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# LAKE ONTARIO FISHING AND FISH CONSUMPTION

by

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## INTRODUCTION

Estimates of fishing effort and fish consumption are used by fishery managers and environmental protection and health professionals when they make management decisions regarding fishery resources and evaluate the adherence of anglers and fish consumers to fish consumption advisory recommendations. Most past studies of Lake Ontario anglers designed to obtain these estimates asked them to recall their effort and consumption over a 12-month period (Brown 1975; Kretser and Klatt 1981; Connelly et al. 1990, 1993; Connelly and Knuth 1993). For this study, a representative group of Lake Ontario anglers used a diary method providing detailed information on each Lake Ontario fishing trip and each fish meal consumed. The results obtained from the 1992 diaries were compared with those from a 1991 mail survey sent to the same anglers.

This study evaluates adherence to the 1991-1992 NYS Department of Health fish consumption health advisory recommending that anglers limit their consumption of certain fish from Lake Ontario, and women of childbearing age consume no fish from Lake Ontario. Decreases in fish consumption resulting from following the health advisory, and the level of use of risk-reducing fish preparation methods by anglers preparing sport-caught fish for consumption were also studied. For the purposes of this study, and to conform with the then-current health advisory, Lake Ontario was defined as the lake itself and all tributaries up to the first barrier impassable to fish. The definition did not include the St. Lawrence River, but did include the lower Niagara River.

## METHODS

To target Lake Ontario anglers, a sample of 2,500 names was drawn from 1990-1991 New York fishing license records for licenses purchased in six counties bordering Lake Ontario (i.e., Cayuga, Monroe, Niagara, Orleans, Oswego, and Wayne), which included resident and nonresident fishing license buyers. To identify the anglers interested in participating in the study, personalized letters with a postage-paid return postcard were mailed to them, followed by phone calls to nonrespondents. From the initial sample

of 2,500 fishing license buyers, 1,202 were willing to participate in the study and intended to fish Lake Ontario in 1992. Of these, 53% were New York State residents and 47% were nonresidents.

Participants were mailed a self-administered questionnaire asking for the 12-month recall of their 1991 fishing trips and fish consumption, use of various fish preparation and cooking techniques for sport-caught fish, and socio-demographic characteristics. They received a diary in early January 1992 for keeping a record of fish consumption and fishing trips to Lake Ontario for the entire year. For each day spent fishing on Lake Ontario, participants were asked to record the location fished, at-site and enroute expenditures, and information about each fish caught (i.e., species, length, and whether it was released, eaten, kept but not eaten, or given away). For each fish meal consumed, participants were asked to record the species of fish eaten, meal size, method by which fish was acquired (sport-caught or purchased at a restaurant or grocery store), fish preparation and cooking techniques used, and the number of other household members eating the meal.

Diary participants were contacted by telephone following every three-month period during the diary year (April, July, and October, 1992, and January, 1993) to retrieve information recorded in the diary and to check on the progress, accuracy, and completeness of the responses. During the final phone contact in January 1993, participants were asked to compare their fishing efforts in 1992 (the diary year) with their efforts in 1991 (the 12-month, recall-questionnaire year). Participants were also asked if they were aware of the Lake Ontario health advisory, if they felt they followed its recommendations during the diary year, and to estimate if and to what extent the health advisory had reduced their consumption of Lake Ontario fish. Participants were provided with a postage-paid envelope to return their diaries after this last phone conversation.

## RESULTS AND DISCUSSION

Of those 1,202 anglers who agreed to participate in the diary project, 69% returned the 1991 mail questionnaire. Although a higher percentage agreed to keep a diary of their fishing activity, in January 1993, at the end of the diary year, only 516 people (43% of the original sample sent diaries) remained active.

