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EXECUTIVE SUMMARY

Introduction

The study had two primary objectives: (1) to identify fish consumption health advisory awareness, understanding, and related behaviors among families whose youth participate in **SAREP** (Sportfishing and Aquatic Resources Education Programs) in upstate New York; and (2) to evaluate the extent to which youth adhere to fish consumption advisory recommendations, including the extent of fish consumption.

Methods

We contacted 210 **SAREP** instructors in central and western New York by telephone to determine if they had an on-going **SAREP** youth group, and if **so**, to obtain the names and addresses of families involved in the group. We sent a mail questionnaire to 123 families to determine family awareness and knowledge of the health advisory and to obtain parental permission for children ages 8 to 14 to participate in the children's diary portion of the study.

We sent diaries to 53 children for whom we had parental permission. Children were asked to record their fishing and fish consumption between July 1 and Oct. 15, 1996. Children were contacted five times by telephone during the study period to obtain information being recorded in the diary and encourage their participation in the project. Children returned their diaries at the end of the study period and were sent thank **you gifts**.

Key Results

- Of the 53 children who were sent diaries in June 1996, all provided some information **on** their fishing activities during the study period and 52 provided information **on** their fish consumption.
- The diary data showed that children consumed an average of 4.8 fish meals from all sources during the diary period (July 1 - ~~Oct.~~ 15, 1996). If meal size was factored in, an estimated 6.6 g/d of fish **from** all sources was consumed by children during the diary period. Of this 29% (1.9 g/d) was sport-caught fish and 38% (2.5 g/d) was canned tuna.
- Estimates of annual daily consumption based on **diary** data were lower **than** during the diary **period** (4.2 g/d versus 6.6 g/d). We assumed that daily consumption during the part of the year not covered by the diary was equal to the daily consumption of nonsport-caught fish in the last **month** of the diary, when sportfishing participation and catch were lowest.
- **Almost** all families (87%) whose children participated in the diary portion of the study said they were aware of the New York State fish consumption advisory.

- During the diary time period, 8% of children consumed fish from waters where the advisory recommended no consumption for children under **15** years old. This represents 3% of all ~~meals~~ consumed by **all** the children we studied.
- The majority of fishing effort occurred during the summer months, when the children were not in school. Average fishing effort in July ranged between 1.5 weeks to once every two weeks. In the fall, average fishing effort was less than once a month.
- Children were generally not fishing the major waterbodies of New York State; the majority of waters fished were ponds or small lakes.
- ~~On most~~ days (71%), children caught fish. The ~~most~~ commonly caught fish were panfish.

Discussion and Implications

- Risk communication: Although advisory awareness was **high**, knowledge of specific advice for women of childbearing age and children was lower. More **risk** communication effort could focus on highlighting information important to certain subgroups (e.g., families with children). The greatest knowledge was associated with use of multiple information sources. Risk communicators could attempt to reach at-risk audiences through multiple channels to maximize the impact of their message. Risk communicators may be able to extend their own efforts by working through “information gatekeepers” such as **SAREP, 4-H, Scout**, and other youth group leaders to inform children and their families about safe fish consumption.
- **Risk** communication: Because children tend to fish smaller, local waters that may not be part of a water quality monitoring program, risk communicators should consider providing information in advisories about what to look for in local waterbodies to help an individual judge the potential for that waterbody to be contaminated.
- Risk assessment: Risk assessors and water quality managers should consider the findings that children tend to **fish** and eat fish from smaller, local waters. This information may help **assess** the extent to which current water quality monitoring programs are sufficient, or if any shift in priorities may be desirable, given resource limitations. **Risk** assessors concerned with potential mercury exposure should note that canned tuna was the most frequently consumed fish, although overall consumption was relatively low (mean **2.5** g/d; highest individual consumption during the study **period**, 10.8 g/d).
- Fisheries management: One focus of fishery management efforts might be to enhance children’s awareness of and access to waterbodies that may provide easily catchable **fish**, particularly panfish. Children tended to use small waterbodies such as ponds and **small** lakes. Providing access for children to these types of waterbodies might be a focus of management efforts. Advertising where these areas are may raise awareness for children and their fishing partners.

- **Use** of diaries ~~with~~ children: Diaries appear to be **a** useful method for collecting fishing activity information from children. After cooperation by the family was **secured**, participation rates by children far exceeded those found for adults in other diary **studies**. The ~~most~~ important **need** for future diary studies with children is finding **a** more cost-effective method of obtaining a representative Sample of children **who fish**.
- Future research needs: Further work is needed ~~with~~ **a** larger, more diverse audience of children, particularly to estimate **fish** consumption in urban areas where local waters may be more affected **by** contaminants. In addition, **annual** estimates based on year-round data collection would be useful.

SECTION I:

INTRODUCTION

The New York fish consumption health advisory, prepared by the Department of Health, recommends that women of childbearing age and children under the age of **15** should not eat any fish caught from the waters listed in the advisory. Many of these waters are within the Great Lakes Basin. It is **unknown** to what extent children (and their families) are aware of this recommendation and follow it. Therefore, we proposed a study to **assess** the extent to which a subset of upstate New York families and children were aware of and adhered to these specific guidelines, focusing on families and children most likely to be engaged in sportfishing. The specific objectives of the study were to:

1. Identify fish consumption health advisory awareness, understanding, and related behaviors (fishing, fish preparation, fish consumption), among families whose youth participate in Sportfishing and Aquatic Resources Education **Programs** (SAREP) focusing on the Lake Ontario watershed.
2. Evaluate the extent to which youth adhere to fish consumption advisory recommendations, including analyzing what types of fish are caught from which locations, the types of fish preparation methods used, and the extent of fish consumption, focusing on fishing and fish consumption during the summer months.

Use of SAREP Resources

The SAREP program offered an accessible means of contacting youth, particularly those ~~most~~ likely to engage in fishing and fish consumption. SAREP is a cooperative federal, state, and local initiative designed to involve youth in fishing, and to use their interest in fishing to encourage development of an understanding of aquatic ecology, an appreciation of the role anglers play in preserving aquatic habitats, and a commitment to fishing ethically, safely, and responsibly. SAREP volunteers are encouraged to form *small* groups or clubs of youth that meet regularly and focus their activities around fishing. For this **first** major study in New York focusing on fish consumption and health advisory awareness among youth, we felt that working through the SAREP program would be advantageous for several reasons. First, we would be able to reach youth with a demonstrated interest in fishing. Second, we hoped that the connection between SAREP instructors and youth in their groups could be used to encourage participation by youth over the course of the study.

Report Organization

This report is divided into three major sections. The first section contains the introduction and a discussion of the study area, basic study design, and results of interviews with SAREP instructors.

The next two sections are **journal** articles we have prepared for submission to a peer-reviewed journal. The first deals with children's fish consumption; the second with children's

fishing and the use of diaries **as** a method to collect such information. Readers should note that the method **sections** of both articles are similar, but the introduction, findings, and conclusions **are** different. Recommendations for health and fisheries management agencies and for future research are included in the second and third sections.

Study Area

The study area covered all New York counties within the Lake Ontario basin. A few additional counties were added to **this** central and western New York area because they were within a 90 mile radius of Lake Ontario. Seventy-five percent of **all** New York resident angler trips to Lake Ontario in 1988 originated from within **this radius**. We believed it was likely that children fishing within **this** slightly larger area might **fish** the Great **Lakes** and tributaries. All counties to the west of a line drawn from and including St. Lawrence County south to Broome County were included in the study area. The area is primarily **rural** with several **urban** centers (Buffalo, Rochester, and Syracuse).

Study Design

The design strategy for this study was to contact **all** SAREP instructors in the study area to determine if they were involved with an on-going youth group. If **so**, we would gather the names of families involved in the groups from the **instructors** and send the families a mail questionnaire asking about family fishing, fish consumption, and health advisory awareness. In the questionnaire, we would ask parents' permission for their children ages 8 to 14 to participate in keeping a diary of their fishing and fish consumption between July 1 and Oct. **15** 1996. We would send the children diaries in late June and then contact them by telephone five times over the diary period to encourage their participation and obtain information recorded in the diary. At the end of the diary period we would collect **all** the diaries and send the children a thank you gift.

Contacting SAREP Instructors:

Of the **210** SAREP instructors in central and western New York (the study area), we contacted 149 by telephone in March 1996. We attempted contact with each instructor up to seven times. We left messages asking those we could not reach to **call** us collect. Of the 149 instructors contacted, 32 **had** on-going SAREP youth groups. Twelve instructors indicated they might start a group before the summer diary portion of the study.

Obtaining Names and Addresses of Families:

During the telephone interview, we requested **instructors** with on-going groups send us the names and addresses of families in their group. We followed the telephone interviews with letters to the instructors requesting the names. If instructors did not send in the **list** of names, we contacted them by telephone **three** times during the month of April to remind them. One of these contacts was made by the Director of the SAREP program (Matthews). We received **lists** from 16 instructors. Of the 12 instructors who said they might start a group before the summer, we found two that did start groups, but we were not able to obtain lists of families from those

instructors. We obtained ~~lists~~ of family names from **16** of the **34** SAREP groups (**47%**) active in central and western New York at the time of the study.

