

# FISH, WILDLIFE, AND ECONOMICS

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Prologue: I believe in materialism. I believe in all the proceeds of a healthy materialism (emphasis added)--good cooking, dry houses, dry feet, sewers, drain pipes, hot water, baths, electric lights, automobiles, good roads, bright streets, long vacations away from the village pump, new ideas, fast horses, swift conversation, theatres, operas, orchestras, bands--I believe in them all for everybody. The man who dies without knowing these things may be as exquisite as a saint, and as rich as a poet; but it is in spite of, not because of, his deprivation. (Francis Hackett, Ireland).

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## INTRODUCTION

And herein lies the dilemma for man in the last quarter of the 20th Century--how to maintain a healthy planet and still go on ever increasing "the proceeds of a healthy materialism." The effective demands of man for fish or wildlife (as items of commerce or sport), the demands for segments of their habitat (sometimes vital and critical parts of the ecosystem) for other uses, and last, but not least, the spillover effects of agricultural and industrial production (whether accidental and obvious or intended and undetected) on fish and wildlife and their habitat, are compounding the problem of conserving these resources.

Obviously, the economic demands and supply possibilities chosen by society to turn out the products of a "healthy materialism" are creating a situation where fish and wildlife habitats are in the main subject to continuous encroachment; fish and wildlife in many instances become the residua of the present process--that is, what remains after all the deductions inherent in the way economic activity is now generally organized and conducted, have been made. The indictment, and it might be considered such, applies with equal force and validity to the conduct of economic activity in the socialist block of countries. Lake Baikal in the U.S.S.R. is but one recent example. Therefore, a rephrasing of the title of this paper lends perspective to this process--"Economic activity; Fish and Wildlife Possibly."

But this is not a new phenomenon; it has been an underlying condition of the scene for centuries. It has been a chronic problem associated with social and economic change, but particularly with the nature of technological change in the last fifty years.

The perennial challenge to man has been to devise management for land and water resources and fish and wildlife resources to serve the dual function of conservation of the resource itself and an equitable allocation to the various user groups demanding it. The many policies which apply to the use of these resources--navigation on inland waters; the dumping of wastes and sewage into estuaries, bays, and the ocean itself; the use of tidelands for garbage fill; and many other uses, stem from the criteria and guidelines set up for the conduct of economic activity.

The important point to note is that these criteria and guidelines are not unalterable; they can be fashioned to reduce the impacts and consequences of economic activity on fish and wildlife, and often at very little cost. And one of the best safeguards to clarify the issues, it is contended, is economic analysis. The predictions of the consequences of a particular policy is more readily discernible and its subsequent control and improvement facilitated by resort to the reasoning and concepts of economics.

In devising and implementing suitable policies for the protection, management, and development of fish and wildlife, economic science is far from dismal; it is most helpful. It is contended that in the field of fish and wildlife management, the primary, if not sole, concern in the past with biology and related sciences has had one result--a de-emphasis of the recognition of the need for research on the inherent economic issues involved in the management of these resources. In many instances, answering the economists' queries serves to delineate the relevant research areas and in some instances helps to establish the ordering of research priorities in the biological and natural science investigations.

Economics does serve to establish relevant and pertinent questions--for example, who receives the benefits of the management of these resources; who bears the costs; and what would be the effect on revenue and participation of a fee increase for fishing or hunting? Also, nearer home, there are obvious gains in applying the proven concepts and procedures of market research to identify factors associated with the steady and sometimes steep decline in annual per capita fishing and/or hunting license sales in many of the States. Useful research approaches to reveal the forces bringing about this state of affairs are suggested subsequently.

There are many well conceived interdisciplinary studies which involve economics and biology being presently conducted. In California, one recent and interesting study by Professors Ciriacy-Wantrup and Phillips (1970) estimates the social benefits of (and suggests measures for) safeguarding the survival of the tule elk. Another study sponsored by the National Audubon Society and conducted by Dr. Bishop is attempting to estimate the gain to society and the costs in maintaining a viable colony of California condor (Bishop 1971). However, my purpose is not to catalogue relevant economic studies of fish and wildlife resources but to indicate some of the areas where economic reasoning might be usefully employed. It is not possible to do more in a short discussion.

#### The Crux of the Economic Problem

Increasing competition for the use of the resources constituting the habitat of fish and wildlife is central to the present and future management concerns for these resources. The resources involved--land and water, free-flowing streams, etc.--have alternative uses. The preservation of land and water for fish and wildlife "use" can incur high costs to society in terms of the proceeds of a "healthy materialism." Benefits that society foregoes from not using the water and land in question for the production of power, water supply, industry, and home real estate in some instances, are considerable; in other situations very few benefits are forfeited to retain habitat.

