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## **Economic Impacts of Scuba Diving on New York's Great Lakes**

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### **Introduction**

The protection and use of underwater resources has become a major management issue worldwide. Davis and Tisdell (1996) suggest that the growing popularity of scuba diving has caused overcrowding and environmental damage to dive sites. Coral reef ecologists are concerned with damage caused by inexperienced divers, who disturb fragile reef environments by stirring up sediments, interacting with reef animals, breaking coral, and leaving litter (Fishman, 1991).

The issue of use versus preservation of underwater resources also exists on New York's Great Lakes. Specifically, two factors have contributed to a heightened interest in cultural resources: increased water clarity due to infestation of zebra mussels and pollution control programs, and passage of the 1987 Abandoned Shipwreck Act (White, 1998). Citizens, tourism professionals, management agencies and community developers concerned with the protection and use of underwater cultural resources in New York's Great Lakes have begun working together to develop policies regarding underwater cultural resources. Scuba divers play an important role in these efforts due to their close interaction with underwater resources and their potential for increasing economic impacts to local communities.

Recreational scuba diving is a rapidly growing component of the marine recreation and tourism industry. In 1991, Fishman reported that there were more than 4 million certified Scuba divers in the United States, and the number of divers was expected to increase worldwide by at least 10 million during the 1990s. By 1997, however, a consumer study commissioned by the Diving Equipment and Marketing Association found that at least 16 million Americans consider themselves to be active divers. This estimate was based on a Gallup Organization survey of more than 800 people in all 50 states. Even more astounding was that an additional 75 million Americans wanted to know more about diving, implying that 45 percent of the American population were either active Scuba divers or interested in the sport. Another study of 1,200 U.S. adults conducted by the Travel Industry Association of America determined that snorkeling/Scuba diving was second only to white water rafting as the most popular outdoor sport, based on number of trips taken in the last five years (PADI, 1998).

Another factor fueling growth in diving is the changing character of the market. Lurie (1998) claims

that women make up about 40 percent of new Scuba divers. Because anyone can participate, Scuba diving and snorkeling are among the country's fastest growing family activities. "In the past, recreational Scuba was viewed as an activity limited to young men who left their wives or children on the beach while they enjoyed the underwater sights. Today, everyone's getting in the water and they are enjoying it so much that they're coming back time and time again" (Young & Atkinson, 1997).

Cline Group Advertising reported that Scuba diving had grown to a \$2.6 billion industry (Forbes, 1996), with \$650 million spent per year on equipment and the rest divided among travel, lodging, dining, boat hiring and related expenses. They also determined that most divers rent their equipment from one of the 2,500 dive shops in the U.S. and that they dive an average of 2 to 3 times per year.

Industry sources suggest that diving sales in the northeast region of the U.S. lag behind those in the south and west; the northeast thus has tremendous potential for growth in the diving market. However, little information exists on the extent of diving in the northeast, or most other areas for that matter. Davis and Tisdell (1995) point out that there is considerable uncertainty about the extent of diving activity even for a major diving area like Queensland, Australia, home of the Great Barrier Reef.

Peterson et al. (1987) documented that, as early as the mid 1980s, there was a population of divers who actively seek Great Lakes dive locations. Their study found that Michigan scuba divers spent an average of \$1287 on all diving trips made during the 1986 season, with over half of this spending occurring in communities near the diving location. Two-thirds of the expenditures were for goods and services not directly related to the diving activity. This study also demonstrated some of the difficulties encountered in studying scuba divers, including obtaining a representative sample of divers who use a given resource and getting a good response rate from the diving community. Peterson et al. (1987) developed their profile of Great Lakes diving activity based on three sources of divers in Michigan (a previous diver survey and mailing lists from two dive shops). Their mail survey received a response rate of 36.4%.

