Developing a New Mixed-Mode Methodology

For a Provincial Park Camper Survey in British Columbia

by

Brian Wesley Dyck
B.A., Seattle Pacific College, 1973
M.A.T., Oregon College of Education, 1974

A Dissertation Submitted in Partial Fulfillment of the
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SUPERVISORY COMMITTEE

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ABSTRACT

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Park and resource management agencies are looking for less costly ways to undertake park visitor surveys. The use of the Internet is often suggested as a way to reduce the costs of these surveys. By itself, however, the use of the Internet for park visitor surveys faces a number of methodological challenges that include the potential for coverage error, sampling difficulties and nonresponse error. A potential way of addressing these challenges is the use of a mixed-mode approach that combines the use of the Internet with another survey mode. The procedures for such a mixed-mode approach, however, have not been fully developed and evaluated.

This study develops and evaluates a new mixed-mode approach –a face-to-face/web response – for a provincial park camper survey in British Columbia. The five key steps of this approach are: (a) selecting a random sample of occupied campsites; (b) undertaking a short interview with potential respondents; (c) obtaining an email address at the end of the interview; (d) distributing a postcard to potential respondents that contains the website and an individual access code; and (e) undertaking email follow-ups with nonrespondents.

In evaluating this new approach, two experiments were conducted during the summer of 2010. The first experiment was conducted at Goldstream Provincial Park campground and was designed to compare a face-to-face/paper response to face-to-face/web response for several sources of survey errors and costs. The second experiment was conducted at 12 provincial park campgrounds throughout British Columbia and was designed to examine the potential for coverage error and the effect of a number of email follow-ups on return rates, nonresponse error and the substantive results.

Taken together, these experiments indicate: a low potential for coverage error (i.e., 4% non-use Internet rate); a high email collection rate for follow-ups (i.e., 99% at Goldstream; a combined rate of 88% for 12 campgrounds); similar return rates between a paper mode (60%) and a web (59%) mode; the use of two email

follow-ups reduced nonresponse error for a key variable (i.e., geographic location of residence), but not for all variables; low item nonresponse for both mixed-modes (about 1%); very few differences in the substantive results between each follow-up; a 9% cost saving for the web mode. This study suggests that a face-to face/web approach can provide a viable approach for undertaking park visitor surveys if there is high Internet coverage among park visitors.

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DEDICATION

To my belated father, Benjamin E. Dyck, and my mother, Anne Dyck, for their ongoing love and support and for teaching me the value of patience, hard work and perseverance.

CHAPTER ONE

INTRODUCTION

1.1 Use of traditional survey modes

Sample surveys are an important management tool for park agencies (Vaske, 2008). Based on a few hundred or a thousand people, this tool can be used to provide precise estimates about the characteristics of thousands or millions of people (Dillman, Smyth, & Christian, 2009). Parks agencies often use sample surveys to gather information for policy or resource management decisions (Dearden & Rollins, 2009; Lesser, Yang, & Newton, 2011; Manning, 2008). The results of these surveys, for example, are used to facilitate land-use decisions (e.g., expanding the size of parks and protected areas system), park investment decisions (e.g., providing new park facilities and services) and operational decisions (e.g., evaluating the quality of park services or current policies; Blythe, 1999; Dyck, Gawalko, & Rollins, 2003; Rollins, Dyck, & Frechette, 1992). In implementing sample surveys with general populations and with park visitors, park agencies and survey researchers have frequently relied on mail, telephone and face-to-face interviews (Dyck & Selbee, 2002; Iachan & Kemp, 1995; Oh, Park, & Hammit, 2007; Vaske, 2008). Some resource management and park agencies, however, are now questioning the strict reliance on these more traditional survey modes (Gigliotti, 2011).

One reason for this questioning is the budget constraints that many agencies are facing and the increasing cost of traditional survey modes (Vaske, 2011). While cost information is often not provided by survey researchers (Hochstim, 1967), face-to-face surveys are usually considered the most expensive survey mode because they involve considerable labor and travel costs for interviewers (Weinberg, 2005). For telephone surveys, the recent decline in response rates in Canada (Baldon, 2010) and in the United States (Curtin, Presser, & Singer, 2005) has led to increasing costs in an effort to improve response rates. The decline in response rates for telephone surveys has been influenced by higher ownership levels of caller ID and increasing growth of cellular phones (Tuckel & O'Neill, 2001). In the United States, for example, it is estimated that more than one-third of American homes (35.6%) had wireless telephone in 2012 (Blumberg & Luke, 2012). The cost of cell phone interviewing in dual frame sampling for landline and cell phones is about twice as high as landline interviewing (Smyth, Dillman, Christian, & O'Neill, 2010). For mail surveys, the costs of monetary incentives have also been increasing (Toepel, 2012). Some general population surveys, for example, are now using $5 pre-paid incentives (Messer & Dillman, 2011) whereas in the past these incentives were usually $1 to $2 (James & Bolstein, 1992; Lesser et al., 2001; Moore & Tarnai, 2002).

A second reason for questioning the strict reliance on more traditional survey modes is the increasing interest in using web surveys (Couper, 2008; Duda & Nobile, 2010; de Leeuw, 2005; Israel, 2010). Web surveys involve the collection of data by self-administered questionnaires on the Internet (Werner, 2005). In comparison to mail surveys, web surveys have no costs for paper, postage, envelopes and data entry. Web surveys also have the potential of including graphical features like pictures and maps that is usually more expensive to use in mail surveys (Couper 2008; Sexton, Miller, & Dietsch, 2011). In addition, the time to respond to email invitations tends to be faster than in mail surveys (Kittleson, 1997). For surveys with specialized populations, like government employees (Couper, Blair, & Triplett, 2001) and university students (Kaplowitz, Hadlock, & Levine, 2002), where nearly everyone uses the Internet and a sampling frame of email addresses is available, the use of this mode by itself is usually considered appropriate.

1.2 Use of web mode by itself for park-related surveys

The use of a web mode by itself for probability-based surveys with general populations or park visitors, however, faces a number of methodological challenges (Duda & Nobile, 2010; Trouthead, 2004). One challenge is the potential for coverage error. In the United States, it is estimated that about two-

thirds of households have access to the Internet and only about two-thirds of these households have a high speed Internet connection (Messer, 2009). In 2010, it is estimated about 79% of Canadian households and 84% of British Columbia households had access to the Internet at home (BC Stats, 2012). In addition, several studies have shown that demographically those not using the Internet in the United States (Israel, 2010) and in Canada (McKeown, Noce, & Czerny, 2007) are older and live in rural areas. Many parks and protected areas in North America are located in rural areas. If visitors to these parks come from rural areas and do not have access to the Internet, they would be prevented from completing a web survey. The lack of access to the Internet, in turn, could lead to coverage error or bias or a non-representative sample of the target population.[1]

A second challenge is sampling difficulties. Probability-based samples hinge on the fact that the probability of selection is known and a random selection process is used in selecting the sample (e.g., systematic sample). In practice, probability-based surveys require a sampling frame (e.g., list of names and addresses) or the use of some sampling algorithmic method when a sampling frame is not available (Messer, 2009). For general population surveys, there is no comprehensive list of

[1]Coverage error is one type of frame error (Weisberg, 2005). This type of error can occur when the sampling frame omits elements from the population. Other types of frame errors are ineligibles (when the sampling frame includes nonpopulation elements), clustering (when groups of units are listed as one in the sampling frame) and multiplicity (when a case appears more than once in a sampling frame).

email addresses, no standardized structure of email addresses (like telephone prefixes) and no mechanism, like random digit dialing, to draw a probability-based sample. For park visitor surveys, email addresses of park visitors are usually not available. In situations where email addresses are available, the list may be based on voluntary (non-probability) sampling and usually requires prior permission of using a person's email address before the survey is conducted (Messer, 2009).

A third challenge is the potential for nonresponse error (Couper, 2000). Response rates for web surveys vary widely (Lesser et al., 2011), but on average have been found to be about 11% lower than for other types of survey modes (Manfreda, Bosnjak, Berzelak, Haas, & Vehovar, 2008). In recent park and recreation surveys with a household population (Graefe, Mowen, Covelli, & Trauntvein, 2011) and with hunter populations (Gigliotti, 2011; Lesser et al., 2011) response rates were found to be lower in web surveys than in mail surveys. While high response rates may not reduce nonresponse error (Groves, 2006; Groves & Peytcheva, 2008) they can reduce the risk of nonresponse error (Groves et al., 2009). A key concern of low response rates is that the characteristics of respondents may not be representative of the underlying target population and that nonresponse from

potential respondents may lead to biased statistics (e.g., means) and affect the confidence levels of the estimates (Bethlehem & Biffignandi, 2012).

Taken together, these methodological challenges have raised legitimate concerns about the use of the web by itself to provide valid and reliable statistical estimates for general population or park visitor surveys (Duda & Nobile, 2010; Gaede & Vaske, 1999; Gigliotti, 2011; Vaske, 2011). More specifically, the use of the web by itself is usually considered inappropriate for probability-based household and park visitor surveys (Duda & Nobile, 2010; Trouthead, 2004).

1.3 Mixed-mode surveys

An approach which combines web surveys with more traditional survey modes is mixed-mode surveys (de Leeuw, 2005; Dillman et al., 2009). Mixed-mode approaches for probability-based surveys can help to overcome the potential weaknesses of web surveys (e.g., coverage error, sampling difficulties, low return rates) while retaining the potential benefits of web surveys (e.g., elimination of data entry steps, reduction in printing costs; Holmberg, Lorenc & Werner, 2010). There are different types of mixed-mode surveys (de Leeuw, 2005; Dillman et al., 2009).

One type of mixed-mode approach now being used for household surveys is a mail/web (and paper) approach (Messer & Dillman, 2011). In the United States, for example, this approach involves selecting a random sample from the U.S. Postal Service's Sequence File (DSF). This File contains nearly a complete listing of residential addresses (Messer, 2009). Potential respondents are contacted by mail and then asked to respond to a web survey. If the potential respondent does not have access to the Internet, they are provided with a paper questionnaire as a last resort. This approach addresses potential sampling difficulties and reduces the potential of coverage and nonresponse error. While some research suggests this type of mixed-mode approach may reduce survey costs (Holmberg et al., 2010), other studies suggest traditional mail surveys may be cheaper than this mixed-mode approach (Messer & Dillman, 2011; Lesser et al., 2011).

Another mixed-mode approach is a face-to-face/mail response or a "basic question" approach (Bethlehem, 2009). In this approach, data are obtained on a few key variables in both the contact phase (i.e., face-to-face mode) and in the response phase (i.e., mail response). A key purpose of this approach is to reduce the response burden for the initial contact phase (e.g., face-to-face interview), obtain contact information for follow-ups (e.g., mail response) and provide the capability of assessing nonresponse error. This approach has been used in

household surveys (Kersten & Bethlehem, 1984) and with flow populations such as attendees at a theatre (Roose, Lievens, & Waege, 2007) and park visitors (Dillman, Dolsen, & Machlis, 1995a). For over 20 years, park visitor surveys conducted by U.S. National Parks have used a personal delivery/mail-back response or face-to-face/mail approach and have maintained response rates of about 70% or higher (Dillman et al., 2009). The use of this approach often assumes that the contact phase provides high quality data and there is no measurement error between the two survey modes (i.e., face-to-face interview and mail response).

Little research, however, has been done on developing a mixed-mode approach using the web for park visitor surveys (Sexton et al., 2011). The extent to which park visitors use the Internet is not known and no studies have attempted to obtain email addresses from park visitors to facilitate email follow-ups (Graefe et al., 2011; Vaske, 2011). There is also little experimental research on the effect of number of email follow-ups on response rates (Kittleson, 1997), nonresponse bias (de Lueew, 2005; Graefe et al., 2011) and how nonresponse bias affects the coverage or confidence levels of the estimates (Biemer & Lyberg, 2003). While the face-to-face mode by itself is often considered the most expensive survey mode (Weinberg, 2005), in some situations like a park setting where staff are available on-site, a face-to-face/web approach may be cost effective.

1.4 Objectives and research questions

The overall goal of this study was to develop a more cost-effective way of conducting a provincial camper survey while trying to maintain data quality and comparability to a previous paper survey. To help fulfill this goal, two research objectives were established. The first objective was to explore the development of a new face-to-face/web approach for a provincial campground survey in British Columbia based on the "total survey error" paradigm that involves consideration of different sources of error and practical considerations such as costs, timeliness and ethical considerations. The aim of this objective was to develop a set of specific procedures for designing and implementing this face-to-face/web approach.

The second objective was to test this new approach through two experiments. The intent of the first experiment was to compare a face-to-face/paper approach to a face-to-face/web approach for several potential sources of survey error and costs at one campground. The intent of the second experiment was to examine the potential for coverage error and the effect of the number of follow-ups on return rates and nonresponse error on a broader geographical basis.

Through these two experiments, this study examines five research questions:

1. What percentage of park visitors do not use the Internet at home?
2. What percentage of park visitors will provide their email address to permit follow-ups?
3. What are the effects of the number of email follow-ups on return rates and the reduction of nonresponse bias for selected visitor characteristics?
4. Would the responses from the face-to-face/web mode be comparable to the face-to-face/ paper mode?
5. Which mixed-mode approach (face-to-face/web vs. face-to-face/paper) would be cheaper?

While the first question focuses on the potential for coverage error, the next two questions focus on nonresponse error and the fourth question focuses on the potential for measurement error. The last question focuses on a cost comparison between two mixed-mode approaches used in park visitor surveys.

1.5 Context of study

BC Parks, a provincial government agency, is responsible for managing one of the largest parks and protected areas system in the world. A primary goal of this

agency is the protection of conservation values of a parks and protected areas system. In 2012, this system contained 1,000 parks and protected areas covering 13.2 million hectares or nearly 14% of British Columbia's land base (BC Parks, 2012).

BC Parks is also responsible for providing opportunities for BC residents and non-residents to participate in a variety of outdoor recreation activities. It manages more than 10,700 vehicle accessible campsites, about 500 day use areas, 126 boat launching areas and over 6,000 kilometers of trails. In 2010, provincial parks received over 2.4 million overnight visits and, in total, received 19.7 million visits (BC Parks, 2012). In 2001, it was estimated that park visitors spent nearly one-half billion dollars during their visits to provincial parks which represented about 6% of total tourism revenue in the Province (Ministry of Water, Land and Air Protection, 2001).

Over the last 30 years, BC Parks has undertaken a considerable number of surveys with the general BC population and park visitors to help manage the provincial parks and protected areas system. While household surveys have focused on park users and non-park users from British Columbia, park visitor surveys have

focused on park users from British Columbia and outside of British Columbia. Since 1985, one specific park visitor survey that has been conducted annually is the provincial park camper survey. This survey focuses on obtaining information about camper characteristics (e.g., where park visitors come from, size of camping party), visitor satisfaction with several park visitor services (e.g., cleanliness of restrooms, sense of security) and visitors' views about specific park management issues (e.g., preferences for facilities and services). The results have been used for different park management purposes such as capital planning (e.g., identifying new facilities and services), policy reviews (e.g., day use parking fees), providing a Ministry of Environment performance indicator (i.e., visitor satisfaction ratings) and identifying the economic benefits of the parks and protected areas system.

Each year an attempt is made to implement this survey in about thirty campgrounds throughout the Province. This survey involves the random selection of occupied campsites each day of the operating season (usually mid-May to early September or about 100 days). A mail package containing a one-page cover letter, a paper questionnaire, a postage-paid return envelope and a golf pencil is distributed to potential respondents by park operators who live onsite or near the

park.[2] Respondents are permitted to return the paper questionnaire in either a drop-off box located in the park after their visit or in the postage-paid return envelope. No attempt is made at follow-ups. Due to budget constraints, BC Parks requested that a more cost-effective survey method be developed for this survey by using the web. In 2009, a pilot study was undertaken to help develop this approach in several campgrounds and in 2010 two experiments were conducted to test this approach. This thesis focuses primarily on the results of these experiments conducted in 2010.

1.6 Organization of thesis

Chapter 2 provides a conceptual framework and a literature review for developing a face-to-face/web approach for the BC Parks provincial camper survey. It also reviews several theories related to the implementation of a face-to-face/web approach and identifies a set of five steps for implementing this new survey mode.

Chapter 3 describes the survey design and methodology for two experiments to test this approach. This description includes the sampling procedures, the

[2]Park operators are private contractors who provide a variety of operational services in the park such as security, maintenance of the campground and the provision of environmental education programs. One specific responsibility of park operators is the implementation of the provincial park camper survey.

questionnaire design, the follow-up strategy and the data analysis plan.

Chapter 4 presents the results of the first experiment conducted at Goldstream provincial park campground located near Victoria, British Columbia. It compares a face-to-face/paper approach and a face-to-face/web approach based on five criteria: non-use Internet rates among campers; response rates; the effect of email follow-ups on return rates and nonresponse bias; data quality and comparability; and costs.

Chapter 5 extends part of the first experiment by testing the approach on a broader geographical basis -- 12 campgrounds located throughout province. It focuses on: non-use Internet rates; characteristics of non-use Internet visitors and Internet visitors; email collection rates; response rates; and the effect of the number of email follow-ups on returns rates and nonresponse bias. It also examines the issue of reducing the time required for data collection and whether the substantive results vary by each follow-up.

