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A STUDY OF THE IMPACT OF
GAME AND NONGAME SPECIES ON
MAINE'S ECONOMY

By

Kevin J. Boyle, Assistant Professor
Stephen D. Reiling, Associate Professor
Mario Teisl, Assistant Scientist
and
Marcia L. Phillips, Graduate Research Assistant

Staff Paper No. 423
Department of Agricultural and Resource Economics
University of Maine

Final Report to:

Commission to Study the Impact of
Game and Nongame Species on Maine's
Economy
Rep. Donald V. Carter, Chair

December 1990

This project was financed in part by the State of Maine, Department of Marine Resources, Appropriation Account Number 1140.3100 and the Department of Inland Fisheries and Wildlife, Appropriation Account Number 1550.5067. Additional funding was provided through the Pittman-Robertson (Wildlife Restoration) and Dingell-Johnson (Fisheries Restoration) Federal Aid Acts, and the Maine Agricultural Experiment Station.

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EXECUTIVE SUMMARY

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INTRODUCTION

In January 1988 the Maine Legislative Commission to Study the Impact of Game and Nongame Species on Maine's Economy contracted with the Department of Agricultural and Resource Economics at the University of Maine to conduct an economic evaluation of recreational uses of Maine's fish and wildlife resources. All key findings and recommendations from this three-year study are presented in this final report. Specifically, overall economic evaluations of consumptive uses (inland fishing, marine fishing, hunting and trapping) and nonconsumptive uses of Maine's fish and wildlife resources are presented and opportunities for the future economic enhancement of these activities are identified.

The Commission had four "duties and responsibilities" to address:

- A. An analysis of the present economic impact of the State's wildlife resources on Maine's economy;
- B. An analysis of the economic, recreational and ecological potential of the State's wildlife resources on Maine's economy;
- C. An analysis of the annual costs associated with managing and maximizing the potential of these resources for the long-term benefit of the entire State; and
- D. An evaluation of alternative funding mechanisms for managing these resources.

Within this report we present data analyses to help the Commission address duties A and B. Duty C can only be addressed when the results of our study are combined with species management plans developed by the Department of Inland Fisheries and Wildlife and the Department of Marine Resources. The combination of our user data with biological data from the species management plans will facilitate the design of management programs and policies to enhance user opportunities and to meet biological objectives. Only at this stage can the costs of alternative management strategies be identified and quantified.

ECONOMIC VALUE AND ECONOMIC IMPACT
ESTIMATES

Total economic values were estimated for consumptive and nonconsumptive uses of Maine's fish and wildlife resources by residents and nonresidents of Maine.

- * The total economic value of inland fishing in Maine is at least \$300.7 million and does not exceed \$494.2 million.
- * The total economic value of marine sport fishing in Maine is estimated to be at least \$135.4 million and does not exceed \$274.5 million. These estimates must be interpreted with caution given difficulties in developing representative samples of resident and nonresident marine, sport anglers.
- * The total economic value of hunting in Maine is at least \$183 million and does not exceed \$291 million.
- * A total economic value was not estimated for trapping. The minimum economic impact of resident trapping is at least \$1.5 million and does not exceed \$3.4 million.
- * The minimum total economic value of nonconsumptive uses of Maine's wildlife resources is \$55.4 million. Nonconsumptive use, for the purposes of this report, are defined as any activity where a person enjoys wildlife in its' natural habitat but the creature(s) are not removed from the wild.
- * Given the figures reported above, the total economic value for select wildlife-related activities in Maine is at least \$675.7 million.

More information on the estimates reported here can be found in Section I of the report.

RECOMMENDATIONS

Section II and III of the report summarize economic information associated with wildlife-related activities in Maine and users' preferences and attitudes toward wildlife-related activities. Both types of information are useful to the agencies charged with the responsibility of designing and implementing management plans for the resources. The purpose here is to present specific recommendations based on the results obtained from the economic study of fish and wildlife resources conducted during the last three years.

Two types of recommendations are made below. First, recommendations are offered to the resource management agencies that manage Maine's fish and wildlife populations. These recommendations are designed to further enhance the utilization of the fish and wildlife resources of the state, and thereby increase the aggregate economic impact and aggregate surplus values these resources generate in Maine. These recommendations should be considered in the design or modification of management plans for specific species or species groups. Some recommendations may actually duplicate existing management plans. If this is the case, our recommendation should be viewed as supporting the continuance, and possibly enhancement, of the current program. Other recommendations are general in nature, unrelated to specific species, and will require the design and implementation of new management programs. Furthermore, it should be noted that the implementation of some of the recommendations will require legislative action.

Since the recommendations described below are based on economic data and the preferences of the users of the resources, they must be evaluated in light of biological and ecological information about the resource. Some of the recommendations listed below may not be achievable because of biological or other constraints that exist. Consequently, the recommendations presented below should be viewed as additional input to be considered by resource managers as they formulate plans for future utilization of fish and wildlife populations.

As in any study, this study identified several topics for further research. Consequently, recommendations for further research are also offered to the Commission. Obviously, any decision to pursue these topics rests with the Commission itself. However, we point out fruitful areas for further research to assist the Commission in assessing the potential value of additional research. We believe the results obtained from the additional research would significantly improve the overall understanding of key wildlife-related issues in Maine.

FISH AND WILDLIFE MANAGEMENT RECOMMENDATIONS

Inland Fishing

- M-1. The Department of Inland Fisheries and Wildlife should work closely with other state agencies to insure the water quality of Maine's rivers, lakes, ponds and streams is sufficient to support fish populations and a quality fishing experience.
- M-2. The Department of Inland Fisheries and Wildlife should work closely with other state agencies to protect the scenic quality of Maine's water bodies. Future development should not detract from scenic quality.
- M-3. The Department of Inland Fisheries and Wildlife should work closely with other state agencies to maintain or enhance public access to Maine's water bodies. Future development should not reduce public access.

- M-4. Management agencies should insure that fish stocks are maintained statewide at a level that satisfies anglers' expectations for a quality fishing experience. Needs for expanded hatchery capacity/stocking programs for brook trout, landlocked salmon and lake trout should be closely monitored.
- M-5. Efforts to expand fishing effort for warm water fish species should be increased to more fully utilize this valuable resource. This effort should focus on nonresident anglers as they are more inclined to fish for warm-water species and because nonresidents have a larger economic impact on the state economy.
- M-6. The Department of Inland Fisheries and Wildlife should closely monitor future ice fishing effort and its impact on fish populations and open water and ice fishing success rates.
- M-7. The Department of Inland Fisheries and Wildlife should maintain the status quo regarding waters open to ice fishing and the allocation of catch among open water and ice fishing in the near future. However, the Department should be prepared to make policy changes should it become clear that the resource can not support the combined impacts of open water and ice fishing effort.
- M-8. The Department of Inland Fisheries should use public service announcements and other means to provide information about ice conditions throughout the ice fishing season. It also should develop and distribute written material to educate ice anglers on methods to test the safety of ice.

Marine Fishing

- M-9. The Department of Marine Resources should consider the implementation of recreational marine fishing licenses for Maine.

Hunting

- M-10. The Department of Inland Fisheries and Wildlife should publicize key management actions designed to improve the quality of the hunting experience. This information should be distributed widely among all current and potential resident and nonresident hunters.
- M-11. The Department of Inland Fisheries and Wildlife should conduct or coordinate hunter education courses that are species specific and accessible to the average hunter.
- M-12. To the extent possible, the Department of Inland Fisheries and Wildlife should set the deer, moose and bear seasons to minimize the overlap among the three seasons for these species.
- M-13. The Department of Inland Fisheries and Wildlife should develop management policies to maintain, and if possible, increase the population of bears in Maine.
- M-14. The Department of Inland Fisheries and Wildlife should develop reasonable policies to reduce the conflicts among hunters who use dogs and those who do not use dogs.
- M-15. The Department of Inland Fisheries should work closely with Maine Guides to enhance the quality of guide services available to bear hunters (and other hunters and anglers) in Maine.

- M-16. The Department of Inland Fisheries and Wildlife should continue to develop management plans to maintain current opportunities of deer hunting in Maine.
- M-17. The Department of Inland Fisheries and Wildlife work closely with the appropriate federal agencies and other states to enhance the number of migratory waterfowl in the state.
- M-18. The number of moose hunting permits issued each year be increased. Biological data should be used to determine the number of permits issued.
- M-19. The Department of Inland Fisheries and Wildlife should continue its efforts to reintroduce turkeys throughout the areas of Maine with suitable habitat.
- M-20. Management programs should continue to focus on increasing the number of upland birds, thereby maintaining or increasing the potential for hunter success.
- M-21. Programs to increase or maintain access should also be continued, along with habitat enhancement programs for upland bird hunting.

Nonconsumptive Uses

- M-22. Brochures or leaflets describing techniques to attract common species of wildlife to residences should be developed and distributed to interested households.
- M-23. The Department of Inland Fisheries and Wildlife should develop educational materials for distribution to residents interested in learning more about different species of wildlife. Materials describing opportune times and viewing locations also should be developed and distributed upon request.
- M-24. Management plans should reflect the importance of nonconsumptive uses of deer, bears and moose management actions should be taken to enhance the nonconsumptive use of these species.
- M-25. The Department of Inland Fisheries and Wildlife should expand efforts to increase the number of nesting pairs of bald eagles in Maine.
- M-26. The Department of Inland Fisheries and Wildlife develop an organized program to increase information and education about the resources it manages. This program should be designed to reach the average Maine resident.

RECOMMENDATIONS TO THE COMMISSION

- C-1 A second study of marine sport fishing in Maine should be conducted. This study should focus only on marine fishing, and should not be part of a larger study.
- C-2 The Commission should consider further research on nonconsumptive uses of wildlife.
- C-3 The Commission should consider seeking legislative approval to allow 10 to 20 moose permits and 10 to 20 any deer permits to be auctioned to potential hunters for the purpose of validating research methods commonly used to determine the value people place on wildlife-related activities.

CAVEATS

In conclusion, we would like to close by noting that the information obtained by this study over the last three years is important and useful input in designing management policies related to the fish and wildlife resources of Maine. However, user preferences change over time; in some cases, these changes occur very rapidly. Therefore the Commission and the agencies that will be utilizing the data obtained during the study should not view the collection and analysis of these types of data as a one-time effort. Studies such as these should be updated every five to ten years, depending on the rates of change in wildlife-related activities and users' preferences. We hope the data collected for this study will illustrate the usefulness and the importance of this type of information so that the agencies and the Legislature will be willing to invest in the collection of economic and user preference data on a regular basis in the future.

Finally, the implementation of the recommendations cited above would, in our opinion, enhance users' enjoyment of Maine's wildlife resources, and would increase the economic impact and surplus values associated with that enjoyment. Furthermore, implementation of the recommendations to the Commission would improve the quality of information available for management decisions, and would thereby enhance wildlife management, the wildlife resource base and wildlife users. However, we recognize that implementation of all of the recommendations would require a substantial increase in resources devoted to wildlife management. We also recognize the funding needed to implement all of the recommendations will not be forthcoming. At the same time, increasing the level of use of these resources will require increases in funding. Both the management agencies and the Legislature will eventually have to set priorities and determine future funding levels. During this process, all parties should remember there is no such thing as a free lunch. Tapping the remaining potential in Maine's wildlife populations is clearly possible, but it can only be achieved through higher levels of funding for wildlife-related programs.

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COMMISSION TO STUDY THE IMPACT
OF GAME AND NONGAME SPECIES
ON MAINE'S ECONOMY

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Environmental Protection

ACKNOWLEDGEMENTS

A number of people put considerable effort into the research reported here. Alan Clark and Owen Fenderson, of the Maine Department of Inland Fisheries and Wildlife, and Dan Campbell, of the Maine Department of Marine Resources, as well as many other resource specialists with these management agencies, made significant contributions to the design and conduct of the various surveys. Lauri Fagerquist and Dee Potter helped in survey design, data analyses and project administration. Earl Anderson, Ellie Atwood, Joan Bouchard, Phillip Drew, Ramona Elhamzaoui, Diane Gerry, Scott Hamel, Trish Heekin, Theresa Heiland, Ann James, Timothy Johnson, Christine Levesque, Michelle Lewis, Laura Ludwig, Vanessa Malcolm, Margo Munn, Phyllis Rebstock, Matt Reiling, Rob Roper, Edward Rudnicki, Beatrice Ssali, Erika Steele, Vicki Trefts, and Cheryl Trott all ably contributed to the data collection process. Finally, Kim Junkins deserves a special acknowledgement for producing this document.

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SECTION I

INTRODUCTION

INTRODUCTION

In January of 1988 the Commission to Study the Impact of Game and Nongame Species on Maine's Economy contracted with the Department of Agricultural and Resource Economics at the University of Maine to conduct an economic evaluation of recreational uses of Maine's fish and wildlife resources. All key findings and recommendations from this three-year study are presented in this final report. Specifically, overall economic evaluations of consumptive uses (inland fishing, marine fishing, hunting and trapping) and nonconsumptive uses of Maine's fish and wildlife resources are presented and opportunities for the future economic enhancement of these activities are identified.

The Commission had four "duties and responsibilities" to address:

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- C. An analysis of the annual costs associated with managing and maximizing the potential of these resources for the long-term benefit of the entire State; and
- D. An evaluation of alternative funding mechanisms for managing these resources.

Within this report we present data analyses to help the Commission address duties A and B. Duty C can only be addressed when the results of our study are combined with species management plans developed by the Department of Inland Fisheries and Wildlife and the Department of Marine Resources. The combination of our user data with the biological data from the species management plans will facilitate the design of management programs and policies to enhance user opportunities and to meet biological objectives. Only at this stage can the costs of alternative management strategies be identified and quantified. Duty D was accomplished using interim data from our study and information on alternative funding mechanisms used by fish and wildlife management agencies in other states. This analysis resulted in the conversion of the Department of Inland Fisheries and Wildlife from a dedicated

revenue agency to an agency supported by Maine's general fund. Given the accomplishment of duty D, we will not discuss this duty further in the report.

Duties A and B were addressed by designing mail surveys which were sent to the various groups who use Maine's fish and wildlife resources. These surveys were conducted in two phases. Surveys in the first phase were designed to collect baseline data on the characteristics of users of fish and wildlife resources and to develop economic profiles of various user activities. These first phase surveys are reported in Section II and address duty A.

Duty B was addressed by the second phase of surveys. After the first phase of the surveys were completed, selected respondents to these surveys were chosen to participate in a second phase survey where respondents answered survey questions designed to identify opportunities for enhancing fish and wildlife management in Maine from users' perspectives. The results of these analyses are reported in Section III.

The final section of our report, Section IV, summarizes key findings, identifies areas of future study and suggests management actions that might be undertaken to enhance fish and wildlife user opportunities in Maine.

STUDY DESIGN/SAMPLE SELECTION

The first phase of surveys to address duty A for the Commission were conducted for each type of consumptive use of wildlife. For inland fishing and hunting, samples were drawn from all residents and nonresidents holding a valid 1987 or 1988 Maine fishing or hunting license, respectively. These surveys will be referred to as the overall fishing and overall hunting surveys. A trapper sample was selected from among all residents holding a valid 1987/88 Maine trapping license. Nonresident trappers were not sampled due to a very small number of licensed, nonresident trappers. Drawing a sample of marine, sport anglers (coastal bays and ocean fishing) was problematic because a Maine fishing license is not required for this type of fishing. Consequently, several screening surveys were conducted to identify samples of resident and nonresident marine, sport anglers (hereafter marine

anglers). Finally, a sample of Maine heads of households over 18 years of age was purchased from a survey marketing firm to conduct the surveys of nonconsumptive users.

The overall inland fishing and hunting surveys served two purposes. The primary purpose was to characterize Maine's anglers and hunters and to develop economic profiles of inland fishing and hunting in Maine. The overall surveys were also used to identify anglers and hunters who would receive detailed surveys on specific types of inland fishing and hunting, respectively, i.e., the second phase of surveys designed to address the Commission's duty B. A fishing or hunting license entitles the holder to participate in a variety of fishing or hunting activities, but the fact that an individual holds a license does nothing to reveal the specific activities in which an angler or hunter participates. For example, does an angler open water fish or ice fish? Or, does a hunter go bear hunting or deer hunting? These types of questions can only be answered by asking anglers and hunters directly. In the second phase of the project open water fishing and ice fishing surveys were administered to licensed inland anglers, and hunters were surveyed regarding bear, deer, migratory waterfowl and upland game bird hunting.

The marine sport fishing and trapping surveys were designed to collect all necessary data without follow-up surveys on specific types of participation within each of these general activities. In turn, no second phase surveys were conducted for these activities. This was done due to the complexity of developing a representative sample of marine anglers who are not required to purchase a fishing license. Thus, we attempted to characterize marine anglers and develop preliminary economic profiles of this activity within Maine, but we felt that it would not be appropriate to investigate this activity further in the current study due to the sampling problems we faced.

A first phase survey only was conducted for trapping for two interrelated reasons. First, Maine trappers were surveyed by the Department of Inland Fisheries and Wildlife several years ago to identify management opportunities from a user's perspective, and the findings from this survey are

currently being implemented. The Inland Fisheries and Wildlife survey, however, did not include questions to collect the economic data needed to develop an economic profile of trapping in Maine. Our phase one survey accomplished this task. The second reason is that there are fewer than 5,000 licensed trappers in Maine. Thus, management actions are unlikely to significantly enhance the economic impact of trapping on Maine's economy. Rather, these actions will improve trapper satisfaction; the topic area covered by the Department's survey of trappers.

The complexity of nonconsumptive uses of Maine's fish and wildlife required that the nonconsumptive survey be conducted in two phases. However, the level of detail accomplished in these two phases is less than the inland fishing and hunting surveys. This difference is due to the earliest investigations of consumptive uses of fish and wildlife dating to the early 1900's and considerable methodological research being conducted to improve data collection procedures for consumptive uses during the 1960's, 1970's and 1980's. Investigations of nonconsumptive uses only date to the late 1970's and through the 1980's, but little methodological work has been conducted to improve data collection procedures for nonconsumptive uses. Thus, we used caution when developing our nonconsumptive surveys. The first phase survey simply characterized nonconsumptive uses of fish and wildlife in Maine. The second phase was used to develop both an economic profile of nonconsumptive uses and to identify management actions that would enhance nonconsumptive use opportunities in Maine.

SECTION II

ECONOMIC VALUE AND ECONOMIC IMPACT ESTIMATES

ECONOMIC VALUES AND ECONOMIC IMPACTS DEFINED

To an economist, economic values and economic impacts are related but distinct concepts. These concepts will be defined to facilitate discussion in the remainder of this report.

Total economic values for consumptive and nonconsumptive uses of wildlife are defined in terms of the individuals who participate in these activities. Total economic value is defined as the maximum an individual would pay rather than forgo the opportunity to participate in an activity. For example, if the maximum an individual would pay for a deer hunting trip is \$100, he/she would go deer hunting as long as the cost of the trip does not exceed \$100. Aggregate total economic values are derived by adding the total economic values of all participants in an activity. Assume, for simplicity, that only four deer hunters exist in the world and each takes only one deer hunting trip per year. The respective total economic values they place on a deer hunting trip are \$50, \$75, \$100 and \$25. The aggregate total economic value of deer hunting is \$250 per year ($\$50 + \$75 + \$100 + \25).

A portion of an individual's total economic value for any activity is dissipated as money is spent to participate in the activity. These expenses represent the cost of participation. Returning to our single deer hunter who would spend no more than \$100, suppose a trip costs \$30. The hunter receives a net total economic value of \$70 ($\$100 - \30). We will refer to these net total economic values as surplus values; the difference between total economic value and actual costs. Anglers, hunters, trappers and nonconsumptive users benefit directly from participating in these activities and their gain is measured in terms of surplus values discussed above. All other factors being equal, the larger the surplus value associated with an activity, the more desirable it is to current participants.

Recreational expenditures constitute economic impacts. In the deer hunting example, the economic impact of the hunter's participation is \$30, the cost of participating.

A word of caution is necessary. For the accounting framework used in this report, only expenditures made within Maine are counted as economic impacts. We will not concern ourselves with expenditures made by nonresidents outside of Maine, e.g., travel expenses incurred in their home states. Nor will expenditures made by residents outside of Maine be considered, e.g., purchases of fishing or hunting equipment from mail order firms located in other states. Only purchases made within Maine are examined since these expenditures (economic impacts) are the means by which local communities, their citizens and the State's economy benefit from fishing, hunting, trapping and nonconsumptive uses of wildlife. Maine residents are affected by angler, hunter, trapper and nonconsumptive user expenditures as these expenditures generate economic activity, employment and income within Maine. Fishing, hunting, trapping and nonconsumptive user opportunities with the largest aggregate expenditures within Maine will generate the largest economic impacts. Expenditures made outside of Maine will not generate these effects. The desire is to measure the effect on Maine's economy of fish and wildlife related activities that occur within Maine.

Before leaving this subject let us briefly consider aggregate surplus values and economic impacts. Recall our simplified world of four deer hunters with total economic values of \$50, \$75, \$100 and \$25 per trip. The aggregate total economic value is \$250. Suppose the hunters incur per trip expenditures of \$25, \$50, \$30, and \$15, respectively. Surplus values for the four hunters, respectively, are \$25 ($\$50 - \25), \$25 ($\$75 - \50), \$70 ($\$100 - \30) and \$10 ($\$25 - \15). Aggregate surplus value is \$130 ($\$25 + \$25 + \$70 + \10) and the aggregate economic impact is \$120 ($\$25 + \$50 + \$30 + \15). Thus, aggregate total economic value equals aggregate surplus value plus the aggregate economic impact ($\$250 = \$130 + \$120$). This is the relationship between economic values and economic impacts that is presented in this report.

Economic values are surplus values and economic impacts are expenditures.¹

The next four sections report empirical results for anglers (both inland and marine), hunters, trappers and nonconsumptive wildlife users, respectively. These sections are organized as follows. Selected socioeconomic and activity-specific characteristics are reported first. Then, surplus values per participant are presented. Subsequently, economic impacts per participant are presented. Finally, aggregate surplus values and aggregate economic impacts are reported for each activity.

ADJUSTMENT OF SURVEY RESULTS TO FOURTH QUARTER 1989 DOLLARS

Since the study began in 1988 and data were collected for 1987, 1988 and 1989, we converted all survey results to fourth quarter 1989 dollars to facilitate comparisons across surveys. Adjustment coefficients for each survey type are reported in Table 1 and, as one might expect, these coefficients are relatively small due to the low rate of inflation during the time frame of the study.

¹For a more complete discussion of these concepts, see: Kevin J. Boyle, Vicki A. Trefts and Parnel Hesketh. 1988. "Economic Values for and Uses of Maine's Inland Fish and Wildlife Resources." Miscellaneous Publication 698, Maine Agricultural Experiment Station, University of Maine.

