PERSPECTIVES ON NATIONAL FOREST FISHERY VALUES FOR LAND-USE PLANNING

Fred H. Everst
Pacific Northwest Forest and
Range Experiment Station
U.S.D.A. Forest Service

ABSTRACT.

Recent congressional legislation requires valuation of all major resources, including fisheries, in National Forest land-use plans. The value of angling recreation, however, is difficult to determine and must be estimated by indirect methods. This paper offers some perspectives on the accuracy and application of fishery values and valuation procedures for land-use planning.

INTRODUCTION

The National Forest Managmenet Act of 1976 requires that land management plans be developed by 1983 for all lands in the National Forest System. Planning required by the act is being accomplished by interdisciplinary teams of specialists representing the major resources of each Forest.

Where do National Forest fisheries fit in the land-planning process? How important are fisheries in the array of resources produced by the National Forests? How should the importance of fisheries be measured? How reliable are estimates of the economic worth of recreational fisheries and how can they be used in planning? A biologist's effectiveness in interdisciplinary planning will be measured largely by how well he or she is able to address the preceding questions. It is my goal in this paper to present perspectives that will provide some general answers.

MEASURES OF FISHERY IMPORTANCE

The importance of a resource is usually measured in social, economic, or ecological terms. The social significance, as measured by recreational use, and the economic value accruing to recreational and commercial interests relative to other resource values are two of the most effective ways of demonstrating the importance of fisheries to society. Ecological importance is often ignored until a species or resource is threatened with extinction.

ANGLING RECREATION IN THE NATIONAL FOREST SYSTEM

Large and diverse sport and commercial fisheries are produced within waters of the National Forests. The Nation's 154 National Forests contain more than 123,000 miles of streams and 1.9 million acres of lakes that support angling recreation (Everest and Summers, in preparation). Angling in these waters is one of the most popular forms of recreation provided by the National Forest System. In 1977 more than 16 million recreational visitor days (RVD) were spent fishing for a variety of species. The USDA Forest Service annually records recreational use for 23 outdoor activities, and in 1977 camping and sightseeing were the only activities more popular than angling (USDA Forest Service 1979a). In addition to important recreational fisheries, National Forests of the West produce about 50 percent of the wild Pacific salmon stocks and 30 percent of the total catch taken by commercial fisheries.

The importance of National Forest fisheries at both the local and national levels is shown by recreation-days of use or by pounds of fish landed for commercial fisheries. These statistics, however, are often unwieldy for use in planning models where the importance of commodity resources is reported in economic terms. To standardize input data, administra-

tors and planners often seek a measure of economic worth for all resources considered in a particular plan, and biologists always have difficulty displaying the value of fisheries in economic terms.

NET ECONOMIC BENEFITS OF FISHERIES

The net economic worth of fisheries is difficult to determine for two reasons. First, outdoor recreation in America has traditionally been made available by the public sector, and sport fishing has traditionally been a free (or nearly free) right; therefore, representative market prices for sport fishing are nonexistent. In the absence of market data, indirect methods have been used to estimate the potential value of fishing to consumers (anglers) if the right to fish was actually sold in a competitive market. The technical design and potential accuracy of these techniques, however, remain in dispute among economists. Many indirect approaches to valuation of extra-market goods and services (those having no market-pricing mechanism) have been tried, and currently, all are considered somewhat imprecise.

Second, the net worth of commercial salmon fisheries is maintained at artificially low levels because, until recently, no attempt was made to limit the number of people participating. When entry to a fishery is unrestricted, desired harvest levels are maintained through regulations that reduce the efficiency of each participant. Under such a plan of regulated inefficiency, net profit per license holder and the total net value of the fishery tend toward zero. Since there is little justification or incentive to protect even large and productive fisheries whose net value is near zero, economists have attempted to determine the potential net value of a fishery conducted in an efficient manner. Neither actual nor potential net benefits to participants, however, are comparable with the net value of sport fisheries, which are measured as benefits to consumers. To place net sport and commercial values in the same context, Brown et al. (1976) developed a method of estimating the benefits from commercial fisheries to consumers. This improvement has resolved several problems by standardizing estimates of value from different fisheries and providing an estimate of actual benefits from commercial fisheries rather than potential benefits, whether the fish are harvested efficiently or not (Brown et al. 1976).

