FISHERIES ECONOMIC IMPACT ASSESSMENT: LESSONS FROM ALASKA

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INTRODUCTION

Alaska's politicians, bureaucrats, special interest groups and the media have been discovering Economic Impact Assessment for the last decade. They have applied and misapplied the results of impact studies to numerous policy questions.

The three authors of this paper have observed the evolution of applied impact assessment to fisheries management issues. We have developed impact assessment models, applied them to policy issues, and conveyed the results to policy makers. In addition, we have observed the development, application, and interpretation of fisheries impact assessment models by others. This paper is about some of the lessons we have learned from our experiences.

Properly applied, impact assessment can be an important and useful analytical tool for addressing fisheries issues. However, as with any analytical tool, a number of problems can arise in using economic impact assessment. In this paper we divide these problem areas into four broad types:

- Fundamental limitations of impact assessment.
- Common misinterpretations of impact assessment.
- Limitations for evaluating policy choices.
- Politics and impact assessment.

We describe each type of problem, and conclude with recommendations for both analysts and policy makers in developing and using economic impact models.

WHAT IS ECONOMIC IMPACT ASSESSMENT?

Economic impact assessment consists of estimating the size and distribution of direct and indirect economic impacts attributable to a given sector of the economy, or resulting from a given economic or policy change. "Economic impacts" are frequently measured in terms of employment or income for different regions and/or groups. A typical economic impact assessment "result" might be that construction and operation of a public works project like a fish hatchery would result in 100 sustained "direct" jobs in fishing and fish processing, and 50 additional "indirect" jobs in transportation, retail trade, and other support industries.

Modeling techniques for economic impact assessment include economic-base models, input-output models, and econometric models. For readers unfamiliar with these techniques, we have described them in an appendix.

Economic impact assessment is different from welfare measurement techniques such as cost-benefit analysis. Cost-benefit analysis focuses on comparing benefits (usually measured in terms of changes in net value of outputs) with costs. In contrast, economic impact assessment usually focuses on measuring specific economic effects, without attempting to measure all costs and benefits. The results of a cost-benefit analysis and an economic impact assessment may be strikingly different. For example, it is possible to have an increase in employment accompanied by a decrease in net value (in open-access fisheries).

Economic impact assessment has been applied to a variety of fisheries issues in Alaska. Table 1 summarizes nine studies which have been performed over the past decade.

Impact assessment models can provide a variety of helpful information to policy makers in addressing fisheries issues. These include:

a. Predicting the economic consequences of a specific policy, project, or new industry. Alaska's fisheries are actively developing and changing. For example, a state ocean ranching program has augmented harvests of salmon. An economic base model is used by the fisheries enhancement division of the Alaska Department of Fish and Game to explore employment consequences of proposed enhancement projects. More generally, employment consequences are a major consideration in funding decisions for projects.

b. Predicting the distributive effects of a proposed policy or project. There is intense political interest in the potential distributive consequences of policies such as limited entry or Americanization of the bottomfish fishery. In the political arena, whether or not the benefits of proposed projects or policies will be enjoyed by Alaska residents (or the residents of a particular region) is a major concern.

c. Increasing awareness among the public and policy-makers of the relative importance of an industry. A recent study funded by a broad group of private and public agencies was intended to demonstrate the importance of Alaska fisheries to the state's economy, and indirectly to increase political support for continuing fisheries programs.

Properly applied, impact assessment can be an important and useful analytical tool for addressing these and other kinds of issues. However, economists and policy makers can encounter a number of problems in developing impact models as well as misinterpretations and misuses of impact projections. The remainder of this paper discusses these types of problems.

FUNDAMENTAL LIMITATIONS TO ECONOMIC IMPACT ASSESSMENT

There are fundamental limitations to how "accurately" we can model the impacts of an existing or proposed economic project or policy. The purpose of economic model building is to simplify reality in a useful way. The art of impact assessment model building is in achieving a balance between an overly simplistic model, which may mis-characterize fundamental relationships in the economy, and an overly complex model, which may be theoretically more realistic but require unavailable data, or may be too difficult to use or expensive to construct. In some cases, the best impact assessments that can be achieved may simply not be very good.