Holecek and Lothrop (1980) surveyed Scuba divers residing in Michigan, Ohio and Indiana to determine their use of shipwrecks and other underwater resources. Their sampling frame was provided by a private firm and was based primarily on listings from the National Association of Underwater Instructors (NAUI). The authors acknowledged three potential sources of bias in their sample: over-representation of younger, recently certified divers; a large number of undeliverable surveys (21%); and non-respondents to the survey (49%). This study found evidence of both rapid growth in diving (indicated by a disproportionate number of new divers) and a high dropout rate among divers. Holecek and Lothrop's economic analysis focused on divers' total investment in diving equipment and their trip expenditures for all diving trips during the 1977 diving season. Results showed an average investment of \$600 in diving equipment and \$300 in trip expenses.

Vrana (1992) used a sample *Skin Diver* magazine subscribers from five regions in the eastern and central United States to survey divers who are familiar with cold water diving. His study focused on diving activity and experience levels, benefits sought through diving, attitudes towards various resource management considerations, and demographic characteristics. The mailing of 2,000 questionnaires

achieved a 41% response rate.

This paper examines the economic impacts of scuba diving on New York's Great Lakes (NYGL) in 1999. Analysis focuses on identification of the amounts of money divers spent in Great Lakes communities as well as elsewhere in New York and outside of the state. This analysis is part of a larger study conducted for the New York Sea Grant Institute whose objectives included: providing baseline and background data on the scuba diving industry in New York's Great Lakes region; estimating the economic impact of scuba diving on New York's Great Lakes; assessing trends that are affecting the scuba diving industry, including dive charter operations, dive shop owners, and dive clubs; identifying the barriers and constraints preventing, limiting, or causing people to cease participation in scuba diving; and testing the applicability of the theoretical models of specialization and amateur/professional development of recreation activity participation to scuba diving.

## Methods

Three methods of data collection were used (focus group interviews, a mail survey, and phone interviews). A total of six focus groups were conducted in key diving locations across the New York Great Lakes Region. Major themes of discussion were gleaned from the focus groups to aid in the development of a written questionnaire. The second method of data collection involved a mail survey with a sample of active and inactive New York State divers. A database of approximately 6,700 individuals was compiled from various sources, including a national certifying agency, a statewide organization, a dive symposium, a dive shop, a non-profit organization, and several dive clubs.

Addresses were stratified by major regions across the state (Figure 1). Emphasis was placed on contacting divers in the regions closest to the Great Lakes. A total of 2,850 surveys were mailed in October, 1999, followed by reminder postcards and a second mailing of the survey. The third method of data collection involved phone interviews of dive shop owners and dive charter boat operators within the state. Primary areas of discussion included perceptions of trends and changes in the dive market and industry, barriers and constraints for customers and businesses, and measures being taken to overcome these obstacles. Data for this paper were drawn primarily from the mail survey of divers.

Seventeen percent (490 surveys) of the surveys were returned as either undeliverable or having been sent to non-divers. As noted earlier, this relatively high undeliverable rate is not uncommon in diver surveys due to the unavailability of relevant and up to date mailing lists. Of the remaining 2,360 potential respondents, 869 usable questionnaires were returned, yielding a 37 percent response rate. A non-response bias check was conducted by telephone. Non-respondents did not differ significantly from respondents in age, gender, education level, number of years spent diving, or stage of development as a diver. However, significantly lower percentages of non-respondents were certified (76% vs. 95% of respondents) or active divers (48% vs. 69% of respondents).

Respondents were asked to report two categories of diving related expenditures: yearly expenses (items typically purchased on an occasional or periodic basis like equipment, insurance, instruction, etc.) and trip expenses (items typically bought on a daily basis while on a diving trip like air fills, meals and

lodging, fuel, etc.). For the yearly expenses, the average amount spent and percentage of divers spending something for each item were tabulated. Expenses were broken down by location of spending (Great Lakes region, NY state, outside of NY) and region of residence. Average spending profiles were extrapolated into population estimates based on an estimate of the proportion of divers within the population for each region. Diving trip expenses were handled in the same manner but also required screening out of trips outside of the Great Lakes region and extrapolating expenses for a single trip to the total number of trips to the Great Lakes region in the past year.

