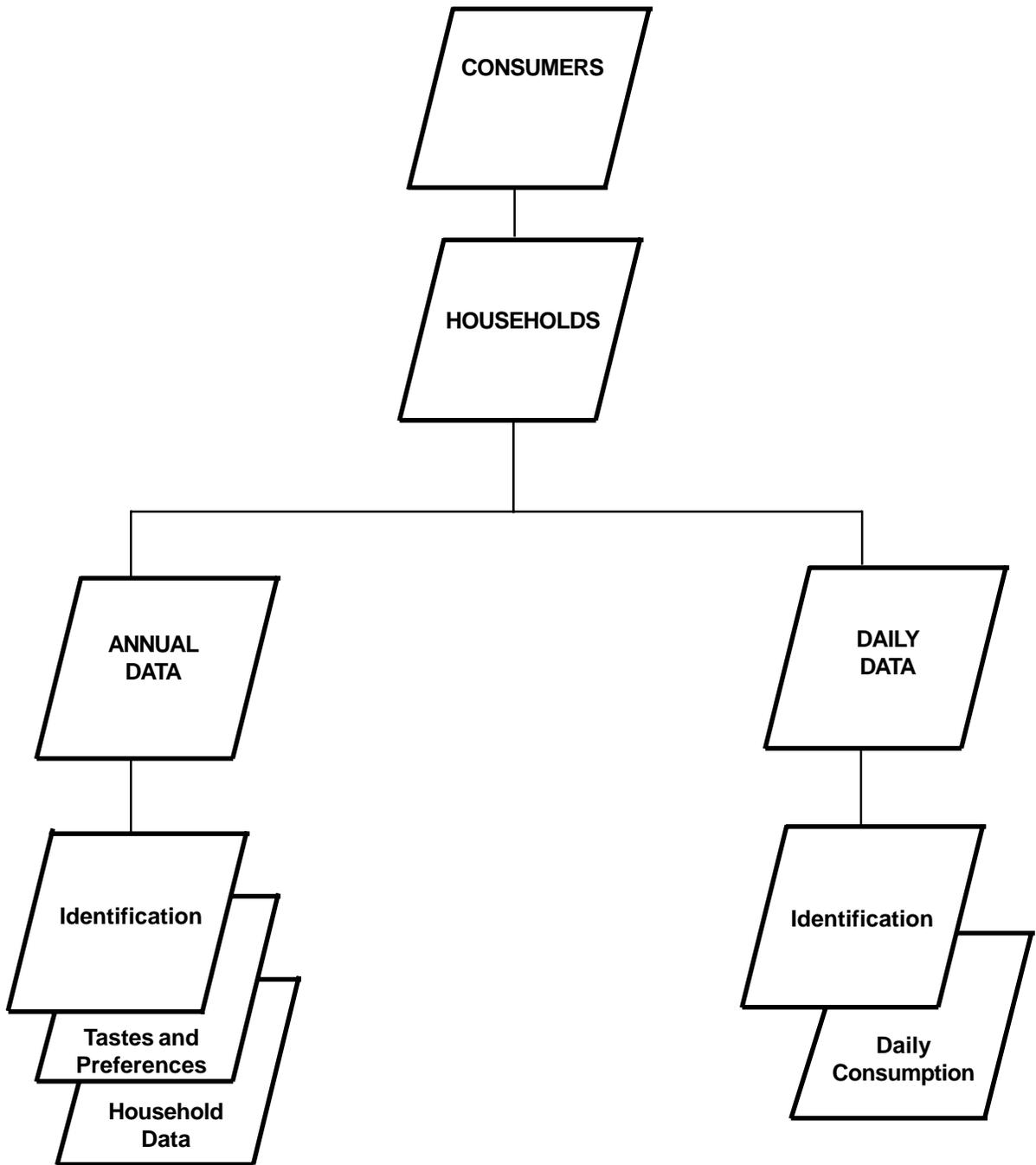


Figure 5. Composition of data elements associated with seafood consumers.