TABLE 1
RECENT ECONOMIC IMPACT STUDIES APPLIED TO ALASKA FISHERIES

Economic Base Models	
Berman and Hull (1989)	Estimated direct and indirect contribution of fish harvesting and processing to total personal income, for six Alaska regions.
Goldsmith (1987)	Developed "HATMOD" model for estimating direct and indirect employment (and income) from fish hatchery operations in five regions of Alaska. Used by ADF&G, to evaluate regional enhancement projects.
McDowell and Calvin (1989)	Estimated direct and indirect contribution of fish harvesting and fish processing to total personal income for six Alaska regions.
Input/Output Models	
Butcher et al. (1981)	Estimated economic impacts of the Alaska shellfish fishery, using secondary data from a previously developed I/O model of Washington.
Jones and Stokes (1987)	Developed estimates of direct and indirect contribution of sport fishing to employment and income in Southcentral Alaska.
Olson et al. (1984)	Developed IPASS Model for U.S. Forest Service ot estimate direct and indirect employment (and income) from alternative land management policies.
Weddleton (1986)	Evaluated a scaled down version of the RIMS II national I/O model and tested against a salmon fishing fleet expenditure survey.
Econometric Models	
ISER (1983)	Developed Man-in-the-Arctic (MAP) econometric model, for evaluating state budget and resource management tradeoffs.
Reaume (1979)	Developed econometric model used for evaluating state budget and resource management tradeoffs.

Problems With Overly Simplistic Models

The simplest impact assessment techniques, and the ones most frequently applied to Alaska fisheries issues, are economic base models. These have the advantages of being conceptually straightforward and not requiring large amounts of data to construct.

A problem with economic base models, however, is that they generally assume fixed economic and technical coefficients over time, such as a fixed multiplier (fixed ratio of support to basic employment), or fixed technical relationships (fixed use of fuel or labor per unit of output). These assumptions may be valid in the short run, or for small economic changes. However, over longer periods of time, or in response to larger impacts, economic and technical relationships may change drastically, causing fixed-coefficient models to greatly under or overstate economic impacts.

For example, ignoring the effects of changes in relative prices may result in overestimating the economic impacts of a project or policy. Construction of a new fish processing plant in a community creates new jobs and increases the demand for labor. However, if labor is scarce in the community, wages may rise, causing other firms to reduce the number of employees on the payroll.[1] As fuel prices increase, fishing boats may change their travel patterns between fisheries.

Another common simplification used in fisheries economic base models is to assume fixed economic or technical coefficients among different sectors, such as a constant economic multiplier for all basic industries. However, expenditure patterns may vary between fisheries and other basic sectors of the economy, between different fisheries, and between resident and non-resident fishermen. Thus the actual economic multiplier associated with a particular fishery may vary greatly from the average multiplier, or the ratio of total employment to total basic employment.

Problems with Overly Complex Models

A common response to these problems of overly simplistic models is to try to create more complex and theoretically realistic models, such as input-output models which track different expenditure patterns of different sectors, or econometric models which use estimated demand and supply functions to model economic substitutions in response to changing relative prices. However, as models become more complex, other problems arise for economic impact assessment.

First, models are only as good as the data upon which they are based. In Alaska, despite the importance of fisheries to the State's economy, there is a dearth of reliable data on fisheries-related employment and expenditures. For example, no public agency currently publishes fish harvesting employment estimates for Alaska. Because of the large number, small size, wide diversity and dynamic nature of many fishing communities and fisheries, it

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[1] In the extreme, if the supply of labor is fixed or inelastic, additional demand for labor would drive up wages but would create no new jobs.

is very difficult to collect data which accurately differences between regions, differences in employment and expenditure patterns between fisheries, and the different roles of resident and non-resident fishermen. Additionally, confidentiality restrictions limit the extent to which the data that *are* collected by management agencies can be used by researchers. Analysts have typically responded to this data problem by making hidden simplifications--such as assumptions about economic relationships based on data from other states, or on ad hoc interviews with a few fishermen and processors.

Second, as models become more complex, they become more difficult to understand. There may be key assumptions which really "drive" the results, but which are difficult for anyone but the analyst who developed the model to be aware of or understand. This person may become the only individual who can use the model. Several models of the Alaska economy which involved substantial development work have "died" when analysts who built them moved on to other jobs.

Third, as models become more complex, they become more expensive both to develop and to maintain. Eventually, the marginal cost may exceed the marginal benefit of increased theoretical rigor and "accuracy."