Table 1. Coefficients to Adjust Survey Results to Fourth Quarter 1989 Dollars

Survey/Data Period	Adjustment Period	Adjustment Coefficients ^a
Overall Inland Fishing/ 1988 Open Water Fishing/ 1988	Third Quarter 1988 ^b to Fourth Quarter 1989 ^d	1.047
Ice Fishing/ 1988/89	First Quarter 1989 ^c to Fourth Quarter 1989	1.029
Marine Fishing/ 1988	Third Quarter 1988 to Fourth Quarter 1989	1.047
Overall Hunting/ 1988 Bear/ 1988 Deer/ 1988 Migratory Waterfowl/ 1988 Moose/ 1988 Upland Birds/ 1988	Fourth Quarter 1988 ^e to Fourth Quarter 1989	1.039
Trapping/ 1987/88	Fourth Quarter 1987 to Fourth Quarter 1989	1.078
Turkey Hunting/ 1989	Second Quarter 1989 ^c to Fourth Quarter 1989	1.018
Nonconsumptive Use/ 1989	Conducted During 1989	No Adjustment

^aThe adjustment coefficients were calculated by dividing the seasonally adjusted gross national product (GNP) price deflator for the fourth quarter of 1989 by the seasonally adjusted GNP price deflator for the quarter in which the respective survey type was administered.

^bThe Economic Report to the President, January 1989.

^cThe Economic Report to the President, February 1990.

^dPersonal correspondence, Richard Aiken, U.S. Fish and Wildlife, Washington, D.C.

^e"Survey of Current Business," U.S. Dept. of Commerce, Bureau of Economic Analysis, Vol. 69, No. 11, 1989.

SPORT FISHING

Two major types of sport fishing are examined here: inland and marine. Inland sport fishing occurs on Maine's lakes and ponds, inland portions of Maine's brooks, streams and rivers, and above head of tide on Maine's coastal brooks, streams and rivers. A Maine fishing license is required to participate in inland fishing, and this fishery is managed by the Maine Department of Inland Fisheries and Wildlife. Conversely, marine fishing occurs on Maine's ocean waters, coastal bays and tidal portions of Maine's coastal brooks, streams and rivers. Marine fishing, which is managed by the Maine Department of Marine Resources, does not require a Maine fishing license

to participate. Further differences in these fisheries occur with respect to species caught and gear used. However, inland and marine fishing may overlap with respect to species sought and gear used at the head of tide of coastal brooks, streams and rivers. Due to the major differences identified above, these sport fisheries are examined separately here.

Inland Fishing

The first phase of the inland fishing survey was conducted in 1988 by surveying anglers who held a 1987 Maine fishing license and again in 1989 by surveying anglers who held a 1988 Maine fishing license. In both years juveniles (nonresident anglers ages 12 to 15) and aliens (non-U.S. citizens) holding a Maine fishing license were not sampled, due to concerns that they would be unable to complete the survey.² Alien anglers were not sampled because of concerns about language and currency exchange rate problems affecting their ability to complete the survey. All other anglers who either purchased a license or held a complimentary license were eligible for selection in the sample.

In 1988 a total of 4,000 licensed anglers, 2,000 residents and 2,000 nonresidents, were surveyed. The response rate to the survey, as a percent of deliverable questionnaires, was 77 percent for residents and 78 percent for nonresidents. In 1989 a total of 3,000 licensed anglers, 1,000 residents and 2,000 nonresidents, were surveyed. The response rates were 83 percent and 81 percent, respectively, for residents and nonresidents.

The 1989 survey of anglers holding a 1988 Maine fishing license is used to develop the economic profile presented here. The sampling frame consisted

²There were 5,635 licensed junior anglers and 224 licensed alien anglers in Maine during 1988, representing 2 percent of all licensed anglers in Maine.

of 214,937 licensed resident anglers and 98,063 licensed nonresident anglers.^{3 4} These figures will be employed to compute aggregate surplus values and aggregate economic impacts.

As stated previously, the first phase of overall fishing surveys was used to develop samples of anglers to receive detailed, activity specific second phase surveys. A total of 1,600 anglers, 800 residents and 800 nonresidents, responding to the 1988 survey were selected to receive an open water fishing survey. Any angler who responded to the 1988 overall survey and indicated they open water fished in Maine was eligible for selection. The response rate to the open water survey was 83 percent for residents and 85 percent for nonresidents.

The 1989 overall fishing survey was used to develop samples of resident (200) and nonresident (130) anglers to receive a second phase survey on ice fishing. Any angler responding to the 1989 overall fishing survey who indicated they ice fished in Maine was eligible for selection in the ice fishing sample. The ice fishing survey response rates were 84 percent and 80 percent, respectively, for residents and nonresidents.

One caveat regarding survey design should be mentioned before proceeding. Economic impact data presented here were developed solely using the overall fishing survey conducted in 1989 for the 1988 fishing year. The surplus values are derived from responses to the open water and ice fishing surveys. The technique we employed to estimate surplus values requires a two step process where preliminary estimates are derived from an initial survey and final (refined) estimates are developed in a second survey using surplus value response data from the initial survey. Our overall surveys provided

³These numbers represent the Department of Inland Fisheries and Wildlife's best estimates of the numbers of licensed anglers in Maine during 1988.

⁴For information regarding the 1988 survey see: Kevin J. Boyle, Marcia L. Phillips and Stephen D. Reiling. 1989. "Highlights from the Survey of Anglers Holding a 1987 Maine Fishing License," ARE 398, Department of Agricultural and Resource Economics, University of Maine.

initial surplus value estimates that were refined in the open water and ice fishing surveys.

Selected Inland Angler Characteristics. Angling and socioeconomic characteristics of respondents, broken down by resident and nonresident anglers, are presented in Table 2. It should be noted that not everyone who purchases a fishing license actually fishes. This occurs for a variety of reasons. For example, a person who purchases a combination hunting and fishing license would be eligible for selection in either the angler sample or the hunter sample. If this individual only hunted and was selected in the angler sample, he/she would be recorded as having not fished in 1988. Or, someone may purchase a fishing license and not fish due to illness, time constraints, or numerous other reasons. In 1988, 82 percent of the residents who held a Maine fishing license actually fished in Maine, and the corresponding figure for nonresidents is 94 percent.

Table 2. Characteristics of Maine's Licensed Inland Anglers During 1988

Characteristic	Residents	Nonresidents
Actually Inland Fished in Maine During 1988	82%	94%
First Inland Fished in Maine	1961	1974
Inland Fished in Maine in More Than Half of the Years	76%	53%
Marine Fished in Maine During 1988	37%	12%
Hunted in Maine During 1988	56%	13%
Trapped in Maine During 1988	2%	0%
Average Age	42	42
Sex (Percent Male)	84%	89%
Average Education	High School Graduate	Some Training Beyond High School
Average Annual Household Income (Fourth Quarter 1989 Dollars)	\$32,700	\$50,300

As one would expect, residents have fished in Maine longer than have nonresidents (about 13 years), and residents fish within Maine on a more regular basis. More than 50 percent of residents also hunted in Maine during 1988, while only 13 percent of the nonresidents hunted in Maine during 1988.

The socioeconomic characteristics of resident and nonresident respondents are quite similar except for education and income. The average household income of nonresidents is roughly \$17,000 greater than that of residents. One should not attach too much significance to this difference since it may reflect, for example, differences in wages and the cost of living between southern New England and Maine. That is, the relative standard of living may be the same for resident and nonresident anglers.

Surplus Values for Selected Types of Inland Fishing. Surplus values per angler, as derived from responses to the open water and ice fishing surveys, are reported in Table 3. Resident surplus values are \$503 per angler per year for open water fishing and \$212 per angler per year for ice fishing. The resident surplus value is substantially larger (nearly 30 percent) than the nonresident surplus value for open water fishing. For ice fishing the resident surplus value once again exceeds the nonresident surplus value but the difference is much smaller (less than 10 percent). Open water fishing surplus values exceed ice fishing surplus values for both residents and nonresidents.

Table 3. Surplus Values for Selected Types of Inland Fishing in Maine During 1988 (Fourth Quarter 1989 Dollars)

Fishing Type	Average Annual Surplus Value Per Inland Angler	
	Residents	Nonresidents
Open Water Fishing	\$503	\$392
Ice Fishing	\$212	\$195

What do these surplus values mean? Using open water fishing as an example, an average resident would pay a maximum of \$503 per year in excess of total trip expenses, rather than forgo the opportunity to open water fish in

Maine. Comparably, an average nonresident angler would pay a maximum of \$392 per year in excess of total trip expenses rather than forgo the opportunity to open water fish in Maine. All other factors being equal, the higher the average surplus value, the more desirable a fishing experience is to anglers. In a relative sense, then, open water fishing is valued more highly than ice fishing in Maine.

Before proceeding to economic impacts of inland fishing, it should be noted that the surplus values in Table 3 cannot be added to obtain aggregate surplus values for resident and nonresident anglers. A resident angler might only open water fish, only ice fish or both open water and ice fish. In other words, not all anglers both open water fish and ice fish. Thus, to add the open water and ice fishing surplus values and multiply this figure by the total number of anglers in Maine would overstate the aggregate surplus value of inland fishing. Thus, more sophisticated aggregation procedures must be employed to derive aggregate surplus values for resident and nonresident inland fishing. These aggregates are reported at the end of this section on inland fishing.

Economic Impacts of Inland Fishing. Economic impacts per angler are reported for all types of inland angling combined. These expenditures are broken down into three categories. Trip specific expenditures are expenses that may be incurred each time an angler goes fishing. The second includes purchases of fishing equipment used solely for fishing that can be reused on a number of fishing trips. Finally, equipment may be purchased to use for fishing and other purposes. This last category of expenditures is adjusted by multiplying the expenditures by the percent of use dedicated to inland fishing. For example, an angler may purchase a boat for \$10,000 and use it 25 percent of the time for inland fishing. Accordingly, \$2,500 ($\$10,000 \times 0.25$) is reported.

Trip specific expenditures reveal an expected pattern (Table 4). Residents spend more on gasoline/personal transportation, and bait, than do nonresidents. Although nonresidents may spend more per trip on gas, residents

take a larger number of fishing trips in Maine each year. This also accounts for the differences in expenditures on bait. In contrast, nonresidents spend more than residents on commercial transportation, lodging and guide fees. Overall, resident anglers spent \$258 per person in Maine for all fishing trips during 1988 and nonresidents spent \$308 per person.

Table 4. Trip Specific Expenditures in Maine for All Inland Fishing Trips During 1988 (Fourth Quarter 1989 Dollars)

Item	Average Annual Expenditures Per Inland Angler	
	Residents	Nonresidents
Gasoline/Personal Transportation	\$ 97	\$ 63
Commercial Transportation	0	8
Food, Beverages, etc.	95	102
Lodging	35	107
Bait	16	6
Boat Launch Fees	3	2
Land Access Fees	3	1
Guide Fees	4	7
Equipment Rental	3	8
Other Miscellaneous Expenditures	<u>2</u>	<u>4</u>
Total Trip Specific Expenditures	\$258	\$308

As expected, resident anglers spend more in Maine for fishing equipment than do nonresidents (Table 5). This result also holds for all individual categories of expenditures except for the purchase of a fishing license since nonresident licenses cost more than resident licenses. Resident equipment expenditures in Maine totaled \$407 per angler in 1988 and nonresidents spent \$138 per angler in Maine.

The expenditures reported in Table 5 are averages for all anglers, and do not, in general, equal the actual purchase price of the items. Many anglers may not purchase an item in any given year. Thus, these nonpurchases are included in the averages as zeros. This is also true for fishing licenses when complimentary licenses are issued.

Table 5. Inland Fishing Equipment Purchased in Maine During 1988
(Fourth Quarter 1989 Dollars)

Item	Average Annual Expenditures Per Inland Angler	
	Residents	Nonresidents
Fishing License (Not Combination)	\$ 13	\$ 28
Rods, Reels and Rod Holders	48	17
Landing Nets	2	1
Tackle and Tackle Boxes	45	22
Waders	6	2
Ice Fishing Equipment	34	2
Bait Buckets and Minnow Traps	3	1
Depth Finder, Fish Finder, etc.	22	3
Down Rigger	4	1
Boat (Canoe), Motor, Trailer and Accessories Used <u>Only</u> for Fishing	210	51
Repair of Fishing Equipment	6	2
Maps	3	2
Clothing Used <u>Only</u> for Fishing	8	5
Taxidermy and Mounting	3	1
Other Miscellaneous Expenditures	<u>0</u>	<u>0</u>
Total Equipment Purchases	\$407	\$138

As with fishing equipment, resident expenditures on equipment used for fishing and other activities exceed nonresident expenditures (Table 6). Total fishing related equipment purchases made in Maine during 1988 by residents is \$936 per angler and the total for nonresidents is \$309 per angler.

Unlike surplus values, the various expenditure categories can be added because there is no overlap in the accounting framework. When adding the totals for the three expenditure categories, resident anglers spent a total of \$1,601 per person (\$258 + \$407 + \$936) in Maine during 1988. The comparable figure for nonresident anglers is \$755 per person (\$308 + \$138 + \$309).

Aggregate Inland Angler Surplus Values and Economic Impacts. As was previously reported, in 1988 a total of 214,937 licensed resident anglers and 98,063 licensed nonresident anglers were eligible for selection in the sample (juvenile and alien anglers were excluded). Recall, however, that only a percentage of all license holders actually fished in Maine during 1988. Therefore, the total number of anglers eligible for selection must be reduced to the number of active anglers in order to derive aggregate surplus

Table 6. Equipment Purchased in Maine During 1988 Used for Inland Fishing and Other Activities (Fourth Quarter 1989 Dollars)

Item	Average Annual Expenditures Per Inland Angler	
	Residents	Nonresidents
Combination Fishing and Hunting License	\$ 9	\$ 5
Boat (Canoe), Motor, Trailer and Accessories	149	29
ATV, Snowmobile, Utility Trailer	47	9
Travel Trailer, Camper, Motor Home	65	4
Car, Truck, etc.	385	77
Recreational Property	215	162
Camping Equipment (Tent, Sleeping Bag, etc.)	24	8
Binocular, Camera, Film, etc.	21	5
Equipment Repair	3	1
Insect Repellent	5	2
Clothing	13	7
Other Miscellaneous Expenditures	<u>0</u>	<u>0</u>
Total Purchases of Equipment Used for Inland Fishing and <u>Other</u> Activities	\$936	\$309

values and economic impacts. Using the percentages reported in Table 2, 176,248 resident anglers ($214,937 \times 0.82$) and 92,179 nonresident anglers ($98,063 \times 0.94$) are used to calculate aggregate surplus values and economic impacts.

Calculation of aggregate surplus values is difficult because some anglers both open water fish and ice fish while others only open water fish or only ice fish. Let us take resident open water fishing as an example. It is first necessary to determine the percentage of resident anglers who actually open water fished (97 percent). The aggregate surplus values for resident open water fishing can now be calculated. The number of resident anglers who actually fished in 1988 (176,248) multiplied by the percentage who open water fished (0.97) yields the number of 1988 resident open water anglers, 170,960. This number is multiplied by the per angler, open water surplus value (\$503) to obtain an aggregate open water surplus value for residents of \$86 million. Similarly, resident anglers who fished in 1988 (176,248) multiplied by the percent who ice fished (0.52) and multiplied again by the per angler, surplus value (\$212) for ice fishing yields an aggregate surplus value for resident

ice fishing of \$19.4 million. These aggregate open water and ice fishing surplus values can now be added to compute the aggregate surplus value for inland fishing in Maine.

The aggregate surplus value for resident inland fishing in Maine during 1988 by licensed anglers is \$105.7 million (Table 7). The comparable nonresident aggregate surplus value is \$36.7 million. Adding these two numbers yields an aggregate surplus value for all inland fishing in Maine of \$142.4 million for 1988. We believe that this is a reasonable estimate of the aggregate surplus value associated with inland fishing in Maine.

Table 7. Aggregate Surplus Values, Aggregate Economic Impacts and Aggregate Total Economic Values for Inland Fishing in Maine During 1988^a
(Fourth Quarter 1989 Dollars)

Values	Residents	Nonresidents	Totals
Aggregate Surplus Values	\$105.7	\$36.7	\$142.4
<u>Aggregate Economic Impacts</u>			
Minimum	117.2	41.1	158.3
Maximum	282.2	69.6	351.8
<u>Aggregate Total Economic Values</u>			
Minimum	\$222.9	\$77.8	\$300.7
Maximum	\$387.9	\$106.3	\$494.2

^aAll numbers are reported in millions of dollars (x \$1,000,000).

Aggregate economic impacts are easier to derive than aggregate surplus values. Maximum total expenditures for residents in 1988 were \$1,601, yielding a maximum aggregate economic impact of \$282.2 million (\$1,601 x 176,248) (Table 7). The maximum aggregate economic impact for nonresidents in Maine during 1988 is \$69.6 million (\$755 x 92,179). These figures can be added to obtain a total economic impact for inland fishing in Maine during 1988 of \$351.8 million.

Caution is warranted when interpreting this estimated aggregate economic impact. The appropriate question to ask regarding the items reported in Table 6 is whether the angler would have purchased the item if he/she did not fish. If the answer is "yes," then the expenditure should not be counted as an economic impact associated with fishing. The purchase would have been made

regardless of whether the person fished. Of course, if the answer is "no," then the expenditure, multiplied by the percentage of use dedicated to fishing, would be counted as an economic impact associated with inland fishing in Maine. This question, however, was not asked of anglers due to the complications of administering it in the survey.

The aggregate economic impact of sport fishing, therefore, is likely to be overstated. A minimum aggregate economic impact is obtained by including only trip specific and fishing equipment purchases. This minimum estimate of the aggregate economic impact is \$158.3 million $[(\$665 \times 176,248) + (\$446 \times 92,179)]$.

Based on the aggregate estimates of surplus value and the minimum and maximum estimates of aggregate economic impacts, it is possible to develop bounds for an aggregate total economic value of fishing in Maine. The estimated minimum total economic value for resident anglers will not be less than \$222.9 million (\$105.7 million plus \$117.2 million) and probably does not exceed a maximum of \$387.9 million (\$105.7 million plus \$282.2 million). For nonresident anglers, the comparable minimum and maximum estimates of aggregate total economic value, respectively, are \$77.8 million (\$36.7 million plus \$41.1 million) and \$106.3 million (\$36.7 million plus \$69.6 million). Overall, aggregate total economic value for all inland fishing in Maine during 1988, then, is no less than \$300.7 million (\$222.9 million plus \$77.8 million) and will not exceed \$494.2 million (\$387.9 million plus \$106.3 million).

Marine Fishing

As was previously stated, marine fishing takes place in the tidal portions of Maine's brooks, streams and rivers, coastal bays and ocean waters. A Maine fishing license is not required to fish these waters and anyone, including a nonresident, is free to fish these waters as long as they can gain shore or boat access. These anglers must still adhere to certain regulations regarding fishing for, and taking of, specific species. The convenience for anglers of being able to freely fish without purchasing a fishing license results in difficulties for a researcher who needs to develop a representative

sample because a comprehensive list of marine anglers does not exist.

Developing a sample of marine anglers is problematic for the reason that this category includes many types of fishing and anglers. The most obvious type of marine sport fishing, perhaps, is anglers fishing from docks and jetties along Maine's coast. Other anglers fish from private boats. Some of these boats are moored at marinas along Maine's coast, while others are launched daily from the many private and public landings along the coast. Other anglers fishing from private boats may actually launch in New Hampshire yet fish in Maine. Finally, smaller numbers of anglers fish from party or charter boats where the captain provides his boat and services for a fee. Party boats typically carry a large number of unrelated passengers and seek ground fish. Charter boats cater to small parties and target a number of marine fish species.

To develop a sample of marine anglers, several procedures were used to obtain a list of names and addresses of individuals who marine fished in Maine during 1988. These procedures are:

1. On-site interviews were conducted at boat launch sites along the Maine coast. These sites were identified with the help of representatives of the Marine Warden Service.
2. On-site interviews were also conducted at docks with people taking trips on party boats and a few charter boat operators submitted lists of names and addresses of their customers.
3. Licensed inland anglers and hunters were asked if they marine fished in the 1987 surveys of inland fishing and hunting.
4. The Maine Sportsman maintains a list of names and addresses of individuals who catch the largest fish each day on party and charter boats. These names and addresses for 1988 were provided to the University.

All of the above procedures yielded lists of names and addresses of both Maine residents and nonresidents who marine sport fished in Maine during 1988. Due to concerns about the representativeness of these lists, one additional step was taken. Concerns arise, for example, because individuals who own and moor a boat along the Maine coast may not be randomly represented in any of the lists. In turn, Northeast Research, Inc. of Orono was hired to conduct a

telephone screening survey during the Fall of 1988 to identify resident marine anglers. This screening was conducted via random digit dialing of all telephone prefixes in Maine. This provides our most representative list of resident marine anglers. A similar procedure was not employed to contact nonresidents since the population from which nonresident anglers might be drawn is much larger than the population of Maine, and a substantially lower participation rate makes telephone screening prohibitively expensive for the existing budget.

Given that the list of names and addresses identified by the telephone screening survey provides the most representative compilation of resident marine anglers, this was used as the beginning point for developing a sample of residents. A total of 150 surveys were sent to anglers from this group (Table 8). In addition, 150 surveys were sent to resident anglers contacted at launch sites or who took party boat trips. Finally, 200 surveys were sent to licensed, resident inland anglers and hunters who said that they marine fished (100 to each group). Although, surveys were sent to resident anglers taking a charter boat trip and individuals from the Maine Sportsman List, which includes anglers taking a charter trip, these individuals are not included in the results reported here due to concerns about the representativeness of these lists.⁵ A similar procedure was used to develop the sample of nonresident, marine anglers. The notable exception being that a telephone screening was not conducted to identify a representative sample of nonresident, marine anglers for reasons explained above.

⁵The survey results indicate that anglers taking charter trips do not have the same characteristics as the other types of marine sport anglers, and we do not know the proportion of charter anglers relative to the total number of marine anglers. Thus, we could not be sure of their correct proportion for representation in the sample. However, there are only a few charter boats in Maine (probably in the range of 10 to 20) that primarily operate on weekends and only take a small number of passengers (typically less than 5). In turn, charter anglers comprise a very small percentage of the total number of marine anglers in Maine.

Table 8. Sample of 1988 Marine Anglers

Source	Residents	Nonresidents
Telephone Screening	150	NA
On-site Interviews and Party Boat Contacts	150	150
Licensed Inland Anglers	100	100
Licensed Hunters	<u>100</u>	<u>50</u>
Total Sample Sizes	500	300

Given the telephone screening to identify resident marine anglers, we feel that some statements can be made regarding the representativeness of the resident sample. However, the nonresident sample is what survey researchers refer to as a sample of convenience. Thus, nonresident data, although providing our best estimates for this report, can not be deemed to be entirely representative of all nonresidents who marine fished in Maine during 1988.

One final piece of information is needed to complete the puzzle: the total number of residents and nonresidents, respectively, who marine fished in Maine during 1988. These figures are not know; consequently, we used National Marine Fisheries Service Statistics from 1986 as best estimates of the numbers of 98,000 residents and 128,000 nonresidents who marine fish in Maine.⁶

Referring to Table 8, 500 surveys were sent to identified resident marine anglers and 300 surveys were sent to nonresidents. These surveys were designed to collect data on marine fishing in Maine during 1988. The response rates, as a percent of deliverable surveys, were 81 percent for residents and 80 percent for nonresidents.

Selected Marine Angler Characteristics. As with the survey of inland anglers, not everyone who received a survey actually marine fished during 1988 (Table 9). This result occurs for a number of reasons. For example, the samples of licensed inland anglers and hunters asked respondents if they marine fished during 1987. However, the marine angler survey asked for 1988

⁶"Marine Recreational Fishery Statistics Survey, Atlantic and Gulf Coasts, 1986," Current Fishery Statistics, No. 8392, 1987, U.S. Department of Commerce, National Marine Fisheries Service, Washington, D.C.

