A SURVEY OF VISITORS TO FIVE MOUNTAIN LAKE AREAS IN NORTH CASCADES NATIONAL PARK COMPLEX

JANE E. SWANSON
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Technical Report NPS/PWRUW/NRTR-2005-03
NPS D-273

April 2005

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PNW CESU and Joint Venture Cooperative Agreement CA9088A0008, Task Agreement J9W88030021

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ACKNOWLEDGMENTS

Thank you to the following park staff and SCAs for serving as survey workers: Cody Hinchcliff, Deanna DiDonato, Kathy Johns, Cathi Jones, Joe Muggli, and Roy Zipp. Also, thank you to Mignonne Bivin and Pat Milliren for their personnel support and assistance with the logistics of the survey. We also appreciate the time that Chris Fowler spent collecting data and overseeing parts of the project. Roy Zipp and Regina Rochefort provided feedback, review, and support on the survey procedures and report.

PREFACE

This document reports the results of the North Cascades Mountain Lake Visitor Survey and protocols for monitoring visitor use along trails and lake shores. The research was proposed and funded by North Cascades National Park Complex. The general purpose of the research was to address social science information needs by 1) developing protocols for monitoring visitor use on trails and along lakeshores, and 2) collecting limited data about visitors to five mountain lake areas. The questions used in the NOCA Mountain Lake Visitor Survey are in the text of the report. However, readers may benefit by reviewing the survey in order to familiarize themselves with the survey items and the format in which they were originally presented. It is anticipated that this report will be used primarily as a reference document, and therefore, depending on each readers' objective, this report may be approached in very different ways. Readers not familiar with statistical analysis of survey data are encouraged to refer to Appendix A, "How to Use This Report." The detailed information reported here should prove useful to managers in many ways, including some that will only become evident in the future.

I. Introduction and Method

Background[1]

Due to natural geologic barriers, most mountain lakes in the North Cascades were fishless until the early 1900's when pioneers, miners, and loggers carried fry into them. In the mid-1930's, the Washington State Hi-Lakers and Trailblazers, two mountain lake fishing organizations, began stocking trout in lakes of the North Cascades. At this time, the area was U.S. Forest Service (USFS) land, and the stocking of these lakes was supported by the USFS and the Washington Department of Game (the precursor to the Washington Department of Fish and Wildlife) supervised the stocking program. In 1968, the land was designated as North Cascades National Park (NOCA). The focus of the national parks on environmental protection and restoration of ecosystems brought to the forefront the issue of continuing to stock the mountain lakes inside park boundaries. Although fishless, these mountain lakes original ecosystems contained plankton, aquatic insects, frogs, and salamanders. The stocking of fish was believed to upset the original ecosystem. Attempts at phasing out stocking of fish in NOCA lakes have been strongly resisted by WDFW and various stakeholders (Louter 2003).

In 1986, the director of the NPS issued a policy waiver that: 1) acknowledged the long-standing fish stocking practices, 2) allowed for continued stocking in select lakes, and 3) called for ecological research into impacts of stocking. This program of research was completed in July 2002. The research found that lakes with high densities of reproducing fish have statistically significant changes in zooplankton, insects, and amphibians. Lakes with low densities of non-reproducing fish did not show any statistically significant effects to native biota. It was also found that fragile lakeshore environments had more human caused damage if the lakes had fish than if they did not have fish (Louter 2003).

[1] The background information is adapted from "The Fish-Stocking Controversy: North Cascades National Park Complex, 1968-2003" by David Louter, Ph.D., historian for the National Park Service. A copy of this document can be found at http://www.nps.gov/noca/whitepaper.htm.

Social Information Needs

The NPS has focused on documenting the ecological impacts of stocking in these historically fishless lakes, while the social and cultural aspects of this issue have largely been overlooked. Fundamental questions such as "How many people fish?" remain unanswered. The park has begun to survey people getting backcountry permits to see if they will be fishing and where. This approach however does not quantify day use or overnight visitors who do not get a permit and there is no way to verify whether or not people with permits are actually doing what they say they are going to do.

The current project begins to address these data needs by focusing on five readily accessible lake areas that provide mountain lake fishing opportunities and experience relatively high use (day and overnight): 1) Hozomeen, Willow, & Ridley Lakes; 2) Thornton Lakes; 3) Monogram Lake; 4) Hidden Lake; and 5) Coon Lake. This approach has been selected with the goal of getting better information at select locations given time, personnel, and funding limitations. Because one summer season's worth of visitor use data collected at several locations yields very limited data, this project is intended as a first-step in a multi-year approach aimed at gathering accurate visitor use numbers and activity information. Given the desire for continued collection of visitor use data within NOCA, protocols for collecting general visitor use data will be developed where the methods are compatible with those used for the angler use survey.

Goals of the Mountain Lakes Visitor Survey

The primary goals of the Mountain Lakes Visitor Survey were to: a) estimate total use at five target lake areas, b) estimate the proportion of day and overnight users that fish in those mountain lakes, c) estimate day and overnight users and compare the estimate of overnight users with that derived from the overnight permit system, d) develop written protocols for monitoring visitor use at target locations, and e) develop a written protocol for documenting how people disperse around lakes and what they are doing. Additional goals of understanding the significance of mountain fishing to the Trailblazers and Hi-Lakers and evaluating the data these groups collect on mountain lakes fishing were addressed in a separate report (see Appendix D).

Survey Design and Development

The project had two components. The first component was an exit survey of visitors to the mountain lake areas. This survey collected information on fishing effort and harvest, type of use (day vs. overnight), individuals' history of fishing in the mountain lakes in NOCA, and general demographics. The second component was developing a protocol for measuring lakeshore use by different types of users.

Sampling and Contact Procedures

The results of the Mountain Lakes Visitor Survey represent the population of all visitors over the age of 18 who spoke English and exited the five lake areas of interest between July 12, 2003 and September 1, 2003. The original sampling schedule had visitors to each lake area being contacted on 6 weekdays and 6 weekend days during the designated sampling times (see below) throughout the study period. The objective of oversampling weekend days was to provide more reliable estimates for that subgroup than would be obtained by sampling days in the naturally occurring proportion of two weekend days for every five weekdays. Due to logistic and personnel constraints, the original schedule was modified somewhat by park staff. Table 1.1 summarizes the number of weekdays and weekend days sampled by lake area. It should be noted that these changes in scheduling resulted in only two weekend days being sampled at the Hozomeen Lake area (actually an oversampling of weekdays) and only four weekdays being sampled at the Monogram Lake area reducing the reliability of the data to represent the intended groups.

Table 1.1. Number of Weekdays and Weekend Days Sampled by Lake Area.

	Lake Area					Total
	Hozomeen	Thornton	Monogram	Hidden	Coon	
Weekend Days	2	9	5	7	7	30
Weekdays	7	5	4	5	5	26
Total days	9	14	9	12	12	56

Because the ratio of weekend to week days sampled at the five lake areas was not 2:5, it was not appropriate to simply combine descriptive data for these two subgroups when people contacted on the weekend differed from people contacted on weekdays. Rather, the data must be weighted to reflect the true proportion of weekend days to weekdays. For each lake area, analyses were conducted to determine if people contacted on the weekend differed from

people contacted on weekdays. When significant differences were observed, they are reported. An absence of a discussion of day of week contacted should be interpreted as indicating no significant effects were found. If significant effects were observed, the data for those lakes were weighted to reflect the proportion of weekend days to weekdays and used in analyses examining differences across the five lake areas.

The survey was designed to obtain information about people who visited the lake area. Thus, survey workers were located either at the trailhead or far enough down the trail from the lake area that they would be sure to intercept all people leaving the lake area. Every person who passed the survey worker as they left the lake area was asked to participate in the survey. Because the survey was designed as an exit survey, the sampling times at four of the lake areas were from 11:00 am to 7:00 pm to capture the majority of visitors leaving the lakes. At Coon Lake, the sampling time was from 9:00 am to 6:00 pm as people who stayed overnight were likely to leave the area throughout the morning.

A total of 33 respondents under age 18 completed the survey. Consistent with OMB and human subjects guidelines, the data from these individuals were excluded from the dataset.

Statistical Considerations

Readers not familiar with statistical analyses of survey data are encouraged to refer to Appendix A, "How to Use this Report". *Consistent with convention, statistical significance was set at the **.05 level** for analyses included in this report.* Statistical tests with *p*-values equal to or less than .05 are interpreted as indicating effects that are reliable or real (observed effects have a 5 percent or less probability of being due to chance alone). Although the analyses highlight statistically significant effects, they do not reveal whether effects have important practical implications. Some effects that fall just short of the .05 significance level may have large practical implications whereas other effects with high statistical significance may have no practical implications. Thus, it is important to consider both the statistical significance and the practical implications of these data.

Limitations

The NOCA Mountain Lakes Survey has several general limitations that should be kept in mind when interpreting the data. 1) In all surveys, it is assumed that respondents provide accurate and honest answers to the questions asked. 2) The data represent respondent

attitudes and opinions at a particular point in time (i.e., the time of the survey) and changes can occur at any time. 3) In addition, there are other limitations noted in the body of the report that are due to the manner in which individual questions were interpreted. Finally, there are limitations that revolve around the issue of non-response (i.e., possible bias in the sample due to differences between the respondents who completed the questionnaires and those who didn't). Less than 5 percent people refused to do the survey when contacted on-site. There was no way to determine if these individuals differed in a systematic way from those who participated. However, given that only a small number of people did not participate, it was unlikely that their responses would alter the conclusions substantially.

Accuracy of the Sample

Subject to the limitations stated previously, the authors generally believe that the data are representative of people aged 18 years or older who were heading toward the exit on the trails leading from the five lake areas during the survey period. This confidence is based on the fact that deviations from the sampling plan were relatively minor and few people refused to participate.

Assuming a random sample and questions of the yes/no type in which the true occurrences of these values in the population are 50%/50%, the data from this survey (n = 471) can be generalized to the population of mountain lake visitors to these five lakes with a 95 percent assurance that the obtained or observed percentages to any item will vary no more than ± 4.5 percent.[2]

Conventions Followed in This Report

As mentioned previously, an on-site survey was used to collect the data presented in this report. This survey is included in this report (see Appendix B) and it is recommended that it be reviewed before reading the body of this report. In the body of this report, each question is presented as it was asked in the survey, and it is followed by corresponding graphs, tables, or analyses. The specific question used to collect the data reported in each chart are noted in

[2] This confidence interval was calculated assuming an infinite population as no good estimate of the true population was available. Results however suggest that the true population size for these lakes is close to 1,500 people (see Section 5). Assuming a finite population of 1,500, the data from this survey can be generalized to the population of mountain lake visitors to these five lakes areas with a 95 percent assurance that the obtained or observed percentages to any item will vary no more than ± 0.008 percent.

the chart titles. The number of respondents (n) whose data are represented in each chart is also reported, generally at the bottom of the chart. The maximum number of respondents was 471. When a chart reports data for a subset of respondents (*c.f. Figure 2.22: Number of Seasons Fished in NOCA Mountain Lakes*), a note describes the sub-sample included in the chart.

Highlights are presented at the beginning of each chapter. A bulleted list is used when the chapter reports primarily descriptive data. When the chapter reports more detailed analyses, each highlight will contain a summary statement followed by additional explanations and/or implications. Readers are encouraged to review the supporting figures or analyses referenced in the highlights.

Missing data for up to 10 percent of respondents to a particular question are generally not considered likely to alter the interpretation of that question. Throughout this report, few questions had more than 10 percent missing data. Exceptions are noted in the text and charts.

Because the ratio of weekend to week days sampled at the five lake areas was not 2:5, it was not appropriate to simply combine descriptive data for these two subgroups if people contacted on the weekend differed from people contacted on weekdays. Rather, the data must be weighted to reflect the true proportion of weekend days to weekdays (2:5). For each lake area, analyses were conducted to determine if people contacted on the weekend differed from people contacted on weekdays. When significant differences were observed, they are reported. An absence of a discussion of day of week contacted should be interpreted as indicating no significant effects were found. If significant effects were observed, the data for those lakes were weighted to reflect the proportion of weekend days to weekdays and used in analyses examining differences across the five lake areas. Charts or analyses using weighted data are noted.

It is neither possible nor desirable that this report describes all possible analyses of the data collected by the survey, or even all analyses that are potentially of interest to park managers. Park managers are encouraged to think creatively about these data and how they may be used to address other questions of interest.

II. Visitor Profile

Visitors participating in the North Cascades Mountain Lakes Survey were asked a series of demographic questions. Responses to these questions are used here to characterize, or give a profile of, visitors to these lakes. The 438 respondents represent a total of 204 different parties with individuals aged 18 or older.

Highlights

- The age of respondents to the NOCA mountain lakes survey ranged from 18 to over 60 years. Respondents contacted at the Hozomeen Lake area (M = 44.3 years) and the Coon Lake area (M = 50.5) were significantly older than respondents contacted at the Thornton Lake area (M = 36.6), the Monogram Lake area (M = 36.1), and the Hidden Lake area (38.1).
- Males were more likely to visit NOCA mountain lakes, however the percentage of males varied significantly by lake area. The Hozomeen Lake area (53.8%) and the Coon Lake area (40.4%) had fewer male respondents than the other three lake areas (range from 68.0% to 72.4%).
- Although the majority of visitors contacted were from WA state, respondents' residence differed by lake area. Respondents contacted at the Hozomeen Lake area were more likely to be non-U.S. residents (69.4%) than respondents contacted at the other lake areas (ranged between 0.0% and 7.9%). This high percentage of non-U.S. residents at the Hozomeen Lake area is consistent with the only road access to the area being via Canadian roads. The Thornton Lakes and Coon Lake areas had the most non-Washington U.S. residents visiting suggesting these areas are more broadly known and easily accessible than Monogram, Hidden, or Hozomeen lake areas for non-Washington U.S. residents.
- Party size ranged from 1 to 12 with the most common party size being 2 (49.0% of parties) and the average party size being 2.46. Parties of friends (36.3%) followed by parties of family members (29.9%) were most common.
- Questions about respondents history of fishing in NOCA mountain lakes indicated that 15.2% of respondents had fished at least once (including this hike) in NOCA mountain lakes[12]. The number of seasons these respondents had fished in NOCA mountain lakes ranged from 1 to 55 with an average of 6.6 seasons. The most common number of seasons fished in NOCA mountain lakes was one (38.9%), and

[12] People who had fished at least once in NOCA mountain lakes are referred to as having ever fished in NOCA mountain lakes. Not all people who had ever fished in NOCA mountain lakes fished on the hike during which they were contacted to participate in the survey (see Trip Characteristics).

for 66.7% of these people who had only fished one season, the current fishing season was that sole season. The average number of years since respondents first fished in NOCA mountain lakes was 11.2 with the most common response being the current year was the first year (25.9%). The total number of hiking trips in which respondents had fished in NOCA mountain lakes ranged from 1 to over 30 with the average being 5.1 trips.

- Examination of the relationships among respondents age and these fishing history variables indicated that although being older was associated with having fished more seasons in NOCA mountain lakes, it was not related to number of years since first fished or number of trips to fish. Furthermore, respondents who had fished more seasons in NOCA mountain lakes had also taken more trips in which they fished in NOCA mountain lakes. These findings suggest that visitors first fish in NOCA mountain lakes across their lives (and not necessarily when they are younger). Furthermore, although there may be a group of older respondents who traditionally fish NOCA mountain lakes, this pattern of behavior was either not typical of all older respondents or not unique to older respondents.

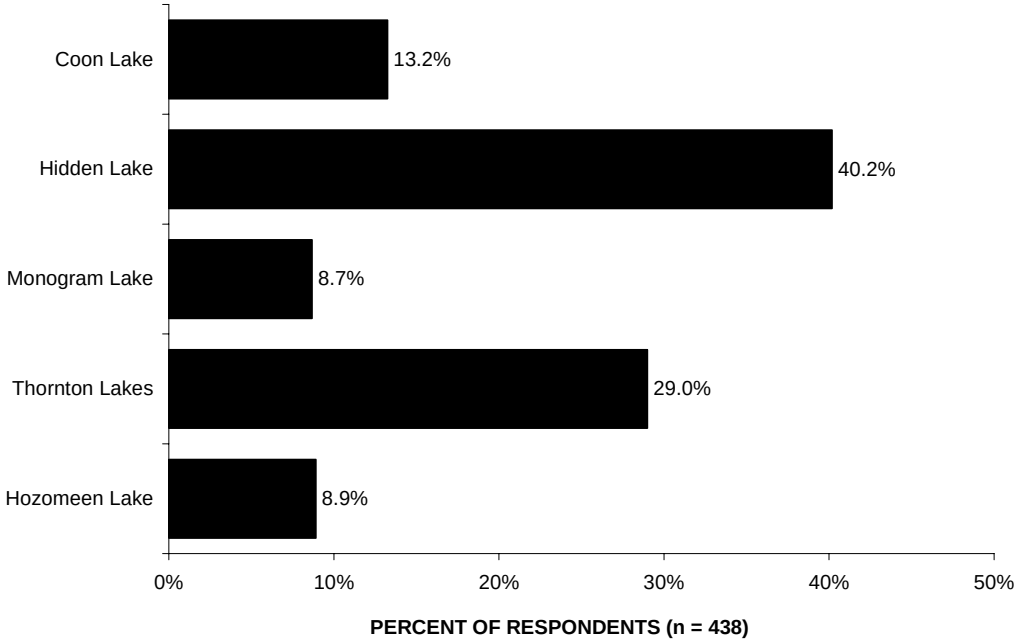
Location and Day of Week contacted

Characteristics of visitors and their trips may differ if they visited on the weekend than if they visited during the week. Identifying these differences were also important because the proportion of weekend to week days that visitors were contacted at each of the five lake areas was not the 2:5 ratio. Thus, simple aggregation of variables that differ by day of week contacted would not accurately portray the population parameter (e.g. average, percent of visitors, etc.). Analyses were conducted to determine if responses varied by day of week contacted. When significant differences were observed, they are reported. Furthermore, the data were weighted to reflect the 2:5 ratio of weekend to weekdays prior to further analyses. Charts or analyses that used weighted data are noted. An absence of a discussion of day of week contacted should be interpreted as indicating no significant effects were found.

Respondents were contacted at five lake areas within NOCA. Figure 2.1 shows the breakout by lake area. Because people or fishing activity may vary by lake area (i.e., contact point), analyses were conducted to determine if responses varied by lake area[13]. When significant differences were observed, they are reported. An absence of a discussion of lake area should be interpreted as indicating no significant effects were found. The number of people contacted at each lake area was a function of the number of days data were collected at each lake area. Thus, Figure 2.1 most likely does not represent the true relative use of these areas.

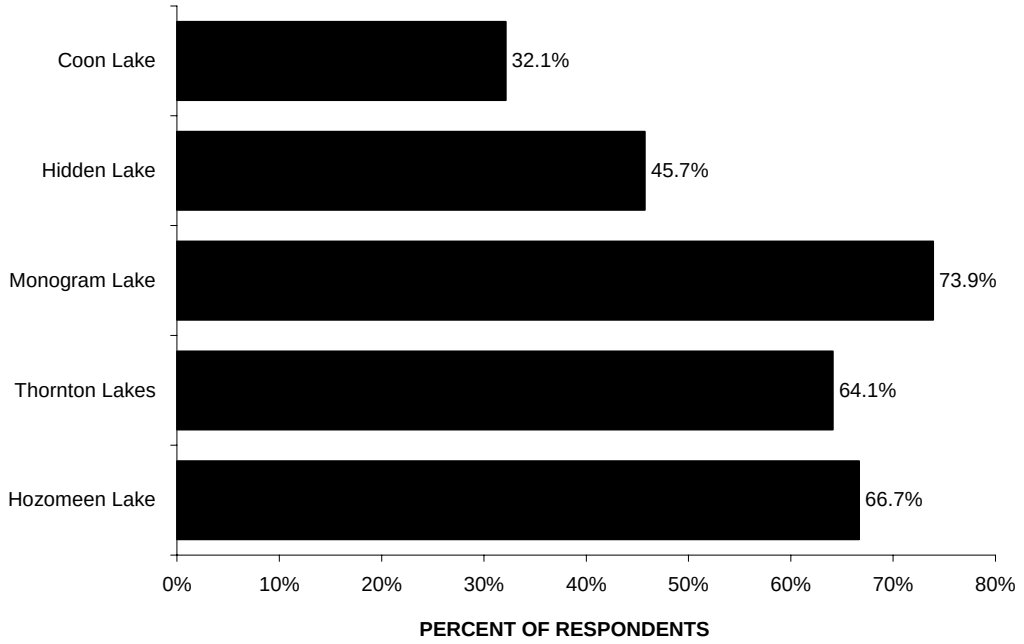
[13] If day of week differences were noted for a lake area, those weighted data were included in these analyses.

Figure 2.1: NOCA Mountain Lakes
PERCENT OF RESPONDENTS CONTACTED AT EACH LAKE AREA



Because the proportion of people who were contacted on weekend and week days was dependent on the number of weekend and week days sampled, these data were weighted for each lake area to reflect the 2:5 ratio of weekend to weekdays (see Figure 2.2). These weighted data more accurately reflect the true relative use of the five lakes areas and were analyzed to see if the five lake areas differed significantly in the percent of visitors contacted on the weekend. A significant difference in the percentage of people contacted on weekends differed by lake area was found, $\chi^2(4, n = 331) = 23.74$, $p < .001$. After adjusting for number of days people were contacted, the Monogram Lake area, the Thornton Lakes area, and the Hozomeen Lake area had a greater percentage of people contacted on weekends than did the Coon Lake or Hidden Lake areas indicating these lakes have higher weekend use. These three lake areas also had more use on weekends than weekdays whereas the Coon Lake area and Hidden Lake area had more use on weekdays than weekends.

FIGURE 2.2: NOCA Mountain Lakes
PERCENTAGE OF RESPONDENTS CONTACTED ON WEEKENDS BY LAKE AREA*



*Data were weighted to reflect the 2:5 ratio of weekend to week days.

Age of Respondents

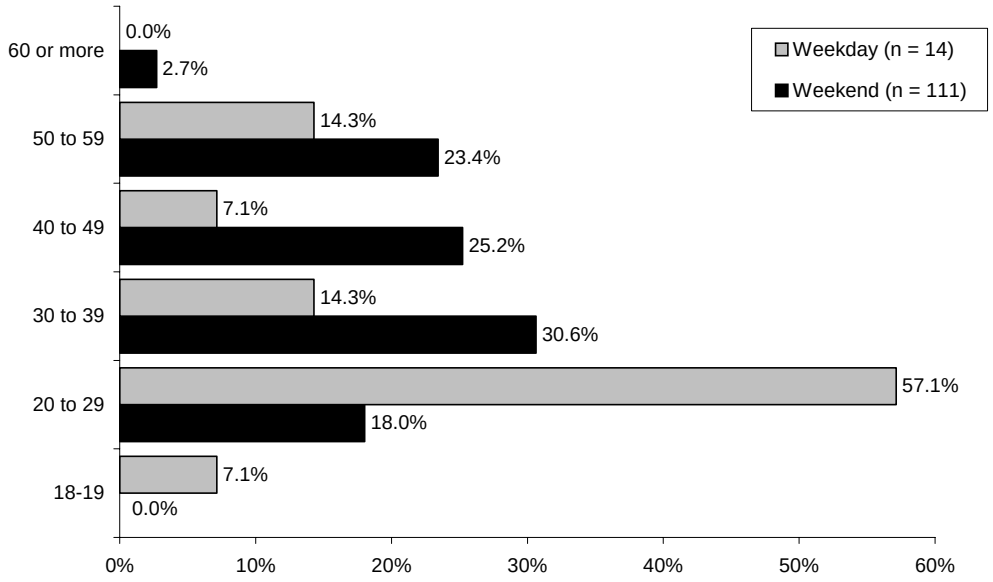
15. What year were you born? 19 ___ ___

Analyses revealed that at two lake areas, the average age of weekend respondents differed weekday visitors. At the Thornton Lakes area (see Figure 2.3), respondents contacted on the weekend were on average older (M = 39.9) than respondents contacted on weekdays (M = 30.6), $t(123) = 3.04$, $p = .003$. This effect was primarily driven by the large percentage of visitors age 20 to 29 who visited the area during the week. Further review of the data indicated that the median age was 23 during the week and 25 during the weekend. These findings may reflect college students taking a mid-week hike.

The reverse pattern was found at the Coon Lake area (see Figure 2.4): Respondents contacted on the weekend were on average younger (M = 44.2) than respondents contacted on weekdays (M = 53.6), $t(55) = -2.84$, $p = .006$. The pattern of findings for Coon Lake suggest that adults age 60 or greater who are more likely to be retired are more likely to visit during the week whereas adults age 40 to 49 who are more likely to be employed are more

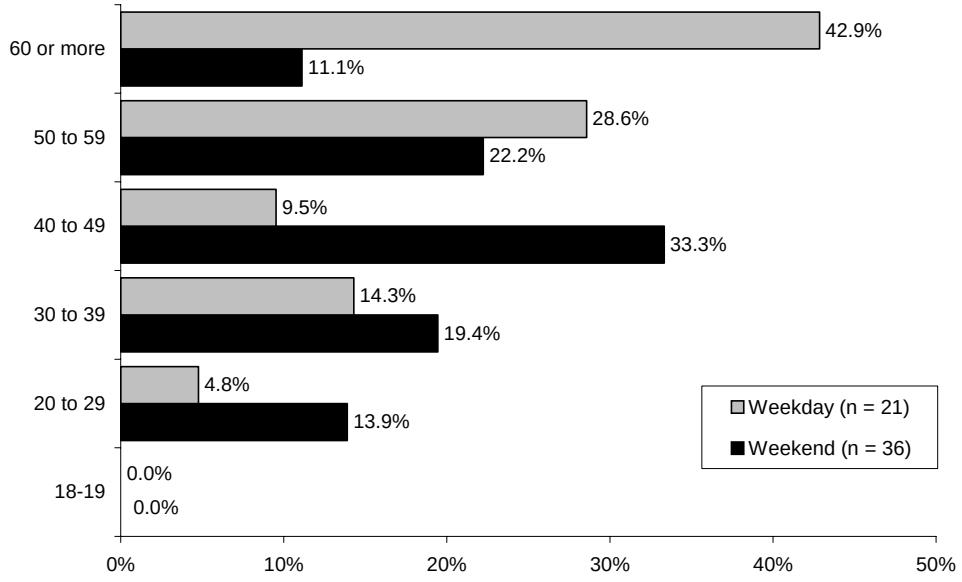
likely to visit on the weekend. This pattern may be due to travel constraints for reaching the Stehekin Valley.

FIGURE 2.3: NOCA Mountain Lake Survey, Q-15
AGE OF RESPONDENTS CONTACTED AT THORNTON LAKES AREA BY DAY OF WEEK



PERCENT OF RESPONDENTS
Average age weekday = 30.6, Average age weekend = 39.9

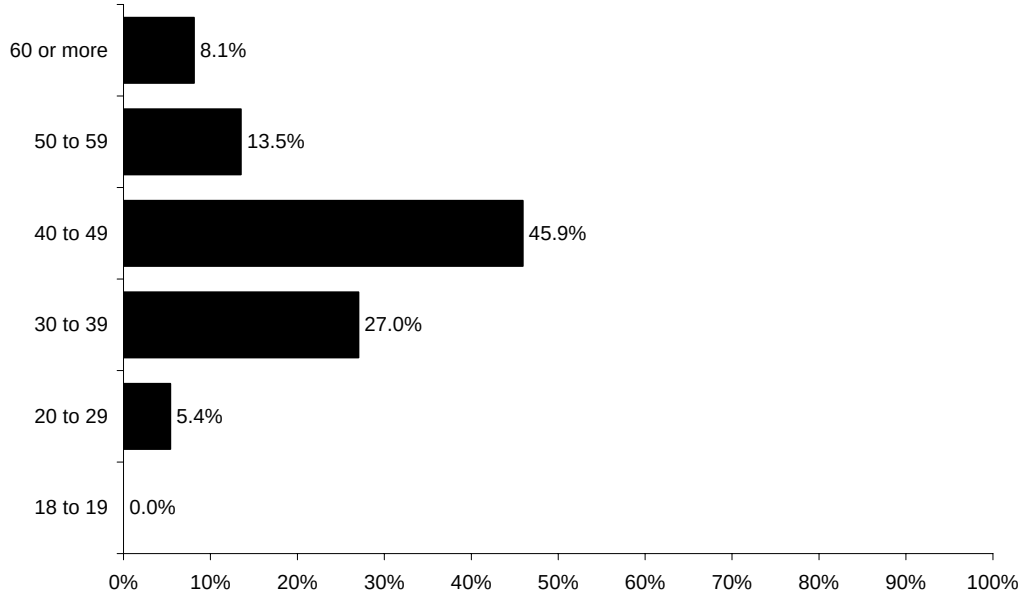
FIGURE 2.4: NOCA Mountain Lake Survey, Q-15
AGE OF RESPONDENTS CONTACTED AT COON LAKE AREA BY DAY OF WEEK



PERCENT OF RESPONDENTS
Average age weekday = 53.6, Average age weekend = 44.2

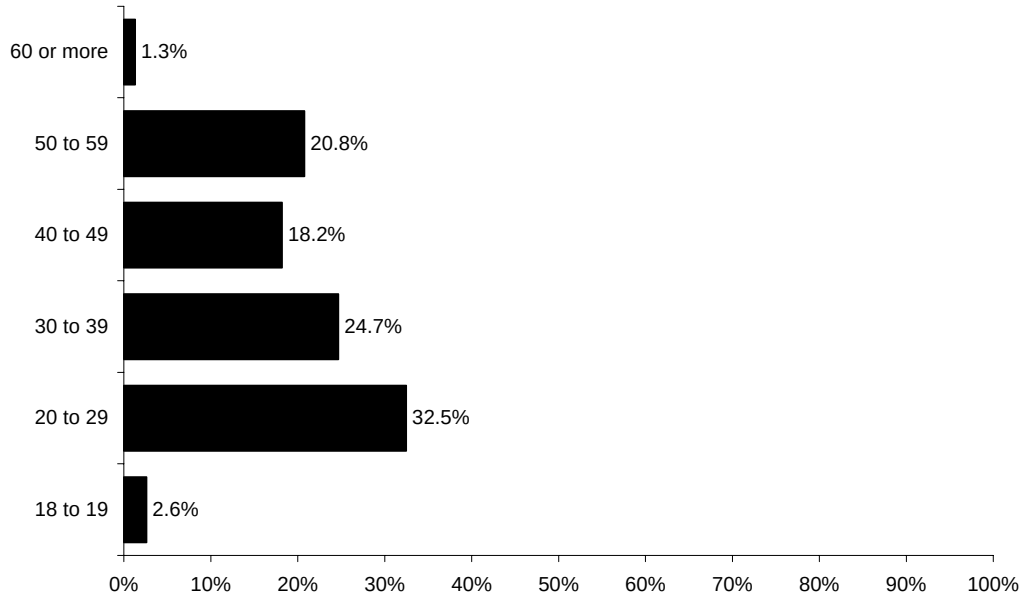
After weighting the data for the Thornton Lakes and Coon Lake areas to reflect the 2:5 weekend to week day ratio, age differed significantly by lake area, $F(4, 357) = 14.54$, $p < .001$ (see Figures 2.5-2.9). Post Hoc Tukey tests revealed that on average respondents contacted at the Hozomeen Lake area and the Coon Lake area were significantly older than respondents contacted at the Thornton Lakes area, the Monogram Lake area, and the Hidden Lake area (all p's < .042). The age of respondents contacted at Hozomeen Lake area did not differ significantly from those contacted at Coon Lake area ($p = .127$). Furthermore, the age of respondents contacted at Thornton Lakes area, the Monogram Lake area, and the Hidden Lake area did not differ significantly (all p's > .890).