Chapter 6 provides a discussion and conclusion about the key findings. It further identifies directions for future research studies.

CHAPTER TWO

THEORETICAL BACKGROUND

2.1 Total survey error approach

A useful framework for considering the development of a new mixed mode methodology is the total survey error approach (Biemer, 2010; Biemer & Lyberg, 2003; Groves, 1989; Weisberg, 2005). Total survey error is the accumulation of all errors that arise in the design, collection, processing and analysis of survey data (Biemer, 2010). These errors occur because of sample frame deficiencies, the sampling process, interviewing and interviewers, questionnaire design, respondents, missing data, coding, keying, and editing processes (Biemer, 2010). Survey errors are problematic because they diminish the accuracy (bias and variance) of a survey statistic. If a survey estimator has small bias and variance, then it will be accurate. This occurs only if the influence of total survey error is small.

The total survey error approach involves consideration of the potential sources of survey errors and practical constraints such as costs, availability of time to provide the results and ethics (Weisberg, 2005). It is part of a broader concept of total survey quality that recognizes that producers and users of surveys often view

survey quality from different perspectives.[3] While producers place high priority on accuracy (reduction of bias and variance), data users often assume the accuracy of survey results and place high priority on such criteria as costs, timeliness and comparability.

The underlying assumption of the total survey error approach is that errors can occur at each step of the survey process (Weisberg, 2005).[4] The term "error" in this context does not refer to a mistake, but to the difference between an obtained value and a true value (Weisberg, 2005). The goal of the total survey error approach is not to make each step of the survey process as error-free as possible because this is likely to exceed the survey budget, but rather to try to avoid the most egregious errors and to control the other errors that are inconsequential and tolerable (Biemer, 2010).

[3]This concept considers the "fitness of use" of an estimate. Besides accuracy, Biemer (2010) identifies several other dimensions of a survey quality framework for large survey organizations. These include: credibility (trustworthiness of data by survey community), comparability (demographic, spatial and temporal comparisons are valid), usability (clear documentation), relevance (data satisfy user needs), accessibility (access to data user friendly), timeliness (results are provided according to schedule), completeness (data are provided without undue burden to respondents) and coherence (estimates from different sources can be reliably combined). These dimensions are used as a checklist for the assessment of survey quality.

[4]Weisberg (2005) identifies 11 steps of the survey process: (1) decide on research objectives; (2) determine target population; (3) choose survey mode and design; (4) choose sampling frame; (5) select sampling method; (6) write questions; (7) pretest questionnaire; (8) recruit respondents; (9) ask questions; (10) process data; and (11) analyze results.

Four major sources of errors are presented on the left side of the teeter-totter in Figure 1 (Weisberg, 2005). One source is the sampling error. It occurs because only a sample rather than the entire population is surveyed. A second source is coverage error. It occurs when there is a mismatch between the sampling frame and the target population. A third source is nonresponse error. It occurs when a considerable number of respondents do not respond to the survey and are different than respondents (Lynn, 2008). A fourth source is measurement error. It occurs when a respondent's answers are inaccurate or imprecise and can come from the survey mode, the questionnaire, the interviewer or the respondent (Salant &

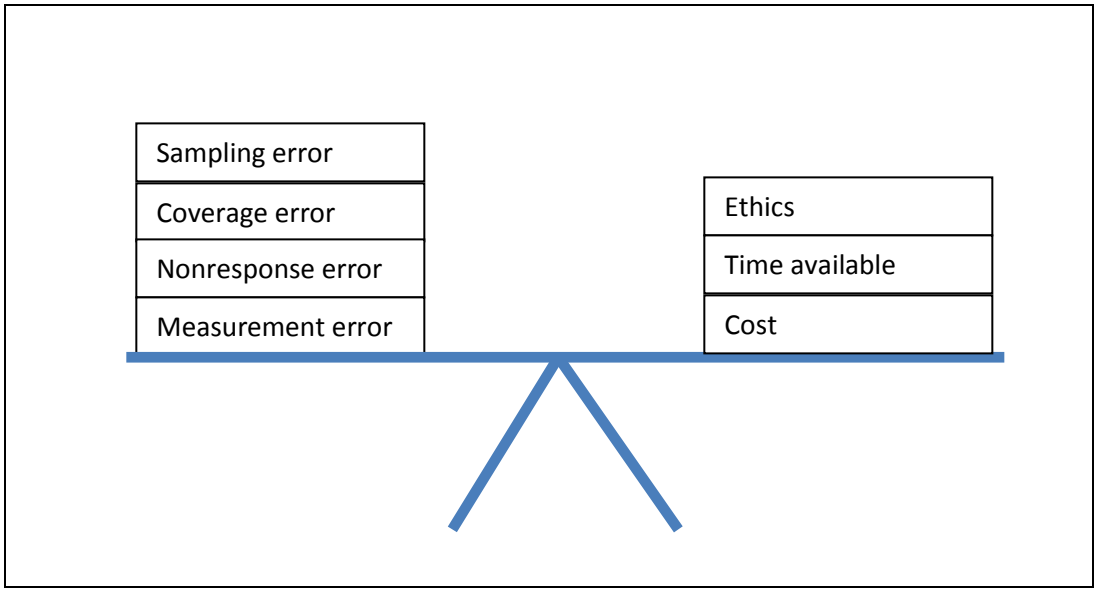

Figure 1. Types of survey errors and constraints. SOURCE: Adapted from Weisberg, pg. 2

Dillman, 1994).[5]

Some practical constraints are shown on the right side of the teeter-totter in Figure 1. One constraint is the budget or costs for the project. These costs are often affected by the selection of the survey mode. While some survey costs are fixed, others costs are variable. In face-to-face surveys, for example, variable costs are affected by the number of interviews required, the average length of the interview and travel costs. A second practical constraint is the time available for the project. If results are required quickly, one survey mode may be more appropriate than another mode. Ethics is another consideration. In the use of a web survey, for example, the use of a respondent's email address usually requires his/her permission.

In trying to balance the reduction of survey errors against practical constraints, survey researchers are often faced with trade-offs (Biemer, 2010). Increasing the sample size, for example, may increase the precision of the estimates, but it may

[5]In addition to these errors, there is specification error which occurs when there is a mismatch between the survey question and concept that is being measured (Biemer, 2010; Biemer & Lyberg, 2003; deLeeuw, Hox, & Dillman, 2008; Groves et al., 2009; Vaske, 2008; Weisberg, 2005). Another source of error is postsurvey error which focuses on data processing and data analysis. Other types of error identified by Weisberg (2005) include mode effects (the differences that occur between survey modes) and comparability effects (the differences that occur between survey result between different organizations, different nations or different points in time). These types of error, however, are sometimes viewed outside the survey process itself (Weisberg, 2005).

also take funds away from developing an effective follow-up strategy that may improve the representativeness of the sample and reduce nonresponse bias. On the other hand, too much money spent on follow-ups may limit funds required for questionnaire development and the potential reduction of measurement error. To a large extent, the allocation of budgets to reducing errors depends on the survey goals and an understanding of the potential magnitude of the errors.

The use of a total survey error approach is intended to facilitate the optimal allocation of budgets by examining several sources of errors simultaneously along with costs and other constraints. More specifically, this approach can be useful in two ways. First, it can be useful in selecting an optimal design by comparing two or more survey designs. If two survey designs, for example, produce similar levels of error and one is cheaper, the total survey error approach allows the identification of the best design. Second, it can help survey researchers to optimally allocate limited resources among potential sources of errors for a given survey design. If a major source of error is due to nonresponse, for example, resources could then be allocated to reduce the effect on nonresponse error.

While ideally it is useful to measure the variance and bias for each type of error

and the extent to which they contribute to the total mean squared error (MSE)[6], in practice this is often difficult to achieve because true measures are usually not available for all major sources of error (Biemer, 2010). The total survey error approach, however, provides a useful paradigm for thinking about the potential of survey errors and the practical constraints when considering a new mixed mode approach. This study focuses primarily on the potential of nonsampling errors - coverage, nonresponse and measurement.

2.2 Methodological considerations and unknowns

2.2.1 Coverage and coverage error

One consideration in developing a face-to-face/web approach was the potential for coverage error. The sampling frame (e.g., list of elements) should be an accurate representation of the target population (Bethlehem, 2009).[7] If a sample selected from the sampling frame differs from the target population, there is a risk of drawing the wrong conclusion from a survey (Bethlehem, 2009). Figure 2 shows

[6]Mean squared error is defined as bias squared and the variance (Biemer, 2010; Biemer & Lyberg, 2003; Deming, 1953).

[7]The target population is the population of interest. The frame population is the set of the target population that is listed and has a chance of being selected into the sample. For a park visitor survey, this may be a list of names and addresses of all camping parties. Often this information is not readily available for camper surveys before the survey is conducted. Thus, a spatial/temporal sampling scheme is often used for this type of survey (Bethlehem, 2009). In using this type of sampling scheme, it is very difficult to determine the potential for coverage error until the actual time of the survey.

two problems that can occur when the elements in the sample frame do not match the target population (Bethlehem, 2009).

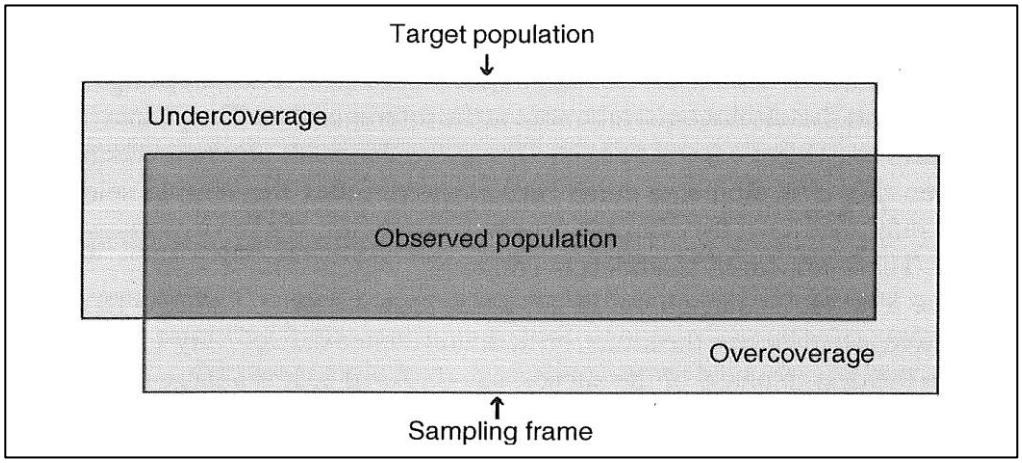

Figure 2. Target population and sampling frame. SOURCE: Bethlehem (2009), pg. 21

The first problem is undercoverage (or sometimes known as noncoverage or incomplete coverage). This occurs when the elements of the target population do not have a counterpart in the sampling frame. An example of this type of problem is the use of a telephone directory for a telephone survey of households, but the telephone directory does not contain people with unlisted numbers and people who have no phone at all.

The second problem is overcoverage. This occurs when the sampling frame contains elements that do not belong to the target population. An example of this type of problem might be that a telephone directory contains telephone numbers of shops, companies and so on that is not part of the target population.

In this study, a primary concern was undercoverage or the potential for coverage error. This type of error could occur, for example, if a large number of camping parties do not have access to the Internet and are different from camping parties who have access to the Internet. If a web mode is used as the primary data collection method, those park visitors without Internet access would have a zero probability of being included in the survey and this could lead to coverage error or bias.

Mathematically, coverage error is defined as (Groves et al., 2009):

$$\bar{Y}_C - \bar{Y} = \frac{U}{N}(\bar{Y}_C - \bar{Y}_U) \quad (1)$$

where,

$\bar{Y}$ = Mean of the entire target population

$\bar{Y}_C$ = Mean of the population on the sampling frame

$\bar{Y}_U$ = Mean of the target population not on the sampling frame

N = Total number of members of the target population

C = Total number of eligible members of the sampling frame (covered elements)

U = Total number of eligible members not on the sampling frame (not covered elements)

While equation 1 does not include the symbol "C", it conveys the notion that N includes both covered elements (C) and not covered elements (U) and it defines the subscript for the mean of the covered population. In statistical terms, the left side of this equation, $\bar{Y}_C - \bar{Y}$, shows that coverage error for the mean is the difference between mean of the covered population and the full target population. The right side of equation 1 indicates that coverage error is the product of two terms: the proportion of the target population not covered in the sampling frame or the noncoverage rate (U/N) and the difference between the mean for those on the sampling frame and the mean for those not on the sampling frame.

While this type of error occurs *before* the sample is drawn (Groves et al., 2009), in this particular study the potential for this error could not be determined until the survey was implemented.[8] No prior list of names, postal addresses or email addresses was available. BC Parks also has no data to indicate Internet coverage

[8]This is analogous to having an out of date listing of households.

levels among campers at the park level. While BC Parks uses a campground reservation system called "Discover Camping" that permits people to make an advance reservation for some campgrounds either online or by phone, this system is used primarily for financial purposes. It does not contain any information about Internet use from first-come/first serve campers (i.e., campers who did not make a reservation) nor does it contain any questions about whether telephone users have an email address.

At the same time, some general population surveys provide an indication of Internet coverage at the household level. A key visitor group of provincial park campgrounds comes from British Columbia. It is estimated that Internet use at home by BC residents has grown from about 63% in 2001 (Dyck & Selbee, 2001) to about 84% in 2010 (BC Stats, 2012). Another key visitor group comes from Washington. In 2007, it was estimated that about 72% of Washington residents had access to the Internet (Messer, 2009). Various studies have also shown that non-Internet users in Canada and the United States tend to live in rural areas, are older, have less formal education and have lower annual incomes (McKeown et al., 2007; Israel, 2009; 2010). While these statistics about Internet access and use at the household level can be useful for planning general population surveys, it would be difficult to use these household statistics on Internet coverage to

estimate coverage levels at individual park campgrounds throughout the Province. Proportions of park visitors with and without Internet access for different geographical groups (e.g., from British Columbia and from outside of British Columbia), for example, are likely to vary by campground.[9]

In considering the use of a web only mode for the BC provincial park campground survey, an important question arises: how many BC provincial park campground visitors are not likely to use the Internet? [10] On the one hand, many BC provincial park campgrounds are located in rural areas. If these campgrounds attract a large number of users from the surrounding rural communities who do not have access to the Internet, they would not be able to complete a web survey. On the other hand, some research suggests that the percent of park visitors who

[9]A possible exception might be a situation where the use of a park requires an advanced reservation for all visitors (i.e., no first come/first serve basis). The use of the Bowron Lakes Canoe Circuit in British Columbia, for example, requires prior registration before the actual visit. The registration form requests information about the size of the party. If the registration form included a question about whether or not the park visitors use the Internet, it is likely that the coverage error for average party size could be determined.

[10]Household surveys which contain questions about the Internet usually focus on both Internet access and use (BC Stats, 2012; Couper, Kapteyn, Schonlau, & Winter, 2007; Messer, 2009; Werner, 2005). While the amount of Internet use is defined in different ways, having Internet access and using the Internet is not equivalent. Werner (2005) suggests that Internet use is viewed as being the more relevant criterion because you need to have some experience in using it before answering a web questionnaire. A household, for example, may have Internet access, but a respondent selected from a household may not use the Internet. In this particularly study, where there were only a few limited questions available for the face-to-face interview, only one question about the Internet was used. It was thought that it would be more appropriate to have a question about Internet use than about Internet access because the latter might lead to substitution in who completes the web survey and contribute to the bias of demographic characteristics of the respondent (e.g., age of respondent). More details are provided in the next chapter.

use BC provincial parks decreases as people get older (Dyck & Selbee, 2002).[11] If a particular campground (e.g., Rathtrevor located at Parksville, British Columbia), for example, attracts younger visitors, it is more likely they would use the Internet and be able to complete a web survey. If a another particular campground (e.g., Charlie Lake located near Fort St. John in Northern British Columbia) attracts older visitors, then it is more likely they would not use the Internet and the use of web response would prevent them from completing the survey.

In reviewing the parks and recreation literature, no other studies were found that indicate Internet coverage levels by park visitors. It was not known, therefore, how many campers using BC Provincial Park campgrounds would be excluded from completing a web response and whether the proportions of campers not using the Internet would vary by campground in different regions of British Columbia. At the same time, if the proportion of campers that do not use the Internet is quite low (e.g., 2% to 4 %), then the potential for coverage error may be low (Biemer & Lyberg, 2003).

[11]It has been estimated that the percentage of BC residents in different age groups using BC provincial parks in 2001 was: 69% for those 18 – 34 years, 62% for 35- 49 years, 53% for 50-64 years, 38% for 65-79 years, and 21% for 80 years and older (Dyck & Selbee, 2002, pg. 15).

