R : Amended 5/21/2007

STATE MENHADEN STUDY

Personnel	**YEAR 1**	**YEAR 2**	**YEAR 3**	**TOTAL REQUEST**	**VIMS and OTHER SUPPORT CONTRIBUTION**	**TOTAL PROJECT**
PI Kirkley (req 6 months each year; match 3 mon/year)	56,000	58,900	61,740	176,640	88,320	264,960
T. Murray (1, .5, 1 mon/year)	6,833	3,587	7,534	17,954		17,954
D. Taylor (1, 1 mon/year)	26,767	27,837		54,604		54,604
Technical Support	66,254	14,100		80,354		80,354
Student Researcher	17,200	18,100		35,300		35,300
Fringe Benefits	23,918	19,825	20,782	64,525	26,496	91,021
Personal Services	**196,972**	**142,349**	**90,056**	**429,377**	**114,816**	**544,193**
Travel						
Travel to survey and interview sites	7,500	750	750	9,000		9,000
Project coordination	750			750		750
Surveys Preparation/printing/mailing	28,000	10,000		38,000		38,000
Printing/Publication Final Report			1,000	1,000		1,000
Collaborating Investigators						
Hicks	10,000	10,000	10,000	30,000		30,000
McConnell	10,000	10,000	10,000	30,000		30,000
Strand	10,000	10,000	10,000	30,000		30,000
Duberg	15,000	10,000		25,000		25,000
Maryland, Marine Advisory Services Program	12,500	12,500	12,500	37,500		37,500
Facilities & Administrative Costs (15%)	**43,608**	**30,840**	**20,146**	**94,594**	**240,855**	**335,449**
Total	**$334,331**	**$236,439**	**$154,452**	**$725,221**	**$240,855**	**$966,077**

Facilities and Administrative Costs:

F&A costs limited to 25% requested. Institutional approved rate is 45%. Remaining costs contributed as part of VIMS match.

VIRGINIA RECREATIONAL FISHING DEVELOPMENT FUND
SUMMARY PROJECT APPLICATION*

R

NAME AND ADDRESS OF APPLICANT:	**PROJECT LEADER (name, phone, e-mail):**
Virginia Institute of Marine Science PO Box 1346 Gloucester Point, VA 23062	James Kirkley 804-684-7160 jkirkley@vims.edu
PRIORITY AREA OF CONCERN:	**PROJECT LOCATION:**
Social and Economic Importance of Menhaden to Chesapeake Bay stakeholders/region	Virginia Institute of Marine Science (VIMS) 1208 Greate Road Gloucester Pt., VA 23062

DESCRIPTIVE TITLE OF PROJECT:

Estimate and assess social and economic importance and value of menhaden to Chesapeake Bay stakeholders and region.

PROJECT SUMMARY:

Determine the social and economic impacts and importance of menhaden to the Chesapeake Bay region. Market and non-market value or net social benefits, along with social and economic impacts will be assessed relative to dependency and relationship to the menhaden resource of the region. This will require extensive ethnographic surveys (field work) and surveys of commercial and recreational anglers and various stakeholders throughout the Bay. A comprehensive assessment of the social and economic importance of menhaden relative to commercial and recreational angling, the reduction fishery and associated processing and distribution activities, water quality, and prey for various commercial species of finfish, sea birds, and marine mammals will be conducted.

EXPECTED BENEFITS:

This work will enable VMRC and the Atlantic States Marine Fisheries Commission to examine alternative regulatory and conservation options for menhaden by knowing the social and economic impacts and potential changes in benefits to society associated with alternative conservation options. It also will provide detailed information about the potential social and economic impacts on various communities in both Maryland and Virginia of alternative regulatory and conservation options. This work will also move Virginia forward relative to ecosystem management, which is now being aggressively pursued on an international basis. In addition, this work will facilitate the development of a Fishery Ecosystem Plan (FEP) for the Bay, which is now being initiated. It will also help Virginia and VMRC be recognized as a world leader in marine ecosystem valuation.

COSTS:

	~~Original~~	**Amended 2/2/07**	
VMRC Funding:	~~$1,127,235~~	**$788,284**	**Year 1 = $363,403**
Recipient Funding:	~~180,357~~	**$177,793**	
Total Costs:	~~$1,307,592~~	**$966,077**	

Detailed budget must be included with proposal.

Updated 6/1/05

***This form alone does not constitute a complete application, see application instructions or contact Sonya Davis at 757-247-8155 or sonya.davis@mrc.virginia.gov : Due dates are June 15 (Jul. – Nov. Cycle) and December 15 (Jan. – May Cycle)**

Table 4: Amended 2/2/07

STATE MENHADEN STUDY

Personnel	**YEAR 1**	**YEAR 2**	**YEAR 3**	**TOTAL REQUEST**	**VIMS and OTHER SUPPORT CONTRIBUTION**	**TOTAL PROJECT**
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Travel						
Travel to survey and interview sites	7,500	750	750	9,000		9,000
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Printing/Publication Final Report			1,000	1,000		1,000
Collaborating Investigators						
Hicks	10,000	10,000	10,000	30,000		30,000
McConnell	10,000	10,000	10,000	30,000		30,000
Strand	10,000	10,000	10,000	30,000		30,000
Duberg	15,000	10,000		25,000		25,000
Maryland, Marine Advisory Services Program	12,500	12,500	12,500	37,500		37,500
Facilities & Administrative Costs (25%)	**72,681**	**51,400**	**33,577**	**157,657**	**177,793**	**335,449**
Total	**$363,403**	**$256,998**	**$167,883**	**$788,284**	**$177,793**	**$966,077**

Facilities and Administrative Costs:

F&A costs limited to 25% requested. Institutional approved rate is 45%. Remaining costs contributed as part of VIMS match.