The accuracy of our results depends on two major factors: the sampling error associated with our survey data and the population estimate used for extrapolating individual diver profiles to the population of all divers. Relative to the former, spending estimates are based on samples of 474 upstate New York residents and 320 Great Lakes Region residents, which should yield margins of error of plus or minus 4 to 6 percent. Regarding the population estimate, there is no listing of relevant divers, nor even a simple value measuring the proportion of the population that dives in a given geographic area. The Diving Equipment and Marketing Association has several estimates for various segments of the diving market (e.g. 13.3% ever tried diving, 8% “active divers,” 3.8% certified divers, 2.7% went Scuba diving in the last 12 months). We used the 3.8% figure for certified divers as a conservative estimate of the population of potential Great Lakes divers. Ninety-five percent of our respondents reported that they were certified divers. In addition, 69 percent of the respondents had gone diving in the past twelve months, which closely approximates the ratio of the DEMA estimates for certified divers and those who reported diving within the previous year (71%).

## Results

**Annual Diving Expenses.** Yearly expenses for diving-related items were tabulated separately for active and inactive divers (Table 1). While inactive divers naturally spent less than active divers, they did report some diving expenditures. For example, even though someone may not have dived during the previous twelve months, they may have bought diving equipment or some other diving-related item or service. One-fifth of inactive divers (20%) reported at least one diving related expenditure during the previous year. They spent an average of \$69.31 for the year. Less than one-tenth of inactive divers reported spending money for any particular expense category. The most common expenses reported by inactive divers were for equipment purchases (8% of inactive divers, average amount spent \$46.74) and diving courses or workshops (5% of inactive divers, average amount spent \$12.34).

Active divers reported spending an average of \$939 for yearly diving expenses. More than two-thirds of this total was for equipment purchases (\$639.83). The next largest yearly expenses for active divers were for diving courses, workshops or seminars (\$124.11). The average spending estimates may appear low, but that is because they include many individuals who spent nothing for each item or category. In total, 84% of active divers reported spending something for at least one of the yearly expense categories. The most common individual category reported was equipment purchases, with 62% of active divers reporting some equipment purchase during the previous year.

Table 1. Yearly Spending Patterns of New York Divers.

	Active Divers (n=586)		Inactive Divers (n=258)	
	Percent of people spending some \$	Average amount spent	Percent of people spending some \$	Average amount spent
Equipment purchases	62%	\$639.83	8%	\$46.74
Equipment repairs	41%	\$49.25	5%	\$3.21
Tank inspections	50%	\$23.33	7%	\$2.19
Dive insurance	36%	\$30.76	5%	\$2.68
Dive maps, books, and magazines	40%	\$25.65	6%	\$2.06
Dive courses, workshops, seminars	30%	\$124.11	5%	\$12.34
Dive trade shows	11%	\$46.06	<1%	\$.08
Total	84%	\$939.00	20%	\$69.31

Survey data showed that divers living within the Great Lakes region and in upstate New York spent nearly \$50 million in the Great Lakes region during the previous year on diving related expenditures (Table 2). Most of this money (76% or \$35,521,544) was spent by divers living within the region. The remaining 24% (\$11,337,595) was spent in the Great Lakes region by residents of upstate New York (i. e. this money was imported from upstate New York into the Great Lakes region). We cannot estimate the amount spent by divers from the New York Atlantic region or from out of state because no divers from those areas reported spending money in the Great Lakes region on yearly diving expenses. We would expect this amount to be fairly small, as most divers would make these types of expenditures closer to home (as reflected by the lower amounts spent by upstate New Yorkers within the Great Lakes region).

More than \$34 million (73% of the total yearly diving expenses made within the NY Great Lakes region) was spent on equipment purchases in the Great Lakes region. The next largest category of expenditures was dive courses, workshops and seminars, followed by equipment repairs.

Table 2. Yearly Expenditures in Great Lakes Region, by region of residence.