2.2.2 Response and nonresponse error

A second consideration was the potential for nonresponse error. This type of error occurs when a statistic obtained from respondents differs from a statistic obtained from an entire sample. There are two types of nonresponse error: unit nonresponse and item nonresponse. Unit nonresponse occurs when there is a failure to obtain any information from the selected person or element. In web surveys, for example, this type of nonresponse can occur when the selected person cannot be contacted (e.g., an email address is incorrect or blocked by spam filters), refuses to respond to the survey for a variety of reasons (e.g., lack of interest, no time, postponing or forgetting to respond) and is not able to respond (e.g., lack of adequate computer skills; Bethlehem & Biffignandi, 2012). While unit nonresponse relies on a decision about a brief description of the survey, item nonresponse occurs after the respondent has decided to respond to the survey (Groves et al., 2009).

Item nonresponse occurs when there is failure to obtain information for a particular question or item. In web surveys, this may be due to an unwillingness to answer a sensitive question (e.g., annual income), inadequate comprehension of the question and not knowing the answer to the question and layout of the questionnaire (Bethlehem & Biffignandi, 2012; Dillman et al., 2009; Groves et al., 2009). Both types of nonresponse can lead to nonresponse bias.

In this study, three measures of nonresponse are examined. One measure is the response rate. It is often used as an indicator of the potential for nonresponse error (Bethlehem & Biffignandi, 2012; Dillman, 1991). In simple terms, the response rate is the percentage of eligible sampled cases that responded to the questionnaire. In practice, 100% response rates are rarely ever obtained with human populations. While response rates can vary from survey to survey, they are typically highest for face-to-face surveys, followed by telephone surveys and mail surveys (Hochstim, 1967; Dillman et al., 2009). In her review of the literature, de Leeuw (1991) found that the mean response rate was 75% for face-to-face interviews, 71% for telephone surveys and 68% for mail surveys. More recent reviews, however, suggest that response rates for telephone surveys in Canada (Baldon, 2010) and the United States (Curtin, Presser & Singer, 2005) have fallen considerably. By contrast, response rates in mail surveys have declined only slightly or been maintained (Connelly, Brown, & Decker, 2003; Dillman et al., 2009).

The use of web surveys is a relatively new survey mode (Couper, 2000). Response rates in web surveys vary widely, ranging from 10% to 95% (Lesser et al., 2011). On average, they have been found to be approximately 11% lower than other modes (Manfreda et al., 2008). In a study of South Dakota turkey hunters, return rates were considerably higher for the mail mode (75%) than for the web

mode (44%; Gigliotti, 2011).Using an experimental design in a survey of hunters' opinions and experiences in Oregon, the response rate for the mail mode (56%) was about 11 percentage points higher than for mail/web mode (45%; Lesser et al., 2011). The reasons for lower response rates in web surveys are not well understood, but two factors that seem to contribute to lower response rates in web surveys are security concerns and a lack of computer literacy among some respondents (Millar, O'Neill, & Dillman, 2009).

Considerable research has focused on different techniques to improve response rates in paper surveys (Connelly et al., 2003; Fan & Yan, 2010; Heberlien & Baumgartner, 1978). Two techniques for improving response rates have been particularly effective. One technique is the use of monetary or cash prepaid incentives (James & Bolstein, 1990; 1992; Topel, 2012). The use of this technique (or sending cash with a survey request), however, is difficult to use in web surveys (Couper, 2008). While electronic gift certificates, cards or other incentives may be provided through Pay Pal, they may not be viewed as money in hand, inconvenient to redeem and less than their actual value when redeemed because of a transaction cost (Topel, 2012). In one experiment, potential respondents were randomly assigned to one of three groups: (a) a $5 cash incentive with a survey invitation through mail; (b) a $5 Amazon.com gift certificate through a postal invitation; and (c) a $5 Amazon.com gift certificate

through email (Birnholz et al., 2003). The response rates were respectively 57%, 40% and 32%. These results suggest that cash-in-hand is more effective than sending electronic gift certificates.

Due to the difficulty of sending cash electronically, a prize drawing or lottery is often proposed as a postpaid or conditional incentive. A number of studies, however, have shown that these types of incentives are not effective in raising response rates significantly in web surveys (Brennan, Rae, & Parackal, 1999; Cobanoglu & Cobanoglu, 2003; Porter & Whitcomb, 2003). At the same time, one study suggests that the use of interviewers may overrule the effect of prepaid incentives (Ryu, Couper, & Marans, 2005). The authors of this latter study found no differences between monetary (cash) and nonmonetary (regional park pass) on response rates in face-to-face interviews. They further suggest that the persuasive abilities of interviewers can raise the salience of the survey and this would overshadow any effect of a cash incentive (Toepel, 2012).

In the present study, a prepaid cash incentive was not used for several reasons. First, the overall intent of developing this new mixed-mode approach was to try to reduce costs. Providing a pre-paid incentive would increase the overall cost of the survey. Second, a post incentive (i.e., a draw to win one of five prizes of two free nights of camping in any provincial park campground in 2011) was viewed as

being easier to implement administratively than providing a financial pre-incentive (i.e., providing a “loonie” or a one dollar Canadian coin; or a “toonie” or a two dollar Canadian coin). While it was recognized that this post incentive may have less appeal for non-BC residents (e.g., a family from Germany may be less likely to use provincial park campgrounds in 2011) than for BC residents, a key objective of this study was to first test the effect of follow-ups before testing the effect of incentives.

A second technique that has been shown to be one of the most effective ways to improve response rates in paper surveys is the use of varied and multiple follow-ups (Dillman et al., 2009; Dillman, Clark, & Sinclair, 1995b; Heberlien & Baumgartner, 1978; Hochstim & Athanasopoulos, 1970). The technique also seems to be an effective way to improve response rates in web surveys (Cook, Heath, & Thompson, 2001; Dillman et al., 2009). In one study of college undergraduates, for example, a four contact strategy increased the response rate 37 percentage points (i.e., 64% response rate) over an initial contact with no follow-ups (i.e., 27% response rate; Wygant, Call, & Olsen, 2006).

Little experimental research, however, has been given to determining the optimal number of follow-ups in web surveys (Couper 2008; Dillman et al., 2009). In an email survey of health educators, respondents were randomly assigned by the

number of follow-ups (Kittleson, 1997). The response rate was 28% with no follow-ups, 52% with one follow-up, 57% with two follow-ups, and 54% with four follow-ups. While no follow-ups were conducted with three follow-ups in this study, the response rate nearly doubled from no follow-up to two follow-ups and then leveled off. This study suggests there may be diminishing returns after two follow-ups. While the use of email follow-ups is easier, faster and less expensive to do in web surveys than in paper surveys, this fact may lead to overuse of similar types of email reminders which may not be effective. The overuse of email follow-ups may potentially annoy and irritate respondents (Couper, 2008; Dillman et al., 2009). This annoyance, in turn, may lead to reactance by respondents and reduce data quality (i.e., reaction by an individual to regain freedom from pressure to comply to a request by putting little effort into answering the question either through leaving the question blank or answering with low motivation; Olson, 2013).

A second measure used in this study is nonresponse error or bias. Recent studies on nonresponse error have shown that response rates alone may not be a good predictor of nonresponse error (Groves, 2006; Groves & Peytcheva, 2008.). The U.S. Office of Management and Budget now requires all surveys with a response rate of 80% or less to undertake an evaluation of nonresponse bias to determine

which estimates have been affected by nonresponse bias (Guideline 1.3.4, Office of Management and Budget, 2006).

Mathematically, nonresponse error is defined as (Lynn, 2008):

$$\bar{y}_r - \bar{y}_n = \frac{nr}{n}(\bar{y}_r - \bar{y}_{nr}) \quad (2)$$

where,

$\bar{y}_r$ = Mean of y for respondents in a specific sample
$\bar{y}_{nr}$ = Mean of y for nonrespondents (not observed) in a specific sample
$\bar{y}_n$ = Mean of y for respondents and nonrespondents in a specific sample
r = Total number of respondents in a specific sample
nr = Total number of nonrespondents in a specific sample
n = Total number of respondents and nonrespondents in a specific sample

While equation 2 looks similar to equation 1, equation 2 deals with a sample rather than the coverage of the target population before a sample is drawn.[12] A closer look at the right side of equation 2 indicates why response rates may not be an adequate indicator of nonresponse error. It is a product of two terms: the nonresponse rate (the complement of the response rate) *and* the difference between respondents and nonrespondents. Even if the nonresponse rate is low, it is possible to have some nonresponse bias if nonrespondents are very different

[12]Different equations are used to measure nonresponse error. Equation two is often referred to as a fixed response model or deterministic view of nonresponse. It assumes that the population breaks down into two strata: a response stratum and a nonresponse stratum in which respondents will respond and not respond with certainty. The use of this model can provide insight about which estimators will be biased (Bethlehem, 2009).

from respondents on a given variable. At the same time, if the nonresponse rate is high, it is possible to have low nonresponse bias on a given variable if the difference between respondents and nonrespondents is low (i.e., the two groups are homogeneous). While the nonresponse rate is a property of the survey, nonresponse bias is a property of the statistic (Wagner, 2012).

In practice, determining nonresponse error is often not done unless it is part of the original survey design (Lynn, 2008). To evaluate nonresponse error requires information about respondents and nonrespondents (Messer, 2009). Various approaches are used to obtain information about nonrespondents such as the use of administrative records, census data, a survey of nonrespondents and the "basic question" approach (Becker & Ilff, 1983; Bethlehem, 2009; Lynn, 2008). Each of these approaches has limitations. In the use of administrative records and census, comparisons are often limited to several demographic variables rather than the variable of interest in the study (Dillman, 1991). The question for the census and the survey may also be conducted at different times and be based on slightly different questions (Lynn, 2008). A survey of nonrespondents, which typically does not have a 100% response rate, may further have nonresponse attached to it. While the basic question approach may obtain high response rates, it is usually limited to a few variables.

Several studies have examined the effect of callbacks in face-to-face surveys and follow-ups in mail surveys on nonresponse error. Using a difference equation, Dunkleberg and Day (1983) examined the effect of callbacks in face-to-face interviews for several demographic variables for the Survey of Consumer Finances. They found that sample values converge with increasing number of callbacks and that about 95% of the initial nonresponse error is eliminated after three callbacks. The use of a difference equation, however, was based on the assumption that the response rate increased in a linear way which may not always occur (Biemer & Lyberg, 2003). Using a regression approach of cumulative responses in a mail survey, Filion (1976) also found that the use of follow-ups in a mail survey reduced estimates of hunting success (i.e., waterfowl killed per day would have been overestimated by about 14% without follow-ups).

In the parks and tourism literature, there has been considerable controversy about the use of follow-ups to reduce nonresponse error (Crompton & Tian-Cole, 2001). On the one hand, some studies have suggested that extensive follow-ups are required to reduce the potential of nonresponse error (Brown & Wilkins, 1978; Hunt & Dalton, 1983). In a study of licensed anglers in New York, Brown and Wilkins (1978) used a "special delivery" follow-up and suggested that without the follow-up the average number of fishing days could be 53% too high. In a coupon conversion study, Hunt and Dalton (1983) estimated that ski expenditures during

the 1980-81 ski season in Utah would have been 51% too high without a second follow-up.[13] In another study of four U.S. National Park visitors that used a personal delivery/mail-back approach, respondents and nonrespondents were compared for average age and average group size (Dolsen & Machlis, 1991). While no statistical differences were found for average group size between respondents and nonrespondents in four National Parks, statistical differences in average age were found between respondents and nonrespondents in two of the four parks. The average age of respondents in these two parks tended to be slightly older than nonrespondents.

On the other hand, other studies have shown that in some recreation settings where recreation activities occur in the same place and at the same time respondents and nonrespondents are quite homogeneous and may not require extensive follow-ups (Becker & Ilff, 1983; Becker, Dottavio & Mengak, 1987; Hammit & MacDonald, 1982; Wellman, Hawk, Roggenbuck, & Buyhoff, 1980). In one of these studies about recreational boaters on the Mississippi River, for example, no significant differences were found between respondents and nonrespondents for 28 of 31 variables (Becker & Ilff, 1983). A significant difference, however, did occur between respondents and nonrespondents for place

[13]Coupon conversion studies are used by travel advertisers to estimate the effectiveness of a particular promotional campaign. Travel advertisement and coupons are placed in various media. Following a travel season, a sample of coupon respondents is surveyed and the results are used to estimate visitor expenditures and other characteristics for the promotional campaign.

of residence. This is important because this variable is often used in economic impact studies of parks and protected area systems.

In an attempt to address this controversy, Crompton and Tian-Cole (2001) examined 13 different data sets from mail surveys with park and tourism populations to determine whether the effect of follow-ups on nonresponse error was due to the type of population or to a specific type of variable. They concluded that key differences often occurred because of the type of variable (e.g., potential underrepresentation from Mexican Americans and younger age groups) and that researchers should carefully consider whether there is a link between the variable of interest and the potential of nonresponse error in their decision about the number of follow-ups to use in a survey.

In considering the number of email follow-ups for a face-to-face/web response for the BC Parks camper survey, there were several unknowns. First, it was not known how many campers (or the proportion of campers) would be willing to provide their email address to permit follow-ups. No previous studies were found that attempted to obtain email addresses in park visitor surveys.

Second, the effect of each email follow-up on the return rate for that follow-up was not known. While it was expected that as the number of email follow-ups

increased the overall return rate would increase, it was difficult to anticipate the effect that each follow-up would have on the return rate for that follow-up.

Third, it was not known how increasing the number of follow-ups would affect the nonresponse error for several visitor characteristics. For location of residence, it was expected that increasing the number of follow-ups would reduce nonresponse error by bringing in greater representation of non-BC residents into the sample. For example, some visitors from Europe may be less motivated to complete the survey after their trip because they would be less likely to return to BC in 2011 for a camping holiday in a provincial park campground and may find the post-incentive (i.e., winning a 2 free nights of camping in 2011) less appealing than to BC residents.[14] By sending them an email follow-up, it could provide them with a reminder about the salience of the survey, their promise to complete the survey (e.g., some people may have loss the postcard) and an easy way to respond to the survey (i.e., clicking on the link of the survey and entering the access code on the email follow-up).

For average group size, it was expected that increasing the number of follow-ups

[14] One factor that may affect a decision to visit a provincial park campground in the following year is the cost of the trip. For example, the cost of four people from Germany camping at Goldstream provincial park campground may be considerably higher than a family of four from Victoria, British Columbia. Because those from Victoria may be more likely to use the park again, they may have a greater vested interest (i.e., high salience) on providing their views about the quality of services in the campground and preferences for future services and facilities.

would have little or no effect on the nonresponse error because this information is usually obtained for security purposes and recorded on camping fee receipts (i.e., McBee permits).[15] For this visitor characteristic, it was expected that nonresponse error would be low and similar for all follow-ups. For the average age and gender of respondent and the average number of nights spent in any BC provincial park campground in the previous year, it was difficult to anticipate how increasing the number of email follow-ups might reduce nonresponse error for these variables.

A third measure of nonresponse used in this study is item nonresponse. This type of error occurs when data are missing for individual questions. In self-administered surveys, item nonresponse tends to be higher than in interviewer assisted survey modes like face-to-face and telephone because there is less social pressure to answer all the questions (Messer, 2009). In comparing mail to web modes in a survey of school principals, Manfreda and Vehovar (2002) found more item nonresponse for the web mode than for the paper mode. Bates (2001) also obtained similar findings in a survey of U.S. Census Bureau employees. In more recent studies, few differences have been found in overall item nonresponse between paper and web modes (Dillman, 2012; Lesser, Yang & Newton, 2012).

[15]A McBee permit is a small receipt usually clipped to the campsite post. This post is located at the entrance to the campsite and indicates the campsite number. The permit usually indicates the partys' last name, the party size, date entered and date leaving, and the amount paid for all nights. Usually, the date the party is leaving is marked with a dark felt pen across the receipt so it is easy to determine if someone has paid and the day the party is leaving.

Given these mixed results, a better understanding is required to determine if item nonresponse will occur between the two mixed- mode approaches (i.e., face-to-face/paper vs. face-to-face/web). A factor which can help to reduce item nonresponse between these two modes is a unimode construction of the paper and web questionnaires (Dillman et al., 2009). It was expected that item nonresponse between the face-to-face/paper and face-to-face/web modes would be similar if the two questionnaires could be made to look almost identical.

2.2.3 Measurement and measurement error

A third consideration was the potential for measurement error. This type of error occurs when the answers to questions are not accurate or imprecise (Salant & Dillman, 1994). Two factors that can affect this type of error are the design of the questionnaire (e.g., the wording of questions; question sequence) and the selection of the survey mode. Over the last 20 years, the BC Parks camper questionnaire has usually contained three parts: one part on visitor satisfaction with several park services; a second part on visitor characteristics (e.g., location of residence; average length of stay, average party size); and the third part on a particular management issue that the agency is facing (e.g., views about new fees, preferences for facilities and services). For the first two parts of the questionnaire, BC Parks has attempted to keep the question wording and the question sequence the same. BC Parks has also used the same survey mode (i.e., a paper survey).

Because the question wording, survey mode and sampling design has been kept similar, BC Parks has been able to compare the results from year to year and to establish trend information. Changes in visitor satisfaction ratings, for example, are likely due to either changes in service delivery or in visitor characteristics and are not due to a mode change (i.e., no mode effect).