Proposal Submission to

Virginia Marine Resources Commission
Recreational Fisheries Advisory Board

By

THE VIRGINIA INSTITUTE OF MARINE SCIENCE
COLLEGE OF WILLIAM AND MARY

The Economic Importance and Value of Menhaden in The Chesapeake Bay Region

James E. Kirkley
Principal Investigator

John Olney
Chair, Department of Fisheries Science

Jane A. Lopez
Director, Sponsored Programs

Dr. Roger Mann
Director for Research
and Advisory Services

15/12/2006

The Economic Importance and Value of Menhaden in The Chesapeake Bay Region

A Research Proposal

James E. Kirkley
College of William and Mary
Virginia Institute of Marine Science
School of Marine Science
Department of Fisheries Science
1208 Greate Road
Gloucester Point, VA 23062
December 2006

Source of Photo: Chesapeake Bay Program

The Economic Importance and Value of Menhaden in The Chesapeake Bay Region

Introduction

The Atlantic menhaden, *Brevoortia tyrannus*, is often perceived as a keystone species of the Chesapeake Bay's ecosystem. Menhaden are noted for their ability to filter the water, and they are an important prey species for major commercial and recreational species of the Bay and Atlantic Ocean (e.g., striped bass, blue fish, sea trout, sharks, and tunas). There are also two major commercial fisheries for menhaden. There is a reduction fishery, which lands menhaden for purposes of producing fishmeal, oil, and solubles, and there is a bait fishery, which captures and sells menhaden for bait for both commercial and recreational purposes.

The most current information available on the status of menhaden suggests that the coastwide stock is healthy because the condition of the resource is within the target and threshold levels specified by biological reference points. Various individuals and recreational and environmental associations, however, have raised concerns about the health of the resource, since it is primarily exploited in the Chesapeake Bay. That is, there are concerns about localized depletion, and its ramifications for water quality and the health of various species of finfish and shellfish in the Chesapeake Bay. It has been estimated that between 50 and 70% of the entire catch of menhaden come from the Chesapeake Bay. There is also concern that age classes—5+, which represent the most important component of the spawning stock are declining.

Presently, only the states of Virginia and North Carolina permit a reduction fishery for menhaden within their territorial sea. Management of the fishery is by the state, but management must be consistent with management goals and objectives specified by the Atlantic States Marine Fisheries Commission (ASMFC). Amendment 1 to the Interstate Fishery Management Plan (FMP) for Menhaden was approved by the ASMFC in 2001. That plan implemented management strategies based on fishing mortality and spawning stock biomass targets and thresholds that are biologically, economically, socially, and ecologically sound. Addendum III was approved in October 2006, and established a five-year annual cap on reduction fishery harvests in Chesapeake Bay of 109,020 metric tons, which is the average annual harvest between 2001 and 2005. The cap will be implemented in 2006 and extend through 2010. Harvest for reduction purposes will be prohibited in the Chesapeake Bay when 100% of the cap is landed. Over-harvest in any given year would be deducted from the next year's quota. The Addendum also includes a provision allowing under-harvest in one year to be credited only to the following year's harvest, not to exceed 122,740 metric tons. The restriction does not apply to the bait fishery.

The commercial fishery has been highly controversial. Both recreational anglers and environmental associations have argued and supported the imposition of more restrictive regulations on the reduction fishery. The commercial sector has been

generally opposed to many of the proposed restrictions because of the absence of scientific documentation, and the potential social and economic consequences of increasingly restrictive regulations. In addition, the stock assessment for 2006 indicates that the condition of the resource is healthy, and thus, the industry perceives no need for additional restrictions.

The controversy between environmental associations, recreational anglers, other concerned stakeholders, and the industry, however, raises several important issues. First, what is the best role of menhaden relative to its ability to help maintain or enhance water quality? Second, how important is menhaden as a contributor to the recreational experience. Third, how important is menhaden as prey for other important commercial and recreational species? Fourth, how important is the reduction fishery in terms of generating jobs, income, output, and taxes to the local economy and state economy. Fifth, what is the economic value or benefit of menhaden oil as a health supplement? Alternatively, what does society gain or lose in terms of economic contributions or impacts and economic value or net benefits to society under different harvesting strategies or resource conditions?

Decisions about management and regulatory strategies for menhaden should partially be based on the economic value and social importance of menhaden to citizens of the Chesapeake Bay region. Information about the economic value and importance of menhaden to the region is sparse and is restricted to economic activity generated by the menhaden fishery in 2004. Kirkley et al. (2005) estimated that the menhaden fishery of Virginia generated approximately $32.9 million in sales or output, $19.0 million in income, and 281 jobs for the economy of Virginia.[1] A report by Southwick Associates, Inc. and Loftus (2006), using models and estimates available in Kirkley et al. (2005), reported that sport fisheries dependent upon menhaden contributed more than $235 million to the economy of Virginia in 2004.[2] Information on the social or community importance of menhaden is virtually absent.

The report by Southwick Associates and Loftus, however, explicitly ignores linkages between economic activity and economic value of anglers and menhaden abundance. Alternatively, their report provides estimates of only the economic activity generated by expenditures by anglers targeting rockfish or striped bass, bluefish, speckled trout, and weakfish or sea trout. Their work offers no conclusions about how economic activity generated by anglers targeting these species might change as the abundance, availability, and age class structure of menhaden changed. Their work also provides no estimates of economic value or benefits to citizens of the Chesapeake Bay region. In addition, their report provides no assessment of net benefits of the commercial industry, or the possible health benefits from the health products produced with menhaden.