Table 9. Characteristics of Maine's Marine Anglers During 1988

Characteristics	Residents	Nonresidents
Actually Marine Fished in Maine During 1988	71%	67%
First Marine Fished in Maine	1970	1975
Marine Fished in Maine in More Than Half of the Years	78%	73%
Inland Fished in Maine During 1988	83%	37%
Hunted in Maine During 1988	72%	19%
Trapped in Maine During 1988	6%	1%
Average Age	42	44
Sex (Percent Male)	93%	95%
Average Education	Some training beyond high school	Some training beyond high school
Average Annual Household Income (Fourth Quarter 1989 Dollars)	\$36,800	\$49,700

fishing data. It was expected that at least some of the inland anglers and hunters would not have marine fished during both 1987 and 1988.

Surprisingly, resident and nonresident marine anglers have fished in Maine for about the same amount of time, and both groups state that they marine fish in Maine with about the same frequency. These results are quite different than those reported for inland anglers. With respect to participation in other consumptive uses of wildlife and socioeconomic characteristics, marine anglers are similar to inland anglers.

Surplus Values for Selected Types of Marine Fishing. Surplus values are reported for three species (bluefish, striped bass and mackerel) and one species group (ground fish: cod, flounder and pollock). As with inland fishing, the surplus values in Table 10 present some expected results. Bluefish fishing has the highest surplus value for both residents and nonresidents. It should be kept in mind when interpreting this result that 1988 was a good year for bluefish fishing. The lowest values, for both groups

of respondents, occur for mackerel fishing. This result is expected because of the significant opportunities to fish for mackerel in Maine relative to bluefish, striped bass and ground fish. One can fish for mackerel from either the shore or a boat, and mackerel can be caught along much of the coast of Maine. Aggregate surplus values will be reported at the end of this section on marine fishing.

Table 10. Surplus Values for Selected Types of Marine Fishing in Maine During 1988 (Fourth quarter 1989 Dollars)

Fishing Type	Average Annual Surplus Value Per Marine Angler	
	Residents	Nonresidents
Bluefish	\$54	\$64
Striped Bass	34	-- ^a
Ground Fish (Cod, Flounder and Pollock)	43	34
Mackerel	30	21*

^aA double dash represents a sample size of less than 20 and a mean is not reported.

^bAn asterisk denotes a small sample size ($20 \leq n \leq 50$).

Economic Impacts of Marine Fishing. As was done for inland fishing, economic impacts per angler are reported for all types of marine angling combined, and these expenditures are broken down into the same three categories. Trip specific expenditures are reported in Table 11. The relationship among resident and nonresident expenditures are roughly the same as reported for inland fishing. Resident expenditures exceed nonresident expenditures for personal transportation and bait. In contrast, nonresidents spend more for lodging and guide fees. Note that the guide fees category is expanded to include charter and party boat fees, and nonresident expenditures in this category are more than three times larger than resident expenditures.

Table 11. Trip Specific Expenditures in Maine for All Marine Fishing Trips During 1988 (Fourth quarter 1989 Dollars)

Item	Average Annual Expenditures Per Marine Angler	
	Residents	Nonresidents
Gasoline/Personal Transportation	\$ 90	\$ 49
Commercial Transportation	0	1
Food, Beverages, etc.	76	61
Lodging	9	61
Bait	12	5
Boat Launch Fees	4	2
Equipment Rental	1	2
Guide, Charter or Party Boat Fees	8	29
Other Miscellaneous Expenditures	<u>1</u>	<u>2</u>
Total Trip Specific Expenditures	\$201	\$212

Marine angler expenditures for equipment follow the same pattern reported for inland anglers; resident expenditures exceed or equal nonresident expenditures for all categories (Table 12). Resident expenditures total \$498 during 1988 and nonresident expenditures totaled \$203. With respect to equipment purchased for marine fishing and other activities (Table 13), residents spent more in total than did nonresidents (\$752 versus \$511). However, nonresident expenditures did exceed resident expenditures in two categories (purchases of travel trailers/campers and recreational property).

Table 12. Marine Fishing Equipment Purchased in Maine During 1988
(Fourth Quarter 1989 Dollars)

Item	Average Annual Expenditures Per Marine Angler	
	Residents	Nonresidents
Rods, Reels and Rod Holders	\$ 67	\$ 27
Landing Nets	3	0
Tackle and Tackle Boxes	54	24
Waders	6	4
Bait Buckets and Minnow Traps	1	0
Depth Finder, Fish Finder, etc.	67	40
Down Rigger	16	4
Boat (Canoe), Motor, Trailer and Accessories Used <u>Only</u> for Fishing	243	84
Repair of Fishing Equipment	25	10
Maps	5	2
Clothing Used <u>Only</u> for Fishing	6	5
Taxidermy and Mounting	2	2
Other Miscellaneous Expenditures	<u>3</u>	<u>1</u>
Total Equipment Purchases	\$498	\$203

Table 13. Equipment Purchased in Maine During 1988 Used for Marine Fishing
and Other Activities (Fourth Quarter 1989 Dollars)

Item	Average Annual Expenditures Per Marine Angler	
	Residents	Nonresidents
Boat (Canoe), Motor, Trailer and Accessories	\$353	\$ 95
Travel Trailer, Camper, Motor Home	10	72
Car, Truck, etc.	320	133
Recreational Property	18	198
Camping Equipment (Tent, Sleeping Bag, etc.)	20	1
Binocular, Camera, Film, etc.	13	4
Equipment Repair	6	2
Clothing	8	6
Other Miscellaneous Expenditures	<u>4</u>	<u>0</u>
Total Purchases of Equipment Used for Marine Fishing and <u>Other</u> Activities	\$752	\$511

Aggregate Marine Fishing Surplus Values and Economic Impacts. Aggregate surplus values are computed in a manner similar to that used for inland fishing with one exception. The number of participants reported by National Maine Fisheries Service are numbers of active anglers. Therefore, these

numbers do not need to be adjusted by the percentages of anglers who actually fished. The aggregate surplus value for resident Maine fishing is \$8.5 million and the corresponding figure for nonresidents is \$5.3 million (Table 14). In sum, the aggregate surplus value of Marine fishing in Maine during 1988 is \$13.8 million. Given that surplus values were not estimated for all marine species sought by sport anglers, this is a minimum estimate of the aggregate surplus value. However, since the number of anglers seeking these species is quite small, the omission of these individual species surplus values probably does not have a large effect on the aggregate surplus value for marine fishing.

Table 14. Aggregate Surplus Values, Aggregate Economic Impacts and Aggregate Total Economic Values for Marine Fishing in Maine During 1988^a
(Fourth Quarter 1989 Dollars)

Values	Residents	Nonresidents	Totals
Aggregate Surplus Values	\$ 8.5	\$ 5.3	\$ 13.8
<u>Aggregate Economic Impacts</u>			
Minimum	68.5	53.1	121.6
Maximum	142.2	118.5	260.7
<u>Aggregate Total Economic Values</u>			
Minimum	\$ 77.0	\$ 58.4	\$135.4
Maximum	\$150.7	\$123.8	\$274.5

^aAll numbers are reported in millions of dollars (x \$1,000,000).

Aggregate economic impacts are derived in the same manner used for inland fishing. First aggregate expenditures per angler are obtained, \$1,451 for residents (\$201 + \$498 + \$752) and \$926 for nonresidents (\$212 + \$203 + \$511). These numbers are then multiplied by the number of resident and nonresident marine anglers, respectively, to obtain a maximum estimate of the economic impacts. The maximum economic impact of resident marine fishing is \$142.2 million (\$1,451 x 98,000) and the maximum estimate for nonresidents is \$118.5 million (\$926 x 128,000). The corresponding minimum estimates are \$68.5 million for residents and \$53.1 million for nonresidents.

Based on the aggregate estimates of surplus value and the minimum and maximum estimates of aggregate economic impact, we estimate that the total economic value of marine fishing in Maine will not exceed \$274.5 million (\$13.8 million plus \$260.7 million) and is not less than \$135.4 million (\$13.8 million plus \$121.6 million). Comparing these numbers to inland fishing, the total economic value of marine fishing is just over 50 percent of the total economic value of inland fishing in Maine.

HUNTING

The procedure used to select a sample of hunters is comparable to the selection of the inland angler sample. Licensed juvenile hunters and licensed alien hunters were not sampled, and all other individuals holding a 1988 Maine hunting license were eligible for selection in the sample.⁷ Thus, the sampling frame consisted of 182,987 licensed resident hunters and 39,335 licensed nonresident hunters.⁸

For the first phase survey in 1989, a total of 4,000 licensed hunters from 1988, 2,000 residents and 2,000 nonresidents, were sampled and mailed a survey designed to obtain information about their 1988 hunting effort within Maine.⁹ The response rates, as a percent of deliverable surveys, were 80 percent and 83 percent, respectively, for residents and nonresidents.

The economic impact data reported here for hunting were developed from the overall survey of 1988 hunting effort. The surplus values reported were derived from the second phase of surveys each dealt with a specific type of hunting, e.g., deer, moose, etc. The procedure employed is the same as was

⁷There were 2,110 licensed alien hunters and 15,365 licensed juvenile hunters in Maine during 1988, representing 7 percent of all licensed hunters in Maine.

⁸These numbers represent the Department of Inland Fisheries and Wildlife's best estimates of the number of licensed hunters in Maine during 1988.

⁹A total of 3,000 hunters (2,000 residents and 1,000 nonresidents) were surveyed in 1988 regarding 1987 hunting effort. See: Marcia L. Phillips, Kevin J. Boyle and Stephen D. Reiling. 1989. "Highlights from the Survey of Hunters Holding a 1987 Maine Hunting License," ARE 397, Department of Agricultural and Resource Economics, University of Maine.

used for inland fishing; preliminary estimates are derived in the initial overall survey and then refined in a second, species-specific survey.

A total of six second phase surveys were conducted for hunting: bear, deer, migratory waterfowl, moose, turkey and upland birds. Since the moose and turkey hunts require all participants to hold a permit and all permit holders are required by law to complete a survey conducted by the Department of Inland Fisheries and Wildlife, we conducted the required moose hunting survey in 1988 and the required turkey hunting survey in 1989.¹⁰ In turn, surveys were sent to all moose hunting and turkey hunting permit holders. The bear, deer, migratory waterfowl and upland bird samples were derived from responses to the 1988 first phase hunting survey. Any respondent who said they hunted bear in Maine during 1988 was eligible for selection in the bear sample. Likewise, anyone who said they hunted deer, migratory waterfowl or upland birds was eligible for selection in the deer, migratory waterfowl or upland bird samples, respectively.

The number of surveys conducted and the response rates for each of the second phase surveys are reported in Table 15. Several points are worth noting. First, all data were collected for 1988 with the exception of turkey hunting where hunters were surveyed regarding the 1989 hunt. Nonresident migratory waterfowl hunters were not surveyed because there were not enough nonresidents in the 1988 overall hunting survey who said they hunted migratory waterfowl in Maine. In fact, we estimate that there were fewer than 800 nonresident migratory waterfowl hunters in Maine during 1988. The nonresident sample of turkey hunters is nine because only nine nonresidents held a permit in 1989. A total of 50 permits are available for nonresident turkey hunters.

¹⁰For more information see: Kevin J. Boyle, Stephen D. Reiling and Marcia L. Phillips. 1989. "Highlights from the Survey of 1988 Moose Hunters," ARE 392, Department of Agricultural and Resource Economics, University of Maine; and Deanna Potter, Kevin J. Boyle and Stephen D. Reiling. 1990. "Highlights from the Survey of 1989 Turkey Hunters," Miscellaneous Publication 413, Maine Agricultural Experiment Station, University of Maine.

Table 15. Response Rates to Hunter Surveys for Specific Species/Species Groupings

Species/ Species Grouping	Residents	Nonresidents
Bear: (1988)		
Sample Size	100	100
Response Rate	71%	85%
Deer: (1988)		
Sample Size	200	200
Response Rate	88%	89%
Migratory Waterfowl: (1988)		
Sample Size	100	N/A
Response Rate	82%	
Moose: (1988)		
Sample Size	900	100
Response Rate	95%	98%
Turkey: (1989)		
Sample Size	434	9
Response Rate	95%	100%
Upland Bird: (1988)		
Sample Size	100	100
Response Rate	87%	88%

The nine nonresident turkey hunters were surveyed because we were conducting the annual turkey hunting survey where all permit holders are required to complete a survey.

Selected Hunter Characteristics. Hunters are similar to inland anglers in that not everyone who holds a hunting license actually hunts (Table 16). In 1988, 86 percent of the resident license holders hunted and 98 percent of the nonresident license holders hunted. These figures are slightly higher than the participation rates reported for resident and nonresident inland anglers.

As reported for licensed anglers, resident hunters have hunted in Maine longer than nonresidents (13 years) and hunt in Maine more frequently. Most resident hunters (76 percent) inland fished in Maine during 1988, but only 29 percent of the nonresident hunters inland fished in Maine during 1988.

The socioeconomic characteristics of resident and nonresident hunters

are quite similar for all categories except for two, as was found for resident and nonresident anglers. The average household income of nonresident hunters is roughly \$15,000 greater than that of resident hunters, and the average education level is slightly higher. As with resident and nonresident anglers, caution should be used when interpreting this difference in income levels.

Table 16. Characteristics of Maine's Licensed Hunters During 1988

Characteristic	Residents	Nonresidents
Actually Hunted in Maine During 1988	86%	98%
First Hunted in Maine	1963	1976
Hunted in Maine More Than Half of the Years	85%	68%
Inland Fished in Maine During 1988	76%	29%
Marine Fished in Maine During 1988	30%	7%
Trapped in Maine During 1988	3%	0%
Average Age	40	42
Sex (Percent Male)	92%	99%
Average Education	High School Graduate	Some Training Beyond High School
Average Annual Household Income (Fourth Quarter 1989 Dollars)	\$30,900	\$46,100

Surplus Values for Selected Types of Hunting. Surplus values per hunter are reported for five species and two groups of species in Table 17. Note the difference in reporting of surplus values for inland anglers and those for hunters. As stated earlier, inland anglers typically fish a certain type of water and can target a single species, or several species simultaneously, while fishing. Hunters, like marine anglers, tend to target a species, or groups of species, and they may incidentally hunt other species at the same time, e.g., grouse hunting while primarily deer hunting. Thus, hunter surplus values are reported by type of species or group of species hunted.

The highest surplus values occur for moose hunting for both residents and nonresidents. The moose hunt is limited to 1,000 participants (900 residents and 100 nonresidents), and more than 90 percent of the hunters get a moose. Recall from the previous discussion of surplus values, all other factors being equal, the higher the surplus value the more desirable the activity is to current participants. For residents, surplus values for other species, in descending order, are migratory waterfowl (\$551), deer (\$294), turkey (\$282), upland birds (\$271), bear (\$140) and rabbit (\$34) (Table 17). The surplus values for nonresidents, in descending order, are deer (\$445), upland birds (\$389) and bear (\$329). It is interesting to note that all pairwise comparisons of resident and nonresident surplus values reveal that nonresident surplus values exceed the comparable resident surplus values.

Table 17. Surplus Values for Selected Types of Hunting in Maine During 1988 (Fourth Quarter 1989 Dollars)

Hunting Type	<u>Average Annual Surplus Value Per Hunter</u>	
	Residents	Nonresidents
Bear	\$140	\$ 329
Deer	294	445
Migratory Waterfowl ^a	551	-- ^b
Moose	818	1,221
Turkey	282	--
Rabbit	34	--
Upland Birds (grouse and woodcock)	271	389

^aIncludes inland and coastal ducks, sea ducks (eiders, old squaws and scoters) and Canada geese.

^bA double dash indicates a sample size that is not sufficient to report a mean surplus value.

The rabbit surplus value was derived from the phase one hunting survey of 1988 hunting and is not refined with a follow-up survey. In turn, we would propose that this is a minimum estimate of the surplus value of resident rabbit hunting in Maine.

As with angler surplus values, the hunter surplus values cannot be added to obtain aggregate surplus values for resident and nonresident hunters. These aggregates are reported at the end of this section on hunting.

Economic Impacts of Hunting. Economic impacts per hunter are reported by expenditure categories as was done for sport fishing. Specific types of expenditures differ within each category to represent unique hunting expenditures and to exclude expenditures that are unique to fishing.

Trip specific expenditures for hunting reveal a different pattern between residents and nonresidents than was reported for anglers. Nonresident expenditures exceed those of residents in all but three categories: personal transportation, bait and ammunition (Table 18). In fact, total nonresident expenditures in Maine for trip specific items (\$282) during 1988 are nearly double the total resident expenditures (\$158).

Total resident purchases of hunting equipment in Maine during 1988 (\$255) exceed nonresident expenditures (\$200) by only \$55, or 27 percent (Table 19). Part of this difference may be explained when resident and nonresident expenditures on equipment are compared line by line. Resident expenditures exceed nonresident expenditures for only 7 of the 13 line items, roughly 54 percent of the cases.

Table 18. Trip Specific Expenditures in Maine for All Hunting Trips During 1988 (Fourth Quarter 1989 Dollars)

Item	<u>Average Annual Expenditures Per Hunter</u>	
	Residents	Nonresidents
Gasoline/Personal Transportation	\$ 65	\$ 59
Commercial Transportation	1	9
Food, Beverages, etc.	53	85
Lodging	12	76
Bait	6	3
Ammunition	18	9
Land Access Fees	1	3
Guide Fees	1	32
Equipment Rental	0	1
Other Miscellaneous Expenditures	<u>1</u>	<u>5</u>
Total Trip Specific Expenditures	\$158	\$282

Table 19. Hunting Equipment Purchased in Maine During 1988
(Fourth Quarter 1989 Dollars)

Item	<u>Average Annual Expenditures Per Hunter</u>	
	Residents	Nonresidents
Hunting License (Not Combination)	\$ 18	\$ 71
Guns	111	33
Telescopic Sights	20	9
Bows and Arrows	19	4
Equipment Holders (Gun Cases, Gun Racks, etc.)	8	4
Decoys and Game Calls	3	1
Repair of Hunting Equipment	12	3
Maps	1	2
Game Scouting Expenses Prior to Hunting Season	6	7
Clothing Used <u>Only</u> for Hunting	35	40
Taxidermy, Mounting and Tanning	15	21
Meat Processing	5	3
Other Miscellaneous Expenditures	<u>2</u>	<u>2</u>
Total Equipment Purchases	\$255	\$200

Hunter expenditures on equipment used for hunting and other activities also portray a different pattern of resident and nonresident expenditures than was reported for anglers (Table 20). Total resident hunter purchases in Maine during 1988 (\$569) exceed total nonresident hunter purchases (\$481) by only \$88. In contrast, total resident angler expenditures for items used for fishing and other activities are nearly three times larger than nonresident expenditures.

Aggregate economic impacts per hunter are computed by adding the column totals from Tables 18, 19 and 20. Resident hunters spent \$982 (\$158 + \$255 + \$569) in Maine during 1988, and the comparable figure for nonresident hunters is \$963 (\$282 + \$200 + \$481). Thus, in total, resident hunters spent approximately the same amount per person in Maine during 1988 as did nonresident hunters.

Table 20. Equipment Purchased in Maine During 1988 Used for Hunting and Other Activities (Fourth Quarter 1989 Dollars)

Item	<u>Average Annual Expenditures Per Hunter</u>	
	Residents	Nonresidents
Combination Fishing and Hunting License	\$ 12	\$ 14
Boat (Canoe), Motor, Trailer and Accessories	17	3
ATV, Snowmobile, Utility Trailer	25	10
Travel Trailer, Camper, Motor Home	10	10
Car, Truck, etc.	357	220
Recreational Property	94	189
Camping Equipment (Tent, Sleeping Bag, etc.)	7	6
Binocular, Spotting Scope, Camera, Film, etc.	14	9
Equipment Repair	2	1
Insect Repellent	1	1
Clothing	14	15
Hunting Dogs	16	3
Other Miscellaneous Expenditures	<u>0</u>	<u>0</u>
Total Purchases of Equipment Used For Hunting and <u>Other</u> Activities	\$569	\$481

Aggregate Hunting Surplus Values and Economic Impacts. There were 182,987 licensed resident hunters and 39,335 licensed nonresident hunters who were eligible for selection in the sample (juvenile and alien hunters were excluded). These totals are reduced to the number of individuals who actually hunted in Maine during 1988 using the percentages reported in Table 16. Totals of 157,369 resident hunters ($182,987 \times 0.86$) and 38,548 nonresident hunters ($39,335 \times 0.98$) are used to calculate aggregate surplus values and economic impacts.

The calculation of aggregate surplus values for hunting is done in a manner similar to that employed for inland and marine sport fishing. Surplus values are aggregated across species, and the aggregate surplus value for resident hunting is \$80.0 million (Table 21). The comparable aggregate surplus value for nonresident hunting in Maine is \$19.4 million. Adding these two aggregate surplus values yields an aggregate surplus value for all hunting in Maine of \$99.4 million in 1988. Given that surplus values were only estimated for selected species, this is a minimum estimate of aggregate

surplus value. However, since the number of participants hunting the omitted species is very small, the omission of these individual species surplus values should not have a substantial effect on the aggregate surplus value for hunting.

The maximum aggregate economic impact of hunting in Maine during 1988 is \$154.5 million for residents (\$982 x 157,369) and \$37.1 million for nonresidents (\$963 x 38,548) (Table 21). The maximum total economic impact for all hunting in Maine during 1988 is \$191.6 million (\$154.5 million plus 37.1 million).

Table 21. Aggregate Surplus Values, Aggregate Economic Impacts and Aggregate Total Economic Values for Hunting in Maine During 1988^a
(Fourth Quarter 1989 Dollars)

Values	Residents	Nonresidents	Totals
Aggregate Surplus Values	\$ 80.0	\$19.4	\$ 99.4
<u>Aggregate Economic Impacts</u>			
Minimum	65.0	18.6	83.6
Maximum	154.5	37.1	191.6
<u>Aggregate Total Economic Values</u>			
Minimum	\$145.0	\$38.0	\$183.0
Maximum	\$234.5	\$56.5	\$291.0

^aAll numbers are reported in millions of dollars (x \$1,000,000).

As with sport fishing, this aggregate economic impact must be interpreted as a maximum estimate since expenditures on equipment used for hunting and other activities may be overstated. A minimum estimate is obtained by including only trip specific and hunting equipment purchases. This minimum estimate of the aggregate economic impact is \$83.6 million [(\$413 x 157,369) + (482 x 38,548)].

The minimum aggregate total economic value of resident hunting is \$145.0 million (\$80.0 million plus \$65.0 million), and the corresponding maximum for resident hunters is \$234.5 million (\$80.0 million plus \$154.5 million). For nonresidents, the minimum and maximum aggregate total economic values, respectively, are \$38.0 million (\$19.4 million plus \$18.6 million) and \$56.5 million (\$19.4 million plus \$37.1 million). In turn, the minimum estimate of

total economic value of hunting in Maine during 1988 is \$183.0 million (\$145.0 million plus \$38.0 million), and the maximum estimate is \$291.0 million (\$234.5 million plus \$56.5 million).