In switching from a paper mode to a web mode for the BC Parks camper survey, there were two particular concerns. One concern related to the use of scale points in visitor satisfaction ratings and the comparability of these ratings between the two modes.[16] A problem that can occur with rating questions is nondifferentiation. It refers to the respondent's limited use of response alternatives on rating scales (Heerwegh & Loosveldt, 2008) and it affects the variability across items within people (Olson, 2013). This type of problem can occur when a respondent is asked to use the same scale in a list question and may not give careful thought to answering each item (Bethlehem & Biffignandi, 2012; Yan, 2008). Nondifferentiation is a form of satisficing behaviour (i.e., taking shortcuts in

[16]After implementing the pilot study in 2009, the satisfaction ratings between 2008 (only a paper survey) and 2009 (only a web survey) were compared and some ratings of services were significantly lower in the web survey. Even though the sampling period was shorter in 2009, it was difficult to explain the drop in visitor ratings to senior park administrators because it was not known if the change in ratings were due to a change in survey mode, a change in the quality of services provided to park visitors by park operators or a change in visitor characteristics.

answering the questions; Krosnick, 1991).[17] While changing the response option for each question can potentially increase the cognitive burden for respondents, straightlining can occur if respondents select the same answer or column for all items of the question. In one study between face-to-face interviews and a web survey, respondents to the web survey used fewer scale values and tended to select the middle option more (Heerwegh & Loosveldt, 2008). While it was expected there would be little difference between the two modes because they were both self-administered modes, it was important to determine if the satisfaction ratings would be different between the face-to-face/paper and face-to-face/web modes.

A second concern was the comparability of the answers between the paper and web modes for other questions (e.g., visitor characteristics, preferences for services and facilities). Studies comparing results between mail and paper modes have shown mixed results. On the one hand, some studies have shown considerable differences between paper and web modes. In a study of panel members in a Gallup World Affairs Survey, Rookey, Hanway and Dillman (2008)

[17]The process of answering questions usually involves four cognitive steps: (1) understanding the intent of the question; (2) searching memory for information; (3) integrating information into a summary judgment; (4) and translating the judgment onto response alternatives (Tourangeau, Rips, & Rasinski, 2000). Weak satisficing behavior often involves implementing steps 2 and 3 in an incomplete manner. For example, in a paper survey respondents may engage in this type of behavior by selecting the response options early in a list (i.e., primacy effect) while in telephone surveys they may select the last option they hear (i.e., recency effect). Strong satisficing involves missing steps 2 and 3 altogether. Nondifferentiation is one type of strong satisficing behavior.

found that about one third of a 92 item questionnaire were different between a mail and web mode. In a study of turkey hunters, Gigliotti (2011) found differences in responses of about 25% of 30 variables. In this later study, however, no significant differences were found on key survey variables and differences that did occur had no effect on key management decisions (Gigliotti, 2011). In another survey of leisure travel retailers, differences in results were found in about 15% of the items (Cole, 2005). On the other hand, some studies have found only a few differences between these modes. In a household survey about recreation participation, conservation attitudes and funding priorities, responses to questions in a mail versus mail/web response were quite similar (Graefe et al., 2011). In a study of hunters, few differences in the responses were found between mail/web return and paper returns (Lesser et al., 2011). Given that some researchers have found considerable differences and others only a few differences in the responses to the questions between the paper and web modes, it was not known if the responses between the face-to-face/paper and face-to-face/web modes would be similar.

Taken together, the potential for these nonsampling errors could lead to bias and reduce the precision of the estimates (Biemer & Lyberg, 2003). As an illustration, Figure 3 indicates the correct sampling distribution on the left and the sampling distribution distorted by variable and systematic (or patterned) nonsampling errors

on the right. The difference between these two distributions is the bias. While bias is frequently not measured and difficult to detect and correct (Biemer & Lyberg, 2003), it has been shown that bias can reduce coverage or the confidence level of the estimates (Bethlehem, 2009). For example, a nominal 95% confidence interval for a mean statistic may actually have a coverage or confidence level of 80% as a result of distortions in the sampling distributions due to nonsampling errors.

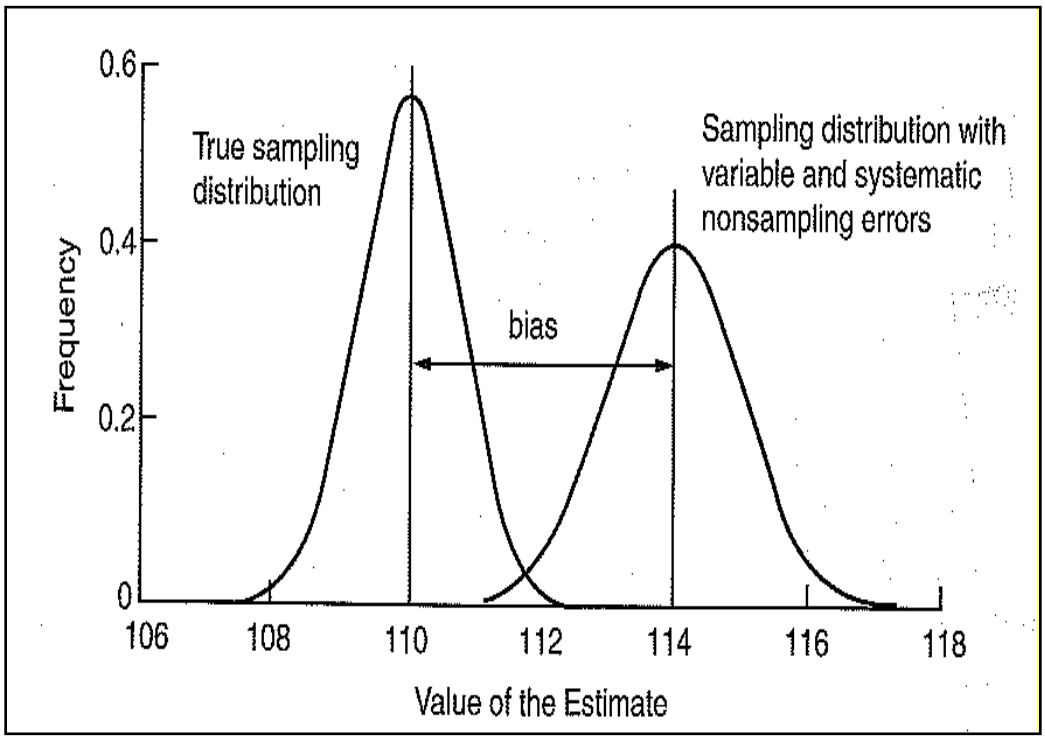

Figure 3. The effect of bias on sampling distributions due to nonsampling errors SOURCE: Biemer and Lyberg, 2003, pg. 336.

2.3 Mixed-mode approaches for park visitor surveys

2.3.1 Personalized delivery/mail-back response

One mixed-mode approach that has been used to improve response rates and to assess the potential for nonresponse error in U.S. National Park visitor surveys is a personalized delivery/mail-back response (Dillman et al., 1995a; Dillman et al., 2009) or a face-to-face/paper approach. While a prior list of visitors' names and addresses are not available, this approach involves selecting a systematic sample of park visitors by a uniformed park attendant after they have entered the park and paid their fee. For those vehicles pulled aside, an attempt is made to undertake a short interview (about two minutes)[18] using a few selected questions that are used to check for the potential of nonresponse error. Near the end of the interview the name and address of the respondent is obtained and a longer paper questionnaire is distributed to a selected respondent in the vehicle. The contact information is used to send a thank you postcard from the Park Superintendent to all respondents after the trip and to undertake follow-ups with non-respondents. Using this approach, an average response rate of 75% was obtained from 1988 to 2007 (Dillman et al., 2009).[19]

[18]Based on personal communication with Margaret Littlejohn, Director of Visitor Services Project for U.S. National Parks on May 27, 2009.

[19]A similar two-step process has been used with other recreation populations like inner tube floaters (Hammitt & MacDonald, 1982); boaters (Becker & Iliff, 1983); Visitor Center users and trail users (Becker et al.,1987).

In developing this mixed-mode approach, several theoretical perspectives were used (Dillman et al., 1995a; Dillman et al., 2009). One perspective was the use of the authority principle. This principle suggests that compliance to a request may be more likely if it comes from a legitimate authority (Biemer & Lyberg, 2003). In this approach, the authority principle involves the use of a uniformed park attendant (or official volunteer uniform) to pull park visitors to the side of the road.

A second perspective was the use of social exchange interaction where an attempt is made to increase potential benefits and reduce potential costs of obtaining a completed questionnaire (Dillman et al., 1995a). The personal interaction that occurs during the interview provides the opportunity to emphasize the value and importance of the survey. The few minutes of the interview is also intended to make the personal interaction more memorable than the few seconds taken to hand someone a paper questionnaire.

A third perspective was the foot-in-the-door principle which suggests that respondents are more likely to comply with a large request if they are willing to agree to a small request (Freedman & Fraser, 1966; Reingen & Kernan, 1977). In this context, if respondents are willing to undertake a short interview, they may be more likely to complete a longer paper questionnaire after their trip.

A fourth perspective was the use of a multiple follow-up procedure with nonrespondents to help improve response rates (Heberlein & Baumgarter, 1978). Obtaining the name and address of potential respondents was left to the end of the interview because it was viewed as being the most sensitive question. This follow-up procedure involved sending a postcard with a picture of the park on one side and a thank you note from the Park Superintendent on the other side to all respondents and then sending two mail packages to nonrespondents that included a letter from the Park Superintendent on U.S. National Park letterhead and a questionnaire. Leverage-salience theory, a recent theory about survey participation, also suggests that the use of follow-ups can be used to emphasize the salience of the study (Groves, Singer, & Corning, 2000).

Little attention in the survey methodological literature, however, has been given to understanding the effect of the number of follow-ups on the response pattern (i.e., diminishing number of returns after the initial follow-up). A concept which may explain this effect is habituation. It is a decrease in response to a stimulus after repeated presentations (Bouton, 2007). In terms of the number of follow-ups, this concept suggests that the first time a request is made there may be a high response because it commands attention and is novel. With repeated stimulation

or follow-ups, there may be decreased decrements in responding because it is no longer novel. In essence, respondents adapt to repeated requests and tune out. [20]

2.3.2 Face-to-face/mail or web response

Prior to testing a face-to-face/web approach for the BC Parks camper survey, no other studies were found using this approach. A recent study in 52 U.S. National Wildlife refuges (Sexton et al., 2011), however, has attempted to use a face-to-face initial contact and then a mail survey asking respondents to respond either by mail or through the web (i.e., concurrent design).[21] The initial contact included a small incentive (e.g., a small magnet, temporary tattoo), an attempt to obtain their name and mailing address and asked whether potential respondents would prefer to complete a web or a paper survey. After the initial contact, all those who agreed to complete the survey were contacted by mail. A five step contact strategy was

[20]Based on personal communication with Dr. Dennis Dyck from Washington State University on August 2, 2012. The effect of decreasing returns with each follow-up may be analogous to the effect of a bouncing ball when dropped from a building. The height of the ball after each bounce decreases. The effect of a bouncing ball has been modeled using a geometric sequence equation (Alexander & Kelly, 1999). While the intent of this study was not to develop a mathematical model of follow-ups, developing such an equation may be useful to survey researchers in the planning of future surveys.

[21]A concurrent mixed mode design permits respondents to respond using different modes at the same time (e.g., permit respondents to respond either by mail or online; Bethlehem & Biffignandi, 2012). A sequential mixed mode design involves contacting all potential respondents using one mode and then asking them to respond in sequential order using another mode and possibly a third mode as a last resort (e.g., initially mail contact phase, then web response and finally as a last resort a mail response). The use of a sequential mixed approach has been shown to be consistently more effective at increasing response rates (Messer, 2009). A possible explanation for why the concurrent mixed-mode design may be less effective than a sequential mixed-mode approach is that if people are presented with too many choices or too much information all at the same time, they are less likely to make a decision to participate in a survey (Messer, 2009; Schwartz, 2004).

used: (a) initial postcard; (b) first survey packet; (c) reminder postcard; (d) second survey packet; and (e) and a nonresponse survey. Each mailing included a link and unique password to the survey. About 6,800 of 8,000 (about 85%) who were contacted received mailings. Of those who received a mailing, about 72% completed the survey (i.e., about a 61% response rate based on all initial contacts). About half of the completed returns came from paper returns and half came from web responses. While the authors of this study indicate that the use of web response resulted in a 36% cost savings in fixed costs for printing, mailing and data entry, this approach is still likely to involve considerable costs for original mailings and mail follow-ups. No attempt was made in this study to obtain email addresses for email follow-ups.

2.3.3 Overview of proposed face-to-face/web approach

This study extends the methodology of these two previous mixed-mode approaches for park visitor surveys. The proposed face-to-face web/approach involved a five step process: (a) selecting a random sample of occupied campsites; (b) undertaking a short interview; (c) obtaining an email address at the end of the interview to permit email follow-ups; (d) distributing a postcard at the end of interview which contained the website and an individual access code; and (e) undertaking email follow-ups with nonrespondents.

This approach differed from previous mixed-mode approaches in several ways. First, the sampling approach was based on a random sample of occupied campsites rather than pulling a sample of vehicles to the side of the road for an interview[22] or intercepting visitors to National Wildlife Refuges on random days. This sampling approach, like the approach used by U.S. National Park visitor surveys, helps to overcome sampling difficulties when there is no prior sampling frame.

Second, a slightly longer interview (six to eight questions) was undertaken in the face-to-face/web approach than the personalized delivery/mail response (5 questions excluding the contact information). This was done to help build rapport with potential respondents prior to asking for their email address. Obtaining an email address was viewed as the most sensitive question during the interview and similar to the personalized delivery/mail approach it was not asked until the end of the interview.

Third, the postcard containing the web site and access code was given out at the end of the interview rather than mailing out a thank you postcard after the trip.

[22] In many U.S. and Canadian National Parks, gatehouse buildings are located at the entrance to the park along major highways. While the spatial configuration of these gatehouses may make it easier to pull vehicles aside, many provincial park campgrounds in British Columbia do not have gatehouses. At these campgrounds without gatehouses, fees are usually collected at campsites. Thus, BC Parks sampling design focuses on selecting a random sample of occupied campsites.

Providing potential respondents with a beautiful postcard after the initial interview was viewed as a small token of appreciation and provided a way of identifying the purpose of the survey, how to access the web survey, contact information and a reminder about being entered into a draw to win two free nights of camping in 2011 if the web questionnaire is completed.

Finally, follow-ups with nonrespondents were done using email addresses rather than mail addresses. This is a key difference between previous mixed-mode approaches and the proposed face-to-face/web mode and is based on the assumption that there is high Internet coverage among park visitors. More details about this approach are provided in the next chapter.

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CHAPTER THREE

METHODS

3.1 Survey design and methodology

3.1.1 Experiment one

The intent of the first experiment was to compare the face-to-face/paper and face-to-face/web approaches based on five criteria: (a) non-use Internet rates; (b) response rates; (c) the effect of follow-ups on return rates and nonresponse bias; (d) data quality and comparability; and (e) costs. The first criterion focused on the potential for coverage error, the next two criteria on nonresponse error, the fourth criterion on the potential of measurement error, and the fifth criterion on costs.

The first experiment was conducted at Goldstream Provincial Park campground. It is located about 25 kilometres (or 15 miles) north of Victoria, the capital of British Columbia. This campground was selected because previous surveys at this campground indicated that a considerable percentage of campers were non-BC residents.[23] It was thought, therefore, that this campground would provide an adequate test of whether a web survey would draw non-BC residents into the sample. This campground was also located near the BC Parks Victoria office

[23]Two previous camper surveys at Goldstream provincial park campground were conducted in 2001 (n=135) and in 2005 (n=77). Both surveys indicated that the percentage of non-BC residents was about 56%. The results from these surveys are available from BC Parks.

where the author was responsible for guiding the second experiment throughout the summer.

The target sample size at Goldstream was 800 completed interviews with half receiving a mail package and the other half receiving the postcard with the web address.[24] The target population for this experiment was all occupied campsites (i.e., someone visibly present from the campground road) and those 18 years and older.[25] These interviews were conducted over 26 days during the months of June, July, August and September (Table 1). Most of these interviews were conducted on Fridays and Saturdays (83%) and the remainder either Tuesdays or Wednesdays (17%).[26]

[24]A key variable of interest in this study was the return rate for the two survey modes. It was assumed that the return rate for the paper mode with no follow-ups might be about 50%. Stuart (1963) provides a set of tables of standard errors for determining significant differences in reported percentages between two samples. These tables can also be used to approximate sampling size requirements for two samples. Assuming two samples of 400 and a return rate of 50 percent for one sample, it was estimated that a difference in the return rates of about 7% or more was required to obtain a significant difference at the 95th confidence level.