Background on SAREP Groups:

To gain an initial understanding of children who participate in SAREP and the types of activities in which they participate, we ~~asked~~ instructors (during the initial telephone interview) to describe the sociodemographic characteristics of their group and the types of activities in which they were involved. Following is a profile of the **34** active groups in the study area:

- average group ~~size~~ = **18**, with **13** active members and **5** inactive
- on average, **88%** of the group was male
- on average, 50% of the group lived in rural **areas**; 25% of groups were exclusively rural, 12% were exclusively **urban**
- on average, 90% of the group was white
- on average, **64%** of the group came from middle income families
- on average, groups spent **41%** of their time practising **fishing** skills, and the rest of the time was evenly split between aquatic ecology, angler ethics, and community service
- only **25%** of groups had gone fishing (~~as~~ a group) on Lake **Ontario** or one of its tributaries in the ~~past~~ year
- half of the groups had cleaned, cooked, and ate sport-caught fish ~~as~~ a group in the Past year
- ~~half~~ of the groups had discussed the problem of chemical contaminants in ~~fish~~ **as** well **as** human health benefits or risks associated with eating fish in the ~~past~~ year
- only onequarter of the groups had discussed the New York health advisory in the Past year.

In conversations with instructors we found that many of the groups were not stand-alone SAREP groups. Rather, the SAREP instructor ~~was~~ also a Boy Scout leader or a **4-H** club leader and incorporated SAREP activities ~~as part~~ of the Boy Scout or **4-H** program.

The following sections provide more information on specific methods and results. The next section addresses children's fish consumption. The final section addresses children's fishing and the use of diaries ~~as~~ a method to collect such information.

To help evaluate the effectiveness of health advisory programs, accurate estimates of fish consumption are needed to assess the extent to which subgroups within the general population follow the recommendations within health advisories (Connelly et al. 1996). Fish consumption estimates are also used in public health risk assessments and water quality regulatory programs that rely on characterizing the risk associated with human exposure to contaminants through fish tissue (Ruffle et al. 1994; Connelly et al. 1996). Estimates of local fish consumption are recommended for health risk assessment purposes, rather than relying on national data, to reflect specific subpopulations who may have higher fish consumption rates than the general public (USEPA 1992). Fish consumption estimates should also reflect the subpopulations of interest, such as those potentially most at-risk from exposure to contaminants. Only a few studies have examined children's fish consumption specifically (e.g., Rupp et al. 1980; West et al. 1989). This study was designed to estimate fish consumption among children who fished in upstate New York

The New York State Department of Health, in cooperation with the Department of Environmental Conservation, issues a fish consumption health advisory recommending that women of childbearing age and children under age 15 should not eat any fish caught from the waters listed in the advisory. In addition, the advisory recommends limiting consumption of fish from any waters in the State to a maximum of one meal of fish per week (for children and adults). It is unknown, however, to what extent children, and their families, are aware of these recommendations and follow them.

Previous studies demonstrated a lack of knowledge among adult anglers about the specific recommendations in New York's health advisories. Lake Ontario, a Great Lake partially in New York State, is listed specifically as a waterbody for which women and children should follow the special recommendations of the NY advisory. In a 1992 study focused on male and female Lake Ontario licensed anglers aged 18-45 (likely childbearing years), over 90% of respondents were aware of the New York health advisory, but only 50% of those could identify correctly the specific consumption recommendation for women of childbearing age and children (Connelly et al. 1993). Consumption of sport-caught fish exceeded the health advisory recommendations for 54% of respondents (Connelly et al. 1993). In another study of NY Lake Ontario anglers, members of sporting associations, low-income residents, and migrant farmworkers reported Lake Ontario fish consumption occurred within families that included women of childbearing age or children (Velicer and Knuth 1994). Statewide, an estimated 85% of licensed anglers were aware of the health advisories in 1990-91, but only 53% of respondents aware of advisories could identify correctly the recommended maximum number of fish meals for women of childbearing age and children under age 15 for waters affected by advisories (Connelly et al. 1992).

Assessing fish consumption among children who fish requires a different approach than those methods focused on adult anglers. In New York State, for example, children are not required to purchase a fishing license until age 16. Therefore, traditional methods of surveying anglers via selecting a sample of license buyers will not work for studies of children who fish. Studies of the general population require a great deal of effort to locate, through random sampling, sufficient participants who fish and are willing to participate in a fish consumption study. Studies of youth anglers face the additional constraints of securing parental permission for youth to participate. For this study, the New York Sportfishing and Aquatic Resources Education Program (SAREP) offered an accessible means for contacting youth, particularly those

'most likely to fish, and therefore eat the fish they catch. SAREP is a cooperative federal, state, and local initiative designed to involve youth and adults in fishing, and to use their interest in fishing to encourage development of an understanding of aquatic ecology, an appreciation of the role anglers play in preserving aquatic habitats, and a commitment to fishing ethically, safely, and responsibly (Matthews 1995). Working through SAREP enhanced **our** ability to reach youth who were likely to have a keen interest in fish and fishing. We worked with SAREP groups in upstate (**central** and western) New York because of the proximity to the Great Lakes and other inland waters for which health advisories are issued.

The objectives of **this** study were to: (1) estimate fish consumption (overall and **sport-caught**) among children who fish in upstate New York; (2) assess fish consumption health advisory awareness among families whose children fish; and (3) evaluate the extent to which youth adhere to fish consumption advisory recommendations.

We recognize that because we studied children who participated in a fishing-oriented youth group **our** results will not be representative of **all** children who fish, but may be biased toward youth who are more likely to fish. Another component of **this** study was to test how well a certain methodology (diaries) provides detailed information about children's fishing activities (reported in Section III) and fish consumption. This study, therefore, was **also** intended to provide methodological insights for future studies of children's fish consumption.

METHODS

Study Area

The central and western portions of upstate New York were chosen **as** the study area because of the proximity to Great Lakes waters. All of New York's Great Lakes waters have fish consumption advisories. Specific advisories recommending limited fish consumption also exist for many inland waters in upstate New York. In addition, New York State advises that "women of childbearing age, infants, and children under the age of 15 should not eat any fish species from waters listed" in the advisory. Thus, the advisories issued for upstate New York affect women of childbearing age and children who **harvest** and/or eat fish caught in many local waters. Anglers in this general region provide **an** audience that **has** reason to be aware of the advisories.

Data Collection Process

To obtain a sample of children who fish, we focused on children who were members of SAREP groups. We **assumed** children active in SAREP would be more likely to **fish** than children sampled from the general population or from other youth organizations not associated with fishing.

We attempted to contact by telephone all SAREP instructors (n=210) in central and western New York to determine if they had an active SAREP youth group. Instructors with active groups were asked about the sociodemographic make-up of their group, and asked to provide names and addresses of parents whose children were in the group.

A mail questionnaire was sent to **123** families in May, **1996**. The questionnaire asked about family members' fish consumption over the **past 12** months. It **also** contained **questions** about fish preparation and cooking techniques and fish consumption **advisory** awareness. Parents were asked to give written permission for their children aged **8** to **14** to participate in the diary portion of the study.

The mail survey implementation followed a standard 4-wave reminder process to increase response rates (**Dillman 1978**; Brown et al. **1989**). A follow-up interview by telephone was conducted with **37** nonrespondents to determine if nonrespondent families differed from responding families.

Children with parental permission to participate in the *diary* portion of the study ($n=53$) were sent diaries in late June **1996** and asked to record fish meals consumed between July **1** and Oct. **15, 1996**. For each fish meal consumed, children were asked to record the date, the type of fish eaten, meal **size**, method by which fish was acquired (e.g., **grocery** store, restaurant, fishing trip and if **so**, specific waterbody), and fish preparation (skin on or **off**), and cooking techniques **used** (e.g., **pan** fried, deep fried, grilled, broiled, baked, canned, other). Fish meals were defined **as** meals containing fresh or saltwater fish but not shellfish. Children were instructed to record the species of fish eaten (if **known**) or some other descriptor (e.g., fish sticks **from** Burger King). Multiple species could be recorded under one meal. The children estimated their meal size by comparing it (including all types of fish eaten at that meal) with pictures of **8-oz (229 g) fish steaks** and fillets on dinner plates (West et al. **1989**). When children noted their meal **size** was smaller than **8 oz**, we assumed a **4-oz (114 g)** size; when they noted it was larger than **8 oz**, we assumed a **12-oz (343 g)** size. To make recording information simpler for children, the diary was constructed such that for each meal the child would write in the date and species and circle all other appropriate answers.

Administration

Children were sent patches identifying them as a participant, a fish identification guide, and a fishing lure to encourage their participation over the course of the project. To maintain contact with the children and obtain information recorded in the diaries, we contacted children five times during the study period. Initial contacts were spaced two weeks apart. Time between contacts was lengthened to one month toward the end **of** the study period. Children were asked to return their diaries at the end of the study period via a postage-paid envelope. This allowed us to make comparisons of data from the phone interviews with that written in the diary. By combining data from **both** sources we produced the most complete dataset possible. Diary data not reported during the phone interviews were added to the computer database developed from the phone interviews. Data reported during the phone interviews but not recorded in the diaries were kept in the computer database.