TRAPPING

The sample of trappers was randomly selected from a subset of all individuals holding a 1987/88 Maine trapping license. As was done for inland fishing and hunting, juveniles and aliens were excluded from the sample.¹¹ In addition, Native Americans holding a combination hunting, inland fishing and trapping license were also excluded from the sampling framework.¹² None of these Native Americans tagged a fur bearer in Maine during 1987/88, which indicates that they probably used their licenses only for hunting and/or inland fishing. Thus, the omission of these individuals from the sample is not a problem. All other individuals who either purchased a trapping license or held a complimentary trapping license were eligible for selection in the sample, a total of 4,767 licensed trappers.

A total of 200 trappers were mailed a survey designed to obtain information about their 1987/88 trapping effort (July 1, 1987 through June 30, 1988). The response rate, as a percent of deliverable surveys, was 87 percent.

Selected Trapper Characteristics. Characteristics of trappers responding to the survey are reported in Table 22. Note that these characteristics are reported only for Maine residents since the sample did not include nonresidents. As with licensed inland anglers and hunters, not all licensed trappers actually trapped during the 1987/88 trapping seasons. Seventy-six percent of individuals licensed to trap in Maine during 1987/88 actually set traps in the State. This figure is lower than the participation rates reported for resident anglers and hunters.

¹¹There were 25 licensed alien trappers and 459 licensed junior trappers in Maine during 1987/88, representing 7 percent of all licensed trappers in Maine.

¹²A total of 1,676 Native Americans held a Maine combination hunting, inland fishing and trapping license during 1987/88.

The average trapper first set traps in 1967, and most have trapped in Maine in more than half of the years since that time. Nearly all trappers also hunt and fish in Maine. This result contrasts with overlaps in participation reported for angler and hunters who hunt or fish, but seldom trap.

The average age of trappers is 44, which is only slightly older than the average ages reported for resident anglers and hunters. Ninety-nine percent of the trappers are male. The average trapper has a high school education and an annual household income of \$25,600. This income figure is somewhat lower than those reported for resident anglers and hunters.

Table 22. Characteristics of Maine's Licensed Trappers During 1987/88

Characteristic	Resident Trappers
Actually Trapped in Maine During 1987/88	76%
First Trapped in Maine	1967
Trapped in Maine More Than Half of the Years	82%
Inland Fished in Maine During 1987	88%
Marine Fished in Maine During 1987	24%
Hunted in Maine During 1987	95%
Average Age	44
Sex (Percent Male)	99%
Average Education	High School Graduate
Average Annual Household Income (Fourth Quarter 1989 Dollars)	\$25,600

Surplus Values for Trapping. As stated earlier in the report, surplus values were not estimated for trapping due to the mixture of commercial and recreational trapping that occurs in Maine. That is, 23 percent of the respondents said they trapped to make money and 37 percent reported trapping income that exceeded their expenditures in 1987. These numbers indicate that some of Maine's trappers probably trap commercially. Simple statistics, like those reported above, provide a starting point for determining whether a

person is a commercial or recreational trapper, but more sophisticated analyses are required to classify trappers as being either recreational or commercial. Once trappers are classified, separate procedures must be employed to measure surplus values for each group. Due to these complications we are unable to report a surplus value for trapping at this time.

Economic Impacts of Trapping. Economic impacts per trapper are reported for the same three expenditure categories that were discussed for fishing and hunting. However, the components within each category are somewhat different so that unique aspects of trapping are represented, and purchases unique to fishing and hunting are excluded.

As was previously stated, all economic data are adjusted to fourth quarter 1989 dollars. Total trip specific expenditures in Maine during 1987 for items purchased each time a trapper set, checked or removed traps was \$201 per trapper in fourth quarter 1989 dollars (Table 23). The largest expenditure was for gasoline. Note that the average trapper does spend some money to have someone else help set, check and remove traps.

Table 23. Trip Specific Expenditures in Maine for All Trapping During 1987/88 (Fourth Quarter 1989 Dollars)

Item	Average Annual Expenditures Per Resident Trapper
Gasoline/Personal Transportation	\$ 89
Food, Beverages, etc.	31
Lodging	3
Baits, Scents, Lures	27
Dye, Wax, Hulls, Antifreeze	11
Land Access Fees	3
Helper Fees	18
Equipment and Airplane Rental	8
Other Miscellaneous Expenses	<u>11</u>
Total Trip Specific Expenditures	\$201

Annual trapping equipment purchases total \$222 per trapper in fourth quarter 1989 dollars (Table 24). The list of trapping equipment is more extensive than the list of inland fishing equipment (Table 5), marine fishing equipment (Table 12), or hunting equipment (Table 19) due to the specialized equipment required for trapping. Not surprisingly, the largest expenditures were made for traps, chains, drags and stakes.

Finally, purchases of equipment used for trapping and other activities are reported in Table 25. The total annual expenditure per trapper is \$526 in fourth quarter 1989 dollars. The largest expenditures were made on vehicles for which at least a portion of the use is dedicated to setting, checking and removing traps.

Aggregate Trapping Economic Impacts. Following the same procedure used for inland fishing and hunting, the number of licensed trappers must be reduced to those who actually trapped during the 1987/88 trapping seasons. Using the percentage reported in Table 21, the number of individuals who actively trapped during 1987/88 was 3,623 ($4,747 \times 0.76$).

The same caution that applied to the aggregate economic impacts for fishing and hunting also applies to the aggregate economic impact of trapping. That is, expenditures on equipment used for trapping and other activities may be overstated. In fourth quarter 1989 dollars, the minimum estimate of total annual expenditures per trapper is \$423 ($\$201 + \222) and the maximum annual estimate is \$949 ($\$201 + \$222 + \526). A minimum estimate of the aggregate annual economic impact of trapping in Maine, therefore, is \$1.5 million ($\$423 \times 3,623$). The maximum annual estimate is \$3.4 million ($\$949 \times 3,623$).

Table 24. Trapping Equipment Purchased in Maine During 1987/88
(Fourth Quarter 1989 Dollars)

Item	Average Annual Expenditures Per Resident Trapper
Trapping License and Tagging Fees	\$ 36
Traps, Chains, Drags, Stakes	52
Wire, Nails, etc.	5
Shovels, Axes, Saws, etc.	13
Ice Auger	6
Knives, Gambrels, Stretchers, etc.	6
Packs, Waders, Snowshoes	18
Boat, Motor, Trailer, Accessories Used <u>Only</u> for Trapping	11
ATV, Snowmobile, Utility Trailer Used <u>Only</u> for Trapping	36
Repair of Trapping Equipment	5
Maps	1
Taxidermy, Tanning and Mounting	10
Clothing Used <u>Only</u> for Trapping	5
Membership Dues	12
Instruction Books, Videos	3
Other Miscellaneous Expenses	<u>3</u>
Total Equipment Purchases	\$222

Table 25. Equipment Purchased in Maine During 1987/88 Used for Trapping and
Other Activities (Fourth Quarter 1989 Dollars)

Item	Average Annual Expenditures Per Resident Trapper
Boat (Canoe), Motor, Trailer and Accessories	\$ 49
ATV, Snowmobile, Utility Trailer	160
Travel Trailer, Camper, Motor Home	1
Car, Truck, etc.	223
Recreational Property	19
Camping Equipment (Tent, Sleeping Bag, etc.)	1
Binoculars, Camera, Film, etc.	15
Pack, Waders, Snowshoes	10
Shovels, Axes, Saws, etc.	6
Ice Auger	2
Knives, Gambrels, Stretchers, etc.	5
Equipment Repair	15
Clothing	15
Other Miscellaneous Expenses	<u>5</u>
Total Purchases of Equipment Used for Trapping and <u>Other</u> Activities	\$526

NONCONSUMPTIVE USE

Nonconsumptive use, for purposes of this report, is defined as any activity where a person comes in contact with wildlife in its' natural habitat and the creature(s) is not removed from the wild. More precisely, nonconsumptive uses include seeing wildlife, hearing wildlife and seeing signs of wildlife. These activities can be intentional where the primary objective is to observe wildlife, e.g., a whale watching trip off the Maine coast. Or, nonconsumptive use can be incidental to an activity that is not directed toward observing wildlife, seeing birds while playing golf.

In 1985 the U.S. Fish and Wildlife Service estimated that 85 percent of Maine residents, 16 years of age and older, participated in some form of nonconsumptive use of Maine's wildlife.¹³ Preliminary results from the first phase of the nonconsumptive component of the current study indicate that this figure may exceed 90 percent for Maine residents 18 years of age and older. Within the current report we will focus on nonconsumptive activities where the primary purpose is to observe wildlife. Such activities involve wildlife observation around one's home and taking trips to specifically observe Maine's wildlife.

Given the above findings, it is desirable to have a sample that represents all adults in Maine. However, we were unable to obtain such a sample. In turn, a sample of 2,000 Maine residents, representing only adults in Maine who are heads of households, was purchased from R.L. Polk and Co. in Boston, MA. This sample was randomly stratified into two groups of 1,000 study participants, and the results presented here are derived from one of these subsamples.¹⁴ The sampling frame from which R.L. Polk drew this sample contains 342,036 households. The response rate to the survey, as a percent of

¹³"1985 National Survey of Fishing, Hunting and Wildlife-Associated Recreation: Maine." U.S. Fish and Wildlife Service, Washington, D.C., 1989.

¹⁴The current nonconsumptive survey, second phase, was preceded by an earlier nonconsumptive survey, first phase, which characterized nonconsumptive uses. The second phase examines marginal surplus values for nonconsumptive uses of selected species of wildlife, e.g., deer, moose, coyotes and bald eagles.

deliverable surveys was 70 percent for the first phase survey and 76 percent for the second phase survey.

Finally, as stated in the Introduction, nonresidents were not surveyed regarding their nonconsumptive use of Maine's wildlife due to the extremely high cost of developing a representative sample.

Selected Nonconsumptive User Characteristics. The average respondent is 45 years old with a household income of roughly \$33,600 and has lived in Maine for 34 years (Table 26). Slightly more than half attempt to attract wildlife to their home or camp, and 35 percent took at least one trip during 1989 where the primary objective was to observe wildlife. These figures are important since the focus of this report is on nonconsumptive activities where the primary purpose is to observe wildlife. Comparing these figures with the earlier result that 85 to 90 percent of Maine's adult population participates in nonconsumptive uses of Maine's wildlife indicates that for nearly half of these nonconsumptive uses of wildlife are incidental to participation in activities that are not associated with wildlife. Finally, more than a third of the nonconsumptive participants also participated in some type of consumptive use of Maine's wildlife during 1988.

Table 26. Characteristics of Respondents to the Nonconsumptive Use Survey

Characteristic	Resident Nonconsumptive Users
Attract Wildlife to Home or Camp in 1989	55%
Took Trips to Observe Wildlife in 1989	35%
Inland Fished in Maine During 1988	42%
Marine Fished in Maine During 1988	23%
Hunted in Maine During 1988	30%
Trapped in Maine During 1988	1%
Age	45
Sex (Percent Male)	70
Education	Some Training Beyond High School
Household Size	3
Annual Household Income	\$33,600
Years a Maine Resident	34

Selected Nonconsumptive User Surplus Values. Surplus values are only reported for selected species of wildlife that are endangered in Maine and are also classified as federally endangered. Surplus values are not reported for specific types of nonconsumptive uses due to measurement difficulties. This problem can best be explained by referring back to the hunting surplus values. Let us take moose hunting as a specific example. As previously stated, the amount that a moose hunter spends is an economic impact. Conceptually, the surplus value of the moose hunt is the most that a hunter would pay, above and beyond expenses, before the hunter would not go moose hunting. The average surplus value for resident moose hunters was \$818 for 1989 (Table 17). Thus, if the cost of a Maine moose hunt increased by \$900, the average resident hunter would choose not to hunt moose in Maine.

The above conceptual framework is difficult to apply to nonconsumptive uses. Consider bird watching around a person's home. This person spends money for bird food to attract wild birds. Assume, in this simple example, that this person spends \$30 per year to attract wild birds. We learn that the most this person would pay per year for wild bird food is \$80. Is this person's surplus value of watching birds around their home \$50 (\$80 - \$30)? The answer is no. Even if the cost of bird food increased to \$100 per year, and the person did not buy any bird food, it is likely that this person would

still be able to watch birds around home. The \$50 surplus value is simply the surplus value associated with improving bird viewing opportunities around a person's home. It is not an all or nothing surplus value as estimated for fishing and hunting.

Surplus values were estimated, collectively, for ten species that are endangered in Maine and are also classified as being endangered federally. These species are: bald eagles, peregrine falcons, roseate terns, right whales, humpback whales, finback whales, ~~sperm whales~~, sei whales, leatherback turtles and Atlantic ridley turtles. Surplus values were estimated for preserving these species in Maine, but were not estimated to preserve these species throughout the United States or throughout the range of their habitats. The average surplus value per head of household was \$15. Multiplying this estimate by the number of households (342,036) yields an aggregate surplus value of \$5.1 million. Given that surplus values were not estimated for specific types of nonconsumptive activities, this is a minimum estimate of the aggregate surplus value.

Economic Impacts of Nonconsumptive Uses. As with fishing, hunting and trapping, expenditures were divided into several categories, primarily, to make the expenditure questions on the survey easy for respondents to answer. Due to the unique aspects of nonconsumptive uses, these expenditure categories, and the items within each category, are quite different from what was reported for fishing, hunting or trapping. The first category is expenditures to attract wildlife to a persons home or camp (Table 27). As reported in Table 26, 55 percent of the households reported that they attempted to attract wildlife to their home or camp. As expected, the largest expenditures were for bird food (\$44) and special landscaping (\$20). The average total expenditures per head of household who attempted to attract wildlife during 1988 was \$78.

Table 27. Items Purchased to Attract Wildlife to Home or Camp in Maine During 1989

Item	Average Annual Expenses Per Resident Head of Household
Bird/Wildlife Food (Seed, Suet, Corn, Salt, etc.)	\$44
Wildlife Shelters (Bird Houses, Bat Houses, etc.)	7
Feeders or Bird Baths	7
Special Landscaping to Attract Wildlife	20
Other Miscellaneous Expenditures	<u>0</u>
Total Expenditures to Attract Wildlife	\$78

The second category of expenditures represents expenses on trips where the primary purpose was to observe wildlife (Table 28). As previously reported, 35 percent (Table 26) of the heads of households reported taking trips in Maine during 1989 where the primary purpose was to observe wildlife. Expenditures here also follow an expected pattern, in that most of the expenses are associated with travel. The total expenditures per head of household taking this type of trip averaged \$170 during 1989.

Table 28. Trip Specific Expenditures in Maine for All Wildlife Observation Trips During 1989

Item	Average Annual Expense Per Resident Head of Household
Gas/Personal Transportation	\$ 63
Food, Beverages, etc.	60
Lodging	31
Access Fees/Guide Fees	5
Other Miscellaneous Expenditures	<u>11</u>
Total Trip Specific Expenditures	\$170

The third category of expenditures deals with equipment purchased to observe wildlife and can also be used for other activities. As with this category of expenses for fishing, hunting and trapping, the costs of these items are adjusted by the percent of use that will be dedicated to observing wildlife. For example, if a person purchased binoculars for \$60, and 50 percent of the use will be dedicated to observing wildlife, \$30 would be counted as the economic impact associated with nonconsumptive uses

(\$60 x 0.50). Thirty-seven percent of the respondents reported equipment purchases during 1989 and the average amount spent was \$100 per head of household (Table 29). The big ticket items were binoculars and other viewing equipment (\$46) and camping/hiking gear (\$38). Finally, 19 percent of the respondents reported making contributions to help Maine's wildlife during 1989. The average contribution was \$33.

Table 29. Equipment Purchase in Maine During 1989 Used for Wildlife Observation and Other Activities

Item	Average Annual Expenses Per Resident Head of Household
Binoculars, Telescope, Camera, Film, etc.	\$46
Camping and Hiking Equipment	38
Wildlife Identification Books	3
Maps	1
Other Miscellaneous Expenditures	<u>12</u>
Total Purchases of Equipment Used for Wildlife Observation and <u>Other</u> Activities	\$100

Aggregate Surplus Values and Aggregate Economic Impacts of Nonconsumptive Uses. Aggregate economic impacts are derived by multiplying the number of households in the state (342,036) by the proportion of the sample reporting making expenditures in the category and multiplying again by the average total expenditures for the category. Using trips to observe wildlife as an example, the number of households (342,036) is multiplied by the percent of respondents making trips to observe wildlife in Maine (35 percent). Thus, 119,713 heads of households made trips to observe wildlife in Maine during 1989 ($342,036 \times 0.35$). Multiplying this figure by the average expenditures of \$170 yields an aggregate economic impact of \$20.4 million ($119,713 \times \170). Likewise, this same procedure is applied to all other categories of use and the contributions, and the resulting category specific aggregate economic impacts are added to obtain the grand total of \$50.3 million spent by heads of households in Maine during 1989 (Table 30).

These aggregate economic impacts can be considered as minimum estimates. That is, the average Maine household is comprised of three people; two adults and one child. Our survey represents only the head of the household. Thus, expenditures for nonconsumptive activities by the second adult in each household that are made independently of the head of the household are not represented here. We would expect that expenditures by the second adult would be less, on average, than those made by the head of the household.

Table 30. Aggregate Economic Impacts of Nonconsumptive Uses of Wildlife in Maine During 1989^a.

Expenditure Category	Aggregate Expenditures
Attract Wildlife to Home or Camp	\$14.7
Trips to Observe Wildlife	20.4
Equipment Purchases	12.7
Contributions	<u>2.5</u>
Total	\$50.3

^aAll numbers are reported in millions of dollars (x \$1,000,000).

In addition, many nonconsumptive uses of wildlife occur simultaneously with other outdoor activities and it is difficult, if not impossible, to separate the component of the activity expenditures that are associated with wildlife. In concluding, a minimum estimate of the aggregate total value of nonconsumptive uses is \$55.4 million (\$5.1 million plus 50.3 million).

AGGREGATE SURPLUS VALUES AND AGGREGATE ECONOMIC IMPACTS FOR CONSUMPTIVE AND NONCONSUMPTIVE USES COMBINED

Aggregate surplus values, economic impacts and total economic values for all consumptive and nonconsumptive uses of Maine's wildlife resources are relatively easy to derive given the data presented in the previous sections. We simply add the aggregate figures for each specific activity. Let us consider residents first (Table 31). Total economic value for Maine residents is estimated to be between \$501.8 million and \$831.9 million given current data. Notably missing from these data are aggregate surplus values for trapping and a maximum economic impact for nonconsumptive uses. Given the

Table 31. Maine Resident Aggregate Surplus Values, Aggregate Economic Impacts and Aggregate Total Economic Values for Consumptive and Nonconsumptive Uses^a (Fourth Quarter 1989 Dollars)

Activity	Aggregate Surplus Values	Aggregate Economic Impacts		Aggregate Total Economic Values	
		Minimum	Maximum	Minimum	Maximum
Inland Fishing	\$105.7	\$117.2	\$282.2	\$222.9	\$387.9
Marine Fishing	8.5	68.5	142.2	77.0	150.7
Hunting	80.0	65.0	154.5	145.0	234.5
Trapping	NE ^b	1.5	3.4	1.5	3.4
Nonconsumptive	<u>5.1</u>	<u>50.3</u>	<u>50.3</u>	<u>55.4</u>	<u>55.4</u>
Totals	\$199.3	\$302.5	\$632.6	\$501.8	\$831.9

^aAll numbers are reported in millions of dollars (x \$1,000,000).

^bNE indicates the numbers were not estimated.

small number of licensed trappers in Maine (less than 5,000), the addition of surplus values for trapping would not have a substantial effect on the aggregate total economic value estimates. Furthermore, given that many nonconsumptive uses are free to everyone who visits or lives in Maine, the omission of a maximum aggregate economic impact for nonconsumptive uses is probably not a serious omission. On the other hand, this same logic leads us to believe that aggregate surplus values for nonconsumptive uses of Maine's wildlife may be substantially larger than reported and, if surplus values were estimated for specific types of nonconsumptive uses, the aggregate surplus value for nonconsumptive uses may be comparable to the \$80.0 million reported for hunting.

Examining the individual categories of use in Table 31 reveals some interesting results. Inland fishing has the largest aggregate surplus values and aggregate economic impacts. Hunting is second in aggregate surplus values and is comparable to marine fishing in terms of aggregate economic impacts. One might ask why the aggregate surplus value for marine fishing is so low and the economic impact is relatively large. Our interpretation is that marine fishing is an expensive activity given the need for a large boat and

specialized fishing gear. However, the quality of the marine fishing experience is inferior, in relative terms, to inland fishing opportunities in Maine.

Turning to nonresidents, estimated total economic value falls between a minimum of \$174.2 million and a maximum of \$286.6 million (Table 32). The omission of values for trapping does not have a substantial effect since there are fewer than 100 nonresident trappers in Maine. The effect of not sampling nonresidents with respect to nonconsumptive uses is difficult to assess. Obviously, this results in a downward bias in the aggregate totals. However, the magnitude of this downward effect is difficult to predict given that observing wildlife is only one of many reasons that nonresidents visit Maine and the number of visits where observing wildlife is the primary purpose may be quite small.

Comparing the separate categories of consumptive uses presents some different results than reported for the resident samples. Inland fishing has the largest aggregate surplus value, but marine fishing generates the largest aggregate economic impacts. We feel that this marine fishing result should be interpreted with caution since the sample of nonresident marine anglers may not be entirely representative of the entire population of nonresident marine anglers.

Table 32. Nonresident Aggregate Surplus Values, Aggregate Economic Impacts and Aggregate Total Economic Values for Consumptive and Nonconsumptive Uses^a (Fourth Quarter 1989 Dollars)

Activity	Aggregate Surplus Values	Aggregate Economic Impacts		Aggregate Total Economic Values	
		Minimum	Maximum	Minimum	Maximum
Inland Fishing	\$36.7	\$ 41.1	\$ 69.6	\$ 77.8	\$106.3
Marine Fishing	5.3	53.1	118.5	58.4	123.8
Hunting	19.4	18.6	37.1	38.0	56.5
Trapping	NE ^b	NE	NE	NE	NE
Nonconsumptive	NE	NE	NE	NE	NE
Total	\$61.4	\$112.8	\$225.2	\$174.2	\$286.6

^aAll numbers are reported in millions of dollars (x 1,000,000).

^bNE indicates the numbers were not estimated.

It is interesting to note, given the relative numbers of nonresident inland and marine anglers, that the nonresident aggregate surplus value for inland fishing is more than six times the aggregate surplus values for nonresident marine fishing. Likewise, inland fishing aggregate economic impacts are roughly two times the comparable figures for hunting.

Overall, the minimum estimate of total economic value of consumptive and nonconsumptive uses of Maine's fish and wildlife resources is \$675.7 million (Table 33). The corresponding maximum estimate is \$1,118.5 million. Overall, the resident component is nearly three times larger than the nonresident component.

Table 33. Aggregate Surplus Values, Aggregate Economic Impacts and Aggregate Total Economic Values for Consumptive and Nonconsumptive Uses of Maine's Fish and Wildlife Resources^a
(Fourth Quarter 1989 Dollars)

User Group	Aggregate Surplus Values	Aggregate Economic Impacts	Aggregate Total Economic Values
<u>Residents</u>			
Minimum	\$199.3	\$302.5	\$ 501.8
Maximum	199.3	632.6	831.9
<u>Nonresidents</u>			
Minimum	\$ 61.4	\$112.8	\$ 174.2
Maximum	61.4	225.2	286.6
<u>All Users</u>			
Minimum	\$260.7	\$415.3	\$ 675.7
Maximum	260.7	857.8	1,118.5

^aAll numbers are reported in millions of dollars (x 1,000,000).