How might economic reasoning be applied in the case where substantial benefits, in terms of commercial products, are forfeited to preserve the habitat? This resolves into a question of the following type: What is the optimum amount of estuary to maintain today, tomorrow, and in the future for its various uses so that the stream of social benefits over time will be maximum? We require a maximization of social welfare not at any point in time or in a short time but in the long term. Quite probably, society can afford the first yard or the first mile with much less loss in fish and wildlife than that involved in taking a subsequent segment; but to determine the point at which values foregone are greater than those gained is extremely difficult, demanding a good knowledge of the working of the total ecosystem and its overall production possibilities.

#### Economic Reasoning: An Aid

The valuation problem is quite complex; many of the "services" produced by an estuary or free-flowing stream are joint products. However, this condition simply suggests that economic evaluation is all the more desirable as in the case of San Francisco Bay and other coastal inlets where industrialization and urbanization, in terms of their derived demands for water, are encroaching on habitat. It is essential to know what fish and wildlife values are being destroyed and when their value of the margin is sufficient to buy off further encroachment. Their value may be such that present users of salt ponds and marshes (for the production of salt and other minerals) can be bought out in favor of extending bird and wildlife preserves.

What is lost as a result of not reclaiming parts of the estuary for homesites as against leaving it as habitat, producing and/or sustaining fish and birds? There is a delicate balance. If we give up too much estuary, the loss of future benefits can be very great. Where the line of demarcation is to be drawn is difficult to gauge, but it is here that economic reasoning is invaluable for providing insight to alternative courses of action. To keep as many options as possible open is the key strategy. The destruction of the natural estuary site may mean the complete destruction of a segment of fish and wildlife.

The following considerations should enter into the decision making. The relative scarcity of the habitat and the relative scarcity of the marine life products it supports should enter the consideration. For example, any projected dredging and retrieval of aggregate from a rich aggregate source such as the Potato Patch outside the Golden Gate would very likely jeopardize the support system for the local supply of crabs in the Bay area. In such a situation, the following questions should be answered: For what purposes is the aggregate required? Is it to be used for concrete constructions or for bay fill to create homesites? If the former, are there other sources of aggregate supply? If the latter, what is the relative scarcity of homesites in this vicinity or close by? In other words, have all the opportunities for the projected homesites and/or supply centers for aggregate for construction been carefully explored. What incremental costs are involved in selecting alternative sites?

On the other side, what would be the repercussions of losing a valuable seafood resource. The impact of losing the local crab resource is not measured solely in the loss of income to fishermen who forfeit all or part of their livelihood. There are indirect or neighborhood effects which must be accounted for. The appeal of Fishermen's Wharf as a tourist attraction would surely decline and income from both local clientele and tourists would fall off with further repercussions on the business sector. These costs are real and have to be measured and entered into the calculus when balancing the gains and costs of deleting or jeopardizing a vital part of any fish and wildlife support system.

Where the fish or wildlife resource is very scarce its appreciating value should be considered. Unique recreational experiences, such as viewing the snowy egret at Bolinas, are worth a great deal to many people, and it is this future income stream which is important for assessment.

One argument that has been advanced for the preservation of rare natural phenomena is that advances in technology provide an ever-increasing flow of goods and services from our agricultural and industrial bases at ever-reducing costs. A variant of this argument is that we do not really need the products of the wilderness or habitat as urgently as in former days--that is, the timber, grass, or minerals. This argument has to be critically examined. It is true that in agriculture we are substituting for land-fertilizers, weedicides, and pesticides; however, the externalities created by this substitution process--viz., the accumulation of DDT in the food chain, the excess of nitrates in the drinking water in some localities, etc.--point to some fundamental omissions in the tally of social costs.

Another condition which is prevalent in California and which, on balance, is probably working to preserve fish and wildlife is the purchase of former poor farming or ranching land (in some instances not so poor) as sites for weekend or vacation homes. The value of this land for recreation is quite high, judging by the prices paid for it. The community is not losing very much in terms of the wool, crops or timber foregone as a consequence of the new owner--the recreationist--not grazing, farming, or logging the land.

