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THE GRAND TRAVERSE BAY SPORT FISHERY:
ANGLER ACTIVITY, REVENUE, AND
ECONOMIC IMPACT

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THE UNIVERSITY OF MICHIGAN SEA GRANT PROGRAM

The University of Michigan Sea Grant Program is a part of the National Sea Grant Program, which is maintained by the National Oceanic and Atmospheric Administration of the US Department of Commerce.

ABSTRACT

Over a one-year period, from May 1971 to May 1972, sport fishing activity in Grand Traverse Bay amounted to an estimated 69,000 angler days. Visitors to the area expended more than two-thirds of total angler activity. An estimated \$418,000 of gross income attributable to the fishery resource accrued to the three-county community adjacent to the bay over the one-year period, mostly from anglers using public launching sites and from charter fishermen. Net income to the community from sport fishing was estimated at \$203,000. Business activity generated by sport fishermen created an estimated 21.5 full-time equivalent jobs which were attributable to the fishery resource.

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The collection of charter fishing data was facilitated through the cooperation of the Grand Traverse Sports Fishing Association, representing charter boat operators in Grand Traverse Bay. Special thanks are due to Messrs. F. Pobuda, D. Allen, D. Hoag, R. Rokos, and J. Rokos for the information they provided.

A recent publication by P. H. Pearse and M. D. Laub, "The Value of the Kootenay Lake Sport Fishery," served as a model for the revenue and economic impact sections of this report.

Finally, I would like to express the appreciation of the University of Michigan Sea Grant Program for the excellent cooperation received from the Department of Natural Resources of the state of Michigan in the planning and implementation of this project and in contributing its personnel for consultation.

INTRODUCTION

The ultimate objective of the University of Michigan Sea Grant Program is to define the consequences of various alternatives in long-term development of water and land resources of the Great Lakes and to present this knowledge to society as a basis for rational decision making.

Grand Traverse Bay has been selected as the focus of pilot efforts to develop a complete model of a small part of the Great Lakes ecosystem. The bay provides a microcosm of the problems and processes encountered in Lake Michigan, and will ultimately lead to models for the Great Lakes in general.

About six years ago, the state of Michigan established a fishery management policy which clearly recognized the economic and recreational benefits that would accrue from a developed recreational fishery on the Great Lakes. Furthermore, in recent years all fisheries agencies on the Great Lakes have become increasingly aware of the need to obtain improved statistical information on the sport fishery for both biological and socio-economic reasons.

Consultations between representatives of the University of Michigan Sea Grant Program and the Department of Natural Resources of the state of Michigan disclosed a mutual interest in the recreational fishing aspects of Grand Traverse Bay. The two agencies thus agreed to initiate a cooperative project in accordance with the overall informational requirements of the Sea Grant Program in its efforts to model physical, biological, sociological, and economic attributes of the Grand Traverse Bay area, and in line with the on-going activities of the state of Michigan in evaluating the biological and socio-economic characteristics of its sport fishery.

Recognizing the opportunity to define and evaluate the role of a developing recreational fishery in a localized area, the project was conceived with three objectives:

1. Measurement of the use received by the Grand Traverse Bay fishery resource in terms of the recreational fishing activity engaged in by community residents and visitors to the bay area;

2. Source identification, and quantification of the seasonal and annual revenue flows stemming from various kinds of fishing activity associated with the Grand Traverse Bay fishery resource;
3. Measurement and evaluation of the economic benefits related to sport fishing activity on Grand Traverse Bay accruing to the Grand Traverse Bay community.

The Grand Traverse Bay Community

For the purposes of this investigation, the Grand Traverse Bay community is considered to be the three-county area located at the southern end of the bay (Figure 1). Included in the community are Antrim, Grand Traverse, and Leelanau counties, with a combined population of nearly 63,000 (US Bureau of Census, 1970). Traverse City, at the southern end of the west arm of the bay, is the economic and cultural center of the community, with a population of about 18,000 (US Bureau of Census, 1970).

The northwest section of the lower peninsula of Michigan, in which the bay area is central, is reported to be one of the most popular tourist areas in the state. Water and related resources are the major natural assets of the area. Availability of unspoiled water and land resources, agreeable climate, and the natural beauty of the region attract visitors on a year-round basis. Tourism and recreation rank with manufacturing as leading economic activities in the region (NMEDDC, 1968).

The Grand Traverse Bay Sport Fishery

The popularity of sport fishing in Grand Traverse Bay is not a recent phenomenon, but dates back to the late 1860s. Just after the turn of the century, a nationally known sport fishing camp was established at Northport, providing "deep sea trolling" for lake trout. Charter fishing in those days was available on a "no catch, no charge" basis (Colby, 1971), attesting to the abundance of the fishery resource.