In closing we would like to acknowledge that the aggregate surplus values, aggregate economic impacts and aggregate total economic values reported above are very large numbers. Given this fact, we would like to offer a few words of caution when interpreting these numbers.

1. The surplus values are minimum estimates since surplus values are not estimated for selected marine species, selected wildlife species, trapping and selected nonconsumptive uses.

2. The minimum aggregate economic impact is a reasonable estimate of the minimum. However, we believe that the maximum estimate of aggregate economic impact is probably an overstatement of the true economic impact. Therefore, extreme caution should be used when using this maximum estimate.
3. Given what we said for (1) and (2) above, the minimum estimate of total economic value for consumptive and nonconsumptive uses of Maine's fish and wildlife resources should exceed the minimum estimate of \$675.7 million, but probably will not exceed the maximum estimate of \$1,118.5 million.
4. Economic multipliers are often applied to expenditure data to account for the effect of money being respent in an economy. The expenditures reported here are direct economic impacts and do not include multiplier calculations to account for the respending effect. If multipliers are applied to our numbers, they should only be applied to the economic impacts and not to the surplus values.

SECTION III

**OPPORTUNITIES FOR IMPROVED WILDLIFE MANAGEMENT
IN MAINE FROM A USERS PERSPECTIVE**

INTRODUCTION

The second duty of the commission, as stated in Section I was to conduct "...an analysis of the economic, recreational and ecological potential of the State's wildlife resources on Maine's economy." In this section we focus on the economic potential of improved recreational opportunities involving Maine's fish and wildlife resources. The ecological potential of these resources are addressed in species management plans developed by the Department of Inland Fisheries and Wildlife and the Department of Marine Resources. The next step, upon completion of this report, will be to combine the user data presented here with biological data in the development of future species management plans.

The best way to consider the potential of improved recreational opportunities is to refer back to the demand framework for economic evaluation outlined in Section II. This relationship is shown graphically in Figure I and we will again use deer hunting as an example. AC represents the average cost of a deer hunting trip for a specific hunter. At a cost of AC, this hunter will choose to take t^* trips during the deer hunting season. AC multiplied by t^* equals the area EI, which is the individual's total expenditures on deer hunting for the year (season). This is the annual economic impact on the Maine economy from this individual's deer hunting, assuming all expenditures are made in Maine. An aggregate economic impact of deer hunting is obtained by adding the individual annual economic impacts for

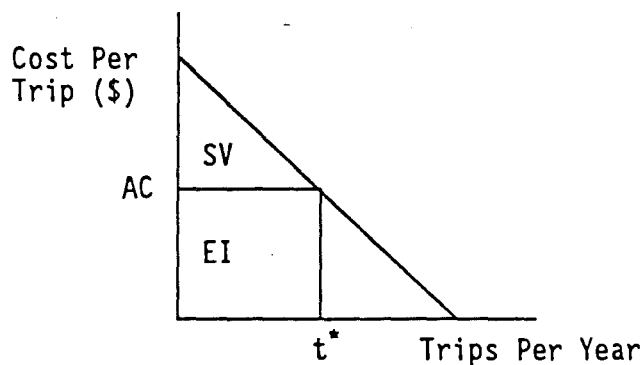


Figure 1. Individual Deer Hunter's Demand for Deer Hunting Trips

all deer hunters in the specified year. The triangle, SV , is what was referred to as surplus value in Section I. This represents the net annual value of deer hunting to participants; the extra amount they would have paid, if necessary, to retain the opportunity to hunt deer in Maine.

For purposes of exposition and clarity, let us assume that the average cost of deer hunting rose from AC to \overline{AC} . What would happen? To add realism one might consider the average cost of a hunting trip rising due to an increase in the cost of gasoline as was experienced during the Fall of 1990. The effect of this change is portrayed in Figure 2. When the cost per trip rises to \overline{AC} we would expect that the number of deer hunting trips taken would decline from t^* to \bar{t} . Furthermore, hunter satisfaction, as measured by surplus value, would be reduced to \overline{SV} . Deer hunters are obviously worse off ($\overline{SV} < SV$). The effect on business' who are the recipients of the hunters' expenditures is not clear. The average cost per trip increases by the difference between \overline{AC} minus AC , resulting in increased expenditures of \overline{EI} . However, fewer trips are taken ($t^* - \bar{t}$) resulting in decreased expenditures of \overline{DE} . The ultimate impact on business depends on whether \overline{EI} is greater than, less than or equal to \overline{DE} , and this relationship depends on the slope of the demand curve. That is, the rate at which trips decrease in response to increased costs. This rate of change must be determined empirically and would be expected to vary with recreational activities, e.g., different types of hunting. If the average cost of a deer hunting trip decreased, the logic

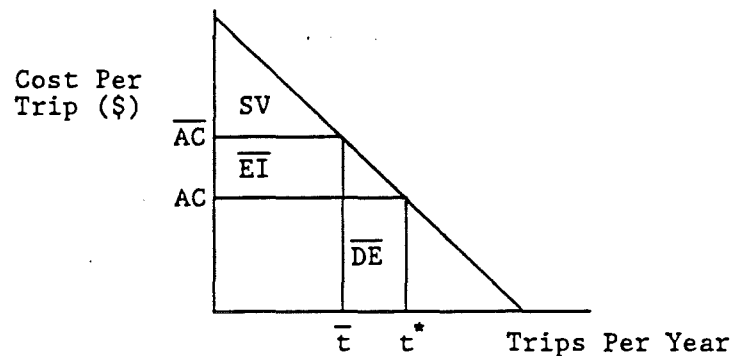


Figure 2. Individual Deer Hunters Demand for Trips with Increased Average Costs

developed above can be used to show that deer hunters benefit and the change in the economic impact on businesses is once again indeterminate.

Our objective in examining the economic potential of improved recreational opportunities involving Maine's fish and wildlife is to first attempt to identify changes that can enhance participant surplus values and the economic impact of these activities on Maine's business community. The easiest way to envision this is to consider a management program to increase Maine's deer herd which would increase hunter success and increase viewing opportunities for hunters and non-hunters alike. This type of management program might have the effect of shifting hunter and nonconsumptive user (viewers) demand curves to the right (Figures 3a and 3b). Assuming that the average cost of participation remain unchanged (AC_H and AC_V), participation (trips per year) increase to t^1 for hunters and v^1 for viewers. In turn, surplus values increases by SV_H for hunters and by SV_V for viewers; making both of these groups better off. Concurrently, expenditures by both hunters and viewers increase by EI_H and EI_V , respectively; increasing the economic impacts of these activities.

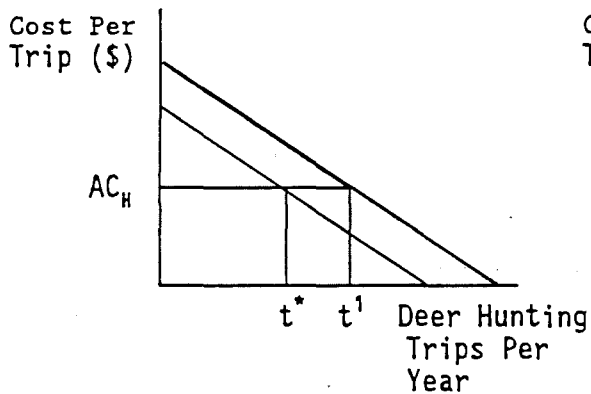


Figure 3a. Shift in Individual Deer Hunters' Demand for Trips

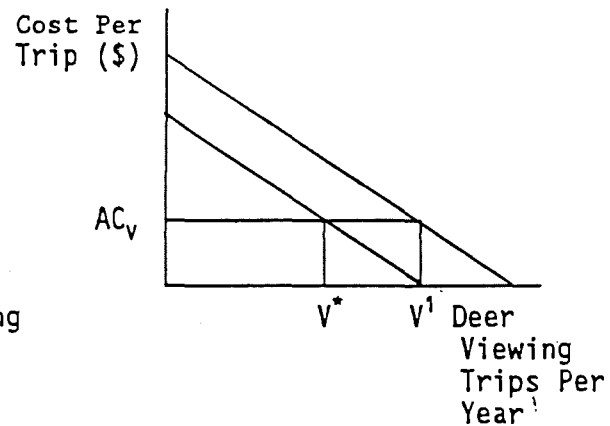


Figure 3b. Shift in Individual Deer Viewers' Demand for Trips

The search for opportunities must start by identifying management activities that will enhance individual participant surplus values, which in turn, make the activities more desirable to participants. Only by this tactic can the process of identifying economic potential of these activities on Maine's economy be accomplished. It is important to note, however, that some enhancements in surplus values may actually result in reduced economic impacts. Consider the deer hunting example above. Increasing the success rate of hunters may actually reduce trips (i.e., hunters take fewer trips to bag a deer) and, thereby, the economic impact of participation. Thus, a second objective will be to identify opportunities that may benefit participants, but might reduce or leave economic impacts unchanged.

When identifying opportunities we will consider three primary factors:

- * activity specific surplus value,
- * activity specific economic impacts, and
- * the number of users participating in an activity.

The number of users is relevant for two general reasons. First, even if individual surplus values and economic impacts are small, a large number of users can generate large aggregate surplus values and aggregate economic impacts. On the opposite end of the continuum, small numbers of participants with a low likelihood of increased participation are not likely to be identified as yielding a potentially large economic windfall. However, such activities may still warrant consideration to maintain equity across user groups and to develop sound management plans from a biological perspective.

To begin the analysis of opportunities, we asked consumptive users to answer four questions. Continuing with deer hunting as our example, the questions posed to deer hunters are as follows:

- * "What one factor would contribute most to an excellent deer hunt for you?"
- * "What one factor would contribute most to a poor deer hunt for you?"
- * "A number of factors can contribute to a high quality deer hunt. How important is each reason listed below for you when hunting deer in Maine?"

* "A number of factors can contribute to a poor quality deer hunt. How important is each reason listed below for you when hunting deer in Maine?"

The first two questions are referred to as "open ended" where a line is provided for respondents to write in any response they choose. After the surveys are returned, we, as researchers, combine responses into common categories for reporting. For each activity we will report the top five response categories contributing to an "excellent" hunt or a "poor" hunt. In cases of a tie for the fifth category, more than five response categories will be reported.

The third and fourth questions asked respondents to evaluate factors provided by the researchers. For deer hunting, selected factors (categories) contributing to a "high" quality hunt were "knowing area where I hunt," "getting a shot at a deer," "seeing few other hunters," etc. Comparable examples contributing to a poor hunt were "not knowing area where I hunt," "not getting a shot at a deer," "seeing other hunters," etc. For a high quality hunt, respondents were asked to rank factors on a scale ranging from "greatly increases quality" to "somewhat increases quality" to "not important." Likewise, factors contributing to a poor quality hunt were ranked on a scale ranging from "greatly decreases quality," "somewhat decreases quality" to "not important." As many as thirty categories might be provided for participants to evaluate for any specific activity. To facilitate reporting, only the top five categories in terms of the percentage of respondents who say the factor "greatly increases quality" or "greatly decreases quality" of the hunt are reported here. Once again, if a tie arises for the fifth spot, more than five factors will be listed.

It is important to note that the open-ended and categorical questions used in the surveys changed between fishing, hunting and nonconsumptive uses, and within each of these activity types factors evaluated for the categorical questions varied with specific activities (e.g., deer hunting versus bear hunting versus moose hunting versus turkey hunting). Activity specific questions will be identified in conjunction with the presentation of the

resulting empirical findings.

In addition to reporting activity specific opportunities, we will also discuss activity specific participation rates, economic impacts and surplus values. Before moving to the empirical results, however, two caveats are warranted. First, opportunities that enhance activity specific economic impacts by Maine residents can not be assumed to increase the economic impact on Maine's economy. Rather, they must be considered as transfers of expenditures from other activities that residents might have participated in in Maine. Second, our objective here is to identify opportunities and it is not to address the costs of these opportunities. Cost can only be developed after user data and biological data are combined to formulate specific management plans.

SPORT FISHING OPPORTUNITIES

As reported in Section II, sport fishing was divided into two categories, inland and marine. This division was based on the jurisdictional boundaries between the Department of Inland Fisheries and Wildlife and the Department of Marine Resources. Opportunities will only be identified only for inland fishing here. Opportunities for marine fishing are not addressed because this study represents the first attempt to develop baseline estimates characterizing marine sport fishing in Maine. With significant sampling problems and small subsamples it would not be appropriate to go beyond this basic characterization of marine sport fishing in Maine. Our recommendation is that marine sport fishing requires further investigation as an independent study with particular attention given to the development of representative samples of resident and nonresident marine sport anglers in Maine. One way to address this sampling problem would be to require a marine sport fishing license for all of Maine's coastal bays and the ocean waters off Maine's coast. In addition to providing a sampling frame for future research, this policy would also allow the Department of Marine Resources to track recreational fishing under their jurisdiction over time and could generate revenue for marine sport fishing research and management. Such a policy may

be useful for developing species specific management policies and ameliorating potential conflicts between sport anglers and commercial fisherman as fish stocks decline and sport fishing effort increases. These advantages must be weighted against the costs of administering and enforcing a license policy. In addition, such a change in policy may generate an adverse public reaction from marine sport anglers who may have come to presume that it is their right to fish Maine coastal waters for free.

Inland Fishing

In the second phase surveys on inland fishing, open-water anglers and ice anglers were asked one open-ended question and one categorical question. These questions were:

- * "What do you consider to be the most desirable feature (or site characteristic) of a fishing location?
- * We would like to know more about the features or site characteristics that you feel are important in choosing the location where you fish. Please indicate how important each factor or site characteristic, listed below, is to you.

Categorical responses provided for respondents varied with each type of activity. Open water anglers evaluated categories such as a "maintained boat launch," and ice anglers evaluated the importance of "safe ice." Open water anglers evaluated 18 site characteristics and ice anglers evaluated 14 site characteristics. The ranking scale for both types of anglers ranged from "not important" to "somewhat important" to "very important."

Responses to the open-ended question are reported in Table 34 for both open water anglers and for ice anglers. Resident and nonresident open water anglers both listed a "remote area" as the most important characteristic of an open water fishing site with "good access" being second for residents and third for nonresidents. Given that our data indicates that most resident fishing takes place within about one hour of an anglers' home, our interpretation of these results indicates anglers desire a wilderness type experience that is easy to get to. These two features may be difficult to obtain simultaneously unless an effort is made to manage both fish stocks and

the land surrounding the bodies of water where angler's fish. An additional feature to note is that resident and nonresident ranking of characteristics are the same except for one additional feature for residents, due to a tie, "desirable species." Furthermore, all of the top five categories listed by resident and nonresident open water anglers are under the control of fishery managers to some extent, with access and pollution being the characteristics being beyond the direct control of fishery managers.

Moving to ice fishing (bottom of Table 34), resident and nonresident responses to the open ended question are once again quite similar, four out of the top five are the same for both groups. However, there is more variability in the ranking of characteristics between resident and nonresidents. Again, nearly all of the top five characteristics are under management control, even the "natural beauty" of a fishing site. This characteristic can be managed by participating in regulation of development around water bodies, selective stocking and regulations of waters open to ice fishing, and publication/advertising (public education) of desirable ice fishing sites.

Table 34. Inland Anglers' Open-Ended Ratings of Characteristics Contributing to a Desirable Fishing Site

Residents		Nonresidents	
Characteristic	Percent Citing Characteristic	Characteristic	Percent Citing Characteristic
** OPEN WATER FISHING **			
Remote Area	40%	Remote Area	40%
Good Access	13	No Pollution	13
No Pollution	8	Good Access	10
Quality of Fishing	6	Quality of Fishing	9
A Lot of Fish	6	A Lot of Fish	8
Desirable Species	6	Other	20
Other	21		
** ICE FISHING **			
Uncrowded Area	21%	Natural Beauty	23%
Well Stocked	13	Easy Access	21
Natural Beauty	12	Well Stocked	16
Easy Access	12	Uncrowded Area	10
Close to Home	6	Deepwater	10
Other	36	Other	20

Responses to the categorical questions yield some similarities and differences to responses to the open ended questions. For resident open water anglers, "desirable species" and "public access" were repeated and no single category was replicated for nonresident anglers (Table 35). We believe that our scenic beauty category is similar to what anglers intended in the remote area response to the open ended question. The type of water may be an important characteristic since 92 percent of resident and 91 percent of nonresident open water anglers fish standing bodies of water (ponds, lakes, etc.) in Maine, while only 74 percent of resident and 53 percent of nonresident open water anglers fish flowing bodies of water (brooks, streams and rivers) in Maine. This historical trend is not likely to be changed easily by fishery managers.

For ice fishing the number one categorical response was "safe ice" for both residents and nonresidents. Although the safeness of ice depends on weather conditions to a large extent, managers can affect this characteristic by management of waters open to ice fishing and public information on ice conditions.

Table 35. Inland Anglers' Categorical Ratings of Importance of Fishing Site Characteristics

Residents		Nonresidents	
Characteristic	Percent Citing "Very Important"	Characteristic	Percent Citing "Very Important"
** OPEN WATER FISHING **			
Scenic Beauty	65%	Scenic Beauty	67%
Few Anglers	48	Desirable Species	55
Desirable Species	48	Few Anglers	51
Type of Water (Pond, River, etc.)	35	Type of Water (Pond, River, etc.)	38
Public Access	31	Past Fishing Success	26
		Close to Camp	26
** ICE FISHING **			
Safe Ice	94%	Safe Ice	89%
Desirable Species	54	Scenic Beauty	67
Scenic Beauty	38	Desirable Species	61
Few Anglers	37	Chance to Catch a Trophy Fish	33
Public Access	35	Public Access	32

Up to this point we have dealt with open water fishing and ice fishing as independent entities. These two activities can be competitive on waters open to both. In 1988, we estimate that there were 170,960 licensed adult resident anglers and 89,414 licensed adult nonresident anglers who open water fished in Maine; a total of 260,374 licensed anglers open water fishing (Table 36). The comparable figures for ice fishing during the winter of 1988/89 were 91,649 residents and 8,296 nonresidents, a total of 99,945 licensed anglers ice fishing. The estimated days of open water fishing for 1988 are 4,839,095 (residents and nonresidents combined), and for ice fishing the comparable figure is 1,266,101. These do not represent complete days of fishing. Rather they represent all of the days which anglers fished for part or all of a day.

Table 36. Selected Characteristics of 1988 Open Water Anglers and 1988/89 Ice Anglers

Characteristic	Open Water		Ice	
	Residents	Nonresidents	Residents	Nonresidents
Number of Active Anglers	170,960	89,414	91,649	8,296
Average Number of Days Fished Per Angler	22.5	11.1	12.8	9.3
Aggregate Number of Days Fished	3,767,310	960,060	1,342,810	92,417
Average Trip-Related Expenditures Per Angler	\$313	\$467	\$138	\$187
Average Surplus Value Per Angler	\$503	\$390	\$212	\$195

Although open water fishing effort is more than three times ice fishing effort in Maine, both of these activities are sufficiently large to compete with each other on bodies of water open to both types of fishing. To take a first step at addressing this trade-off we asked open water anglers and ice anglers to answer several policy questions. The majority of all anglers, residents and nonresidents, open water anglers and ice anglers, prefer that

the number of waters open to ice fishing should stay the same (Table 37). Furthermore, more than 80 percent of all anglers do not agree with some waters being open only to ice fishing. Thus, the status quo is favored. Moving to the allocation of harvest on waters open to both open water and ice fishing, some disagreement arises among angler groupings. Nonresident open water anglers prefer the majority of harvest being allocated to open water fishing. All other groups prefer an equal allocation of harvest, and only small percentages of each group favor a majority of the harvest being allocated to ice fishing. These results are not surprising given nonresident anglers primarily open water fish, while roughly half of the resident anglers ice fish.

Table 37. Angler Opinions Regarding the Allocation of Harvest Between Open Water Fishing and Ice Fishing

Harvest Policies	<u>Open Water Fishing Survey</u>		<u>Ice Fishing Survey</u>	
	Resident	Nonresidents	Residents	Nonresidents
Waters Open to Ice Fishing Should:				
Increase	23%	18%	33%	27%
Stay the Same	52	55	57	64
Decrease	25	27	10	9
Should some waters be open only to ice fishing?				
Yes	15%	8%	19%	18%
No	85	92	81	82
Allocate Catch so:				
Majority (> 50%) Open Water Fishing	44%	63%	26%	30%
Equal Allocation	51	36	64	60
Majority (> 50%) Ice Fishing	5	1	10	10

Implications

- * Since the fishing environment (scenic beauty, remote area, access and pollution) is the most important aspect of the fishing environment, the Department of Inland Fisheries and Wildlife should work with other resource management agencies to maintain and enhance these aspects of Maine's water bodies.

- * Our results indicate that most anglers, who fish in Maine, prefer to catch cold water species (brook trout, lake trout (togue) and landlocked salmon). This implies the existing stocking programs must be maintained and opportunities to increase hatchery capacity should be considered.
- * Given the abundance of warmwater species in Maine (large mouth bass, small mouth bass, yellow perch, etc.), an opportunity may exist to redirect angler effort away from cold water species and toward desirable warm water species. This would reduce the pressure on expensive stocking programs for cold water species. This opportunity may be particularly relevant for nonresident, 65 percent of whom already seek to catch warmwater species in Maine.
- * Ice fishing in Maine could be significantly enhanced by regular reporting of ice conditions throughout the state during ice fishing season.
- * The number of waters open to ice fishing should remain constant, and no waters should be open only to ice fishing.
- * The harvest of fish on waters open to open water fishing and ice fishing should be equitable between these two user groups.
- * Preferences of resident and nonresident anglers appear to be quite similar. Although the relative rankings of specific attributes do change between resident and nonresident anglers, there is a remarkable consistency between attributes being listed among the top five factors for these two distinct user groups. Thus, we would conclude that by satisfying resident anglers, it is possible to go a long way toward satisfying nonresident anglers. However, if an objective is to attract nonresident anglers to enhance economic impacts, a mechanism must be established to publicize "key" management actions. This publicity must reach the average angler, both resident and nonresident. Such publicity might include weekly articles in Maine's major newspapers and seasonal articles (periodically) in major newspapers in other New England states.

HUNTING OPPORTUNITIES

To consider improved hunting opportunities we surveyed users of six species/species groupings: bear, deer, migratory waterfowl, moose, turkey and upland birds. We will consider each of these in alphabetical order within the text. All hunting surveys contained two open-ended and two categorical questions, as presented for deer in the introduction to this section. For the open-ended questions, deer was simply replaced by the appropriate species/species group name. This same protocol was followed for the categorical questions, and some of the categories were changed. For example, the turkey hunting survey contained categories of "being able to call turkeys" and "not being able to call turkeys." Obviously, these categories would not

be replicated in surveys for other species/species groupings. Categories not species specific, such as "limited land access," were replicated in all surveys.