In this balancing of gains and losses from various alternative schemes of management, what is required is a prognosis of the market and the extra-market values. As noted, the cost, in terms of other uses foregone (power, water supplies, etc.) of preserving a stretch of river or tideland habitat can be very high. That extra-market benefits in the past have been incompletely assessed does not mean that, in any future development decision which greatly affects the environment, the extra-market benefits should be considered the sole guide to its preservation. This is an extreme position no more valid than that of placing sole reliance on the assessed market values. Until satisfactory

methods of measuring extra-market values are evolved, there are bound to be cases where these values are either underestimated or overestimated. As Professor Crutchfield (1967) summarizes:

"We (economists) must be in on plans (involving decisions on fish and wildlife) and we must be in on the plans using economic evaluation techniques that fall within the confines of the accepted practices of other water uses. If you do not use economic evaluations at all your case is hopeless. If you use phony evaluations it is not much better. I think we have to work at the problem in these lights...Those days (of no conflict) are gone and I think we are going to have to face the evaluation problem and do a better job than we have in the past if these values are to be preserved at all."

There is, consequently, a need to devise methods of objectively scrutinizing extra-market values and of weighing the market and extra-market values. The challenge to the discipline of economics still remains to provide meaningful indicators of the relative advantages and disadvantages of different alternative schemes or systems of development and management of these resources encompassing all costs and all benefits.

The claim has been made that economic reasoning, whether employed deliberately or intuitively, is useful for decisions on the development and management of fish and wildlife. With a fixed budget and defined objective, it is precisely an economic question to ascertain where the most can be obtained for a given expenditure. For any given program we need to know what it is costing, and where a choice is made that is not the most efficient, what is obtained for the additional costs. The location of hatcheries, the determination of size, even to the extent of phasing out obsolete ones, are all matters for the economic assessment. A more important extension of this type of work is to conduct economic analysis of the mitigation measures and facilities that have already been incorporated in water projects to "make good the loss of fish and wildlife caused by the original dam." A least-cost solution based on knowledge prevailing on the time of construction does not necessarily result in the best net benefit solution. In many cases as shown in post-mortem of fish losses incurred below dams in the Columbia River, some structures compound losses. Again, in the examination of old hydro dams now coming up for relicensing, there is excellent scope based on sound economic analysis to appraise the possibilities for fish enhancement and minimum flow releases. Economic studies should not be restricted to finding solutions to problems of expediency but should be made to serve the useful function of providing broader perspectives--i.e., what is the future role of fish and wildlife and how these resources are to be managed to fit them into an evolving society and economy.

#### Fish and Wildlife Management: The Need for Reappraisal

The broad demographical and sociological changes that have occurred since World War II suggest revision and innovation of management techniques if the fish and wildlife resource is to yield optimum benefit to society. Up to the present, wildlife management might be categorized as not really being directed to serve the "needs of society" so much as to carry out recognized principles of management itself and habitat used by wildlife. I recognize that proceeding this way constitutes a valuable safeguard for the conservation of the resource, but fish and wildlife are held in trust by the states to be managed for the people. And it is the preferences of people which have to be acceded to by any wise sovereign.

The State Departments of Fish and Game aided and abetted by the Federal Bureau of Sport Fisheries and Wildlife, have been the custodians of what is now belatedly recognized as a major and vital part of our environment. In protecting and managing commercial and game fish and game wildlife, these agencies have been instrumental in conserving not only these valuable resources but other valuable environmental assets. However, the all encompassing custodial role of these agencies is not fully appreciated and certainly not recognized in terms of adequate funding and staffing. A parsimonious sovereign has decreed that the "gamekeeper's" purse cannot be filled from the public's coffers but only from hunting and license fees. This state of affairs is all the more bewildering since these common property resources are held in trust for all the people. It might be expected that

a wise sovereign would have been more generous over time to the gamekeeper to enable him to undertake the research and management to take proper care of his charge. An enlightened public aware of the true role that Fish and Game Agencies are playing in protecting environmental quality can and should insist that the sovereign be more benign thus ensuring that their basic interests in all fish and wildlife are adequately protected.

While the predilection of wildlife management has not been oriented necessarily to the rural dweller, in certain areas he may have benefited more than others. There is already an apparent need for fish and wildlife agencies to reorganize their services and provide more for urban people. The present day interest and distribution of population (70 percent of the population in the United States live on ten percent of the land, with more than half a million people leaving rural areas for the cities annually) should be recognized in management programs. As Marion Clawson has suggested, the popularity of bird and animal watching and feeding in the suburbs suggest that the State agencies might sponsor such activities. Their programs are tied chiefly to game management and protection.

The importance of predicting future trends in consumption of fish and wildlife resources is fully apparent. The present and future behavior of the consumer should be one of the principal focal points of investigation. And here market and economic research provide insights and guiding principles for allocation.