Analysis

We examined the representativeness of diary participants in three ways: **(1)** by comparing families with children in the diary project with families who we contacted by mail or phone but did not have children in the diary project; **(2)** by comparing SAREP youth groups for which the

instructor had provided family names to us with those groups for which we were unable to obtain family names; and (3) by comparing diary families with 1990 **Census** information.

Past research on anglers' fish consumption (Connelly et al. 1996) indicated that those who participated throughout the project might have consumed **more** fish during each time period than those for whom we **had** only partial data. To compensate for **this** potential bias and build a dataset without missing information, we substituted estimates for the missing data. For cases that had missing data in a given time period, we replaced the missing data with the mean meals of those who participated in that time period but not throughout the project.

Estimates of year-long consumption were made by assuming that consumption of nonsport-caught fish during the last month of the project (Sept. 16 - Oct. 15) was representative of **all** fish consumption during the remainder of the year not covered by the diary. This time frame corresponded with children's routine of attending school. It was a conservative measure of **annual** fish consumption because some sport-caught fish meals may have been **consumed** in the spring or early summer, but we did not have data about children's fishing activities over this time period.

Data were analyzed with the **SPSSX** computer program (SPSS 1986). Chi-square and paired t-tests were used to test for statistically significant differences at $P \leq 0.05$. Ninety-five percent confidence intervals were calculated using the MIXED procedure in **SAS** to account for the effects of siblings in the sample and are shown in parentheses when appropriate (**SAS** Institute, Inc. 1996).

RESULTS

Response Rates and Potential Diary-Related Biases

From the initial sample of 210 registered SAREP instructors, we found 34 with currently active youth groups. We obtained sociodemographic characteristics for each of these groups. Sixteen of those **instructors** provided us with lists of families **that** we could contact via **mail** questionnaire. Comparisons of **SAREP** youth group characteristics between instructors who provided **names** versus not indicated that we received **names** from more rural groups and groups whose families had lower incomes. No differences were found in terms of racial or gender mix of the groups or in types of fishing activities in which they participated.

From the 123 questionnaires that were mailed to families, 61 questionnaires were returned, resulting in a 51% response rate (adjusted for undeliverables). Nonrespondent telephone follow-up interviews were conducted with 37 families. No significant differences were found between families who gave permission for their children to participate in the diary portion of the project (*diary families*) and those who did not have children participating.

Diary families were not representative of upstate New York families. Diary families were more likely to live in rural areas, consist of 2-parent households, and be white (U.S. Bureau of the Census 1991).

Of the 53 children who were sent diaries in June 1996, all but one provided some information on their fish consumption between July 1 and Oct. 15. We had complete information from all 5 time periods for 30 children; information for 4 of the 5 time periods for 13 children; information for 3 of the 5 time periods for 7 children; and information for 2 of the 5 time periods for 2 children. Substitution of missing data occurred for these children as discussed above in Methods.

General Fish Consumption

The diary data showed that children consumed an average of 4.8 (10.9) fish meals from all sources during the diary period (July 1 - Oct. 15, 1996). Of these fish meals, 23% were sport-caught. The maximum number of meals consumed by one child during the study period was 12. All children ate some fish; 49% ate some sport-caught fish. Children ate primarily tuna (44% of all meals) followed by fish sticks (12%) and haddock (10%).

The average meal size (148 g) was smaller than the 8 oz (229 g) picture of fish in the diary. If meal size was factored in, an estimated average 6.6 (± 1.5) g/person/d of fish from all sources was consumed by children during the diary period. Of this 29% (1.9 g/p/d) was sport-caught fish and 38% (2.5 g/p/d) was canned tuna. These percentages differ from percent of meals because sport-caught meals were larger than average (185 g/meal) and tuna meals were smaller than average (125 @meal). The child consuming the most fish during the diary period consumed 23.8 g/p/d. The child consuming the most sport-caught fish consumed 22.5 g/p/d of sport-caught fish during the diary period. Similarly, the child consuming the most tuna consumed 10.8 g/p/d of tuna during the study period.

According to diary data, children's consumption varied by time period, with highest consumption in the summer and tapering off during the fall (Figure 1). Average consumption in the first two-week period of the study was 10.5 g/p/d; maximum consumption by one child during that period was 45.5 g/p/d. Although more sport-caught fish were consumed as a proportion of total consumption during the summer, children consumed sport-caught fish in all time periods.

Estimates of annual daily consumption based on diary data were lower than during the diary period (4.2 g/p/d versus 6.6 g/p/d) because we assumed that daily consumption during the part of the year not covered by the diary was equal to the daily consumption of nonsport-caught fish in the last month of the diary. This is likely a conservative assumption because sport-caught fish might be consumed year-round. Winter and spring fishing opportunities exist in central NY, and children tend to frequent local waterbodies (Section III), but we did not have data on fishing activities year-round. Based on children's meal sizes, the 4.2 g/p/d estimate is roughly equivalent to 10 fish meals/year. Parents' estimates of annual consumption for children in the diary study were approximately twice (21 meals/year) the estimates derived from diary data (statistically significant using paired t-test at $P \leq 0.05$).

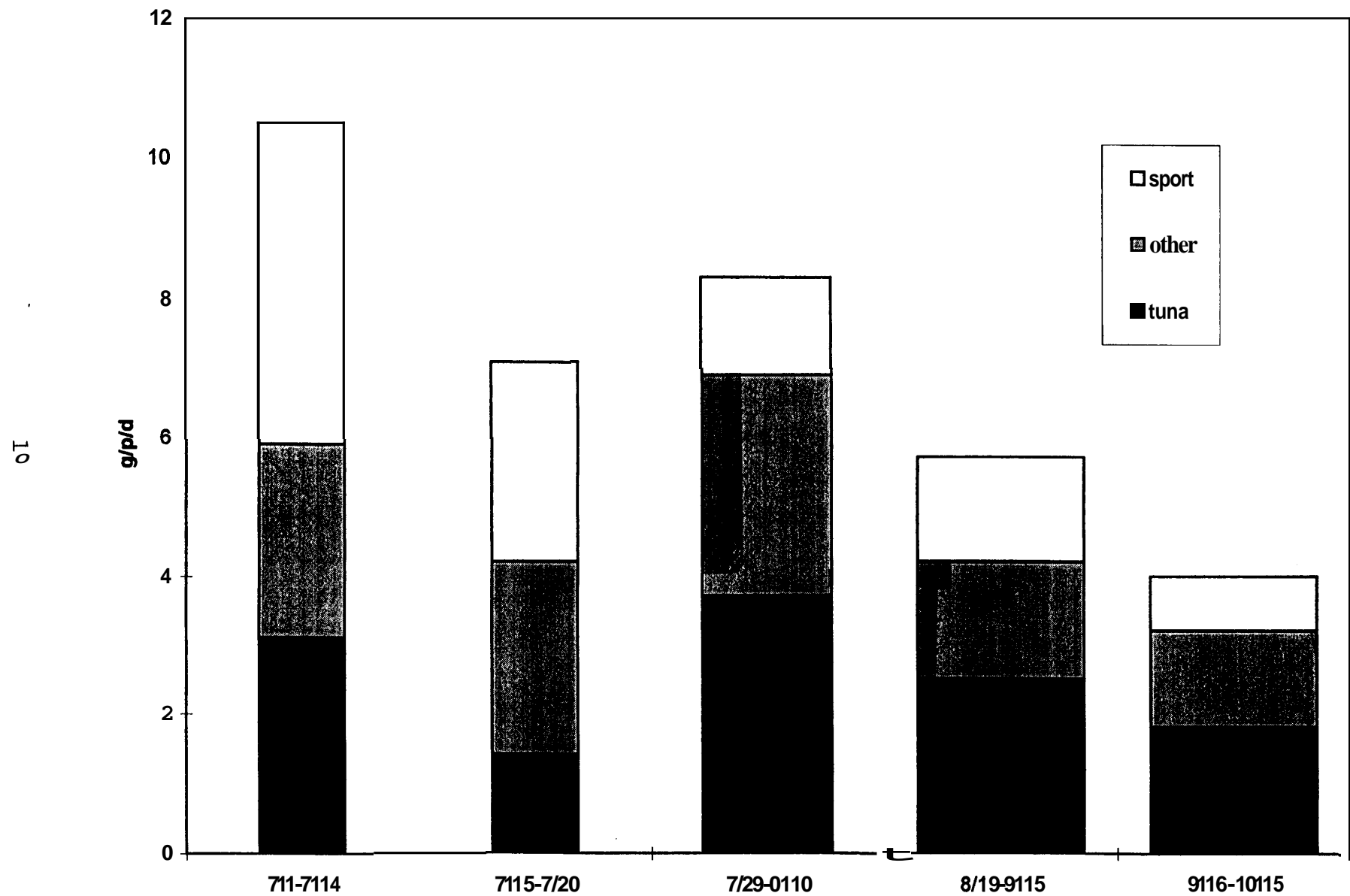


Figure 1. Average fish consumption (g/p/d) by time period, as reported by children who kept fish consumption diaries. Proportion that is canned tuna, sport-caught, or other is indicated in bars. (Note the column widths vary to represent different amounts of time covered in each reporting period.)