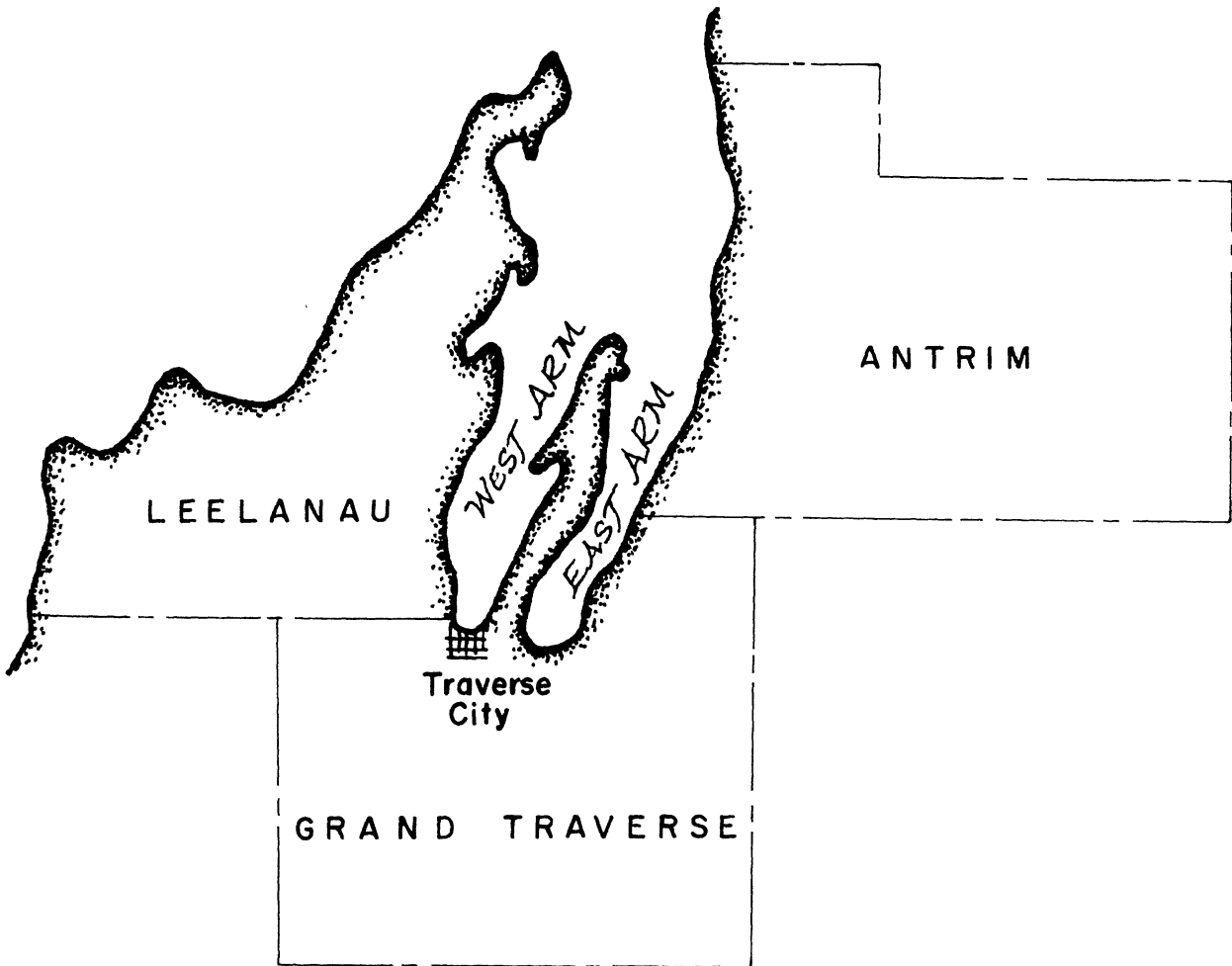
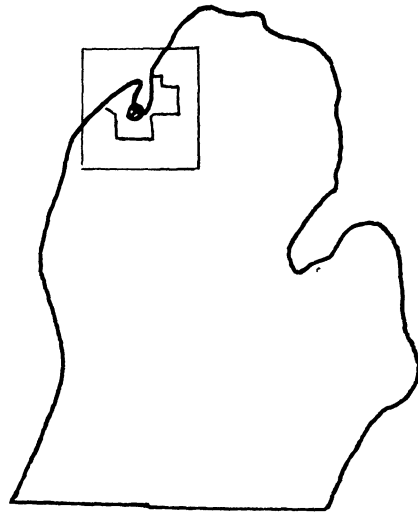


Figure 1. The Grand Traverse Bay Community

From the mid-1940s to the early 1960s, fish populations probably were in a state of decline due to the parasitic sea lamprey, first reported in Lake Michigan in 1936 (Wells and McLain, 1972), and perhaps because of very intensive commercial fishing. Initial attempts, during depression years, to limit commercial fishing were unsuccessful. Then, in 1945 the lower portion of the bay was closed to commercial fishing. In 1970 the entire bay was set aside exclusively for sport fishing. However, through the 1950s, sport fishing remained at low ebb. In the early 1960s, as a result of the increasing success of the lamprey control program and advent of fish stocking, sport fishing activity began to increase. Lake trout were planted in the bay in 1966, and coho salmon were first introduced in 1968. Indicative of the growth of sport fishing activity on Grand Traverse Bay is the rebirth of the charter fishing industry in recent years. In 1966 there were no active charter operators on the bay; during the 1971 season there were 22.

Although the successful introduction of coho salmon in Lake Michigan has received wide publicity in recent years, the Grand Traverse Bay sport fishery is based primarily on its lake trout resource. Lake trout accounted for about two-thirds of the estimated 87,000 salmon and trout caught in Grand Traverse Bay in 1969, while coho salmon accounted for less than 20 percent of the total catch (Jamsen et al., 1970). Lake trout are available to the fishery on almost a year-round basis; however, coho and chinook salmon and steelhead trout are available only seasonally. In addition to salmon and trout, including brook trout, small-mouth bass, rock bass, and yellow perch are caught in inshore areas. Smelt are dipped during their spawning runs.

Sport Fishing Facilities on Grand Traverse Bay

There are 16 public boat launching sites on Grand Traverse Bay from Northport to Elk Rapids, with a total estimated parking capacity* of about

* Capacities of developed launching sites were determined by counting the number of marked-off parking spaces at each site. At underdeveloped sites, capacities were estimated based on the parking area available for car-trailer combinations.

400 car-trailer combinations (Figure 2; Table 1). In terms of the total shoreline of the bay (estimated at 132 miles from Lighthouse Point to Norwood), there is an average of one public boat launching site for each 8.2 miles of shoreline, or an average of 3.1 parking spaces at public launching sites per mile of shoreline. However, public boat launching sites and parking capacities are unevenly distributed over the bay. For example, the parking capacities of the two largest boat launching sites in the lower part of the west arm (the Elmwood Township Facility and Clinch Park Marina) account for more than one-half of the total public parking capacity on the bay, while along the more than 20 miles of shoreline from Elk Rapids to Norwood there are no public boat launching sites. A charge of \$1.50 for boat launching is made at the Elmwood Township Facility and parking is metered at the Clinch Park and Boardman launching sites; all other public launching sites may be used without charge. Furthermore, there are five public marinas^{*} on the bay (included in the 16 public access sites mentioned above) and two private marinas.[†] Also, in addition to the 16 public launching sites, or areas adjacent to them, there are at least 6 more sites of various sizes along the shoreline that afford public access.[¶]

NOTE: The west and east arms of Grand Traverse Bay are often referred to (especially locally) as West Bay and East Bay, respectively.

* Northport, Suttons Bay, Elmwood Township Facility, Clinch Park, and Elk Rapids marinas are administered by local governments and provided through cost sharing with state government. Each marina provides fuel and slips where boats may be kept on a daily or seasonal basis, except for the Elmwood Township Facility, which has no fuel or slips, but provides mooring bouys.

† Traverse Harbor Marina and East Bay Marina. Two additional private marinas have not been included because they offer no permanent docking facilities, moorings, or boat launching ramps.

¶ Lighthouse Point, Omena, Suttons Bay Point, Bryant Park, Old Mission Point, and Acme Park.