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[1]Kirkley, J.E., T.J. Murray, and D. Duberg. (2005). Economic Contributions of Virginia's Commercial Seafood and Recreational Fishing Industries: A User's Manual for Assessing Economic Impacts. VIMS Marine Resource Report No. 2005-9. VIMS/SMS, College of William and Mary, Gloucester Point, VA 23062.

[2]Southwick Associates, Inc. and A.J. Loftus, Loftus Consulting. (2006). Menhaden Math: The Economic Impact of Virginia's Recreational and Commercial Fisheries.

A starting framework for managing menhaden is to recognize its role in the ecosystem of the Bay and related tributaries. Next, a rigorous analysis of the associated economic impacts associated with all consumptive and non-consumptive uses of menhaden needs to be conducted. The economic value or net benefits generated by both consumptive and non-consumptive users should be estimated and assessed (e.g., the net benefits to recreational anglers targeting species dependent on menhaden, or the values derived by society from menhaden's contributions to clean water). Alternatively, economic benefits are derived by society just by knowing that the menhaden population is healthy (existence value). Then, the potential impacts on commercial and recreational communities somehow related or dependent on menhaden need to be estimated and assessed. In essence, the best management of menhaden requires an ecosystem approach and the preparation of an environmental impact statement or EIS.

An EIS, however, is not legally required for managing any territorial sea fishery of Virginia. Environmental impact statements are legally required only for federal actions or actions subject to federal regulations. An EIS, though, would be beneficial to the state for making informed decisions about menhaden. We propose to develop the equivalent of an EIS relative to the menhaden resource of the Chesapeake Bay region. The emphasis of the research will be to estimate and compare economic impacts or contributions to the economy of Virginia, net benefits to the region, and potential social impacts generated by menhaden, relative to both consumptive and non-consumptive uses.

The study proposal, however, should be considered in a sequential timeframe. It is, thus, proposed that the first year be devoted to collecting and compiling information and data related to the commercial and recreational fisheries perceived as directly dependent on the menhaden resource (i.e., the reduction fishery and the commercial and recreational fisheries for striped bass, bluefish, speckled sea trout, and gray sea trout). In addition, extensive review of both the peer-reviewed and gray literature will be conducted to determine the availability of additional information and knowledge on the potential physical and biological interactions between menhaden, water quality, and the abundance and health of the four game fish species. Also during the first year, efforts will be initiated to integrate the on-going studies by VIMS with economic valuation and social impact assessment work. It is intended that this study be conducted in collaboration with on going studies by VIMS on water quality and menhaden and the role of menhaden as prey. Also, profiles of the various communities dependent upon menhaden will be developed, with the emphasis being on the significance of menhaden relative to community structure and viability (e.g., would restricting the commercial catch to zero cause massive social and economic problems for Reedville, Virginia). It is proposed to complete the study over a two-year, eight month period, with an additional four months required to prepare a final report. A draft report, however, will be issued within the two-year, eight-month period. The additional four months are required to edit the report.

Objectives of Study:

The primary goal of the proposed study is to determine the economic and social importance of menhaden to stakeholders in the Chesapeake Bay region. There are several related objectives: (1) determine the economic contributions to the economies of Virginia and Northumberland (the Virginia county where the Omega Protein reduction plant is located) of the menhaden reduction fishery, which includes processing sales of all products; (2) determine the contributions to the economies of communities dependent upon recreational fishing for species dependent upon menhaden; (3) develop economic and social profiles of Reedville and Northumberland; (4) develop economic and social profiles of communities and counties identified as being at least partially dependent upon recreational fishing for species perceived as being dependent upon menhaden; (5) estimate and assess the economic value or benefits of menhaden relative to commercial and recreational catches of striped bass, speckled sea trout, weakfish, and bluefish, which will focus mostly on the role of menhaden as a prey species; (6) estimate and assess the economic value of the abundance of menhaden relative to populations of marine mammals and birds; (7) estimate and assess the economic value of menhaden relative to water quality, which will focus on changes in abundance of species dependent on menhaden; benefits from swimming in clean water; benefits from other forms of water-based recreation; and benefits from improved aesthetics; (8) determine the economic values or net benefits of the reduction fishery and recreational fisheries dependent upon menhaden, which will focus on marginal value of menhaden for the recreational fisheries and the total economic value for the commercial fishery; (9) estimate and assess the net benefits of nutritional supplements produced with menhaden; and (10) develop models for estimating and assessing the economic impacts and net benefits of alternative allocations or catch quotas on menhaden.

Caveats Relative to Proposed Research:

Items (1) – (4) can be done with the collection of data and development or update of existing mathematical models. Items (5) - (9) will require extensive research to complete, and are partially dependent upon on-going work at the Virginia Institute of Marine Science and several surveys relating economic value to water quality; to enhanced recreational experiences; to the value society derives from bird watching and conservation of marine life; to the value of improved water-based recreation; and to the value of menhaden-based nutritional supplements. Item (10) is dependent upon items (1) – (9). Because of the extreme complexity of the proposed work and necessity of other on-going studies being completed, it is proposed that the research be conducted over a two-year, eight month period, with an additional four months allowed for editing the final report.

Some Background Basics

The proposal purports to estimate both economic impacts and economic values. These two concepts are similar, but are quite different metrics, and have substantially different implications for resource use and allocation. Economic impacts are simply

that—impacts; they represent economic activity generated by consumers and businesses. We normally measure impacts in terms of total sales or output generated, total income generated, and total employment generated by a given economic activity. For example, if I purchase fish, which were locally caught, I generate sales for the grocery store; sales of supplies and utilities for the store, wholesaler, processor, and watermen; and the watermen, processor, wholesaler, etc., generate additional sales, income, and employment. These sales or outputs, however, are nothing more than transfer payments; they are important to economies of Virginia and local areas, however, because they generate employment, income, and tax revenues.