Because of these problems, more complex models are not always better for meeting a particular modeling need. The art of impact assessment model building is in achieving a balance between the problems of overly simplistic and overly complex models. Any model is by definition too simplistic--no model can completely accurately describe reality. But after a certain point more complexity may reduce rather than enhance the utility of a model.

Sometimes the best that can be done may not be very good. For example, given existing data, it is simply not possible to determine accurately the economic contributions of specific fisheries to different regions of Alaska. We simply do not have enough detailed information about harvester and processor expenditures, not to mention the widely differing structures of the regional support and service sectors.

Sometimes both data and theory may be inadequate for projecting impacts, as with projects which involve substantial uncertainty, have little historical precedent, or involve complex interrelationships. How could any model have accurately projected the impacts of the building of the Trans-Alaska Pipeline upon Alaska fisheries? These involved not only the consequences of potential future oil spills, but also major indirect effects such as the contribution of state oil revenues to fisheries management and enhancement in Alaska. Alaska currently faces major policy decisions about the development of mariculture. However, it is very difficult to model the impacts of different policy alternatives, as history does not offer Alaska a useful guide to the fundamental changes in local and world salmon markets which may result from the widespread and rapid growth of fish farming.

These problems do not mean that impact assessment is not a valid and useful tool for addressing policy issues. However, they do mean that it is sometimes simply not possible to accurately predict the economic impact of a particular project or policy. It may, however, be possible to determine a reasonable range within which impacts are likely to lie, through

the use of sensitivity analysis or different "cases" which explore likely impacts under different sets of reasonable assumptions.

COMMON MISINTERPRETATIONS OF ECONOMIC IMPACT ASSESSMENT

The most basic misinterpretations of impact assessment arise when policy makers (and sometimes analysts) don't understand what the model projections show or what particular variables measure. A common source of confusion is over different definitions of "employment." Employment statistics can be expressed in a variety of ways, such as the total number of jobs (which counts part-time and full-time jobs the same), the total number of people working, full-time equivalent employment (which counts a part-time job as less than a full-time job), average annual employment (which averages seasonal variations in employment) or resident employment (which looks only at the employment of persons living in a region or the state).[2] These different kinds of jobs may represent vastly different contributions to the economy or to social goals. However, model users can easily confuse these definitions, especially when comparing the results of different studies that used different measures of employment.

A second type of misinterpretation arises when policy makers place an undue amount of emphasis upon particular model coefficients, rather than actual impact measures. Sometimes interest groups seize upon a high "multiplier" or a high resident employment share as evidence of high economic impact or significance. However, these coefficients have little meaning by themselves: if a project generates only a small number of direct jobs, it will not have a large impact despite having a high multiplier. A project may well have a high resident share in income generated, but provide such a low rate of return that it actually generates less income for residents than an alternative project with a lower resident share.

A third kind of misinterpretation arises in assuming that all impacts are "benefits." While an economic impact such as regional employment or income may well be of importance to policy makers, it is not necessarily the only or most important criterion to policy makers in considering the merits of a project. Carried to its extreme, this kind of reasoning would suggest that more expensive or less efficient projects are "better" because they generate more jobs or income. More generally, many decision makers do not understand the difference between economic impact analysis and benefit-cost analysis.

A fourth kind of misinterpretation involves extracting irrelevant or unjustified conclusions from a valid study result. A common example of this is the assumption that the *marginal* impacts of a particular project are equivalent to the *average* impacts of the entire industry.

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[2]Probably very few people know the particular definition used by the U.S. Department of Labor in measuring "employment": the total number of employees reported by all employers during the pay period which includes the 12th of the month. This does not distinguish between part-time and full-time employees, does not include self-employed persons (or most fishermen), and may double count some employees who hold more than one job or who change jobs during the week of the 12th.

This problem arises particularly frequently because policy choices or projects usually involve marginal changes, but impact studies often focus on the total impacts of an industry or fishery.

For example, several recent studies have examined the contribution of sportfishing to the regional economies of Southcentral and Southeast Alaska. These studies have shown that significant employment and income (as well as nonmarket or amenity values) can be attributed to sport fishing. Some sport fishing groups have attempted to argue, based on these studies, for increasing allocations to sport fishing, because of their economic importance. However, it is incorrect to conclude from these studies alone that the marginal impacts from increased allocations would necessarily be as high as the average impact of the total fisheries.