### Fishing Effort

From diary-based information, anglers who fished Lake Ontario in 1992 fished the Lake an average of  $4.0 \pm 0.4$  days. Respondents whose data could be matched between the 1991 mail questionnaire and 1992 diary were compared. All respondents said they fished Lake Ontario in 1991, while only 68% said they did so in 1992. The mean days fishing (including those who did not fish in 1992) was significantly different between 1991 ( $10.7 \pm 1.4$  days) and 1992 ( $4.6 \pm 0.6$  days). This represents a decline of 57%. The decline in fishing on Lake Ontario in 1992 came out in the final phone interviews where 62.5% of respondents said they thought they fished less in 1992 than in 1991. Data from the New York State Department of Environmental Conservation (NYSDEC) fishing boat census showing a decline of 23.8% in boat angler trips between 1992 and 1991 corroborates the decline (Eckert 1993). This decline could be attributed to several factors, including errors in memory recall and/or inclement weather during the 1992 fishing season.

Fishing effort differed by age, with older anglers fishing more often than younger anglers (Table 1).

There were no statistically significant differences for other socio-demographic characteristics, but there was a tendency for those with higher levels of education and income to fish more frequently.

## Fishing-related Expenditures

Anglers spent an average of \$17 per day getting to Lake Ontario and \$43 while at the fishing site (Table 2). These expenditures include gas, food, and lodging as well as fishing-related supplies. Out-of-state residents spent three to seven times more than New York State residents (Table 2). There were no significant differences between the 1992 and 1991 estimates for mean daily expenditures.

## Catch Rates

In 1992, no fish were caught by Lake Ontario anglers on 36% of the days spent fishing. This is consistent with NYSDEC fishing boat census data for 1992, which found that zero-catch days ranged from 21% to 50% depending on species sought (Eckert 1993). No significant difference was found between Lake Ontario catch rates for the 1992 diary ( $2.8 \pm 0.6$  fish/day) and the 1991 mail questionnaire ( $3.1 \pm 0.6$  fish/day).

## Fish Consumption

Based on the diary data, anglers who fished Lake Ontario in 1992 consumed an average of  $30.3 \pm 2.3$  fish meals in 1992, of which 28% were sport-caught. Factoring in meal size, Lake Ontario anglers consumed an estimated 17.9 grams/day of fish. Monthly variation in fish consumption existed, with the highest consumption in the spring and the lowest in late fall (Figure 1). Highest overall consumption occurred in April, which corresponds with the Lenten season. Although sport-caught fish were consumed in greater quantities as a percentage of total fish consumption from late spring to early fall, anglers ate sport-caught fish year-round. Among 1992 Lake Ontario anglers, fish consumption was higher for older anglers, women, out-of-state anglers, and those living in small cities (compared with large urban areas; Table 1). No statistically significant differences were found for income or education.

The fish consumption estimate was higher for 1991 (41.6 meals/year) than for 1992 (30.3 meals/year). A decline in fishing along Lake Ontario in 1992 (Eckert 1993) may have contributed to the comparatively lower fish consumption estimate in 1992. Consumption estimates between the 1991 and 1992 portions of this study differed by 47% for sport-caught meals, compared with a 10% difference for non-sport-caught meals. Non-sport-caught fish consumption might not be as greatly affected by a decline in fishing (Connelly and Brown [in review]).

## Use of Risk-reducing Preparation and Cooking Techniques

Trimming fat from fish, removing the skin before cooking, and grilling, broiling, and baking fish have been suggested in health advisory recommendations and other public educational/outreach efforts as methods of reducing consumption of contaminants (e.g., PCBs) that accumulate in higher concentrations in fish fat. Most fish meals (78-79%) were prepared by Lake Ontario anglers using risk-reducing **cleaning** techniques, and many anglers (48-58%) used these techniques for every sport-caught meal they consumed. Risk-reducing **cooking** methods, however, were used for less than half of all sport-caught

meals, and few anglers (16%) used these methods for all sport-caught meals they prepared. Even fewer anglers (8%) used all possible risk-reducing techniques (removing skin, trimming fat, cooking so fats are drained) for all sport-caught fish meals.