In contrast, economic value or benefits represents the value of a good, service, or state of the environment or resource to an individual or a collection of individuals (society). Economic impact analysis does not account for social benefit or value; it does not explicitly consider what has to be given up or the alternatives that must be foregone (these are referred to as opportunity costs). An example provided in Lipton et al. (1995) illustrates the difference between economic value or benefit and economic impact.[3] An economic impact analysis would not contain an analysis of what individuals would do with their time and money if, as a result of a fishery closure, they could not go fishing; they might, however, go bowling. More important, however, is that economic impact analysis does not take into account anything that is not traded in a market.

Economic value to a consumer represents the maximum amount an individual is willing to forego in other goods and services in order to obtain some good, service, or desired state of the environment or resource. An economic value for menhaden might be the amount society is willing to pay to ensure that menhaden are at a certain level necessary to support striped bass. Note that this is a non-marketable good, which cannot be easily purchased via a market transaction. Another simple example is recreational angling. An angler might be willing to spend $30.00 per angling trip, but only has to spend $20.00 for the trip. The angler receives at least the $20.00 in value for the trip, but the angler also receives a surplus of $10.00 for the trip. This latter amount represents the net benefit to the angler.

Another related aspect to economic valuation is producer welfare. Producer welfare is simply the difference between revenues received and total operating or total variable cost. This represents a net return to the factors owned by a producer. Total net benefits to society, thus, equal the sum of consumer and producer welfare. How we measure or estimate these two measures of welfare are the topics of numerous texts, but there are relatively standard procedures for estimating and assessing economic value or welfare.

Last, consider the notion of making decisions using impact analysis vs. valuation. The Exxon Valdez oil spill off Alaska was a major spill in the United States. Most individuals would consider society to be better off without the spill. The spill, however,

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[3]Litpon, D.W., K. Wellman, I.C. Sheifer, and R.F. Weiher (1995), "Economic Valuation of Natural Resources: A Handbook for Coastal Resource Policymakers." U.S. Department of Commerce, NOAA, NOAA Coastal Ocean Program, Decision Analysis Series No. 5.

generated large economic impacts in terms of economic activity generated by expenditures on cleaning up the spill. The economic impacts of the spill were positive, but it is highly unlikely that the economic value or benefit to society was positive.

The valuation of menhaden involves both consumptive and non-consumptive uses. Alternatively, there are market and non-market values. The market side mostly involves determining the consumer and producer welfare associated with the harvesting, processing, and sales of menhaden and related products. On the non-market side, we have to consider the economic values or benefits of recreational fishing, water-based sports, bird watching, and all activities, which could be dependent on menhaden. Next, we then must estimate or determine the economic values of the services of menhaden to the ecosystem—ecosystem valuation. This latter issue has become of international importance as nations move away from single species to multi-species fisheries management, and eventually, to ecosystem management.[4]

Back to the Caveats

A study of this type is extremely complicated and time demanding. Moreover, it must be done in a sequential manner; that is, parts of the study cannot be accomplished until previous components are finished and other on-going work at VIMS/SMS is done. Moreover, this study will require considerable upfront review of existing literature and other studies. Extensive fieldwork will be required just to develop community profiles, which are necessary to determine potential social and economic impacts of alternative allowable levels of harvest of menhaden. Separate surveys and valuation studies relative to the contributions of menhaden to water quality and health of finfish species dependent upon menhaden, the health of marine mammals, and the abundance and health of sea birds. New surveys will be required to obtain information from stakeholders and representatives of the reduction fishery.

A remaining issue is the need to consider stakeholders in the state of Maryland. Individuals in Maryland have also expressed concerns about the relationship between menhaden, water quality, and desired commercial and recreational species. Residents of Maryland, however, also receive benefits or are affected by the ecosystem services of menhaden. It is, thus, necessary to include stakeholders from both states to accurately depict the economic values and social impacts. This also, however, will require development of new impact models for the recreational angling sector of Maryland, as well as various surveys of Maryland stakeholders.

Research Proposal

As previously stated, the estimation and assessment of the potential economic impacts, and particularly, the economic value or net benefits is extremely complicated. Development and construction of the impact models, which are input/output models, are

[4]An excellent text on valuing ecosystem services is available from the National Academy Press, "Valuing Ecosystem Services: Towards Better Environmental Decision-Making," by the Water Science and Technology Board (2004).

relatively straightforward, but are time consuming.[5] Although developing both impact and valuation frameworks are well documented in the economics literature, valuation studies are typically more difficult and require more extensive surveys.[6]

Input/output modeling is relatively straightforward. We simply need to identify the linkages among consumers and producers; determine the production requirements of each industry; assess the leakages for each of the goods and services (how much of an input comes from in state or region vs. out of state or region, and how much of each good or service stays in the state); develop appropriate multipliers, which indicate how economic activity for one agent or industry reverberates throughout the economy; and then estimate and assess the impacts in terms of sales or output, income, and employment. The I/O model can also be used to estimate how much a given economic activity by an industry generates in tax receipts. The I/O model is really a very simplistic general equilibrium type model; that is, economic activity by all industries and consumers (supply and demand) is assumed to be in equilibrium through a given economy.