A different example is provided by the commercial salmon fishery. If we were to evaluate the historical distribution of expenditures from commercially harvested salmon we would find small average returns to boat owners. But if the sustained harvest level were to increase, we might find that much of the increased catch could be harvested with little additional cost. Thus the marginal change in income to boat/permit owners and/or crew could be much larger than the average return from fishing.

LIMITS OF ECONOMIC IMPACT ASSESSMENT FOR EVALUATING POLICY CHOICES

A more fundamental misinterpretation of economic impact assessment results from failing to realize the kind of answers which impact assessment cannot provide. Economic impact assessment cannot, by itself, provide answers to normative questions which require value judgements.

Economic impact assessment does not in itself require explicit or implicit value judgements. However, using economic impact assessment to evaluate policy choices may, if the policy choices involve different costs and benefits for different groups.

Economic tools do not provide a means of making normative judgments about distributional effects. Economic models cannot say whether policy choices should be made such as foregoing some net economic benefits for distributing wealth to individuals with lower income. They can, however, help policy makers to better understand the nature of distributive choices.

Economists use various measures of "net social benefit" which are typically based on net societal income regardless of distribution. However, both economists and policy makers should realize that the policy that produces the highest "net social benefit" is not necessarily the best policy choice, unless society is indifferent to distributional issues. Few Alaskans would argue that the fisheries policies which produced the greatest net income for American fishermen were optimal, if that income went only to a few fishermen or primarily to non-resident fishermen.

POLITICS AND IMPACT ASSESSMENT

In theory, policy makers want to make decisions based upon the best possible information about the effects of their choices, and therefore they want impact assessments to be carried out and interpreted correctly. In reality, however, many impact assessment users are less interested in having impact assessment carried out and interpreted correctly than in having results that appear favorable to a particular policy choice.

The potential for politicization of impact assessment is particularly great in Alaska, where fisheries issues generate intense political conflicts[3]. These conflicts make the job of government more difficult as different management and regulatory branches try to interpret information on the biological health of the resource, and synthesize this with information on the economic consequences of fishing. They create temptations to misinterpret or misapply, consciously or unconsciously, both economic impact assessment as well as other kinds of scientific evidence, in order to strengthen the case for a particular side.

When users of impact assessment--policy makers, interest groups, or the public--are more interested in getting a favorable result than a correct result, all of the kinds of problems which we have described above begin to occur. Users who care only about results tend to ignore the uncertainty associated with favorable results, as well as any questionable assumptions or methodological approaches. They tend to criticize models which produced unfavorable results as being too simplistic or based on unrealistic assumptions. They tend to interpret data incorrectly where it is convenient. They tend to welcome impact assessment results as objective scientific evidence on behalf of normative policy choices.

This politicization of impact assessment also occurs on a more fundamental level, in the decision-making over what kinds of impact studies are carried out, and by whom. Many impact assessment models are funded by private interest groups or public agencies with a vested interest in obtaining a particular result. Even if the analysts carrying out these studies work completely independently, the funding of impact assessment research tends to

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[3]Alaskans tend to believe that fishery resource conflicts are more intense in Alaska than in other areas of the country. They are certainly greater in number and variety. These conflicts may be divided into three broad types:

1. *Conflicts between user groups.* Conflicts arise between commercial, recreational and subsistence fishermen; between different commercial gear groups; and between users from different regions (in particular between residents and non-residents).

2. *Conflicts between fisheries and other resources.* Conflicts typically arise where development of other resources, oil development and transportation, logging, or mining is perceived to adversely affect fisheries habitat or harvesting.

3. *Conflicts over allocation of state funding.* As State revenues decline, funding for fisheries management, enhancement projects and research must increasingly compete with other State spending needs.

result in studies being carried out which will support a particular policy choice. Moreover, the degree of publicity which a study receives after completion is not independent of the results.

We do not mean to suggest that impact assessment results should not be used in the political process. Impact assessment provides useful information for making policy choices and it is entirely proper to use this information in political debate. However, we believe that both analysts and policy makers should strive to avoid misinterpreting impact assessment results. Wherever possible, policy makers and the public should demand the best possible information on which to base policy choices.

CONCLUSIONS

We have argued in this paper that impact assessment is a valuable analytical tool, but is subject to limitations in the information it can provide, as well as unintentional or intentional misinterpretation. Based on our experience in observing and participating in the development and use of impact assessment for Alaska fisheries issues, we offer the following recommendations for practitioners and users of economic impact assessment.