Figure 2.5: NOCA Mountain Lakes, Q-15
AGE OF RESPONDENTS CONTACTED AT HOZOMEEN LAKE AREA



PERCENT OF RESPONDENTS (n = 37)
Average age = 44.32 years

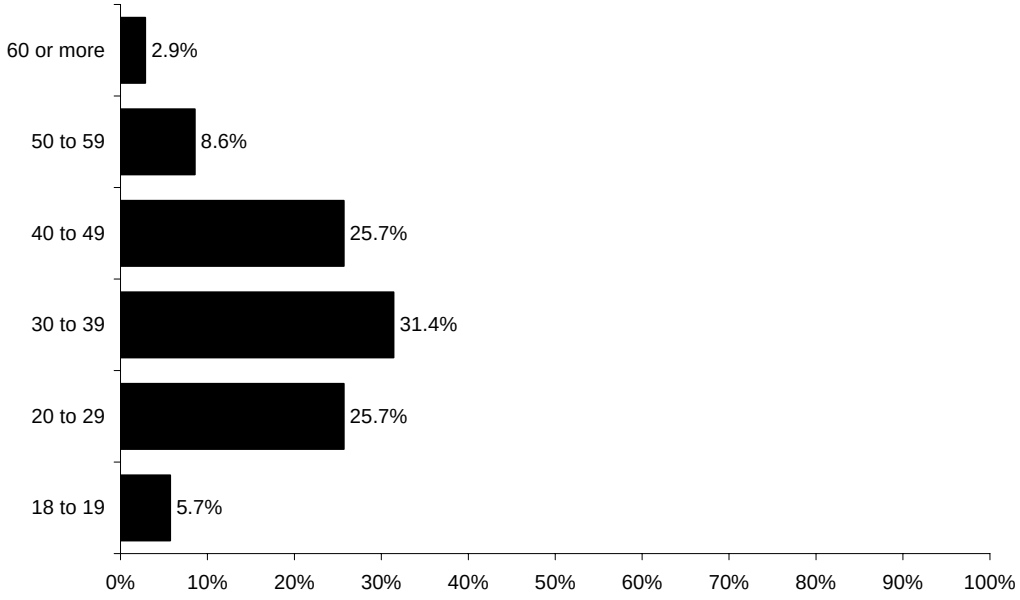
Figure 2.6: NOCA Mountain Lakes, Q-15
AGE OF RESPONDENTS CONTACTED AT THORNTON LAKES AREA*



PERCENT OF RESPONDENTS (unweighted n = 126)
Average age = 36.56 years

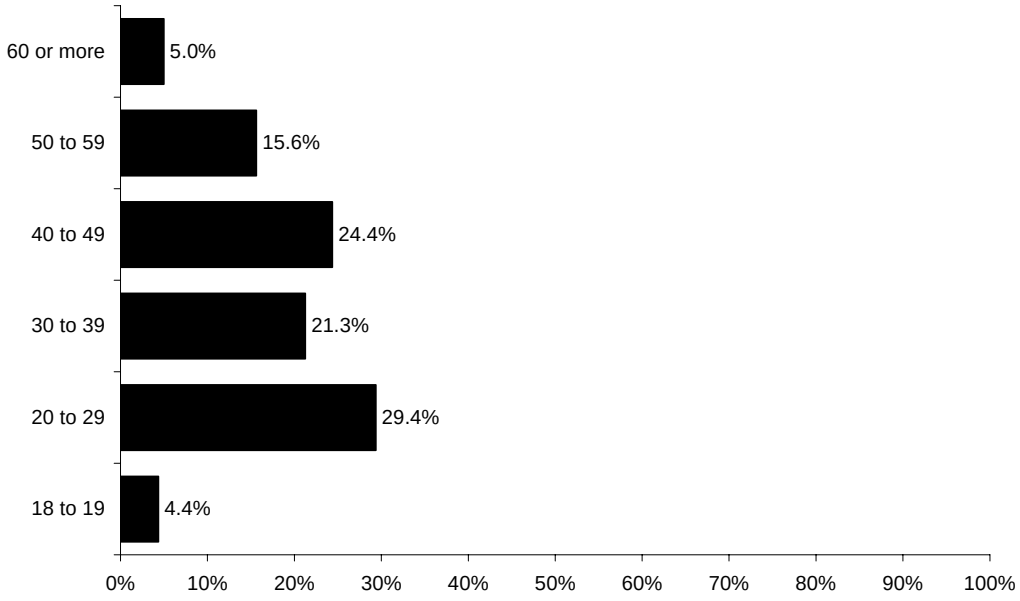
*Data were weighted to reflect the 2:5 ratio of weekend to week days.

Figure 2.7: NOCA Mountain Lakes, Q-15
AGE OF RESPONDENTS CONTACTED AT MONOGRAM LAKE AREA



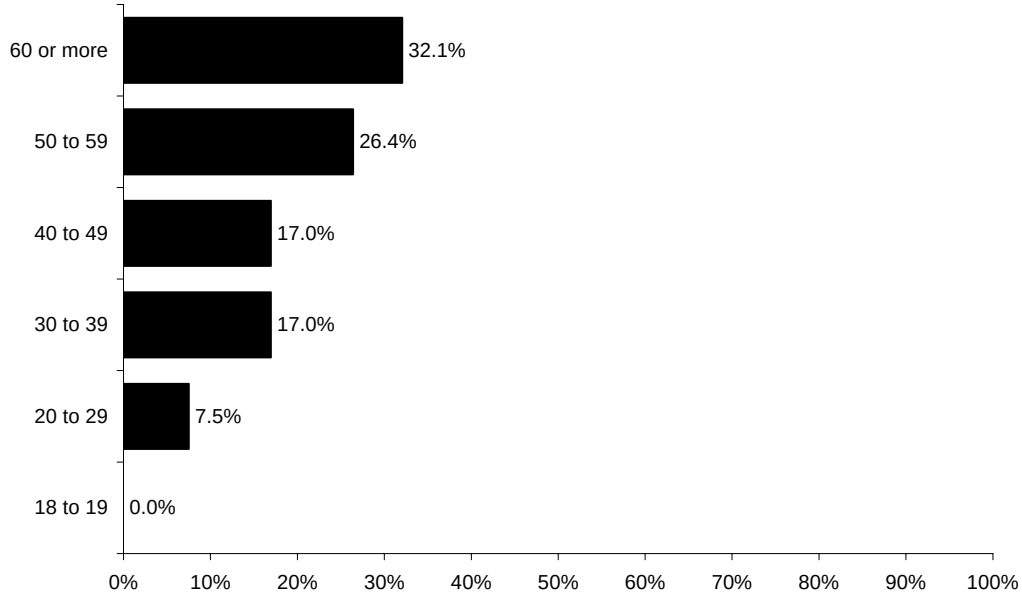
PERCENT OF RESPONDENTS (n = 35)
Average age = 36.09 years

Figure 2.8: NOCA Mountain Lakes, Q-15
AGE OF RESPONDENTS CONTACTED AT HIDDEN LAKE AREA



PERCENT OF RESPONDENTS (n = 167)
Average age = 38.07 years

Figure 2.9: NOCA Mountain Lakes, Q-15
AGE OF RESPONDENTS CONTACTED AT COON LAKE AREA*



PERCENT OF RESPONDENTS (unweighted n = 57)
Average age = 50.49 years

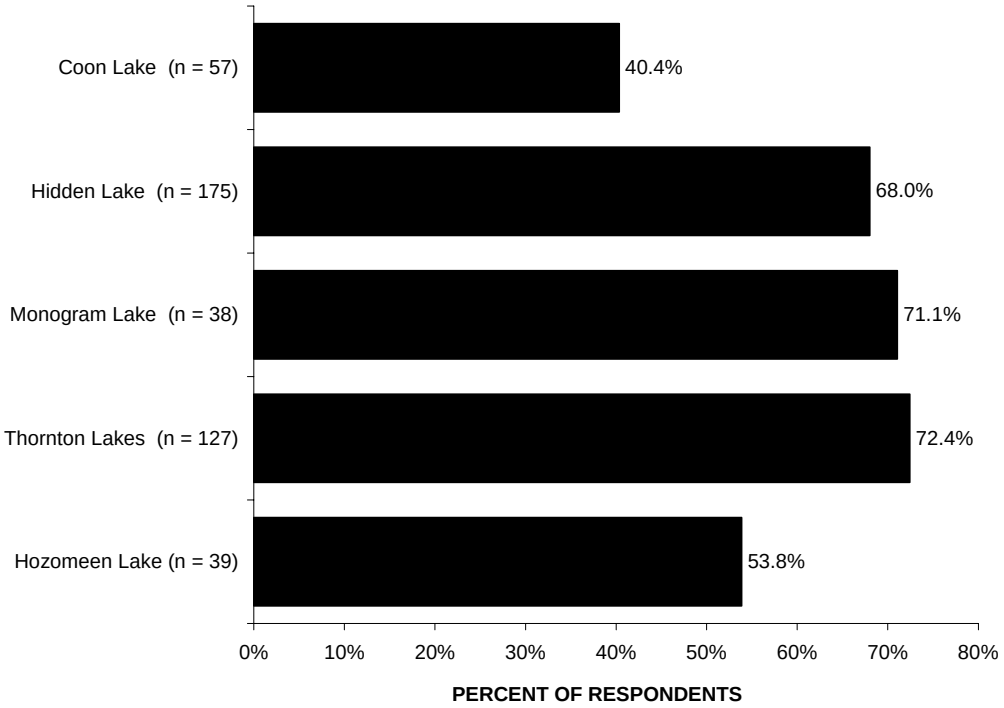
*Data were weighted to reflect the 2:5 ratio of weekend to week days.

Sex

14.	Are you:	Female	Male

Although 64.5% of all respondents were male, the percentage of respondents that were male differed significantly by lake area, $\chi^2(4, n = 436) = 21.64$, $p < .001$. As can be seen in Figure 2.10, there were fewer male respondents at Hozomeen Lake area (53.8%) and Coon Lake area (40.4%) than the remaining three lake areas (ranged from 68.0% to 72.4%).

Figure 2.10: NOCA Mountain Lakes, Q-14
PERCENTAGE OF MALE RESPONDENTS BY LAKE AREA



Residence

16. What is your home Zip code?
(Write country name if you are not a US resident.)

___ ___ ___ ___ ___

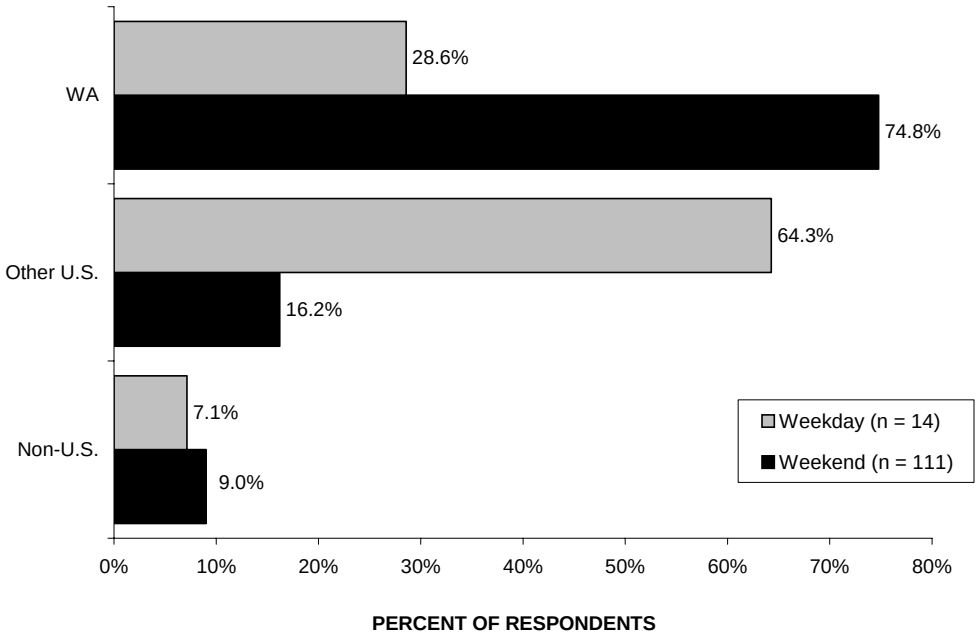
Respondents' home zip code was used to classify them as Washington residents, other U.S. residents, or non-U.S. residents. Overall, the majority of non-U.S. residents were Canadians.

Residence of respondents contacted at Thornton Lakes area varied by day of week contacted, $\chi^2(2, n = 125) = 17.16$, $p < .001$[14] (see Figure 2.11). The low number of weekday respondents at Thornton Lakes resulted in two cells with expected frequencies less than five leading to a potentially inflated and significant chi-square value. Caution should therefore be

[14] Expected frequencies less than five occurred in two cells. It was not possible to eliminate these cells and also maintain the key differences of interest.

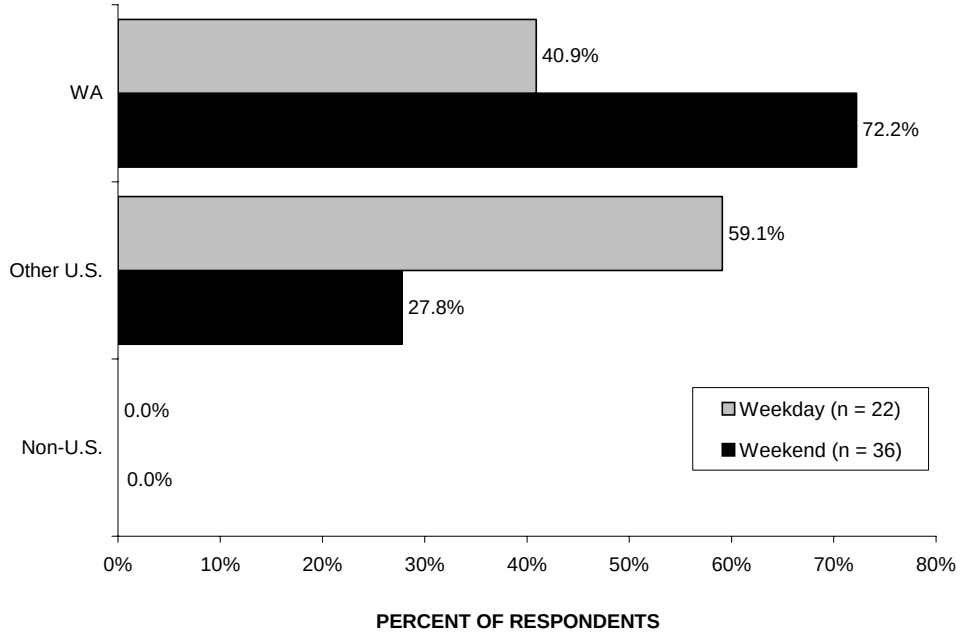
used when interpreting these data as evidence of a strong difference in use by WA and other U.S. respondents depending on whether it is a weekend or week day.

FIGURE 2.11: NOCA Mountain Lake Survey, Q-16
RESIDENCE OF RESPONDENTS CONTACTED AT THORNTON LAKES AREA BY DAY OF WEEK



Residence of respondents contacted at the Coon Lake area varied by day of week contacted, $\chi^2(1, n = 58) = 5.60$, $p < .001$. As can be seen in Figure 2.12, a greater percentage of weekend visitors were residents of Washington State whereas a greater percentage of weekday visitors were from other U.S. states. These findings suggest increased use by local residents on the weekend.

FIGURE 2.12: NOCA Mountain Lake Survey, Q-16
RESIDENCE OF RESPONDENTS CONTACTED AT COON LAKE AREA BY DAY OF WEEK



Residence data for the Thornton Lakes and Coon Lake areas were weighted to reflect the 2:5 ratio of weekend to week days, and used when examining differences by lake area. As can be seen in Figures 2.13-2.17, the distribution of respondents' residence varied by lake area, $\chi^2(8, n = 366) = 204.32$, $p < .001$[15]. Respondents contacted at Hozomeen Lake area were more likely to be non-U.S. residents than respondents contacted at other lake areas. The Hozomeen Lake area is accessible by car via Canadian roads, by boat via Ross Lake, or by foot via trails that originate from the North Cascades Highway. These findings were consistent with higher use by Canadians than Americans due to easier road access. Also compared to respondents contacted at other lake areas, those contacted at the Thornton Lakes and Coon Lake areas were more likely to be other U.S. residents.

[15] Expected frequencies less than five occurred in two cells. It was not possible to eliminate these cells and also maintain the key differences of interest (i.e., the high percentage of non-U.S. respondents at Coon Lake).

FIGURE 2.13: NOCA Mountain Lakes, Q-16
RESIDENCE OF HOZOMEEN LAKE RESPONDENTS

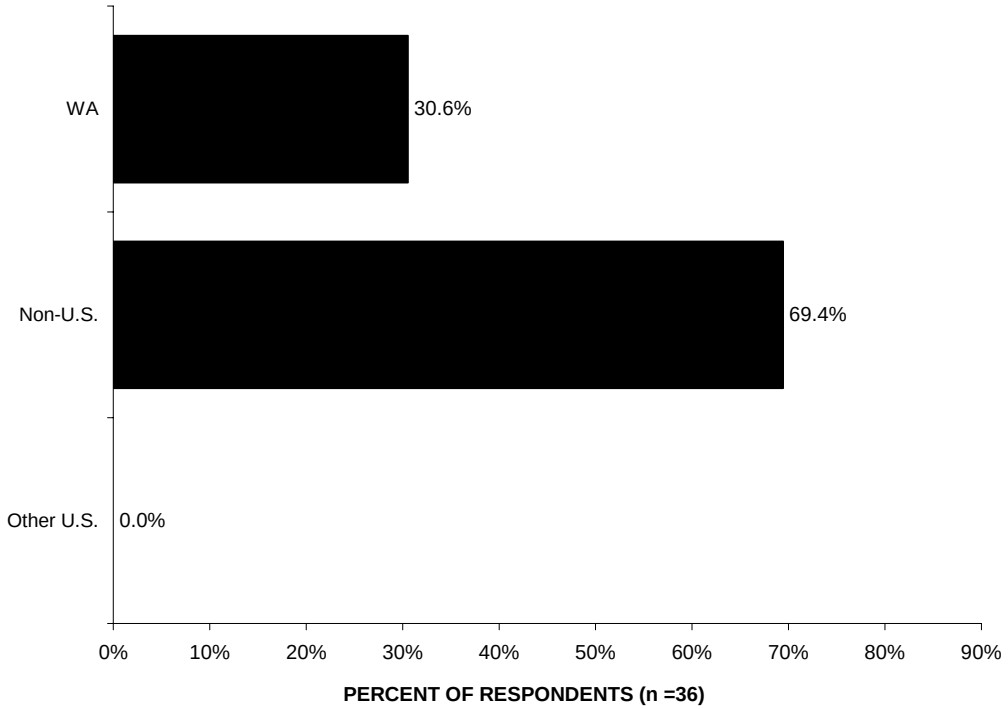
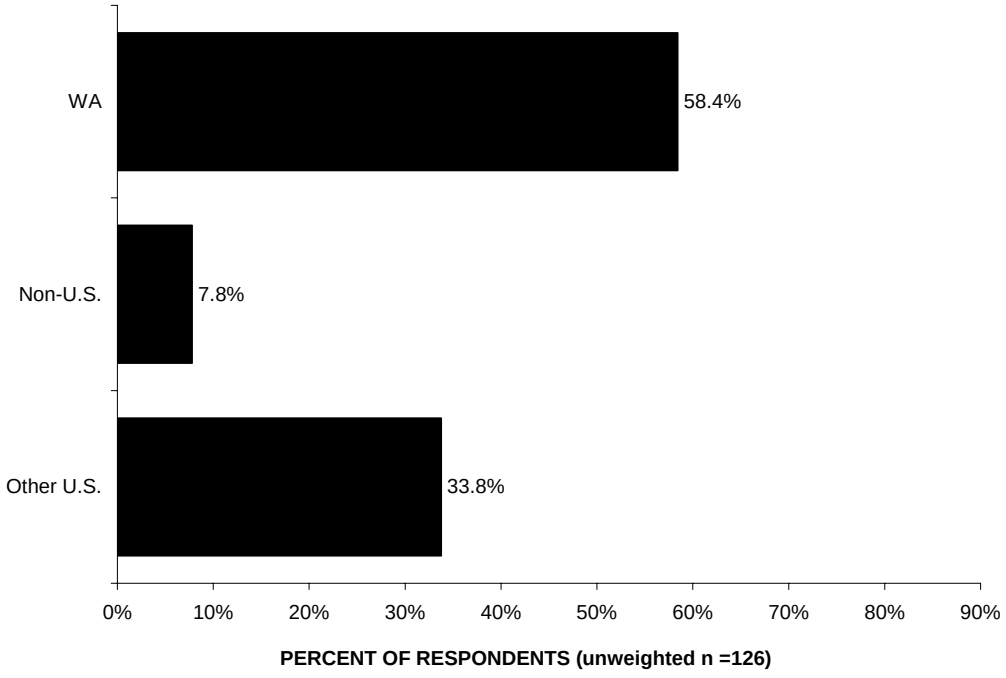


FIGURE 2.14: NOCA Mountain Lakes, Q-16
RESIDENCE OF THORNTON LAKES RESPONDENTS*



*Data were weighted to reflect the 2:5 ratio of weekend to week days.

FIGURE 2.15: NOCA Mountain Lakes, Q-16
RESIDENCE OF MONOGRAM LAKE RESPONDENTS

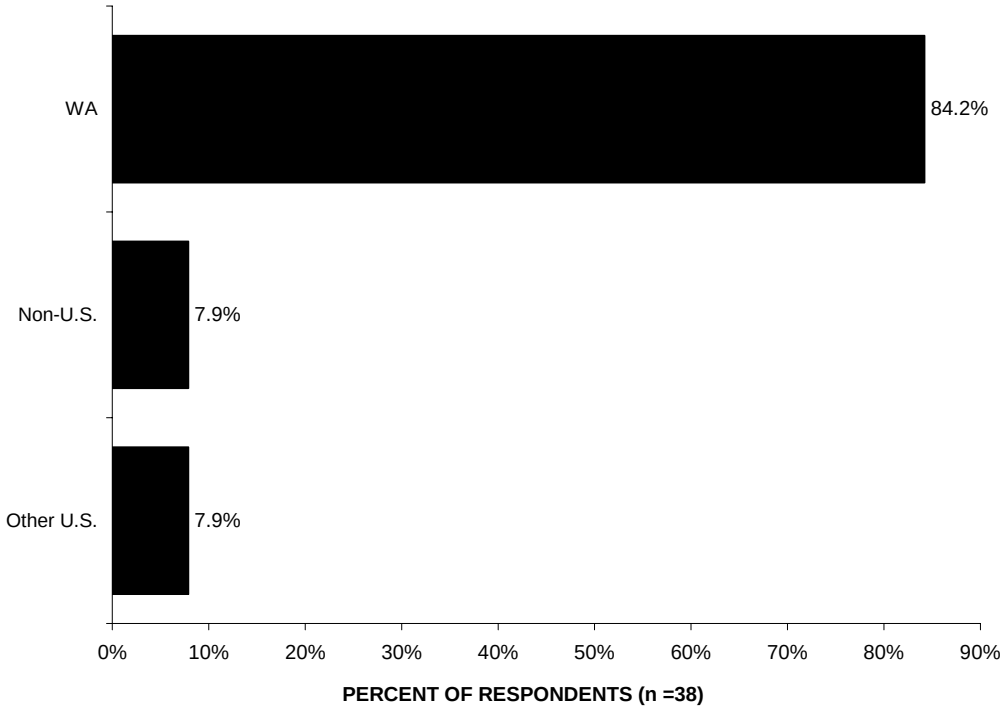


FIGURE 2.16: NOCA Mountain Lakes, Q-16
RESIDENCE OF HIDDEN LAKE RESPONDENTS

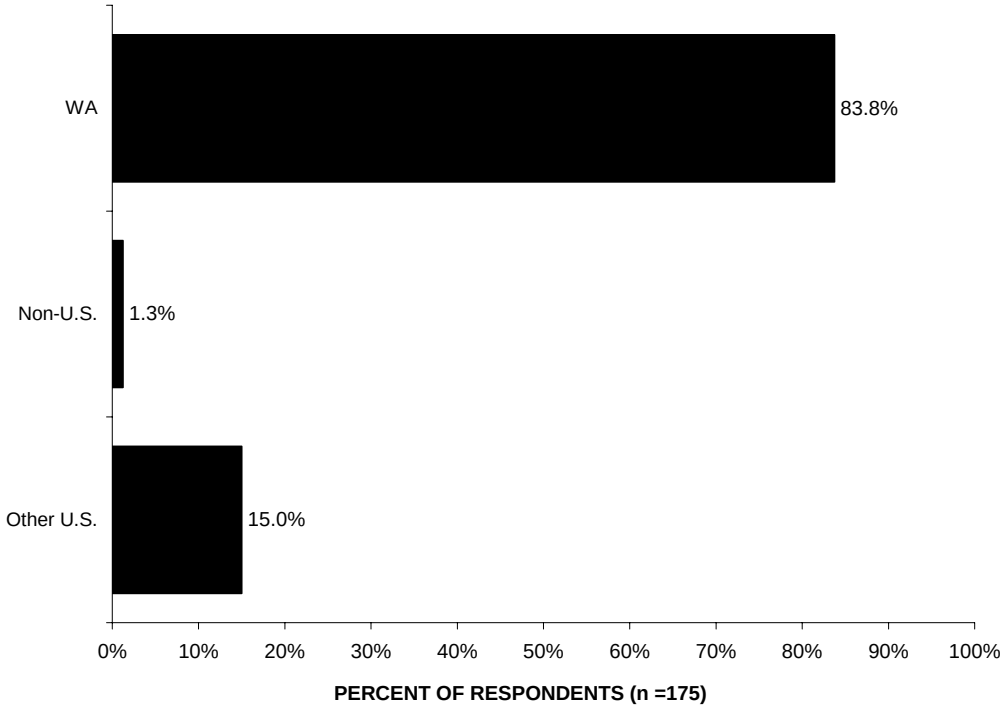
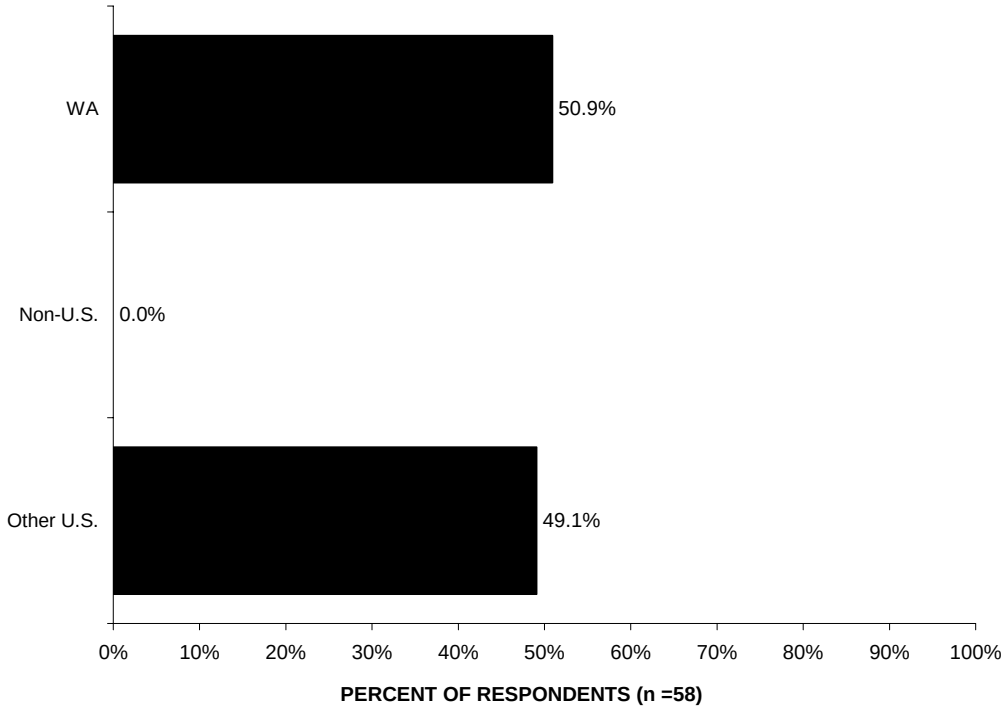


FIGURE 2.17: NOCA Mountain Lakes, Q-16
RESIDENCE OF COON LAKE RESPONDENTS



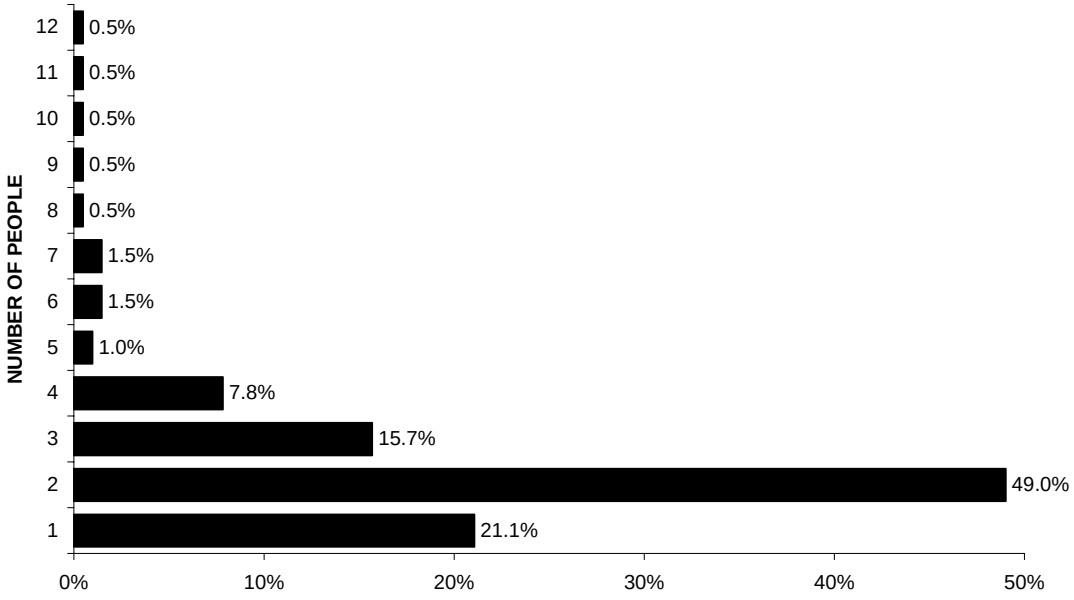
Party Size

1. How many people are in your hiking group?

_____ People are in my group

Because all members of a party age 18 or older were asked to participate in the survey and provide a value for party size, the data were adjusted to reflect only one value per party. A total of 204 parties were contacted with an average party size of 2.46 people. As can be seen in Figure 2.18, more than 90 percent of parties had four or fewer people.