Use of Risk-Reducing Preparation and Cooking Techniques

Removing the skin from fish before cooking, and grilling, broiling, and baking fish have been suggested in fish consumption advisory recommendations as methods to reduce consumption of contaminants (e.g., PCBs) that accumulate in higher concentrations in fish fat. Slightly less than half (**46%**) of children's sport-caught fish meals were prepared by removing the skin before cooking and even fewer (**36%**) were cooked using risk-reducing cooking techniques. Many meals were prepared with the **skin-on (52%)** and **pan fried (40%)**. The most frequently consumed sport-caught fish were trout (**27%** of meals), bass (**18%**), and perch (**18%**).

Most families reported they do not always **use** risk-reducing preparation and cooking techniques in preparing sport-caught meals. Although sample sizes were small, it appeared that children from families reporting that they always used risk-reducing techniques also reported that their diary meals were prepared using such techniques.

Awareness of the Fish Consumption Advisory

Almost all families (**87%**) whose children participated in the **diary** portion of the study said they were aware of the New York State fish consumption advisory. They became aware of the advisory through the fishing regulations guide (**65%**) and the newspaper (**56%**), and to a lesser extent from television and radio (**41%**), information from SAREP (21%), and talking with their child (**6%**). The advisory recommended that children under **15** years old not consume any fish from waters listed in the advisory. **Half** of the families (**53%**) who were aware of the advisory knew this fact, **32%** thought some consumption was allowed, and **15%** were **unsure** what the advisory recommended.

The advisory also recommended that no one eat more than one meal per week of fish caught from any New York State waters. One-third (**33%**) of respondents knew **this** recommendation, 18% did not know the answer, and **49%** believed the correct answer was more restrictive (e.g., **2-3** meals per month, **1** meal per month) than it actually was.

We found a statistically significant association between gaining health advisory information from magazines and from multiple sources of information and knowledge of the consumption recommendations for women and children. Eighty-five percent of those who indicated they used magazines as a source **of** health advisory information knew the correct recommendation for women and children, compared with **33%** who received their information from other sources. Magazines, however, were not the sole source of advisory information for any of the respondents. As the number of different information sources used increased, **so** did the likelihood of knowing the correct recommendation for women and children. For respondents indicating only one source of health advisory information, **29%** knew the correct answer; for **2-3** sources, **45%** knew the correct answer; and for **4** or more sources, **100%** knew the correct answer.

Adherence to the Fish Consumption Advisory

During the **diary** period, 8% of children consumed fish from waters for which the advisory recommended no consumption for children under **15** years old. This represents **3%** of all meals

consumed by all the children we studied. Although the sample size of meals from these restricted waters was quite *small*, ~~most~~ were prepared with the skin-on and ~~pan~~ fried (not ~~risk~~-reducing techniques).

Consumption of fish recommended against in the ~~advisory~~ ~~was~~ limited to ~~two~~ families in ~~our~~ study. Both families said they were aware of the health advisory and answered correctly the question about the advisory recommendation that children under **15** not consume any fish from specific waters ~~listed~~ in the advisory.

DISCUSSION

Representativeness of the Sample

The sample of children participating in the diary portion of the study was intended to be representative of SAREP youth and to some degree representative of children who catch and eat fish. **Our** sample generally reflects SAREP youth but with slightly higher rural proportions ~~than~~ found in all central and western New York SAREP groups. The sample was not intended to be representative of all upstate New York youth ~~because~~ not **all** youth ~~fish~~. Our sample was more **rural** and less racially mixed ~~than~~ the upstate New York population. However, **our** sample was **similar** to the population of adult anglers which tends to be more **rural** and white ~~than~~ the general population (USFWS 1993). **Our** sample is generally representative ~~of~~ youth anglers, but may include children more likely to be avid anglers (and therefore to eat sport-caught fish) as evidenced by their membership in a SAREP group.

Comparisons with Other Estimates of Fish Consumption

Children ages 8 - 14 participated in **this** study. Our estimate of children's annual average fish consumption (**4.2 g/p/d**) was somewhat lower ~~than~~ estimates produced in other studies. West et al. (1989) reported an average consumption of **9.5 g/p/d** for **0 - 10 year** olds, and **10.8 g/p/d** for **11 - 20 year** olds, using a mail survey of licensed anglers. Questionnaire recipients were asked to recall fish consumption patterns for **all** household members for the **7 day** period prior to completing the questionnaire (West et al. 1989). Ruffle et al. (1994) reported and analyzed data ~~first~~ produced by Rupp et al. (1980), ~~based~~ on a nationwide assessment of fish consumption in which participants reported fish consumed during a one month time ~~period~~, with the sample staggered over the ~~course~~ of a year to assess annual fish consumption. Average consumption rates for saltwater and freshwater finfish for children in the Mid-Atlantic region (including New York State) were **5.1 g/p/d** for children **1-11 years** old, and **8.85 g/p/d** for children **12-18 years** old; and 50th percentile consumption rates were **3.37 g/p/d** for children **1 - 11 years** old, and **5.97 g/p/d** for children **12-18 years** old (Rupp et al. 1980 as reported in Ruffle et al. 1994), comparable to **our** estimate of **4.2 g/p/d** for children **8 - 14 years** old. Maximum fish **consumption** by any child in **our** diary period was **45.5 g/p/d** (over a two-week period), which falls between the **90th** percentile (**19.29 g/p/d**) and the **99th** percentile (**49.45 g/p/d**) for children **12-18 years** old, **and** is higher ~~than~~ the **99th** percentile (**29.45 g/p/d**) for children **1 - 11 years** old (Rupp et al. 1980 as reported in Ruffle et al. 1994).

Annual estimates for children (4.2 g/p/d) are about one-third that of adults in our diary study of Lake Ontario anglers (17.9 g/p/d) (Connelly et al. 1996). Annual estimates for children based on diaries (4.2 g/p/d or the equivalent of 10 meals/year) are about 1/2 of the parents' estimates of their children's fish consumption (21 meals/year); therefore, parents' recall estimates of children's fish consumption may be overestimates. Connelly et al. (1996) found fish consumption estimates based on diaries were generally lower than estimates for similar populations based on annual recall via a mail survey. We caution, however, that our study did not measure fish consumption during the spring, when trout fishing may be a popular activity. In the months for which diary data were collected, trout was the most frequently consumed sportcaught fish (27% of meals).

Implications for Risk Assessment Exposure Estimates

Other studies have suggested that fish consumption estimates in areas for which advisories are issued may be suppressed because of the health advisories (Connelly et al. 1996), i.e., if the advisories did not exist, fish consumption would be higher. Most of the waters children fished during this study, however, were not waters listed in the health advisory. Thus, fish consumption suppression may not be at work in this study, except as manifested through a general sense of caution about dietary risks from contaminants as a result of growing general public awareness of the relationship between dietary contaminants and human health.

Several explanations are plausible regarding why children were not fishing listed waters. Waters listed specifically in the advisory tend to be larger bodies of water (rivers, lakes). Children tend to fish smaller bodies of water more likely to produce easily-harvested panfish (Section III). Smaller bodies of water may tend to be less polluted by industrial contaminants, because industries have not located on them or because they did not provide enough dilution potential to be used as waste discharge sites. However, given the resource limits of water quality agencies and the need to set priorities, smaller water bodies may also tend to be monitored less than larger bodies of water. Larger bodies of water are usually more visible to the public, are more heavily fished by adult anglers, and are more likely to have evident point-source polluters. Water quality problems in smaller, local waters may be less likely to be detected through statewide monitoring programs because relatively few small waters can be tested, although contaminant problems may exist either from point or nonpoint sources. Risk assessors and water quality managers should consider the findings from this study (Section III) regarding children's tendency to fish and eat fish from smaller, local waters. This information may help assess the extent to which water quality monitoring programs are sufficient, or if any shift in priorities may be desirable, given resource limitations.

Of potential interest to risk assessors concerned with mercury exposure, tuna was the most frequently consumed type of fish. Overall consumption (mean 2.5 g/p/d; highest individual consumption of 10.8 g/p/d during the study period), however, was within the "fish intake" ranges recommended by USEPA for use in risk assessments (USEPA 1997).

Implications for Risk Communication and Health Advisory Evaluation

Children's fish consumption generally followed the recommendations within the health advisory, with a few exceptions, and families were generally aware of advisories. Few children

tended to fish waters listed in the advisory, probably reflecting a species-preference (i.e., easily caught panfish in smaller, local waterbodies) rather than a conscious response to the recommendations in the health advisory.

Risk communicators could consider providing information in advisories about what to look for in local waterbodies to help an individual judge the potential for that waterbody to be contaminated. Children tend to fish smaller, local waterbodies that may not be tested regularly as part of statewide water quality monitoring programs. Previous research indicates that many anglers judge water quality based on features such as appearance, smell, taste, or behavior of fish (Belton et al. 1986), or turbidity, taste, or smell of the water (Cable et al. 1987). Risk communication information could clarify what indicators to rely on when deciding to eat fish from a waterbody that may not have been tested as part of the statewide monitoring program, addressing fallacies that may exist. In addition, anglers may believe that acute infectious diseases are the health problems of concern, rather than chronic health problems that may take a long time to become evident (Belton et al. 1986). Seeing no indication of such acute infectious diseases as a result of local fish consumption may increase an angler's confidence in the safety of local fish as a food source.