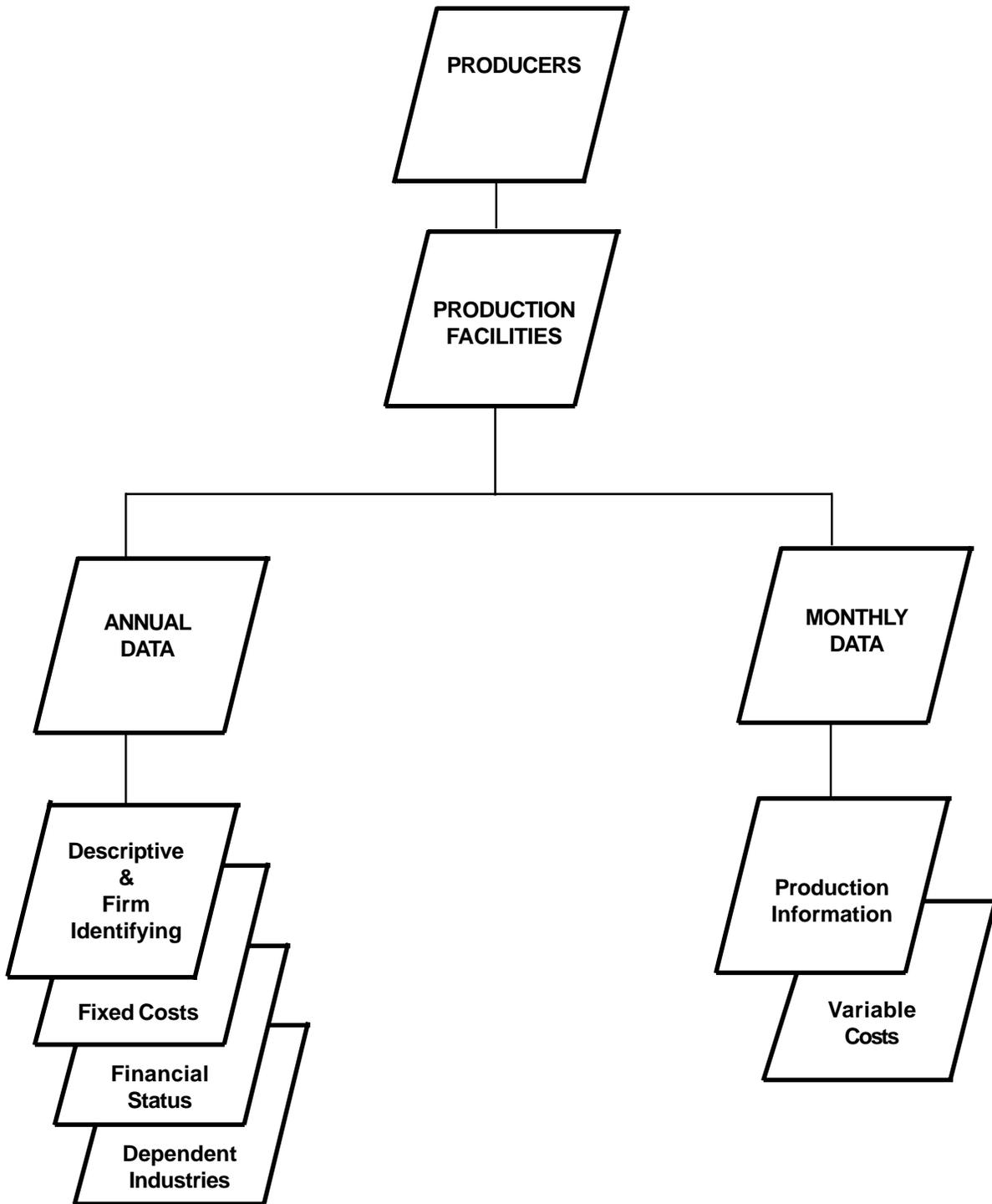


Figure 6. Composition of data elements associated with aquacultural producers.