	Region of Residence			
	Great Lakes Region (320)		Upstate New York (n=474)	
	Average amount spent per diver in the Great Lakes Region	Total spent by all divers living in region <sup>a</sup>	Average amount spent per diver in the Great Lakes Region	Total spent by all divers living in region <sup>b</sup>
Equipment purchases	\$266.37	\$25,940,709	\$48.15	\$8,417,968
Equipment repairs	30.78	2,997,541	4.93	861,902
Tank inspections	12.18	1,186,161	2.62	458,049
Dive insurance	5.34	520,041	0.72	125,876
Dive maps, books, and magazines	7.43	723,578	1.81	316,439
Dive courses, workshops, seminars	41.33	4,024,963	6.6	1,153,865
Dive trade shows	1.32	128,550	0.02	3,497
Total	\$364.75	\$35,521,544	\$64.85	\$11,337,595

<sup>a</sup> Total estimated by multiplying average spending per diver times 97,386 estimated divers living in the Great Lakes region (3.8% of the population)

<sup>b</sup> Total estimated by multiplying average spending per diver times 174,828 estimated divers living in the upstate New York region (3.8% of the population)

New York divers spent more money on yearly diving expenses in other parts of New York than in the Great Lakes region (Table 3). Great Lakes region divers spent an average of \$60.65 in the remainder of the state, compared to the \$364.75 they spent in the Great Lakes region for yearly expenses. But upstate New York divers spent an average of \$250.34 in the remainder of the state, versus \$64.85 in the Great Lakes region. In total, nearly \$50 million was spent for yearly diving expenses in the state of New York (but outside of the Great Lakes region) by residents of upstate New York and the Great Lakes region. Most of this money (88%) was spent by residents of upstate New York, with the remaining 12 percent contributed by divers living in the Great Lakes region. Again, these estimates do not include any spending by divers living in the NY Atlantic region due to the small number of divers from this region in our sample. Unlike the amount spent by NY Atlantic divers in the Great Lakes region, the amount spent by these divers in the state of New York could be substantial, given the large population of this area (i.e. New York City).

Taken together, Tables 2 and 3 demonstrate that divers are most likely to make their yearly diving-related purchases in the region in which they live. Divers living in the Great Lakes region spent over \$35 million in their region, compared to only \$6 million in the rest of New York state. Conversely, those living in the upstate New York region spent \$11 million in the Great Lakes region compared to \$44 million in the rest of the state.

Table 3. Yearly Expenditures in New York State (excluding Great Lakes Region), by region of residence.

	Region of Residence			
	Great Lakes Region (320)		Upstate New York (n=474)	
	Average amount spent per diver in New York	Total spent by all divers living in region <sup>a</sup>	Average amount spent per diver in New York	Total spent by all divers living in region <sup>b</sup>
Equipment purchases	\$48.44	\$4,717,377	\$190.39	\$33,285,502
Equipment repairs	3.91	380,779	14.19	2,480,809
Tank inspections	1.9	185,033	7.71	1,347,924
Dive insurance	0.08	7,791	3.35	585,674
Dive maps, books, and magazines	0.54	52,588	5.63	984,282
Dive courses, workshops, seminars	5.47	532,701	26.84	4,692,384
Dive trade shows	0.31	30,190	2.23	389,866
Total	\$60.65	\$5,906,460	\$250.34	\$43,766,441

<sup>a</sup> Total estimated by multiplying average spending per diver times 97,386 estimated divers living in the Great Lakes region

(3.8% of the population)

<sup>b</sup> Total estimated by multiplying average spending per diver times 174,828 estimated divers living in the upstate New York region (3.8% of the population)

New York divers also spend a lot of money out of state on yearly diving expenses (Table 4). Again, equipment purchases was the number one expenditure category, followed by dive courses and trade shows. It is notable that divers from both the NYGL region and upstate New York were more likely to buy dive insurance through an out of state provider than through a New York based company. Not surprisingly, sampled divers were least likely to pay for tank inspections and equipment repairs out of state.