Figure 2.18: NOCA Mountain Lakes, Q-1
SIZE OF PARTY



Average party size = 2.46

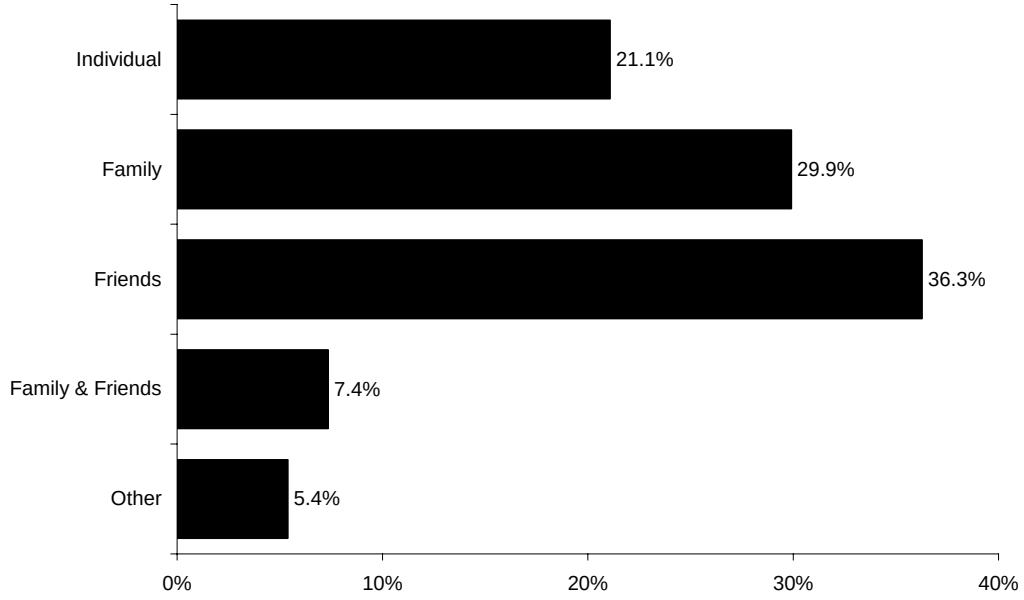
Party Type

2. What is the make-up of your hiking group? (*Check one box)*

Individual
Family
Friends
Family & Friends
Other (Please specify) _____

Because all members of a party age 18 or older were asked to participate in the survey and provide a response for the make-up of their hiking group, the data were adjusted to reflect only one value per party. As can be seen in Figure 2.19, the most common party type consisted of friends (36.3%) followed by family (29.9%). The "Other" group type consisted primarily of organized groups.

Figure 2.19: NOCA Mountain Lakes, Q-2
TYPE OF GROUP



Ever Fished in NOCA Mountain Lakes

6. INCLUDING THIS YEAR, during how many fishing seasons (May through October) have you fished at least once in mountain lakes in North Cascades National Park Complex? *Note: For purposes of this survey, mountain lakes are all lakes within the park and recreation areas except Ross Lake, Diablo Lake, or Lake Chelan.*

I have never fished in mountain lakes→GO TO Q-14 ON OTHER SIDE.

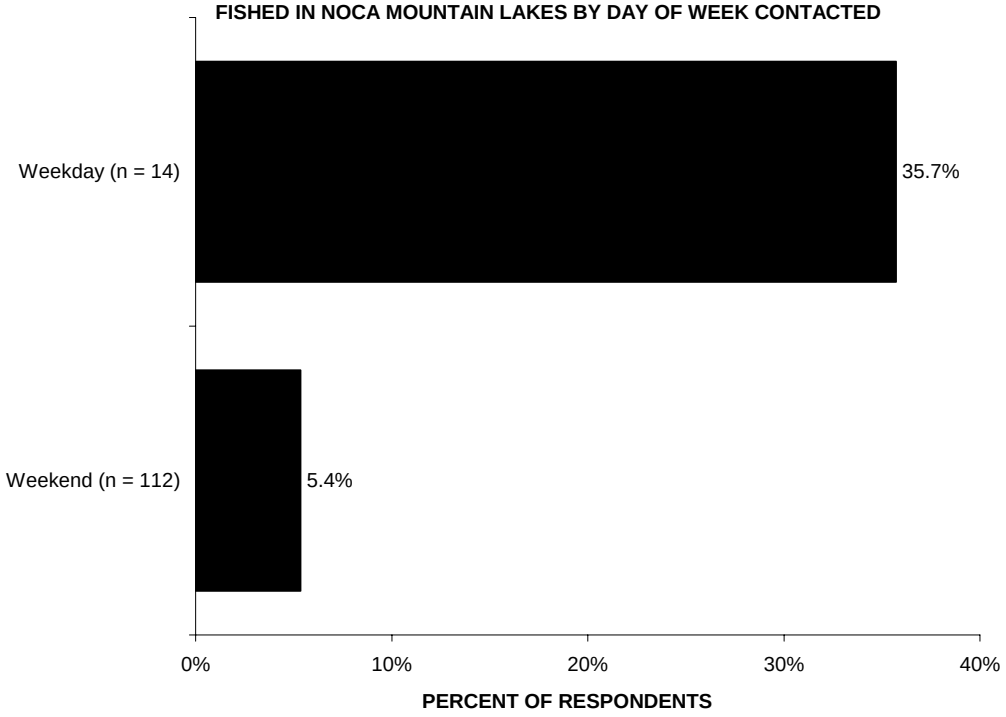
I have fished ____ seasons in mountain lakes.

Responses to the above question are presented in two charts. The first chart shows the percentage of respondents who ever fished in NOCA mountain lakes and the second chart shows the number of seasons they fished (see below).

At the Thornton Lakes area, the percentage of respondents who had ever fished in NOCA mountain lakes differed for those contacted on the weekend and those contacted on weekdays, $\chi^2(1, n = 126) = 14.39$, $p < .001$ (expected frequencies less than 5 could not be eliminated). As can be seen in Figure 2.20, a greater percentage of weekday respondents had

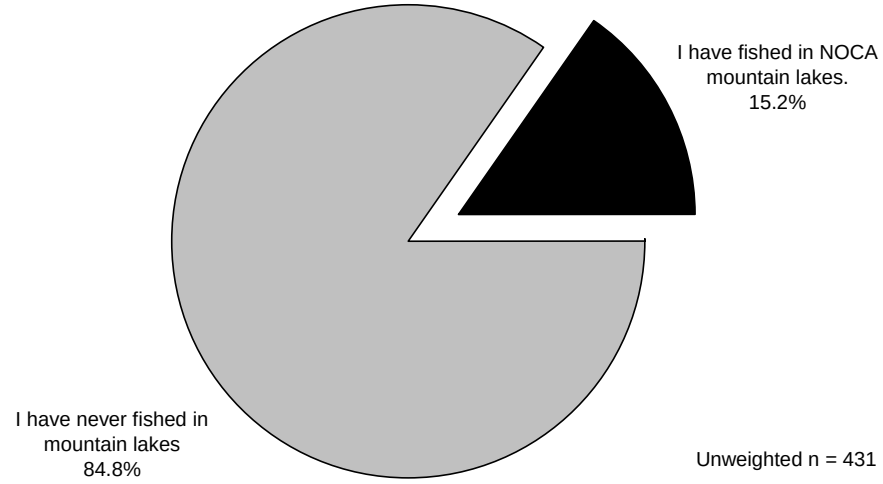
ever fished in NOCA mountain lakes than weekend respondents. Because of the small number of weekday respondents (n = 14), caution should be exercised when interpreting these data as evidence of differences in likelihood of having ever fished in NOCA mountain lakes for people visiting Thornton Lakes area.

FIGURE 2.20: NOCA Mountain Lakes, Q-6
PERCENTAGE OF RESPONDENTS CONTACTED AT THORNTON LAKES WHO HAD EVER FISHED IN NOCA MOUNTAIN LAKES BY DAY OF WEEK CONTACTED



The data for the variable ever fished for the Thornton Lakes area were weighted to reflect the 2:5 ratio of weekend to week days, and used when examining differences by lake area. As no significant differences among lake areas were observed, Figure 2.21 presents the combined data (weighted for weekend-weekday differences observed at the Thornton Lakes area).

Figure 2.21: NOCA Mountain Lakes, Q-6
PERCENTAGE OF RESPONDENTS THAT HAVE EVER FISHED IN NOCA MOUNTAIN LAKES*



*Data for the Thornton Lakes area were weighted to reflect the 2:5 ratio of weekend to week days.

Number of Seasons Fished

6. INCLUDING THIS YEAR, during how many fishing seasons (May through October) have you fished at least once in mountain lakes in North Cascades National Park Complex? *Note: For purposes of this survey, mountain lakes are all lakes within the park and recreation areas <u>except</u> Ross Lake, Diablo Lake, or Lake Chelan.*

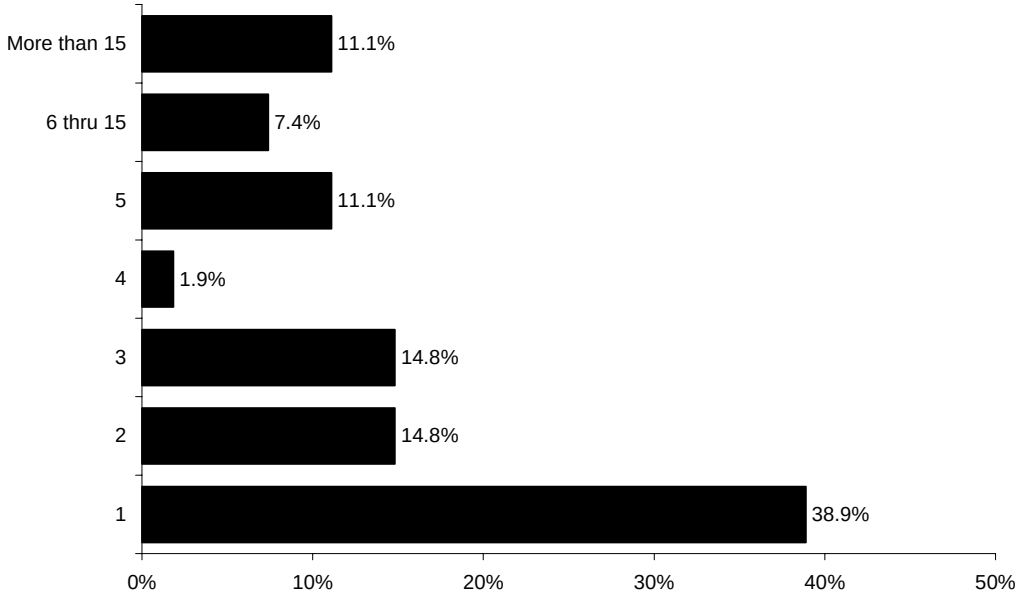
I have never fished in mountain lakes→GO TO Q-14 ON OTHER SIDE.

I have fished ____ seasons in mountain lakes.

Responses to the above question are presented in two charts. The first chart shows the percentage of respondents who ever fished in NOCA mountain lakes (see section above) and the second chart shows the number of seasons they fished (see Figure 2.22). Additional analyses revealed that 66.7% of respondents who had fished only one season, the current fishing season was that sole season. It is possible that first-time anglers prefer the more readily accessible lakes sampled in this study whereas more experienced anglers seek out

more remote lakes. Another possibility is that there are more people who try fishing than who continue to fish.

Figure 2.22: NOCA Mountain Lakes, Q-6
NUMBER OF SEASONS FISHED IN NOCA MOUNTAIN LAKES



PERCENT OF RESPONDENTS (n = 54)
Average number of seasons fished = 6.58
Includes only those respondents who had ever fished in NOCA mountain lakes

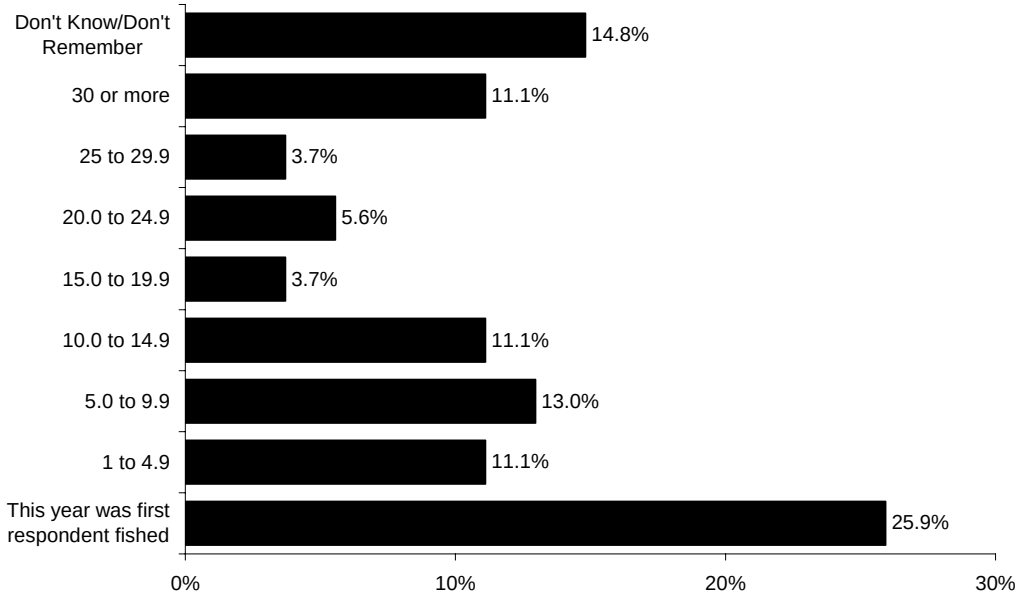
Number of Years Since First Fished in NOCA Mountain Lakes

7. What year did you first fish in mountain lakes in North Cascades National Park Complex?

The first year I fished in mountain lakes was _____.
Don't know/Don't Remember

Responses to the question above were used to calculate the number of years since respondents had first fished in NOCA mountain lakes (see Figure 2.23).

FIGURE X.XX: NOCA Mountain Lakes,
NUMBER OF YEARS SINCE FIRST FISHED IN NOCA MOUNTAIN LAKES



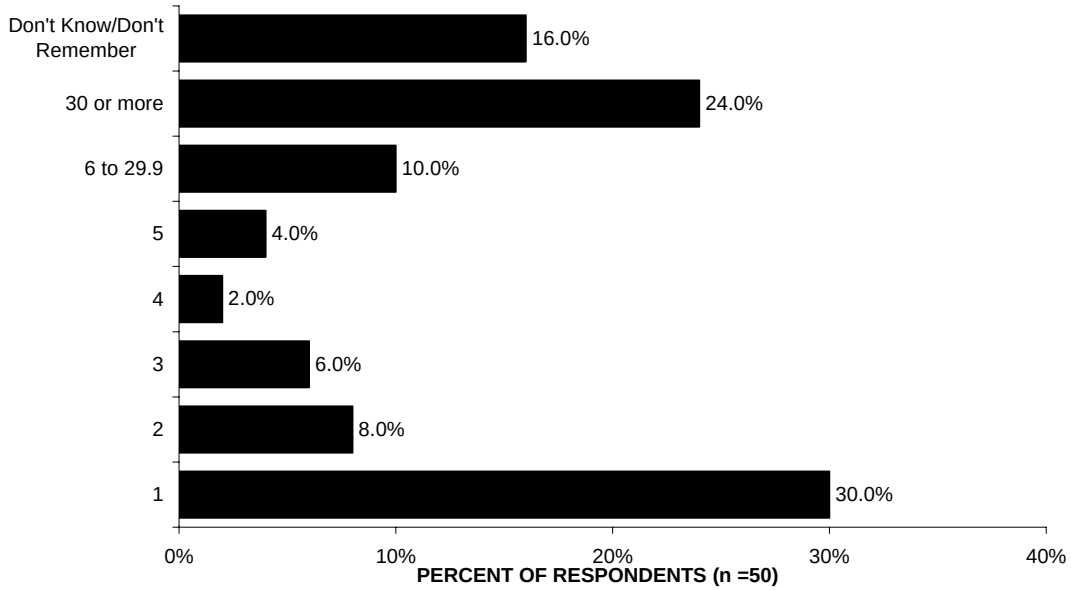
PERCENT OF RESPONDENTS (n = 54)
Includes only those respondents who had ever fished in NOCA mountain lakes

Number of Trips to Fish in NOCA Mountain Lakes

8. INCLUDING THIS HIKING TRIP, how many trips have you made in which you fished in mountain lakes in North Cascades National Park Complex?

I have made _____ mountain lakes fishing trips.
I can't remember exactly but it was more than 30 trips.
Don't know/Don't Remember

FIGURE 2.24: NOCA Mountain Lakes, Q-8
NUMBER OF TRIPS PEOPLE WHO HAVE EVER FISHED IN NOCA HAVE MADE TO FISH IN NOCA MOUNTAIN LAKES*



PERCENT OF RESPONDENTS (n =50)
Average number of trips = 5.06
Includes only those respondents who had ever fished in NOCA mountain lakes

*A total of 12.3% (7/57) of respondents did not respond to this question.

Relationships Among Age and Fishing History Variables

Compared to younger respondents, older respondents would have had more opportunity to: 1) first fish in NOCA mountain lakes more years ago, 2) fish more seasons in NOCA mountain lakes, and 3) take more mountain fishing trips in NOCA. Similarly, respondents who had first fished in NOCA mountain lakes more years ago would have more opportunity to: 1) fish more seasons in NOCA, and 2) take more mountain fishing trips in NOCA. However, correlational analyses revealed that only some of these relationships existed. Specifically, being older was associated with having fished more seasons in NOCA mountain

lakes, $r(n = 48) = .31$, $p = .030$[16], and respondents who had fished more seasons in NOCA mountain lakes had taken more NOCA mountain lake fishing trips, $r(n = 41) = .38$, $p = .014$. No other significant correlations were observed (all p's > .497).

These findings indicated that although being older was associated with having fished more seasons in NOCA mountain lakes, not all older respondents consistently returned over the years to fish (either in terms of seasons or number of trips). Furthermore, respondents first visited NOCA mountain lakes at different points in their lives and not necessarily when they are younger.

[16] Because there were weekend-weekday differences for age observed at Thornton Lakes area and Coon Lake area, the data were weighted to reflect a 2:5 ratio of weekend to weekday at these lake areas for these analyses.

III. Trip Characteristics and Fishing Activities

Visitors participating in the North Cascades Mountain Lakes Survey were asked a variety of questions about their trip and fishing activities during their trip. This section reports the data that were collected with these questions.

Highlights

- People who drove to hike the trail that day be it from home, other lodging, or campsite at a different location were considered day users. People who camped overnight in the backcountry whether or not it was by the particular lake were considered overnight users. The majority of respondents were day users (72.1%), and the percentage of day users did not differ significantly by lake area. Day users were on average older (M = 42.2) than overnight users (M = 34.8) and more likely to be WA residents (72.4%) or non-U.S. residents (83.3%) than other U.S. residents (56.3%).
- Although half of all respondents drove from home or other lodging to day hike, the distribution of trip types varied significantly by lake area. Whereas 76.9% of respondents contacted at the Hozomeen Lake area camped overnight at another location and drove to day hike, less than 23% of respondents contacted at the other lake areas did so. Consistent with backcountry campsite availability at the lake areas, the Monogram Lake area had the highest percentage of respondents who camped overnight at a backcountry campsite by the lake (42.1%).
- The number of self-reported hours respondents spent within 12 feet of the lakeshore varied significantly by lake area. Respondents contacted at the Hozomeen Lake area (M = 4.52 hours) and at the Monogram Lake area (M = 5.78 hours) spent significantly more time by the lakeshore than respondents contacted at the other lake areas (M's < 1.50 hours).
- One or more people fished in 10% of all parties. The most people in any party that fished was four. Of the nineteen parties that had at least one member fish, in 68.4% (13 out of 19) of these parties everyone fished. None of the remaining parties had fewer than half of the people fish. Parties where all members fished were equally likely to be comprised of individuals, family, or friends.
- Of all respondents, 6.5% reported fishing on the hike during which they were contacted and this percentage did not differ significantly by lake area. However, of people who had ever fished in NOCA mountain lakes, the percentage who fished on this hike differed by lake area. All of the people who had ever fished that visited the

Thornton Lakes area (n = 11) fished on this hike compared to 53.8% or less at the other four lake areas (n's range from 6 to 20). Thornton Lakes are a popular angling destination and therefore anglers may be more likely to seek it out for fishing.

- The percentage of respondents who had ever fished in NOCA mountain lakes for whom fishing was a primary motivation for their trip varied significantly by lake area. Fishing was a primary motivation for 58.3% of respondents who had ever fished that were contacted at the Coon Lake area compared to 18.3% or less of respondents who had ever fished that were contacted at the other lake areas. No respondents contacted at the Monogram Lake or Hozomeen Lake areas were primarily motivated by fishing for the trip during which they were contacted. For those who had ever fished and whose primary motivation was not fishing, viewing scenery (29.6%) was the most common listed primary motivation followed by hiking (22.2%), backpacking (11.1%), and exercise (7.4%).
- Of people who reported fishing being a primary motivation for their hike, 16.7% (2 out of 12) reported not fishing on their hike. No information was gathered about why these people did not fish. The majority (63.0%) of people who fished on their hike indicated that fishing was not their primary motivation for their hike. This finding is consistent with other research looking at primary motivations of anglers in the Alpine Lakes Wilderness (Hendee, Clark, & Dailey 1977).
- People who fished spent anywhere from less than an hour to ten hours fishing during their hike. For people who fished, the average number of hours fished was 2.80.
- The number of fish caught by people who fished ranged from 0 to 16 with the average being 4.00 fish. The number of fish harvested by people who fished ranged from 0 to 6 with the average being 1.54 fish. Although people who caught more fish harvested more fish, $r(n = 31) = .87$, $p < .001$, over one-third (37.5%) of respondents who caught fish did not keep any of them.
- People who spent more hours fishing caught and kept more fish. They also spent over three times as long within 12 feet of the lakeshore (M = 4.98 hours vs. M = 1.25 hours).

Trip Type

4. Which of the following best describes this trip?

I drove from my home or other lodging to hike for the day.
I camped overnight at another location and drove to this trail to do a day hike.
I camped overnight at a backcountry campsite by the lake(s).
I camped overnight in the backcountry, but not by the lake(s).

Respondent's trip type varied significantly by lake area, $\chi^2(12, n = 437) = 141.16$, $p < .001$[12]. As can be seen in Figures 3.1 – 3.5, respondents contacted at Hozomeen Lake area were more likely to have camped overnight at another location and drove there for a day hike than respondents contacted at the other lake areas. Respondents contacted at Monogram Lake area were also more likely to have camped overnight at a backcountry campsite by the lake than any of the other respondents. These findings were consistent with the facilities available at the different lake areas (e.g., nearby campgrounds, backcountry campsites near the lakes). Furthermore, hiking to Monogram Lake is an arduous day hike for most users as the trail gains 4,000 feet of elevation over approximately five miles.

[12] Expected frequencies less than 5 occurred in two cells. Excluding the data for the Monogram Lake area eliminated the expected frequencies less than five while indicating significant differences for the lake areas.