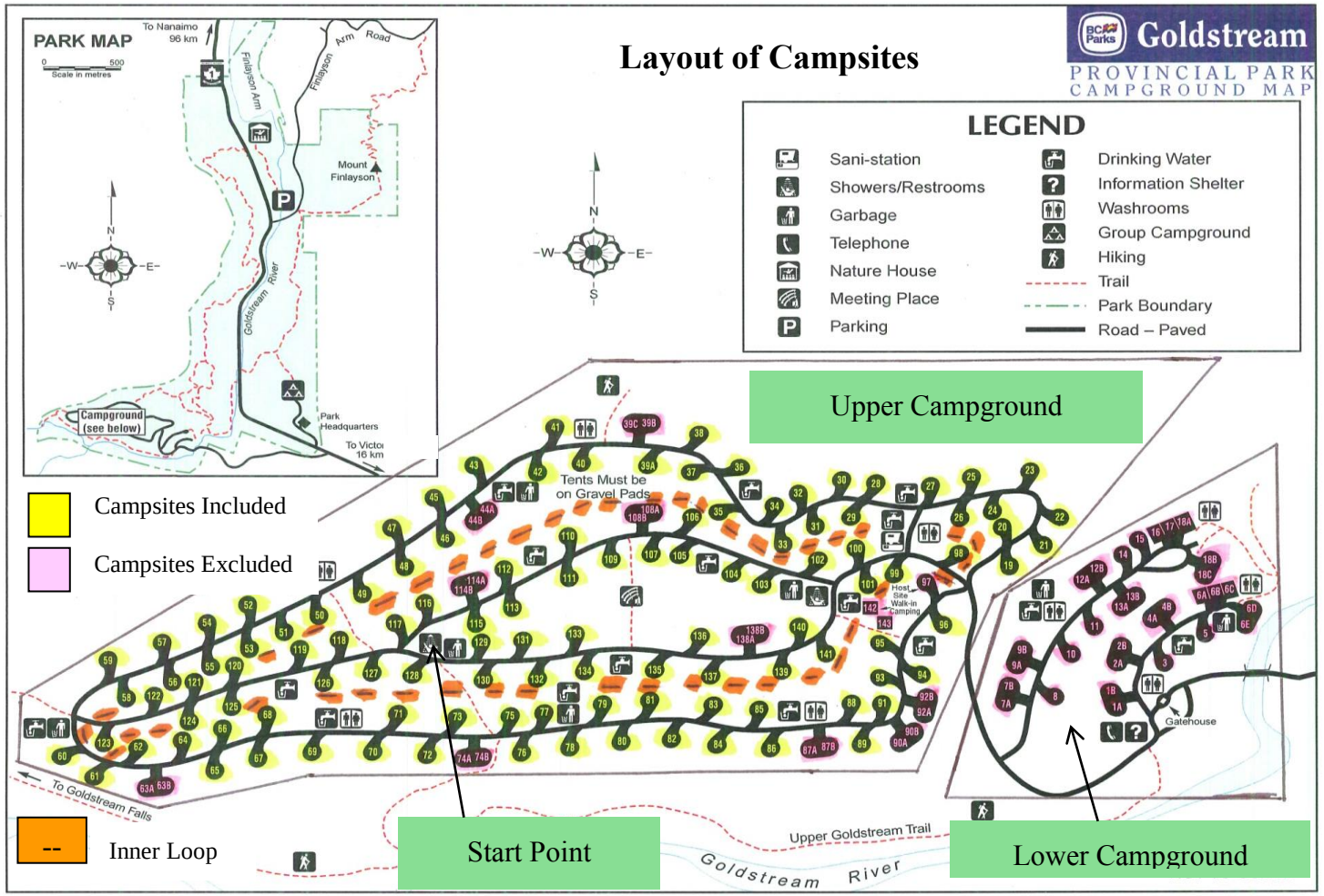
[25]For household and visitor surveys, BC Parks has used 18 years and older as a cutoff for survey eligibility.

[26]For this experiment, no attempt was made to randomly select the days of the interviews and the hours within interview days. Fridays and Saturdays were chosen for interview days because they often have the highest occupancy rates, but this can vary by campground and by season. A check with attendance statistics indicated that the percentage of interview and percentage of attendance was similar for the core season (i.e., July and August, 74% for interviews vs. 69% for attendance) and for the shoulder season (June and September, 26% for interviews vs. 31% for attendance).

Table 1. Number of completed interviews by day of week and month, 2010

	Month				
Day of Week	June	July	August	September	Total
Monday					
Tuesday			67		67
Wednesday			70		70
Thursday					
Friday	49	131	149	12	341
Saturday	155	147	41		343
Sunday					
Total	204	278	327	12	821
Percent	24.8	33.9	39.8	1.5	100

The upper level or main campground contains a 113 single campsites located along an outer loop (or road) and an inner loop of the campground (see map of layout of campsites). It also contains two shower/flush toilet buildings that are located at the north end and south end of the campground. Starting at a similar point of an inner loop (i.e., the shower/flush toilet building at the west end of the campground where the interviewer parked his car), an attempt was made to sample *all* occupied campsites over a four hour period. This usually involved circulating the campground twice each sampling day (usually after breakfast and


Layout of Campsites
Goldstream
PROVINCIAL PARK
CAMPGROUND MAP
PARK MAP
To Nanaimo
96 km
Finlayson Arm Road
Finlayson Arm
Mount Finlayson
Goldstream River
Campground (see below)
Park Headquarters
To Victo
16 km
LEGEND
Sani-station
Showers/Restrooms
Garbage
Telephone
Nature House
Meeting Place
Parking
Drinking Water
Information Shelter
Washrooms
Group Campground
Hiking
Trail
Park Boundary
Road – Paved
Upper Campground
Tents Must be on Gravel Pads
Campsites Included
Campsites Excluded
Gatehouse
To Goldstream Falls
Inner Loop
Start Point
Upper Goldstream Trail
Goldstream River
Lower Campground

before dinner)[27] and selecting all occupied campsites. Suppose, for example, the first sampling day was a Friday. During the first circulation of this day, a campsite layout map was used to record completed interviews at occupied campsites (i.e., someone who was visibly present at the campsite), temporarily unoccupied campsites (i.e., a tent or recreation vehicle was visible from the campground road, but no person at the campsite was visible from the road) and unoccupied campsites (i.e., no vehicle, tent or recreation vehicle set up in the campsite and no person on site). During the second circulation of this day, an attempt was made to contact all temporarily unoccupied campsites from the previous circulation. On the second sampling day (e.g., a Saturday), another two circulations were made to contact all camping parties that were temporarily unoccupied.[28]

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[27]The decision to sample after breakfast and near suppertime was arbitrary. It should be noted, however, that Goldstream provincial park campground is located near Victoria which contains many tourist attractions. This campground has a number of trails, but it is not located next to a lake where people might go swimming or enjoy other water-related activities during the day. Thus, a number of campers leave the campground shortly after breakfast. While the most efficient or optimum times for undertaking the interviews may vary from one campground to the next depending on whether it is a destination campground (i.e., typically a longer length of stay) or a stop-over campground (i.e., typically a shorter length of stay), the two daily time periods that seemed to produce the most completed interviews was morning (i.e., about 9:00 A.M.) and late afternoon (i.e. starting around 4:00 to 5:00 P.M.). Many people who leave the campground for the day will return in the late afternoon. After 6:00 or 6:30 P.M., however, it was difficult conducting interviews because many campers are preparing supper, trying to get young children ready for bed or sitting by the campfire and trying to relax.

[28]Initially, the goal was to try to complete 50 interviews per day and to select a systematic sample of occupied campsites. Given there were 113 individual campsites, this meant sampling about every 2nd campsite. If the randomly selected campsite was not occupied then the next sequentially numbered occupied campsite was to be selected. On the first day that this procedure was implemented, it was difficult to achieve the goal of 50 completed interviews because the campground was not full. (On average, about 31 interviews were completed each day with only one of the 26 sampling days obtaining 50 interviews completed). To improve sampling efficiency an attempt was made to survey all occupied campsites in a sequential order (e.g., campsite #19 was occupied and selected; campsite #20 was unoccupied and not selected; campsite #21 was

The use of this procedure assumes campers are self-randomizing with one exception.[29] There may be some groups (e.g., families with young children, older campers, and disabled) that may prefer to stay at campsites located near the washroom building with flush toilets and showers. To avoid the possibility of campsite selection bias, the direction of the interviews were rotated (inner loop, outer loop, inner loop) for each sampling time or campground circulation.

In approaching potential respondents, the interviewer wore a BC Parks cap and a vest with a logo indicating "BC Parks" to convey legitimacy (Figure 4), tried to use a friendly approach and indicated the interview would only take a few minutes (i.e., 3 to 4 minutes). To select the respondent for the interview, the most recent birthday method was used (Gaziano, 2005).

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occupied and selected and so on) rather than every nth campsite over a four hour period. While the systematic sample works well when the sampling intensity is low (say 3 to 6 interviews per day in a 100 campsite campground), it is difficult to use when the sampling intensity is high (e.g., 50 interviews per day). The use of the next sequentially numbered occupied, along with the most recent birthday method, was intended to help avoid interviewer bias. A check on the distribution of interviews throughout the campground indicated that the average number of interviews per campsite was about 6.7 for the northern loop (campsites19 - 59), 6.8 for the southern loop (campsites 60 - 96) and 8.20 for the inner loop (campsites 98 - 141). This suggests the interviews were distributed quite evenly throughout the campground.

[29]By self-randomizing, it is meant that when campers arrived at the campground they "select" their campsite without knowledge if they will be surveyed or not. So there is no reason to believe that the people selected would be more or less likely to participate in the survey. There is also some randomization in that many campers don't select particular campsites, but will select one of several campsites that meet their needs (personal communication with Carl Schwarz, 2013). It should also be kept in mind that a camper population is a flow population (i.e., new people are arriving and others leaving at different times). While random samples usually imply that each member has a known probability of selection (often equal), in this study it is hard to know if this is exactly true.

Figure 4. Attire used by interviewer at Goldstream

The interview form included 7 to 10 questions depending on whether or not people used the Internet (see Appendix A). All the questions focused on visitor profile or demographic information rather than opinion questions related to the services provided in the campground since the latter may have been influenced by social desirability bias. The questions focused on number of nights spent in the previous year in any BC provincial park campground, location of residence, group size, age of respondent, gender of respondent (by observation), whether or not the person used the Internet from their home in the past 12 months, whether or not

they would do an online survey and then a request for their first name and email address.

The first question about nights spent in any BC provincial park campground in the previous year was viewed as being a difficult question. It involved distinguishing between different types of campgrounds (e.g., National Park, Provincial Park, Ministry of Forest campsites, private campgrounds), just in a British Columbia (e.g., not other parts of Canada, U.S.) and about a year later. While it is typically better to use an easier question for the first question (Dillman, 1978), the number of nights spent in the previous year was relevant to the camping experience (high salience) and the results would fulfill an information need for BC Parks.

The next four questions were intended to provide visitor profile information for BC Parks and a check on nonresponse bias. Of these questions, the most important question was the location of residence because the results of this question are frequently used in economic impact studies to estimate total visitor expenditures and associated economic benefits (e.g., employment, tax revenues, etc.). The question about party size was also important because the results of this question are used as check on park attendance statistics which is a key Ministry performance indicator used for investment and other management decisions (i.e., total camping parties are multiplied by an average party size to derive total

camper nights).[30] The questions on age of respondents and gender are sometimes used to examine views of specific groups (e.g., opinions of older versus younger people).

The question about use of the Internet at home was intended to identify how many people might be prevented from completing a web survey. While it was recognized there are other locations where respondents could complete a web survey (e.g., at work, at the library, etc.), using "at home" was thought to provide a conservative estimate of people able to complete a web survey (i.e., some respondents may be unlikely to go to a library to complete the survey). Keeping in mind that a goal of the interview was to keep it short (three to four minutes), a question about the use of the Internet was thought to be a more appropriate than having a question about access to the Internet.

The question about providing the email address was thought to be most sensitive and was not asked until the end of the interview. Prior to this question, an attempt was made to emphasize the usefulness of the study and if required to address any

[30]An attempt was made to use similar question wording of group size as used in the personalized delivery/mail approach for U.S. National Parks park visitor survey in 2008 (personal communication with Margaret Littlejohn on May 27, 2009). The question used in the BC Parks Interview Form in 2010 was: How many people, in total, are in your group today? The question used in the U.S. National Parks Interview Form in 2008 was: How many total people are in your group visiting today? List both personal and tour group, if applicable. Prior to this question, however, the U.S. National Park Interview Form included the following question: What kind of group are you traveling with today? The response categories were: alone, family, family and friends and other.

potential concerns of providing their email address (e.g., the use of a provincial government website to try to invoke the element of trust; the access code was unique; the email address would not be passed on). If a potential respondent indicated he/she was willing to do the web survey, an E-mail Form was placed on a clipboard and handed to the respondent to write down his/her first name and email address. Throughout the interview, the postcard was kept out-of-sight of the park visitor until after the respondent had provided his/her email address.[31] If a potential respondent refused to do a web survey, he/she was asked to complete a

[31]Maintaining interaction and tailoring are two principles often recommended for undertaking household interviews (Groves & Couper, 1998). Maintaining interaction refers to attempts to extend conversations with the sampled persons and tailoring refers to addressing concerns the sampled person might have in participating in the interview. During the interviews at Goldstream, an attempt was made to implement four principles. The first principle was being ***approachable***. This involved a public relations approach like smiling, waving, saying good morning/afternoon and wearing a symbol of authority (e.g., a vest and baseball cap that indicated BC Parks). The introduction of the interview also emphasized the interview would only take a few minutes or there was just a few questions. The second principle was being ***adaptable*** to the situation. In practice, this meant undertaking the interview at the campsite, picnic table or fire-ring wherever the respondent felt most comfortable or at another appropriate time. The third principle just before requesting an email address was on ***applied use*** of the results. For example, when planning new facilities or services, potential respondents were reminded that it is often useful to ask people first if they have interest in using a particular service or facility before it is built or provided (i.e., typically it is not a good use of taxpayer money to provide a new service if people are not interested in using the service). The fourth principle was ***appropriate timing*** of presenting the postcard. This was not presented or made visible until after the email address was obtained because it was thought if it occurred early, the potential respondent would refuse providing an email address. The picture on the front cover was presented first and then the reverse side with the web address and the unique access code was presented to the potential respondent. While the second and third principles are similar to tailoring and maintaining interaction, the first and fourth principle addresses the beginning (i.e., reducing refusals during the initial contact) and the ending of the interview (i.e., reducing refusals to obtaining an email address). In this study, the intent was not to test these principles. These principles are presented here to convey the experience of one interviewer trying to implement this new mixed-mode approach.

paper survey. The underlying rationale for this substitution was the door-in-the-face principle which suggests that people may comply with a second request if it is viewed as being similar or less difficult than the initial request (Mowen & Cialdini, 1980). If potential respondents refused to do an interview, to do a web survey or to provide an email address, an attempt was made to learn the reason(s) for the refusal.

To facilitate randomization in implementing the two approaches, a mail package for the paper survey and postcards were distributed in an alternating manner (e.g., paper, postcard, paper, etc.). The mail package contained an eight page coloured questionnaire, a cover letter from the project manager, a postage-paid return envelope and a golf pencil. A drop-off box was attached to the gatehouse where respondents could return their completed questionnaire and a small 8 x 11 poster announcing the survey was posted at the gatehouse where park visitors first entered the park and paid their camping fee. In terms of ethical considerations (i.e., a requirement of the Ethics Review Board at the University of Victoria) the poster indicated that BC Parks was undertaking a survey, completing the survey would be helpful to BC Parks and visitors were not required to answer any questions if they did not want to.

The postcard contained a picture of the Okanagan Lake campground on one side and a short message from the project manager, the website and the access code on the other side. The access code was six digits that were "chunked" into two groups of three digits (Miller, 1956).[32] The first digit was one of four letters that determined the number of follow-ups (A= no follow-ups, B=one follow-up, C=two follow-ups and D=three follow-ups). The message also contained contact information (name of project manager, phone number and email address) and a postscript about the opportunity to win one of five prizes for two nights of free camping in 2011 if the survey was completed. While it was recognized that this incentive would have a greater appeal for BC residents (i.e., about a $60 value for two nights of camping), it was thought that follow-ups would provide potential leverage for non-BC residents (i.e., email reminder about importance of survey). In total, 821 eligible contacts were made with potential respondents.[33]

[32]Chunking is the idea that information (words, digits, etc.) is organized into chunks and that the number of chucks humans can hold in short-term memory is 7 +/- 2. This idea is the basis of grouping numbers such as phone numbers or social insurance numbers into small groups to make them easier to remember and work with.

[33]Eligible contacts excluded those who were surveyed in another campground in 2010 and anyone younger than 18 years. In total, 825 interviews were undertaken. Four records were removed from the analysis because the access codes were inadvertently written down incorrectly. It was thought these incorrect access codes could affect the analysis of follow-ups (i.e., sending an email follow-up with the wrong access code would not permit the respondent to complete the survey).

3.1.2 Experiment two

The intent of the second experiment was to examine more closely the effect of follow-ups on return rates and nonresponse bias on a larger geographical basis. More specifically, it was designed to examine the first three criteria of the first experiment: (a) non-use Internet rates; (b) response rates; and (c) the effect of follow-ups on return rates and nonresponse bias. It also provided a basis for addressing the practical issue of time constraints (i.e., could the data collection period be reduced?) on survey quality by examining the number of cumulative returns and return rates by each follow-up over the data collection period and whether or not there were differences in the substantive results by each follow-up.