Awareness of the health advisory was high (87% of families aware), based on responses from the family member who completed and returned the family survey. Extent of specific knowledge about the recommendations within the advisory was similar to levels of knowledge among the general population of licensed anglers determined in previous studies, although our study population was different because it focused specifically on families with children. Although each of the families involved in this study included children under 15 years old, only 53% of participating families were aware that the advisory recommended that children under 15 years old not consume any fish from waters listed in the advisory. A prior statewide study of licensed anglers found that 52% of respondents were aware of this special advice for children (Connelly et al. 1992). More effort could focus on highlighting information important to certain subgroups (e.g., families with children).

The greatest knowledge about advisories was associated with use of multiple information sources. Risk communicators could attempt to reach at-risk audiences through multiple channels to maximize the impact of their message. Based on interviews with SAREP instructors, only 25% of groups had discussed fish consumption advisories. Risk communicators may be able to extend their own efforts by working through "information gatekeepers" such as SAREP, 4-H, Scout, and other youth group leaders to inform children and their families about safe fish consumption.

Health advisories could include more emphasis on the potential benefits of certain fish cleaning and cooking methods, particularly for reducing exposure to lipophilic contaminants (USEPA 1995). Children reported that 46% of their sport-caught fish meals were prepared by removing the skin, and 36% of meals were cooked using risk-reducing methods such as broiling or grilling. Although most fish consumed by children did not include species listed in the advisory as affected by contaminants, learning these potentially risk-reducing preparation methods could carry over into adulthood when fish harvest is more likely to include fish species and sizes affected by contaminants.

Although we identified only 2 families whose children consumed fish that the advisory recommended should not be **consumed**, these families were aware of the health advisory and knew the recommendation of no consumption for children under 15 for waters listed in the advisory. It is possible these families were not aware that the **specific** waterbody their children fished was listed in the advisory, or they may have had no intention of following the recommendations, or viewed the benefits of fish consumption **as** more important than the risks. Future research focused on understanding how and why people respond to advisory content would be **useful**.

Future Research Needs

Our study focused on a select group of children in the Lake Ontario Basin participating in an organized sportfishing and aquatic resource education program. Further research is needed to estimate fish consumption by children from other backgrounds, especially in **urban** areas or in **areas** where local waters are affected by contaminants. In addition, **our diary** period was limited. Future research could expand **our** work to collect data on year-round fishing and fish consumption activities.

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REFERENCES

- Ahmed, F.E. 1991. Seafood safety. National Academy Press, Washington, D.C. 432 pp.
- Belton, T., R. Roundy, and N. Weinstein. 1986. **Urban** fishermen: managing the risks of toxic exposures. Environment 28: 19-20, 30-37.
- Brown, T.L., D.J. Decker, and N.A. Connelly. 1989. Response to mail surveys on resource-based recreation topics: a behavioral model and an empirical analysis. Leisure Sciences. 11:99-110.
- Cable, T.T., E. Udd, and J.D. Fridgen. 1987. Effects of toxic chemical perceptions on fishing behavior. Pages 1888-1893 in O.T. Magoon, H. Converse, D. Miner, L.T. Tobin, D. Clark, and G. Domurat, eds. Coastal Zone '87. American Society of Civil Engineers, New York
- Connelly, N.A. and B.A. Knuth. In preparation. Using diaries to examine children's fishing patterns. To be submitted to the **North** American Journal of Fisheries Management.

- Connelly, N.A., B.A. Knuth, and C.A. Bisogni. 1992. Effects of the health advisory and advisory changes on fishing habits and fish consumption in New York ~~spot~~ fisheries. **Human Dimensions Research Unit Series No. 92-9**. Department of Natural Resources, Cornell University, **Ithaca**, New York 120 pp.
- Connelly, N. A., B. A. Knuth, and T. L. Brown. 1996. Sportfish consumption **pattern** of Lake Ontario anglers and the relationship to health advisories. North American **Journal of Fisheries Management** 16:90-101.
- Connelly, N.A, B.A. **Knuth**, and J.E. Vena. 1993. New York State angler cohort study: health advisory knowledge and related attitudes and behavior, with a focus on Lake Ontario. **Human Dimensions Research Unit Series No. 93-9**, Department of Natural Resources, Cornell University, **Ithaca**, New York 57 pp.
- Dillman, D.A. 1978. Mail and telephone surveys: the total design method. Wiley, New York
- Matthews, B.E. 1995. What is SAREP? New York State College of Agriculture and Life Sciences, Cornell University, Department of Natural Resources, SAREP Resource Publication 95-5, **Ithaca**, New York
- Ruffle, B., D.E. Burmaster, P.D. Anderson, and H.D. Gordon. 1994. **Lognormal** distributions for fish consumption by the general U.S. population. **Risk Analysis** 14(4):395-404.
- Rupp, E.M., E.L. Miller, and I.C.F. Baes. 1980. Some results of recent surveys of fish and shellfish consumption by age and region of **U.S.** residents. **Health Physics** 39:165-175.
- SAS Institute, Inc. 1996. SAS/STAT **software**: changes and enhancements through release 6.11. SAS, Cary, NC.
- SPSS. 1986. SPSS user's guide, edition 2. SPSS, Chicago.
- U.S. **Bureau** of the Census. 1991. 1990 Census of population and housing, *summary* population and housing characteristics - New York U.S. **Govt.** Printing Office, Washington, D.C.
- USEPA (**U.S.** Environmental Protection Agency). 1992. Consumption surveys for fish and shellfish: a review and analysis of survey methods. **EPA-822/R-92-001**. Washington, D.C.
- USEPA (U.S. Environmental Protection Agency). 1995. Guidance for assessing chemical contaminant **data** for **use** in fish advisories. Volume 4: Risk communication. EPA-823-R-95-001. Washington, D.C.
- USEPA (**U.S.** Environmental Protection Agency). 1997. Exposure Factors Handbook. Volume II. Food Ingestion Factors. **EPA-600-P-95-002Fb**. Washington, D.C.
- USEPA (**U.S.** Environmental Protection Agency). 1997. Fact Sheet. Update: Listing of Fish and Wildlife Advisories. EPA-823-F-97-07, Washington, D.C.

USFWS (U.S. Fish and Wildlife Service). **1993**. **1991** National survey of fishing, hunting, and wildlife-associated recreation. U.S. Government Printing office, Washington, **D.C.**

Velicer, C.M. and B.A. Knuth. **1994**. Communicating contaminant risks from sport-caught fish the importance of target audience assessment. **Risk Analysis** **14(5):833-841**.

West, P. C., J. M. Fly, R. Marans, and F. **Larkin**. **1989**. Michigan sport anglers **fish** consumption survey. University of Michigan, Natural Resource Sociology Research Lab, Technical Report **1**, **Ann Arbor**.

SECTION 111:

USING DIARIES TO EXAMINE CHILDREN'S FISHING PATTERNS

Nancy A. Connelly and Barbara A. Knuth

ABSTRACT

We used a diary methodology to study the fishing patterns of children who participated in the Sportfishing and Aquatic Resources Education Program in central and western New York in **1996**. Of the **53** children who were sent diaries **in June 1996**, all provided some information about their fishing activities during the study period (July **1** - October **15,1996**). The mean number of days fished for all children during the study period was 5.2 days (**± 1.6**), or **once** every three weeks (**.35 days/week**). However, fishing effort was not uniform across the study period; the majority of fishing effort occurred during the summer months, when the children were not in school. We derived **from** the diary data a conservative estimate of mean annual fishing effort of **9.3** days per year. Children were generally not fishing the major waterbodies of New York State. Based **on** the descriptions of where children said they fished, the majority of the waters fished were small ponds or lakes. Most (**60%**) fishing days for children involved fishing with a family member. Children were accompanied by friends for about one-third (**35%**) **of** the days. Children caught fish **on** most days (**71%**). Panfish (e.g., sunfish, yellow perch, bullhead, and crappies) were the most commonly caught fish (**56%** of days). For children, the diary methodology provided valuable detailed information **on** recreation participation after cooperation in the study was established. Publicizing access availability and locations for small, local panfish waters that could sustain additional harvest may be an effective management strategy for recruiting and retaining youth anglers.

INTRODUCTION

According to the **1996** National Survey of Hunting, Fishing, and Wildlife-associated Recreation (**USFWS 1997**), nearly two-fifths of the nation's children aged **6** to **15** fished in **1995**. That represents over **14.8** million children, about which little is **known** in terms of their fishing habits, needs and preferences. In New York State, about **768,000** children aged **6** to **15** fished in **1995** (**USFWS, 1997**). It is important to learn more about the needs of children because they are the future of fishing. Interest in youth recruitment, retention, and aquatic stewardship attitudes and behaviors is increasing (**Dann 1993; Matthews 1996**).

Aas (**1996**) documented the lack of research **on** children, finding only **5** articles dealing with children or youths among 80 articles in a literature review of the human dimensions of angling. Aas' (**1996**) **own** research focused **on** motivations for fishing among

children, and showed that catch was the most important motivation for children and more important to children than adults (Aas and Kaltenborn 1995). **This** suggests that fisheries managers should take the unique needs of children into account when managing fishery resources.