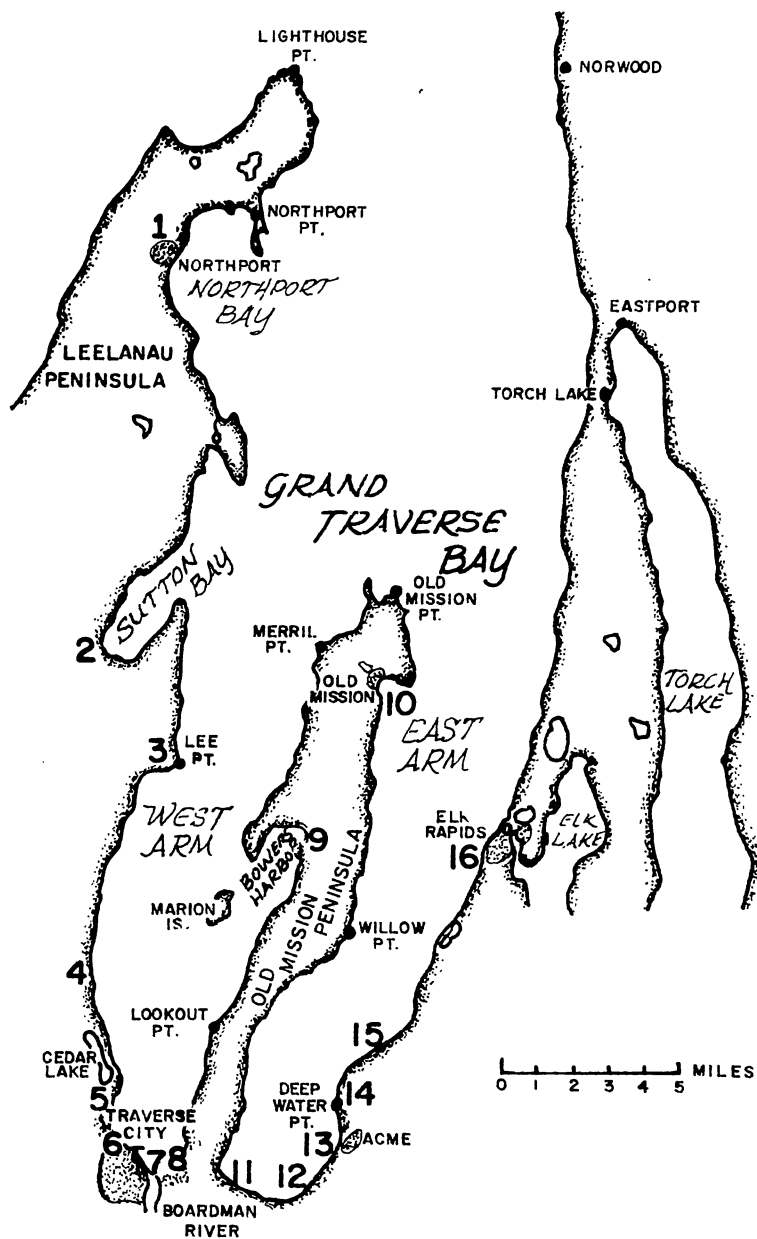


Figure 2. Location of Public Boat Launching Sites on Grand Traverse Bay

Table 1. Public Boat Launching Sites on Grand Traverse Bay

Launching Site	Parking Spaces for Automobile-Trailers
1. Northport	40
2. Suttons Bay	20
3. Hendrix Park	4
4. MI 22 at CR 618	15
5. Elmwood Township Facility	137
6. Clinch Park Marina	70
7. Boardman River at Grandview Parkway	--*
8. Sunset Park	5
9. Bowers Harbor	11
10. Old Mission Harbor	5
11. East Bay Park	7
12. MI 31 at 4 Mile Road	30
13. Acme	5
14. Deepwater Road at Dock Road	12
15. Yuba Road	8
16. Elk Rapids	<u>25</u>
TOTAL	<u>409</u>

* The launching ramp is at the end of a large, metered parking lot which serves the downtown area of Traverse City. The number of parking spaces available for the use of fishermen was indeterminate.

SPORT FISHING ACTIVITY ON GRAND TRAVERSE BAY

The Grand Traverse Bay fishery resource provided an estimated 61,847 (± 5 percent)* angler days[†] of recreational activity during the period from May 1971 to May 1972. Visitors[¶] to the bay area accounted for an overall 69 percent of the total fishing activity (42,878 [± 7 percent] angler days).

The principal categories of sport fishing activity on Grand Traverse Bay are boat fishing originating at public launching sites, charter fishing, shore fishing in the late summer and fall, ice fishing, and shore fishing in the spring (Table 2).

Fishing Activity Originating at Public Launching Sites

In 1971 boat fishing activity began in late May and continued until mid-October. Fishing activity was most intensive during August and September. Lake trout was the principal species sought in the fishery from May to mid-August, after which coho salmon were also included in the fishery. Boat fishing activity originating at public launching sites amounted to an estimated 41,279 (± 4 percent) angler days during the 1971 season. Visitors to the bay area accounted for 77 percent of total boat fishing activity (33,073 [± 7 percent] angler days).

*Throughout the report 95 percent confidence limits are expressed as a percentage of the estimate.

†An angler day is the recreational fishing activity engaged in by one individual at any time during one calendar day, and as such is an appropriate measure of the recreation provided by the fishery resource. Because of repeat fishing trips, especially by local residents, the actual number of individuals who utilized the resource is considerably less than indicated by the fishing activity expressed in angler days.

¶Estimates of nonresident fishing activity were based on the proportions of visitors encountered during interviews with sample fishermen.

Table 2. Categories of Sport Fishing Activity on Grand Traverse Bay

Category of Fishing Activity	Temporal Distribution	Important Fish Species
Boat Fishing	Late May Through Mid-October	Lake Trout, Coho Salmon
Charter Fishing	Early May Through Early November	Lake Trout, Coho Salmon
Summer-Fall Shore Fishing	Mid-August Through November	Lake Trout, Coho Salmon
Ice Fishing	February Through Mid-April	Lake Trout, Perch
Spring Shore Fishing	Mid-April Through May	Steelhead Trout

Using empty boat trailers as indices of fishing activity, "simultaneous"^{*} counts of trailers were made at the Elmwood Township Facility (hereafter referred to as the "Facility") and at 11 other public launching sites[†] in the a.m.[¶] (Table 2, Figure 2). Based on observations made over 13 days in July, August, and September, and using linear regression analysis, boat fishing activity originating at 11 public launching sites could be predicted when fishing activity at the Facility was known.

$$\text{Boat fishing activity at 11 public launching sites in the a.m.} = 1.89 \left(\begin{array}{l} \text{Number of empty trailers} \\ \text{parked at the Facility} \\ \text{in the a.m.} \end{array} \right) - 4.32 ,$$

$$R^2 = 0.77,$$

where R^2 is the coefficient of determination--the proportion of variability in the dependent variable explained by the independent variable (e.g., 77 percent of the boat fishing activity at 11 launching sites is explained by the number of empty trailers parked at the Facility in the a.m.).