Bear Hunting

Overall, 20,458 residents and 8,095 nonresidents hunted bear in Maine during 1988 (Table 38). Residents rated their hunt as being "good" while nonresidents rated their hunt slightly better at "very good." The average expenditures to hunt bear by residents was \$227 and \$784 for nonresidents. Average surplus values per hunter were \$140 for residents and \$329 for nonresidents. These differences may be explained by two factors. First, nonresidents travel a greater distance resulting in higher travel and lodging expenses. Second, 62 percent of nonresidents hired a guide and 26 percent bagged a bear, while only four percent of residents hired a guide and 12 percent bagged a bear. Thus, hiring a guide raises the cost of a hunt for nonresident hunters, but may also have enhanced the quality of the hunt, thereby, enhancing the qualitative rating and surplus value relative to resident hunters.

Table 38. Selected Characteristics of the 1988 Maine Bear Hunt

Characteristics	Resident	Nonresident
Number of Active Hunters	20,458	8,095
Hunters' Qualitative Evaluation of the Hunt:		
Poor	27%	10 %
Fair	27	28
Good	23	18
Very Good	11	12
Excellent	10	16
Perfect	2	16
Average Response	Good	Very Good
Average Trip-Related Expenditures Per Bear Hunter in Maine	\$227	\$784
Average Annual Surplus Value Per Bear Hunter	\$140	\$329

Resident and nonresident bear hunters agreed in their responses to the open ended questions that "bagging a bear" was the most important attribute contributing to an excellent hunt (Table 39). The second most important attribute is "seeing live bears" while hunting. This category was tied for second with not "encountering bear hunters with dogs" for residents. These reasons are supported by the fact that most resident and nonresident bear hunters did not get a bear in 1988, and 23 percent of residents and 37 percent of nonresidents reported not seeing any bears. The higher success rate for nonresident bear hunters is probably due to the fact that 62 percent hired a guide while only four percent of resident bear hunters hired a guide. Given these results, it is not surprising that bagging a bear and seeing bears would be cited as the two factors contributing most to an excellent bear hunt when hunters responded to the open-ended questions.

Resident and nonresident rankings of open-ended responses of characteristics contributing to a poor bear hunt are not as similar (Table 39). For residents, the two characteristics contributing most to a poor bear hunt are "not seeing bear sign" and "too many hunters." These characteristics rank fifth and third, respectively, for nonresidents. Nonresidents ranked "bad weather" and a "poor guide" as the two most important characteristics contributing to a poor hunt. "Bad weather" was fourth for residents, and a "poor guide" was not listed. These differences

Table 39. Bear Hunters' Open-Ended Ratings of Attributes Contributing to an "Excellent" Hunt and to a "Poor Hunt"

Residents		Nonresidents	
Attribute	Percent Citing Attribute	Attribute	Percent Citing Attribute
** Attributes Contributing to an "Excellent" Hunt **			
Bagging a Bear	35%	Bagging a Bear	24%
Live Bear Sightings	12	Live Bear Sightings	16
No Dogs	12	Good Guide	14
Good Weather	12	Good Weather	9
Knowing Area Where Hunt	9	Bagging a Trophy Bear	5
Wilderness Setting	4	Other	32
Bagging a Trophy Bear	4		
Few Other Hunters	4		
Other	16		
** Attributes Contributing to a "Poor" Hunt **			
Not Seeing Bear Sign	19%	Bad Weather	31%
Too Many Hunters	14	Poor Guide	21
Presence of Dogs	13	Too Many Hunters	10
Bad Weather	11	Presence of Dogs	8
Not Getting a Bear	11	Not Seeing Bear Sign	7
Timing of Season	6	Other	23
Other	26		

between resident and nonresident bear hunters are not surprising. Resident hunters have more flexibility in the timing of their hunt than do nonresidents who have to travel a significant distance to hunt in Maine, often requiring significant advance planning. Most residents do not hire a guide so they would be unlikely to cite a "poor guide" as contributing to a "poor bear hunt." Conversely, nonresidents may be more likely to see bear sign because most do hunt with a guide.

Slightly different results arise when we examine bear hunters' responses to the categorical evaluation of attributes of a bear hunt. For both residents and nonresidents, the top five attributes "greatly increasing quality" of a bear hunt deal with safe hunting by other hunters, and the hunters own pre-hunt preparation and skill as a hunter (Table 40). A similar picture occurs when we consider attributes "greatly decreasing" the quality of the hunt.

Table 40. Bear Hunters' Categorical Rating of Attributes "Increasing" or "Decreasing" Quality of Hunt

Residents		Nonresidents	
Attribute	Percent Citing Attribute	Attribute	Percent Citing Attribute
** Attributes "Greatly Increasing" Quality of Hunt **			
Safe Hunting by Other Hunter	97%	Equipment Works Well	99%
Not Losing a Wounded Bear	94	Safe Hunting by Other Hunters	97
Making an Excellent Shot	93	Having Right Equipment	96
Equipment Works Well	91	Not Losing a Wounded Bear	96
Having Right Equipment	87	Making an Excellent Shot	92
** Attributes "Greatly Decreasing" Quality of Hunt **			
Hunting with Poor Partner	91%	Hunting with Poor Partner	96%
Losing a Wounded Bear	88	Losing a Wounded Bear	92
Equipment Failure	86	Others Hunting Too Close	88
Not Having Right Equipment	82	Equipment Failure	86
Not a Clean Kill	77	Shooting a Cub	86

Deer Hunting

In 1988, 98 percent of resident hunters and 98 percent of nonresident hunters hunted deer in Maine; 149,500 residents and 32,380 nonresidents (Table 41). Both resident and nonresident hunters rated their hunts as being "good." Expenditures per hunter averaged \$98 for residents and \$365 for nonresidents, with the major difference being travel and lodging expenses. Interestingly, the nonresident average surplus value is roughly 50 percent higher than the average surplus value for resident deer hunters. This result is somewhat surprising in that 25 percent of residents and 22 percent of nonresidents bagged a deer, and more than half of each group bagged a buck. The average number of deer seen during the hunt averaged 5 for residents and 4 for nonresidents. Thus, the outcome of resident and nonresident hunts are quite similar.

Table 41. Selected Characteristics of the 1988 Maine Deer Hunt

Characteristic	Residents	Nonresidents
Number of Hunters	149,500	32,380
Hunters' Qualitative Evaluation of Hunt:		
Poor	21%	12%
Fair	21	19
Good	25	22
Very Good	15	21
Excellent	12	18
Perfect	6	8
Average Response	Good	Good
Average Trip-Related Expenditures Per Hunter in Maine During 1988	\$ 98	\$365
Average Annual Surplus Value Per Hunter	\$294	\$445

"Seeing many deer" and "good weather" were the two responses cited most often as contributing to an excellent hunt (Table 42). "Getting a deer" ranked third for resident hunters and fourth for nonresident hunters in terms of contributing to an excellent hunt. The top three reasons cited by residents and nonresidents contributing to a poor hunt are "not seeing any game," "too many hunters" and "bad weather." The relative ranking of these categories varies between resident and nonresident deer hunters. It is interesting to note the attributes most likely to contribute to a "poor" deer hunt are similar to those reported for bear hunting in Table 39.

Table 42. Deer Hunters' Open-Ended Ratings of Attributes Contributing to an "Excellent" Hunt and to a "Poor" Hunt

Residents		Nonresidents	
Attribute	Percent Citing Attribute	Attribute	Percent Citing Attribute
** Attributes Contributing to an "Excellent" Hunt **			
Seeing Many Deer	32%	Good Weather	28%
Good Weather	22	Seeing Many Deer	26
Getting a Deer	14	Large Deer	12
Seeing Wildlife	5	Getting a Deer	11
Few Hunters	5	Good Friends	5
Other	22	Other	18
** Attributes Contributing to a "Poor" Hunt **			
Not Seeing Deer	26%	Bad Weather	39%
Too Many Hunters	24	Not Seeing Deer	27
Bad Weather	22	Too Many Hunters	10
Getting Hurt	7	Not Getting a Deer	5
Limited Land Access	4	Getting Hurt	4
Other	17	Other	15

Deer hunter responses to the categorical evaluation of attributes either "greatly increasing" or "greatly decreasing" the quality of a deer hunt are quite similar to those reported by bear hunters. These are safe hunting by other hunters, and the hunters own pre-hunt preparation and hunting skill (Table 43). Responses for both residents and nonresidents are also quite consistent with respect to attributes "greatly increasing" quality and those cited as "greatly decreasing" quality.

Table 43. Deer Hunters' Categorical Ratings of Attributes "Increasing" or "Decreasing" Quality of Hunt

Residents		Nonresidents	
Attribute	Percent Citing Attribute	Attribute	Percent Citing Attribute
** Attributes "Greatly Increasing" Quality of Hunt **			
Others Hunting Safely	94%	Others Hunting Safely	98%
Not Losing a Wounded Deer	93	Not Losing a Wounded Deer	95
Making an Excellent Shot	86	Getting Away from Daily Routine	88
Hunting Equipment Works Well	86	Hunting Equipment Works Well	88
Having the Right Hunting Equipment	80	Making an Excellent Shot	86
		Having the Right Hunting Equipment	86
** Attributes "Greatly Decreasing" Quality of Hunt **			
Losing a Wounded Deer	90%	Losing a Wounded Deer	94%
Poor Hunting Partner	90	Poor Hunting Partner	94
Hunting Equipment Failure	82	Hunting Equipment Failure	85
Others Hunting Too Close	77	Killing a Fawn	80
Not a Clean Kill	77	Others Hunting Too Close	80

Migratory Waterfowl Hunting

As stated earlier, we did not survey nonresident migratory waterfowl hunters. However, we did survey residents who hunted migratory waterfowl during 1988, and we estimated there were 17,311 of these hunters (Table 44).

Migratory waterfowl hunting can be divided into three general categories:

1. Sea ducks, which includes eiders, old squaws and scoters.
2. Other ducks, which include common and hooded mergansers, mallards, black ducks, green-winged and blue-winged teals, wood ducks, ringnecked ducks, goldeneyes and buffle heads.
3. Geese, which includes Canada geese and snow geese.

Each of these types of migratory waterfowl hunting were rated as being "good" on average during 1988. Hunter expenditures averaged \$160 and surplus values were substantial at \$551 per hunter.

Table 44. Selected Characteristics of the 1988 Maine Migratory Waterfowl Hunt

Characteristics	Residents		
Number of Active Hunters	17,311		
Hunters' Qualitative Evaluation of the Hunt:	<u>Sea Duck</u>	<u>Other Duck</u>	<u>Goose</u>
Poor	8%	10%	26%
Fair	17	20	21
Good	37	35	32
Very Good	13	23	11
Excellent	21	10	5
Perfect	4	2	5
Average Response	Good	Good	Good
Average Trip-Related Expenditures Per Hunter in Maine	\$160		
Average Annual Surplus Values Per Hunter	\$551		

The largest open-ended response category for attributes contributing to an "excellent" hunt and attribute contributing to a "poor" hunt deal with the number of birds available to hunters (Table 45). "Plenty of birds" is the attribute contributing most to an "excellent" hunt and "no birds" is the attribute contributing most to a "poor" hunt.

Table 45. Migratory Waterfowl Hunters' Open-Ended Ratings of Attributes Contributing to an "Excellent" Hunt and to a "Poor" Hunt

Attribute	Residents
	Percent Citing Attribute
** Attributes Contributing to an "Excellent" Hunt **	
Plenty of Birds	36%
Good Weather	12
Good Access	8
Courteous Hunters	8
Earlier Season	7
Seeing Birds	7
Few Hunters	5
Other	17
** Attributes Contributing to a "Poor" Hunt **	
No Birds	38%
Too Many Hunters	13
Bad Weather	10
Bag Limits	7
Poor Hunters	7
Steel Shot Regulations	5
Other	20

Migratory waterfowl hunters follow the pattern reported for bear and deer hunters when responding to the categorical evaluations. The top attributes either "greatly increasing" or "greatly decreasing" the quality of a hunt are safe hunting, and the hunters own pre-hunt preparation and hunting skill (Table 46). However, seeing many birds was the third attribute greatly increasing the quality of a hunt.

Table 46. Migratory Waterfowl Hunters' Categorical Ratings of Attributes "Increasing" or "Decreasing" Quality of Hunt

Attribute	Residents
	Percent Citing Attribute
** Attributes "Greatly Increasing" Quality of Hunt **	
Safe Hunters	89%
Equipment Works Well	84
Seeing Many Birds	80
Making an Excellent Shot	79
Knowing Where Birds Are	78
** Attributes "Greatly Decreasing" Quality of Hunt **	
Hunting with Poor Partner	90%
Losing Wounded Bird	85
Equipment Failure	81
Others Hunting Too Close	79
Limited Land Access	69

Moose Hunting

Moose hunting is strictly regulated in Maine with 1,000 permits being issued each year; 900 to residents and 100 to nonresidents. The hunt lasts for six days and each permit holder is allowed to take one moose. In 1988, 894 of the 900 resident permit holders hunted moose and all nonresident permit holders hunted moose (Table 47). Both resident and nonresidents rated their 1988 moose hunt, on average, as being excellent. Nonresident expenditures (\$1161) were more than two times resident expenditures (\$409), and the major differences once again were travel and lodging expenses. Average surplus value per hunter was \$818 for residents and \$1,221 for nonresident hunters.

Table 47. Selected Characteristics of the 1988 Maine Moose Hunt

Characteristics	Residents	Nonresidents
Number of Hunters (Permit Holders)	894 (900)	100 (100)
Hunters' Qualitative Evaluation of Hunt:		
Poor	2%	1%
Fair	2	0
Good	8	4
Very Good	12	15
Excellent	35	40
Perfect	41	40
Average Response	Excellent	Excellent
Average Trip-Related Expenditures Per Hunter	\$409	\$1,161
Average Annual Surplus Value Per Hunter	\$818	\$1,221

As we've seen for other species, the top two, open-ended responses for attributes contributing to an "excellent" moose hunt are "getting a moose" and "good weather" (Table 48). "Getting a moose" was actually third for nonresidents with "getting a trophy bull" being second. "Getting a trophy bull" was fifth for resident hunters. Unlike bear and deer where significantly less than half of the hunters bag an animal, 94 percent of residents and 98 percent of nonresidents bagged a moose in 1988. "Bad weather" and "few or no moose" were the attributes contributing most to a "poor" moose hunt.

Table 48. Moose Hunters' Open-Ended Ratings of Attributes Contributing to an "Excellent" Hunt and to a "Poor" Hunt

Residents		Nonresidents	
Attribute	Percent Citing Attribute	Attribute	Percent Citing Attribute
** Attributes Contributing to an "Excellent" Hunt **			
Getting a Moose	18%	Good Weather	21%
Good Weather	18	Getting a Trophy Bull	15
Seeing Many Moose	9	Getting a Moose	11
Permit for Desired Zone	7	Few Hunters	6
Getting a Trophy Bull	5	Good Guide	6
Other	43	Seeing Game/Sign	6
		Other	35
** Attributes Contributing to a "Poor" Hunt **			
Bad Weather	25%	Bad Weather	33%
Few/No Moose	17	Few/No Moose	17
Not Getting a Moose	15	Crowding	13
Crowding	7	Not Getting a Moose	12
Not Getting Permit for Desired Zone	5	Poor Guide	4
Other	31	Other	21

Moose hunters are similar to bear and deer hunters in their categorical evaluations of attributes "greatly increasing" or "greatly decreasing" the quality of a hunt. The important attributes for moose hunting are safe hunting by others, and the moose hunters own pre-hunt preparation and hunting skill (Table 49).

Table 49. Moose Hunters' Categorical Ratings of Attributes "Increasing" or "Decreasing" Quality of Hunt

Residents		Nonresidents	
Attribute	Percent Citing Attribute	Attribute	Percent Citing Attribute
** Attributes "Greatly Increasing" Quality of Hunt **			
Not Losing a Wounded Moose	97%	Others Hunting Safely	95%
Others Hunting Safely	95	Making an Excellent Shot	91
Hunting Equipment Works Well	93	Not Losing a Wounded Moose	90
Making an Excellent Shot	92	Having the Right Hunting Equipment	89
Having the Right Hunting Equipment	91	Hunting Equipment Works Well	89
** Attributes "Greatly Decreasing" Quality of Hunt **			
Losing a Wounded Moose	92%	Poor Hunting Partner	94%
Poor Hunting Partner	89	Losing a Wounded Moose	92
Having the Wrong Hunting Equipment	82	Hunting Equipment Failure	79
Hunting Equipment Failure	82	Limited Land Access	79
Missing Most or All Shots	80	Having the Wrong Hunting Equipment	78
Not Seeing a Moose	80		

Turkey Hunting

Turkey hunting, like moose hunting, is regulated by a permit system with a maximum of 500 permits being issued each year; 450 to residents and 50 to nonresidents. Because Maine's turkey hunt is relatively new and there are a small number of birds in the state, hunter success (bagging a turkey) is low. Only 437 resident permits and 9 nonresident permits were issued in 1989 (Table 50). Furthermore, only 227 resident and 6 nonresidents actually hunted turkeys in Maine during 1989. The reason many permit holders choose not to hunt during 1989 may have been due to poor weather conditions throughout the season.

Both residents and nonresidents rated their turkey hunts as being good.
¹⁵ Average expenditures were \$74 for residents and \$164 for nonresidents, and the average surplus value for residents is \$282.

Table 50. Selected Characteristics of the 1989 Maine Turkey Hunt

Characteristics	Resident	Nonresident
Number of Active Hunters (Permit Holders)	227 (437)	6 (9)
Hunters' Qualitative Evaluation of the Hunt:		
Poor	17%	17%
Fair	24	17
Good	31	32
Very Good	13	0
Excellent	12	17
Perfect	3	17
Average Response	Good	Good
Average Trip-Related Expenditures Per Turkey Hunter in Maine	\$ 74	\$164
Average Annual Surplus Values Per Turkey Hunter	\$282	--

A surplus value for nonresidents can not be calculated due to the small sample size.

The top two open-ended responses contributing to an "excellent" turkey hunt are "more turkeys" and "being able to call in a turkey" (Table 51). Eight percent of resident hunters bagged a turkey and 17 percent (one person) of nonresident hunters bagged a turkey, while residents reported seeing an average of four turkeys and nonresidents reported they saw one turkey on average. These results seem to indicate that the availability of turkeys is a major concern of turkey hunters. More turkeys would increase the opportunities for calling turkeys.

¹⁵We report figures for nonresidents. With only 6 respondents these figures can not be assigned any degree of statistical reliability.

Table 51. Turkey Hunters' Open-Ended Ratings of Attributes Contributing to an "Excellent" Hunt and to a "Poor" Hunt

Residents		Nonresidents	
Attribute	Percent Citing Attribute	Attribute	Percent Citing Attribute
** Attributes Contributing to an "Excellent" Hunt **			
More Turkeys	15%	Being Able to Call in a Turkey	32%
Being Able to Call in a Turkey	12	More Turkeys	17
Seeing a Turkey	10	Expansion of Hunting Area	17
Bagging A Turkey	8	Hearing Turkeys	17
Few Hunters	6	Better Scouting	17
Other	49	Other	0
** Attributes Contributing to a "Poor" Hunt **			
Too Many Hunters	17%	Hunter Interference	67%
Bad Weather	15	Too Many Hunters	33
Hunter Interference	10	Other	0
Not Seeing Turkey Sign	8		
Poor Turkey Population	7		
Other	43		

The top three reasons contributing a "poor" turkey hunt for residents are "too many hunters," "bad weather" and "hunter interference." Too many hunters and hunter interference by other turkey hunters may be direct results of the small number of birds in Maine being concentrated in one specific geographic region of the state.

Turkey hunters' categorical evaluations of attributes "greatly increasing" the quality of a hunt differ from what we have observed for other species. Safe hunting, pre-hunt preparation and hunting skills are repeated (Table 52). However, "having a turkey respond to a call" also shows up. Attributes "greatly decreasing" the quality of the hunt follow the pattern established for other species; safety, pre-hunt preparation and skill.

Table 52. Turkey Hunters' Categorical Ratings of Attributes "Increasing" or "Decreasing" Quality of Hunt

Residents		Nonresidents	
Attribute	Percent Citing Attribute	Attribute	Percent Citing Attribute
** Attributes "Greatly Increasing" Quality of Hunt **			
Safe Hunting by Other Hunters	97%	Knowing Where to Look for Turkeys	100%
Not Losing A Wounded Bird	94	Hearing a Turkey	100
Knowing Where to Look for Turkeys	87	Having a Turkey Respond to a Call	100
Making an Excellent Shot	86	Seeing Other Wildlife	100
Having a Turkey Respond to a Call	85	Having Right Equipment	100
		Equipment Works Well	100
** Attributes "Greatly Decreasing" Quality of Hunt **			
Unsafe Hunting by Others	96%	Losing a Wounded Turkey	100%
Hunting with Poor Partner	92	Unsafe Hunting by Others	100
Losing a Wounded Turkey	91	Not Knowing Where to Look for Turkeys	83
Interference by Other Hunters	86	Hunting with Poor Partner	83
Equipment Failure	81	Interference by Other Hunters	83
Limited Land Access	81	Limited Land Access	83

Upland Bird Hunting

We estimate there were 78,684 resident and 5,782 nonresident upland bird hunters in Maine during 1988 (Table 53). Within this category, two major types of upland bird hunting occur: grouse and woodcock. Expenditures per upland bird hunter average \$111 for resident hunters and \$284 for nonresident bird hunters. The major difference between resident and nonresident expenditures were travel and lodging expenses. Surplus values averaged \$271 for resident hunters and \$389 for nonresident hunters.

Table 53. Selected Characteristics of the 1988 Maine Upland Bird Hunt

Characteristics	Resident		Nonresident	
Number of Active Hunters	78,684		5,782	
Hunters' Qualitative Evaluation of the Hunt:	<u>Grouse</u>	<u>WoodCock</u>	<u>Grouse</u>	<u>WoodCock</u>
Poor	7%	13%	8%	16%
Fair	27	40	15	16
Good	37	27	33	37
Very Good	14	20	21	16
Excellent	15	0	14	5
Perfect	0	0	9	10
Average Response	Good	Good	Good	Good
Average Trip-Related Expenditures Per Upland Bird Hunter in Maine	\$111		\$284	
Average Annual Surplus Values Per Upland Bird Hunter	\$271		\$389	

The two attributes contributing most to an "excellent" upland bird hunt, as rated by upland bird hunters' responses to the open-ended question are "getting a bird" and "seeing many birds" (Table 54). Attributes contributing to a "poor" hunt are "bad weather" and "not seeing birds." In 1988, 87 percent of the resident grouse hunters bagged at least one grouse and 67 percent bagged at least one woodcock. The comparable figures for nonresident are 91 percent and 88 percent, respectively, for grouse and woodcock. Thus, it would seem that most upland bird hunters are able to meet their expectations.

Table 54. Upland Bird Hunters' Open-Ended Ratings of Attributes Contributing to an "Excellent" Hunt and to a "Poor" Hunt

Residents		Nonresidents	
Attribute	Percent Citing Attribute	Attribute	Percent Citing Attribute
** Attributes Contributing to an "Excellent" Hunt **			
Getting a Bird	27%	Getting a Bird	26%
Seeing Many Birds	15	Seeing Many Birds	15
Good Weather	10	Good Weather	11
Undisturbed Habitat	9	Undisturbed Habitat	11
Less Posted Land	9	Less Posted Land	10
Few Hunters	4	Few Hunters	4
Good Dog Performance	4	Good Dog Performance	4
More State Stocking of Birds	4	Safe Hunters	4
Other	18	Other	15
** Attributes Contributing to an "Poor" Hunt **			
Bad Weather	21%	Not Seeing Birds	29%
Not Seeing Birds	21	Bad Weather	24
Limited Access	18	Limited Access	16
Disturbed Habitat	15	Disturbed Habitat	8
Too Many Hunters	8	Unsafe Hunters	4
Seeing Abused Land	4	Poor Dog Performance	4
Other	13	Too Many Hunters	4
		Other	11

Once again the primary categorical responses deal with safe hunting, pre-hunt preparation and hunter skill (Table 55). This is true for both attributes "greatly increasing" and attributes "greatly decreasing" the quality of an upland bird hunt.