Figure 3.1: NOCA Mountain Lakes, Q-4
TRIP TYPES AT HOZOMEEN LAKE

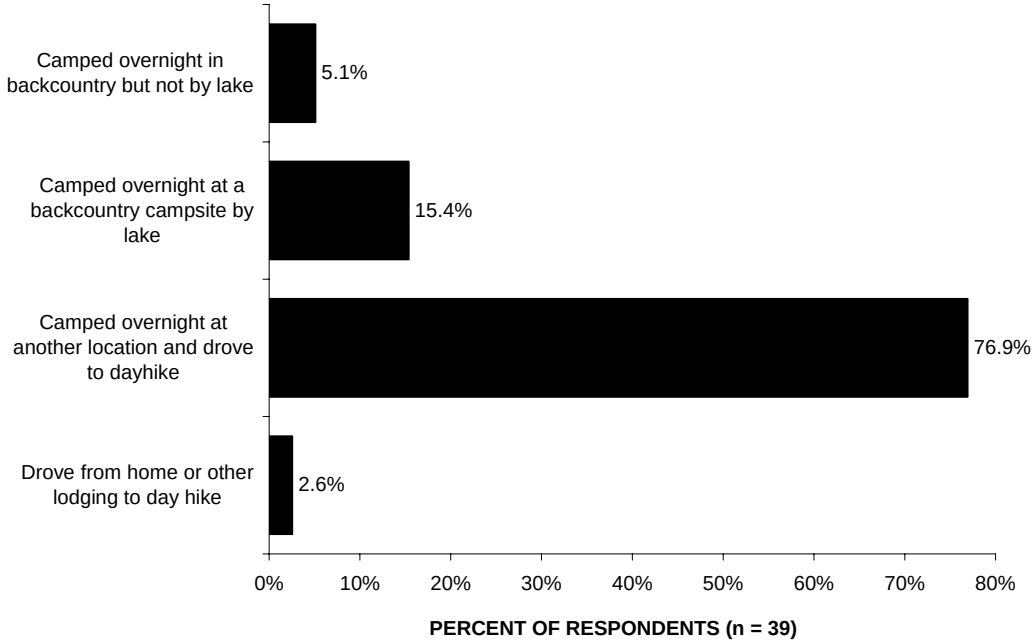


Figure 3.2: NOCA Mountain Lakes, Q-4
TRIP TYPES AT THORNTON LAKES

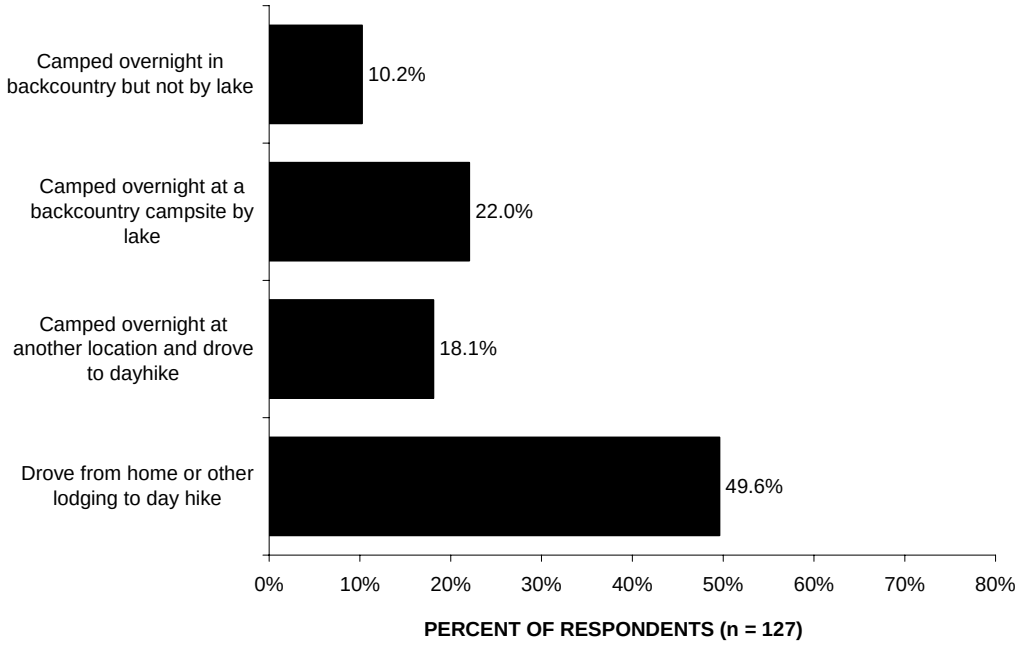


Figure 3.3: NOCA Mountain Lakes, Q-4
TRIP TYPES AT MONOGRAM LAKE

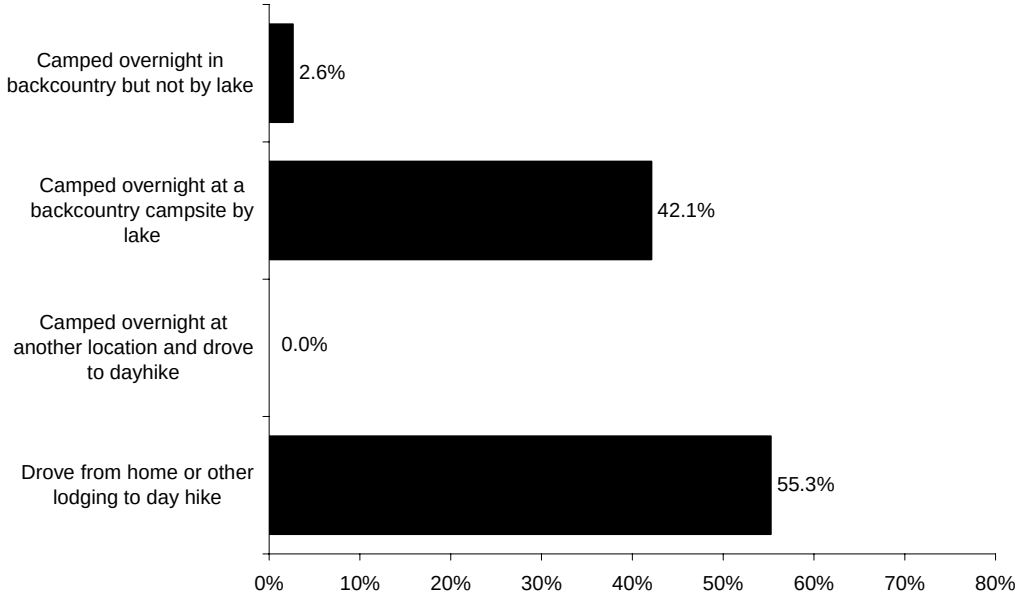


Figure 3.4: NOCA Mountain Lakes, Q-4
TRIP TYPES AT HIDDEN LAKE

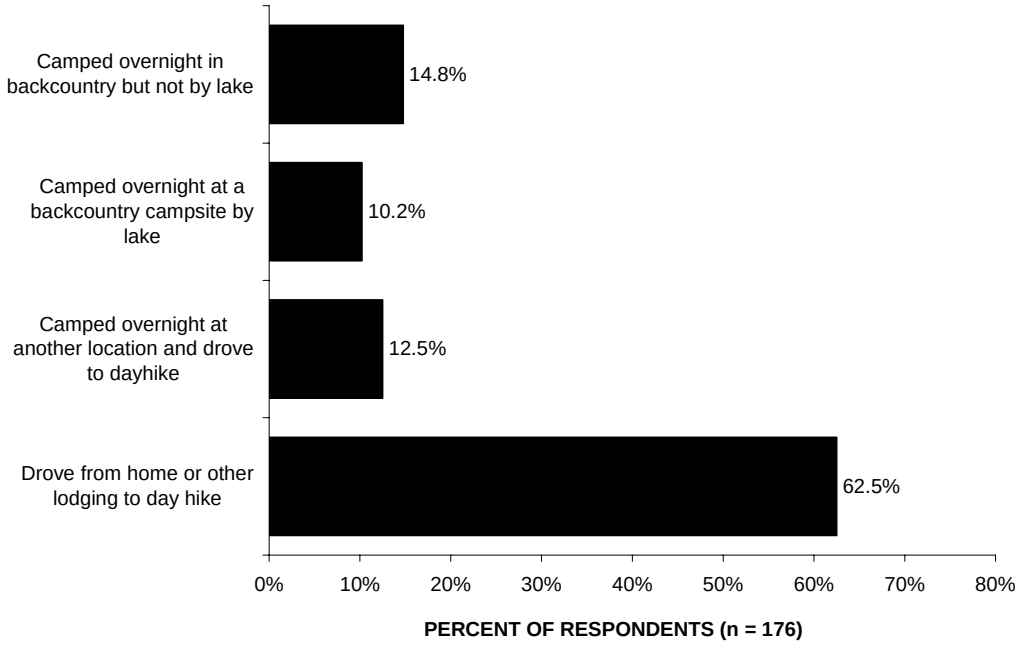
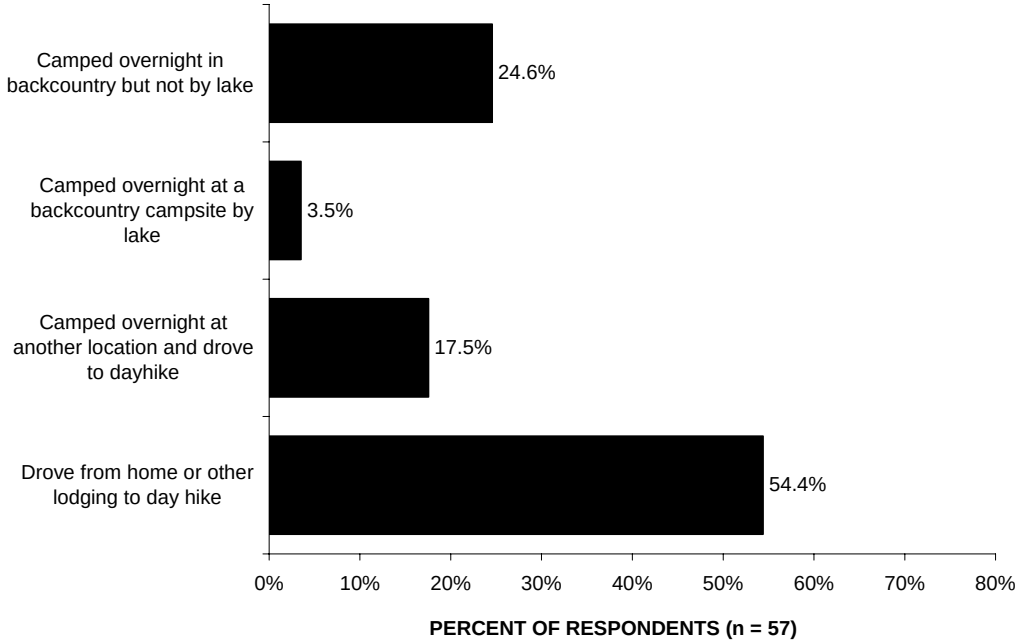


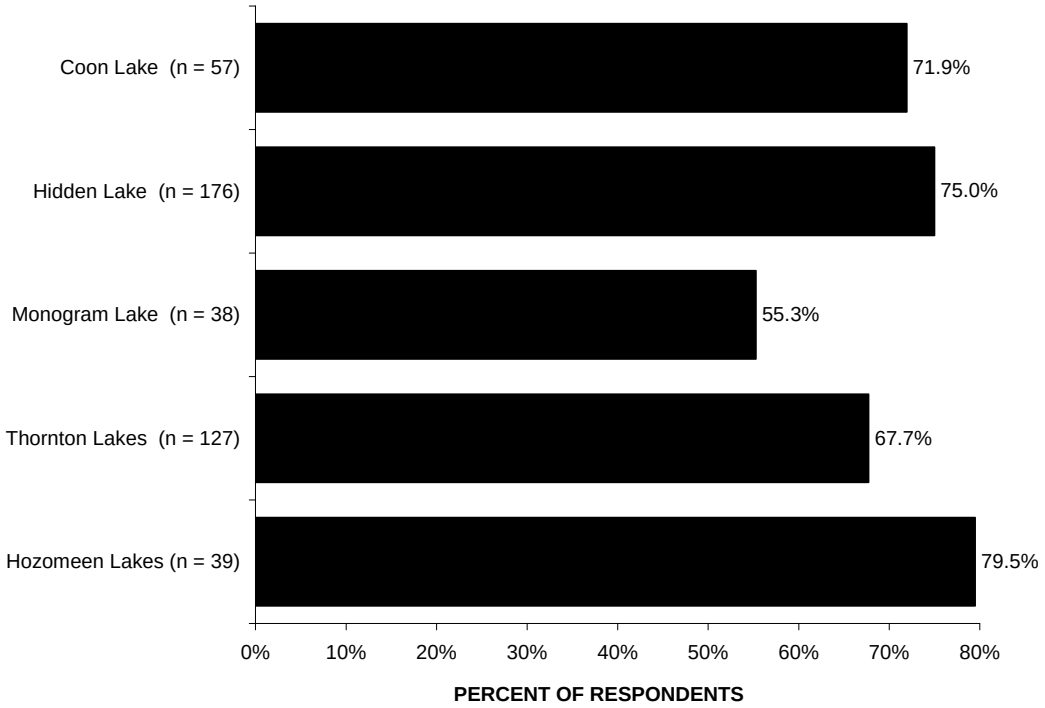
Figure 3.5: NOCA Mountain Lakes, Q-4
TRIP TYPES AT COON LAKE



Day Users

Based on responses to the type of trip question, respondents were classified as day users or overnight users. Day users were people who drove to hike the trail that day be it from home, other lodging, or campsite at another location. Overnight users were people who camped overnight in the backcountry whether or not it was by the particular lake. The overall percentage of day users was 71.2% of respondents. Although the percentage of day users did not differ significantly by lake area, $\chi^2(4, n = 437) = 8.01$, $p = .091$, Figure 3.6 presents the data by lake area for management purposes.

FIGURE 3.6: NOCA Mountain Lakes,
PERCENTAGE OF DAY USERS BY LAKE



Other U.S. residents were less likely to be day users (M = 56.3%) than WA residents (M = 72.4%) or non-U.S. residents (83.3%), $\chi^2(2, n = 366) = 10.92$, $p = .004$.[13] Day users were also on average older (M = 42.2) than overnight users (M = 34.8), $t(360) = -5.06$, $p < .001$.[14]

[13] Because Thornton Lakes area and Coon Lake area had weekend/weekday differences for residence, the data for this analysis were weighted to reflect the 2:5 ratio of weekend to weekdays at these lake areas.
[14] Because Thornton Lakes area and Coon Lake area had weekend/weekday differences for age, the data for this analysis were weighted to reflect the 2:5 ratio of weekend to weekdays at these lake areas.

Hours Spent By the Lakeshore

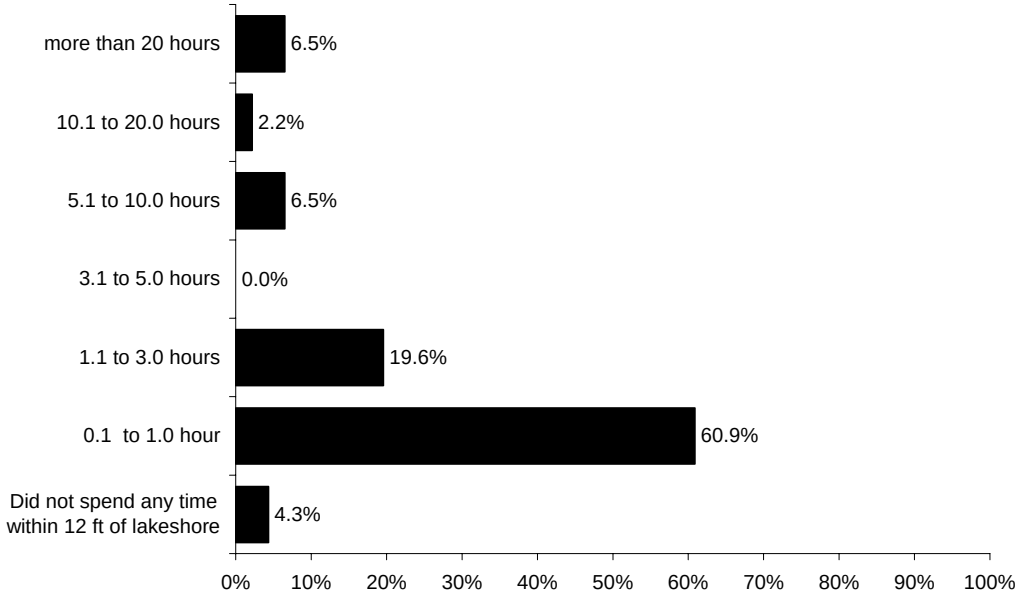
5. How many hours did you spend within 12 feet of the lakeshore during this trip?

I spent ____ hours within 12 ft. of the lakeshore.

The number of hours respondents spent within 12 feet of the lakeshore varied significantly by lake area, $F(4, 430) = 14.71$, $p < .001$ (see Figures 3.7 – 3.11). Post Hoc Tukey tests revealed that respondents contacted at Hozomeen Lake area or Monogram Lake area did not differ significantly in the average number of hours they spent by the lakeshore ($p = .787$) although respondents to these two lakes spent significantly more time on average by the lakeshore than respondents contacted at Hidden Lake area, Thornton Lakes area, or Coon Lake area (all p's $\leq .007$). The differences in average time spent by the lakeshore for respondents contacted at Hidden Lake area, Thornton Lakes area, and Coon Lake area were not significant (all p's $>.198$). As can be seen in Figure 3.10, most respondents contacted at Hidden Lake did not spend any time within 12 feet of the lakeshore. This finding reflects that many people visit a nearby lookout and do not walk down to the lake.

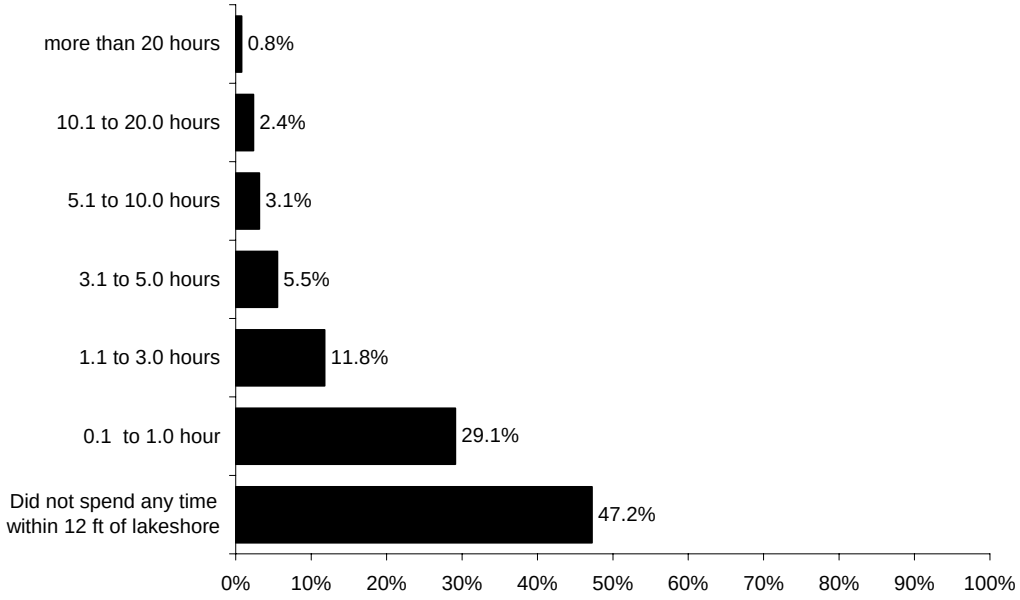
People who fished on the hike during which they were contacted spent more hours along the lakeshore (M = 4.98) than did people who did not fish on the hike during which they were contacted (M = 1.25), $t(413) = -3.71$, $p < .001$.

Figure 3.7: NOCA Mountain Lakes, Q-5
NUMBER OF HOURS SPENT WITHIN 12 FEET OF HOZOMEEN LAKESHORE



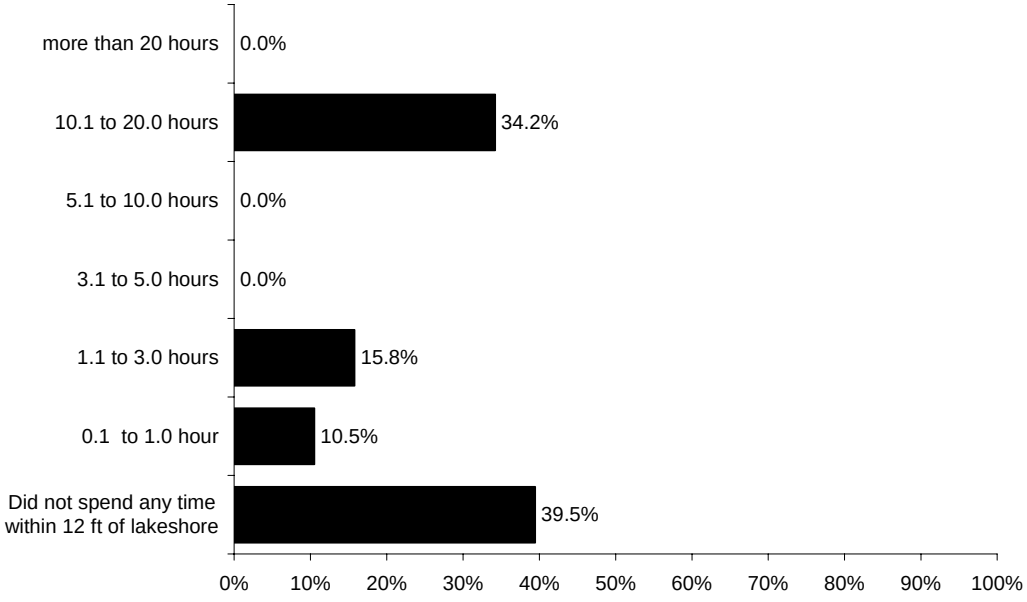
PERCENT OF RESPONDENTS (n = 39)
Average number of hours = 4.52

Figure 3.8: NOCA Mountain Lakes, Q-5
NUMBER OF HOURS SPENT WITHIN 12 FEET OF THORNTON LAKESHORE



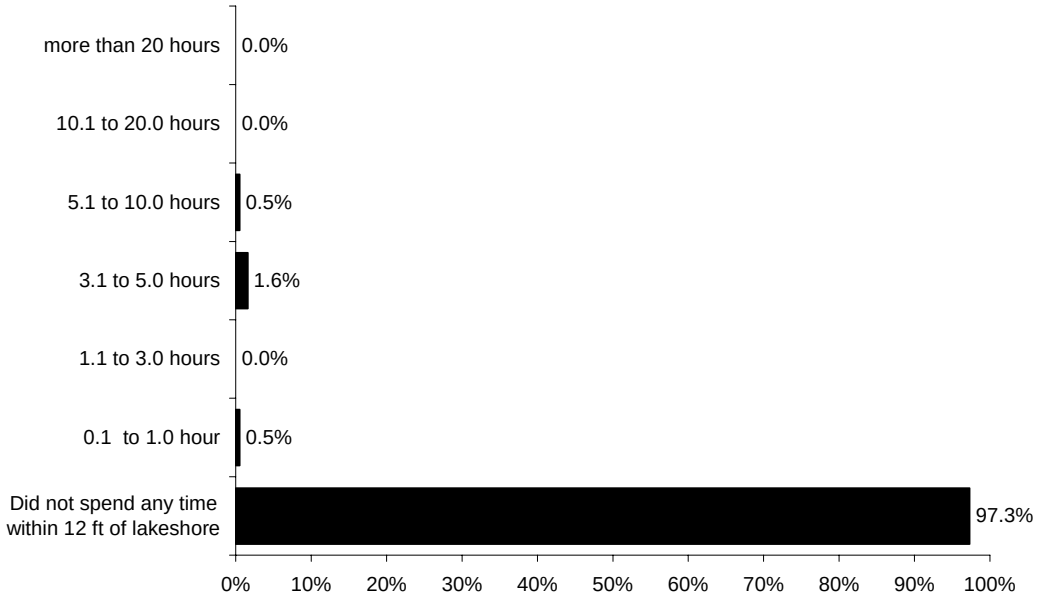
PERCENT OF RESPONDENTS (n = 125)
Average number of hours = 1.37

Figure 3.9: NOCA Mountain Lakes, Q-5
NUMBER OF HOURS SPENT WITHIN 12 FEET OF MONOGRAM LAKESHORE



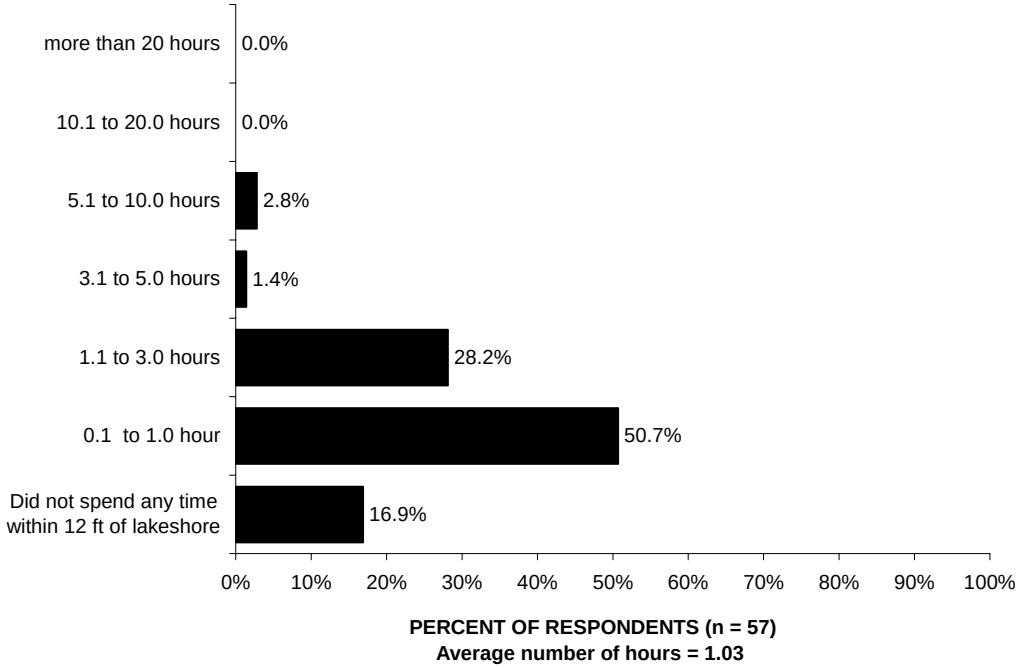
PERCENT OF RESPONDENTS (n = 38)
Average number of hours = 5.78

Figure 3.10: FIGURE X.XX: NOCA Mountain Lakes, Q-5
NUMBER OF HOURS SPENT WITHIN 12 FEET OF HIDDEN LAKESHORE



PERCENT OF RESPONDENTS (n = 176)
Average number of hours = 0.13

FIGURE 3.11: NOCA Mountain Lakes, Q-5
NUMBER OF HOURS SPENT WITHIN 12 FEET OF COON LAKESHORE



Number of People Fishing Per Group

3. How many people in your group fished during your hike? *(Enter "0" if no one fished.)*

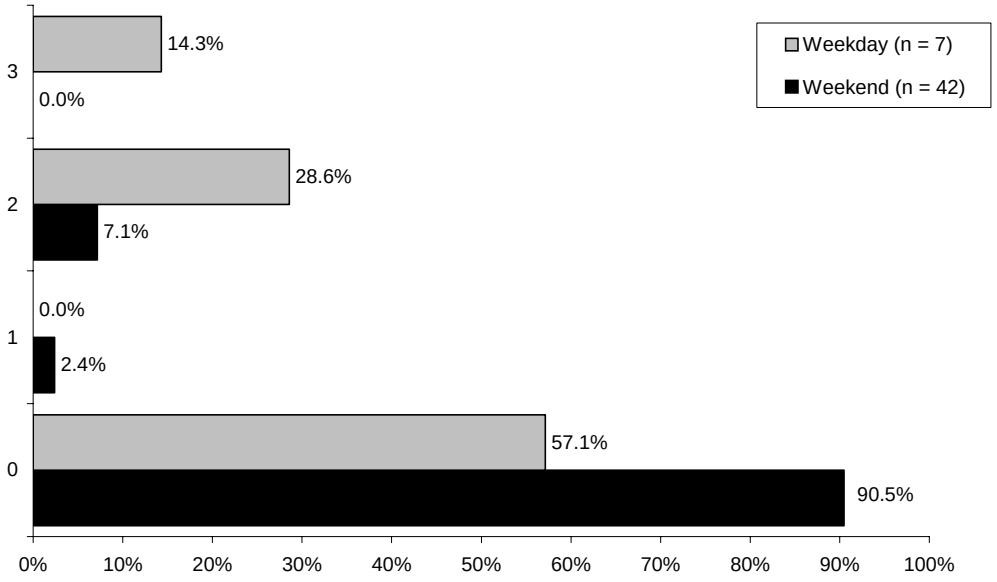
_____ People in my group fished

Because all members of a party age 18 or older were asked to participate in the survey and provide a value for number of people in party who fished, the data were adjusted to reflect only one value per party. A total of 204 parties were contacted.

At the Thornton Lakes area, the number of people in a party who fished was greater on weekdays (M = 1.00) than on weekends (M = .16), $t(47) = -3.00$, $p = .004$ (See Figure 3.12). Number of people in party that fished for the Thornton Lakes area were weighted to reflect the 2:5 ratio of weekend to week days, and used when examining differences by lake area. The number of people in party who fished differed significantly by lake area, $F(4, 368) = 2.58$, $p = .037$. Post Hoc Tukey tests, which adjust for multiple comparisons, revealed no significant differences between lake areas, and thus, the data were presented in aggregate. Figure 3.13 shows that about 10 percent of parties had members that fished on the hike

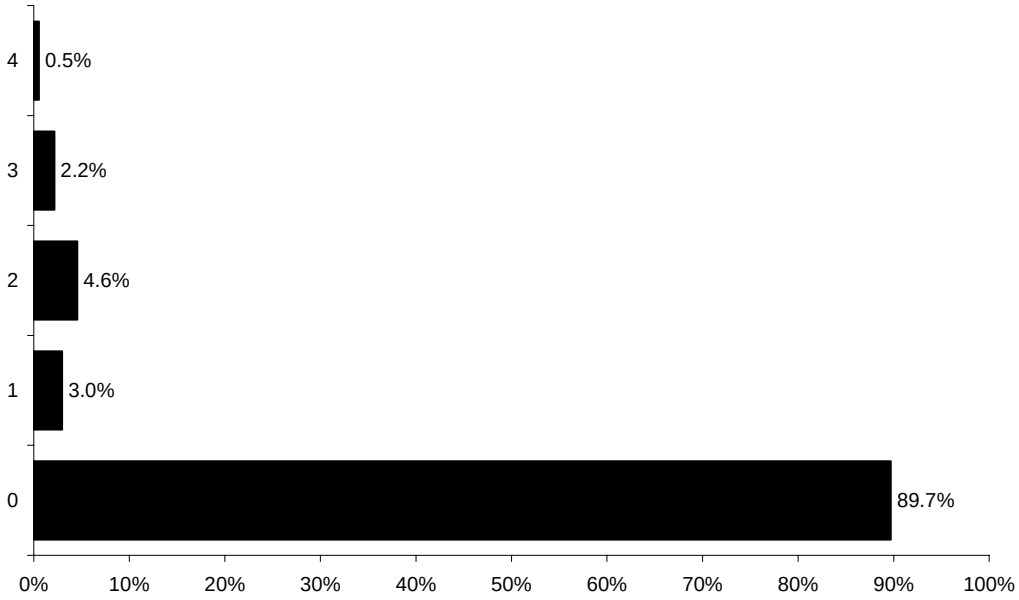
during which they were contacted. Of the nineteen parties that had at least one member fish, in 68.4% (13 out of 19) of these parties everyone fished. None of the remaining parties had fewer than half of the members fish. Parties where everyone fished were equally likely to be comprised of individuals, family, or friends.

FIGURE 3.12: NOCA Mountain Lake Survey, Q-3
FOR PARTIES CONTACTED AT THORNTON LAKES THE NUMBER OF PEOPLE IN PARTY WHO FISHED



PERCENT OF PARTIES
Average number weekday = 1.00, Average number weekend = 0.16

Figure 3.13: NOCA Mountain Lakes, Q-3
NUMBER OF PEOPLE IN PARTY WHO FISHED



PERCENT OF PARTIES (unweighted n = 204)
Average number people in party who fished = 0.21

*Data for the Thornton Lakes area were weighted to reflect the 2:5 ratio of weekend to week days.

Fishing Motivation

9. Was fishing your primary motivation for your hiking trip today?

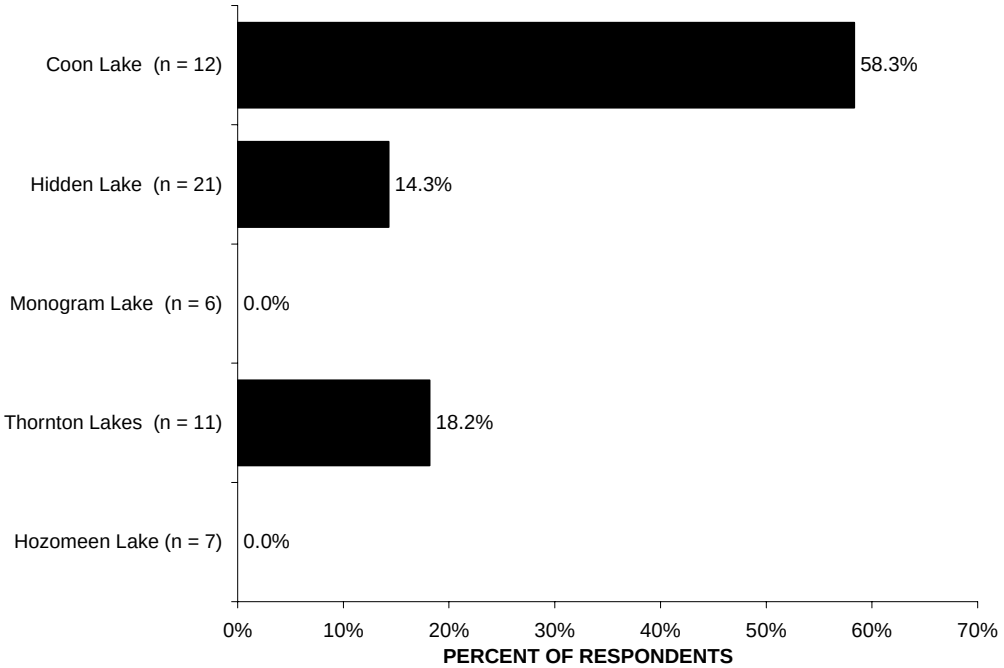
Yes
No →**What was your primary motivation?**

_____

The percentage of respondents for whom fishing was a primary motivation for their trip varied significantly by lake area, $\chi^2(4, n = 57) = 14.14$, $p = .007$.[15] As seen in Figure 3.14, fishing was a primary motivation for 58.3% of respondents contacted at the Coon Lake area compared to 18.3% or less at the other lake areas. No respondents contacted at the Monogram Lake area or the Hozomeen Lake area were primarily motivated by fishing for the trip during which they were contacted. For respondents for whom fishing was not their primary motivation for the trip, viewing scenery (29.6%) was the most common listed primary motivation followed by hiking (22.2%). Backpacking (11.1%), camping (7.4%), and exercise (7.4%) were also listed as primary motivations. There was little consensus among the remaining respondents as to their primary motivations.