Observations of the number of empty boat trailers parked at the facility in the a.m. were not available for all days during the season, but could be predicted in terms of the daily number of boat launching tickets sold there, using regression analysis on 26 pairs of observations made from July to October.

$$\text{Daily number of empty boat trailers at the Facility in the a.m.} = 0.59 \left(\begin{array}{l} \text{Daily number of boat} \\ \text{launching tickets sold} \\ \text{at the Facility} \end{array} \right) - 3.49 ,$$

$$R^2 = 0.92.$$

* The trip around the bay required about 90 minutes to cover a distance of approximately 55 miles. Starting times during the a.m. and the point of departure (Elk Rapids or Northport) were selected at random.

† Site numbers 1-3, 5, 6, 8, and 11-16 (see Table 1, Figure 2).

¶ Hourly counts of empty trailers at the facility over 8 days indicated that maximum fishing activity occurred between 9 a.m. and 11 a.m.

Assuming that the linear relationship between total daily fishing activity at the Facility and fishing activity occurring there in the a.m. obtains for other launching sites on the bay, then total daily fishing activity at all launching sites may be predicted by

$$\begin{array}{l} \text{Total daily boat fishing} \\ \text{activity at the Facility} \\ \text{and 11 other public launch-} \\ \text{ing sites} \end{array} = \left(\frac{B}{C} \right) D + B ,$$

where

B = daily number of boat launching tickets sold at the Facility,

C = daily number of empty boat trailers at the Facility in the a.m. (from $C = 0.59B - 3.49$),

D = boat fishing activity at 11 public launching sites in the a.m. (from $D = 1.89C - 4.32$).

The model was used to predict fishing activity in terms of daily numbers of boats over 142 days using daily ticket sales at the Facility as the input. Daily numbers of boats were expanded to boat fishing activity in terms of anglers by applying a factor of 2.47 (± 5 percent), representing the mean number of anglers observed in 232 boats.

Daily predictions of fishing activity were summed over each month and for the entire season to obtain monthly and total estimates (Table 3). Thus it is estimated that a minimum 41,279 (± 4 percent) days of angler activity were expended in boat fishing originating at public launching sites during the 1971 season.

The model for prediction of boat fishing activity has several sources of bias. Upward bias stems from the assumption that all empty trailers were indicative of boats engaged in fishing activity. Observations made over the course of the season show that, with the exception of Clinch Park Marina, very little use is made of most of the access sites for purposes other than fishing. Furthermore, the attendants at the Facility, the busiest launching site on the bay, estimate that launchings for purposes other than fishing constitute less than 5 percent, and less than 1 percent of total launchings.

Table 3. Boat Fishing Activity Originating at Twelve Public Launching Sites on Grand Traverse Bay During 1971

Month	Angler Days
May	419 ± 42%
June	6,213 ± 12%
July	8,157 ± 8%
August	11,422 ± 6%
September	12,010 ± 7%
October	3,058 ± 19%
TOTAL	41,279 ± 4%

Downward bias has its source in the unaccounted for fishing activity originating at 5 (31 percent) of 16 launching sites, where trailer counts were not made; however, these sites account for a relatively small portion of boat fishing activity. When the capacities of all public launching sites are considered in terms of parking spaces for car-trailers, the total capacity of launching sites where observations were not made amounts to less than 15 percent of the estimated total public launching capacity on the bay.

Charter Fishing Activity

In 1971, charter fishing in Grand Traverse Bay extended over a period of six months, from early May to early November. During the season, 22 charter operators were active in the bay. Seven operators left the bay during July, August, and September to engage in salmon fishing on Lake Michigan. Lake trout is the principal species in the fishery; however, coho and chinook salmon are sought in the latter part of the season. Charter fishing activity is estimated at 4,030 (±4 percent) angler days, of which 85 percent (3,430 [±11 percent] angler days) were expended by visitors to the bay area.

Charter fishing activity in terms of numbers of charter trips and numbers of charter customers was obtained directly from cooperating charter operators. Over the 1971 season, activity records were obtained from 80 percent of the active charter operators. The data from these records provided the basis for estimation of total charter fishing activity.

One-way analysis of variance indicated no significant^{*} difference among the numbers of charter fishermen carried by each boat on each trip over the six months of the season (where the mean (\bar{x}) was 3.8 ± 4 percent fishermen/boat/trip). In contrast, there was a significant difference among the numbers of charter trips made on a monthly basis; however, the trips data could be combined for June through September ($\bar{x} = 15.7 \pm 16$ percent trips/boat/month) and for May and October ($\bar{x} = 5.3 \pm 35$ percent trips/boat/month). Using these statistics and the number of active charter operators during each month, total charter fishing activity could be estimated on a monthly basis using

$$\text{Monthly angler days} = \left(\begin{array}{c} \text{Mean number of} \\ \text{trips /boat/month} \end{array} \right) \left(\begin{array}{c} \text{Mean number of} \\ \text{charter fisher-} \\ \text{men/boat} \end{array} \right) \left(\begin{array}{c} \text{Total boats} \\ \text{active during} \\ \text{each month} \end{array} \right) .$$

Accordingly, total estimated charter activity for the 1971 season is 4,030 (± 4 percent) angler days (Table 4).

Summer-Fall Shore Fishing Activity

Intensive shore fishing activity begins with the appearance of coho salmon in the vicinity of the streams where they were planted. In 1971, the activity commenced in the middle of August. Shore fishing activity was concentrated in the lower west arm of the bay at the mouth of Brewery Creek, and from the mouth of the Boardman River upstream to the Union Street Dam. Northport and Suttons Bay are usually other centers of shore fishing activity, but during 1971, coho fishing did not materialize there.

^{*}
 α was set at 0.05 for all statistical tests mentioned in the text.