Table 55. Upland Bird Hunters' Categorical Rating of Attributes "Increasing" or "Decreasing" Quality of Hunt

Residents		Nonresidents	
Attribute	Percent Citing Attribute	Attribute	Percent Citing Attribute
** Attributes "Greatly Increasing" Quality of Hunt **			
Safe Hunters	90%	Safe Hunters	95%
Getting Away From Routine	84	Observing Beauty of Nature	87
Equipment Works Well	80	Getting Away from Routine	83
Knowing Where Birds Are	76	Seeing Other Wildlife	78
Observing Beauty of Nature	74	Equipment Works Well	74
** Attributes "Greatly Decreasing" Quality of Hunt **			
Hunting with Poor Partner	92%	Hunting with Poor Partner	93%
Losing a Wounded Bird	87	Losing a Wounded Bird	92
Equipment Failure	82	Limited Land Access	82
Limited Land Access	80	Others Hunting Too Close	78
Others Hunting Too Close	76	Equipment Failure	77

Implications

Three overall conclusions can be drawn from the above results.

- * Preferences of resident and nonresident hunters appear to be quite similar. Although the relative rankings of specific attributes do change between resident and nonresident hunters, there is a remarkable consistency between attributes being listed in the group of top five for these two distinct user groups. Thus, we would conclude that by satisfying resident hunters, it is possible to go a long way toward satisfying nonresident hunters. However, if an objective is to attract nonresident hunters to enhance economic impacts, a mechanism must be established to publicize "key" management actions. This publicity must reach the average hunter, both resident and nonresident. Such publicity might include weekly articles in Maine's major newspapers and seasonal articles (periodically) major newspapers in other New England states.
- * Responses to the categorical questions regarding attributes "greatly increasing" or "greatly decreasing" the quality of a hunt consistently focus on issues of safety, pre-hunt preparation and hunter skill. It would seem the satisfaction of all hunters, particularly resident hunters, could be enhanced by conducting hunter education seminars each year that are species specific. Such programs might enhance hunter safety, improve public opinion of hunters and enhance the accomplishment of wildlife management objectives. These hunter education seminars might be done cooperatively with local rod and gun clubs and other hunting groups, and may involve the development of videos on safe hunting and the hunting of specific species in Maine. This hunter education program must also be designed to reach the average hunter.

- * Bear, deer and moose hunting represent big game hunting in Maine. To maintain hunter opportunity, and to distribute the economic impact of hunting these species through time in regions of the State not benefiting from general tourism, we suggest the setting of seasons to minimize the overlap in the hunting seasons for these species.

Other implications appear to be more species specific and we will address them as such.

- * Bear Hunting

1. The most important attributes to bear hunters appears to be seeing bears and bagging bears. Given that bear hunting participation has increased in recent years and wildlife managers have concerns about the population of bears in Maine, it seems that the objective here, from an economic perspective, is to develop management policies that will at least maintain, if not enhance, the population of bears in Maine. This may warrant short run reductions in the number of bear hunters and their economic contributions to enhance the long-run potential.
2. The presence of bear hunting dogs was cited a negative attribute by both resident and nonresident bear hunters. With 8 percent of resident hunters using dogs and 16 percent of nonresidents using dogs, it seems reasonable to develop policies to reduce conflicts between those who hunt with dogs and those who do not. For example, the rule instituted for the 1990 bear hunt, after our survey was done, restricted hunting with dogs to only one part of the bear hunting season.
3. Nonresidents cited a "good guide" as contributing to an "excellent" hunt and a "poor guide" as contributing to a "poor" hunt. This does not mean a problem exists with bear guides. However, if nonresident bear hunting and the associated economic impact is to be maintained, Inland Fisheries and Wildlife may want to consider working with Maine Guides to develop a uniform quality of guide service across the state.

- * Deer Hunting -- No Recommendations. Given an increasing deer herd and nearly 100 percent hunter participation, we see little room to identify opportunities. The challenge is to maintain existing opportunities for Maine's premier big game species in terms of total participation.

- * Migratory Waterfowl Hunting

1. There seems to be little opportunity to enhance nonresident participation in the near future given the low number of nonresidents currently participating.
2. Improving opportunities entails increasing the number of birds in Maine. Any such program must be jointly conducted with other states and the U.S. Fish and Wildlife Service due to the fact that these birds only spend part of the year in Maine.

* Moose Hunting

1. Although deer is Maine's premier big game species in terms of hunter participation, moose is Maine's premier big game species in terms of per hunter surplus values and per hunter economic impacts. We recommend an increase in the number of moose hunting permits issued each year. Any increase in the number of permits should include an increase in the allocation to nonresidents, as well as residents, to enhance the economic impact on Maine's economy.

* Turkey Hunting -- No recommendations. The reintroduction of turkeys to Maine is relatively new and we do not see any significant opportunities on the horizon other than maintaining the program which has proved successful to date.

* Upland Bird Hunting

1. "Getting a bird" and "seeing many birds" are important to both resident and nonresident hunters. It seems management programs should focus on increasing the number of birds and maintaining the potential for hunter success.
2. It also seems "access," although not the most important issue, is an issue for upland bird hunters. Perhaps more so than the hunting of other species. It would seem, then, that management programs might focus on maintaining and improving upland bird habitat, while working to insure hunter access.

TRAPPING OPPORTUNITIES

No opportunities were considered for this activity in the survey. We only characterized the status quo. With less than 5,000 licensed trappers in Maine, the potential for significant economic enhancement is not substantial. However, our results indicate this is an important recreational activity for those who do participate.

NONCONSUMPTIVE USE OPPORTUNITIES

We examined nonconsumptive use opportunities in a slightly different manner than we examined consumptive uses. This was done because survey work examining nonconsumptive uses of wildlife is in a much more formative stage than is the development of surveys to examine consumptive uses. Thus, we choose to proceed with caution. The first step was to send a survey to 1,000 Maine heads of households in June 1989.

Within this survey we identified species and species groupings that people attempt to observe in Maine. We defined observation, for purposes of

the study, as seeing wildlife, hearing wildlife or seeing signs of wildlife. Respondents also answered categorical questions where we asked them to evaluate the importance of various attributes for a successful wildlife observation trip. We also asked respondents to identify species/species groups that they thought should be decreased in Maine. Based on the results of the first survey, we conducted a second survey of 1,000 Maine heads of households in December 1989, to examine the economic value (surplus value) that they place on increasing or decreasing selected species.

Wildlife Observation

We asked respondents about two types of wildlife observation. The first was observation around one's home or camp. The top five species/species groups that people observe around their home or camp are species that are relatively abundant across most of the state (Table 56). Thus, these species can be observed without any special effort on the part of the observer. However, actions like putting out food and doing special landscaping may enhance viewing opportunities.

A different set of species/species groups arises when we consider trips to observe wildlife in Maine. Maine's premier big game species, deer, moose and bear, are the top three species (Table 56). Eagles, primarily bald eagles, an endangered species, is fourth.

Table 56. Wildlife Observation

Around Home or Camp		Take Trips to Observe	
Species	Percent Respondents	Species	Percent Respondents
Birds	29%	Deer	20%
Squirrels	11	Moose	17
Deer	9	Bear	7
Chipmunks	6	Eagles	6
Blue Jays	5	Birds	6
Chickadees	5		

The number one factor contributing to a successful wildlife observation trip is "enjoying the experience even if wildlife is not observed" and "learning about wildlife" is second (Table 57). The third, fourth and fifth categories all deal with seeing wildlife. We did ask respondents to evaluate categories that involve hearing wildlife or seeing signs of wildlife, but these types of observation did not rank among the top five factors.

The fact that enjoying wildlife and learning about wildlife are the top two factors indicates to us that respondents are concerned with the total experience and are not simply focused on observing wildlife. However, when wildlife is observed, the key factor is being able to see it.

Table 57. Respondents' Categorical Rating of Factors as Being "Very Important" to a Successful Wildlife Observation Trip

Factor	Percent of Respondents Citing Factor as "Very Important"
Enjoying experience even if wildlife is not observed	70%
Learning about wildlife	58
Seeing one of the types of wildlife sought	49
Seeing wildlife not sought	44
Seeing more than one of wildlife sought	35

Species/Species Groupings That Should be Increased or Decreased in Maine

We first asked respondents to tell us what species/species groupings they feel should be increased in Maine and why they feel the populations should be increased. The top five species listed are deer, caribou, moose, fish and eagles (Table 58). The most common reason for increasing the deer herd was so there would be more to hunt. However, the next four reasons deal with reasons more akin to nonconsumptive use: to increase numbers, to offset hunting, for their beauty/dignity and to observe.

It is not surprising to us that hunting arose as a reason to increase the deer herd. Fully 30 percent of the respondents stated that they hunted in Maine during the past year. This characteristic is an artifact of the head of household sample. Seventy percent of respondents were male and the state

issues roughly 180,000 resident hunting licenses each year of which over 90 percent are issued to men.

The primary reasons to increase caribou simply were to "increase their numbers," "to observe" and "it represents a good project." We suspect that respondent citations of caribou are due to the widespread media coverage the caribou reintroduction project was receiving and that our survey was conducted before the project experienced significant set backs.

The species that respondents would like to see decreased present some surprises (Table 58). Mosquitoes and blackflies are not generally considered to be wildlife and do not come under the presumed management directive of the Maine Department of Inland Fisheries and Wildlife. Furthermore, moose and deer are cited for increase by some respondents, but for decrease by other respondents.

Table 58. Wildlife Species/Species Groupings Respondents feel Should be Increased or Decreased

Wildlife to be Increased		Wildlife to be Decreased	
Species/ Species Grouping	Percent of Respondents	Species/ Species Grouping	Percent of Respondents
Deer	13%	Coyotes	13%
Caribou	6	Mosquitoes	3
Moose	4	Moose	3
Fish	4	Blackflies	2
Eagles	4	Deer	2

The primary reasons that coyotes were cited for reduction is due to their preying on other animals. Mosquitoes were cited for being a nuisance and causing human discomfort, as were blackflies. Moose were cited because they are a road hazard and some people feel the current moose herd is too large. Deer were cited for being over populated, eating gardens and being a road hazard.

As can be observed in Table 58, no one species/species grouping was cited by a large percentage of respondents. Thus, in the second nonconsumptive survey we asked more detailed questions about increasing versus

decreasing the deer and moose herds, about increasing the population of bald eagles in Maine and about decreasing the population of coyotes in Maine. We wanted to ask a complete sample of respondents whether the deer and moose herds should be increased or decreased, whether the population of bald eagles should be increased and whether the population of coyotes would be decreased. We also asked questions designed to learn the surplus values people place in support of such actions.

To add realism and management relevance to these questions we worked with representatives of the Maine Department of Inland Fisheries and Wildlife to establish current population levels and to define changes in population that could be reasonably accomplished with existing habitat and without requiring substantial increases in management personnel. The current population of deer is estimated to be 250,000 animals and we examined 20 percent (50,000 animals) increases and decreases. The current population of moose is roughly 25,000 and we again examined 20 percent (5,000 animals) increases and decreases. For bald eagles we only evaluated an increase since bald eagles were not targeted for a decrease in the first nonconsumptive survey. We examined an increase from 109 pairs currently nesting in Maine to 200 nesting pairs, an increase of 182 eagles. Two hundred young eagles would be produced each year. Finally, the current population of coyotes in Maine is estimated to be 13,000 animals of which trappers and hunters kill about 1,400 each year. Since it is extremely difficult, if not impossible, to significantly reduce coyote populations, we asked respondents to evaluate a doubling in the average, annual kill rate from 1,400 to 2,800.

Referring to Table 59, 61 percent of the respondents favored increasing the deer herd by 50,000 animals and they place per person surplus value on this change of \$17 per year, resulting in an aggregate surplus value per year of \$3,663,000. Only 2 percent supported a reduction in the deer herd of 50,000 animals and 37 percent did not support either the increase or the decrease of 50,000 animals. These results indicate that the majority of Maine heads of households support increasing Maine's deer herd by 50,000 animals,

with most supporting both increased observation and hunting opportunities. Such a program is economically efficient to undertake if costs do not exceed \$3.6 million per year. A value was not estimated for reducing the deer herd because there were too few respondents to estimate a mean. However, those people who favor reducing the deer herd may actually place a negative value on increasing Maine's deer herd.

Table 59. Respondent Support of Increasing/Decreasing Selected Wildlife Populations in Maine.

Species	Policy	Percent of Respondents	Annual Surplus Value Per Respondents	Aggregate Annual Surplus Respondents
Deer:	Increase herd size from 250,000 to 300,000	61%	\$17	\$3,663,000
	No change	37	NA	NA
	Decrease herd size from 250,000 to 200,000	2	--	--
Moose:	Increase herd size from 25,000 to 30,000	60%	\$15	\$3,130,000
	No change	35	NA	NA
	Decrease herd size from 25,000 to 20,000	5	\$0	\$0
Bald Eagle:	Increase population from 109 nesting pairs to 200 nesting pairs	86%	\$14	\$4,118,000
	Do not increase population	14	NA	NA
Coyotes:	Decrease population of 13,000 by increasing kill from 1,400 to 2,800 per year	53%	\$ 8	\$1,368,120
	Do not decrease population	47%	NA	NA

As with deer, the majority of respondents (60 percent) favor increasing the Maine's moose herd by 20 percent and only 5 percent favor decreasing the herd by 20 percent. For those who favor increasing the moose herd, they place an average surplus value on this change of \$15 per person per year resulting in an aggregate value of \$3.1 million per year. Of the individuals who favor decreasing Maine's moose herd, all said that they would not pay anything to support a reduction.

The majority of respondents, fully 86 percent, favor working to increase

Maine's population of nesting bald eagles. The average annual surplus value is \$14 per person resulting in an aggregate value of \$4.1 million per year.

The results for coyotes are mixed. Fifty-three percent of respondents favor increasing the kill of coyotes while 47 percent do not favor this policy. Given this mixed public support and the management difficulties of actually reducing coyote populations, we would recommend not undertaking a program to increase the annual kill of coyotes.

Table 60. Respondent Opinions Regarding the Trade-Off Between Increasing the Deer Herd and Increasing the Moose Herd

Policy	Evaluation			
	Very Undesirable	Somewhat Undesirable	Somewhat Desirable	Very Desirable
Increase Deer Herd Statewide Even if Moose Herd Decreases	44%	26%	20%	10%
Increase Moose Herd Statewide Even if Deer Herd Decreases	56%	30%	12%	2%
Increase Deer Herd in Some Parts of State and Increase Moose Herd in Other Parts of State	14%	10%	39%	37%
Manage to Increase <u>Both</u> the Deer and Moose Herd Statewide, Regardless of Which Herd is the Largest	22%	17%	28%	33%

Finally, deer and moose can compete for the same habitat and it may not be possible for wildlife managers to increase the populations of both across the entire state. Thus, we asked respondents their opinions regarding four management options for increasing Maine's deer and moose herds. Policies where either the deer herd or the moose herd is increased at the expense of other are not desirable to respondents (Table 60). A result we might expect from the results reported above. The policy receiving the most support, 39 percent somewhat desirable and 37 percent very desirable, increases the deer herd in some parts of the state and increases the moose herd in other parts of

the state. This is also the most practical policy from a wildlife management perspective. The fourth policy, to increase the total number of deer and moose without regard for the individual herd sizes, also received a favorable evaluation.

Implications

We have three general recommendations to offer here.

- * Wildlife observation around one's home or camp can be enhanced by providing the public with information, perhaps in the form of leaflets, explaining how to attract and observe common species in Maine. This type of observation does not require increased wildlife management to be enhanced. This information should be made available to all households in Maine.
- * Opportunities for trips to observe wildlife can be enhanced by management practices that facilitate the public's ability to see wildlife. This should include opportunities for multiple viewing of individual species and a mix of species. It is important to keep in mind that respondents are concerned with the total experience and learning about wildlife. Thus, management must focus on the total viewing experience not just wildlife management. Finally, the public needs to be informed of opportunities and locations for viewing wildlife.
- * This last recommendation does not come directly from the data presented here. Rather, it is a general impression from all of the findings from our nonconsumptive surveys. Wildlife is very important to the people of Maine, yet they know very little about Maine's wildlife, the current status of many species, management efforts and opportunities for viewing. We suggest that public satisfaction and management effectiveness could be substantially improved by developing an organized effort by the Department of Inland Fisheries and Wildlife to provide more information and education about the resources it manages. Such a program must be designed to reach the average Maine citizen, not just hunters, anglers, trappers, members of Maine Audubon and other special interest groups, but individuals who comprise the more than 80 percent of Maine citizens who say they enjoy and observe wildlife in Maine.

We also offer three species-specific recommendations.

- * Significant nonconsumptive opportunities can be attained by increasing the populations of deer, moose, bear and eagles in Maine and creating opportunities for the public to view these species in the wild. Such an opportunity might include creating bear viewing areas in the wild, like has been done in Alaska, with a naturalist available to manage people and answer questions.
- * Public opinion is strongly in favor of increasing the population of bald eagles in Maine and the economic benefits of such a policy are substantial. We recommend Inland Fisheries and Wildlife should continue, and perhaps increase, its efforts to restore a viable population of bald eagles to Maine.

- * With public opinion split on coyotes and management opportunities for reducing the coyote population limited at best in Maine, we advise that wildlife management dollars be spent on activities other than reducing the coyote population. Perhaps the only coyote management program should be for representatives of Inland Fisheries and Wildlife to remove problem animals that kill livestock.

SECTION IV

RECOMMENDATIONS

INTRODUCTION

Earlier sections of the report summarize economic information associated with wildlife-related activities in Maine and users' preferences and attitudes toward wildlife-related activities. Both types of information are useful to the agencies charged with the responsibility of designing and implementing management plans for the resources. The purpose of this section of the report is to present specific recommendations based on the results obtained from the economic study of fish and wildlife resources conducted during the last three years.

Two types of recommendations are made below. First, recommendations are offered to the resource management agencies that manage Maine's fish and wildlife populations. These recommendations are designed to further enhance the utilization of the fish and wildlife resources of the state, and thereby increase the aggregate economic impact and aggregate surplus values these resources generate in Maine. These recommendations should be considered in the design or modification of management plans for specific species or species groups. Some recommendations may actually duplicate existing management plans. If this is the case, our recommendation should be viewed as supporting the continuance, and possibly enhancement, of the current program. Other recommendations are general in nature, unrelated to specific species, and will require the design and implementation of new management programs. Furthermore, it should be noted that the implementation of some of the recommendations will require legislative action.

Since the recommendations described below are based on economic data and the preferences of the users of the resources, they must be evaluated in light of biological and ecological information about the resource. Some of the recommendations listed below may not be achievable because of biological or other constraints that exist. Consequently, the recommendations presented below should be viewed as additional input to be considered by resource managers as they formulate plans for future utilization of fish and wildlife populations.

As in any study, this study identified several topics for further research. Consequently, recommendations for further research are also offered to the Commission. Obviously, any decision to pursue these topics rests with the Commission itself. However, we point out fruitful areas for further research to assist the Commission in assessing the potential value of additional research. We believe the results obtained from the additional research would significantly improve the overall understanding of key wildlife-related issues in Maine.

RECOMMENDATIONS TO RESOURCE MANAGEMENT AGENCIES

Recommendations related to fishing are reported first, followed by recommendations related to hunting and to nonconsumptive uses of wildlife.

Inland Fishing

Inland fishing, including both open water and ice fishing, generate the largest aggregate surplus values and economic impacts of all wildlife-related activities studied. For example, inland fishing accounts for about 55 percent of the total aggregate surplus values and about 38 percent of the minimum aggregate economic impacts associated with all wildlife activities studied. Inland fishing also has the largest number of participants. Consequently, it is critical to maintain and enhance the quality of inland fishing opportunities in Maine.

Analysis of angler responses to questions about the attributes significantly affecting the quality of a fishing experience identified two crucial factors that must be addressed to maintain and enhance the quality of fishing in Maine. One of these factors is the characteristics of the fishing site. Characteristics of the site that influence the quality of a fishing trip include remoteness, good access, no pollution, natural beauty, close to home, and few anglers. These responses form the basis for the following specific recommendations:

- M-1. the Department of Inland Fisheries and Wildlife should work closely with other state agencies to insure the water quality of Maine's rivers, lakes, ponds and streams is sufficient to support fish populations and a quality fishing experience;

- M-2. the Department of Inland Fisheries and Wildlife should work closely with other state agencies to protect the scenic quality of Maine's water bodies. Future development should not detract from scenic quality;
- M-3. the Department of Inland Fisheries and Wildlife should work closely with other state agencies to maintain or enhance public access to Maine's water bodies. Future development should not reduce public access.

Clearly, the responsibility to protect the quality of Maine's scenic resources rests with several state agencies. The Department of Inland Fisheries and Wildlife currently participates in state processes to determine the environmental impact of new development in Maine. However, the results of this study show that the quality of the fishing environment is an overwhelmingly important factor determining the quality of the fishing experience. Therefore, it is important to emphasize future involvement of the Department in managing the fishing environment as well as fish stocks and fish habitat.

The other important factor identified from the responses of anglers relates to the number and types of fish available. This factor was voiced through responses such as a lot of fish, well-stocked waters, good quality fishing, and desirable species. These responses form the basis for the following specific recommendations:

- M-4. management agencies should insure that fish stocks are maintained statewide at a level that satisfies anglers' expectations for a quality fishing experience. Needs for expanded hatchery capacity/stocking programs for brook trout, landlocked salmon and lake trout should be closely monitored;
- M-5. efforts to expand fishing effort for warm water fish species should be increased to more fully utilize this valuable resource. This effort should focus on nonresident anglers as they are more inclined to fish for warm-water species and because nonresidents have a larger economic impact on the state economy.

Declining fish populations and the commensurate decline in the quality of the fishing experience could decrease the surplus values and the economic impact of fishing. Given the importance of fishing to the Maine economy, the state should be prepared to invest in the programs needed to maintain and enhance fishing opportunities. For example, an increased stocking program may require expansion of hatchery capacity. If this becomes necessary, the state

should support the needed increase in capacity. Other programs, such as natural habitat enhancement and increased promotion of catch and release programs should be considered as well, since these programs are substitutes for expensive hatchery expansion.

Another opportunity to increase economic impacts of fishing without increasing hatchery capacity is to more fully utilize warm-water species. We believe that high quality warm water fishing opportunities exist in the state. However, these opportunities are not well known among nonresident anglers. Distributing information about fishing opportunities for warm-water species, such as locations, the best times of the year to fish, and fishing techniques, could increase the economic impact of fishing without increasing the pressure on cold-water species.

The above recommendations are based on the results of both the open water fishing survey and the ice fishing survey. We also offer some recommendations regarding the potential competition between open water and ice fishing.