[15] Six cells had expected frequencies less than five. Combining contact areas that had similar percentages (Hozomeen and Mongram, Thornton and Hidden) also resulted in significant differences, but with two cells with expected frequencies less than five.

Figure 3.14 NOCA Mountain Lakes, Q-9
PERCENTAGE OF RESPONDENTS WHO HAD EVER FISHED FOR WHICH FISHING WAS A PRIMARY MOTIVATION BY LAKE AREA



Includes only those respondents who had ever fished in NOCA mountain lakes

Fished on This Hike

10. On this hike, how many hours did you fish?

I did not fish on this hike. → GO TO Q-12

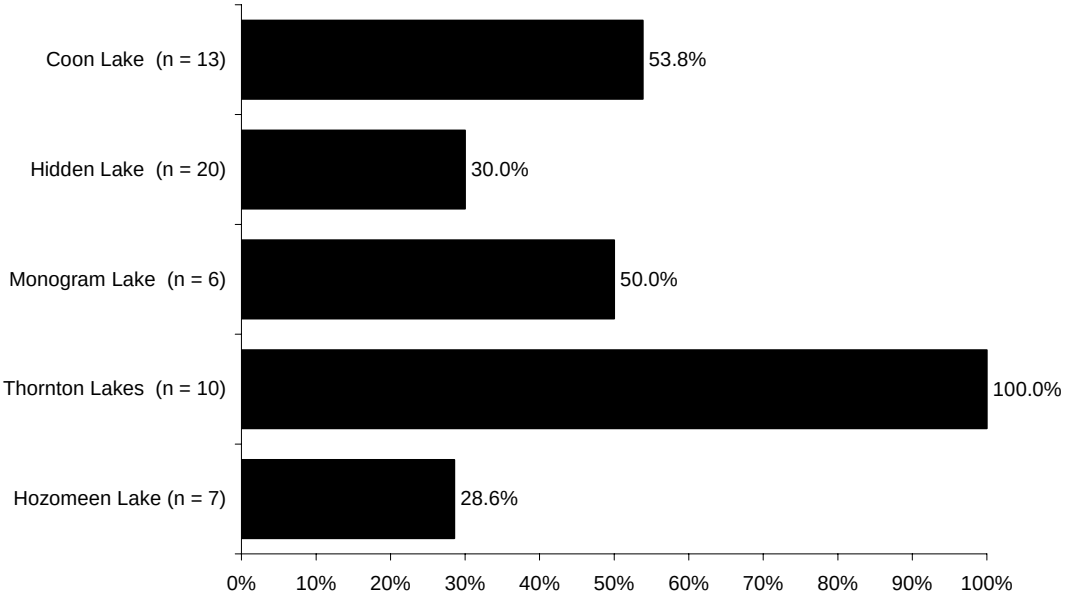
I fished for _____ hours on this hike.

Respondents who reported ever fishing in NOCA mountain lakes were asked whether they fished on the hike during which they were contacted. The percentage of respondents who had ever fished in NOCA mountain lakes who fished during the hike when they were contacted varied significantly by lake area for respondents, χ^2 (4, 56) = 14.56, p = .006.[16] As seen in Figure 3.15, every respondent contacted at the Thornton Lakes area who had ever fished in NOCA mountain lakes fished during the trip in which they were contacted whereas less than

[16] Four cells had expected frequencies less than five. Combining contact areas that had similar percentages (Hozomeen and Hidden lake areas, Monogram and Hidden Lake area) resulted in significant differences, without cells with expected frequencies less than five.

54% of respondents contacted at the other lake areas who had ever fished in NOCA mountain lakes fished during the trip.

Figure 3.15: NOCA Mountain Lakes, Q-10
PERCENTAGE OF RESPONDENTS WHO HAD EVER FISHED IN NOCA MOUNTAIN LAKE THAT FISHED ON THIS HIKE



Includes only those respondents who had ever fished in NOCA mountain lakes

However, a comparison of the percentage of all respondents (rather than of respondents who had ever fished) who fished on the hike during which they were contacted found no differences across lake areas. These findings were not surprising given the relatively small number of respondents that had fished on this hike or had ever fished.

Of people who reported fishing being a primary motivation for their hike, 16.7% (2 out of 12) reported not fishing on their hike. No information was gathered about why these people did not fish. The majority (63.0%) of people who fished on their hike indicated that fishing was not their primary motivation for their hike.

Table 3.1 summarizes the percent of all respondents who fished by type of user (day vs. overnight) and day of week (weekend vs. week day) for each lake area. In addition to the point estimate of percent of respondents who fished, the 95% confidence interval is presented for each point estimate. The 95% confidence interval provides information about the reliability of the point estimated obtained from the survey data. A 95% confidence interval indicates the interval in which we can be 95% confident that the true (unknown) population percent of visitors who fish falls. A narrower confidence interval suggests that the observed

percent of visitors who fished is a more reliable estimate of the true population parameter. The width of a confidence interval is a function of the size of the sample (larger sample = smaller interval) and the proportion of people who fish (with a 50%/50% split resulting in the largest interval).

Table 3.1. Percent of Visitors Who Fished By Type of User and Day of Week

	Lake Area				
	Hozomeen	Thornton	Monogram	Hidden	Coon
DAY USERS					
Weekend Days					
# of visitors sampled	17	75	20	90	25
Percent who fished	0.0	0.0	0.0	0.0	24.0
95% Confidence Interval	---	---	---	---	23.4 - 24.6
Week Days					
# of visitors sampled	14	9	1	29	11
Percent who fished	7.1	22.2	0.0	6.9	1.0
95% Confidence Interval	6.2 - 8.0	0 - 49.3*	---	0 - 16.1*	0 - 18.0*
OVERNIGHT USERS					
Weekend Days					
# of visitors sampled	6	36	14	29	7
Percent who fished	16.7	13.9	21.4	3.4	0.0
95% Confidence Interval	0 - 46.5*	13.7 - 14.1	20.0 - 22.8	3.2 - 3.6	---
Week Days					
# of visitors sampled	2	5	3	11	9
Percent who fished	0.0	60.0	0.0	0.0	0.0
95% Confidence Interval	---	17.1 - 100.0*	---	---	---
ALL DAYS					
Day Users					
# of visitors sampled	31	85	21	130	36
Percent who fished	3.2	2.4	0.0	2.3	19.4
95% Confidence Interval	0 - 9.4*	2.37 - 2.43	---	2.28 - 2.32	19.1 - 19.7
Overnight Users					
# of visitors sampled	8	41	17	44	16
Percent who fished	12.5	19.5	17.6	6.8	0.0
95% Confidence Interval	0 - 35.4*	19.2 - 19.8	16.6 - 18.6	6.6 - 7.0	---
All Users					
# of visitors sampled	39	126	38	174	52
Percent who fished	5.1	7.9	3.0	3.4	13.5
95% Confidence Interval	4.9 - 5.3	7.87 - 7.93	2.9 -3.1	3.3 - 3.5	13.3 - 13.7

*The 95% confidence interval was calculated assuming an infinite population because the number of people sampled was not 10% of the highest estimate of the population (see Table 5.1). The highest estimate of the population was used as it was the most conservative.

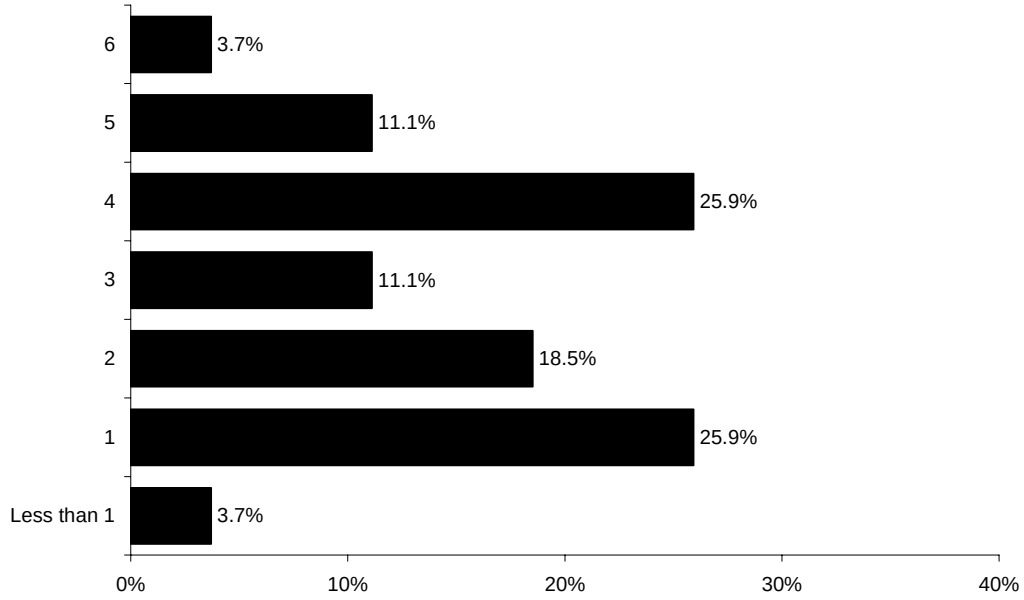
Review of Table 3.1 reveals the following:

- Although the 95% confidence intervals for some sub-groups of users are fairly wide, the 95% confidence intervals for estimates for all users are narrow and suggest relatively low fishing rates.
- Coon Lake has the highest observed fishing rate (13.5%) followed by Thornton Lakes (7.9%). Monogram Lake and Hidden Lake had the lowest rates (3.0% and 3.4%, respectively). Actual numbers of people fishing are reported in Section 5 (see page ??).
- Fishing is more likely to be done by day users during the week and overnight users on the weekend.
- Where the other three lake areas were fished by day and overnight users, Coon Lake was only fished by day users and Monogram Lake was only fished by overnight users.

Number of Hours People Fished During Hike

Data from Question 10 were also presented a second way. For respondents who fished on the trip during which they were contacted, Figure 3.16 shows the number of hours these respondents fished on this hike.

FIGURE 3.16: NOCA Mountain Lakes, Q-10
NUMBER OF HOURS FISHED ON THIS HIKE



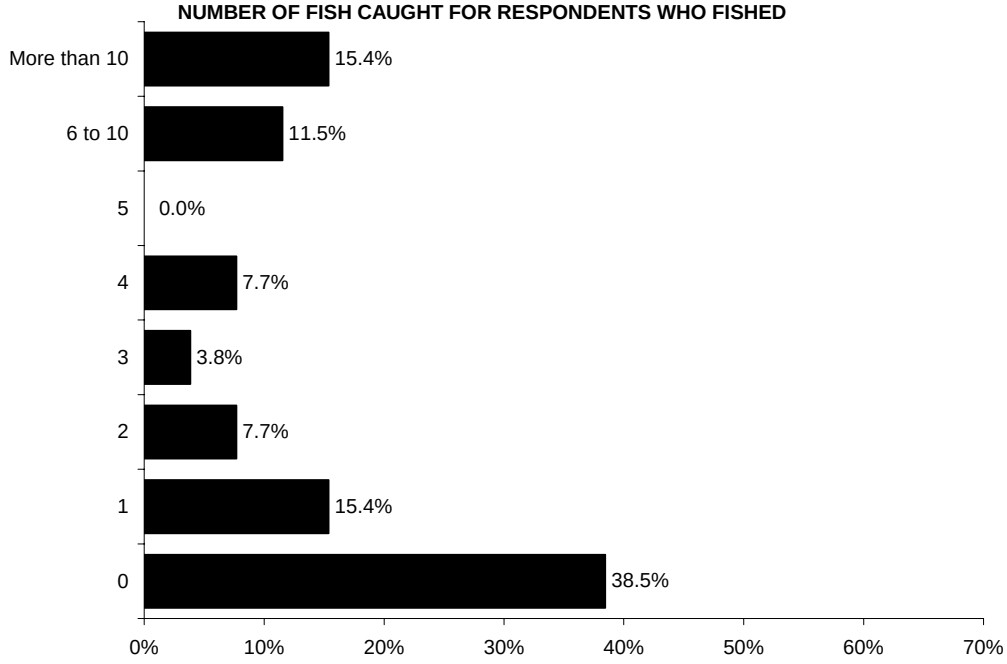
PERCENT OF RESPONDENTS (n = 27)
Average number of hours fished = 2.80
Includes only those respondents who fished during their hikes

Fishing Catch and Harvest

12. On this hike, how many fish did you . . .

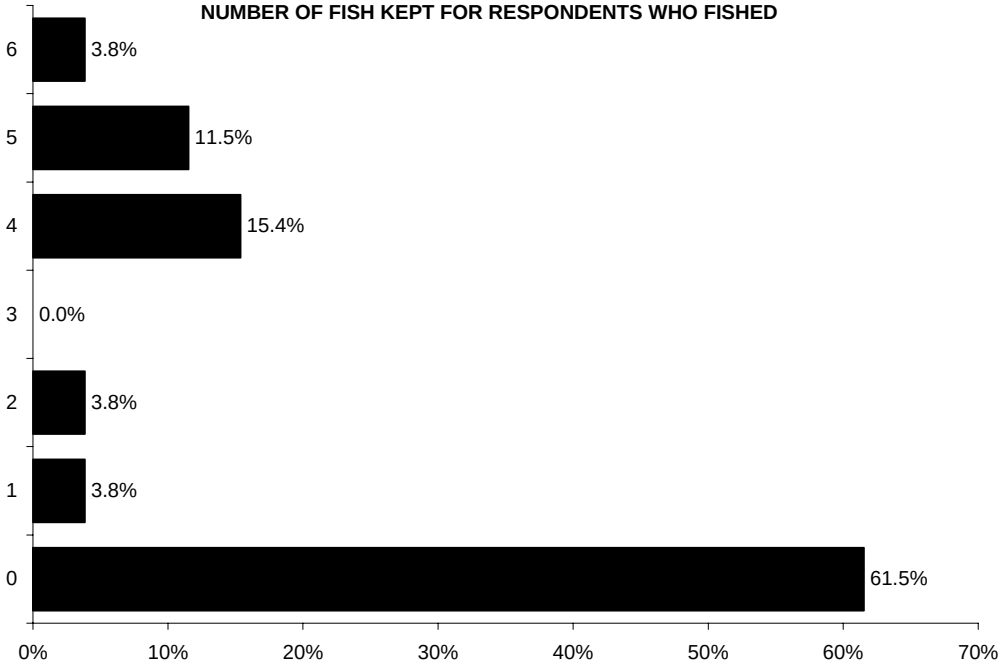
. . . catch? I caught ____ fish.
. . . keep? I kept ____ fish.

Figure 3.17: NOCA Mountain Lakes, Q-12
NUMBER OF FISH CAUGHT FOR RESPONDENTS WHO FISHED



PERCENT OF RESPONDENTS (n =26)
Average number of fish caught = 4.00, Range = 0 - 16
Includes only those respondents who fished during their hikes

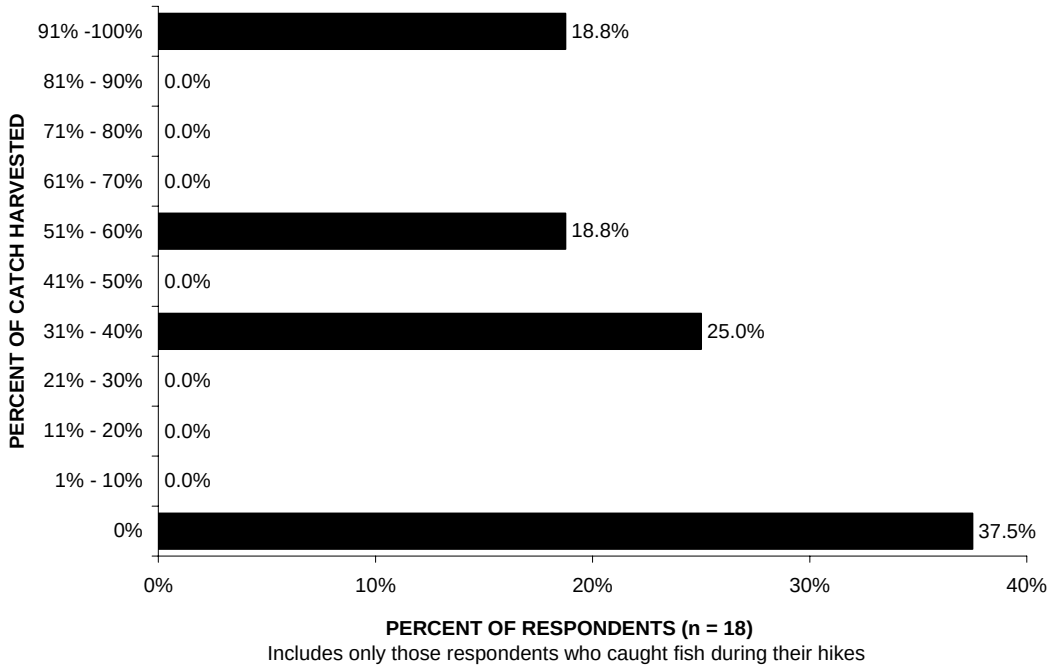
Figure 3.18: NOCA Mountain Lakes, Q-12
NUMBER OF FISH KEPT FOR RESPONDENTS WHO FISHED



PERCENT OF RESPONDENTS (n =26)
Average number of fish kept = 1.54, Range = 0 - 6
Includes only those respondents who fished during their hikes

For respondents who caught fish, Figure 3.19 shows the percent of catch they harvested. All the fish caught by 37.5% of respondents who caught fish were released whereas 18.8% of respondents who caught fish kept all the fish they caught.

Figure 3.19: NOCA Mountain Lakes, Q-12
PERCENT OF CATCH HARVESTED FOR RESPONDENTS WHO CAUGHT FISH



Includes only those respondents who caught fish during their hikes

Relationships Among Age, Hours Fishing, Time along Lakeshore, Catch and Harvest

People who spend more time fishing would be expected to spend more time within 12 feet of the lakeshore and hopefully, catch more fish. Whether anglers who fished longer would keep proportionally more fish was less clear as was whether older anglers would spend more time fishing or catch or keep more fish. Analyses examining these relationships were examined.

For people who fished on the hike during which they were contacted, fishing more hours was associated with spending more time within 12 feet of the lakeshore, $r(n = 27) = .60$, $p = .001$; catching more fish, $r(n = 25) = .82$, $p < .001$; and keeping more fish, $r(n = 25) = .84$, $p < .001$.

People who fished were not older than people who did not fish, $t(53) = .46$, $p = .647$. For those respondents who fished, being older was associated only with keeping fewer fish, $r(n = 23) = -.53$, $p = .008$. [17]

[17] Because Thornton Lakes area and Coon Lake area had weekend/weekday differences for age, the data for these analysis were weighted to reflect the 2:5 ratio of weekend to weekdays at these lake areas.

IV. Acceptable Substitute Destinations

Visitors participating in the North Cascades Mountain Lakes Survey were asked whether there was an acceptable substitute destination if they had not been allowed to fish in NOCA mountain lakes on this hike and what those destinations would be. This section reports the data that were collected with these questions and analyses examining how people who reported an acceptable substitute destination existed from those who did not.

IV. Acceptable Substitute Destinations

Highlights

- Of respondents who fished on this hike, 46.2% indicated that no acceptable substitute destination exists, 23.1% listed acceptable substitute destinations and 30.8% indicated they would need to be informed of alternatives. There was no consensus in the acceptable substitute destinations listed, perhaps due to the small number of people listing destinations (n=8).
- Exploratory analyses revealed that older respondents were more likely to indicate that no acceptable substitute destination existed. For people who fished on this hike, increasing age was associated with having fished more seasons in NOCA mountain lakes. It has been suggested that there is a group of long-term users of NOCA mountain lakes for whom the tradition of fishing in NOCA mountain lakes cannot be replaced. The findings from these analyses are consistent with this interpretation, however, further research would be needed to gain additional confidence in these exploratory findings based on limited data.

IV. Acceptable Substitute Destinations

Substitute Destinations for Fishing in the NOCA Lakes Area

12. If mountain lakes fishing in North Cascades National Park Complex had not been allowed today, would there be an acceptable substitute destination for you to fish?

There is no acceptable substitute.→ GO TO Q-14
There is an acceptable substitute.

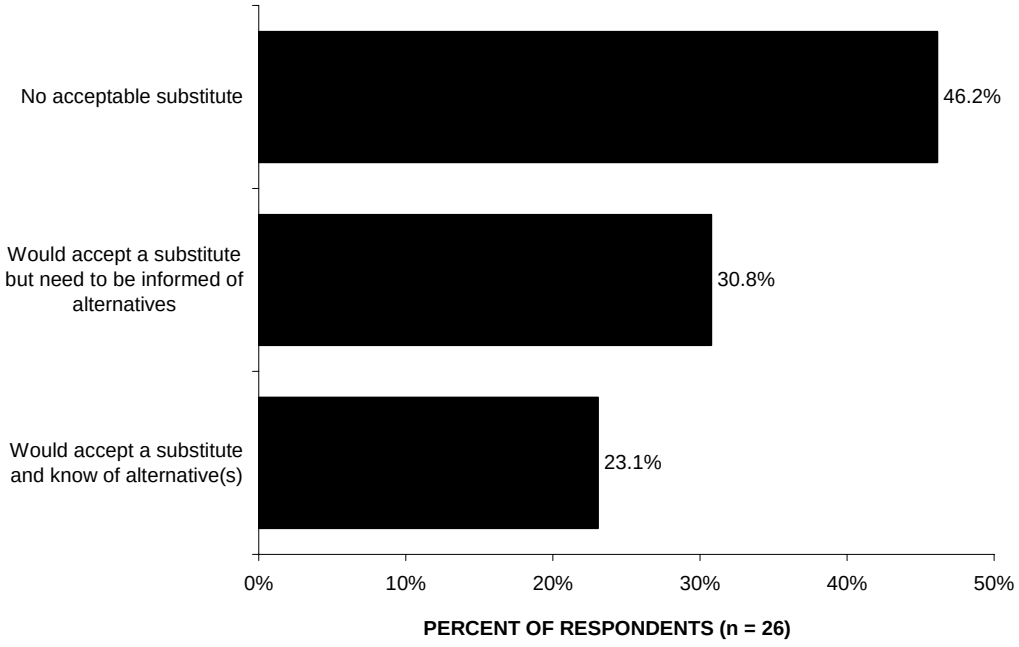
12a. List acceptable substitute destinations OUTSIDE of North Cascades National Park Complex. *(List in order of preference or check the box below.)*

1_____

2_____

Would accept a substitute but would need to be informed of alternatives.

Figure 4.1: NOCA Mountain Lakes, Q-13 & 13a
PERCENTAGE OF PEOPLE FOR WHOM SUBSTITUTE DESTINATION FOR TRIP TAKEN EXISTS



Eight people indicated they would accept a substitute and provided an alternate destination(s). Although alternatives outside the NOCA complex were sought, two alternatives provided (Stehekin River in Lake Chelan SRA and Ross Lake) are within the complex. There was only one alternative that was listed twice, and that was Skagit River.

Table 4.1 contains all the responses received.

Table 4.1. Acceptable Substitute Destinations If Mountain Lakes Fishing Was Not Permitted

Agnes Gorge
Baker Lake area
Glacier Peak Wilderness
Other high lakes in Forest Service area
Ross Lake
Secret lakes
Skagit River (mentioned by two people)
Stehekin River in Lake Chelan NRA
Texas pond

Predicting Who is Likely to Report That An Acceptable Substitute Destination Does Not Exist

Of respondents who fished on the trip during which they were contacted, 43.8% indicated that there was no acceptable substitute destination if mountain lakes fishing had not been allowed in NOCA on the day they were contacted. Understanding how, if at all, these respondents differed from those respondents who indicated there would be an acceptable substitute (whether or not they would need to be informed of it) can inform park staff about people who report they would be completely displaced[12] if fishing were no longer allowed at these lakes. A series of analyses were done comparing the two groups of respondents on the variables listed in Table 4.2.

[12] Displacement can take several different forms. People can be displaced to another location within the park (spatially displaced) or displaced to visit at a different time (temporally displaced). If people say there is no acceptable substitute destination, then these people are considered completely displaced from the location.

Table 4.2. Individual and Trip Variables Used in Comparison Analyses

Number of people in group who fished
Number of hours spent within 12 ft. of lakeshore
Number of seasons fished in NOCA mountain lakes
Number of hours fished on this hike
Age
Number of fish caught
Number of fish kept
Whether fishing was a primary motivation for hike
Residence (WA vs. Non-WA residents)
Sex
Day of week contacted (Weekend vs. Weekday)
Day vs. overnight User
Lake area

Because the number of people who fished on the hike during which they were contacted was low (n = 26), the analyses in this section should be viewed as exploratory. The small sample results in limited power to detect significant relationships that may exist.

Logistic regression analysis was used to determine whether any of the measured individual or trip characteristics (see Table 4.2) predicted who reported there would be an acceptable substitute location[13]. Logistic regression is a form of linear regression used when the dependent variable is dichotomous (e.g., acceptable substitute location?: yes or no)[14]. In logistic regression, predictor variables may be either categorical (e.g., sex: male or female) or continuous (e.g., number of people in group who fished).

In logistic regression there are multiple ways to evaluate whether the generated model is a good fit to the data. The first is the omnibus chi-square test of the model coefficients. A significant chi-square indicates that the coefficients in the model as a whole significantly predict the dependent variable. When a model has only one predictor variable, a significant model chi-square indicates that the predictor variable significantly predicted the dependent

[13] Because there were only two options—an acceptable substitute destination exists or there is no acceptable substitute destination, the probability of no acceptable substitute destination is 1 – probability of an acceptable substitute destination.

[14]Discriminant function analysis may also be used to predict membership in two or more groups. Given that there were only two groups, logistic regression was selected over discriminant function analysis because it requires fewer assumptions in theory, is more statistically robust in practice, and easier to use and understand.

variable. Second, the Hosmer and Lemeshow's Goodness of Fit test statistic[15] can be computed when the predictor variables are continuous. The Hosmer and Lemeshow's Goodness of Fit test statistic is a measure of the difference between the data predicted by the model and the observed data. A significant Hosmer and Lemeshow's Goodness of Fit test statistic indicates that the data predicted by the model differ significantly from the observed data and thus, the model is not a good fit. Third, examining the percent of cases correctly classified by the model provides information on the goodness of fit of the model. Higher percentages correctly classified indicate a better fitting model.

A separate logistic regression was run for each predictor variable listed in Table 4.2 with substitute destination (yes vs. no) as the dependent variable. The maximum number of observations for these analyses was 26. Of the 16 variables, 3 variables resulted in models with significant model chi-squares indicating they were significant predictors of whether an acceptable substitute destination exists: 1) number of hours spent within 12 feet of the lakeshore, 2) number of seasons fished in NOCA mountain lakes, and 3) age of respondents (in years). None of these models had significant Hosmer and Lemeshow test, therefore all models were considered good fits. Table 4.3 contains the results of the three logistic regressions.

Table 4.3. Model Summaries for Predicting Whether an Acceptable Substitute Location Existed

Predictor Variable	**Constant**	**B***	**Chi-Sq *p*-value**	**Hosemer & Lemeshow**	**% classified**
Number of hours spent within 12 ft. of the lakeshore during trip	-0.80	0.20	.044	.591	73.1%
Number of seasons fished in NOCA mountain lakes	1.01	-0.20	.042	.522	70.0%
Age of respondents (years)	3.69	-0.08	.010	.632	67.6%

*In logistic regression, the regression coefficients are interpreted as the amount of change in the log odds of the event occurring for a 1 unit change in the predictor variable. Because the dependent variable being predicted is the log odds of the event and not the probability of the event occurring, interpreting the regression coefficient as the amount of change in the likelihood that an event will happen for a 1 unit change in the predictor variable is incorrect.

[15] The Hosmer and Lemeshow's Goodness of Fit test examines the null hypothesis that the data were generated by the model fitted by the researcher. The test divides subjects in to deciles based on predicted probabilities, and then computes a chi-square from observed and expected frequencies. If the computed test statistic has a probability of .05 or less, the null hypothesis that there is no difference between the observed and model-

To understand the unique relationship of each of the predictor variables with the probability of reporting an acceptable substitute destination existed, a logistic regression was performed that included all five variables as predictor variables. A backward stepwise procedure was adopted to determine the best fitting model. The final model included 'age' as the only predictor of probability of reporting an acceptable substitute destination existed. The omnibus test of the model was significant, $\chi^2(1, n = 20) = 4.05$, $p = .044$, the Hosmer and Lemeshow test statistic was not significant, $\chi^2(3) = 2.15$, $p = .542$, and the model correctly classified 81.3 percent of people who reported there was an acceptable substitute destination and 42.1 percent of people who reported there was not an acceptable substitute destination for a total of 69.9 percent of respondents correctly classified by the model. Together, these findings indicate a good fitting model.