## **Adherence to the Health Advisory**

Virtually all diary participants (>95%) who fished Lake Ontario in 1992 said they were familiar with the then-current New York State Department of Health fish consumption health advisory. The general advisory recommended that anglers limit their total sportfish consumption to 52 meals/year; only 2% of 1992 Lake Ontario angler diary participants who consumed sport-caught fish ate more than this amount. However, 36% of 1992 Lake Ontario anglers consumed fish in excess of the species-specific limits recommended for Lake Ontario. Fourteen percent of anglers ate fish from Lake Ontario within the limits recommended in the advisory. The remaining 50% did not consume any fish from Lake Ontario in 1992. Among diary participants, older respondents were more likely to consume more than the recommended limit, while participants from out-of-state were four times as likely to consume more than the limit as New York State residents.

Those who did not keep their consumption within the limits had two primary reasons for not doing so: because they did not believe the health advisory or because they felt their consumption was well within the limits. When asked if they believed their consumption was within the limits, a startling 90% of those who actually consumed more than the limit said they believed their consumption was within the recommended limits in 1992. Anglers who ate in excess of the recommended limit of fish meals were far more likely to use risk-reducing cleaning and cooking techniques when preparing sport-caught fish meals than those who ate no Lake Ontario fish or who ate within the recommended limits. These anglers may believe that by using risk-reducing cleaning techniques they have decreased their risk enough so that increased consumption of listed species is acceptable.

## **Fish Consumption Reduction**

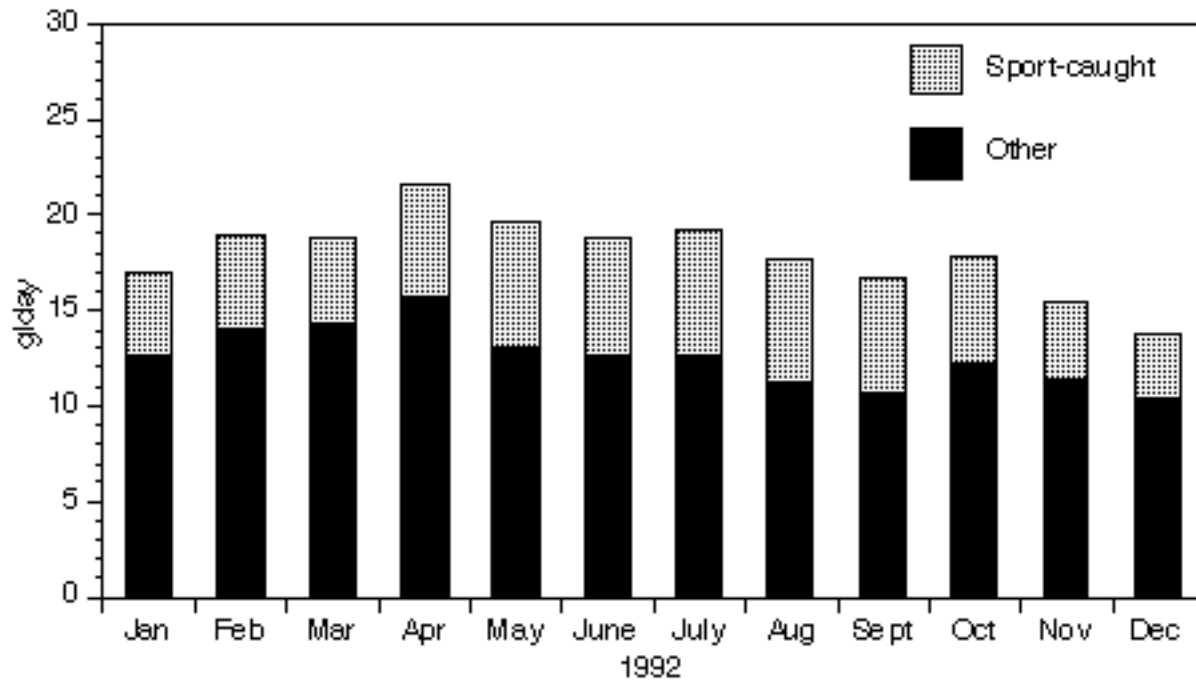
Among diary participants who fished Lake Ontario in 1992, 32% said they would eat more fish if health advisories did not exist. Of these anglers, 73% said they would eat slightly more than what they currently consume (e.g., those who eat no fish now said they would eat one or two meals per year or one per month if health advisories did not exist); 6% of anglers already consume more than what they said they would consume if there was no health advisory; and the remaining 21% said they would greatly increase their consumption (e.g., people who eat no fish now said they would eat one meal per week or more than one meal per week). Thus, a reduction in fish consumption due to the health advisory does exist .