This experiment was conducted in 12 individual campgrounds located throughout the province. Five campgrounds were located in the South Coast Region (Vancouver Island and Lower Mainland Economic Regions), five campgrounds were located in the Southern Interior Region (Thompson and Okanagan Economic Regions) and two campgrounds were located in the Northern Region (Skeena, Cariboo, Omineca and Peace Economic Regions) of the Province (see map). Half of the campgrounds were classified as large (5,500 or more camping parties per year) and half of the campgrounds were classified as small (from 1,300 to 5,499 camping parties per year). Large campgrounds usually have more development

(e.g., washrooms with showers and flush toilets, playgrounds) and higher camping fees than smaller campgrounds.[34]

For this experiment, a similar sampling design was used as in previous years. It involved undertaking the survey with a small number of visitors each day of the operating season from May to September (i.e., about 100 days).[35] For each

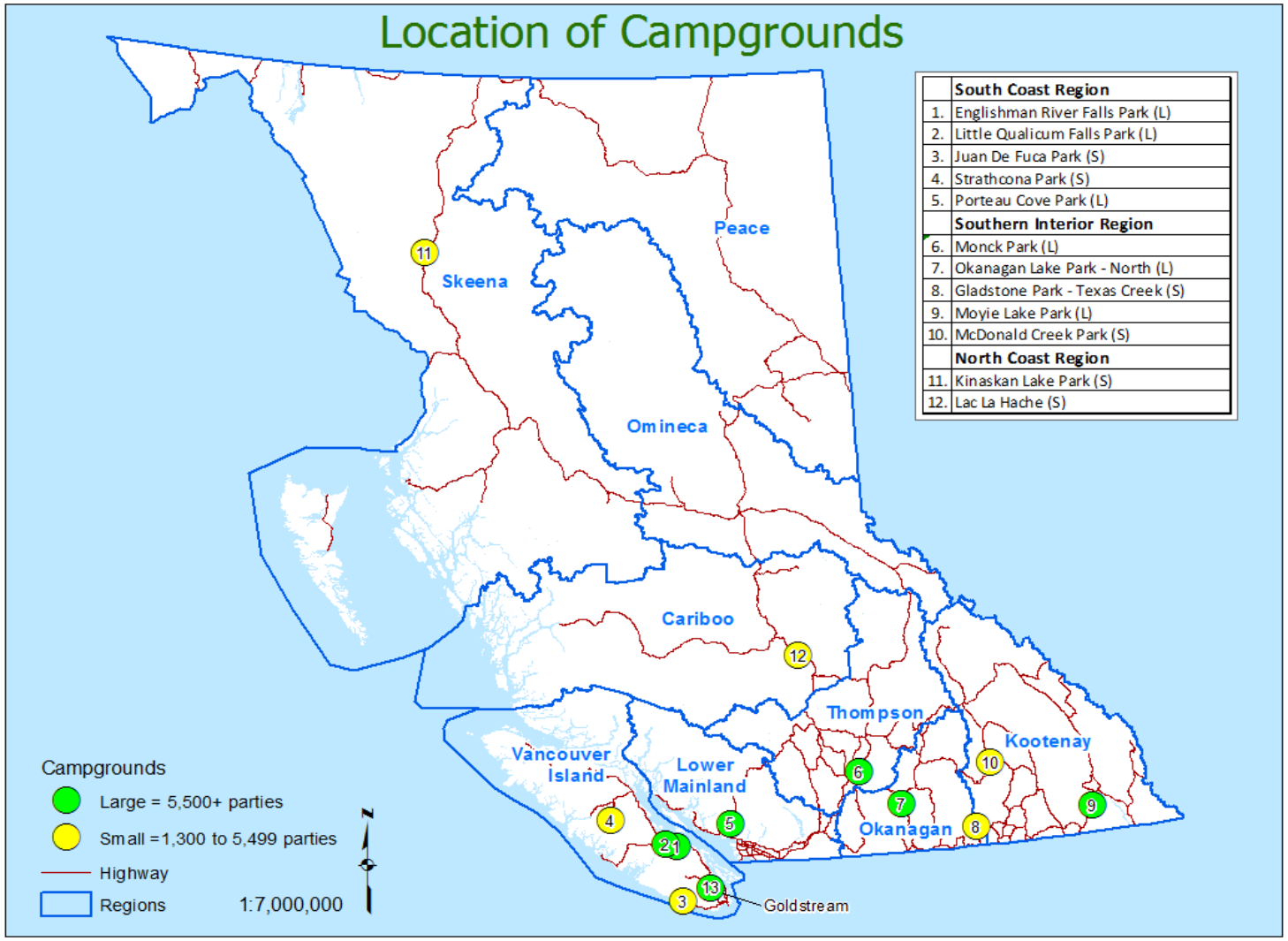
[34]Originally, the intent of this study was to implement the second experiment in 34 other campgrounds throughout the province. In one of these campgrounds (Brandywine Falls), a very small campground, the campsites had been removed. During the implementation of the survey in the other 33 campgrounds, there was some resistance from park operators about implementing the survey because no additional funds were provided for undertaking the interviews. While implementing the survey is one of the functions that park operators are required to perform under their contracts, these contracts were based on a previous approach of delivering a mail package to every nth campsite (i.e., like a mail carrier).This task of delivering a mail package is much easier and faster than attempting to undertake interviews. Since the author had little control over this situation, two criteria were established to help assess if the sampling and interviewing instructions were maintained in each campground after the survey was completed. One criterion was that the survey needed to be implemented in at least 80% of the total number of sampling days from May 24 to September 7 (104 sampling days). While there are some factors beyond the control of park operators such as heavy rains and temporary closure of campgrounds due to forest fires, an effort is required to adhere to the daily sampling schedule to ensure the results reflect visitation levels during the shoulder season (May, June and September) and the core season (July and August). A second criterion was that each campground needed to obtain a minimum of about 100 online returns. BC Parks has used this as a minimum sample size target for many years based on the margin of error and budget considerations. In addition to these two criteria, other considerations included whether the distribution of postcards was given out in an alternating manner, whether other surveys were conducted at the same time in the park and whether the interviews were conducted at the campsites or alternative location. Based on these considerations, 12 campgrounds were selected for this analysis.

[35]Since 1985, BC Parks has attempted to implement three different sampling approaches for this survey. One is called a "one time" snapshot approach which involved undertaking the survey each day of a one week period. This period usually occurred when the campground had high use (e.g., last week of July). A second approach is called a "multiple snapshot" approach which involved undertaking the survey on a selection of random days throughout the operating season. The third approach is called a "daily snapshot" approach in which a small number of park visitors are selected each day of the entire operating season. Currently, BC Parks uses a "daily snapshot" approach because it is intended to provide a more complete visitor profile and visitor satisfaction ratings. In using the multiple snapshot approach, for example, if a major water pipe breaks in a flush toilet/shower building on a random sampling day, it could skew the results for that park.

campground, a five-year average attendance was obtained for each month. The number of overall postcards (300 for small campgrounds and 400 for large campgrounds) was allocated proportionally based on monthly attendance. This monthly allocation is further broken down by weekday/weekend day (i.e., about a 50/50 split). For each day of the operating season, a systematic sample of campsites with a random start number and then every nth campsite was selected as a designated campsite.[36] Interviewers were instructed to sample the next occupied campsite if: (a) the campsite was not occupied; (b) the party had been surveyed before; or (c) the person selected was under 18 years of age.

As in experiment one, the target population for this experiment was also all occupied campsites and with those 18 years and older. These interviews were undertaken by park operators or a campground host (i.e., someone who lives at the campground and provides public information and other assistance to campers). An interviewer manual, a one-hour teleconference and ongoing monitoring was provided by the author before the implementation of this experiment. The

[36]The random selection of daily campsites (Daily Record Sheet) for each campground was prepared by Dr. Carl Schwarz of the Department of Statistics and Actuarial Sciences at Simon Fraser University using a SAS random number generator of selecting two random numbers and taking the average of the two for the start number (n/2) and then a systematic interval thereafter (for an illustrative example of the sampling procedures, see Appendix B).


Location of Campgrounds
Peace
Skeena
Omineca
Cariboo
Thompson
Kootenay
Okanagan
Lower Mainland
Vancouver Island
Goldstream
Campgrounds
Large = 5,500+ parties
Small = 1,300 to 5,499 parties
Highway
Regions
1:7,000,000
N
South Coast Region
1. Englishman River Falls Park (L)
2. Little Qualicum Falls Park (L)
3. Juan De Fuca Park (S)
4. Strathcona Park (S)
5. Porteau Cove Park (L)
Southern Interior Region
6. Monck Park (L)
7. Okanagan Lake Park - North (L)
8. Gladstone Park - Texas Creek (S)
9. Moyie Lake Park (L)
10. McDonald Creek Park (S)
North Coast Region
11. Kinaskan Lake Park (S)
12. Lac La Hache (S)

Interview Manual was sent to park facility operators before the teleconference.[37] It included an overview about the purpose of the survey, survey implementation instructions, the necessary Interview Forms, Email Forms and Daily Record Sheets (i.e., daily random selection of campsites) along with typical questions and answers that potential respondents might have. Interviewers were instructed to sample a party only once, to use the most recent birthday method for selecting the respondent from the selected party and to distribute the postcards in an alternating manner (A, B, C, D, A…). In total, 3,704 eligible contacts were made with potential respondents.

3.1.3 Questionnaire design and materials

A unimode construction was used both for the paper questionnaire (used at Goldstream) and for the web questionnaire (Dillman et al., 2009). Radio buttons and check boxes, for example, were used rather than precodes which are often used in paper questionnaires (e.g., circle number of your answer). Using this type of construction involves trying to make the questionnaires look similar in terms of visual and content components in order to present the same stimuli to respondents and reduce the potential of measurement error.

[37]Due to budget constraints, it was not possible to hold on-site training sessions with interviewers.

The paper and web questionnaires were kept short and contained 18 questions. The questions focused on trip behaviour, satisfaction ratings with several services provided in the campground, preferences for new services and facilities and visitor characteristics.[38] In one question (e.g., types of overnight shelters like tent, tent trailer), graphical symbols were used to distinguish one type of shelter from another and to add interest to the survey. To help maintain consistency in page layout, the same question order, the same number of questions per page and per screen, the same question formats and the same visual characteristics were used. The mail package used at Goldstream included a cover letter from the project manager, a full colour eight page 8 ½ x 14 folded in half booklet, a postage-paid return envelope, a golf pencil and an outer envelope that contained these items in it. In terms of messaging, an attempt was made to keep the content of the cover letter and the postcard similar. Visually, the picture on the postcard, the front cover of the paper questionnaire and on the welcome page of the web survey was the same.

[38]The rating scale for the satisfaction question was based on a study of public and private campgrounds in the United States (LaPage & Bevins, 1981). In 1985, when BC Parks first started the camper survey, three different scales were tested in an experiment. The one developed by LaPage and Bevins, with a very small modification ("above average" rather than "if better than average"), had high reliability based on Cronbach's alpha (internal consistency) and was retained for the BC Parks camper survey. The rating scale for the preferences of services and facilities was based on a questionnaire about housing and community needs obtained from Don Dillman. While it is not known how the scale was developed, it has been used in a province-wide household survey on camping in 1988 (Dyck, 1989). For the present study, the number of items for both questions was reduced to keep the length of the questionnaire short.

The placement of the picture on the welcome page was in the top left-hand corner of the screen. The use of the picture on the welcome page was intended to provide a visual link to the postcard that had been distributed in the park and to add interest to the questionnaire. The welcome page also provided brief instructions of how to proceed with completing the survey. To reduce potential frustration of respondents incorrectly entering a six-digit access code at the bottom of the welcome page, chunking was used for the first three characters in the left answer box and for the last three characters in the right answer box.

The layout of the web questionnaire was designed using cascading style sheets and HTML to ensure the visual stimulus was similar for potential respondents.[39] Throughout the entire questionnaire, a coloured background for the header (dark green) and questions (lighter green) and contact information at the bottom of each page (white and in small font) were used. Page numbers similar to the paper version were also inserted into web questionnaire (e.g., page 1 of 8) to help respondents know how much of the questionnaire they had completed (Couper, 2008). Error messages were also carefully designed to remind the respondent they he/she made an error in the response and to encourage the respondent to try again (Couper, 2008). These error messages were placed underneath the response option

[39]In terms of server-side programming, PHP and MySQL were used to make the survey interactive and to provide analytics about the status of the survey (e.g., time to complete question, time to complete entire questionnaire).

in light red. For example, if a respondent entered the incorrect access code, he/she were reminded that it was invalid and asked to try again. The web questionnaire was also tested on a number of different web browsers to ensure the questionnaire looked consistent before implementation of the survey.[40]

An attempt was also made to keep the questions in the Interview Form and in the paper and web questionnaires similar (Figure 5). There were, however, some slight differences in order to facilitate each mode. For the question on location of residence, the response options were slightly shorter on the Interview Form than the paper or web questionnaire to facilitate a face-to-face conversation and to make it easier and faster for implementation by interviewers. The question on party size for the interviews focused on the day of the interview while in the paper/web questionnaire it focused on after the trip. While asking someone's age may not be a sensitive question for many potential respondents, a brief introductory phrase, "May I ask…" was used to soften the question slightly. The question on gender was based on observation during the interview rather than a question in the paper and web questionnaires.

[40]These browsers included Internet Explorer 7 and 8 and the latest versions of Firefox, Chrome, Opera and Safari.

Interview Form	Paper/Web Questionnaire
First, about how many nights, in total, did you spend in any BC provincial park campground in 2009?	About how many nights, in total, did you spend in any BC provincial park campground in 2009?
And where is your home located? Is it in (READ)…B.C., Alberta, Other parts of Canada, the United States or Abroad (outside Canada and U.S.)	Which of the following best describes the region where your home is located? The response options were: British Columbia, Alberta, Ontario, Other Canada, Washington, Oregon, California, Other U.S.A, Abroad (outside of Canada and the U.S.A)
How many people, in total, are in your group today?	Including yourself, how many people were in your group when you stayed in this campground?
May I ask how old you were on your last birthday?	May I ask how old you were on your last birthday?
Gender (By observation)	What is your gender? The response options were: female, male

Figure 5. Question wording for the interview form and paper/web questionnaires

3.1.4. Follow-up strategy

The follow-up strategy for the web survey involved several steps. The first step was the development of an implementation schedule for follow-ups to nonrespondents. While some research has examined implementation schedules for mixed-mode surveys of the general population (Dillman et al., 2009), little research has been given to examining the timing of follow-ups for a face-to-face/web mode for a park visitor survey.

Several considerations were taken into account in determining the follow-up strategy. One consideration was to have the email follow-up arrive after the respondent returned home rather than having the email follow-up buried in a long list of unread emails. The exact timing of sending this email, however, was difficult to determine because some campers might be on a shorter trip (e.g., just for the weekend) while others might be on a longer trip (e.g., four to five weeks for visitors from Europe or the United States). A second consideration was the recall of the park experience. The previous approach used by BC Parks allowed campers to complete the questionnaire as they left the park while the experience was fresh in their mind. If the email follow-ups were sent at the end of the season, it was not clear how the time delay between the end of the trip and completion of the questionnaire might influence the answers to some of the questions. A third consideration was that logistically the information from the email form used

during the interviews needed to be entered into a database to facilitate sending out personalized emails.

Based on these considerations, follow-ups were implemented in two periods (Table 2).The first period was for field interviews conducted from May 24 to July 11. The second period was interviews conducted from July 12 to September 5. After about a month (or the 37th day) after the last day of interviews in both periods, the first follow-up was implemented. This was done to permit adequate time for potential respondents to return home after their trip and to permit data entry of the Interview Forms and email addresses. After one week, a second email follow-up was sent out and about a week later a third email follow-up was sent out.

The second step of the follow-up strategy was the crafting of each email letter. Several researchers have suggested keeping the email quite short (Couper, 2008; Dillman et al., 2009). The content and tone of each email varied slightly. While the intent of the first email was to provide a gentle reminder that BC Parks would appreciate getting respondents' views about their recent visit to the campground they stayed in, the intent of the second email was more of an appeal to help BC Parks improve services. The intent of the third email was to indicate that the

survey was drawing to a close and the importance of hearing from everyone to ensure accuracy of the survey results.

Table 2. Schedule of follow-ups by interview period

	Number of follow-ups	Period 1 (May 24 to July 11)		Period 2 (July 12 to Sept 5)	
Card A	None				
Card B	One	17-Aug	37th day	12-Oct	37th day
Card C	Two	17-Aug	37th day	12-Oct	37th day
		25-Aug	45th day	20-Oct	45th day
Card D	Three	17-Aug	37th day	12-Oct	37th day
		25-Aug	45th day	20-Oct	45th day
		03-Sep	53rd day	28-Oct	53rd day

Note: Day refers to number of days after last interview day of period.