With the difficultues in evaluating fisheries, is there any reason to proceed with attempts to define their economic worth? Yes! Clawson (1976), in a critical review of the economics of National Forest management, states that there is simply no alternative to making indirect estimates of the value of recreational resources. If recreational activities, including sport fishing, are to be considered along with forest commodity outputs during the land-planning process, estimates of the value of recreational goods and services must be supplied to managers. Also, the National Forest Management Act of 1976 requires that such estimates be made.

With this direction, an attempt must be made to estimate the value of fisheries involved in any land-use-planning effort. But what concept of economic value should be sought and how should it be derived? The preferred concept of value, called "consumer surplus," approximates total net benefits to consumers, or the willingness of consumers to pay in excess of their present costs to participate. Consumer surplus is the amount that a discriminating monopolistic owner could collect if each user of a resource was charged the maximum price the user was willing to pay.

Two techniques for estimating consumer surplus are accepted by economists (Dwyer et al. 1977). The travel cost (TC) method measures differences in the cost of travel and related activities to recreationists at varying distances from the recreation site and then infers how recreationists would behave if higher costs were required for participation. This method, although theoretically sound, is subject to potential biases caused by availability of substitute recreation, tastes and preferences, income levels, the value of a recreationist's time, and several assumptions.

The second method is called the hypothetical valuation (HV), or survey method (Dwyer et al. 1977). With this method, recreationists might be asked how much they would be willing to pay to participate in an activity, or how much compensation would be required for them to give up their right to participate. This method is subject to numerous problems, but

gamesmanship in answering questions is probably the most serious source of bias. People responding to questions on willingness to pay often (1) answer conservatively because of fear that their response might in some way alter the future cost of participation or (2) answer liberally, knowing that they do not actually have to pay and hoping to influence the supply of a good service. Hypothetical questions on valuation relating to compensation often elicit similar biased responses.

Until recently, the degree to which these two procedures estimated the actual value of an extra-market recreation activity was unexplored. Bishop and Heberlein's (1979) study gives some indication of the magnitude of biases associated with the procedures. The study used three methods to estimate the consumer surplus value of goose hunting in the Horicon Zone of east-central Wisconsin; 14,000 hunters were issued permits for the area and three separate samples of hunters were drawn at random. The first sample consisted of 237 hunters who were sent actual cash offers ranging from $1 to $200 for their permit and were asked to return either the permit or the money. The second sample was sent mail questionnaires designed to develop HV measures of the value of their permits. A third sample received questionnaires designed to estimate a TC demand curve for goose hunting in the Horicon Zone.

The result of these methods was not encouraging. Responses to the actual cash offers yielded an average consumer surplus of $63 per permit. Bishop and Herberlein (1979) assumed that $63 represented the hunter's actual willingness to sell (and willingness to pay) and compared the results of the HV and TC analyses with that figure. The HV of willingness to sell of $101 per permit was 60 percent higher than the actual cash value, whereas the HV of willingness to pay of $21 per permit was one-third of the actual cash value. TC estimates were made with a hunter's travel time valued at zero, one-fourth, and one-half of current salary; all three estimates fell well below actual cash value.

Bishop and Heberlein concluded that HV of willingess to sell represented an upper boundary estimate of value and HV of willingness to pay, a lower boundary. They also concluded that TC estimates of value are highly conservative unless there is adequate accounting of time costs. They indicate, however, that TC values are preferred by most economists because evidence has shown that people often act differently than they say they will. Their general conclusion was the valuation techniques used by recreation economists cannot claim accuracy comparable to measurement of actual market phenomena.

What does all this mean to evaluation of fisheries and land-use planning? Although recreation economists are constantly improving estimating procedures, it is unlikely that any past studies have produced precise values of recreational fisheries.