Children will be the anglers of the future, and **as** anglers, will have an interest in preserving the resource. Activity participation **as** a child is related to activity participation **as** an adult (Sofranko and Nolen 1972; Kelly 1974). **As** individuals, children have a right to access to public **goods** and **services**. Fisheries managers who understand the needs of children **can** provide opportunities specifically for them. Understanding children's resource **use** patterns and preferences can help managers provide such opportunities.

We used a diary methodology to study the **fishing** patterns of children who participated in the Sportfishing and Aquatic Resources Education Program (SAREP) in central and western New York in 1996. SAREP is a cooperative federal, state, and local initiative designed to involve youth in fishing. Interest in fishing is used to encourage an appreciation of the role anglers play in preserving aquatic habitats, and a commitment to fishing ethically, safely, and responsibly (Matthews 1995). SAREP activities are conducted primarily within other youth groups such **as** Boy **Scouts** or 4-H clubs, but some stand-alone SAREP clubs exist **as** well. We recognize by the nature of the sample frame (i.e., children who participate in a youth group) that our results will not be representative of all children who fish. Therefore, we view this study **as** exploratory in nature, providing insights about children's fishing patterns while testing a methodology (diaries) that provides detailed information **on** children's fishing activities and fish consumption. The fish consumption component of this study is reported elsewhere (Section **11**).

Information obtained from diaries may be more accurate than that obtained from telephone **or** mail surveys (Parfitt 1967; Guadagnolo 1989; Lemmens et al. 1992). **This** is particularly true for records of frequent events (Casper and Shaw 1985) and is attributed to reduced memory recall bias (LaPage 1987). Diaries also eliminate digit preference bias for the number of days of participation if the diary contains one entry for each day fished. Digit preference bias **occurs** when respondents round **off** responses to numbers ending in certain digits such **as** 0 or **5** (Vaske et al. 1996). Diaries reduce digit preference bias for other numeric variables because they reduce memory recall bias (Tarrant and Manfredo 1993). Diaries also provide detailed information **on** each event (fishing trip) not normally available from mail or telephone recall surveys.

Diaries, however, are prone to low participation and completion rates because of the reporting burden placed **on** participants. It is often difficult to find people willing **to** participate (Walsh 1977; Anderson and Thompson 1991) and high dropout rates usually occur during the course of the study (Sztramko et al. 1991; Connelly and Brown 1996). Therefore, the representativeness of the sample and the generalizability of the results is often **a** cause for concern (Aneshensel et al. 1989).

We chose a diary methodology for this study because we could examine the details of each fishing trip, such **as** where the children fished, who accompanied them **on** the trip, and what **types** of fish were caught. This method also allowed **us** to examine the seasonal

nature of children's fishing, and to evaluate the effectiveness of the diary method for obtaining information about children's fishing and fish consumption (see Section 11.).

METHODS

Sample Selection

To obtain a sample of children who fish, we focused on children who were currently active in youth groups that included **SAREP** activities. We will hereafter refer to these youth groups as "**SAREP** groups" with the understanding that some of these groups focused solely on **SAREP** activities while others mixed **SAREP** activities with other non-fishing Boy Scout or 4-H activities. **SAREP** groups exist throughout New York State, but we focused on groups in central and western portions of upstate New York. This area is largely rural but has several urban centers (e.g., Rochester, Syracuse, Buffalo). We focused on children in **SAREP** groups because of concerns regarding efficiency and cost in contacting children who fish. We assumed children who were active in a **SAREP** group would be more likely to fish than children sampled from the general population or from other youth groups not associated with fishing, thus allowing us to target study resources on retaining children in the project rather than on identifying children who fish.

Attempts were made by telephone to contact all registered **SAREP** instructors ($n=210$) in central and western New York to determine if they had an active **SAREP** youth group. Instructors with active groups were asked about the sociodemographic make-up of their group. They were also asked to provide names and addresses of parents whose children were in the group.

A mail questionnaire was sent in May, 1996, to 123 families with children involved in **SAREP** groups. The questionnaire asked about family members' fishing activities Over the past 12 months, and for a parent's written permission for children aged 8 to 14 to participate in the study by keeping a diary of their fishing activities.

The mail survey implementation followed a standard 4-wave reminder process to increase response rates (Dillman 1978; Brown et al. 1989). A follow-up interview by telephone was conducted with 37 nonrespondents to determine if nonrespondent families differed from responding families.

Diary Design

Children with parental permission to participate in the diary portion of the study ($n=53$) were sent diaries in late June, 1996, and asked to record fishing trips taken between July 1 and Oct. 15, 1996. For each day the child fished, the child was to record the date, place, who they fished with, and the number and species of fish caught. Pictures of eight common fish found in New York were placed at the beginning of the diary to assist children in identifying their catch.

Administration

To encourage participation over the course of the project, we sent children embroidered patches identifying them as participants in the project. In the middle of the study period, we sent children a fish identification guide along with a note encouraging their participation. At the end of the study period, we sent children a fishing lure and thank you letter.

To maintain contact with the children and obtain information recorded in the diaries, we contacted children by telephone five times during the study period. Initial contacts were spaced two weeks apart. Time between contacts was lengthened to one month toward the end of the study period.

We asked children to return their diaries at the end of the study period. Children were provided a postage-paid envelope for this purpose. We made comparisons between returned diaries and phone interview data for the 77% of children who returned their diaries. Diary data not reported during the phone interviews were added to the computer database developed from the phone interviews. Data reported during the phone interviews but not recorded in the diaries were kept in the computer database. By combining data from both sources, we were able to develop the most complete dataset possible.

Analysis

We examined the representativeness of diary participants in three ways: (1) by comparing families with children in the diary project with families who we contacted by mail or phone but did not have children in the diary project; (2) by comparing SAREP groups for which the instructor had provided family names to us with those groups for which we were unable to obtain family names; and (3) by comparing diary families with 1990 Census information.

Past research on angler diaries (Connelly and Brown 1995) indicated that those who participated throughout the project might have fished more during each time period than those for whom we had only partial data. To compensate for this potential bias and build a dataset without missing information, we substituted estimates for the missing data. For cases that had missing data in a given time period, we replaced the missing data with the mean days fished of those who participated in that time period but not throughout the project.

Data were analyzed with the SPSSX computer program (SPSS 1986). Chi-square and paired t-tests were used to test for statistically significant differences at $P \leq 0.05$. Ninety-five percent confidence intervals were calculated using the MIXED procedure in SAS to account for the effects of siblings in the sample and are shown in parentheses when appropriate (SAS Institute Inc. 1996).

Fishing Participation

Of the 34 children with complete information, **only** one did not fish at all during the study period. (For that child, the fish consumption **portion** of the diary was complete.) The mean number of days fished for all children in the 15 week study was 5.2 days (± 1.6), or **once** every three weeks (.35 days/week) during the study period.

However, fishing effort was not uniform across the study period (Fig. 1). The majority of fishing effort occurred during the summer months, when the children were not in school. Schools in New York State are generally in session from the first Wednesday after Labor Day (in September) through the third **full** week of June. The mean fishing effort in the first half of July was **once** every week and a half; in the second half of July it was **once** every **two** weeks. In the fall (after school was in session) the mean was less than **once** a month.

Children were generally not fishing the major waterbodies of New York State. Only 9% of days fished were **on** Great Lakes waterbodies, although for adult anglers, 21% of days in 1996 were **on** Great Lakes waterbodies (Connelly et al. 1997). Two-thirds of days fished (66%) were **on** waterbodies other than any of the 200 most frequently fished by adult anglers (C. Creech, NYSDEC, Bureau of Fisheries, personal communication). Based **on** the descriptions of where children said they fished, the majority of the waters fished were small ponds or lakes.

Most (60%) fishing days for children involved going fishing with a family member. For about one-third (35%) of the days children were accompanied by friends (family members may **also** have been involved). Few days (9%) involved fishing with youth groups, such **as** SAREP, or children fishing alone (7%).

Children caught fish **on** most days (71%). Panfish (e.g., sunfish, yellow perch, bullhead, and crappies) were the most commonly caught fish (56% of days). **Bass** were caught **on** 45% of days when something was caught. Trout were caught **on** about one-quarter (23%) of the days when fish were caught.

Comparison of Diary Information with Parents' Estimates

Parents overestimated their children's level of fishing activity compared with data from the children's diaries. According to the diary data, children fished New York State waters an average of 4.8 days during the study period (July 1 to **Oct 15**). (For comparability with parents' estimates we had to **use** only children's fishing trips in New York State.) Parents estimated that their children fished New York State waters an average of 17 days per year. Extrapolating the diary data (3 1/2 months) to an annual rate would mean children fished 16.6 days per year, very similar to parents' estimates. However, the diary data showed children fished less frequently during the fall (when school was in session). Using the fall fishing activity **as** the basis for a conservative estimate for the part of the year (8 1/2 months) not covered by the study period, children would have fished an average 9.3 days per year. In this **case**, parents' estimates of children's fishing were almost **two** times greater than that reflected by diary data.