In obtaining reasonably reliable forecasts of consumption, on the supply side, appraisal must account for the improvement or deterioration of the quality of the outdoor experience and the changes in price of accessibility to the recreationist whether he be bird watcher or water fowl hunter.

On the demand side, changes in consumers' habits, population increase, increased income per capita, and the price and quality of substitute and complementary recreational pursuits are all logical topics for study aimed at improving management of fish and wildlife.

To study what types of people use fish and wildlife resources is a very different question from the total amounts expended on these activities, although determining why people behave as they do might be an integral part of gross expenditure surveys. The National Surveys of Fishing and Hunting, four in all conducted for the years 1955, 1960, 1965 and 1970 are remarkably free of any innovation and ignore useful promptings from economic and market research to better identify the consumer of fish and wildlife services.

Examination of behavior means objective scrutiny of how sportsmen and others behave with respect to their use of fish and wildlife resources and normally includes a documentation of (1) their frequency and place or places of participation, (2) their overt acts (hunting success, distance travelled, length of stay, etc.) and (3) which feature of the activity of the quality of the experience is worthwhile to the consumer. It would appear as basically important to ascertaining the gross expenditure patterns of sportsmen using fish and wildlife resources that the characteristics and nature of the "customers" and their consumption patterns should be better known and that the characteristics of these services provided by these resources in relation to competing activities and their seasonal patterns be also revealed.

It is inconceivable that the direction of future management programs should ignore the preferences of society. One of the basic problems in the planning of water projects have been to exclude from the pre-planning procedures any concerted effort to obtain the preferences of all groups with interest in water resources development.

Arguments of the type, ". . . it is possible that a reasonably abundant supply of game fish (other than anadromous fish) can be produced in the Columbia system in spite of the construction of dams authorized or completed. However, these fish will be mainly of the species considered inferior by most resident sportsmen although they have been acceptable to fishermen in reservoirs elsewhere in the country" illustrate the tendency to ignore preferences particularly where these preferences obstruct development for other purposes (Water Resources Policy Commission 1950). Obviously, in this instance sportsmen preferred salmon and steelhead fishing. Their preference should be taken into account. It is, therefore, basic to any water management program that the consumer and his preferences be

ascertained and that agencies virtually managing and developing aquatic habitats in their many dimensions provide as wide a range of services and endeavor to ensure that the broad spectrum of consumer's tastes is satisfied--the golden trout fisherman as well as the steelhead angler; no minority group should be excluded. Water decisions concerned with water allocation have to be taken not only with as complete a knowledge of the conditions and consequences of change in water use on fish and wildlife resources but together with a comprehensive assay of society's preferences for these and other resources.

In many instances research which would elucidate the characteristics of the fisherman or hunter has not been undertaken. Such a state of affairs is in contrast with the large detailed market research studies which are a feature of the food and appliance industry. But it is "this market"--the fishermen and the hunters and others who enjoy wildlife--that agencies are "catering for." The art of useful projection is dependent on detailed information on the consumer and respective market area.

Tastes do change and are changing with the shifts in urbanization, mobility of the populace, and increased standards of living; and these changes in preferences have to be reckoned with in projections. To catalogue preferences for various groups is fundamental to projecting future consumption, but some indications of the changes that have occurred over time must be gauged and accounted for.

A preliminary study of the trends in sales of fishing and hunting licenses by States for two periods, (1) the long term, 1946 to 1966, and (2) a recent short term period, 1960 to 1966, is revealing as to what has happened. The annual total license sales and per capita license sales were plotted over time. Linear regression analysis was applied. The trends obtained for each State were classified into three categories: (1) increasing (+), (2) decreasing (-), and (3) no change (0).

A preliminary appraisal of past and recent history of annual fishing and hunting license sales is possible from Table 1 where the number of States experiencing one or other of the three types of trends are shown.

Table 1. Comparison of trends in annual sales of fishing and hunting licenses.

Type of Trend	Fishing Licenses				Hunting Licenses			
	Total Sales		Per Capita Sales		Total Sales		Per Capita Sales	
	1946- 1966	1960- 1966	1946- 1966	1960- 1966	1946- 1966	1960- 1966	1946- 1966	1960- 1966
Increasing (+)	39	30	24	13	38	27	23	16
Decreasing (-)	8	8	18	22	7	12	23	23
No Change (0)	3	12	8	15	5	11	4	11
Total	50	50	50	50	50	50	50	50

The interesting point is that while total fishing and hunting license sales have increased over the long period, 1946 to 1966, in about 39 of the 50 States, per capita license sales have increased in only 24 States. Again, over the post-war period of 20 years, 1946 to 1966, per capita sales of hunting licenses have declined more sharply than per capita sales of fishing licenses; 24 States (Table 1) recorded decreasing per capita hunting license sales as against 18 States where per capita fishing licenses sales have declined (Bollman and Winnor 1970, Winnor 1970).