Table 4. Charter Fishing Activity on Grand Traverse Bay During 1971

Month	Charter Trips	Angler Days
May	32 (-----)	116 (-----)
June	298 (\pm 16%)	1,130 (\pm 17%)
July	298 (\pm 16%)	1,130 (\pm 17%)
August	283 (\pm 16%)	773 (\pm 17%)
September	203 (\pm 16%)	595 (\pm 17%)
October	74 (\pm 35%)	280 (\pm 35%)
November	1 (-----)	6 (-----)
TOTAL	1,189 (\pm 8%)	4,030 (\pm 4%)

* Reports were obtained from all charter operators in May and November.

Lake trout enter the shore fishery about mid-October, also in the lower west arm of the bay. In 1971, intensive fishing for lake trout took place at night at City Marina, lasting for the first three weeks of November, after which fishing effort tapered off to a few anglers per day during December. An estimated 4,192 (\pm 25 percent) angler days of shore fishing activity were expended during the late summer and fall of 1971, of which 2,815 (\pm 27 percent) angler days were by visitors (67 percent).

Early morning counts of shore anglers were made over a period of 24 days from mid-August through early November. December counts showed no appreciable shore fishing activity. The areas covered by the counts included the Boardman River from its mouth to the Union Street Dam and the shoreline of the lower west arm of the bay from Traverse City to Brewery Creek in Greilickville.

Shore fishing activity was calculated as the product of the mean number of shore anglers counted in the a.m. (\bar{x} = 35.8 \pm 25 percent) and the number of days in the fishery from mid-August to November 30 (117).

Thus, total fishing activity in late summer and fall is estimated at 4,192 (± 25 percent) angler days.

Shore fishing activity has doubtless been underestimated for November since counts were made only during the a.m. During peak fishing from 9-14 November, up to 100 anglers were engaged in night fishing for lake trout at Clinch Park (personal communication, Don Reynolds, fish habitat biologist, Department of Natural Resources).

Ice Fishing Activity

In 1972, ice fishing began in Grand Traverse Bay at the end of January, when sheltered areas were first frozen over; however, intensive ice fishing commenced only after the lower portions of the west and east arms of the bay solidified, between 7 and 9 February. From a peak in mid-February, ice fishing activity steadily declined through March and April. By the second week of April, the ice began getting soft, and the fishing terminated about 14 April. The principal species sought during the ice fishery were lake trout on the open ice and perch in the inshore areas.

An estimated 11,055 (± 23 percent) angler days were expended during the 1972 ice fishery, of which 2,787 (± 32 percent) angler days were accounted for by visitors (25 percent). Estimation of ice fishing activity was based on counts of ice fishermen and ice shanties made over 26 days in February, March, and April. The area in which the counts were made was expanded as progressively more of the bay became frozen over. When the ice reached its maximum extent, counts were made from Suttons Bay south to Traverse City, on the east and west sides of Old Mission Peninsula, and on the east shore of the east arm of the bay from Acme to Yuba (Figure 2).

Ice fishermen and shanties were counted with the aid of binoculars at observation points along the bay. All individuals on the ice were assumed to be fishermen. Comparison of morning and afternoon counts made on the same day disclosed that more fishing activity took place in the morning than in the afternoon. Thereafter, counts were made only in the a.m., with the starting time for the counts picked at random.

One-way analysis of variance indicated that there was no significant difference between the number of ice fishermen observed on Saturdays and Sundays, and these counts were combined; however, there was a significant difference between the number of fishermen observed on weekend days ($\bar{x} = 278 \pm 40$ percent, $N = 10$) and weekdays ($\bar{x} = 126 \pm 31$ percent, $N = 16$). Weekend ice fishing activity was estimated as the product of the mean number of anglers counted on weekend days and the number of weekend days occurring through the period of the fishery (18). Similarly, weekday ice fishing activity was calculated using the mean number of anglers fishing on weekdays and the number of weekdays occurring during the fishery (45).

The number of fishermen occupying a shanty could not be directly observed during the daily counts; however, by making spot inquiries on several days, it was estimated that there was a mean of 0.39 (± 9 percent) fishermen per shanty. Thus, the number of ice fishermen in shanties was calculated as the product of the mean number of fishermen per shanty, the mean number of shanties per day (39.5 ± 9 percent), and the number of days in the fishery (63). The total angler activity estimated for the 1972 ice fishery is 11,055 (± 23 percent) angler days.

Spring Shore Fishing Activity

Spring shore fishing is primarily for steelhead trout and begins soon after the ice breaks up on the bay, continuing until the end of the steelhead run. In 1972, this fishery commenced during the third week of April and continued until the last week of May. Fishing effort was concentrated primarily at Elk Rapids on the Elk River, at Acme on Acme Creek, and at Traverse City on the mouth of the Boardman River. Fishing activity was sporadic at Northport.

Spring shore fishing activity is estimated at 1,291 (± 27 percent) angler days, of which 773 (± 30 percent) angler days (60 percent) were expended by visitors to the bay area. Counts of shore fishermen were made over 13 days from late April through early June.* The daily counts were

*Although the steelhead run terminated in late May, fishing activity continued until early June, mostly for suckers.

stratified with regard to weekend days ($\bar{x} = 60.5 \pm 23$ percent anglers, $N = 4$), and weekdays ($\bar{x} = 18.8 \pm 7$ percent anglers, $N = 9$). Shore fishing activity was thus calculated as the product of mean anglers on weekend days and weekdays and the number of weekend days (12) and weekdays (30) during the period from 20 April to 31 May 1972. Total shore fishing activity is estimated at 1,291 (± 27 percent) angler days.

Summary of Sport Fishing Activity

Total annual sport fishing activity on Grand Traverse Bay for the period of May 1971 to May 1972^{*} has been estimated at 61,847 (± 5 percent) angler days. Estimates for each category of fishing (with the exception of charter fishing) are probably on the conservative side of the actual angler activity expended on the bay. The model for boat fishing activity does not incorporate fishing activity originating from 5 of 16 public launching sites on the bay. Furthermore, no attempt was made to estimate angling effort originating from private bay-front properties or that associated with boats permanently moored at marinas, although it is believed that fishing activity of this nature is quite small in relation to that originating from public launching sites. Moreover, the daily counts on which the estimates were based were of an "instantaneous" nature. Although counts were made during peak fishing hours, angling activity ending before the counts were made, and beginning after the counts were concluded was not observed. Thus, the estimate of 61,847 angler days must be considered as representing the *minimum* amount of angler activity expended on the bay during the period over which sport fishing activity was measured.

In terms of angler activity, boat fishing originating at public launching sites was the most important fishing activity on Grand Traverse Bay, accounting for an estimated two-thirds of all activity expended. Ice fishing was second in importance, with 18 percent of the total activity.