Table 4.4 summarizes the parameters of the model. The logistic coefficient (i.e., B) provides information about how changes in one of the predictor variables affects the likelihood that respondents will report there are acceptable substitute destinations when all other predictor variables are held constant[16].

Table 4.4. Summary of Model for Acceptable Substitute Destination with One Predictor Variable

Predictor Variable	**B***	**S.E.**	**Wald**	**df**	***p***	**exp(B)**
Age	-0.08	0.04	3.48	1	.062	0.92
Constant	3.77	1.71	4.88	1	.027	43.25

*In logistic regression, the regression coefficients are interpreted as the amount of change in the log odds of the event occurring for a 1 unit change in the predictor variable. Because the dependent variable being predicted is the log odds of the event and not the probability of the event occurring, interpreting the regression coefficient as the amount of change in the likelihood that an event will happen for a 1 unit change in the predictor variable is incorrect.

The generic form of a model with one predictor variables is given below:

$$\ln\left(\frac{p}{1 - p}\right) = \text{constant} + B_1*(\text{predictor variable } 1)$$

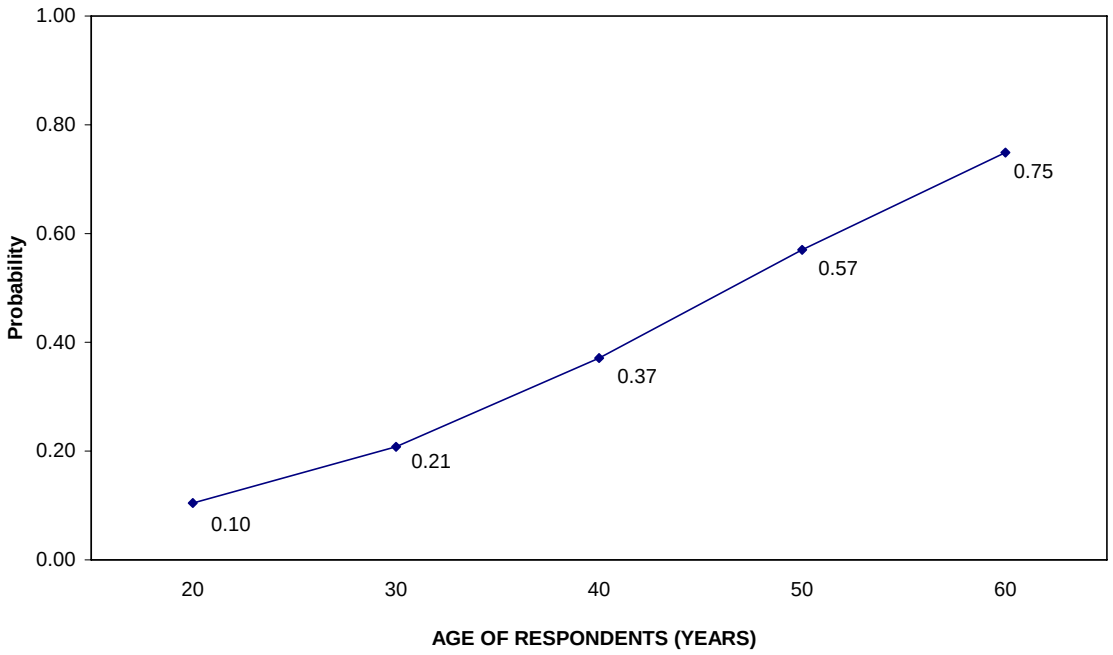
predicted values of the dependent variable is rejected. Well-fitting models generate data that do not differ from what was observed and their Hosmer and Lemeshow's Goodness of Fit Test statistic is not significant.

[16] Because only one predictor variable was significant in the final model, there are no other predictor variables to hold constant. This description of the logistic coefficient is provided for completeness and accuracy.

Where: *p* is the probability that one will report an acceptable substitute destination and B_1 is the logistic coefficient for the predictor variable—age.

A logistic curve can be drawn by computing the probability of reporting an acceptable substitute destination existed for different levels of respondents' age. Whereas the statistical model predicts likelihood of responding there is an acceptable substitute destination, the likelihood of responding there is no acceptable substitute destination can be computed using the following: 1 – likelihood of reporting there is an acceptable substitute. Figure 4.2 contains this logistic curve for probability of reporting *no* acceptable substitute destination for different levels of respondents' age.

Figure 4.2: PROBABILITY OF REPORTING THERE WAS NO ACCEPTABLE SUBSTITUTE DESTINATION FOR DIFFERENT RESPONDENTS' AGES



The curve shows that older respondents have a greater likelihood of reporting no acceptable substitute destinations existed. Specifically, the probability of respondents age 40 to report there was no acceptable substitute was .37 whereas the probability of respondents age 60 to report no acceptable substitute was .75.

Age remained the only significant predicator in the backward stepwise logistic regression analyses indicating that neither of the other two predictor variables provided any unique

predictive ability beyond what was captured by age. However, understanding the relationships among the three predictor variables can provide insights into factors associated with age that may be responsible for the observed differences in the likelihood of reporting an acceptable substitute destination exists. This additional information can help park managers better understand who reports no acceptable substitute destinations exist.

Because the logistic regression analyses included only a subset of respondents, the relationships among the five predictor variables were examined only for the 26 people who fished on this hike. For these respondents, the only significant correlation observed was between age and number of seasons fished in NOCA mountain lakes. The older respondents were the more seasons they had fished in NOCA mountain lakes, $r(n = 20) = .49$, $p = .027$. Age was also marginally correlated with number of hours spent within 12 feet of the lakeshore, $r(n = 20) = -.39$, $p = .057$, such that being older was associated with spending less time within 12 feet of the shore. Age was the variable that shared the most variance with the remaining two variables of any predictor—not surprising given that age remained the only significant predictor in the backward stepwise logistic regression analyses indicating that none of the other variables provided any unique predictive information.

The observed relationships between age and the other two predictors suggest that respondents who were older (and thus less likely to report an acceptable substitute destination exists) are those who have fished more seasons in NOCA mountain lakes. It has been suggested that there is a group of long-term users of NOCA mountain lakes for whom the tradition of fishing in NOCA mountain lakes cannot be replaced. The findings from these analyses are consistent with this interpretation, however, the reader is reminded that the small sample size makes these findings exploratory in nature. Further research would be needed to gain additional confidence in the observed findings.

IV. Acceptable Substitute Destinations

V. Estimates of Visitor Use

Estimates of visitor use were calculated from the survey data, and therefore, cover the time period between July 12 and August 31, 2003. There is no way to know whether use in this time period will change in future years. Survey workers contacted people eight hours a day although the exact eight hours varied somewhat by lake area and survey worker. For the most part, the hours between 10 am and 7 pm were covered. Although the times selected to contact people were believed to capture most visitors, the extent to which we did cannot be determined. Some visitors departed at times outside the survey period, therefore the calculated estimates most likely underestimate use to some extent. The estimates assume that our random sample of days represent use throughout the time period. In some cases very few days ended up being sampled due to logistics, and those estimates should be used with caution (see Reliability of Estimates section below).

Estimates of use (including fishing behavior) whether from the survey data or the permit data revealed a range of visitor use for the five lake areas. Readers are reminded that there is no statistical basis for extending the findings from these lake areas to any other mountain lake area in NOCA. Furthermore, differences among the five lake areas were noted on a number of visitor and trip characteristics. Thus, aggregating the five lakes data may not represent all visitors to NOCA mountain lakes.

Seasonal use estimates were calculated by multiplying the mean number of visitors per day sampled by the number of days in the survey period. For example, the seasonal use estimates for weekend day-users at each lake area were calculated in the following manner (The same general procedure was used for the other seasonal use estimates.):

1. The average number of day-users who left the lake areas between 10 am to 7 pm on weekends was calculated based on the survey data (total number of day users divided by number of days sampled).
2. The average number of weekend day-users per day for a lake area was multiplied by the number of weekend days during the survey period (16) to estimate the total number of weekend day-users at that lake area.

These estimates as well as their corresponding number of days sampled and mean number of visitors per day for each lake area are summarized in Table 5.1. The degree to which these estimates reliably reflect the true population mean for these groups varies and is discussed below.

Reliability of Estimates

A 95 percent confidence interval around the mean number of visitors per day was calculated to provide information about the reliability of that estimate obtained from the survey data. A 95 percent confidence interval indicates the interval in which we can be 95% confident that the true (unknown) population mean number of visitors per day falls. A narrower confidence interval suggests that the observed mean number of visitors per day is a more reliable estimate of the true population mean. The width of a confidence interval is a function of the observed variability in the sample and the size of the sample. Thus, when visitation is more consistent across days and more days are sampled, estimates will be more reliable. In other words, factors that reduce sampling error are associated with smaller confidence intervals and thus, more reliable estimates.

As can be seen in Table 5.1, the 95% confidence interval for weekend day users at Hozomeen Lake was –4.4 to 21.4. Because it makes no sense to have negative visitors, the effective confidence interval is between 0 and 21.4 visitors per day. In contrast, the 95% confidence interval for weekend day users at Thornton Lakes was 5.4 to 11.4. Although these two lake areas had comparable observed mean number of day uses, the Thornton Lakes confidence interval is smaller because more days were sampled (9 versus 2) and there was less variability among days.

Because the seasonal estimates of visitor use were calculated by multiplying the mean number of visitors per day by the number of days during the survey period, the reliability of the seasonal estimates depends on the reliability of the daily estimates. If the true population mean for the number of visitors per day fell in the lower end of the 95% confidence interval, then the seasonal estimate based on the observed mean would be overestimated. Similarly, if the true population mean fell in the upper end of the 95% confidence interval, then the seasonal estimate based on the observed mean would be underestimated. A range of visitor use based on the upper and lower ends of the 95% confidence interval for mean number of visitors per day is reported in Table 5.1.

Table 5.1. Summary of Visitor Use Estimates for July 12, 2003 through August 31, 2003 by Lake Area

	Lake Area				
	Hozomeen	Thornton	Monogram	Hidden	Coon
DAY USERS					
Weekend Days (N = 16)					
# of days sampled (n)	2.0	9.0	5.0	7.0	7.0
Mean # of visitors/day	8.5	8.4	4.0	12.9	4.0
95% CI (Mean +/- Interval)	-4.4 - 21.4	5.4 - 11.4	0.9 - 7.1	6.9 - 18.9	2.4 - 5.6
Visitor Use 7/12-8/31					
Estimate	136	135	64	206	64
Range based on CI	0 - 342	87 - 183	14 - 114	110 - 302	38 - 90
Week Days (N = 35)					
# of days sampled (n)	7.0	5.0	4.0	5.0	5.0
Mean # of visitors/day	2.0	1.8	0.3	6.0	2.6
95% CI (Mean +/- Interval)	0.4 - 3.6	0 - 3.6	-0.2 - 0.8	2.3 - 9.7	0.9 - 4.3
Visitor Use 7/12-8/31					
Estimate	70	29	4	96	42
Range based on CI	14 - 126	0 - 126	0 - 26	81 - 340	32 - 151
OVERNIGHT USERS					
Weekend Days (N = 16)					
# of days sampled (n)	2.0	9.0	5.0	7.0	7.0
Mean # of visitors/day	3.0	4.0	2.8	4.1	1.0
95% CI (Mean +/- Interval)	1.1 - 4.9	2.5 - 5.5	1.0 - 4.6	1.8 - 6.4	0.3 - 1.7
Visitor Use 7/12-8/31					
Estimate	48	64	45	66	16
Range based on CI	18 - 78	40 - 88	16 - 74	29 -103	5 - 27
Week Days (N = 35)					
# of days sampled (n)	7.0	5.0	4.0	5.0	5.0
Mean # of visitors/day	0.3	1.0	0.8	2.2	1.8
95% CI (Mean +/- Interval)	-0.1 - 0.7	-0.5 - 2.5	-0.7 - 2.3	-0.4 - 4.8	0.5 - 3.1
Visitor Use 7/12-8/31					
Estimate	11	35	28	77	63
Range based on CI	0 - 25	0 - 88	0 - 81	0 - 168	18 - 109

Table 5.1. Summary of Visitor Use Estimates for July 12, 2003 through August 31, 2003 by Lake Area (continued).

	Lake Area				
	Hozomeen	Thornton	Monogram	Hidden	Coon
ALL DAYS (N = 51)					
# of days sampled (n)	9	14	9	12	12
Day Users					
Mean # of visitors/day	4.0	3.6	1.4	7.8	2.9
95% CI (Mean +/- Interval)	0.2 - 7.8	2.1 -5.1	0.3 -2.5	4.6 - 11.0	1.4 - 4.4
Visitor Use 7/12-8/31					
Estimate	204	184	71	398	148
Range based on CI	10 - 398	107 - 260	15 - 128	235 - 561	71 - 224
Overnight Users					
Mean # of visitors/day	1.1	1.9	1.3	2.8	1.4
95% CI (Mean +/- Interval)	0.0 - 2.2	0.8 - 3.0	0.2 - 2.4	0.9 - 4.7	0.3 - 2.5
Visitor Use 7/12-8/31					
Estimate	56	97	66	143	71
Range based on CI	0 - 112	41 - 153	10 - 128	46 - 240	15 - 128
All Users					
Mean # of visitors/day	4.9	5.6	2.7	10.8	4.6
95% CI (Mean +/- Interval)	0.0 - 9.8	3.4 - 7.8	1.4 - 4.0	7.0 - 14.6	2.9 - 6.3
Visitor Use 7/12-8/31					
Estimate	250	286	138	551	235
Range based on CI	0 - 500	173 - 398	71 - 204	357 - 745	148 - 321

Review of Table 5.1 reveals the following:

- Day use is higher at all five lake areas on the weekend than during the week.
- Overnight use was higher on week days than the weekend for the Hidden Lake area and the Coon Lake area.
- The Monogram Lake area has the fewest total visitors (138) and the Hidden lake area has the most (551).
- The 95% confidence intervals and corresponding ranges of seasonal estimates provide relatively wide ranges in which the true population estimates falls. These wide intervals are due to the small number of days sampled and the variability across days in the number of visitors to each lake area. Future research may benefit by using trail

counters in addition to sampling visitors on scheduled days. The trail counters will provide information about the number of visitors to an area across a larger number of days.

Comparison of Overnight Use Estimates: Survey versus Overnight Permit Database

One objective of the project was to compare the overnight use estimates derived from the survey data with those obtained through the park's overnight permit database. All parties staying overnight in the backcountry are required to obtain a permit. The information gathered through the park's permitting process includes the number of people per party and what zone or camp area they will be visiting. From these data, park staff were able to provide a tally of people who said they would be staying at camp areas or zones and thus, would have been expected to use the lakes and trails where survey workers contacted visitors. Table X.X contains the tally of overnight visitors for camp areas located near the five targeted lakes and compares these data with use estimates obtained with the survey data.

Table 5.2. Comparison of Estimates of Overnight Users Calculated from Permit Data and Survey Data

Lake Area	Camp Areas/Zones	Estimated Number of Overnight Visitors		
		Permit (P)	**Survey (S)**	**Difference (S – P)**
Coon	Bullion Camp	6		
	High Bridge Camp (6, 6)	105		
	COON TOTAL	**111**	**71**	**-40**
Hidden	Hidden Lake Cross Country Zone 1	**86**	**143**	**57**
Hozomeen	Willow Lake *(Willow and Ridley Lakes)*	1		
	Hozomeen Lake Camp (4, 4, 8)	82		
	Hozomeen Cross Country Zone II *(includes Ridley and Willow Lakes)*	1		
	HOZOMEEN TOTAL	**84**	**56**	**-28**
Monogram	Monogram Lake Camp	**46**	**66**	**20**
Thornton	Thornton Lake Camp	**95**	**97**	**2**
GRAND TOTAL		**422**	**433**	**11**

A review of Table 5.2 reveals that at the Coon Lake area and the Hidden Lake area the estimates of overnight users for the period July 12 to August 31, 2003 from the survey data were substantially greater than the estimates from the permit data. The same comparisons for the Hozomeen Lake area and Monogram Lake area showed moderate differences. As can be

seen in Table 5.2, the estimate from the survey was equally likely to exceed or fall short of the permit data suggesting no systematic bias across lake areas.

The differences between survey and permit estimates might be due to several factors. First, overnight visitors were defined in the survey as anyone who stayed overnight in the backcountry whether or not it was near the lake. Thus, it was possible that the survey captured overnight users who did not stay in camps or zones in the immediate vicinity of the targeted lakes—the criteria for estimating overnight use by lake area with the permit data. Second, the survey estimate may reflect people who stayed overnight in the backcountry without obtaining a permit. Although some noncompliance is expected, the differences observed here would suggest a significant noncompliance issue. Higher rates of noncompliance at the Hidden Lake area and the Monogram Lake area were observed than at the remaining three areas. As these two lakes are accessed via US Forest Service trailheads, either visitors do not realize they need a NPS permit to camp overnight once they reach NPS land or they may choose not to get a permit at all. Third, the observed differences may be due to sampling error. By sampling at most fourteen days at a lake area, it is possible that the days sampled did not result in a representative sample of the survey period. For example, there may have been a greater percentage of days with good weather in these samples than what occurred across the whole survey period. As people are more likely to visit in good weather, the estimates per the survey would overestimate seasonal overnight use. It is also possible that the days selected were not representative in a way that resulted in the survey estimates underestimating seasonal overnight use (e.g., a sample with more bad weather days than the survey period). Fourth, the 8-hour time periods sampled did not include times when some overnight users were leaving the lake areas resulting in the survey estimates being low. The sampling time period at the Coon Lake area was earlier than the other lakes (from 9:00 a.m. to 5:00 p.m. instead of 11:00 a.m. to 7:00 p.m.). As it was possible that overnight users may have left the backcountry after 5:00 p.m., this may be the primary source of the difference between the survey and permit estimates.

There is no way to know whether the estimate derived from the park's permit data or the survey data more accurately reflects actual visitor use to the targeted lake areas. For all lake areas, the estimate per the permit data fell within the 95% confidence interval derived from the survey data. Thus, the range of visitor use suggested by the confidence intervals,

although wide in some cases, provides a reasonable estimate of the range in which actual visitor use is likely to occur.

Estimates of Number of Visitors who Fished in Mountain Lakes

The percent of visitors who fished at each lake area and the corresponding confidence intervals were presented in Trip Characteristics and Fishing Activities. Seasonal estimates of the number of visitors who fished for each lake area were calculated by multiplying estimates of seasonal visitor use by the percent of visitors who fished. Table 5.3 summarizes the seasonal estimates and also includes a range based on the confidence interval for 1) percent of respondents fishing and 2) the range for seasonal estimates of visitor use. Specifically, the low end of the seasonal estimate of visitors fishing was computed by taking the low end of the range of seasonal use multiplied by the low end of the 95% confidence interval of the percent of visitors fishing. The high end of the seasonal estimate of visitors fishing was computed by taking the high end of the range of seasonal use multiplied by the high end of the 95% confidence interval of the percent of visitors fishing. This method results in a very conservative (i.e., wide) range in which the true number of visitors who fished is expected to fall.

Review of Table 5.3 reveals the following:

- Fishing is more likely to be done by day users during the week and overnight users on the weekend.
- Where the other three lake areas were fished by day and overnight users, Coon Lake was only fished by day users and Monogram Lake was only fished by overnight users.
- Monogram Lake had the fewest estimated total anglers for the season (4) whereas Coon Lake had the most (32).

Table 5.3. Seasonal Estimates of Number of Visitors Fishing at Each Lake Area

	Lake Area				
	Hozomeen	Thornton	Monogram	Hidden	Coon
DAY USERS					
Weekend Days (N = 16)					
Estimate	0	0	0	0	15
Range	---	---	---	---	9 - 22
Week Days (N = 35)					
Estimate	5	6	0	7	4
Range	1 - 10	0 - 62	---	0 - 55	0 - 27
OVERNIGHT USERS					
Weekend Days (N = 16)					
Estimate	8	9	10	2	0
Range	0 - 36	5 - 12	3 - 17	1 - 4	---
Week Days (N = 35)					
Estimate	0	21	0	0	0
Range	---	0 - 88	---	---	---
ALL DAYS (N = 51)					
Day Users					
Estimate	7	4	0	9	29
Range	0 - 37	3 - 6	---	5 - 13	14 - 44
Overnight Users					
Estimate	7	19	12	10	0
Range	0 - 40	8 - 30	2 - 24	3 - 17	---
All Users					
Estimate	13	23	4	19	32
Range	0 - 27	14 - 32	2 - 6	12 - 26	20 - 44

VI. Protocols for Observing Activity Along Lakeshores

One objective of this project unrelated to the NOCA Mountain Lakes Survey was to develop a protocol for capturing information about how visitors disperse around lakes and what activities they do. An initial protocol was developed during the 2003 summer and field tested on one occasion. This initial protocol was further refined for data collection at Mount Rainier National Park (MORA) during the 2004 summer. Current fieldwork at MORA suggests that the refined protocol is a viable means of data collection. The protocol presented in this section is therefore based on the one currently being used at MORA.

The ability to systematically measure human use of lakeshores can provide important information in understanding impacts to these ecosystems. It may be that people who engage in particular activities have more or less impact on the lakeshore zone. Data about how people disperse along a lake, what activities they engage in, and how much time they spend at the lake can be used along with biological data to determine if there are particular user groups that contribute disproportionately to biological impacts in these areas. The protocol below describes how human use data can be collected for a lake's shore.

General Overview of Procedure

The protocol entails systematic field observations of a lake's shore that are documented on photocopied maps of the lake and in an observation log. Two types of observations are involved: 1) taking a "snapshot" of visitor position and activity at the lake and 2) "tracking" up to three individuals as they move about the lake in between "snapshots." These observations are made from a position selected to provide a good view of the lakeshore and the immediate area around the lake.

Some Initial Considerations

When information is desired about a particular lake, several things must be considered when using this protocol. First, is there a location from which all of the shoreline of interest is visible? If not, are there several locations that together allow observation of all or most of the shoreline? Multiple locations may also be desirable if the lake is sufficiently large to make viewing the entire shoreline difficult. If information is desired only for sections of the lakeshore (rather than the whole lakeshore) and these sections can be seen from another location(s), then this procedure can be used for those targeted areas.

Second, what is the visitor turnover rate at the lake and how many visitors are there? This information is necessary for setting an interval between "snapshot" observations and for determining the length of an observation period (the total amount of time spent on one day making observations at the lake). At lakes with higher turnover rates and large number of visitors, more frequent "snapshots" during a shorter observation period will provide better data by limiting observer fatigue. If a lake has few visitors and a low turnover rate, less frequent "snapshots" and a longer observation period can provide good quality data because there are fewer demands on the observer.

Third, are there any other factors that might affect how people use the lake area that can be measured? For example, in cool weather people may choose to visit the sunny side of the lake whereas in hot weather people may choose to visit shady areas. Or, in overcast or wet weather more people who fish may visit a lake. Another factor may be day of week visited. Certain user groups may be more likely to visit on weekdays than weekends. If there are particular user groups of interest that are associated with day of week, then this factor should be incorporated into the protocol.

Materials

A geographically accurate and detailed map of the lakeshore and immediate area is needed for each lake. One source is USGS quadrant maps (1:24,000). From this map good quality copies should be made on which to record observations. These maps will be used for recording both the "snapshot" and "tracking" observations.

Also needed are a spiral notebook that can be used as an observation log, and a mechanical pencil or pen that will not smear if it gets wet. A relatively fine tipped instrument will make the notations easier to read. If there is a high likelihood of the maps and/or observation log getting wet (e.g., rain, mist), waterproof paper such as Rite-in-the-Rain should be considered.

Although binoculars might be useful for observing people, some issues associated with their use should be considered. For example, if binoculars are used, then it is most likely that the person being observed would have difficultly seeing the observer and thus, may think that they have a certain amount of privacy that the binoculars impede upon. A second issue is that if the observer is seen using binoculars, then people may know they are being observed and thus, alter their behavior. The research at MORA did not use binoculars.

Guidelines for Developing a Sampling Plan

Assuming a representative sample, the more data collected the more reliable the estimates based on those data. When establishing a sampling plan, the amount of observer time available (i.e., people—paid or volunteer) will most likely be the limiting factor. The discussion here will assume that resources are limited and will address some of the considerations in designing a sampling plan. Additionally, this discussion assumes that "days" are the unit of measure. That is, the estimate(s) that are being derived are in terms of number of ____ per day. For example, number of overnight hikers to lake per day or the total number of person hours spent on the lakeshore per day.

The following information needs to be collected or estimated prior to designing the sample plan.

- The number of observers and their availability (number of hours per day and from when to when each day they can work) should be determined.
- The number of observation locations necessary for viewing the entire lakeshore. Is the whole lakeshore visible from one location? Two?
- The hours of the day for which estimates are desired. Although estimates may be desired for total use (i.e., 24 hours), often it is more practical to reduce the interval to cover the heaviest use period(s) of the day. For example, if most people are day users and it takes 3 hours to hike to a lake, then observations might start at 10:00 am or 11:00 am and go through 6:00 pm or 7:00 pm.
- The desired estimates and any potential comparisons should be determined. Are separate estimates for weekday and weekend users desired? Morning versus afternoon? Month to month comparisons? When more estimates are desired for comparison purposes, more data collection is required to get reliable estimates for each group. Thus, the addition of comparison groups can dramatically increase data collection needs.
- The rate of visitor use at the targeted lake. Do many visitors go to the lake? How long do they stay? If estimates for different comparison groups are desired, is the information for these groups similar or different?
- The length of interval between "snapshots" and the length of the observation period. These intervals are based on the rate of visitors use. As noted earlier, lakes with high

turnover and many visitors can have shorter intervals between "snapshots" and probably require shorter observation time periods to reduce observer fatigue. Lakes with low turnover and few visitors can have longer intervals between "snapshots" and longer observation periods. Determining the actual length of these intervals for a particular lake may require some pre-testing. As a starting point, the recommended length between "snapshots" is 30 minutes and an observation period of 4 hours.

The objective of the sampling plan is to schedule observation periods that together are representative of the periods and user groups for which estimates are desired. To illustrate, suppose estimates are desired for weekend and weekday users between the hours of 10:00 am and 6:00 pm for the months of July and August and the observation period is four hours long. Because information is desired for a span of eight hours (10:00 am to 6:00 pm), two four-hour observation periods are necessary: 1) early block from 10:00 am to 2:00 pm and 2) late block from 2:00 pm to 6:00 pm. Observation periods would thus need to be scheduled so that they are equally distributed across the early and late blocks, these early and late blocks are equally distributed across weekend and weekdays (including the different weekdays), and weekdays and weekend days are equally distributed across July and August. There is enough observer time to allow for data to be collected on 14 weekend days and 14 weekdays.

Table X.X contains a sample observation period schedule for the above scenario. Table X.X summarizes the number of observation periods by the different parameters to allow a double-check on the distribution of observation periods given the constraints.

A couple of points to note. First, although there are 5 weekdays for every 2 weekend days, an equal number of weekdays and weekend days were sampled because separate estimates for each were desired. Care should be taken when producing estimates that combine weekend and weekday data to be sure that when weekend and weekday visitors differ, the estimate adjusts for this oversampling of weekend visitors. Second, determining the appropriate sample size for reliable estimates and balancing it with available observer time can be complex. When a population of infinite size is assumed, 30 time periods of the smallest subset should provide reliable estimates. However, in many cases, the population of days (or time periods of interest) is finite and considerably smaller so assuming an infinite population is too conservative and sampling 30 time periods inefficient. A finite population

correction factor can be used to adjust the variance estimate when computing the sample size for a particular confidence interval. Even after accounting for finite populations, there may not be enough observer time to provide reliable estimates. Given the complexity of these issues, it is recommended that when developing a sampling plan, a person knowledgeable about survey methods and sampling should be consulted.

Table X.X. Example Schedule of Observation Periods

Su	M	T	W	Th	F	Sa
1	2 Early	3	Holiday 4 Early	5	6 Late	7 Early
8 Late	9	10	11 Early	12	13	14 Late
15 Early	16	17 Late	18	19	20 Early	21 Early
22 Late	23	24	25	26 Early	27	28
29	30	31 Early	1	2	3	4 Late
5 Early	6 Late	7	8 Late	9	10	11 Early
12 Late	13	14 Late	15	16	17 Late	18 Late
19 Early	20	21	22	23 Late	24	25
26 Late	27 Early	28	29 Early	30	31	

Early = The observation period from 10:00 am to 2:00 pm.
Late = The observation period from 2:00 pm to 6:00 pm.

Table X.X. Tallies to Assess Distribution of Observation Periods

	Su	M	T	W	Th	F	Sa
# of Early Observation Periods							
July Wkend	1			1			2
July Wkday		1	1	1	1	1	
July Early Total	1	1	1	2	1	1	2
Aug Wkend	2						1
Aug Wkday		1		1			
Aug Early Total	2	1	0	1	0	0	1
Total Early	3	2	1	3	1	1	3
# of Late Observation Periods							
July Wkend	2						2 *
July Wkday			1	1			
July Late Total	2	0	1	1	0	0	2
Aug Wkend	2		1	1	1	1	2
Aug Wkday		1					
Aug Late Total	2	1	1	1	1	1	2
Total Late	4	1	2	2	1	1	4
Total July	3	1	2	3	1	1	4
Total Aug	4	2	1	2	1	1	3
GRAND TOTAL	7	3	3	5	2	2	7

* Includes the Fourth of July holiday even though it falls on a Wednesday because holidays are more like weekends than weekdays with regard to visitation.

Once a sampling plan is established, it is important that data collection occur on the days as scheduled. If poor weather makes data collection infeasible, then it may be more appropriate to include it as a day sampled and assume no visitors than to reschedule it for a nicer day. If a day does need to be rescheduled, it is important that the new day have the same characteristics (or as many as possible) as the original day (e.g., weekend day, early period, etc.) If there are factors that may determine use levels such as weather or multiple locations to observe the whole lakeshore, it may be helpful to collect data on those factors for each day data is collected so that it is available when analyzing data.