The economic valuation component, however, is considerably more difficult. This is because there are numerous approaches for determining the economic value of market and non-market goods and services, and for the purposes of this study, the primary difficulty will be the estimation and determination of the value of the ecosystem services of menhaden—a non-market good or service. Valuation is normally determined via willingness to pay or willingness to accept (e.g., what would an individual be willing to pay to catch and keep one more striped bass on an outing, or what would an individual be willing to accept to release one more striped bass per outing?). That is the easy part! From there, it becomes increasingly complex and difficult.

Some of the valuations of the ecosystem services might be determined using what is referred to as revealed preference. There are basically two methods of utility valuation—revealed preference method and stated preference method. Revealed preference uses observations from actual behavior revealed in actual or surrogate

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[5]Kirkley et al. (2005) in Kirkley, J.E., T.J. Murray, and J. Duberg (2005), Economic Contributions of Virginia's Commercial Seafood and Recreational Fishing Industries: A User's Manual for Assessing Economic Impacts," provides a detailed discussion on the construction and development of input/output (I/O) models.

[6]There are several excellent texts on how to conduct benefit-cost and economic welfare analysis. These include the following: (1) Gramlich, E. (1990). A Guide to Benefit-Cost Analysis. Illinois: Waveland Press, Inc.; (2) Adler, M.D. and E.A. Psoner. (2000). Cost-Benefit Analysis: Legal, Economic, and Philosophical Perspectives. Chicago: University of Chicago Press; (3) Nas, T.F. (1996). Cost-Benefit Analysis: Theory and Applications. London: Sage Publications; (4) Boardman, A., D. Greenberg, A. Vining, and D. Weimer. (2001). Cost-Benefit Analysis: Concepts and Practice. New Jersey: Prentice Hall; (5) Campbell, H. and R. Brown. (2003). Benefit-Cost Analysis: Financial and Economic Appraisal Using Spreadsheets. Cambridge: Cambridge University Press; (6) Layard, R. and S. Glaister. (1994). Cost-Benefit Analysis. Cambridge: Cambridge University Press; and (7) Johansson, P. (1993). Cost-Benefit Analysis of Environmental Change. Cambridge: Cambridge University Press. An additional, but comprehensive, discussion on methods of valuing ecosystem services is Cangelosi, A., R. Wiher, J. Taverna, and P. Cicero. (2001). Revealing the Economic Value of Protecting the Great Lakes. Northeast-Midwest Institute and National Oceanic and Atmospheric Administration.

markets, while stated preference requires survey instruments to construct hypothetical markets in which the respondents are asked to express their preferences. The revealed preference method is often used to determine the value of recreational fishing. If we can observe the amount an individual spends on travel and other costs associated with a recreational outing, we can infer the value of recreational fishing by an angler.

Alternatively, the value of the waterfront property (e.g., the aesthetics and enjoyment) might be inferred by examining the purchase price or appraised values of waterfront homes. We might also be able to determine the value of swimming and other forms of water-based sports by examining travel time and related expenditures. The same applies to individuals who derive value from observing sea birds or marine mammals in the Bay region. The problem with using revealed preference to determine the value of the ecosystem services of menhaden, however, is that that is no direct link between home purchases, recreational angling, and observing sea birds and marine mammals and the abundance and availability of menhaden. That is, we do not know how menhaden actually contribute to the value of individuals owning waterfront homes or engaged in water-based or eco-tourism type activities. In addition, there are no market transactions or observations relating economic value or benefits to indirect uses and non-users (e.g., individuals might receive benefits from knowing that menhaden are protected or not over-exploited, even though they will never use or even see a menhaden).[7]

There are numerous approaches for obtaining information necessary for using the method of revealed preference to value goods and services. One might use a travel cost method; a hedonic price method, which relates value to characteristics of an ecosystem service; or a production function method that relates marketable output levels and values to changes in ecosystem services. All methods, however, require information on actual market level transactions.

Stated preference is an alternative approach, which has been increasingly used to estimate the value of goods and services, particularly goods, services, or states of the environment for which there are no markets.[8] The method of stated preference has been widely used to evaluate various types of health care, the economic value of ecosystem services, and the value of numerous non-market goods and service. Stated preference techniques use a survey instrument in which a hypothetical market for the item (e.g., menhaden) being valued is created. The hypothetical market describes the item; reasons why a payment is needed; and a practical payment method (e.g., change in recreational license fee). There is some confusion among researchers about various methods of stated preference. Some researchers view a method known as contingent valuation method (CVM) as one method of stated preference, while other researchers view CVM and stated

[7]Other non-user values included bequest value and option value. Bequest value relates to the premise that individual receive benefits by protecting the value or resource for future generations, and option value relates to the notion that individuals receive value by reserving the option to exploit or use the resource at some future date. These are further discussed in Russell, C.S. (2001). Applying Economics to the Environment, New York: Oxford University Press.

[8]At the present time, Kirkley, Hicks, McConnell, and Strand are using a stated choice or stated preference survey to determine the preferences of Bay stakeholders relative to possible Bay restoration activities identified in Chesapeake 2000 or Chesapeake 2K.

preference as distinct and separate methods. Also, some researchers view conjoint analysis, which is widely used by marketing firms to determine the optimal product in terms of design, price, and characteristics or attributes of the product. There is, nevertheless, an increasing use of stated preference to determine preferences and values of environmental goods and services.