In the past 18 years, at least three major studies using TC and HV procedures have estimated the value of anadromous fisheries of the Pacific Northwest (Table 1). All these studies are out of date and suffer one or more conceptual problems in their design; nevertheless, all are still used for evaluating sport fisheries for anadromous salmonids. Assuming that Bishop and Heberlein's (1979) observations hold true in a general way for past TC and HV studies, we might speculate on the accuracy of each study mentioned in Table 1. Mathews and Brown (1970) used the HV technique to estimate anglers' willingness to sell their rights to fish for salmon in Washington for one year. Values estimated by this procedure might have been high. Brown et al. (1964, 1972, 1976) and Gordon et al. (1973) used the TC procedure, but both failed to ascribe any value to a recreationist's time; therefore, estimates from these studies might have been substantially low.

Another set of values has been developed for the Renewable Resources Planning Act (RPA) Assessment for 1980 (USDA Forest Service 1979b). Consumer surplus values derived for the RPA 1980 assessment were highly conservative estimates based on a composite of results from previous studies (Table 1). The figures for anadromous salmonids are based on 1974 statistics from Brown et al. (1976) and are sure to underestimate values when applied to USDA Forest Service RVD (the application currently recommended by the U.S. Department of Agriculture), but they are likely to underestimate current values even when applied to angler days of recreation (the correct application). An angler-day averages about 4 hours in the Pacific Northwest, whereas an RVD represents 12 hours of recreational activity. An average of three angler-days are contained in each RVD.

TABLE 1. Estimates of net consumer benefits (consumer surplus) per angler-day for sport fisheries and per pound for commercial fisheries, for anadromous salmonids, cold water resident game fish, and warm water game fish in the Pacific Northwest.

Evaluation procedure and location	Fishery	Consumer benefits/ angler-day	Consumer benefits/ commercial pound	Year of study	Reference
Hypothetical valuation		Dollars	Dollar		
Washington	Salmon	28-63	--	1967	Mathews and Brown (1970)
Travel cost					
Oregon	Anadromous salmonids	20	--	1962	Brown et al. (1964,1972)
Columbia River	Anadromous salmonids	22	0.80	1974	Brown et al. (1976)
Idaho	Anadromous salmonids	15.20-30.60	--	1967	Gordon et al. (1973)
	Resident salmonids	8.20-24.00	--	1967	Gordon et al. (1973)
	Warm water	16.60	--	1967	Gordon et al. (1973)
National Forests[1/]	Anadromous salmonids				
	Sport benefits	19.50	--	1978	USDA Forest Service (1979b)
	Commercial benefits	--	0.63	1978	USDA Forest Service (1979b)
	Sport habitat improvement	19.50	--	1978	USDA Forest Service (1979b)
	Commercial habitat improvement	--	0.80	1978	USDA Forest Service (1979b)
	Inland sport fish				
	Cold water/warm water use	5.25	--	1978	USDA Forest Service (1979b)
	Cold water habitat improvement	6.25	--	1978	USDA Forest Service (1979b)
	Warm water habitat improvement	4.25	--	1978	USDA Forest Service (1979b)

[1/] Values for use on National Forests are for 1980 Renewable Resources Planning Act Assessment.

Although probably none of the above studies has accurately estimated the daily consumer surplus benefits of sport angling for anadromous salmonids, they do provide the only well-documented estimates available for evaluating specific fisheries. Daily consumer surplus benefits reported by Gordon et al. (1973) and Brown et al. (1976) were derived by TC studies and are probably the most theoretically sound estimates of value currently available for evaluating western fisheries. RPA values are probably also theoretically sound when correctly applied.