Field Procedures

The field observer should allow sufficient time to reach the observation location prior to the start of the observation period. Assuming a standard four hour observation period with "snapshots" taken every 30 minutes, the observer will need:

- a total of 20 copies of the map (9 for "snapshots", 8 for tracking phase, plus a few extras for mistakes),
- an observation log, and
- writing instruments.

Indicating Observation Location and Blind Spots

Upon arriving at the lake, the observer should go to the designated observation location. The observer should mark the observation location on the map with a large X, and record his/her arrival time, date, and name of lake in the observation log. Areas along the lake shore shielded with brush or another cover type that may prevent the observer from recording activity in those areas should be marked with a circle and hash marks to indicate a "blind spot." The observer should mark the observation location and blind spots on each map completed.

"Snapshot" Observations of Visitor Activities

At the start of the observation period, the observer should note the interval number and time in the logbook (e.g., "Interval 1: 10:00 am") and on the top right corner of the map. Next, the observer should mark the location and activity of each person (i.e., the subject) at the lakeshore or within the targeted immediate vicinity of the lake. To do so, the letter indicating the person's activity should be written and circled on the map where the person is located. If the person is engaged in two activities, write the two letters corresponding to the activities inside the circle.

Table X contains codes for a few common activities engaged in near lakes. There are many possible activities and codes for other activities should be derived. It is important that each activity have a unique code. Even though some activities may be grouped during data analysis, it is better to collect detailed information than to group activities at the observation phase and not be able to separate them later.

Code	Activity	Code	Activity
F	**F**ishing	P	**P**icnicking
C	Using a **C**amera to take pictures	W	Getting **W**ater (for drinking or camp)
S	**S**wimming/wading	R	At **R**est
L	**L**eaves the observation area	T	**T**alks to another person

When 30 minutes have lapsed since the last interval, a new map should be used to record the observations for the next interval using the procedures outlined above. Again, the interval number and time should be written on the map and in the logbook.

"Tracking Phase" Observations of Visitor Activities

In between snapshot intervals, up to three subjects' movement around the lake will be tracked during a "tracking phase." In most cases, three people will be a reasonable number to track without error, however, in some circumstances this number may need adjustment. For example, at a busy lake with short "snapshot" intervals, only one subject may be able to be tracked between snapshots.

A new map will be needed for each tracking phase. On the map, each of the three people (see below for how these subjects are selected) being tracked should be assigned a unique symbol: a circle, a square, or a triangle. These symbols will help the observer and the people processing the data to distinguish between the three subjects. Inside the symbol, the letter code (use the same codes as in the snapshot procedure) corresponding to the person's activity should be written. Each person's movement around the lake should be captured by tracing his/her route with a line on the map. At any point the subject begins a new activity, terminates an activity, or leaves the area, the location should be marked with the appropriate symbol and letter code and the time the change in behavior occurred.

As a rule, when a subject leaves the observation area for more than ten minutes or leaves in such a manner that the observer feels confident they will not return, assign the subject's symbol to the next person that arrives. The new arrival will become one of the three subjects the observer will track.

When the observer first arrives at the observation area, the following rule should be used to select the first three persons as subjects to be tracked. This simple rule will avoid systematic bias in subject selection. To select the first three subjects, the lake area should be visualized as four quadrants: Northeast, Northwest, Southwest, and Southeast. On odd observation days (i.e., the first, third, fifth, etc. day at the lake) the quadrant to the left of the observer location should be the first quadrant from which a person is selected and then select one person from each quadrant until you have selected a maximum of three subjects. On even days (e.g., second, fourth, sixth, etc. day at the lake) repeat this exercise by starting with the quadrant to the right of the observer location and move counter-clockwise. Within each quadrant, a subject may need to be selected from among several people. In the first quadrant, the person closest to the observer should be selected. In the next quadrant, the person farthest from the observer should be selected, and continue alternating closest and farthest person in

the remaining quadrants. If no people are in a quadrant, move to the next selecting the appropriate closest or farthest person. Do not track more than one person from an affiliated group if you are able to discern group affiliation from their behavior. If a group member is selected, ignore the remaining group members while following the process outlined above. Unless a lake is extraordinarily busy, this procedure should provide an unbiased sample of people.

Each person selected to be tracked should be recorded in the logbook. Each tracking subject should be numbered sequentially (e.g., 1, 2, 3, etc.) and the following recorded after the number: his/her symbol (circle, triangle, or square), the letter code for the activity engaged in when selected, the time he/she started being tracked, and a simple reference to some recognizable feature of the subject (e.g., shirt color, hat color, etc.). For the first three subjects selected also note whether the subject was the closest (C) or farthest (F) candidate. The time a subject leaves should be recorded in the logbook as well. Once a subject leaves, the next arriving person will become a tracking subject.

Integrating Tracking and Snapshot Phases

People should be tracked as described above until it is time for the next snapshot observation. At that time, the procedures for recording the snapshot should be performed, and then subjects selected during the previous interval should continued to be tracked.

At the End of the Observation Period

When the observation period ends, complete a final "snapshot" observation on a fresh map, gather your supplies, and make a final entry in the logbook recording the time you completed the observation period.

Data Analysis

The data obtained may be entered into a GIS database and/or a flat database (e.g., SPSS, Excel) for further analyses. The specific analyses will depend on what information is desired and the availability of other information. For example, estimates of the number of people who engage in a particular activity may be obtained from a flat database whereas examining whether biological damage is associated with greater use may be most easily done in a GIS format.

VI. Protocols for Observing Activity Along Lakeshores

As noted above, if weekend days were oversampled to provide valid estimates for weekend days, then care should be taken when aggregating data for all days. If weekend respondents differed from weekday respondents on a variable, simple aggregation of the data may misrepresent the true distribution across all visitors[1]. It is recommended that the data be weighted to reflect the true proportion of weekend and weekday visitors. If no combined estimate is desired, then data for weekend and weekday visitors should be presented separately, indicating any statistically significant differences.

[1] If estimates of use are calculated separately for weekend and week days, then it would be appropriate to add the two use estimates without weighting the data. However, if the proportion of males differs by day of week, then the data should be weighted to reflect a 2:5 ratio of weekend to weekdays prior to calculating the overall percentage of males. Failing to do so will result in a biased estimate of percentage of males.

VII. Protocols for Monitoring Visitor Use of Trails

The NOCA Mountain Lakes Survey was developed to collect information about visitors and their use of five lake areas. A detailed description of the methods used for that survey is included in the Introduction. This section describes a general protocol for monitoring visitor use on trails based on the methods used in the NOCA Mountain Lakes Survey.

The ability to systematically measure human use of trails can provide important information including descriptions of how visitors distribute themselves in the park; how, if at all, visitor use is associated with ecological impacts; and degree of compliance with overnight permit system. The protocol below describes how human use data can be collected for visitors to simple trail systems.

General Overview of Procedure

The protocol entails systematic contacts with visitors on a trail for the purposes of collecting some survey information from them. If only the number of total visitors is desired, a well-placed and calibrated trail counter may be more cost-efficient. However, if any detailed information (e.g., number of overnight visitors, age of visitors, etc.) is desired, then contacting visitors to complete a survey is necessary. This protocol assumes that a brief on-site survey will be distributed. It also assumes a relatively simple trail system such as an out-and-back trail or a trail that has only a couple of entry points.

Although using a trail counter is not included as part of this protocol, the information provided by a well-placed trail counter[1] in conjunction with the data obtained from an on-site survey can provide significantly more information than the same data collected over two different survey periods. For example, a trail counter collects data 24 hours a day, 7 days a week. These data can be used to determine if the observation period for a day covered the time when the majority of visitors passed the contact point. Additionally, the trail counter data can be used to further weight the descriptive data gathered through the on-site survey providing more accurate estimates for all users.

[1] The trail counter should be placed where all the people who walk past the contact point will walk past the trail counter. However, it needs to be far enough away from the contact point so that people who walk around the area while being surveyed do not continuously trigger it.

Some Initial Considerations

When information is desired about a particular trail, several things must be considered when putting this protocol into practice. First, what information are you interested in obtaining? If information about what people did on their trip is desired, contacting people at the end of the trip provides the most accurate information. Not all visitors end up doing what they planned to do. Sometimes they do activities they did not plan to do and sometimes they do not do all the things they thought they would. However, if information such as general demographic information or whether they obtained a permit is desired, then this information should be the same whether respondents are contacted when they enter or leave an area.

Second, the structure of the trail system for which visitor use information is desired and how people use the trail must be considered. The best estimates can be obtained for a trail system where all visitors pass a common point. In a simple out-and-back trail, the trailhead is the best place to contact visitors as all people start and end there. The trailhead may also be the best location for a trail that has multiple branches, if most people enter or exit from the trailhead branch. Understanding how visitors use the trail system in conjunction with the information desired, can help to determine if an entrance or exit survey is most appropriate and where is the best place to contact visitors. If two locations are selected for contacting visitors, there must be some means by which to identify if the same person has been contacted (or counted) at both locations, otherwise the estimate will be falsely inflated.

Third, general information about where and when most visitors use the trail. This information is necessary for establishing the window, if any, of when most visitors pass the selected contact point. If most people enter a trail system through a particular trailhead and do so between 6:00 am and 2:00 pm, then contacting people as they enter will be most efficient. The rate at which visitors pass the designated contact point (e.g., trailhead) is important to know when selecting a sampling interval—that is, sampling every n^{th} person. Ideally, the sampling interval should be one that can be maintained during the busiest period so that the sampling of visitors is unbiased (i.e., the sample does not under-sample visitors during busy times). If there are dramatic differences in visitation rates on slow and busy days, it may work better to have two survey workers on busy days and one survey worker on slow days.

Fourth, are there any other factors that might affect how people use the area that can be measured? For example, more people may choose to do a less exposed hike in bad weather than good weather. Another factor may be day of week visited. Certain user groups may be more likely to visit on weekdays than weekends. If there are particular user groups of interest that are associated with day of week, then the sampling plan should have adequate weekend and weekdays to capture the user groups of interest. Finally, different survey workers may have different styles that result in different response rates or in the worse case, that alter respondents' answers. Recording the survey worker for each contact allows for these potential differences to be examined.

Materials

An on-site survey that asks for the desired information must be developed. It is recommended that the developer of the survey be knowledgeable of survey research as information obtained from a poorly written survey can be misleading and difficult to interpret. An on-site survey that takes five minutes to complete would be considered moderately long whereas one that takes 10 minutes would be considered extremely long. Three minutes or less is the preferred length of an on-site survey. Factors such as whether visitors will be in a hurry to move on (e.g., leave at the end of hike versus the contact point is at a common rest point) and their personal involvement with the issue can affect respondents' willingness to complete an on-site survey. A well-designed survey can reduce the burden on respondents and increase response.

Also, a refusal tracking sheet is needed for each survey worker and data collection period. The refusal tracking sheet should have a place to record some general observable descriptive (e.g., gender, party size, overnight vs. day hiker) data for each person who refuses to participate. This data should be collected from those who agree to participate to allow for comparisons between groups. A sample refusal tracking sheet can be seen in Figure X.X

Figure X.X. Sample Refusal Tracking Sheet

ID #[1]	Party Size[2]	Gender[3]	Day Hiker? [4]
101	2	M	Y
102	2	F	Y
103	1	M	N
104	4	M	U

[1]ID #: Assigned by survey worker
[2]Party Size: A line should be included for each person in party who refuses to participate, if more than one is asked to participate (Note: This will depend on sampling plan).
[3]Gender: Gender of person in party who was contacted.
4Day Hiker?: If obvious from pack that person is day hiker, mark "Y." If obvious from pack that person is overnight hiker, mark "N." If undecided, mark "U."

All survey materials and procedures must be approved by the Office of Management and Budget (OMB) prior to contacting visitors. The expedited approval process takes up to 60 days and information is available at http://www.nature.nps.gov/socialscience/survey.htm.

Other materials that are needed are clipboards and writing instruments for respondents to use when completing the survey. Sufficient numbers of these supplies should be brought each time. If dampness or wet weather is a concern, then plastic bags and/or Rite-in-the-Rain paper should be considered.

Guidelines for Developing a Sampling Plan

Assuming a representative sample, the more data collected the more reliable the estimates based on those data. When establishing a sampling plan, the amount of observer time available (i.e., people—paid or volunteer) will most likely be the limiting factor. The discussion here will assume that resources are limited and will address some of the considerations in designing a sampling plan. Additionally, this discussion assumes that "days" are the unit of measure. That is, the estimate(s) that are being derived are in terms of number of ____ per day. For example, number of overnight hikers on trail per day or the total number of visitor nights spent.

The following information needs to be collected or estimated prior to designing the sample plan.

- The number of observers and their availability (number of hours per day and from when to when each day they can work) should be determined.

- The amount of time it takes for observers to travel to the observer location (include car and hiking time).
- The number of observation locations necessary for contacting all visitors to trail system. Does everyone pass one contact point (e.g., trailhead)? Two?
- The hours of the day for which estimates are desired. Although estimates may be desired for total use (i.e., 24 hours), often it is more practical to reduce the interval to cover the heaviest use period(s) of the day. For example, if an exit survey is being conducted and most people day users and end their hikes in the afternoon, then observations might start at noon or 1:00 pm and go through 8:00 pm or 9:00 pm.
- The desired estimates and any potential comparisons should be determined. Are separate estimates for weekday and weekend users desired? Morning versus afternoon? Month to month comparisons? When more estimates are desired for comparison purposes, more data collection is required to get reliable estimates for each group. Thus, the addition of comparison groups can dramatically increase data collection needs.
- The rate of visitor use on the targeted trail. Do many visitors use the trail? When do they start or end hiking? If estimates for different comparison groups are desired, is the information for these groups similar or different? The length of the sampling interval—that is, the value for n in sampling every n^{th} visitor is based on the rate of visitor use. If there are many visitors then the value for n will be greater allowing the survey worker to complete their initial contact with one visitor before the n^{th} visitor passes by.
- The length and timing of the observation period is dependent on the concentration of visitor use at the selected contact point. If most people pass the contact point in a four-hour window, then the observation period need only be four hours long.

The objective of the sampling plan is to schedule observation periods that together are representative of the periods and user groups for which estimates are desired. To illustrate, suppose for two trails estimates are desired for weekend and weekday users between the hours of 10:00 am and 6:00 pm for the months of July and August and the observation period is eight hours long. Observation periods would thus need to be scheduled so that they are

equally distributed across weekend and weekdays (including the different weekdays), and weekdays and weekend days are equally distributed across July and August. There is enough observer time to allow for data to be collected on 14 weekend days and 14 weekdays.

Table X.X contains a sample observation period schedule for the above scenario. Table X.X summarizes the number of observation periods by the different parameters to allow a double-check on the distribution of observation periods given the constraints.

A couple of points to note. First, although there are 5 weekdays for every 2 weekend days, an equal number of weekdays and weekend days were sampled because separate estimates for each were desired. Care should be taken when producing estimates that combine weekend and weekday data to be sure that when weekend and weekday visitors differ, the estimate adjusts for this oversampling of weekend visitors. Second, determining the appropriate sample size for reliable estimates and balancing it with available observer time can be complex. When a population of infinite size is assumed, 30 time periods of the smallest subset should provide reliable estimates. However, in many cases, the population of days (or time periods of interest) is finite and considerably smaller so assuming an infinite population is too conservative and sampling 30 time periods inefficient. A finite population correction factor can be used to adjust the variance estimate when computing the sample size for a particular confidence interval. Even after accounting for finite populations, there may not be enough observer time to provide reliable estimates. Given the complexity of these issues, it is recommended that when developing a sampling plan, a person knowledgeable about survey methods and sampling should be consulted.

Table X.X. Example Schedule of Observation Periods

Su	M	T	W	Th	F	Sa
1	2 Trail A	3	Holiday 4 Trail A	5	6 Trail B	7 Trail A
8 Trail B	9	10	11 Trail A	12	13	14 Trail B
15 Trail A	16	17 Trail B	18	19	20 Trail A	21 Trail A
22 Trail B	23	24	25	26 Trail A	27	28
29	30	31 Trail A	1	2	3	4 Trail B
5 Trail A	6 Trail B	7	8 Trail B	9	10	11 Trail A
12 Trail B	13	14 Trail B	15	16	17 Trail B	18 Trail B
19 Trail A	20	21	22	23 Trail B	24	25
26 Trail B	27 Trail A	28	29 Trail A	30	31	

Table X.X. Tallies to Assess Distribution of Observation Periods

	Su	M	T	W	Th	F	Sa
# of Trail A Observation Periods							
July Wkend	1			1			2
July Wkday		1	1	1	1	1	
July Early Total	1	1	1	2	1	1	2
Aug Wkend	2						1
Aug Wkday		1		1			
Aug Early Total	2	1	0	1	0	0	1
Total Early	3	2	1	3	1	1	3
# of Trail B Observation Periods							
July Wkend	2						2 *
July Wkday			1	1			
July Late Total	2	0	1	1	0	0	2
Aug Wkend	2		1	1	1	1	2
Aug Wkday		1					
Aug Late Total	2	1	1	1	1	1	2
Total Late	4	1	2	2	1	1	4
Total July	3	1	2	3	1	1	4
Total Aug	4	2	1	2	1	1	3
GRAND TOTAL	7	3	3	5	2	2	7

* Includes the Fourth of July holiday even though it falls on a Wednesday because holidays are more like weekends than weekdays with regard to visitation.

Once a sampling plan is established, it is important that data collection occur on the days as scheduled. If poor weather makes data collection infeasible, then it may be more appropriate to include it as a day sampled and assume no visitors than to reschedule it for a nicer day. If a day does need to be rescheduled, it is important that the new day have the same characteristics (or as many as possible) as the original day (e.g., weekend day, early period, etc.) If there are factors that may determine use or participation levels such as weather, trail locations, or survey workers, it may be helpful to collect data on those factors for each day data is collected so that it is available when analyzing data.

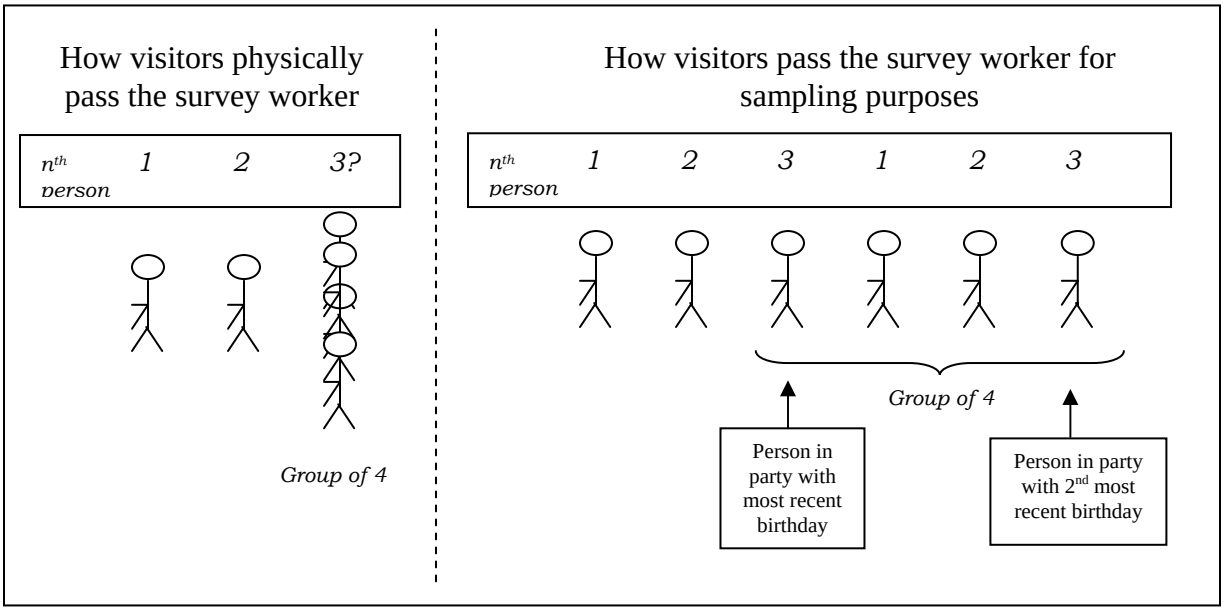
Field Procedures

The survey worker should allow sufficient time to reach the contact point prior to the start of the observation period. The survey worker will need:

- sufficient copies of the on-site survey,
- a refusal tally sheet,
- clipboards, and
- writing instruments.

Based on the sampling plan every n^{th} visitor should be contacted. To determine every n^{th} visitor, visitors should be viewed as a continuous line of people that pass the contact point. If the trail is only wide enough for one person then people will pass by single file even if they are traveling with others. If the trail is wider so more than one person can pass at a time, then it is possible that two or more people will pass at the same time. If one of those visitors would be the n^{th} visitor, the survey worker will need to use a procedure that selects one person from the party to be the n^{th} visitor. An easy procedure that generally does not introduce bias into the sample selection process is to select the visitor who has had the most recent birthday. If the party is large enough that more than one n^{th} visitor would be selected, then select the visitors with the most recent birthdays. For example, suppose every 3rd person is being contacted and a party of four passes on a wide part of trail. If the next person was to be contacted, then the survey worker would need to select that person from the party using the birthday rule. Because there are three remaining people who would effectively walk after the person selected to be contacted, a second person from this party would also be a 3rd person. Thus, the survey worker would use the birthday rule to select this second 3rd person.

Figure X.X. Selecting n^{th} Person from Party



Below is a sample script for contacting visitors. A similar script should be available for every survey worker. It is also important that survey workers are trained properly to reduce the likelihood that they will introduce any bias into the data collection process.

SAMPLE CONTACT SCRIPT:

Hello. My name is _____. The park is conducting a survey of mountain lake hikers this summer. The information we are collecting is important because it will help managers and planners maximize the quality of visitor experiences in this area. This survey is voluntary and any information you provide is confidential. The survey takes about two minutes to complete.

Would you be willing to participate in the survey?

NO → Thank you for your time.
YES → ***Thank you. Here is the survey and a pencil. Please return your completed survey to me.***

If visitors refuse to participate, then the survey worker should complete the Refusal Tally Sheet.

Data Analysis

The data obtained may be entered into a flat database (e.g., SPSS, Excel) for further analyses. Potential non-response bias should be examined by incorporating the data collected on the Refusal Tally Sheet with that obtained in the on-site survey. If people who agreed to participate differ significantly from those who refused, additional analyses will be needed to assess the degree of non-response bias.

As noted above, if weekend days were oversampled to provide valid estimates for weekend days, then care should be taken when aggregating data for all days. If weekend respondents differed from weekday respondents on a variable, simple aggregation of the data may misrepresent the true distribution across all visitors[2]. It is recommended that the data be weighted to reflect the true proportion of weekend and weekday visitors. If no combined estimate is desired, then data for weekend and weekday visitors should be presented separately, indicating any statistically significant differences.

[2] If estimates of total weekend and weekday use are calculated separately, then it would be appropriate to add the two use estimates without weighting the data. However, if the proportion of males differs by day of week, then the data should be weighted to reflect a 2:5 ratio of weekend to weekdays prior to calculating the overall percentage of males. Failing to do so will result in a biased estimate of percentage of males.

APPENDIX A: How To Use This Report

This section is a brief introduction to the basic statistical methods included in this report. It defines some key terms and illustrates the ways in which the statistical tables and graphs have been prepared.

The main tool used in statistics is data--those observations and measurements that are recorded in a study. As commonly used, the word "data" is plural. For example, all of the visitors' ages comprise data. A single unit of data -- for example, the age of a single visitor -- is a datum.

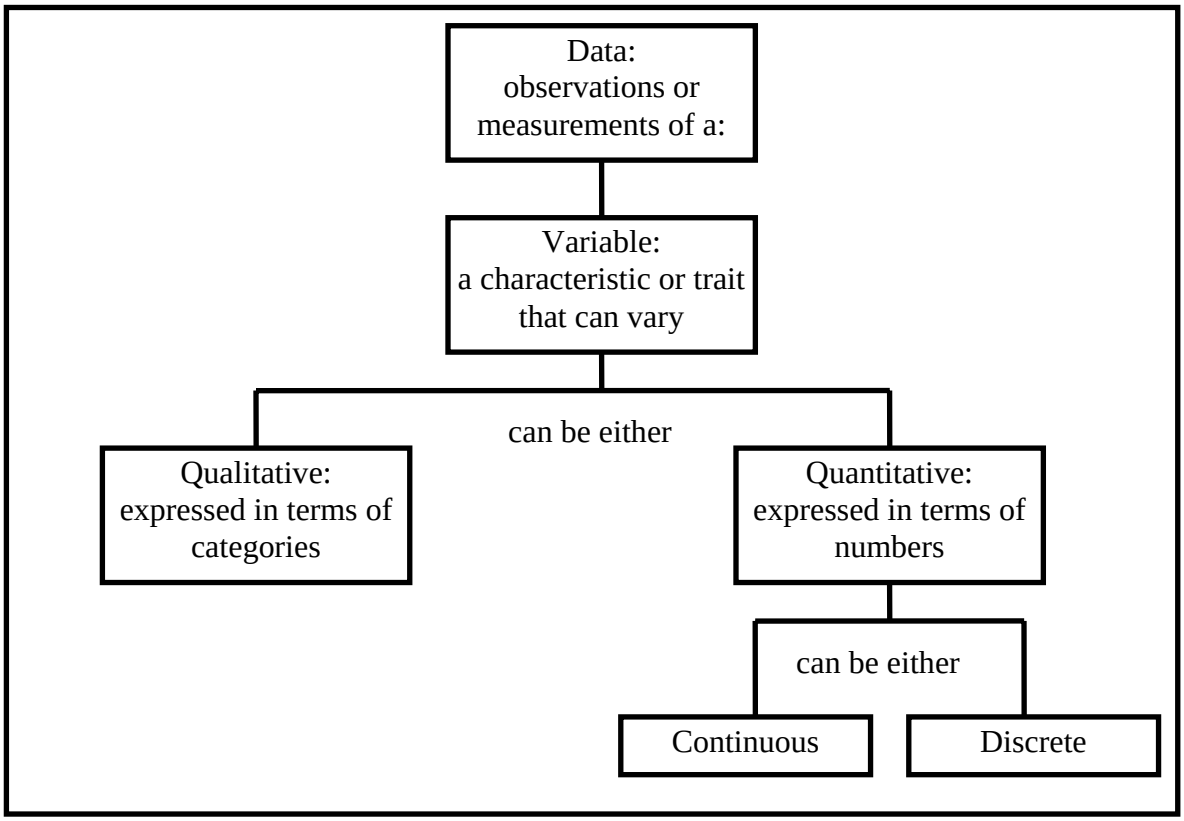
Data are collected about relevant variables. A variable is simply a characteristic or trait of interest that can vary. For example, the ages of visitors, their party characteristics, or their encounters with military overflights can all be considered variables: Each of these traits or characteristics varies from person to person in the study sample.

Variables can be of two types: Qualitative variables are expressed in terms of categories, such as whether or not a person was annoyed by military overflights. Quantitative variables are expressed in terms of numbers, such as the number of military overflights encountered.

Discrete quantitative variables have distinct and separate units. There are no values possible between the units of a discrete variable. For example, the number of visitors in a single party consists only of whole numbers of people. One cannot talk about a party of 1 1/2 persons.

Figure A1.1 illustrates these concepts.

FIGURE A1.1. FLOW CHART OF STATISTICAL CONCEPTS AND TERMINOLOGY



Often data for more than one variable are collected. The data for the unit of analysis under consideration (an individual visitor, a single party, a specific park) are a case. Statistical analyses are done on groups of cases to form a data set. The number of cases in a data set is usually referred to as "n." For example, if 1000 visitors answered a question, n = 1000.

In many instances, respondents do not answer all of the questions in a survey. They either inadvertently skip a question or are asked to skip question because it does not apply to them. When a respondent does not answer a question that they should have answered, he/she is a "missing case" for that question. If the number of missing cases exceeds 10 percent of those who should have answered the question, a corresponding footnote or statement in the text will indicate this fact.

Data can be collected for all of the possible cases. This is a census. Alternately, data can be collected for a sample of the total population. There are many ways to choose a sample. One common approach is a random probability sample, in which each individual has an equal chance of being included in the data set. In the strictest mathematical sense, the NOCA Mountain Lake Survey sample is not random due to the possibility of bias through non-response. However, the authors believe that the potential bias is so minimal that, for ordinary management purposes, the sample can be considered random and therefore, representative of the population of visitors to those areas.

The data are reported as descriptive statistics. Descriptive statistics are used to summarize a large group of numbers and to describe general characteristics of the data set. For example, there might be a long list of each visitor's age. Descriptive statistics can be used to quickly summarize this long list. The average (mean) age would be the total of all the cases' ages divided by the number of cases. The modal age (mode) would be the most frequently reported age. The range would be the spread of ages from the youngest to the oldest.

In addition to descriptive statistics, inferential statistical procedures have been used to determine the likelihood that observed relationships among the different variables are due to chance. The smaller the likelihood that an observed effect is due to chance the more confident one can be that the effect is due to systematic variation. The *p*-value is the probability of obtaining the observed result due to chance alone and is directly related to the results of the statistical test. By convention, when the probability of obtaining a result due to chance is very small ($p < .05$), then it is concluded that the observed effect is due to systematic variation or a "real" effect. Results with *p*-values less than .05 are also referred to as significant. In this report, you will see the value of the statistic and its corresponding *p*-value (e.g., $\chi^2(1, n = 25) = 3.44, p < .01$). The important thing to remember is that effects that have *p*-values less than .05 are considered real effects.

The most common statistical procedure used in this report is the chi-square test for independence. This statistical test determines if the pattern of responses for one categorical variable differs across different categories of the second categorical variable. For example, suppose a chi-square test examining the relationship between sex of respondent and day of week contacted was significant. This means that the proportion of males and females among respondents contacted on weekdays (e.g., 50% males, 50% females) differed significantly from that of respondents contacted on the weekend (e.g., 60% males, 40% females).