* Estimation of boat and charter fishing activity began in May 1971; however, no estimates were made for spring shore fishing in 1971. In 1972, spring shore fishing estimates were made through 31 May to compensate for the spring shore fishing activity not monitored during 1971.

Charter activity and the two categories of shore fishing amounted to only 19 percent of the total (Table 5).

More than 70 percent of all fishing activity took place during the warmer months of the year, from June through September; however, some fishing activity occurred on an almost year-round basis. December and January were months during which there was minimal fishing activity.

Visitors to the bay area used the fishery resource more heavily than did residents. Overall, an estimated 69 percent of angler activity was counted for by visitors. Charter fishing and boat fishing originating at public launching sites attracted the largest proportions of nonresidents. Ice fishing was the only activity in which residents used the resource more extensively than did visitors to the bay area (Table 5).

Table 5. Sport Fishing Activity on Grand Traverse Bay, May 1971-May 1972

Category of Fishing Activity	Total Angler Days	Percentage of Total	Nonresident Angler Days	Percentage of Total	Percentage Nonresidents
Boat	41,279 (\pm 4%)	67	33,073 (\pm 7%)	77	80
Charter	4,030 (\pm 4%)	6	3,430 (\pm 11%)	8	85
Summer-Fall Shore	4,192 (\pm 25%)	7	2,815 (\pm 27%)	6	67
Ice	11,055 (\pm 23%)	18	2,787 (\pm 32%)	7	25
Spring Shore	1,291 (\pm 27%)	2	773 (\pm 30%)	2	60
Total	61,847 (\pm 5%)	100	42,878 (\pm 7%)	100	69

SPORT FISHING REVENUE

The spending of fishermen in the bay area generates a flow of revenue which accrues to the bay-area community. The revenue flow is dependent on the magnitude of sport fishing activity and the intensity of angler spending.

The revenue flow stemming from angler spending has been identified and estimated. For the period of May 1971 to May 1972, the revenue flow from the spending of nonresident anglers who came to the bay area primarily for fishing in Grand Traverse Bay and who regarded fishing in the bay as a unique recreational experience amounted to an estimated \$418,501. In addition to the magnitude of this revenue flow, other aspects of the revenue of importance to the community are the temporal distribution of the revenue flow and the relative contributions of each type of fishing activity to the revenue flow.

Nonresident Sport Fishing Revenue

It is assumed that resident fishermen make no significant contribution to the revenue generated by sport fishing activity on Grand Traverse Bay. The expenditures associated with fishing on the bay made by resident fishermen would likely take place in the community even in the absence of the fishery resource, given the ample alternatives for fishing elsewhere in the bay area and the availability of other recreational facilities and activities. Therefore, if the spending of residents were to be allocated to some activity other than fishing in Grand Traverse Bay, no revenue would be lost to the community.

In contrast, nonresident fishermen, in the absence of the fishery resource in Grand Traverse Bay, might seek fishing or other recreational opportunities at locations outside the bay area. If this were so, the revenue flow from nonresident sport fishermen would be lost to the community. Thus, it is assumed that the revenue flow and the economic impact from sport fishing on Grand Traverse Bay stem entirely from the spending of nonresident fishermen.

Spending characteristics of nonresident fishermen* on a daily per person basis within each category of fishing activity were determined through interviews and questionnaires. Two-way analysis of variance indicated that, for each category of fishing, the expenditures of fishermen who stayed overnight in the bay area were significantly different from the expenditures of fishermen visiting the bay area on day trips. Further analysis showed that the spending by day-trip fishermen among summer-fall shore fishermen, ice fishermen, and spring shore fishermen could be combined. Total amounts spent by overnights among all categories of fishing activity were significantly different.

However, not all of the spending by sport anglers who fish in Grand Traverse Bay can be attributed to the existence of the fishery resource. Many visitors come to the bay area on multipurpose trips for which fishing may be only a small part of the planned activities or incidental to the primary purpose of the visit. Still other individuals come to the bay area with fishing as the primary purpose of the visit, but at the same time may be equally content to fish in nearby lakes or in Lake Michigan in lieu of fishing in Grand Traverse Bay. Obviously, the spending of these anglers cannot be entirely attributed to the Grand Traverse Bay fishery resource.

In determining the spending of nonresident anglers that could be directly attributed to the existence of the Grand Traverse Bay fishery resource, both the motivation behind the visit and the attitude of the anglers to fishing opportunities at alternative locations in the bay area were considered. Anglers indicating that the opportunity to fish in Grand Traverse Bay provided more than half of their motivation for visiting the bay area and who would not have visited the community in the absence of the bay fishery resource were termed "motivated anglers."

Motivated angler activity, based on the preceding criteria, was estimated as the product of fishing activity derived for day-trip and overnight

* Only expenditures made within the bay community are considered herein.

Table 6. Daily Per-Person Expenditures of Day-Trip and Overnight Fishermen Among the Categories of Fishing Activity*

Types of Fishermen	Category of Fishing Activity							
	Boat		Summer-Fall Shore		Ice		Spring Shore	
	\bar{x}	N	\bar{x}	N	\bar{x}	N	\bar{x}	N
Day-Trip	\$2.54 ± 32%	107	\$4.17 ± 19%	38	\$5.25 ± 15%	42	\$5.56 ± 15%	35
Grand Mean = \$5.02 ± 16% [†]								
Overnighters	\$12.40 ± 6%	152	\$9.36 ± 9%	64	\$21.42 ± 4%	19	\$14.48 ± 6%	80

* Expenditures of charter fishermen were not stratified. The daily per-person expenditure in this category was \$32.09 (±17 percent), not including the usual charter fee of \$25/person.

† Expenditures of day-trip fishermen among shore and ice fishermen were not significantly different, and therefore, these data were combined.

fishermen in each category of fishing (Table 5) and the percentage of motivated anglers among day-trip and overnight fishermen in each of these categories, as determined from interviews.

The spending of motivated anglers was calculated as the product of the motivated angler activity of day-trip and overnight fishermen in each category of fishing and the spending characteristic of day-trip and overnight anglers in each of these categories (Table 7). The total spending of motivated anglers is termed the revenue attributable to the Grand Traverse Bay fishery resource. Taken over all categories of fishing activity, it is estimated that the revenue attributable to the fishery resource was \$418,501 during the one-year period from May 1971 to May 1972.