To reflect the different tone in each email follow-up, the subject lines were modified slightly for each follow-up:

1st Follow-up Subject: Your Recent Visit to BC Parks

2nd Follow-up Subject: Your Recent Visit to BC Parks – Please Help Us

3rd Follow-up Subject: Your Recent Visit to BC Parks – Final Request

In addition, the subject lines deliberately did not contain the word "survey" to avoid possible spam filtering of the email follow-up. The survey link and access code were prominently displayed near the end of the email in different colours.

A third step of the follow-up strategy was sending out the email follow-ups and monitoring the returns. To help personalize the email follow-ups, each potential respondent received an individual email. This involved a merge of the email address, the first name (e.g., Dear John or Visitor if the first name was not provided), the campground name and the unique access code for each nonrespondent.[41] An effort was made to send out all emails midweek – usually from Tuesday to Thursday in mid or late afternoon.

If bounce backs occurred, the email address was checked against the original email forms to determine if a data entry error occurred. Where appropriate, corrections were made to the email addresses and the email letter was usually resent about a day later. When nonrespondents received the email follow-up, they were required to click on the web address from the email letter which brought them to the welcome page and then to enter the access code at the bottom of the welcome page. A special email address (i.e., surveybcparks@gov.bc.ca) and telephone number was provided at the bottom of each page of the web questionnaire. Both forms of contact were monitored throughout the

[41]In a study of personalized salutations for an online survey with students from the Open University of the United Kingdom, Joinson and Reips (2007) found that the response rate (16.6%) for the salutation of "Dear John" or first name was significantly higher than response rates for other salutations (e.g., Dear Student, 12.4%; Dear Open University Student, 12.5%; Dear John Doe, 14.6%).

implementation of the survey to address any concerns potential respondents might have.

No follow-ups were used in the paper questionnaires for the Goldstream experiment. Paper questionnaires were picked up at the drop-off box (that was locked and could only be opened by the author) on interviewing days or returned in a postage-paid return envelope and dated. The last cut-off date for accepting web returns and paper questionnaires was November 30, 2010.

3.2 Data analysis plan

Prior to the data analysis, the data was reviewed and adjustments were made for outliers in two variables. One adjustment was the total number of nights spent in the previous year. Many campgrounds are only open for a few months of the year. While it was thought that outliers (i.e., over 60 nights) would not have much effect on the means, they could affect the standard deviations greatly and the standard errors and make it difficult to detect differences in the means of the number of nights between groups. Thus, this variable was truncated at 60 nights.[42]

[42]For Goldstream, the number of cases excluded from the analysis about the number of nights spent in previous years was: interviews, n=1; paper return, n=1; online returns, n=0. For the 12 individual campgrounds, the number of cases excluded from the analysis was: interviews, n=15

A second adjustment was the party or group size. BC Parks policy restricts the party size per campsite to eight people or less. Park operators, however, may permit more people on a campsite during periods of heavy use. Because it was thought that outliers might affect the standard error and to be consistent with previous camper surveys, party size was truncated at 10 people.[43]

3.2.1 Response and coverage

In both experiments, the non-use Internet rates, the email collection rates, the return rates and the response rates were calculated for each campground. To compare Internet and non-use Internet visitors for five visitor characteristics (i.e., location of residence, gender of respondent, average age of respondent, average group size and average nights spent in previous year) obtained during the interviews, a Pearson chi-square test for frequency distributions and the t-test for

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(range from 61 to 250 nights;about 80% were 100 nights or more); online returns, n=4. In addition to statistical concerns, several factors were taken into consideration in truncating the number of nights at 60. First, 60 nights of camping is a considerable amount of camping, This may occur if someone has a travel trailer or motorhome and travels to a location with a longer camping season like Arizona or southern California. Second, this was a difficult question. It required respondents to recall the total number nights camped in the previous year and to distinguish between provincial park campgrounds and other campgrounds and then to determine how many nights were spent just in provincial park campgrounds. Without some type of aid like a dairy (Schwarz, 1996), some respondents may have overestimated the nights camped in provincial park campgrounds.

[43]For Goldstream, the number of cases excluded from the analysis about party size was: interviews, n=1; paper return, n=1; online returns, n=0. For the 12 individual campgrounds, the number of cases excluded from the analysis was: interviews, n=10; online returns, n=52 (with a range from 11 – 28). It should be noted that sometimes large groups (e.g., a church youth group; motorcycle clubs) use provincial park campgrounds and use a number of campsites. Some respondents may have included all the people in their group in their answer rather than individuals just staying on their particular campsite.

means were used.[44] Effect size for 2 x 2 contingency tables (i.e., location of residence and gender of respondent) was computed using phi and for means (i.e., average group size, average age and average nights spent in previous years) using Cohen's d' where equality of variances are not assumed (Vaske, 2008, respectively pg. 107 and pg 357).[45]

3.2.2 Effect of follow-ups on return rates and nonresponse error

To examine the effect of follow-ups on return rates, the Pearson chi-square test was used to determine if the return rate was the same for all postcard types and the Jonckheere-Terpstra test (Hollander & Wolfe, 1999) was used to test for an ordered alternative (i.e., A < B < C < D). The data for web return rates for the 12 campgrounds were combined and the Cochran-Mantel-Haenszel general association chi-square test (Agresti, 2000), using campgrounds as a stratification

[44] Welch's two-tailed t-test with unequal variance was used (Sokal & Rohlf, 2012; Vaske, 2008). Ruxton (2006) suggests that a combination of an initial test for homogeneity of variance and then the Student's t-test (i.e., assumes variances are the same) performs less well in controlling Type 1 error (i.e., false positive) than Welch's t-test. The formula for this test and degrees of freedom are shown in Vaske (2008, pg. 355).

[45] The formula for phi is $\phi = \sqrt{\frac{x^2}{N}}$ and the formula for Cohen's is $d' = \frac{M_1 - M_2}{\sqrt{\frac{s_1^2 + s_2^2}{2}}}$.

variable, was used to determine the overall effect of follow-ups on return rates. These tests were performed using SAS FREQ procedures. [46]

In both experiments, nonresponse bias was examined between respondents in both the paper and web survey and the interviews (including both respondents and nonrespondents) by each follow-up for five questions: location of residence; gender of respondent; age of respondent; average group size; and average number of nights spent in provincial park campgrounds in the previous year using equation two.

The effect that the nonresponse bias has on the coverage (or confidence levels) at the 95% confidence interval was computed using the following formula (Bethlehem, 2009)[47]:

[46] These tests were initially performed by Dr. Carl Schwarz from the Department of Statistics and Actuarial Sciences and Statistical Consulting Services at Simon Fraser University and then verified by the author using SAS Frequency procedures. The verification involved comparing the output from Dr. Schwarz with the output from the author. All the results were exactly the same. (It should be noted that a coworker wrote the code or script using SAS Frequency procedures. The SAS code is available from the author).

[47] Appendix C provides more details about the computations using this formula and illustrates it with an example.

$$P(\bar{Y} \in I_R) = \phi(1.96 - \frac{B_{\bar{y}_R}}{S_{\bar{y}_R}}) - \phi(-1.96 - \frac{B_{\bar{y}_R}}{S_{\bar{y}_R}}) \quad (3)$$

where,

ϕ = the standard normal distribution

$B_{\bar{y}_R}$ = the bias of the estimate (e.g., mean)

$S_{\bar{y}_R}$ = the standard error of the estimate (e.g., mean)

3.2.3 Data quality and comparability

In the Goldstream experiment, average (or mean) item nonresponse was computed for 20 items where respondents were expected to give an answer, but were not forced to answer in the web questionnaire. Four items were behavioural, eleven items were opinion related and five items were factual (i.e., mainly demographic). This was computed by totaling the number of blanks for all required items, dividing it by the number of expected answers of the respondents and then multiplying the answer by 100.[48]

[48]An item is defined as a response the respondent is required to make (Dillman, 1978). Suppose, for example, there were 100 respondents and each person was required to complete 4 items. The total expected answers would be 400. If the total number of blanks (not answered items) was 13 (item #1=2; item #2=4; item #3=2; item #4=5), the average item nonresponse as a percent would be 3.25% [(13/(100 x 4)]x100. Another procedure for computing average item nonresponse is to take the sum of the percent blank for each item and divide it by the number of items. In the above

The extent of non-differentiation for visitor satisfaction ratings for five services was also examined. The five services were: cleanliness of restrooms; cleanliness of grounds; your sense of security; control of noise; and condition of facilities. The response options for each of these services were: poor; below average; average; above average; and excellent. To provide a comparative basis with a previous study on nondifferentiation (Heerwegh & Loosveldt, 2008), only respondents answering all five satisfactions questions were included in the analysis.

To determine if non-differentiation occurred, an individual P_d (rho) statistic was computed for each paper and web respondent answering all five items and then comparing the average rho between the two groups using a t-test (McCarty & Shrum, 2000). The P_d (rho) statistic is defined as:[49]

example, the average item nonresponse would be 3.25% (13%/4= 3.25%). This latter method is reported by Messer (2009), but both methods give identical answers.

[49]A higher value of the rho statistic indicates more differentiation and reflects that the respondent used more response options (Heerwegh & Loosveldt, 2008; Krosnick & Alwin, 1988). This measure was originally developed by Linville, Salovey and Fischer (1986) in a study about stereotypes and was further used by Krosnick and Alwin (1988) in a study of rating the importance of 13 characteristics desired in children. In the later study, the authors found that those with higher levels of education tended to discriminate more (i.e., used more points of a five-point importance scale) than those with lower levels of education.

$$P_d = 1 - \sum_{i=1,n} P_i^2 \quad (4)$$

where,

P_d = probability of differentiation

P_i = the proportion at each scale point on a five point satisfaction scale

i = ranges from one to five because there are five scale points

Comparison of responses between the web and paper questionnaires for 20 items and the follow-ups for substantive results was also analyzed using Pearson chi-square tests for frequency distributions and t-tests for means.[50]

3.2.4 Costs

In the Goldstream experiment, total costs and the cost per completed questionnaire were computed for data collection and compared between the face-to-face/paper and the face-to-face/web approach. More details about data collection costs are provided in the next chapter.

[50]Data from online returns were downloaded into Excel and the data from the interview forms and paper questionnaires were entered into Excel. This data was transferred into SAS and SPSS (v 14). SAS Frequency procedures were used for computing the CMH and Jonckheere tests. Basic frequencies and descriptive statistics (e.g., means, standard error) were run in SPSS (V.14). Formulas for the Pearson chi-square test, the Welch's t-test, rho statistic, formula 3 and effect sizes were written and computed in Excel 2010 using descriptive statistics from SPSS. Checks on the computations for formulas were made to ensure they were correct. For example, a Pearson chi-square test was performed in SAS, SPSS and the formulas prepared in Excel and the results were the same.

CHAPTER FOUR

RESULTS FOR THE GOLDSTREAM EXPERIMENT

One key purpose of using the total survey error paradigm is to compare two mixed-mode approaches for several sources of survey errors and practical constraints. Five criteria were used in evaluating the face-to-face/paper and face-to-face/web approaches.

4.1 Response and coverage

The first criterion was to determine which of the two mixed mode approaches would provide higher response rates. The response rate was defined as the percentage of those who responded out of the total number of eligible groups that were contacted.

Table 3 indicates that the combined response rate for both mixed-modes was 50%. Out of a total of 821 groups contacted, 406 campers completed and returned either a paper or web questionnaire. Of these completed returns, 240 campers completed the paper questionnaire (59%response rate) and 166 campers completed the web questionnaire (40% response rate). The difference in the response rates between the two groups was statistically different ($\chi^2 = 28.49$, $d.f.=1$, $p < .0001$). The reason for the difference in the response rates between these two modes is not clear, but it may be partly influenced by having a paper questionnaire in hand and

Table 3. Response and non-use Internet rate at Goldstream

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Goldstream	Number of groups contacted	Refusal rate (%)	Number of groups interviewed	Non-use Internet rate (%)	Number of groups who accepted question-naires/ postcard	Email collection rate (%)	Number of returns	Return rate (col 7/ col 5)	Response rate (col 7/col 1)
Paper[a]	408	2	401	7	399	N/A	240	60	59
Web	413	3	400	1[b]	395	99	166	42	40
Combined	821	2	801	4	794		406	51	50

[a]This includes 22 switchovers. A switchover is someone who was originally asked to do a web survey and refused. When offered a mail package, they accepted it. Because the sample size for switchovers was small, the data were not separated out for analysis.

[b]During the interviews, two respondents, who were selected to do the web survey did not use the Internet. When asked to do the paper questionnaire,they also refused to complete it. .

the ease of returning it to a drop-off box attached to the campground gatehouse. When the returns for the paper survey were examined by method of return, about three-quarters of all the paper returns were returned in the drop-off box and about one-quarter were returned in the postage paid return envelope.

Out of 408 groups contacted to complete the paper questionnaire, 22 campers refused to accept the postcard but indicated a willingness to complete the paper survey (i.e., switchovers). Of these switchovers, 11 paper questionnaires or half were returned. While the total number of switchovers is small, it suggests that a paper survey might be used as a last resort if people are unwilling to complete a web survey (i.e., application of the door-in-the-face principle). This approach is similar to using a paper questionnaire as a last resort in a mail/web (and paper) approach for probability-based household surveys (Messer & Dillman, 2011).

The response rate for the face-to-face/paper mode at Goldstream (59%) was considerably lower than the overall mean response rate of 75% obtained for 21 U.S. National Park visitor surveys from 1988 to 1990 (Dillman et al., 1995a). The response rate for the paper mode at Goldstream, however, contained no follow-ups as occurred in the U.S. National Park visitor surveys (i.e., postcard and two follow-ups to nonrespondents). When the response rate for the paper mode at Goldstream (59%) was compared to the final response rate at the U.S. National

Park visitor surveys prior to a postcard follow-up (54%; Dillman et al., 1995a), it was slightly higher. Thus, if follow-ups are not included, the response rate for the Goldstream paper response is similar to the mean response rates obtained in previous U.S. National Park visitor surveys from 1988 to 1990.

The response rates for the two mixed modes at Goldstream take into account the refusal rates. The combined refusal rate was about 2% (i.e., 2% for paper and 3% for web response).[51] The refusal rate was slightly lower than the mean refusal rate (6.6%) obtained for the 21 National Park visitor surveys obtained from 1988 to 1990 (Dillman et al., 1995a). The low refusal rates for both mixed-modes in this study suggest that the short interview is effective (i.e., application of the foot-in-the-door principle) for obtaining some information from both respondents and nonrespondents. The reasons given for refusals at Goldstream included: inappropriate timing (e.g., going whale watching, going to a musical concert, putting baby to sleep, playing with young children); unable to complete an interview (e.g., helping wife who had eye surgery, helping person with wheel chair); and only a few direct refusals (e.g., just got up from a nap, trying to wind down before mealtime, cooking lunch). These reasons do not seem to suggest specific biases.

[51]It should be noted that the total number of contacted groups refers to the final disposition of the interviews. If the option of switching from refusing to complete a web survey to a paper survey would not have been provided, then the overall refusal rate would have been about 5% (i.e., 42/821).

The response rate for the web mode further takes into account the email collection rate. The email collection rate is the proportion of groups providing both first name/email address and only an email address (without a first name) out of all those willing to accept a postcard. Table 3 indicates the email collection rate for the web mode was very high (99%). While it is difficult to determine from these results why many campers were willing to provide their email address, the interviewer attempted to convey the importance of the survey and to alleviate security or other concerns about providing their email address. At the same time, a few respondents indicated they did not want to give their email address because they did not want to be contacted for further follow-ups and simply did not want to give out this private information.

The second criterion was to determine the extent to which campers do not use the Internet from their home. Table 3 further indicates that about 4% of park visitors at Goldstream did not use the Internet from their home. This was much lower than originally expected and suggests the potential for coverage error is low at this campground.

To gain further insight about how the potential for coverage error might be influenced by using only a web mode, five visitor characteristics between non-use Internet visitors and Internet visitors were examined (Table 4). Two significant

Table 4. Characteristics by non-use Internet visitors and Internet visitors at Goldstream

Visitor Characteristics	Non-use Internet Visitor	Internet Visitor	χ^2 or t	p-value	Effect Size [a] (Phi or Cohen's d')
Location of residence					
British Columbia (%)	68	69			
Outside B.C. (%)	32	31			
Total respondents	31	770	0.03	0.8734	-0.0056
Gender of respondent					
Female (%)	32	49			
Male (%)	68	51			
Total respondents	31	770	3.38	0.0660	0.0650
Group Size					
1 - 2 people (%)	65	38			
3 - 4 people (%)	29	41			
5 - 6 people (%)	6	17			
7-10 people (%)	0	4			
Total respondents	31	769			
Mean (s.e.)	2.6 (.21)	3.4 (.06)	3.89	0.0004	-0.6123
Age of respondent					
18 - 34 years (%)	10	28			
35 - 54 years (%)	48	54			
55 years & older (%)	42	18			
Total respondents	31	767			
Mean (s.e.)	52 (2.2)	42 (0.45)	4.49	0.0001	0.8187

Nights Previous Year					
0 Nights (%)	50	47			
1 - 5 nights (%)	3	21			
6 - 10 nights (%)	10	17			
11 or more nights (%)	37	15			
Total respondents	30	768			
Mean (s.e.)	8.5 (2.1)	5.1 (0.3)	1.62	0.1159	0.3519

[a] Effect size is an index of the strength of a relationship between an independent variable and a dependent variable (Vaske, 2008). While Vaske (2008) uses similar measures as Cohen (1988) for effect sizes, he has suggested different labels to describe the strength of the relationships because they are more appropriate for parks, recreation and human dimensions research (i.e., the primary focus of Cohen's research was applied psychology). This study uses labels based on Vaske. For location of residence and gender, the labels for the phi coefficient are: 0.1 = minimal relationship; 0.5 = typical relationship; and 0.8= substantial relationship. For average group size, average age of respondent and average nights spent in previous year the labels for Cohen's d' are: .20= minimal relationship; .50 = typical relationship and .80= substantial relationship.

differences were found. First, the average age was significantly higher among non-Internet visitors (52 years) than among Internet visitors (42 years). This finding is consistent with other studies in household surveys in Canada (McKeown et al., 2007) and with specialized populations such as extension clients (Israel, 2010). Second, the average group (or party) size was significantly lower among non-Internet visitors (2.6) than among Internet visitors (3.4).