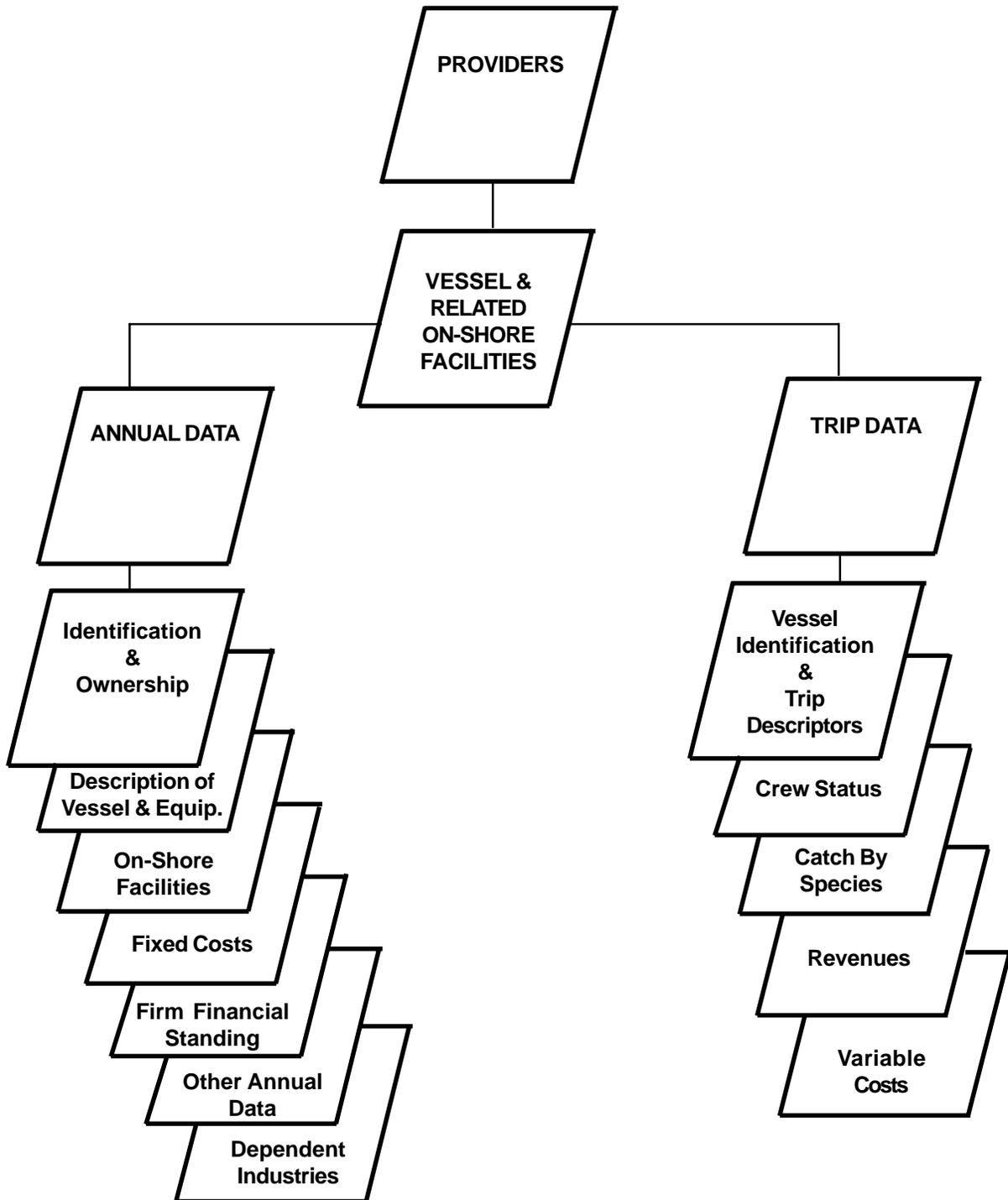


Figure 7. Composition of data elements associated with recreation providers.