Summary of Sport Fishing Revenue

The revenue attributable to the fishery resource represents the spending of fishermen who regard fishing in Grand Traverse Bay as a unique recreational experience for which there is no substitute in the bay area. Stated differently, the revenue attributable to the fishery resource is an estimate of the amount of gross income which might be lost to the bay community if the Grand Traverse Bay fishery resource were to suddenly disappear. Therefore, the revenue attributable to the fishery resource, and not the total spending of sport fishermen, is the appropriate measure of community income from which the economic impact of the Grand Traverse Bay sport fishery resource may be derived.

Boat fishermen contribute approximately one-half of the revenue attributable to the fishery resource (Table 7). Although numerically small in terms of fishing activity, charter fishermen, by virtue of their large daily spending (\$57.09), provided about 38 percent of the attributable revenue (Table 7). More than three-fourths of the annual revenue flow occurred during the warmer months of the year, when fishermen were most active.

Because fishermen on day trips are in the bay for a relatively short time, and because most required goods are purchased in home areas, the revenue accruing to the community from day-trip anglers is relatively

Table 7. Nonresident Sport Fishing Revenue Attributable to the Grand Traverse Bay Fishery Resource

Category of Fishing Activity	Attributable Revenue			Percentage by Category	Percentage from Overnighters
	Day-Trip	Overnight	Total		
Boat	\$28,662 (± 33%)	\$175,880 (± 15%)	\$204,542 (± 13%)	49	86
Charter*	\$38,902 (± 22%)	\$120,051 (± 13%)	\$158,953 (± 11%)	38	76
Summer-Fall Shore	\$3,448 (± 48%)	\$8,967 (± 40%)	\$12,415 (± 32%)	3	72
Ice	\$2,966 (± 60%)	\$35,285 (± 38%)	\$38,251 (± 36%)	9	92
Spring Shore	\$821 (± 50%)	\$3,519 (± 45%)	\$4,340 (± 38%)	1	81
Total	\$74,799 (± 17%)	\$343,702 (± 10%)	\$418,501 (± 9%)	100	82

* Expenditures of charter fishermen were not stratified; the revenues derived for day-trip and overnight charter fishermen were calculated as the product of motivated day-trip and overnight fishing activity and the mean daily expenditure of charter fishermen (\$32.09 plus the usual charter fee of \$25/day).

small compared with that available from overnigheters. Over all categories of fishing, revenue from overnigheters accounted for about 82 percent of the total attributable revenue accruing to the community.

ECONOMIC IMPACT OF THE GRAND TRAVERSE BAY SPORT FISHERY

From the viewpoint of the Grand Traverse Bay community, the economic impact of the fishery manifests itself as increased employment and income accruing to the bay-area community. Increased employment and income have their source in the economic activity generated in the community through the spending of nonresident sport fishermen whose expenditures are attributable to the fishery resource in Grand Traverse Bay. These benefits would not have accrued to the community in the absence of the bay fishery resource.

Estimates of fishing activity on the bay and the spending characteristics and motivation of anglers using the bay between May 1971 and May 1972 have been brought together to provide an estimate of the total revenue attributable to sport fishing on Grand Traverse Bay (\$418,501). In estimating the economic impact of the fishery resource, the revenue attributable to the fishery resource has been used as a starting point. The attributable revenue represents gross income accruing to the bay community. Because some large proportion of this income must be used to purchase goods and services originating outside of the bay area, the gross income estimate in itself does not serve as an appropriate index of economic impact.

Some necessary data on which estimates of economic impact were based could not be obtained either through local sources or in the form of published state and federal documents. In the absence of some of these data, pertinent values have been selected from reports on studies conducted elsewhere. Although literature values, where required, have been selected with care, the resulting economic impact estimates should not be rigidly interpreted, but are meant to convey only an approximation of the actual values.

Impact of Sport Fishing Revenue on Community Income

The gross income accruing to the Grand Traverse Bay community attributable to the fishery resource, as previously stated, has been estimated at \$418,501. In most cases, not all of the goods and services required by a small community can be produced within its confines. Therefore, a large

proportion of the gross income which the community receives must eventually leave the area as payment for imported goods and services. The income remaining after payment becomes salaries and wages to community workers; profits to area industries; interests; and rents.

Because almost all of the sales to fishermen occur in the retail trade and service industries, it follows that most of the direct income associated with the sport fishery must be some proportion of total sales to fishermen in these industries. For the bay area, a value of 30 percent, representing the proportion of total sales in retail and service industries accruing as direct income to the community, seems applicable.* Thus, \$135,550, 30 percent of the revenue attributable to fishermen (\$418,501), is an estimate of direct community income attributable to the fishery resource.

In addition to a direct effect on community income, the spending of sport fishermen also exerts a multiplying effect. Simply stated, additional money available in the community as income will induce an increase in spending. Money spent by one individual in the community becomes, in part, income to the person or business providing the goods or services purchased. Thus, successive rounds of re-spending exert a multiplying effect on community income. However, this effect is progressively reduced as some of the income is used to pay for goods and services imported by the community, and some is saved.

An income multiplier of 1.5 was selected as a reasonable value to be applied to the direct income attributable to the fishery resource. The use of this value is based on apparent similarities between economic profiles of Walworth County, Wisconsin, and Antrim, Grand Traverse, and Leelanau counties combined. The profiles are based on total sales in retail, wholesale, and service industries, value of sales in agriculture, and value added in manufacture as well as on the relative distribution of employment among

* An income component of sales of 28 percent has been estimated for Census District No. 2, B.C., Canada, by Pearse and Laub (1969), based on the value added in retail and service sales. In contrast, a value of 51 percent has been derived from information presented on the economy of Walworth County, Wisconsin, by Kalter and Lord (1968). Consistent with earlier estimates made in this report, a conservative value for the income component of sales has been selected.

these industries (using the 1967 Survey of Business, 1967 Survey of Manufacturers, and 1969 Survey of Agriculture as sources). Kalter and Lord (1968) have calculated an income multiplier of 1.52 for Walworth County. When the value of 1.5 is applied to the Grand Traverse Bay area community, the total community income attributable to the fishery resource approximates \$203,500.

Impact of Sport Fishing Revenue on Community Employment

As with income, the revenue accruing to the community from sport fishing has both a direct and multiplying effect on employment. The spending of sport fishermen provides the direct effect, as some employees are required to handle the sales generated by fishermen. The multiplying effect occurs as part of the spending of sport fishermen becomes income to community residents. As community income increases, so does community spending, and additional employment is required to handle the increased volume of sales. Of this, increases in employment directly associated with the charter fishing industry and with the Elmwood Township Facility has been separately identified and estimated using the following techniques.