Table 4. Yearly Expenditures outside of New York State, by region of residence.

	Region of Residence			
	Great Lakes Region (320)		Upstate New York (n=474)	
	Average amount spent per diver outside of New York	Total spent by all divers living in region <sup>a</sup>	Average amount spent per diver outside of New York	Total spent by all divers living in region <sup>b</sup>
Equipment purchases	\$115.05	\$11,204,259	\$68.85	\$12,036,907
Equipment repairs	2.87	279,498	0.38	66,435
Tank inspections	0.42	40,902	0.21	36,714
Dive insurance	11.55	1,124,808	6.25	1,092,675
Dive maps, books, and magazines	6.22	605,741	2.83	494,763
Dive courses, workshops, seminars	21.67	2,110,355	12.55	2,194,091
Dive trade shows	15.88	1,546,490	18.41	3,218,583
Total	\$173.66	\$16,912,053	\$109.48	\$19,140,169

<sup>a</sup> Total estimated by multiplying average spending per diver times 97,386 estimated divers living in the Great Lakes region (3.8% of the population)

<sup>b</sup> Total estimated by multiplying average spending per diver times 174,828 estimated divers living in the upstate New York region (3.8% of the population)

In sum, New York divers spent over \$130 million on yearly diving-related purchases during the previous year (Table 5). Over two-thirds (73%) of this money was spent in New York state, with the remaining 27% spent outside of the state of New York. Of the \$58 million spent by divers living within the NY Great Lakes region, 61 percent (\$36 million) was spent in the Great Lakes region. An additional \$6 million was spent elsewhere in New York and nearly \$17 million was spent out of state by divers from the Great Lakes region.

Divers residing in upstate New York spent almost \$75 million on diving related expenses. Only about 15 percent of this total (\$11,337,595) was spent in the Great Lakes region. Most of the dollars spent by upstate New Yorkers were spent in New York State but not in the Great Lakes region. One-fourth of the money spent by this group (\$19 million) was spent out of state.

Table 5. Summary of Yearly Diving-related Expenses, by location of spending and region of residence

Location of Spending	Region of Residence		
	Great Lakes Region	Upstate New York	Total
Great Lakes Region	\$35,521,544	\$11,337,595	\$46,859,139
Elsewhere in New York	\$5,906,460	\$43,766,441	\$49,672,901
Out of State	\$16,912,053	\$19,140,169	\$36,052,222
Total	\$58,340,057	\$74,244,205	\$132,584,262

**Diving Trip Expenditures.** Diving trip expenditures were estimated by using data on the costs associated with the last diving trip made to the Great Lakes region and the reported number of diving trips to the NYGL region during the previous year. Spending was considered only for those divers who reported making trips to the NYGL region. About half (165 of 320) of the divers living within this region reported at least one diving trip to the New York Great Lakes. About one-fourth (125 of 474) of those living in upstate New York reported diving in New York's Great Lakes. The average number of diving trips reported was 10.3 for residents of the region and 2.5 for residents of upstate New York (these averages include those reporting zero trips). The average number of trips among those who made at least one trip to New York's Great Lakes was 20.0 and 9.5 for NYGL region residents and upstate New Yorkers, respectively.

Total individual trip expenditures were estimated by multiplying the most recent trip expenses by the number of trips reported by each respondent. These totals were then expanded from the sample of divers to the overall population of divers living within the regions (Table 6). Results showed that divers living within the Great Lakes region and in upstate New York spent about \$61 million on diving trips to the Great Lakes during the previous year (1999). This is somewhat greater than the amount spent by these divers on yearly diving expenses (\$47 million) reported earlier. As in the case of the yearly expenses, most of the trip expenses (72% or \$43,767,216) were made by divers living within the region. The remaining 28% (\$17,435,596) was spent by residents of upstate New York on diving trips to the Great Lakes region (i.e. this money was imported from upstate New York into the Great Lakes region). Economic sectors impacted most by diving trip expenditures were fuel (gas and oil for both boats and automobiles), restaurants and lodging. Very few diving trips to the Great Lakes were reported by respondents living in the NY Atlantic region or outside of New York. Hence, we cannot estimate the amount of money generated from diving trips originating from these areas.