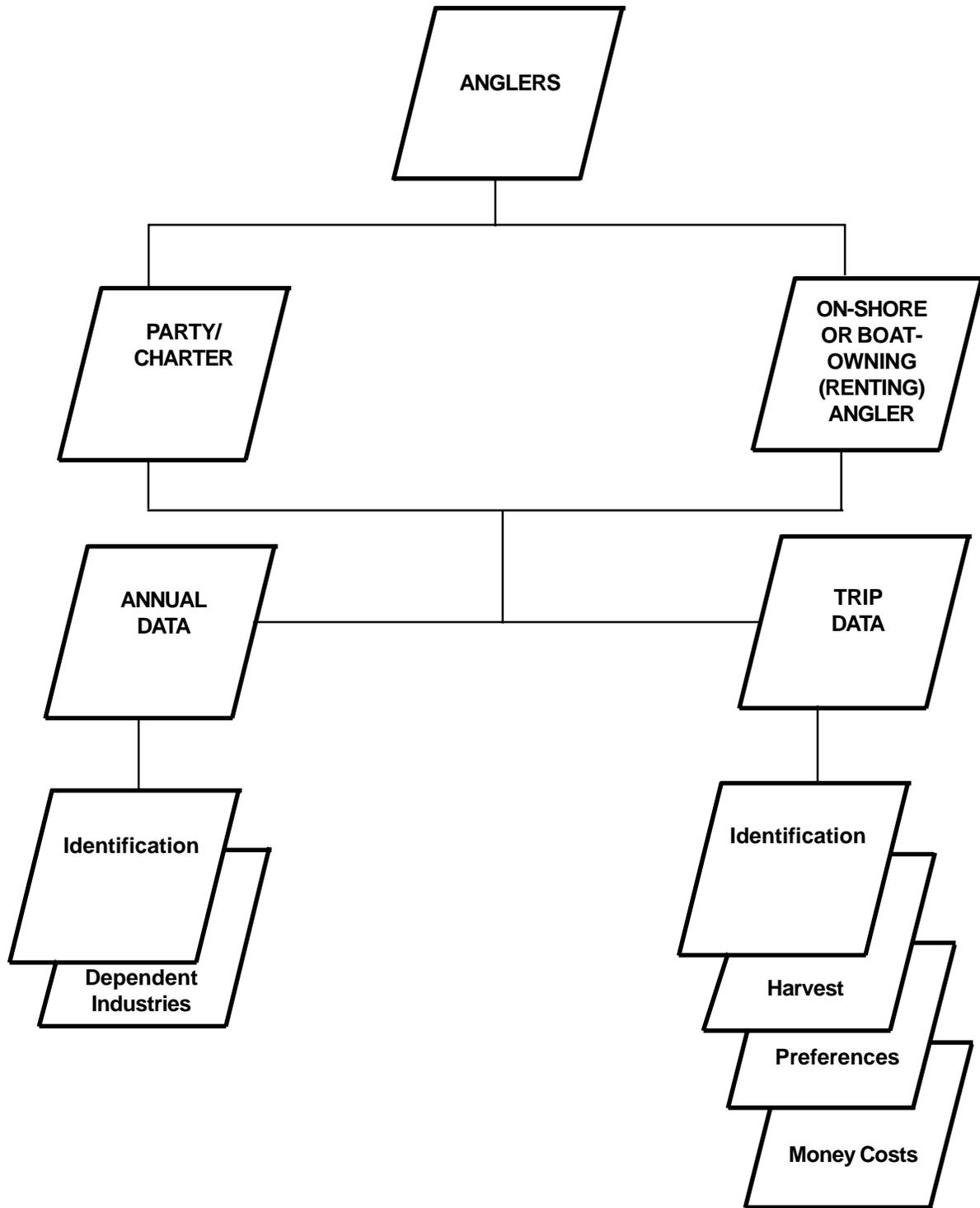


Figure 8. Composition of data elements associated with recreation anglers.