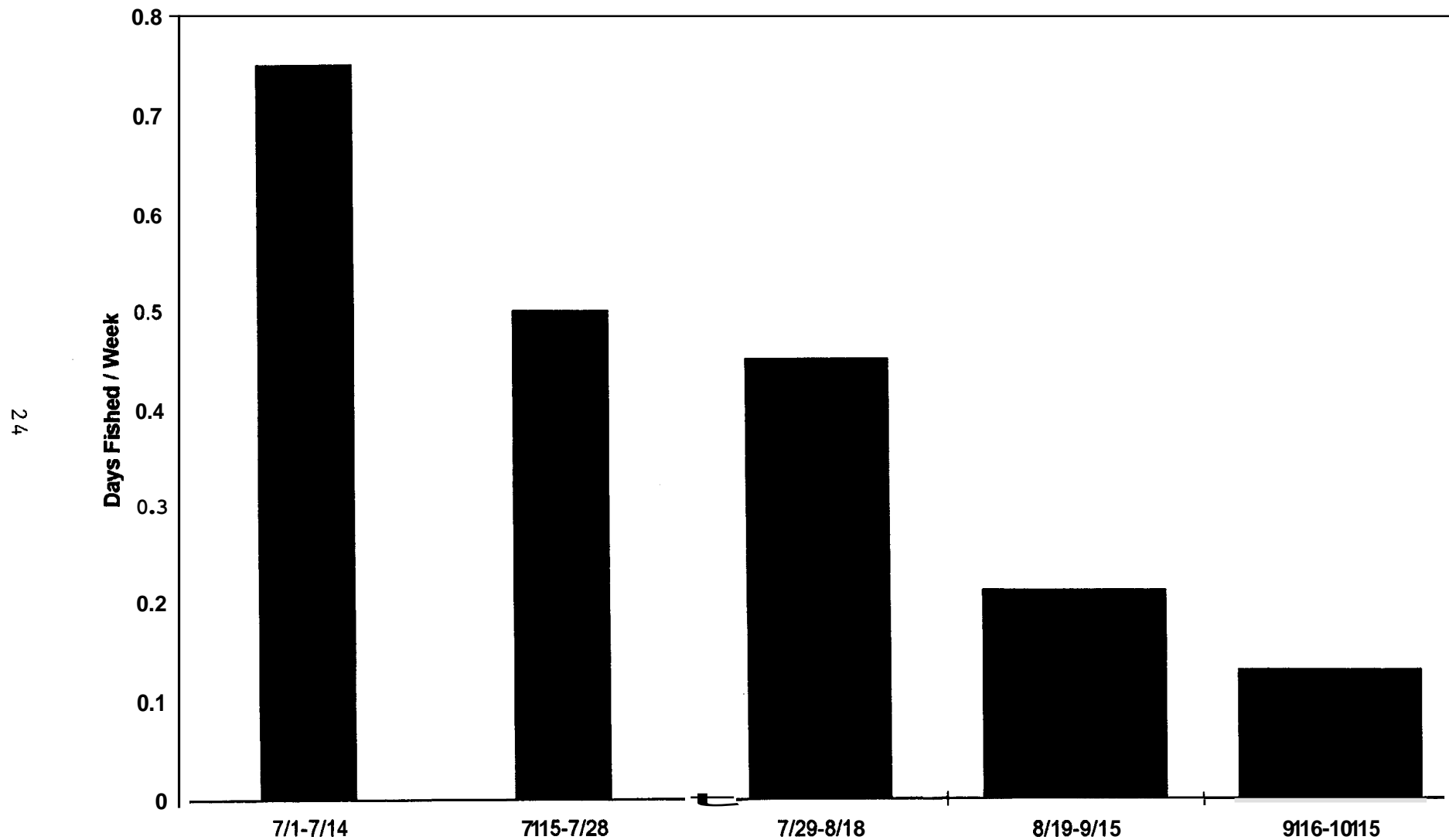


Figure 1. Mean days fished per week by time period, as reported by children who kept fishing diaries. (Note the column widths vary to represent different amounts of time covered in each reporting period.)

Family Fishing Experiences

At least one parent fished in most (80%) households with children who participated in the diary portion of the study. Most households had **two** parents (**92%**), with **no non-white** household members (**95%**), and lived in rural areas of less than 5,000 people (85%). In these households, **73%** of fathers fished an average of **26** days in the past year; **40%** of mothers fished an average of **11** days in the past year. Many households (**64%**) had other children under the age of **18** living in the household who were not participating in the diary portion of the study. Of the male siblings aged **4** and older, **74%** fished an average of **14** days in the past year. **Of** the female siblings aged **4** and older, **58%** fished an average of **6** days in the past year. Because parents' estimates of diary children's fishing were somewhat high we can assume that these estimates of the number of days fished are high **as** well.

DISCUSSION

Representativeness of the Sample

The sample of children participating in the diary portion of the study was intended to be representative of SAREP youth and to some degree representative of children who fish. Our sample generally reflects SAREP youth but with slightly higher rural proportions than found in all central and western New York SAREP groups. The sample was not intended to be representative of upstate New York youth because not all youth fish. Our sample was more rural and less racially-mixed than the upstate New York population.' However, our sample was similar to the population of adult anglers which tends to be more rural and white than the general population (USFWS 1997). Therefore, our sample is generally representative of children who fish, but may include children with greater interest in fishing **as** evidenced by their membership in a SAREP group.

Diaries as a Method for Collecting Data from Children

Diaries have both strengths and weaknesses **as** a method for collecting information from children. On the negative side, it was difficult and time consuming to obtain the names of families with children who fish and **to** obtain parental permission for the children to participate in the diary project. This was the case even though we worked through an established youth fishing organization with close ties to our **own** institution (through Cornell Cooperative Extension). These difficulties raise the question of representativeness of diary participants compared with the general population of youth who fish.

After cooperation was obtained, however, participation rates by children far exceeded those found for adults in other diary studies. We obtained at least some information from all children and none dropped out during the course of the study. Other adult diary studies have reported final participation rates of 43 to **64%** (Sztramko et al. 1991; Connelly and Brown 1996). We expended a great deal of effort keeping in contact with the children and encouraging their participation. Future studies might try using fewer contacts and **gifts** to assess the effect **on** participation vs. cost to researchers.

Another strength of **this** approach was that digit preference bias was generally not a **concern** for data collected in this study. Most data were not numeric (i.e., who the child fished **with**, where they fished). The estimate of days of fishing was not susceptible to digit preference bias because each day represented a **case**.

Additionally, the children's diaries showed that parents overestimated children's fishing participation by up **to** two times. **Thus**, diaries provide a method for obtaining accurate participation data, free **from this** recall bias.

For children, diaries provide valuable detailed information **on** recreation participation after cooperation in the **study** is established. However, children's diaries, like adult diaries, require substantial resources (time and money) and some concerns still exist regarding the representativeness of the sample.

Of great concern for future diary studies with children is identifying a more cost-effective means of obtaining a representative sample of children who fish. We expended a great effort to contact **SAREP** instructors and obtain lists of families. We learned from **our** contacts **with** SAREP instructors that they were frequently performing **SAREP** activities within the context of another youth organization, primarily Boy Scouts or **4-H**. Future studies might consider direct contact with these organizations for membership **lists** to identify children likely to **fish**. Parental permission, however, **will** need to be obtained for children to participate in a study.

Children's Fishing Patterns

Several patterns emerged from the data we collected on children's fishing. First, the level of **fishing** activity was seasonal, with most activity occurring during the summer months when children were not in school. However, we did not assess spring fishing activity, when trout fishing may be of high interest to at least some children. Second, children tended to fish smaller, less well known waterbodies **than** adult anglers. In the 1988 New York statewide angler study, 40% of **trips** taken by adults were to less frequently fished waterbodies (Connelly et al. 1990) compared with **66%** for children in **our** study. Preliminary **data** from the 1996 New York statewide angler survey indicates that the percentage for adults, now **36%**, **has** changed little over time (unpublished **data**).

Third, we observed that on most trips children caught at least one fish and the species group most commonly caught was panfish. **This** catch rate (**71%**) is higher **than** the catch rate of anglers fishing Lake **Ontario** in 1992 who filled out a **similar** diary (**64%**) and lower **than** anglers fishing other New York waters (80%) as part of the same diary study (Connelly and Brown 1995). Species caught by adult anglers is not available statewide, but in 1996 adult anglers directed **16%** of their effort (**2.9** million days) at catching panfish (Connelly et al. 1997).

Fourth, children went fishing with other family members and sometimes with friends, but rarely fished alone. These children generally came from families where **other** family members fished, especially fathers. Fathers fished **an** average of 26 **days per** year, which is above the average (**21 days**) for New York state anglers (Connelly et al. 1997). Thus, children in **our** study may come from more avid fishing families. We must remind readers that **our** sample **size was**

'small' and was drawn from a select group of children participating in an organized angling program. Caution should be used in generalizing the results to a broader group of children.

Implications for Fishery Management

Most of the children in our study came from families that fish. A recent statewide angler survey in New York indicated that approximately 700,000 children under the age of 16 were living in households where at least one adult fished in 1996 (unpublished data). Given there were 881,819 active anglers fishing New York in 1996 (Connelly et al. 1997), the potential audience of children is quite large in comparison with the number of adults.