Stated Preference and Menhaden: The Method Of Analysis

The method of revealed preference can be used to estimate the economic value of the reduction fishery, and to some extent, the value of the health effects of the menhaden-based nutritional supplement. Revealed preference also might have some applicability to some non-market valuations relating to menhaden. Stated preference, however, would appear to be the preferred method for estimating most, if not all, the non-market values of menhaden. There are concerns, though, about the appropriateness of using stated choice. First, there is considerable uncertainty because of the lack of knowledge relating menhaden to water quality, the health of fish stocks, and the condition of sea birds and marine mammals. Second, it is uncertain that a stated preference survey could be designed to adequately elicit responses by Bay stakeholders (e.g., could they understand an attribute expressing water quality or abundance of sea birds). Third, it may be difficult to adequately design a survey instrument to facilitate individuals expressing the willingness to pay or to accept for various states of menhaden, water quality, the importance of prey, and the levels and health of sea birds and marine mammals.

It is, therefore, proposed that stated preference be examined as the primary approach for determining the economic value of the non-market aspects of menhaden. It is further proposed that a workshop be held to obtain an expert consensus on using stated preference or some alternative method to estimate the non-market values of menhaden. The workshop will be a two-day session in which individuals will be educated about the issues under consideration, the available scientific information, and options for valuing the ecosystem services of menhaden. Each workshop will include six or more individuals in addition to the principal investigator. There will be six external experts, who will be compensated $2,500.00 per meeting plus travel reimbursement. The experts will be assigned the task of helping select the best method for determining the value to society of the ecosystem services of menhaden. This also has the added advantage of ensuring that the results will have been subjected to an international peer review. The workshop will be held during the first year of the proposed study. A report describing the preferred approach and associated reasons will be prepared and submitted to VMRC during the first year of the study period. Following the development of the preferred methodology, appropriate surveys will be designed and field-tested. The workshop will be funded via NOAA fisheries, Virginia Sea Grant, and Maryland Sea Grant. All three agencies have verbally pledged financial support.

Details of Proposal

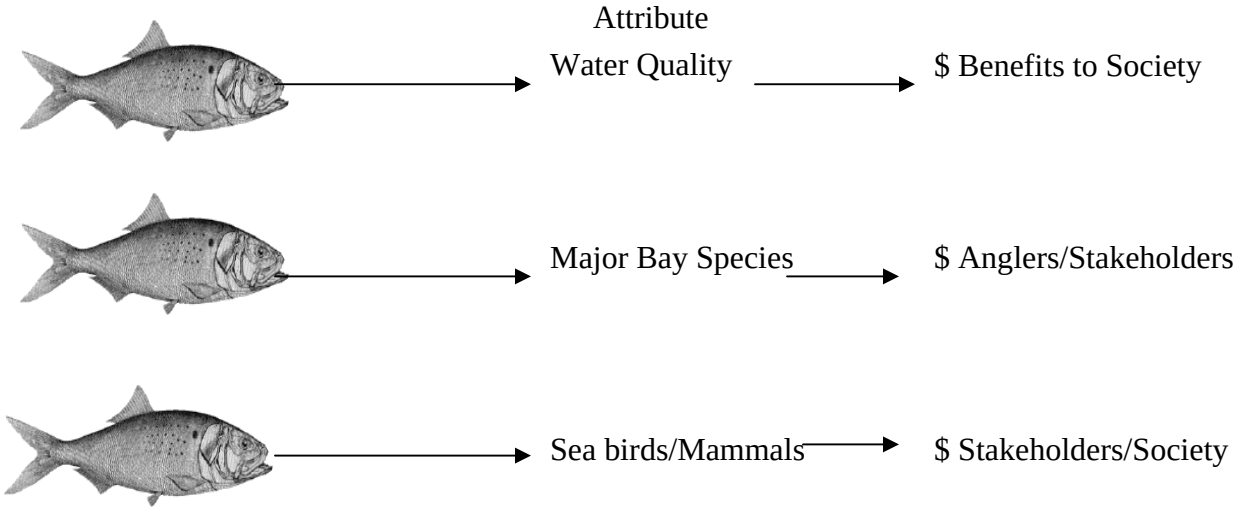
The purpose of the proposed research is to determine the social and economic importance of menhaden to stakeholders of the Chesapeake Bay region. This will require

the following: (1) an assessment of the economic impacts of various activities dependent upon menhaden, which includes the reduction fishery, recreational angling sector, charter operators, and businesses providing goods and services to the commercial and recreational sectors; (2) the development of community and county profiles in Maryland and Virginia, which are perceived as being dependent or somehow related to menhaden (e.g., Reedville, Virginia); and (3) the economic value or net benefits, with special reference to non-use values, of menhaden to society relative to water quality, prey for important game fish and commercial species, and relative to the health of sea birds and marine mammals. While items (1) and (2) are relatively straightforward, all three items, particularly item (3), are extremely complicated and time consuming.

Initially, an extensive amount of background research will have to be conducted. This is necessary to determine what information is available; the nature and scope of previous and existing studies, which might provide useful information or results for the proposed study; and development of a list of potential economic valuation techniques, which are applicable to ecosystem valuation. In addition, it will be necessary to obtain an expert consensus on the method to be used to evaluate the ecosystem services of menhaden.

In simple graphical form, we consider the economic valuation. We desire to determine the economic value to society of menhaden relative to its ramifications for water quality, healthy stocks of four major species of the Bay, and health and welfare of sea birds and marine mammals (Figure 1).

Figure 1. Menhaden and Economic Valuation



In order to estimate and assess the economic value of menhaden, it will be necessary to develop an appropriate valuation methodology, conduct various surveys, and subsequently estimate various statistical models. In addition, the methodology and results will have to be peer-reviewed to ensure the validity of the models and results.