When one of the variables is measured on a continuous (e.g., age) rather than categorical (e.g., gender) basis, the statistical procedure used to examine differences across groups is a *t*-test when there are two groups and Analysis of Variance (F-test) when there are three or more groups. A significant F-value indicates that there is a significant difference among the groups. Follow-up tests (e.g., post hoc Tukey tests) can be performed to determine which groups differ from each other. Additional statistical procedures used in this report are explained briefly either in the text or a footnote when they are first introduced.

Statistics can be presented in several formats. Tables simply organize the data into horizontal and vertical columns and sometimes include brief explanations. Graphs or figures illustrate the data through a visual presentation. All of these formats are present in this report.

Appendix A: How to Use This Report

APPENDIX B: NOCA Mountain Lakes Survey

North Cascades Mountain Lakes Visitor Survey

Thank you for participating in this survey. Please complete both sides of this survey, and when finished, return the survey to the survey worker.

PRIVACY ACT and PAPERWORK REDUCTION ACT statement:
16 U.S.C. 1a-7 authorizes collection of this information. This information will be used by park managers to better serve the public. Response to this request is voluntary. No action may be taken against you for refusing to supply the information requested. Your name has not been requested. Thus the permanent data will be anonymous. Please do not put your name or that of any member of your group on the questionnaire. Data collected through visitor surveys may be disclosed to the Department of Justice when relevant to litigation or anticipated litigation, or to appropriate Federal, State, local or foreign agencies responsible for investigating or prosecuting a violation of law. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Burden estimate statement:
Public reporting burden for this form is estimated to average 2 minutes per respondent. Direct comments regarding the burden estimate or any other aspect of this form to the Office of Information and Regulatory Affairs of OMB, Attention Desk Officer for the Interior Department, Office of Management and Budget, Washington, D.C. 20503; and to the Information Collection Clearance Officer, WASO Administrative Program Center, National Park Service, 1849 C Street, N.W., Washington, D.C. 20240.

IMPORTANT: We are interested in people who visit mountain lakes in North Cascades National Park, Ross Lake National Recreation Area, and Lake Chelan National Recreation Area. For purposes of this survey, mountain lakes are all lakes within the park and recreation areas *except* Ross Lake, Diablo Lake, or Lake Chelan. Mountain lakes outside of the park and recreation areas are not included unless specifically stated.

1. How many people are in your group today?

_____ People are in my group

2. What is the make-up of your group today? (*Check one box)*

- ☐ Individual
- ☐ Family
- ☐ Friends
- ☐ Family & Friends
- ☐ Other (*Please specify)* _____

3. How many people in your group fished during your hike? *(Enter "0" if no one fished.)*

_____ People in my group fished

4. Which of the following best describes this trip?

- ☐ I drove from my home or other lodging to hike for the day.
- ☐ I camped overnight at another location and drove to this trail to do a day hike.
- ☐ I camped overnight at a backcountry campsite by the lake(s).
- ☐ I camped overnight in the backcountry but not by the lake(s).

5. How many hours did you spend within 12 feet of the lakeshore during this trip?

I spent ____ hours within 12 ft. of the lakeshore.

NOTE: Mountain lakes refer only to those within the park and recreation areas and do not include Ross Lake, Diablo Lake or Lake Chelan.

6. Including this year, during how many seasons (May through October) have you fished in mountain lakes?

- ☐ I have never fished in mountain lakes→GO TO Q-14 ON OTHER SIDE.
- ☐ I have fished ____ seasons in mountain lakes.

7. What year did you first fish in mountain lakes?

The first year I fished in mountain lakes was _____.

- ☐ Don't know/Don't Remember

8. Including this hiking trip, how many trips have you made to fish in mountain lakes?

I have made _____ mountain lakes fishing trips.

- ☐ I can't remember exactly but it was more than 30 trips.
- ☐ Don't know/Don't Remember

9. Was fishing your primary motivation for your hiking trip today?

- ☐ Yes
- ☐ No → **What was your primary motivation?**

_____

10. On this hike, how many hours did you fish?

- ☐ I did not fish on this hike. → GO TO Q-14
- ☐ I fished for _____ hours on this hike.

11. In what lake(s) did you fish on this hike?

_____

_____

- ☐ Don't know the name of the lake

12. On this hike, how many fish did you . . .

. . . catch? I caught ____ fish.

. . . keep? I kept ____ fish.

13. If mountain lakes fishing in North Cascades National Park had not been allowed today, would there be an acceptable substitute destination for you to fish?

- ☐ There is no acceptable substitute. → GO TO Q-14
- ☐ There is an acceptable substitute.

13a. List acceptable substitute destinations OUTSIDE of North Cascades National Park . *(List in order of preference or check the box below.)*

1_____

2_____

- ☐ Would accept a substitute but would need to be informed of alternatives.

14. Are you: ☐ Female ☐ Male

15. What year were you born? 19 ___ ___

16. What is your home Zip code?
(Write country name if you are not a US resident.)

___ ___ ___ ___ ___

17. Please use the space below to write any comments you care to make about the positive or negative aspects of your trip to North Cascades NP, or about National Park Service management of the area.

APPENDIX C: Visitor Comments from the NOCA Mountain Lakes Survey

The last question of the survey provided respondents with an opportunity to write any comments about the positive or negative aspects of their trip to North Cascades National Park Complex, or about National Park Service management of the area. All of these comments were coded to reflect main themes of the comments, and it is not uncommon for a comment to have multiple codes. If a comment had multiple codes, the first code represents either the main theme (if one stood out) or the first theme (if not main theme was apparent). Below we present these general comments. All comments addressing fishing issues whether as a main or secondary theme are presented first, followed by the other comments sorted by their first code (i.e., main theme).

Code Legend

p General positive comments
t Negative trail comments
tt Positive trail comments
s Negative comments about fish stocking
ss Positive comments about fish stocking
ff Non-stocking related fishing comments
a Permit comments
b Bug comments
c Crowding comments
f Facilities comments
i Comments on park information
r Ranger comments
v Comments on preservation of natural resources
m Miscellaneous comments

Code	Comment
a, ss	Never abandon the back country permits requirements. I think its important to keep stocking the lakes.
ff	Fishing in the lakes was a definite plus to the trip.
ff, p	It was a great place to fish and relax, because of the solitude of the Thornton Lakes. Definitely a good fishing experience.
ff, t	Hidden Lake is very hard to got to for fishing and swimming. Other lakes I've hiked to are much more accessible.
ff, t, a	Love hiking and fishing. Most trips I do both. Also climbing and scrambles. Hidden Lake is my favorite day hike. Trail needs more brushing please. Life time pass for trailheads!
p, s	Very positive experience. Prefer no stocking, prefer natural settings and avoid man-induced impacts.

p, s	So far the park has had great hiking, nice campground at Newhalem. While I like to fish I would rather not see mountain lakes stocked with fish that do not naturally support fish.
s	Don't mess with the ecology of the lakes. Let the fishermen go down to the rivers.
s	The park should stop stocking the mountain lakes, or they should stock the lakes with bigger fish.
s	Please stop the stocking of high lakes in the Park. Let the native amphibian and invertebrate populations recover.
s	Stop stocking non-native fish. Try rainbows and Dolly's.
ss	We enjoy fishing in the park. Fish management is good quality in lakes with fish. Fish stocking in low density works! Today we just went for scenery.
ss	I strongly believe mountain lakes should be stocked with fish.
a, p	I wasn't sure whether I needed some kind of pass, since they are not needed in Ohio, but the hike was fantastic.
c	Hidden Lake is too popular nowadays.
f	Supply clean restrooms.
f	Nice to have restrooms at the trailhead.
f, tt	Slightly larger campsites would have been nicer. Thanks for the toilet and well maintained trails.
f, tt	Campsite - trail very well maintained.
m	Mountain climbers.
m	Someone had left a campfire at the campsite at Lake Hozomeen that had not been extinguished properly nor completely. We used plastic bags of water to try to put it our and did earth-moving work too. We reported it (fire not out yet) to 2 conservation volunteers.
m	No problems.
m	On 7-26-03, several vehicles broken into at Monogram Lake trailhead. Suggestion: Notices posted at ranger stations and info boards re: "Don not leave items in vehicles. Theft is common!"
p	I thought it was all wonderful. Everything was well kept and pretty well marked. We had a wonderful trip.
p	100% great

p It was great! Much more than we expected in views, beauty, cleanliness, and isolation. We'll be back.

p Great trip.

p Absolutely spectacular views. I will definitely come back again, and will probably camp.

p Things look good!

p Hidden Lake lookout was amazing!

p It was a totally awesome experience!

p Had a great day!

p The flowers are gorgeous.

p It's great, we love it.

p Having a maintaining area like this is how I love to see my tax money spent.

p This place rocks.

p Beautiful place.

p Beautiful views.

p We had a wonderful time.

p Thanks

p I have only been up here twice and I have had two good trips.

p I love hiking in the North Cascades.

p Beyond gorgeous.

p Awesome.

p Beautiful hike.

p Wonderful hike, quite well maintained. Will be back for sure.

p It was great.

p Great hike.

p It was a beautiful hike and lake.

p First time visitor to Hozomeen. Unfortunate fire mess at Hozomeen Lake. Beautiful lake - great to see loons.

p	There are great views and campsites. It's a great place. Start: Eastbank. End: Hozomeen. Roll-in creek, Lightning creek times 2, Nightmare. Company: Moondance.
p	Love it.
p	Nice hike.
p	Great climbing on TRIUMPH.
p	Very nice. Glad we endured.
p, a	Park is great, but forest pass has to go.
p, b	Wonderful park. Bugs were bad but really nice camping.
p, b	Positive: this trip was very fun and exciting because of water and wildlife. Negative: I wish there were less mosquitoes.
p, f	Beautiful hike. Road up to Ross Lake could be maintained better.
p, f, r	Beautiful area. Campsites and trail well maintained. Park rangers at Marblemount stations helpful.
p, r	Scenery is superb, some rangers I've met lack social graces (referring to wilderness rangers at Cascade Pass).
p, r	Keep up the good work! And practice good customer service when meeting others in the back country, don't just be a person with a badge and a list of rules. There is a happy medium. Otherwise, I absolutely love my time spent in the trips I take to the Back country. A beautiful place to visit and protect, thanks for all your hard work on trails etc.
p, r	You do a great service for everyone. One request; more backcountry rangers. I realize there are budget restrictions, but we need more. Thank you.
p, r	Canoed and hiked Ross lake for 7 days. It was beautiful. Great campsites. Helpful rangers.
p, r	Finally I get to say something about the National Park. Today was the last hike of a two-month hiking trip through several National Parks. I am very impressed by them and the management. This Park, the rangers and the visitors center are great!
p, tt	It was excellent. Trails in beautiful shape.
p, tt	Beautiful. Lots of people, but very clean. Great lookout maintenance.
p, tt	Wonderful hike. Well maintained trail. Love the lookout.

p, tt	It's beautiful here. Nice trails.
r, tt,p	The rangers in Marblemount were very friendly and helpful, a good resource. This trail is beautiful! The lookout building is wonderful to have up there.
t	My son and I could not get close enough to the lake to fish. No established trail.
t	Need trail to lake. Lots of huge boulders. By lake is cliff.
t	Too wet. Trails need maintenance.
tt	Great well maintained trail.
tt	Thanks for the nice upkeep of the trail.
tt	Trail improvements look great! (Hidden lakes Peak)
tt	Very well kept trails. Good walkway.
tt	I am very impressed by how well maintained these trails are!
tt	Great trails!
tt	Nice trail. Very wet day for August. Saw fish didn't catch 'em.
tt, b	Nice trails and lake, nasty bugs.
tt, i	Great trails. Need more on-line trail map access.
tt, p	The Steep trail coming was well worth the trip. The trails seemed well maintained. We appreciate the North Cascades Park Complex is kept natural and a wilderness. Thank you and all the volunteers that donated time and effort to preserve the parks.
v	Excellent sign use/barriers across social trails and re-vegetation sites.
v	Preserve, keep people on leash from polluting. Beautiful area.

Appendix C: Visitor Comments

APPENDIX D: Significance of Fishing in NOCA for Members of Trailblazers and Hi-Lakers and Evaluation of Fishing Data Collected by These Organizations

TA#J9W88030021 2/9/04

MEMORANDUM

To: Roy Zipp, Gina Rochefort, Darryl Johnson
From: Chris Fowler
Re: TA #J9W88030021 Recreational Activities and Associated Human Impacts Near Lakes Stocked with Fish. Task #9

Introduction

Stocking of trout in lakes that were historically fishless has been a controversial management issue in the North Cascades National Park Service Complex (NOCA) since Congress established the park in 1968. To improve understanding of the ecological impacts of stocking, the National Park Service (NPS) funded more than a decade of research and learned a great deal about the within-lake ecological impacts of stocking. However, the NPS focus on documenting the aquatic ecological impacts of stocking overlooked the human dimensions of this recreational enhancement action. For example, fundamental questions such as "How many people fish?" remain unanswered.

As part of a much larger study being conducted under the auspices of the "Mountain Lakes Fishery Management Environmental Impact Statement" (EIS), the NPS undertook several efforts to quantify and characterize fishing in the NOCA during the summer of 2003. These efforts included: the addition of fishing-related questions to the established backcountry permitting system, collection of exit surveys from users of lakes in five easily accessed areas, and a review of an existing database of fishing trips in Washington State managed by the members of the Trailblazers and HiLakers fishing clubs. In addition, NPS tried to develop a more thorough understanding of fishing use patterns at NOCA lakes through interviews with exit survey respondents who reported multiple fishing trips.

Researchers collected 471 exit surveys at selected trailheads during the summer of 2003. These surveys represent the NPS' principle data collection effort to date with regards to the human dimensions of fish stocking.[1] While it was hoped that the exit surveys would generate good baseline information on the levels of fishing at NOCA lakes, NPS recognized several limitations with the data collection method. First, the NPS exit surveys were designed as a pilot study and as such, the sample size was small. The surveys monitored use at five areas within the park representing nine lakes out of a total of 105 lakes documented to contain fish.[2] Second, the lakes monitored with the exit survey were selected because of their relative accessibility. The lakes sampled in this study may experience different use patterns than more remote lakes.

Objectives

This memorandum reports on the outcome of two efforts to gather better information on the location and frequency of fishing at the NOCA lakes. The first effort was an assessment of the database maintained by the Trailblazer and HiLaker fishing clubs. The Trailblazers and HiLakers have made the database available to the NPS; however, the extent to which this data source might

[1] A report detailing the objectives, methods, and results of the exit survey study is currently in preparation.
[2] Downen, M. (2003). "North Cascades National Park High Lakes Fishery Management Program Report." Washington Department of Fish and Wildlife. Draft Report 6/9/03. p.14.

fill the gaps in the NPS' in-house data collection efforts was unknown. The database was examined for its completeness, relevancy, and data quality.

The second area of investigation sought to broaden the NPS' understanding of fishing practices in the NOCA lakes and to gather indirect information on the fishing practices at lakes that were not easily monitored with exit surveys. This information was to be collected through extended interviews with exit survey respondents who indicated that they had fished in the NOCA lakes on multiple occasions. It was expected that this additional information would shed light on how well the exit surveys and backcountry permit questions were likely to capture actual fishing use at lakes throughout NOCA. Furthermore, it was hoped that this qualitative information could broaden the NPS' understanding of fishing impacts at the lakes and provide an additional check on more systematic use information collected during an earlier research effort.[3]

These tasks were completed under the Task Agreement J9W88030021 "Recreational Activities and Associated Human Impacts Near Lakes Stocked with Fish." This Task Agreement is between the NPS and the University of Washington.

It is recognized that one summer season's worth of visitor use data collected at select locations will yield very limited data. Furthermore, the characterization of use patterns based on a small number of unstructured responses is not sufficient to meet the long-term needs of the NPS. Therefore, this project is intended to be a first step toward a multi-year, phased approach aimed at gathering accurate visitor use numbers and activity information.

Methods

Reviewing the database maintained by the Trailblazers and HiLakers was one of the principle tasks associated with this Task Agreement. The database is maintained by the fishing clubs as a means of organizing members' reports of fishing conditions at a wide range of locations within Washington State. One of the primary missions of the Trailblazers and HiLakers clubs is to assist the Washington Department of Fish and Wildlife (WDFW) in the stocking of lakes in Washington. Trailblazers members are responsible for stocking the fish at many lakes, and both clubs work to provide survey data that can help WDFW decide which lakes need stocking and with what types of fish in what quantity.

For this study, the researcher provided a limited set of questions to Brian Curtis, the individual in charge of managing the database for the clubs, and he queried the database based on those questions. Mr. Curtis then provided the results of these queries to the researcher as Excel files. One question asked for the total number of Washington State surveys included in the database for each of the last fifteen years. A second question asked for the date, location, duration of trip, and the time spent fishing from each survey completed at one of the NOCA lakes for the entire time period covered in the database (the earliest recorded survey from NOCA is from 1960). The database includes a great deal of additional data related to the size, type, and stomach contents of the fish

[3] Hospodarsky, D. and P. Brown (1992). Assessment of the Effects of Angling on High Lake Riprarian Environments North Cascades National Park Service Complex. Corvallis, OR, National Park Service Cooperative Unit College of Forestry Oregon State University.

caught, but this information did not appear to be directly relevant to the particular objectives of this report and was not included in the database review.

This Task Agreement also included an effort to collect qualitative information from exit survey respondents who indicated that they had fished in NOCA lakes on multiple occasions. In keeping with the goal of gathering a broad range of information on fishing practices at NOCA lakes, this qualitative information was to be collected through an open-ended interview conducted after completion of the exit survey. While the interview was intended to be unstructured, key topics of interest were: the names of all NOCA lakes where the respondent had fished, typical duration of trips, number of trips per season, and fishing methods. In addition, an important goal of the interview was to collect information on the substitutability of fishing opportunities within NOCA for opportunities elsewhere in the region. However, the effort to collect qualitative information from frequent users of NOCA fishing opportunities was unsuccessful due to a lack of responses. The interviewer collected responses over the course of sixteen eight-to-ten hour days at four different survey sites (while at the same time collecting exit surveys). The interviewer encountered only a single fisherman who reported multiple fishing trips within NOCA during this period. Furthermore, this individual had only fished at one lake (Hozameen Lake), having returned to the same spot every year for thirty years.

When the interview effort associated with the exit surveys failed to produce usable information, the researcher generated a minimal amount of information on fishing practices within NOCA by contacting three members of the Trailblazers. In support of this effort, the researcher conducted an unstructured interview of approximately two and a half hours with the president of the Trailblazers and sent a series of nine or ten e-mails to two other active Trailblazer members. Although these responses are not a representative sample, they represent the informed opinions of three individuals with a great deal of experience fishing in the NOCA lakes.

There is clearly a limit to the conclusions that can be drawn from the information gathered in this task. The failure to capture a representative sample of frequent users of NOCA lakes limits what can be said about the fishing use patterns at remote lakes within the NOCA complex. The discussion that follows should therefore be treated as preliminary and at least partially speculative although it is based on the best information currently available. The efforts undertaken by the NPS to gather information on fishing use patterns at NOCA lakes were meant to be preliminary, and to this end the final section of this memorandum provides some suggestions for future data collection efforts.

Results

Database Review

The primary purpose of the database maintained by the Trailblazers (and supported with surveys from the HiLakers) is to collect as much information as possible on fishing conditions at the lakes with fish populations managed by WDFW. This information is then presented to WDFW's biologists who make decisions on the quantity, type, and timing of fish stocking at the lakes. The database is fairly large, due in part to the number of years for which data are available. However, there are a relatively small number of surveys taken within the NOCA complex. The total number of NOCA surveys is 243 with only 77 in the past ten years. Table 1 reports the total number of surveys and the total NOCA surveys for the past ten years.

Table 1: Number of Surveys in Trailblazer Database 1992-2002		
Year	Surveys	NOCA Only
1992	184	10
1993	324	8
1994	318	1
1995	373	4
1996	324	6
1997	332	11
1998	355	10
1999	407	12
2000	422	6
2001	482	8
2002	485	1
Total	4006	77

In practice, surveys appear to be collected on a rather sporadic basis, probably driven by anticipated stocking needs. Lower Thornton Lake, one of the lakes for which exit surveys were collected, has only two data points in the Trailblazer database: one from 1967 and another from 1995. Hidden Lake has six reports: the earliest in 1968 followed by two on the same date in 1987 and one each in 1993, 1996, and 1997. Table 2 shows the number of surveys reported in the database for each NOCA lake for which surveys exist. Lakes that were part of the 2003 NPS exit survey effort are shown in **bold**.

Table 2: Number of Reports in Trailblazer Database by Lake (NOCA Only)			
Lake name(s)	Num.	Lake name(s)	Num.
Battalion; MLY-2	4	Panther Pot, Lower; RD-5-2	4
Berdeen, Lower; M-7	1	Panther Pot, Upper; RD-5-1	4
Berdeen, Upper; M-9	1	Price; MSH-3	2
Berdeen; M-8	1	Pyramid; RD-3	2
Bouck; Balch; DD-4	1	Quill, Lower; M-24-2	2
Bowan; MR-12	9	Rainbow, Lower; MR-14	5
Coon; MM-10	13	Rainbow, Upper South; MR-13-2	4
Dagger; MR-4	9	Ridley; HM-3	14
Doubtful; CP-1	8	Sandalee, Middle; MM-7	1
Firn; MP-2	1	Silent, Lower; MA-3	2
Green View; GM-2	1	Silent, Upper; MA-2	2
Hi Yu; M-1	1	Sourdough; PM-12	2
Hidden Lake Tarn; EP-14	6	Stiletto; MR-1	11
Hidden; SB-1	6	Stout; Mystery; EP-9-2	2
Hozomeen; HM-2	7	Tamarack; Dee Dee; MR-15-1	11
Jeanita; DD-1	2	Thornton, Lower; M-20	2
Juanita; SM-1	2	Thornton, Middle; M-19	4
Kettling, Upper; MR-6	2	Thornton, Upper; M-18	2
Kettling; MR-5	8	Thunder	1
Last Chance; MM-3	2	Trapper; GM-1	7
McAlester; MR-10	12	Triplet No. 1 (Lower); SM-2-1	4
MLY-1	1	Triplet No. 2 (Upper); SM-2-2	5
MM-11	2	Triumph; M-17	4
Monogram; M-23	2	Twisp Pass Pond, North; MR-2	1
MR-11	8	Twisp Pass Pond, South; MR-3	2
MR-13-1; Rainbow, Upper North	2	Unnamed	2
MR-15-2; Dee Dee, Lower	2	Unnamed; MR-8	2
MR-16	7	Unnamed-6790	2
MR-9	8	Waddell; Sandalee, Lower; MM-6	2
Noname; PM-1	1	Willow; HM-4	5

The infrequency of these reports suggests that they do not represent a good count of fishing activity at these lakes. In comparison, NPS backcountry permit data for May through August of 2003 alone shows eight permits issued to parties that intended to fish at or near Hidden Lake and twenty four parties intending to fish at or near Thornton Lake. Because the backcountry permits only include

persons who are planning on camping overnight in the backcountry and are difficult to enforce (thus excluding day users and parties who did not obtain a permit), they may underreport the number of people fishing at those lakes.

The Trailblazer database also reports on the duration of the trip when the survey was undertaken and the number of hours spent fishing. On an average basis these values are 11.9 hours and 1.5 hours respectively. However, these figures are based on an insufficient number of cases to make broad claims about use patterns at the lakes. Many of the survey reports in the database do not include this additional information, and so the sample size is only sixty surveys. Furthermore, many of these reports are generated for the express purpose of monitoring fish populations for stocking. If trips for which the intended purpose is to monitor fish populations at a particular lake or lakes have different characteristics than trips taken purely for recreational purposes, this sample would likely then have some bias.

The Trailblazer database may be sufficient for answering questions about fish populations within the lakes and for guiding stocking decisions. However, the sporadic nature of the reports contained therein do not lend themselves well to estimating either total numbers of users at the lakes within NOCA nor the fishing patterns of individual lake users. Opportunities may exist for the NPS to work with the clubs to improve certain types of reporting in conjunction with the collection of fishing data on these lakes. In its present form, however, the database does not provide much information that can help the NPS estimate usage at the lakes within the NOCA complex.

Results of Interviews

The purpose of the interview process was to try and ascertain how the fishing community uses NOCA lakes. More specifically, the questions that the researcher directed towards the three members of the Trailblazers who made themselves available for questions regarded the choice of lakes, the duration of trips, and the time spent near the lakeshore fishing. Because the responses are drawn from just a few individuals, they should not be construed as a representative sample or an objective analysis of fishing practices. Instead, they provide a rather subjective assessment of how the lakes are used. The researcher has a great deal of trust in the knowledge of these individuals and their responses represent the most detailed information on fishing practices collected by the NPS during the summer of 2003. However, the results reported here should not be construed as more than the three sets of informed opinion that they represent.

One of the principle questions that the NPS hoped to answer was, "how much fishing activity do the NOCA lakes experience?" This proved to be a more difficult question to answer than expected. The data from backcountry permits should provide considerable information on trips that are overnight, and the exit survey was designed to collect information on users of some of the most easily accessible, stocked lakes. The gap that remains is the level of use at relatively remote lakes that may still be fished in a day. One conclusion that might be drawn from the exit survey data is that, since there are very few day users at the lakes who fished and since these lakes represent some of the most accessible NOCA lakes, then there may be very few day trips for fishing at NOCA lakes.

In an effort to capture lakes that experienced relatively high use, the exit surveys may have selected lakes that are not seen as desirable by some members of the fishing community, and therefore

underreported day use at NOCA lakes. One interviewee said, "seeing a trail to a lake is an immediate red flag, I don't even consider lakes with trails to them."[4] While this is certainly not a universal rule, of the 243 survey reports for NOCA lakes in the Trailblazer database, 77% are to lakes that were not considered in the survey effort. Determining the efficacy of the exit surveys in estimating levels of fishing day use then becomes a matter of determining the percentage of trips to NOCA lakes that are day use.

Estimating the percentage of fishing trips within NOCA that are day trips is quite difficult. Based on the smaller sample of surveys from the Trailblazer database which also include information on the number of days spent at the lake, 73% were day trips and 69% of these were to lakes not covered in the exit surveys. In response to questions about the duration of trips to NOCA lakes, Mike Swayne, an active member of the Trailblazer and one of the database managers, went through the Trailblazers' stocking reports for 2002 (which include all of Washington State, not just NOCA lakes) and identified seventy six day trips, twenty two-day trips and two three-day trips (77.6%, 20.4%, and 2.0% respectively). However, stocking trips represent somewhat of a special case because the survival of the fish is closely linked to the amount of time they spend in transport. Mr. Swayne also estimated (from personal experience) that 60% of fishing trips would be day trips, but that the remoteness of the NOCA lakes might drop that percentage down to around 40%.

Overall it is difficult to make strong claims about the levels of use at NOCA lakes. There is anecdotal evidence taken from interviewees' personal experience that suggests that a significant portion of day trips may not have been captured by the combined backcountry permit and exit survey data. In addition, the data available from the Trailblazers' database and stocking reports suggests that day trips to remote lakes do occur. Without a more thorough data collection effort, these claims can not be confirmed or denied.

Recommendations for Future Data Collection

One of the clear lessons of the data collection efforts undertaken during the summer of 2003 is that established data collection methods are not sufficient for estimating the levels of fishing use at NOCA lakes. Accordingly, the last section of this report will attempt to focus on ways that the Park Service might improve its data collection efforts in the future.

The system of backcountry permits could very easily become an important source of use data for members of the fishing community who fish in the Park's remote lakes. Park personnel reported few problems with the data collection effort undertaken through this process during the 2003 season, though data collection efforts were reportedly inconsistent between permit stations and even park personnel.[5] If the Park Service were willing to prioritize just a very few additional data points, this method of data collection could be very successful.

While effective for overnight trips, the backcountry permit system does not cover the fishing trips that are completed in only one day. This means that the Park Service must identify an alternative system for collecting day use data at remote lakes. The exit survey method employed during the summer of 2003 is relatively expensive and does not capture data from a sufficient number of lakes

[4] Conversation with Sandy McKean, July 6, 2003.
[5] E-mail Cathi Jones, NPS staff October 27th, 2003

to provide reliable information for NOCA as a whole. Consequently it is unlikely that exit surveys will be a viable long-term strategy for collecting use data.

One obvious solution would be to require some sort of fishing permit system for fishing in the NOCA lakes. This could be operated in much the same way as the free backcountry permit system to encourage participation or it might be issued on a seasonal basis with a requirement that permit holders report the number of fishing trips and location of trips as a condition of use. At the very least a fishing permit or additional questions on the backcountry permit would provide the NPS with the names and addresses of people fishing in the NOCA lakes that could then be used as needed for more detailed survey efforts.[6] While this option is limited in its enforceability and may pose some difficulties in terms of checking on the quality of the data collected, it may be the best option for long term data collection with regards to fishing in the NOCA lakes.

Conclusion

The degree to which NOCA lakes are used for fishing is still uncertain. Although the survey efforts undertaken in 2003 have shed some light on use patterns at these lakes, much remains to be done. Data collection is difficult and its comprehensiveness is difficult to judge reliably. The Trailblazers' database does not appear to provide a sufficient number of reports to estimate total usage at the NOCA lakes. Furthermore, the lakes chosen for completing exit surveys did not provide a sufficient number of respondents reporting multiple trips to NOCA lakes to provide more detailed information on usage at remote lakes. Although the effort to collect data on these remote lakes was secondary and not expected to provide sufficient use data for the remote lakes, the project scope did anticipate collection of some information. While the backcountry permit data is useful, it cannot capture the extent of day use within the NOCA complex and is not itself sufficient as a means of collecting use data on the lakes. If the NPS wishes to develop use information on the NOCA lakes that is commensurate with the detailed ecological information it has already prepared, then data collection efforts must be expanded in future years.

[6]Collecting names and addresses of Park users for use in subsequent survey efforts would require additional effort on the part of NPS to comply with the requirements of the Privacy Act with regards to maintaining databases of personal information.

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environment and cultural values of our national parks and historical places, and providing for enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interest of all our people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under US administration.

Technical Report NPS/PRWUW/NRTR-2005-03
NPS D-273