Understanding the limitations of our data, how can managers use this information to positively influence children's fishing experiences? One focus of management efforts might be to enhance children's awareness of and access to waterbodies that may provide easily catchable fish. Rushton of the Future Fisherman Foundation (Vance 1993) said "catching fish is important for the first-time angler" and taking kids out for big game fish is a mistake. "It's better if they catch ANY fish, even...just sunfish." Past research has shown that children's needs differ from those of adults (Aas and Kaltenborn 1995) and seem to focus more on catching fish (Aas 1996). Our study also supports this. On most trips children caught fish, but the fish caught were not "trophy" types of fish. According to Bryan's (1977) concept of specialization, anglers may evolve through a "continuum of behavior from the general to the particular reflected by equipment and skills used in the sport and activity/setting preferences". Children, therefore, would begin as generalists. Decker and Connelly's (1989) research on hunters demonstrated that hunting motivations change from achievement to appreciative as hunters age. This same pattern of change may occur in anglers. Thus, we would expect children to be oriented to achievement (catch). Haworth (1983) found that younger British anglers (aged 12-24) rated activity, adventure, competitive, and excitement satisfaction statements higher than did older anglers (aged 25+). Because children must, by definition, just be starting fishing, they are more likely to have an achievement orientation. Providing children with the knowledge and skills they need to almost certainly catch fish would be an effective management strategy.

Management actions might focus on cognitive, physical, and attitudinal factors. In this study, children tended to fish in small waterbodies such as ponds and small lakes. Some smaller waterbodies are not well-known even in local communities. Management targeted toward cognitive factors would focus on publicizing access availability and locations for small, local panfish waters that could sustain additional harvest. Information for children and their fishing partners regarding where to fish and how to catch fish may be an effective stimulus for recruiting and retaining youth anglers. Physically, access for children to these types of waterbodies may be increased through easements or bikeways to sites. In addition, information such as maps, public transportation directions, and signs at sites may be useful. Information may also target children's attitudes about the ease of reaching particular sites, safe fishing behaviors, or difficulty associated with catching and keeping panfish to eat.

Further research is needed on children's preferences for different sizes and types of fish (Aas 1996). Our study focused on catch, not preference, and children were typically catching panfish. This is likely different from adult anglers who only focused 16% of their effort on panfish. If children do indeed prefer smaller fish or fish species that are of limited interest to

adults and could *sustain* increased *harvest*, managers might effectively focus on *this* species group to address the needs of children. In addition, *free* fishing days, adultchild fishing events, and *educational/promotional* materials targeted toward families might emphasize locations, species, and fishing techniques that target children's needs rather than solely adult interests. Fishery managers should consider, however, the extent to which such activities and information address, collectively, the total fishing experience, including fishing techniques, ethical behavior, and aquatic stewardship (Dann 1993).

Many agencies recognize the need for information about children as they strive to serve a diversity of clientele, but more remains to be learned about the preferences and needs of children. This study, the *first* to examine fish consumption among children who fish, was by design exploratory and not intended to be representative of the population of children who fish. We tested a methodology, diaries, with children who belonged to SAREP youth groups and thus were likely to fish. Future research is needed with a larger, more diverse audience of children.

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REFERENCES

- Aas, O. 1996. Use of two approaches to measure children's motivations to fish in Norway. *Human Dimensions of Wildlife* 1(3):15-28.
- Aas, O., and B. P. Kaltenborn. 1995. Consumptive orientation of anglers in Engerdal, Norway. *Environmental Management* 19:751-761.
- Anderson, L. E., and P. C. Thompson. 1991. Development and implementation of the angler diary monitoring program for Great Bear Lake, Northwest Territories. *American Fisheries Society Symposium* 12:457-475.
- Aneshensel, C. S., R. M. Becerra, E. P. Fielder, and R. H. Schuler. 1989. Participation of Mexican American female adolescents in a longitudinal panel survey. *Public Opinion Quarterly* 53:548-562.
- Brown, T. L., D. J. Decker, and N. A. Connelly. 1989. Response to mail surveys on resource-based recreation topics: a behavioral model and an empirical analysis. *Leisure Sciences* 11:99-110.
- Bryan, H. 1977. Leisure value systems and recreation specialization: the case of trout fishermen. *Journal of Leisure Research* 9:174-187.

- Connelly, N. A., and T. L. Brown. **1995.** Use of angler diaries to **examine** biases associated with 12-month recall on **mail** questionnaires. *Transactions of the American Fisheries Society* **124:413-422.**
- Connelly, N. **A.**, and T. L. Brown. **1996.** Using diaries to estimate fishing effort and **fish** consumption: a contemporary assessment. *Human Dimensions of Wildlife* **1(1):22-34.**
- Connelly, N. A., T. L. Brown, and B. A. **Knuth.** **1990.** New York statewide angler survey **1988.** New York Department of Environmental Conservation, Bureau of Fisheries, Albany.
- Connelly, N. A., T. L. Brown, and B. A. Knuth. **1997.** New York statewide angler survey **1996,** Report **1:** angler effort and expenditures. New York Department of Environmental Conservation, Bureau of Fisheries, Albany.
- Cosper, R. L., and S. M. **Shaw.** **1985.** The validity of time-budget studies: a comparison of frequency and diary **data** in Halifax, **Canada.** *Leisure Sciences* **7:205-225.**
- Dann, S. L. **1993.** **Youth** recruitment into fishing: the influence of familial, social, and environmental factors and implications for education intervention strategies to develop aquatic stewardship. Ph.D. dissertation. Michigan State University. **363pp.**
- Decker, D. J., and N. **A.** Connelly. **1989.** Motivations for deer hunting: **implications** for antlerless deer harvest **as** a management tool. *Wildlife Society Bulletin* **17:455-463.**
- Dillman, D. A. **1978.** Mail and telephone surveys: the total design method. Wiley, New York
- Guadagnolo, F. B. **1989.** A comparison of recall and diary methodologies in the collection of expenditure **data.** U.S. Forest **Service** General Technical Report **NE-132:125-128.**
- Haworth, M. **1983.** Satisfaction statements and the study of angling in the United Kingdom. *Leisure Sciences* **5:181-196.**
- Kelly, J. R. **1974.** Socialization toward leisure: **A** developmental approach. *Journal of Leisure Research* **6:181-193.**
- Knuth, B. A., and N. A. Connelly. In preparation. Fish consumption among children who fish in upstate New York implications for risk assessment and health advisory programs. To be submitted to the North American **Journal** of Fisheries Management.
- La Page, W. F. **1987.** Using panels for tourism and travel research. Pages **425-431** **in** J. R. B. Ritchie and C. R. Goeldner, editors. *Travel, tourism, and hospitality research.* Wiley, New York
- Lemmens, P., E. S. **Tan,** and R. A. Knibbe. **1992.** **Measuring** quantity and frequency of drinking in **a** general population survey: a comparison of five indices. *Journal of Studies on Alcohol* **53:476-486.**

- Matthews, B. E. **1995**. What is SAREP? New York State College of Agriculture and Life Sciences, Cornell University, Department of Natural Resources, SAREP Resource Publication **95-5**, Ithaca.
- Matthews, B. E. **1996**. Recruiting, training, and retaining hunters and anglers: Challenging the natural resources education community. New York State College of Agriculture and Life Sciences, Cornell University, Department of Natural Resources, SAREP Resource Publication **96-1**, Ithaca.
- Parfitt, J. H. **1967**. A comparison of purchase recall with diary panel records. *Journal of Advertising Research* **7(3):16-31**.
- SAS Institute Inc. **1996**. SAS/STAT software: changes and enhancements through release **6.11**. SAS, Cary, NC.
- Sofranko, A. J., and M. F. Nolen. **1972**. Early life experiences and adult ~~sport~~ participation. *Journal of Leisure Research* **4:6-18**.
- SPSS. **1986**. SPSS user's guide, edition **2**. SPSS, Chicago.
- Sztramko, L. K., W. I. Dunlop, S. W. Powell, and R. G. Sutherland. **1991**. Applications and benefits of an angler *diary* program on Lake Erie. Pages **520-528** in D. Guthrie and seven coeditors. Creel and angler surveys in fisheries management. American Fisheries Society, Symposium **12**, Bethesda, Maryland.
- Tarrant, M. A., and M. J. Manfredo. **1993**. Digit preference, recall bias, and nonresponse bias in self reports of angling participation. *Leisure Sciences* **15:231-238**.
- U.S. Bureau of the **Census**. **1991**. **1990** Census of population and housing, *summary* population and housing characteristics - New York U.S. Government Printing Office, Washington, D.C.
- USFWS (U.S. Fish and Wildlife Service). **1997**. **1995** National survey of fishing, hunting, and wildlife-associated recreation. U.S. Government Printing Office, Washington, D.C.
- Vance, R. **1993**. Mom, will **you** take me fishing? *Outdoor America* **58(1):4-5**.
- Vaske, J. J., J. Beaman, M. J. Manfredo, D. D. Covey, and R. Knox. **1996**. Response strategy, recall frame and digit preference in self-reports of angling participation, *Human Dimensions of Wildlife* **1(4):54-68**.
- ~~Walsh~~, T. C. **1977**. Selected results from the **1972-73** diary surveys. *Journal of Marketing Research* **14:344-352**.