These admittedly are simple observations but they do point to the need to explain why such a large number of States show decreasing per capita license sales. The right questions have to be posed and it is in selecting the behavioral relationships to be tested that economics (consumer demand theory is most helpful).

#### CONCLUSION

Fish and Game Departments are at a distinct disadvantage in assessing the overall impact on a species or the habitat of many of the water projects currently under investigation. It is one thing to say we need better knowledge; buying knowledge about the behavior of complex systems will require a lot more resources. Improved capability in economic

Table 1. Summary of trends in total license sales and per capita license sales for Fishing and Hunting

State	Fishing				Hunting			
	Total license sales		Per capita license		Total license sales		Per capita license	
	1946-1966	1960-1966	1946-1966	1960-1966	1946-1966	1960-1966	1946-1966	1960-1966
Maine	+	0	+	-	+	0	-	-
Vermont	0	0	-	-	+	+	+	+
New Hampshire	-	0	0	0	-	0	-	-
Massachusetts	-	-	-	-	-	-	-	-
Connecticut	+	+	0	-	+	+	-	-
Rhode Island	-	-	-	-	+	0	-	-
New York	+	-	-	-	+	0	+	0
Pennsylvania	-	-	-	-	+	-	0	-
New Jersey	+	+	-	-	+	-	-	-
Maryland	+	+	0	0	+	+	0	-
Delaware	+	-	0	-	+	0	-	-
West Virginia	-	0	-	+	-	-	-	-
Virginia	+	0	0	-	+	-	+	-
North Carolina	+	+	+	0	+	+	+	0
South Carolina	+	+	+	+	+	+	+	+
Georgia	+	+	+	+	+	+	+	+
Florida	+	+	+	-	+	+	-	+
Ohio	+	a/	-	-	0	-	-	-
Michigan	-	-	-	-	+	+	-	-
Indiana	-	-	-	-	-	-	-	-
Wisconsin	+	+	-	-	+	-	+	+
Illinois	0	0	-	-	0	-	-	-
Kentucky	+	+	+	+	+	+	+	+
Tennessee	+	+	+	-	+	0	+	-
Alabama	+	+	+	+	+	+	+	+
Mississippi	+	+	+	+	+	+	+	+
Minnesota	+	0	-	-	+	-	-	-
Iowa	+	+	+	0	-	-	-	-
Missouri	+	+	0	0	+	+	+	+
North Dakota	+	+	+	+	+	0	0	+
South Dakota	+	+	+	+	+	+	+	+
Nebraska	0	0	-	-	-	-	-	-
Kansas	+	+	0	0	0	0	-	0
Arkansas	+	+	+	0	+	+	+	+
Louisiana	+	+	+	0	+	+	+	0
Oklahoma	+	+	+	0	+	+	+	0
Texas	+	+	+	0	+	+	+	+
Montana	+	-	+	-	+	+	+	0
Wyoming	+	0	+	0	+	0	0	0
Colorado	+	+	+	+	0	0	-	0
New Mexico	+	0	+	0	+	-	+	+
Idaho	+	0	-	-	0	-	-	-
Utah	+	+	+	+	+	+	-	-
Arizona	+	+	0	0	+	+	+	0
Nevada	+	+	-	-	+	+	-	-
California	+	+	-	-	+	+	-	-
Washington	-	+	-	+	-	+	-	0
Oregon	+	+	+	+	+	+	+	+
Alaska	+	+	+	0	+	+	+	+
Hawaii	+	+	+	+	+	+	+	+

a/ Blanks indicate no data available.

expertise within these departments could be helpful both in guiding the overall program of the search for such knowledge. Society's benefits may be great for an investment in economic capability--it is a legitimate policy alternative for agencies responsible for fish and wildlife management.

Economic analysis of a high order can only proceed with a greatly increased body of ecological, biological knowledge than is presently known.

Some of the most urgent problems in fish and wildlife management are inadequately understood and therefore inadequately coped with. Good economic analysis and a capability to undertake such research should be sought by agencies responsible for management of the biological stock of our environment. In a society now aware of the necessity to maintain environmental quality, such a capability is essential if they are to play their role effectively.

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