As previously mentioned, an estimated 1,189 charter trips were made in Grand Traverse Bay during the 1971 fishing season. Assuming each trip was of 5 hours duration, as is the usual case, each trip would provide a total of 10 hours of employment (5 hours each for the skipper and mate). Pro-rated for motivated nonresidents (those whose trips are attributable to the fishery resource) and allowing 250 eight-hour working days in the year, full-time equivalent employment created in the charter fishing industry is estimated at 4.0 full-time equivalent jobs attributable to the fishery resource.

There were two caretakers at the Elmwood Township Facility, one on a full-time basis and the other in a part-time capacity. In total, it is estimated that 16 hours of work were accomplished at the Elmwood Township Facility during each day that it was open to fishermen. Assuming the labor force at the Facility worked a total of 16 hours per day for every day

when boat launching ticket sales were recorded (1½ days), pro-rating for motivated nonresident fishing originating there, and allowing 250 eight-hour working days in the year, the full-time equivalent employment at the Facility is estimated at 0.7 jobs attributable to the fishery resource.

Additional direct employment created in the community from sport fishing revenue can be estimated using the relationship between total sales and total employment in retail trade and service industries. In the Grand Traverse Bay community, an average of one individual is employed for every \$35,912 in sales in the retail and service industries (1967 Survey of Business).*

The revenue flow (sales in the community) from motivated nonresident anglers amounts to \$343,390 (less revenue to the charter fishing industry and to Elmwood Township, for which direct employment has been calculated). At the rate of one employee for each \$35,912 in retail and service sales, the equivalent of 9.6 full-time jobs were created by the revenue attributable to the fishery resource. Thus, in total, direct employment created by the spending of motivated sport fishermen is estimated at 14.3 full-time equivalent jobs which are attributable to the fishery resource.

As community income is increased, additional employment is required to handle the increased volume of sales. Thus, there is a community-wide increase in employment in addition to that directly generated by sport fishermen's spending. Again, an employment multiplier of 1.5 has been selected as indicative of the effect of bay sport fishing on total community employment. Thus, by applying this multiplier to the 14.3 full-time equivalent jobs directly created by sport fishing, an estimate of 21.5 jobs in the community is attributable to the Grand Traverse Bay fishery resource.

* Employment figures are given for March. Additional individuals are probably employed in the summer, and thus, the actual volume of sales per employee is probably less than \$35,912.

Summary of the Economic Impact of the Grand Traverse Bay Sport Fishery

The economic impact of the Grand Traverse Bay sport fishery has been estimated in terms of increased community income and employment stemming from the spending attributable to motivated nonresident anglers who fished in Grand Traverse Bay between May 1971 and May 1972. Because some of the basic economic data have been borrowed from the literature, results convey only an approximation of the economic impact of the fishery resource.

The spending of all nonresident anglers which could be attributed to the bay fishery resource provided an estimated \$418,000 of gross income to the community over the one-year period. Boat fishermen using public launching sites were the primary source of revenue. Charter fishermen, although small numerically, accounted for the second-largest flow of revenue to the community.

The economic impact of the fishery resource was measured in terms of income and employment generated by the spending of motivated nonresident sport fishermen. Total community income was increased by an estimated \$204,000 through the spending of these anglers.

Because of the seasonality of sport fishing, with most fishing activity occurring during the warmer months, maximum revenue flows, and subsequent increases in community income and employment also occur during this period. Employment attributable to the fishery resource has been estimated at 21.5 full-time equivalent jobs. Given the temporal distribution of revenue flow, it is likely that many more than 21.5 jobs are created in the community through the spending of fishermen, but the employment is seasonal and occurs mainly during the summer months.

Neither the revenue estimates nor the estimates of economic impact should be construed as representative of the total value of the Grand Traverse Bay sport fishery. On the one hand, the fishery has as yet unmeasured recreational value to its nonresident users; on the other hand, the value of the fishery to local residents, whether they engage in fishing or not, may far surpass the value estimated for it in terms of increased employment and income accruing to the community. Furthermore, the sport

fishery may have still other unquantified impacts. Colby (1971) has suggested that the first visitors to the bay area were sport fishermen and that their use of the fishery resource may have stimulated the creation of additional recreational facilities and activities. It is likely that the rebirth of sport fishing activity in the last decade has had a similar effect.

REFERENCES

- Colby, L., "Grand Traverse Bay in the Great Lakes Basin: A History of a Changing Area," MICHU-SG-71-205, Ann Arbor: Sea Grant Program, The University of Michigan, 1971.
- Jamsen, G.; Ryckman, J.; and Jamsen, F., "Michigan's 1969 Salmon and Trout Sport Fishery," R&D Report 203, Lansing: Michigan Department of Natural Resources, 1970. (See Appendices A-1, A-2, and A-3.)
- Kalter, R., and Lord, W., "Measurement of the Impact of Recreation Investments on a Local Economy," *American Journal of Agricultural Economics* 50(2):243-56 (1968).
- Northwestern Michigan Economic Development District Commission (NMEDDC), "Prologue for Accelerated Growth of the Economy, NMEDDC, 1968.
- Pearse, P., and Laub, M., "The Value of the Kootenay Lake Sport Fishery: An Economic Analysis," Victoria, B.C., Canada: Fish and Wildlife Branch, Department of Recreation and Conservation, 1969.
- US Bureau of Census, "Census of Agriculture, 1969," Vol. I, Area Reports; Part 13, Michigan; Section 2, County Data, Washington, D.C.: US Government Printing Office, 1972.
- _____, "Census of Business, 1967," Vol. II, Retail Trade--Area Statistics; Part 2, Iowa to North Carolina, Washington, D.C.: US Government Printing Office, 1970.
- _____, "Census of Business, 1967," Vol. V, Selected Services--Area Statistics; Part 2, Iowa to North Carolina, Washington, D.C.: US Government Printing Office, 1970.
- _____, "Census of Manufacturers, 1967," Vol. III, Area Statistics; Part 1, Alabama to Montana, Washington, D.C.: US Government Printing Office, 1971.
- _____, "Census of Population, 1970," Vol. I, Characteristics of the Population; Part A, Number of Inhabitants; Section 1, US, Alabama to Mississippi, Washington, D.C.: US Government Printing Office, 1972.
- Wells, L., and McLain, A., "Lake Michigan: Effects of Exploitation, Introductions, and Eutrophication on the Salmonid Community," *Journal of Fish Research Bulletin* (Canada) 29:889-98 (1972).

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