Tuttle et al. (1975), Kunkel and Janik (1976), and Everest (1977) have developed models (e.g., Fig. 1) that can utilize results of any previous TC or HV studies to estimate the value of specific fisheries. Several fishery statistics, including escapement, catch-to-escapement ratio, division of sport catch between river and ocean fisheries, division of catch between sport and commercial fisheries, and angler-effort expended per fish caught, are needed to use the models. All these fishery statistics must be estimated from sample data. Because of the potential errors associated with estimated fishery statistics and possible errors in daily consumer benefits used, values of specific sport fisheries derived by use of the models must be considered rough estimates of actual value.

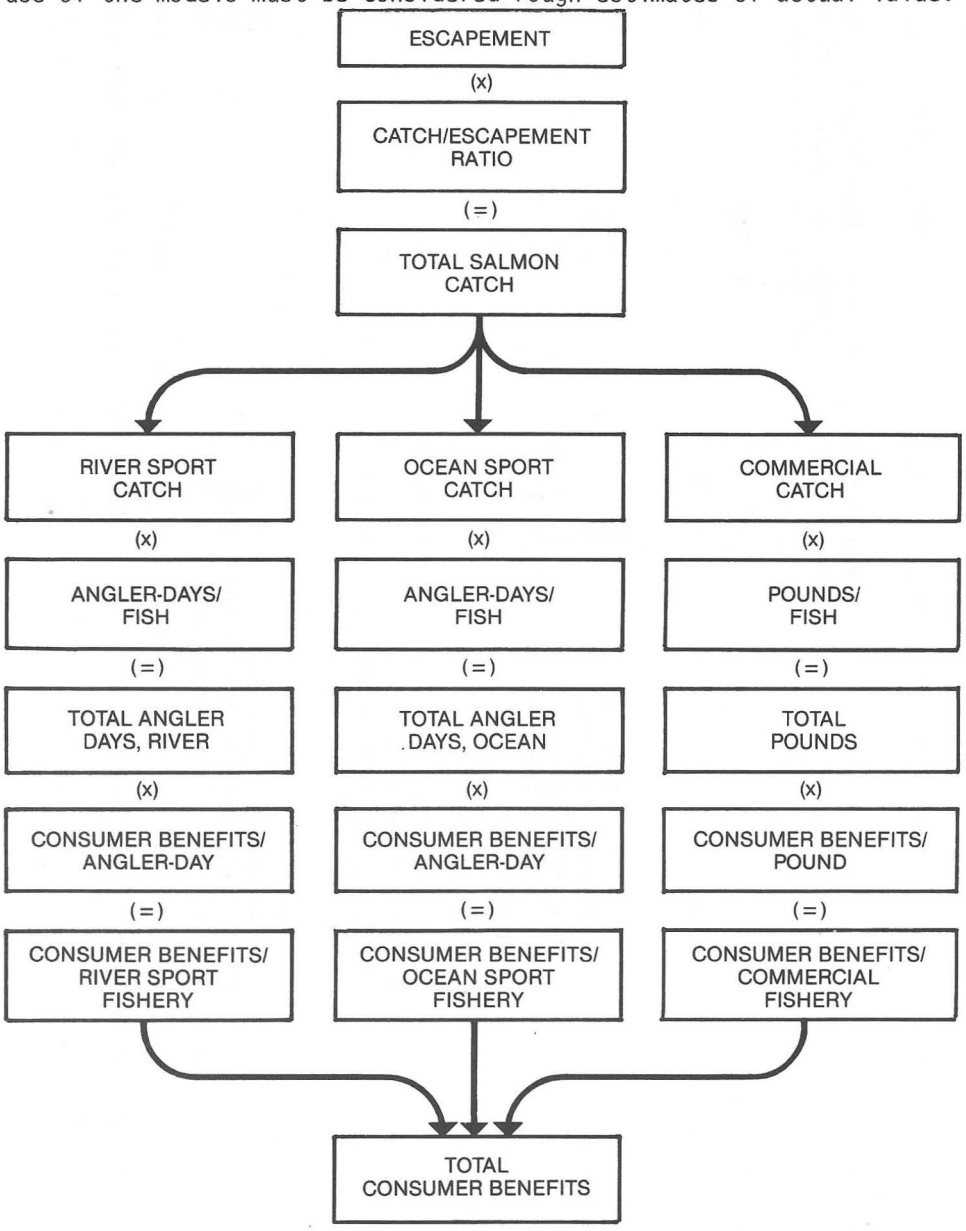

FIGURE 1. Procedural model for valuation of a National Forest Pacific salmon fishery.