1. Recognize the fundamental limitations of impact assessment. Recognize that economic impact assessment is an art as well as a science. Tradeoffs are required between overly simple and overly complex models, and no model is perfect. Sometimes it is simply not possible to project impacts accurately.

2. Use sensitivity analysis to explore the effects of model assumptions and to avoid illusions of accuracy. Sensitivity tests also help model users to realize the limitations of model projections and the key assumptions behind projections.

3. Support basic data collection as a foundation for economic and other policy analysis. Good data are the foundation for good analysis and good decision making. Policy makers often pinch pennies on data collection when better data could result in better decision making and significant economic benefits for society. Economists should also talk to each other, and encourage standardization of data and approaches across studies. This can make the results of different studies more comparable and more useful.

4. Educate impact assessment users about impact assessment; encourage their participation in model design and assumptions. Impact assessment models should not be a "black box." If possible, model users should participate in key decisions about model design and assumptions. This will help ensure that models meet the needs for which they are intended and that they understand the results. In addition, thinking through the linkages between cause and economic impact can be as valuable for users as having the actual projected impact results.

5. Discourage misinterpretation of impact analysis results. Encouraging correct use of economic information and analysis should be a constant goal of economists working for or interacting with public agencies, as well as for decision makers addressing controversial public policy issues.

APPENDIX: A BRIEF OVERVIEW OF IMPACT ASSESSMENT TECHNIQUES

Regional impact models have been available since the 1930's as a technique to describe the structure of national economies. More recently, the methods for deriving these models have been changed to make them adaptable to regional and local economies. This appendix defines some basic concepts for those uninitiated in the techniques used buy economists for estimating regional impacts.

Economic Base Models:

The most common economic impact modeling approach used for fisheries in Alaska is the economic-base model. *Basic* sectors of the economy are the group of industries that bring in money from outside the region or state. For Alaska, the basic sector industries are mining (including oil and gas), fishing, tourism, timber, and federal government (including military) spending. Depending on the application of the model, some portion of state government is often included in the basic sector.

In economic base models, a *multiplier* is computed as the ratio of total economic activity (usually measured in terms of employment or income) to basic sector activity. For example, if there are 250,000 jobs in the economy, and basic sector employment is 100,000 jobs, the basic sector multiplier is 2.5. The multiplier shows how basic sector activity is "multiplied" into total economic activity, as income generated in basic industries is spent, thus creating demand for secondary industries such as transportation, retail trade, and services.

To estimate multipliers, it is necessary first to determine the direct increases of employment and income resulting from the fishery, and also to determine the indirect and induced increases in other industries. The actual multiplier is defined as the sum of the direct and indirect increases divided by the direct increase.

Economic base models may be adjusted with information from other types of regional impact models. Some economic base models may have more complex features such as two or more fisheries sectors and formal linkages between direct effects in one region and forward indirect effects in other regions.

Input-Output Modeling:

An input-output model is an accounting system showing economic transactions between local business, households, and governments, as well as transactions between public and private entities. An increase in production in one economic sector leads to smaller production increases in other sectors, which in turn leads to further increases.

Ideally, an economic impact model should be based on direct observation of purchase and sales patterns of all industries in the economy. This would allow accurate measurement of leakages from the regional economy and improve estimates of secondary impacts of fisheries related activity. Practically, the extensive primary data collection effort this would entail is not possible. To keep the cost of impact analysis within reason, some scaled-down derivation of the Bureau of Labor Statistics (BLS) national Input-Output matrix of the

purchase and sales patterns of 485 Standard Industrial Classification (SIC) industries is often employed to model the interaction among industries in the state.

The basic problem with this approach is that it assumes industries in Alaska have purchase and sales patterns that are similar to those in the rest of the U.S.. Many economists who have reviewed these types of studies agree that even when large leakages from the Alaska economy are explicitly accounted for, this approach tends to produce multipliers that are too large. The most common way of dealing with this problem is to judgmentally adjust interindustry relationships to more closely resemble those in Alaska.

Econometric Models

Econometric models develop demand and supply functions for inputs with multiple regression analysis. These functions are developed with time series information. These models tend to be statistically complex and have not been used extensively in Alaska for evaluating fisheries impacts.

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