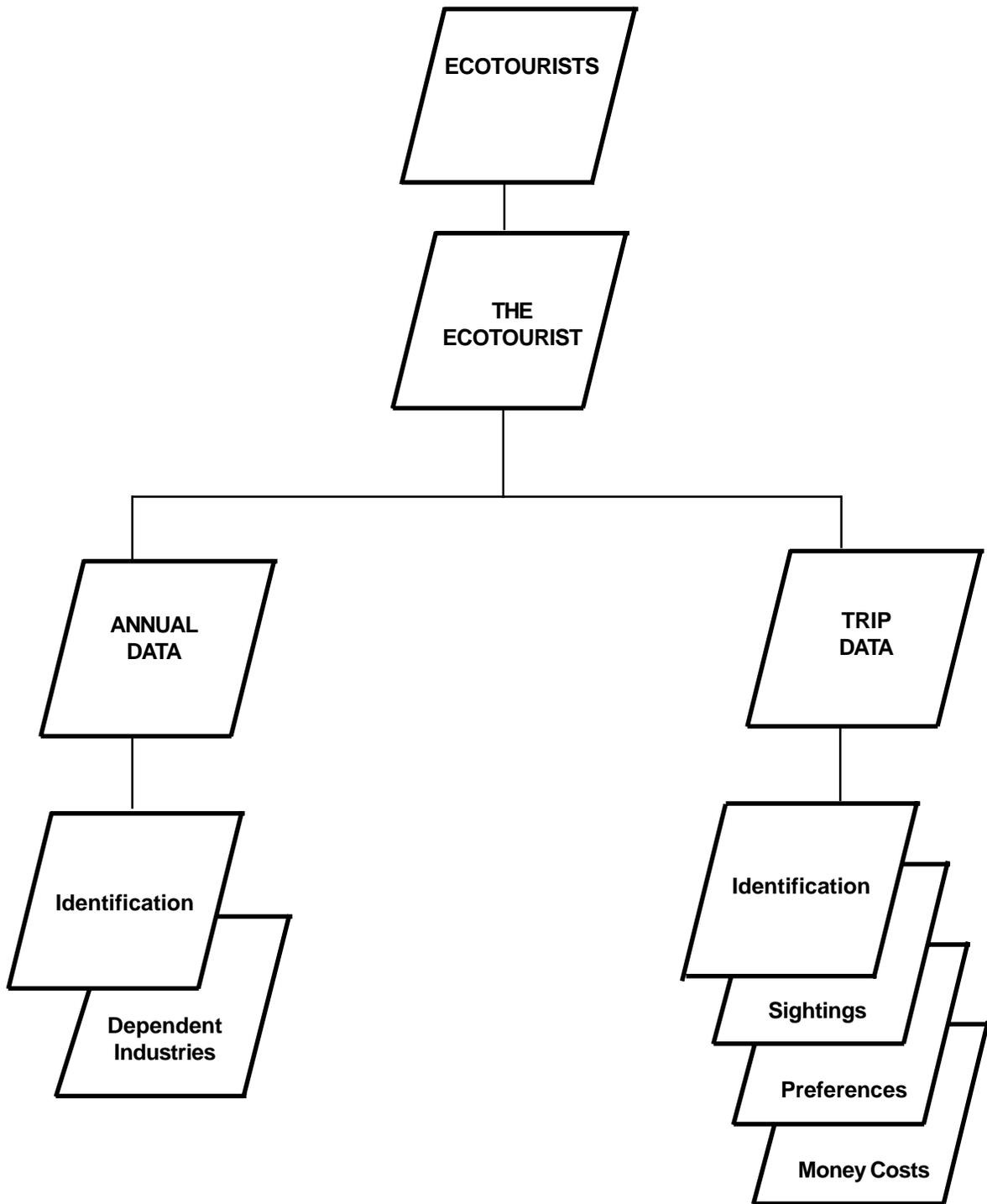


Figure 9. Composition of data elements associated with ecotourists.

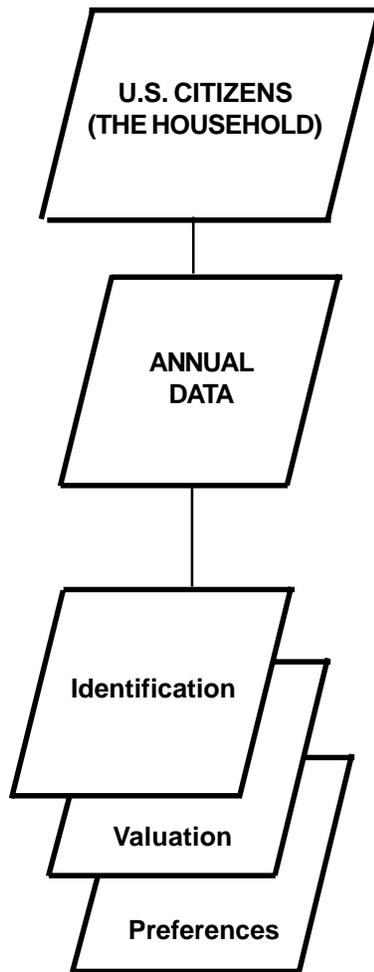


Figure 10. Composition of data elements associated with existence values for U.S. citizens.