Year 1:

During the first year of the proposed research, the following tasks will be completed:

(1) Review of existing literature on physical and biological relationships between menhaden, water quality, population and health of striped bass, blue fish, speckled sea trout, weakfish, sea birds, and marine mammals;
(2) Review of on-going research to determine feasibility of applying results of such studies to this study to value menhaden;
(3) Design survey instruments for recreational and commercial fisheries related to menhaden, including the menhaden reduction fishery;
(4) Conduct survey of recreational anglers and commercial industry;
(5) Develop product mix and market profile of reduction firm;
(6) Determine the communities in Maryland and Virginia perceived as having some dependency on menhaden (e.g., a community with a large charter fleet that primarily targets striped bass, blue fish, weakfish, or speckled trout, and of course, Reedville, Virginia);
(7) Develop community and county profiles (social and economic) of communities partially dependent on menhaden;
(8) Prepare detailed social and economic profile of employees of the reduction fishery, with an emphasis on dependency on the resource; and
(9) Host one workshop with national and international experts on non-market valuation, with the objective of determining the most appropriate methodology for estimating the economic value of the ecosystem services of menhaden (the actual selection of the valuation method will be done in year 2);
(10) Develop input/output models for the Virginia reduction fishery, and the recreational fisheries for striped bass, blue fish, speckled trout, and weakfish (Maryland and Virginia);
(11) Determine, in consultation with workshop participants, the appropriate valuation methodology for assessing the economic value or benefits of the ecosystem services of menhaden;
(12) Review literature and work with industry to determine appropriate valuation method for estimating the economic value of menhaden-based nutritional supplements (likely to be accomplished via revealed preference but has been done using stated preference/contingent valuation);

Year 2:

In year two, the following tasks will be completed:

(1) Complete development of input/output or economic impact assessments models and economic assessment of potential impacts associated with menhaden;
(2) Complete social/economic profile of reduction fishery;
(3) Develop and field test appropriate survey instrument for determining the economic value of the ecosystem services of menhaden;

(4) Develop list of stakeholders in Maryland and Virginia to survey for the purpose of determining the economic value of menhaden;
(5) Develop stratified random sampling scheme to facilitate survey of Bay stakeholders;
(6) Conduct mail survey to obtain information necessary for estimating the economic value of the ecosystem services of menhaden;
(7) Prepare analytical data base using survey results;
(8) Develop mathematical/statistical models for estimating the value of the ecosystem services of menhaden relating to the potential attributes (e.g., water quality, prey for fish, and pray/diet for sea birds and marine mammals);
(9) The models will likely be random utility models requiring specifications consistent with multinomial logit models, and thus, the estimation algorithms will be developed;
(10) Estimate the economic valuation models and conduct sensitivity analysis; and
(11) Using estimates from the economic valuation models, estimate the economic value of the ecosystem services of menhaden for the Bay region.

Year 3:

(1) Update product mix assessment of menhaden product distribution;
(2) Complete comprehensive assessment of the social and economic impacts and value of menhaden to Bay region;
(3) Prepare draft report containing an assessment of the social and economic impacts and values of menhaden relative to the Chesapeake Bay region;
(4) Submit to VMRC and other appropriate entities for comments and suggestions; and
(5) Based on reviews and comments, prepare and submit final report to VMRC and other appropriate agencies.

Note: Item 2 will be submitted in the eighth month of the third year, and item 4 would be completed within the last four months of the third year. Item 4 is required to edit final report; there would be no substantial changes to the estimates provided in the draft report.

Proposed Budget

The questions to be addressed in this proposed study are extremely complex. Answers will require "state of the art" economic valuation, and will have to be subjected to a rigorous peer-review process. On the one hand, the proposed work will determine the economic importance or impacts of menhaden and the recreational and commercial fisheries perceived as being dependent upon menhaden. At the other extreme, the proposed work will determine the economic value or benefits to society of both consumptive and non-consumptive (non market and non direct use) uses of menhaden. In addition, the proposed work will determine the social and economic dependence of communities perceived as somehow being related to menhaden (e.g., it is clear that citizens of Reedville, Virginia are partially dependent on menhaden for their income and

standard of living, but residents of communities, such as Deltaville, may also be dependent on menhaden, since Deltaville is home to a charter boat fleet, which frequently targets species dependent upon menhaden as prey).

Assessing the economic impacts and potential social or community impacts is tedious, but relatively straightforward. The valuation of ecosystem services, however, is just now in its infancy, with most of the valuation being done on components of an ecosystem and using relatively simple valuation methods. More recent work on valuation has included conjoint analysis, contingent valuation, and particularly, stated choice or stated preference analysis. All assessments—social and economic impacts and valuation—require extensive surveys of stakeholders and time. The fieldwork required for a social or community impact assessment involves 12 months of work, and most of that work must be done on-site in the community.

The tasks and personnel are chronologically listed in Tables 1-3, which depict activities by year. Work to be completed in the first year is the most expensive because it involves the participation of a social scientist to conduct extensive ethnographic fieldwork, and the development of numerous community and county social and economic profiles. These profiles are essential for developing an impact assessment and depicting the importance of menhaden to communities. The proposed budget for this project, over the three-year period, is ~~$1,127,235~~ (Table 4). The budget includes all labor costs, fieldwork, survey design and implementation, mathematical and statistical analyses and model development, social and economic impact assessment, and preparation of final reports.