Models of the type mentioned above can be used with local fishery statistics and with daily consumer benefits of the type developed by Brown et al. (1976) for the RPA 1980 Assessment to estimate the value of fisheries for land-use planning. From these statistics, sport and commercial fisheries are valued in like terms and can be added.

How comparable are values of fisheries as estimated by TC and HV procedures and the value of commodities determined in actual market transactions? Because of the indirect methods of deriving fishery values, the many underlying assumptions, and the potential errors in estimated statistics, the values of extra-market angling recreation cannot be considered directly comparable with commodity values. Nevertheless, biologists are required by both recent legislation and resource managers to produce their best possible estimates of the value of fisheries they manage. Despite the fact that fishery values calculated by the preceding techniques are often in dispute among managers and economists, they can be used and have been in land-use planning as is illustrated by the following example.

FISHERY VALUES IN LAND-USE PLANNING

While serving as a part-time member of a Forest Service land-use-planning team, I used biological, social, and economic data to document the importance of fisheries on the Mt. Butler-Dry Creek planning unit (Everest 1979). The Mt. Butler-Dry Creek unit is located in the northwest corner of the Siskiyou National Forest and contains 22,100 cares of incredibly rough, steep, and unstable terrain. Portions of the two major coastal watersheds drain the unit--Elk River and Sixes River. The area contains a variety of resources and is largely untouched by human activities.

Many streams that originate within or traverse through the unit contain large populations of anadromous salmonids. More than 27,000 adults of four species--chinook (*Oncorhynchus tshawytscha*) and coho salmon (*O. kisutch*), steelhead (*Salmo gairdneri*), and cutthroat trout (*S. clarki*)--enter Elk and Sixes River on spawning migrations each year. Not all adults spawn within the planning unit, but all are influenced by the land-management practices followed there. Elk River also provides water for a large Oregon Department of Fish and Wildlife salmon hatchery.

To demonstrate the importance of the fishery resources, I provided administrators with an estimate of the annual commercial salmon catch, angler-days of recreation, dockside commercial value, and consumer surplus value of recreational fisheries produced by the unit, as well as the methods and assumptions used in derivation of these figures. Next, I documented the fact that conventional timber management activities (clearcutting, high-lead yarding, fall broadcast slash burning, sidecast road construction) conducted on similar lands along the perimeter of the unit in the early 1960's seriously damaged habitat of anadromous salmonids and totally curtailed production in one segment of a major tributary. Using the preceding items as a reference point, I illustrated the potential consequences to fisheries that could result from harvesting timber in the unit with anything less than the most sophisticated techniques. These and other data were used by managers in arriving at a decision for allocation of unit lands.

Approximately 45 percent of the area has been allocated for protection of fish habitat, water quality, and recreation; 53 percent of the area, containing 66 percent of the potentially available softwood timber, was allocated primarily for timber management. The final environmental impact statement for the unit requires use of sophisticated logging and road systems to protect fish habitat and water quality on lands managed primarily for timber production.

The extent to which valuation of fisheries affected allocation of lands in the Mt. Butler-Dry Creek unit is unknown. Fishery values were only one of many items of data supplied by planning team members for the consideration of administrators. The balanced way in which the land was allocated, however, would indicate that the values were an important consideration in the decision-making process.

CONCLUSION

The state-of-the-art for estimating the value of sport fisheries is not well developed. Although techniques for evaluating fisheries are available, their accuracy is unknown, and

the value of extra-market items derived by these techniques are not directly comparable with commodity values established in the marketplace. Nevertheless, fishery managers and economists must, under force of law, continue to estimate the economic worth of the resources they manage and press for additional research that will improve estimating procedures.

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