### **CONCLUSION**

Anglers fished Lake Ontario less frequently in 1992 than in 1991 but spent the same amount of money per day on fishing and trip-related expenditures. Older anglers fished more frequently than younger anglers, while other socio-demographic differences were not statistically significant.

Health advisory awareness was high among diary participants (>95%), but compliance was not universal. Increased communication of health advisory information is recommended to increase anglers' knowledge of the risks and recommendations. Clarification of how risk is calculated and whether it assumes the use of risk-reducing cleaning techniques by anglers should also be included in the health advisory. In general, health advisory communication efforts need to address this lack of "compliance," especially in

light of our finding that most of these people (90%) believe that their consumption is currently within the limits recommended in the advisory.



**Figure 1.** Proportion of fish meals each month that were sport-caught versus acquisition by other methods (e.g., bought at a grocery store or restaurant) for 1992 Lake Ontario diary participants, expressed in g/day. The percentages of sport-caught fish meals each month are included.

**Table 1.** Mean days fished in 1992 on Lake Ontario and annual fish consumption by 1992 Lake Ontario anglers overall and by socio-demographic characteristics.

**Overall:** 4.0 mean days fished, 17.9 g/day fish consumed annually

**Socio-demographic characteristics**

**Sex**

Male: 4.6, 17.9

Female: 3.4, 23.2

**State of residence**

New York State: 4.0, 15.6

Out-of-state: 4.0, 20.3

**Residence area**

Rural: 4.4, 17.6

Small city: 4.6, 20.8

City of 25,000 - 100,000: 5.0, 19.8

Large city > 100,000: 3.9, 13.1

### **Income**

Less than or equal to \$20,000: 3.2, 20.5

\$21,000 - 34,000: 3.4, 17.5

\$35,000 - 50,000: 4.7, 16.5

Greater than or equal to \$51,000: 5.0, 20.7

### **Age**

< 30: 3.1, 13.0

30 - 39: 3.7, 16.6

40 - 49: 5.1, 18.6

50+: 5.1, 21.9

### **Education**

< High school: 3.8, 17.3

Graduated high school: 3.7, 17.8

Some college: 4.7, 18.8

Graduated college: 5.6, 17.4

Some post graduate: 4.9, 20.5

**Table 2.** Mean per day expenditures for 1992 Lake Ontario diary participants (95% confidence interval).

### **Lake Ontario and tributaries**

At-site: \$43.24 ( $\pm$  \$8.80)

Enroute: \$17.00 ( $\pm$  \$2.90)

Total: \$60.17 ( $\pm$  \$10.40)

### **New York State residents**

At-site: 11.19 ( $\pm$  3.86)

Enroute: 8.99 ( $\pm$  3.40)

Total: 20.17 ( $\pm$  5.30)

**Out-of-state-residents**

At-site: 75.07 ( $\pm$  15.42)

Enroute: 25.06 ( $\pm$  4.32)

Total: 100.44 ( $\pm$  17.86)

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