Table 6. Annual Trip Expenditures in Great Lakes Region, by region of residence.

	Region of Residence			
	Great Lakes Region (320)		Upstate New York (n=474)	
Type of purchase	Average amount spent for diving trips in the Great Lakes Region	Total spent by all divers living in region <sup>a</sup>	Average amount spent for diving trips in the Great Lakes Region	Total spent by all divers living in region <sup>b</sup>
Equipment rental	\$3.07	\$298,975	\$0.57	\$99,652
Air fills	44.67	4,350,233	7.81	1,365,407
Gas/oil for boat	108.40	10,556,642	15.32	2,678,365



Launching fees for boat	12.86	1,252,384	2.76	482,525
Entrance fees	0.84	81,804	0.45	78,673
Charter boat fees	51.29	4,994,928	6.13	1,071,696
Gas for automobile	82.51	8,035,319	20.02	3,500,057
Lodging/overnight fees	31.47	3,064,737	10.30	1,800,728
Restaurant meals	56.58	5,510,100	22.18	3,877,685
Groceries, ice and beverages	55.64	5,418,557	13.75	2,403,885
Other	2.09	203,537	0.44	76,924
Total	449.42	43,767,216	99.73	17,435,596

<sup>a</sup> Total estimated by multiplying average spending per diver times 97,386 estimated divers living in the Great Lakes region (3.8% of the population)

<sup>b</sup> Total estimated by multiplying average spending per diver times 174,828 estimated divers living in the upstate New York region (3.8% of the population)

## Discussion

The economic impact of diving in the NYGL region depends more on diving trip expenses (\$61 million) than on annual diving expenses (\$47 million). The majority of the impact is from residents of the region, although a sizable amount comes from those living in upstate New York. Divers living in the Great Lakes region spent almost even amounts within the region for diving trips (\$44 million) and annual diving expenses (\$47 million). Those traveling to the Great Lakes from upstate New York spent more within the Great Lakes region on diving trips (\$17 million) than on annual diving expenses (\$11 million).

Conversely, the total economic impact of diving on the state of New York depends more on annual expenses than on diving trip expenses. The majority of this impact occurs outside of the Great Lakes region and is attributable to the larger populations outside of this region and the tendency of divers to make their yearly purchases closer to home.

It is important to remember that the numbers presented here are estimates, albeit the best estimates we can make from the database. The most significant limitation is the omission of spending and associated impacts from New York City and out of state divers. The small number of divers in our sample who live in the New York Atlantic region (n=38) preclude accurate statistical estimates but do provide some insight into the potential impact of this group. Generally these divers spent more on annual diving expenses than their counterparts from upstate New York and the Great Lakes region. The majority of their annual expenses were made within New York State, but most of their diving trips were out of state (primarily out of the United States). This spending pattern, coupled with the large population living in this region (total population = 11,032,027, accounting for 419, 217 potential divers @ 3.8 percent of the population), suggests that the economic impact of these divers could be substantial. Most of this impact would be within the annual expense categories and would be money spent in the state of New York. Relatively little of this spending would impact the Great Lakes region, as these divers are unlikely to make diving trips or annual diving expenditures in the Great Lakes region.

Divers from other states also undoubtedly spend some money for diving related goods and services

within New York. Again, it is not possible to estimate the amount of this economic impact because of the small number of out of state divers within the sample.

It is also important to note that the spending patterns reported in this paper represent only the direct expenditures of divers and do not include any multiplier effects of these initial expenditures within the economy. Additional analysis of the indirect and induced impacts associated with the direct diver expenditures is currently underway.

Thanks Steve, Can I ask for one additional favor. Would you please add the following acknowledgment to the sponsor of our paper:

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