Table 1. Tasks and projected time required to complete tasks, Year 1

Year 1/Tas 1	Review existing literature on physical, biological, social, and economic relationships between keystone species (e.g., menhaden, water quality, population and health of striped bass, blue fish, speckled sea trout, weakfish, sea birds, and marine mammals)	4 mm Kirkley (3) Ryan (1)
Task 2	Review of on-going research to determine feasibility of applying results of such studies to this study to value menhaden	1 mm Kirkley (1)
Task 3	Design survey instruments for recreational and commercial fisheries related to menhaden, including the menhaden reduction fishery	3 mm Kirkley (2) Ryan (1)
Task 4	Conduct survey of recreational anglers and commercial industry;	3.5 mm Kirkley (0.5) Technician (3)
Task 5	Develop product mix and market profile of reduction firm	1 mm T.J. Murray
Task 6	Determine the communities in Maryland and Virginia perceived as having some dependency on menhaden (e.g., a community with a large charter fleet that primarily targets striped bass, blue fish, weakfish, or speckled trout, and of course, Reedville, Virginia)	5.5 mm Kirkley (.5) Ryan (3) Taylor (2)
Task 7	Develop community and county profiles (social and economic) of communities partially dependent on menhaden	5 mm Ryan
Task 8	Prepare detailed social and economic profile of employees of the reduction fishery, with an emphasis on dependency on the resource	2.5 mm Kirkley (0.5) Ryan (2)
Task 9	Host one workshop with national and international experts on non-market valuation, with the objective of determining the most appropriate methodology for estimating the economic value of the ecosystem services of menhaden	Workshop costs: Externally funded All planning, facilitating, etc. done by Kirkley/Lipton/VIMS
Task 10	Develop input/output models for the Virginia reduction fishery, and the recreational fisheries for striped bass, blue fish, speckled trout, and weakfish (Maryland and Virginia)	4 mm Kirkley (2)
Task 11	Determine in consultation with workshop participants the appropriate valuation methodology for assessing the economic value or benefits of the ecosystem services of menhaden	4 mm Kirkley (1)
Task 12	Review literature and work with industry to determine appropriate valuation method for estimating the economic value of menhaden-based nutritional supplements (likely to be accomplished via revealed preference but has been done using stated preference/contingent valuation)	2 mm Kirkley (2)
Additional	Collaborating Investigators: Hicks McConnell Strand Duberg Maryland Marine Advisory Services Program Lipton Travel for Field Work: Trips to Reedville, VA Various Virginia and Maryland communities Commercial/Recreational Surveys Commercial—4,000 @ $2.00 Recreational—8,000 @ $2.50 Student	 Assist in tasks 1,2,3, 9, and 11 “ “ Tasks 3, 4, and 10 Tasks 3,4, 6,7,8,9, and 11 Tasks 4, 6, 7, and 8 All Tasks

Table 2. Tasks and projected time required to complete tasks, Year 2

Year 2/Task 1	Complete development of input/output or impact models and assess associated economic impacts	4.5 mm Kirkley (2.5)
Task 2	Complete social/economic profile of reduction fishery	.5 mm Murray (.5)
Task 3	Develop and field test appropriate survey instrument for determining the economic value of the ecosystem services of menhaden	5 mm Kirkley (3) Technician (2)
Task 4	Develop list of stakeholders in Maryland and Virginia to survey for the purpose of determining the economic value of menhaden	4 mm Taylor (3) Technician (1)
Task 5	Develop stratified random sampling scheme to facilitate survey of Bay stakeholders;	1.5 mm Kirkley (1.5)
Task 6	Conduct mail survey to obtain information necessary for estimating the economic value of the ecosystem services of menhaden	2.5 mm Kirkley (.5) Technician (2)
Task 7	Prepare analytical data base using survey results	1.5 mm Technician (1.5)
Task 8	Develop mathematical/statistical models for estimating the value of the ecosystem services of menhaden relating to the potential attributes (e.g., water quality, prey for fish, and prey/diet for sea birds and marine mammals)	2 mm Kirkley (2)
Task 9	The models will likely be random utility models requiring specifications consistent with multinomial logit models, and thus, the estimation algorithms will be developed	.5 mm Kirkley (.5)
Task 10	Estimate the economic valuation models and conduct sensitivity analysis	.5 mm Kirkley (.5)
Task 11	Using estimates from the economic valuation models, estimate the economic value of the ecosystem services of menhaden for the Bay region	1.5 mm Kirkley (1.5)
Additional	Collaborating Investigators: Hicks McConnell Strand Duberg Maryland Marine Advisory Services Program Lipton Surveys of stakeholders: 4,000 @ $2.50 Student	 Assist in tasks 1,4, and 7-10 “ “ Task 1 Tasks 2,3,4, and 7-10 All Tasks

Table 3. Tasks and projected time required to complete tasks, Year 3

Year 3/Task 1	Update menhaden production distribution assessment	1 mm Murray (1)
Year 3/Task 2	Complete comprehensive assessment of the social and economic impacts and value of menhaden to Bay region	6 mm Kirkley (4)
Task 3	Complete draft report of assessment of social and economic impacts and economic value	7 mm Kirkley (4)
Task 4	Submit to VMRC and other appropriate entities for comments and suggestions	.25 mm Kirkley (.25)
Task 5	Based on reviews and comments, prepare and submit final report to VMRC and other appropriate agencies	5.75 mm Kirkley (3.75)
Additional	Collaborating Investigators: Hicks McConnell Strand Maryland Marine Advisory Services Program Lipton Student	 Assist in tasks 2,3 and 4 “ “ Tasks 2,3 and 4 All Tasks

BUDGET NARRATIVE:

Technical support, Year 1 includes Ph.D. social scientist.

NOTE: One workshop on ecosystem valuation wil be conducted in Year 1; funding for this workshop will be provided by other sources (e.g., NOAA Fisheries and the Sea Grant Programs in Virginia and Maryland)

Specific tasks, time commitment, and participants are outlined in the chart above (Tables 1-3)

Table 4 is a project total categorical budget.