Based on a comparison of the ice fishing results with the results obtained in an earlier study, it is clear that ice fishing grew significantly in popularity during the last decade. For example, the percent of anglers participating in ice fishing increased from about one-third of all resident anglers in 1980 to almost one-half of all resident anglers in 1988. Although total ice fishing participation by residents and nonresidents has remained relatively constant at roughly one-quarter of all inland fishing, the actual number of anglers participating has grown substantially in recent years.

Based on the increasing popularity of ice fishing, we recommend:

- M-6. the Department of Inland Fisheries and Wildlife closely monitor future ice fishing effort and its impact on fish populations and open water and ice fishing success rates;
- M-7. the Department of Inland Fisheries and Wildlife maintain the status quo regarding waters open to ice fishing and the allocation of catch among open water and ice fishing in the near future. However, the Department should be prepared to make policy changes should it become clear that the resource can not support the combined impacts of open water and ice fishing effort;

M-8. the Department of Inland Fisheries should use public service announcements and other means to provide information about ice conditions throughout the ice fishing season. It also should develop and distribute written material to educate ice anglers on methods to test the safety of ice.

Recommendation 8 is based on the obvious safety hazards associated with ice fishing on unsafe ice. Safe ice was identified as the most important factor influencing the quality of the ice fishing experience.

Marine Fishing

As noted in earlier sections of the report, sampling difficulties hindered the marine fishing component of the study. Because we can not be certain that the results obtained accurately reflect all marine anglers, we will not present specific recommendations about marine fishing management options. However, we do offer the following thoughts.

First, the Department of Marine Resources should also be involved in efforts to protect and enhance public access, scenic quality and other site characteristics that influence the quality of the fishing experience. Therefore, Recommendations M-1, M-2 and M-3 apply to the Department of Marine Resources as well as the Department of Inland Fisheries and Wildlife. Again, we are aware of both Departments' efforts to work with other state agencies to protect environmental and scenic quality. However, the importance of these items and their effect on the quality of the fishing experience justifies emphasis on the need for continued involvement.

In addition, we recommend:

M-9. the Department of Marine Resources consider the implementation of recreational marine fishing licenses for Maine.

We believe there are several advantages associated with marine fishing licenses. First, from a research perspective, licenses would make it much easier and less expensive to study marine fishing activities and to provide information about marine fishing effort. More importantly, however, marine recreational licenses would make it easier to monitor growth in marine recreational fishing over time and thereby provide information about potential conflicts among commercial and recreational fishing and other issues that can be addressed through management programs. The revenue from the sale of

licenses would also provide a source of income to support management programs, such as habitat enhancement and stocking programs. Hence, recreational anglers could help defray the costs of programs from which they benefit.

Perhaps the two largest disadvantages of requiring marine angler licenses are the cost of implementing and enforcing the program and the resistance among marine anglers to such a license. The Department of Marine Resource should assess the cost of implementing marine angler licenses. Angler resistance could be reduced if the license revenue was used to improve the quality of marine sport fishing in Maine. There is abundant research indicating recreationists are willing to pay reasonable fees if the revenue is used in ways that benefit the resource and thereby enhance the quality of the recreational experience.

Hunting

Recommendations for hunting are made in this section. General recommendations unrelated to specific species are made first, followed by recommendations for some of the species studied.

As noted earlier, the economic impact of hunting is enhanced more by nonresidents because they bring "new" money into the state. Residents, in contrast, do not bring new money into the state. An increase in hunting expenditures by residents may be offset by a reduction in expenditures for other activities in Maine. Therefore, it is important to increase the number of nonresident hunters to enlarge the economic impact. Furthermore, the most popular species for hunting in Maine are deer, moose and bear, all of which are hunted in the fall and attract large numbers of nonresident hunters. Finally, hunters' rankings of attributes contributing to a successful hunt illustrate the importance of hunter safety, pre-hunt preparation, and hunter skills while hunting. These findings form the basis for the following general recommendations:

- M-10. the Department of Inland Fisheries and Wildlife should publicize key management actions designed to improve the quality of the hunting experience. This information should be distributed widely among all current and potential resident and nonresident hunters;

- M-11. the Department of Inland Fisheries and Wildlife should conduct or coordinate hunter education courses that are species specific and accessible to the average hunter;
- M-12. to the extent possible, the Department of Inland Fisheries and Wildlife should set the deer, moose and bear seasons to minimize the overlap among the three seasons for these species.

Key management decisions can influence the number of resident and nonresident hunters that actually hunt in any given year. Regulation changes and management actions designed to enhance the quality of the hunting experience should be publicized among hunters to increase participation and the overall economic impact. It is especially important to inform nonresidents of these changes to maintain high participation rates and the economic impact of nonresident hunting. Several methods could be used to distribute this information. For example, the Department could publish a semi-annual or quarterly newsletter outlining policy changes that could be mailed to all hunters that purchased a license in the previous year. Alternatively, articles about regulation changes could be published in the Maine Sportsman magazine, which could then be distributed to all license holders. Newspaper articles could also be used to keep residents informed. Although these methods of distributing information are expensive and would require additional resources, we believe it is crucial that more information be distributed to the users who are affected by regulation and management changes. Such an information program also would allow the Department to explain the reasons for the changes. A similar program could be implemented for inland fishing.

Species-specific hunter seminars are another way to distribute information about regulation changes as well as hunting methods, equipment, the behavior and preferred habitat of a species, and other information, including hunter safety. Based on the results of the study, these seminars may be quite popular among hunters, and perhaps could be self-supporting through a registration fee. These seminars could be offered in cooperation with local hunting clubs and other interested groups. Videos could also be prepared on safe hunting methods, survival techniques and hunting techniques

for the popular species. These videos could be shown through hunting clubs and perhaps rented or sold to individuals. These techniques could improve hunter safety, improve public opinion of hunting and help to accomplish wildlife management objectives.

Recommendation 12 addresses the fact that the seasons for the three most popular species overlap to some degree. This overlap may be an advantage to some hunters since they can hunt more than one species on a single hunting trip. In fact, some nonresident hunters may hunt in Maine because of the opportunities to hunt multiple species. However, the economic impact associated with hunting multiple species on the same trip may be less than if hunters took more trips and only targeted one species on each trip. Reducing the overlap may also reduce hunter crowding and thereby enhance the quality of the hunting experience.

Recommendations related to specific species are now presented. The species are presented in alphabetical order.

Bear

The most important attributes contributing to a high quality bear hunt are seeing bears and bagging a bear. Therefore, we recommend that:

M-13. the Department of Inland Fisheries and Wildlife develop management policies to maintain, and if possible, increase the population of bears in Maine.

Bear hunting participation has increased in recent years and wildlife managers are concerned about the sustainability of current effort and harvest levels. It is crucial that the long-run potential of this resource be protected, even if it means short term reductions in the number of people allowed to hunt bears. If short-term reductions in the number of bear hunters are necessary, the Department should develop an equitable method of allocating bear hunting opportunities among resident and nonresident hunters.

Our results also suggest that actions to reduce conflicts among bear hunters may be warranted. The use of dogs to hunt bears was cited as a negative attribute by both residents and nonresidents. Therefore:

M-14. the Department of Inland Fisheries and Wildlife should develop reasonable policies to reduce the conflicts among hunters who use dogs and those who do not use dogs.

It should be noted the Department initiated a change in the regulation affecting the uses of dogs to hunt bears in 1990. That change limits the use of dogs to a specific time during the season. This change should be monitored to determine whether it solves the conflicts among bear hunters.

Finally, the use of guides for bear hunting is a common practice among nonresident hunters. Having a "good" guide or a "poor" guide significantly influences the quality of the hunting experience. Although we do not perceive a problem in the quality of guide services available in Maine, we recommend:

M-15. the Department of Inland Fisheries should work closely with Maine Guides to enhance the quality of guide services available to bear hunters (and other hunters and anglers) in Maine.

This recommendation is based on the importance of guide services to nonresident hunters and the increased economic impact associated with the hiring of guides.

Deer

Deer hunting is the most popular hunting activity in Maine; it also accommodates the largest number of participants and generates the largest economic impact. Therefore, it is important to maintain deer hunting opportunities and participation rates, but it is probably not possible to expand opportunities significantly. Therefore, we recommend:

M-16. the Department of Inland Fisheries and Wildlife continue to develop management plans to maintain current opportunities of deer hunting in Maine.

This recommendation should not be interpreted to mean that no additional effort is needed to maintain current opportunities. Not only must the deer population be closely monitored and managed for sustainability, but efforts must be undertaken to maintain land access, recruit new participants to replace those that stop hunting, and to improve public perceptions of hunters to prevent the erosion deer hunting opportunities.

Migratory Waterfowl

We have estimated only about 17,300 residents hunted migratory waterfowl in Maine in 1988. In addition, nonresidents were not surveyed because there were too few nonresidents to draw a sample. However, hunter expenditures and surplus values are substantial, which indicates that waterfowl hunting is an important activity for those who participate. Among the attributes influencing the quality of a waterfowl hunting trip, the availability of a large number of birds was the most significant. Therefore, we recommend that:

- M-17. the Department of Inland Fisheries work closely with the appropriate federal agencies and other states to enhance the number of migratory waterfowl in the state;

Efforts to increase migratory waterfowl must be a joint effort with federal agencies and other states, since the waterfowl are migratory species. At the same time, it is important for Maine to do its share to increase waterfowl populations through habitat protection and enhancement programs.

Moose

Although participation in Maine's annual moose hunt is restricted to 1,000 hunters each year, the expenditures per hunter and the surplus values per hunter are the highest for all consumptive and nonconsumptive uses of wildlife studied during the last three years. Moose hunting also has the highest overall qualitative evaluation of the hunting experience of all hunting activities. Therefore, assuming biological data are supportive, we recommend:

- M-18. the number of moose hunting permits issued each year be increased. Biological data should be used to determine the number of permits issued.

The number of permits issued to both residents and nonresidents should be increased, thereby maintaining the current policy of allocating 90 percent of the permits to residents and the other ten percent to nonresidents. We recognize that this is a controversial recommendation and that legislative approval is required before more permits can be issued. We also know the Legislature has not acted favorably toward previous legislation proposing an increase in the number of moose permits. However, we believe such a

recommendation is warranted based on the Commission's objective to capitalize on the potential associated with Maine's wildlife resources. It is clear that an increase in the number of moose permits would substantially increase the economic impact associated with the hunt.

Turkey

The program to reintroduce turkeys into Maine is a relatively new program. Although the number of turkey hunters and the economic impact of the turkey hunt is quite small, we recommend that:

- M-19. the Department of Inland Fisheries and Wildlife continue its efforts to reintroduce turkeys throughout the areas of Maine with suitable habitat.

We believe turkey hunting will become more popular as the number of birds and the areas in which they can be hunted increase. Given the special skills required for turkey hunting, a species-specific seminar on turkey hunting techniques may be popular and could increase participation in this relatively new hunting opportunity in Maine.

Upland Birds

Our results indicate that seeing many birds, getting a bird, and having access to hunt upland birds are the major factors influencing the quality of upland bird hunting. Therefore, we recommend that:

- M-20. management programs continue to focus on increasing the number of upland birds, thereby maintaining or increasing the potential for hunter success;
- M-21. programs to increase or maintain access should also be continued, along with habitat enhancement programs.

Nonconsumptive Uses

Nonconsumptive use of wildlife where a person encounters wildlife in its natural environment and the wildlife is not removed from its environment, is the most popular form of wildlife use among Maine residents. Participation rates in nonconsumptive wildlife activities by heads of households in Maine exceed participation rates for both hunting and fishing. Furthermore, based on current trends in society, nonconsumptive uses will increase more rapidly

than consumptive wildlife uses in the future. Consequently, wildlife managers must be cognizant of current nonconsumptive activities and plan for further growth in the future.

Survey results clearly indicate large numbers of residents attract wildlife around their home or camp to increase viewing opportunities. Many also take trips specifically for the purpose of viewing wildlife. The quality of these trips partially depends on whether participants actually view the species of wildlife they were seeking. However, nonconsumptive users are also interested in the total viewing experience, including learning more about different species of wildlife. Based on these findings, we recommend:

- M-22. brochures or leaflets describing techniques to attract common species of wildlife to residences be developed and distributed to interested households;
- M-23. the Department of Inland Fisheries and Wildlife develop educational materials for distribution to residents interested in learning more about different species of wildlife. Materials describing opportune times and viewing locations also should be developed and distributed upon request.

The former recommendation will assist people interested in increasing viewing opportunities around their homes, while the latter is designed to enhance the number and quality of trips taken to view wildlife. The material developed to describe potential viewing locations may take the form of self-guided tours in a given area, the types of habitat in which to find various species, and the techniques to be used when seeking/viewing different types of wildlife. General information about the habits of various species may also be useful. The Department may want to form advisory groups and/or conduct some additional surveys to determine which types of information programs would be most useful.

Because deer, bears and moose are premiere species for viewing as well as for hunting, management plans have to accommodate both uses. Therefore, we recommend:

- M-24. management plans reflect the importance of nonconsumptive uses of these species and that management actions be taken to enhance the nonconsumptive use of these species.

Nonconsumptive uses of deer, bears and moose should not be of secondary importance in their management. The results of the study suggest that the state would benefit from management actions specifically designed to increase viewing opportunities for these species. Other states, such as Alaska, have developed viewing zones and have managed these zones in ways to increase viewing opportunities. The Department of Inland Fisheries and Wildlife may want to consider creating viewing zones in Maine.

As expected, the survey results show strong support for increasing the number of nesting pairs of bald eagles in Maine. Fully 86 percent of all respondents favored such a program; respondents placed a value of over \$4 million per year on the program. Therefore,

M-25. the Department of Inland Fisheries and Wildlife should expand efforts to increase the number of nesting pairs of bald eagles in Maine.

Finally, the results of the nonconsumptive surveys gave us the general impression that the State's wildlife resources are very important to the people of Maine. Yet they are not well informed about many types of wildlife and wildlife issues in Maine. These issues include the current status of various species, management efforts to enhance wildlife populations, and efforts to increase viewing opportunities. Therefore, we suggest that:

M-26. the Department of Inland Fisheries and Wildlife develop an organized program to increase information and education about the resources it manages. This program should be designed to reach the average Maine resident.

We believe such a program could improve public satisfaction derived from the resources and could even enhance management goals as people respond to the information in ways that protect the resources and their habitat. To be effective, the program must be designed to reach the average Maine citizen, and not just hunters, anglers, trappers and others already aware of wildlife programs and issues. The program should reach out to the 80 percent of Maine's citizens who have indicated they enjoy and observe the state's wildlife resources.

RECOMMENDATIONS FOR FUTURE RESEARCH

The research conducted by the University of Maine for the Commission to Study the Impact of Game and Nongame Species on Maine's Economy is perhaps the most comprehensive study of wildlife-related activities conducted by a state. Nevertheless, additional topics for further research have been identified and are presented for consideration by the Commission.

The results obtained for marine fishing in Maine indicate it is an important activity, especially in terms of the economic impact it has on the state economy. However, the results obtained for marine fishing are of much lower quality than the results for inland fishing and hunting. The most significant factor affecting the quality of the marine fishing results is the absence of a list of the people who participate in Marine fishing activities. Such a list is required to select a random sample of both resident and nonresident participants to survey. In the absence of such a list, researchers must construct one before a sample can be drawn.

Compiling such a list, however, presents two problems. First, the cost of compiling the list is extremely high. Researchers must either telephone people to compile a list of people who say they are marine anglers, or they must go to access points from which people marine fish and collect the names and addresses of marine anglers. Both techniques are costly in terms of money and time.

The second problem is the compiled list of anglers may not be representative of all people who marine fish. For example, the telephone survey would exclude all marine anglers who do not have a telephone; a list compiled at marine access points would also exclude some anglers, since it is impossible to cover all access points when constructing the list. Therefore, the list from which the sample is drawn may be biased in that certain anglers or types of anglers are excluded. These types of exclusions can significantly affect the accuracy of survey results. This potential bias reduces the

usefulness of the study results because one can not be confident that the results are accurate. The marine fishing results obtained in this study suffer from these types of problems.

Furthermore, these problems make it impossible to estimate the total number of people who marine fished in Maine in 1988. Consequently, estimates compiled by the National Marine Fisheries Service had to be used. These estimates also may be subject to error, which would have a direct impact on the aggregate measures of surplus values and economic impacts derived in the study.

Given the problems encountered in the marine fishing sampling process, we strongly recommend:

- C-1 a second study of marine sport fishing in Maine be conducted. This study should focus only on marine fishing, and should not be part of a larger study.

Based on knowledge obtained from this study, we also recommend some specific procedures that should be used in the new study. First, a telephone survey should be used to compile a list of resident marine anglers. The telephone survey should identify all randomly selected adults in households that marine sport fish in Maine. A sample of marine anglers can then be drawn from the compiled list. Although this approach would exclude marine anglers who do not have telephones, this is not considered to be a serious omission. Furthermore, the telephone survey is the most cost effective method available to compile a list of resident marine anglers.

An alternative method must be used to construct a list of nonresidents who participate in marine sport fishing in Maine. Because only a very small percentage of nonresidents marine fish in Maine, a telephone survey would not be cost effective. One may have to call more than 100 nonresident households to identify one person who marine fished in Maine in a given year. Perhaps the most cost-effective method of determining the economic impact of nonresident marine fishing is to include marine fishing as a specific component of a general study of nonresident tourism in Maine. Such a study would require the development of a method of randomly selecting a sample of

tourists that is representative of all tourists that visit Maine. These tourists could be mailed a survey about their tourist activities in Maine, including marine fishing. A study of this type would be expensive to conduct because it requires the construction of a list of nonresident tourists from which to draw the sample. Furthermore, the list must be constructed in a way that allows the researchers to estimate the total number of nonresident tourists that visit the state. This is a difficult and expensive undertaking, but it is the only way to accurately estimate the economic impact of tourism in Maine and the economic impact of specific activities such as marine fishing.

Of course, an alternative is to require marine anglers to purchase a license to marine fish. This would not only reduce the cost of research, it would also provide useful information to the Department of Marine Resources. The advantages of requiring such a license were presented above.

The research that addressed the nonconsumptive uses of wildlife in this study was the first of its kind to be conducted by a state. The results indicate that nonconsumptive uses of wildlife by residents are substantial, even though the results obtained from the study are incomplete. Two factors contribute to the incomplete results. First, the resident survey of nonconsumptive users was a head-of-household survey rather than a general survey of all adults in Maine. Consequently, the results are representative of the activities and expenditures made by household heads and, therefore, excludes the activities and expenditures of other members of the household. Again, the expense of obtaining a random sample of all adults in Maine made it impossible to conduct a general survey of all adults in this study.

Second, nonresidents were not surveyed to determine their nonconsumptive wildlife activities and the expenditures they made in Maine to participate in those activities. The complex sampling problems and the cost of constructing a representative list of nonresidents that participate in nonconsumptive

activities in Maine was prohibitive. However, we believe that the economic impacts associated with nonconsumptive wildlife activities of nonresidents may be quite large.

Based on the economic importance of nonconsumptive activities and its apparent growth in popularity during the last 10-20 years, we recommend:

- C-2 the Commission consider further research on nonconsumptive uses of wildlife.

The additional research for resident nonconsumptive activities should utilize the same techniques described above for marine fishing. That is, a telephone screening survey should be used to identify a list of Maine adults that participate in nonconsumptive activities. Once identified, they can be surveyed by mail using the procedures employed in this study. This approach would produce results reflective of the activities and expenditures made by all adults in Maine rather than just the heads of households.

The study of nonconsumptive uses of wildlife by nonresidents would also parallel those outlined above for nonresident marine anglers. In other words, the most cost effective way to obtain the required information would be to gather it through a general survey of nonresident tourists in Maine. Questions regarding nonresidents' nonconsumptive wildlife activities, expenditure levels and other information about nonresident preferences about wildlife-related activities could be obtained in a section of the survey instrument.

Finally, this study has generated two types of economic measures of the importance of wildlife to the people of Maine. The measure that receives the most attention among legislators and citizens is the economic impact of wildlife activities as measured by the expenditures made to participate in these activities. However, from a resource allocation viewpoint, the aggregate surplus values estimated as part of the study are the measures that should be used by decision makers. That is, when deciding which type of programs should be implemented to improve wildlife-related activities, the aggregate surplus values are of the greatest importance.

In this study, individual and aggregate surplus values were estimated using the best techniques available. In fact, the study was able to contribute to the economics literature related to the measurement of surplus values associated with wildlife-related activities. However, there is a continual need on the part of researchers to validate the results obtained from the use of these techniques. Validation is needed to insure that the values people state for a given activity are, in fact, an accurate indication of their true value for the activity. Validation is crucial because results are used to set priorities among management policies; results are also used in litigation to determine damages associated with environmental accidents, such as the EXXON VALDEZ oil spill. Consequently, the validity of the techniques is of utmost importance.

From a research perspective, Maine has some unique opportunities to contribute to the research designed to validate the techniques used to determine aggregate surplus values. This could be accomplished if researchers were given permission to allocate 10 to 20 moose permits and 10 to 20 any deer (doe) permits through an auction. The prices that people would pay for a permit through the auction could be compared with the values people say they place on moose hunting and deer hunting to see if the values are the same. This represents an excellent opportunity to validate the results obtained from the methods used to measure individual and aggregate surplus values in this study. Therefore, we recommend:

- C-3. the Commission consider seeking legislative approval to allow 10 to 20 moose permits and 10 to 20 any deer permits to be auctioned to potential hunters for the purpose of validating research methods commonly used to determine the value people place on wildlife-related activities.

We recognize this request is somewhat unusual and perhaps even controversial; at the same time, the proposed research is crucial to the development of improved estimates of surplus values for wildlife-related activities. The work of the Commission to date has given Maine a reputation as a state that is dedicated to the protection and enjoyment of its wildlife resources. Maine has become an example for other states interested in

wildlife-related economic research and its use in wildlife management. The Commission and the legislature can look upon this recommendation as an opportunity to contribute to the improvement of economic research associated with wildlife that will improve future wildlife evaluation efforts in Maine and across the U.S.

CAVEATS

In conclusion, we would like to close by noting that the information obtained by this study over the last three years is important and useful input in designing management policies related to the fish and wildlife resources of Maine. However, user preferences change over time; in some cases, these changes occur very rapidly. Therefore the Commission and the agencies that will be utilizing the data obtained during the study should not view the collection and analysis of these types of data as a one-time effort. Studies such as these should be updated every five to ten years, depending on the rates of change in wildlife-related activities and users' preferences. We hope the data collected for this study will illustrate the usefulness and the importance of this type of information so that the agencies and the Legislature will be willing to invest in the collection of economic and user preference data on a regular basis in the future.

Finally, the implementation of the recommendations cited above would, in our opinion, enhance users' enjoyment of Maine's wildlife resources, and would increase the economic impact and surplus values associated with that enjoyment. Furthermore, implementation of the recommendations to the Commission would improve the quality of information available for management decisions, and would thereby enhance wildlife management, the wildlife resource base and wildlife users. However, we recognize that implementation of all of the recommendations would require a substantial increase in resources devoted to wildlife management. We also recognize the funding needed to implement all of the recommendations will not be forthcoming. At the same time, increasing the level of use of these resources will require increases in funding. Both the management agencies and the Legislature will



eventually have to set priorities and determine future funding levels. During this process, all parties should remember there is no such thing as a free lunch. Tapping the remaining potential in Maine's wildlife populations is clearly possible, but it can only be achieved through higher levels of funding for wildlife-related programs.

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