The effect sizes for Goldstream also indicate that both age and party size have an influence on whether the respondent is a non-use Internet visitor. Campers who are older and have a smaller party size are more likely to be non-use Internet visitors. While these differences may not strongly affect the potential for coverage error at Goldstream because the non-use Internet rate is low, the use of the web only response may lead to coverage bias in other campgrounds if the level of non-use Internet rates are higher than occurred at Goldstream.

4.2 Effect of follow-ups on return rates and nonresponse error

The third criterion was to determine the effect of each follow-up on return rates and nonresponse error. The return rate refers to the number of returns out of the total paper questionnaires or postcards that were given out.

Table 5 indicates that the return rates without any follow-ups were significantly

higher for the paper mode (60%) than for the web mode (25%; $\chi^2 = 39.67$, *d.f.*=1, $p < .0001$). This suggests that if no email follow-ups for the web mode were undertaken, it would have a much lower return rate and a smaller sample size than the paper mode. At the same time, this table indicates that the return rate for the web mode with three email follow-ups (59%) and the paper mode with no follow-ups (60%) was nearly the same. Thus, if effort is put into three email follow-ups for the web mode, then the return rate is likely to be similar to the paper mode with no follow-ups.

The effect of each email follow-up on web return rates is also shown in Table 5. Based on the Jonckheere-Terpstra test, the return rates for the web mode were significantly higher with each follow-up (i.e., 25% for no follow-ups, 32% for one follow-up; 53% for two follow-ups; and 59% for three follow-ups). After the second follow-up, however, the return rate tapered off. This pattern of diminishing returns after the second follow-up is consistent with the findings of Kittleson (1997). It suggests that continuing to send out email follow-ups may not be effective after two or three follow-ups. The pattern of return rates for the paper mode and web mode raises an important question: how many follow-ups, if any, are required to reduce nonresponse bias for selected visitor characteristics?

Table 5. Effect of follow-ups on return rates at Goldstream

	No follow-ups (Card A)		One follow-up (Card B)		Two follow-ups (Card C)		Three follow-ups (Card D)		Chi-square test		J.T. test[a]
Goldstream	N	Return rate (%)	N	Return rate (%)	N	Return rate (%)	N	Return rate (%)	χ^2	P	p value
Paper	408	60									
Web	100	25	98	32	98	53	99	59	32.1	<.0001	0.0000

[a] Jonckheere- Terpstra test for ordered alternatives.

Table 6 indicates the nonresponse bias, the relative bias and the effect that this bias has on the coverage of the 95% confidence intervals of the estimates for five visitor characteristics. Columns 1- 3 represent only the respondents of either the paper or web mode while columns 4 - 5 represent both respondents and nonrespondents from the interviews.

For location of residence, the relative bias (column 7) for the percentage of campers from British Columbia was slightly underrepresented (-2.6%) for the paper mode while for the web mode the relative bias decreased steadily with an increasing number of follow-ups (11.1% with no follow- ups; 8.7% with one follow-up; 4.7% with two follow-ups; and -2.1% with three follow-ups). This pattern was consistent with the expectation that increased follow-ups would increase the proportion of non-BC residents. The absolute relative bias for the paper mode with no follow-ups and the web mode with three follow-ups were nearly the same (see Figure 6).

Researchers often compute the precision of the estimates based on the 95% confidence level (e.g., 19 times out of 20 the estimate of the statistic is plus or minus a number of percentage points or the confidence interval). This

Table 6. Nonresponse bias for selected visitor characteristics at Goldstream

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Respondents			All[a]		Measures[b]			
Visitor Characteristics	N	Proportion or Mean	s.e.	N	Proportion or Mean	Bias (col 2 - col 5)	Relative bias (%) (col 6/col 5)*100	Bias/s.e. (col 6/ col 3)	Coverage (%) of nominal 95% confidence interval (col 2) due to bias (col 8)
From BC (%)									
Paper (0 follow-ups)	240	0.67	0.03	399	0.68	-0.02	-2.6	-0.6	91
Web (0 follow-ups)	25	0.80	0.08	100	0.72	0.08	11.1	1.0	83
Web (1 follow-up)	31	0.71	0.08	98	0.65	0.06	8.7	0.7	89
Web (2 follow-up)	52	0.77	0.06	98	0.73	0.03	4.7	0.6	91
Web (3 follow-up)	58	0.67	0.06	99	0.69	-0.01	-2.1	0.6	94
Web (all)	166	0.73	0.03	395	0.70	0.03	4.3	0.9	86
Female (%)									
Paper (0 follow-ups)	235	0.60	0.03	399	0.48	0.13	26.2	3.9	2
Web (0 follow-ups)	25	0.44	0.10	100	0.50	-0.06	-12.0	-0.6	91
Web (1 follow-up)	29	0.52	0.09	98	0.46	0.06	12.6	0.6	90
Web (2 follow-ups)	52	0.54	0.07	98	0.50	0.04	7.7	0.6	91
Web (3 follow-ups)	57	0.47	0.07	99	0.52	-0.04	-8.0	-0.6	90
Web (all)	163	0.50	0.04	395	0.49	0.00	0.7	0.1	95
Age of respondent (Mean)									
Paper (0 follow-ups)	235	44.1	0.83	396	43.0	1.1	2.5	1.3	75
Web (0 follow-ups)	25	46.7	2.89	100	42.5	4.2	9.9	1.5	69
Web (1 follow-up)	27	41.7	2.01	98	41.4	0.4	0.9	0.2	95
Web (2 follow-ups)	51	44.9	1.76	98	42.3	2.5	6.0	1.4	70
Web (3 follow-ups)	55	44.6	1.47	99	43.6	1.0	2.3	0.7	90
Web (all)	158	44.5	0.95	395	42.5	2.1	4.9	2.2	42

Group size (Mean)									
Paper (0 follow-ups)	238	3.5	0.11	399	3.5	0.1	3.0	0.5	92
Web (0 follow-ups)	25	3.5	0.38	100	3.5	0.0	0.3	0.0	95
Web (1 follow-up)	31	3.6	0.32	98	3.3	0.4	11.6	1.2	78
Web (2 follow-ups)	51	3.6	0.27	98	3.4	0.5	13.4	0.8	88
Web (3 follow-ups)	58	3.6	0.26	98	3.3	0.3	8.8	1.1	79
Web (all)	165	3.6	0.15	394	3.4	0.3	8.5	1.6	65
Nights Previous Year (Mean)									
Paper (0 follow-ups)	234	5.6	0.56	397	5.1	0.5	10.6	1.0	84
Web (0 follow-ups)	25	6.7	1.66	100	5.1	1.6	30.7	1.0	84
Web (1 follow-up)	30	5.6	1.17	98	6.2	-0.5	-7.2	-0.6	91
Web (2 follow-ups)	52	8.3	1.14	98	4.9	3.4	68.6	3.0	15
Web (3 follow-ups)	58	6.0	1.00	98	4.7	1.2	26.1	1.2	77
Web (all)	165	6.8	0.60	394	5.3	1.5	28.3	2.5	30

[a] All includes both respondents and nonrespondents from interview.
[b] Computation for column 9 based on equation 3 (Bethlehem, 2009, pg. 224)

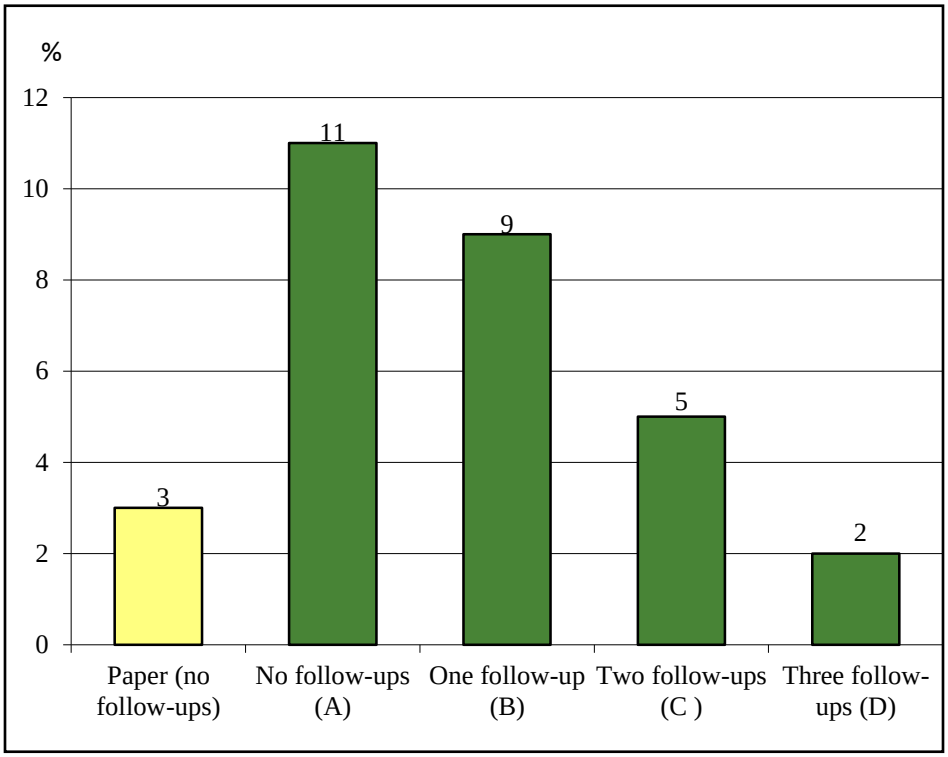

Figure 6. Absolute relative bias (%) for percentage of BC residents by number of follow-ups

computation usually does not include a measure of bias (Biemer & Lyberg, 2003). Column 9 in Table 6 indicates the coverage or the nominal 95% confidence interval of the proportion of BC residents by number of follow-ups. While none of the follow-ups reached the 95% confidence level, the coverage with additional follow-ups improved steadily and approached this level with three follow-ups (i.e., about 94% coverage level with three follow-ups). The coverage level of the paper mode without any follow-ups was 91%. The coverage with three email follow-ups is slightly better than the paper survey with no follow-ups (Figure 7).

These results suggest that the use of three follow-ups not only improved returns rates, but also reduced nonresponse error and brought coverage nearly to the 95% confidence level.

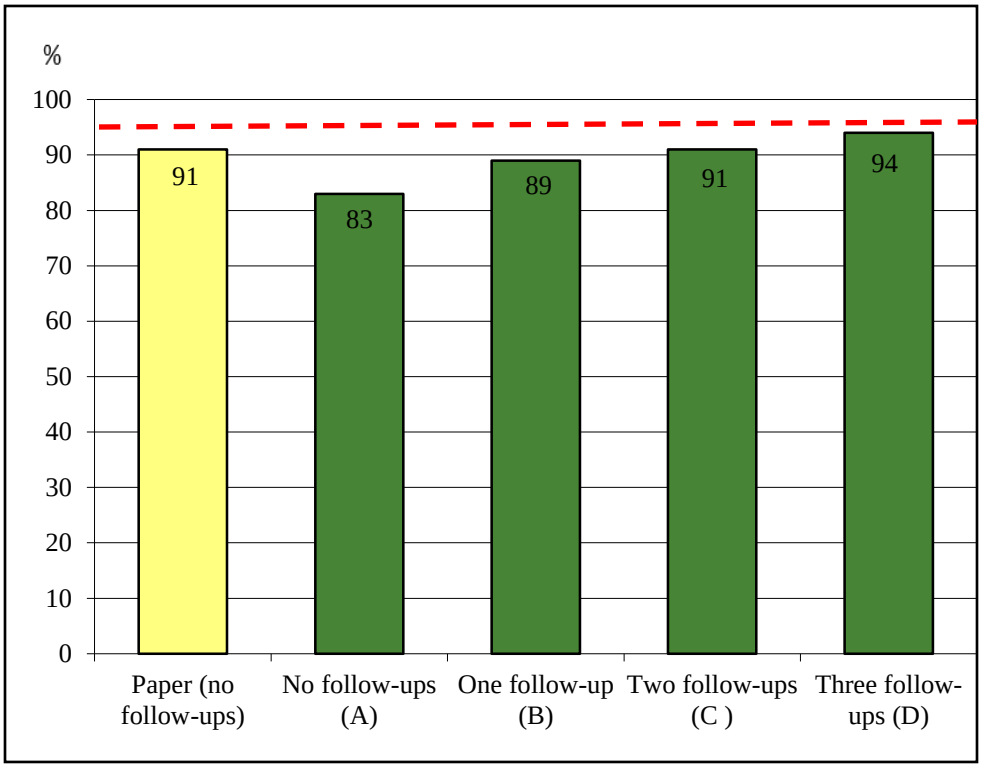

Figure 7. Coverage (%) of 95% confidence interval due to nonresponse bias for percentage of BC residents by follow-up; red-dashed line = 95% confidence level

The pattern of reducing nonresponse bias by increasing follow-ups, however, was not as clear and consistent for other visitor characteristics at Goldstream. For average party size, the relative bias for the paper mode was about 3% while for the web mode it was quite low with no follow-ups (0.3%) and quite high for the

remaining follow-ups (11.6% for one follow-up; 13.4% for two follow-ups; 8.8% for three follow-ups). The pattern that emerged was not consistent with the expected pattern that the relative bias for party size would be low and similar across all follow-ups.

A possible factor that may have contributed to the pattern that emerged for this variable is measurement error (Biemer & Lyberg, 2003) or more specifically the misinterpretation of the word "group" in the questionnaire. For example, sometimes people who use provincial park campgrounds travel with other extended family groups or friends. The respondent may have included a count of several groups travelling together in his/her answer to the question whereas during the interview the interviewer was able to clarify that the question only included people staying overnight at this campsite.[52] In U.S. National Park visitor surveys, party size is recorded during an interview with people in a vehicle, but involves a prior question of whether the group is travelling with others or by themselves. So, having a prior question may help to clarify who is intended by the word "group" for the question. In this study, however, no prior question during the interview nor in the questionnaire were used to determine if the respondent was travelling with extended family or friends.

[52]BC Parks, for example, uses the term "party size" rather than group size. The word "group" was used instead of "party" because it was thought to be a more understandable term.

For average age of respondent, the relative bias for the paper mode was 2.5% while for the web mode with three follow-ups it was 2.3%. However, for the web mode the relative bias did not decrease in a consistent manner (i.e., 9.9% with no follow-ups; 0.9% with one follow-up; 6.0% with two follow-ups; and 2.3% for three follow-ups). For the percentage of females, the relative bias was considerably higher for the paper mode (26%) than for any of the relative biases in the web mode (i.e., -12.0% with no follow-up; 12.6% with one follow-up; 7.6% with two follow-ups; and -8.0% after three follow-ups). For average number of nights spent in any provincial park campground, the relative bias was usually high and inconsistent for the web mode (i.e., ranged from -7.2% for one follow-up to 68.6% for two follow-ups) while for the paper mode it was high (10.6%). Out of a total of 36 confidence levels that were examined, only three reached the 95% confidence level.

In comparing nonresponse bias for these two mixed-modes, several patterns emerge. First, the relative bias for the paper mode with no follow-ups was 5% or less for three of the five variables. An exception to this pattern is the high percentage of females in the paper mode. It is not clear, however, why there would be a high relative nonresponse bias toward female respondents for the paper mode. Second, increasing the number of email follow-ups in the web mode

seemed to be effective in reducing the relative bias for one variable (i.e., location of residence), but seemed to be less effective for other variables. With the exception of average nights spent in British Columbia, which had a large and inconsistent pattern of nonresponse bias, the relative bias with three email follow-ups was about 9% or less for three variables (% female, average age, average party size). The inconsistency of a pattern suggests that either the variable is not affected by follow-ups or measurement error is influencing the pattern (e.g., recalling the total number of nights spent only in BC provincial park campgrounds in the previous year, inconsistent understanding of the word "group'' in the party size question). Third, the coverage of the 95% confidence interval was not reached for many of the variables. Even though increasing the sample size increases the precision of the estimates, if bias exists the confidence levels will likely be lower. Finally, if the selection of the survey mode is based on the selection of one variable (e.g., location of residence) then the web mode with three follow-ups was as effective as or slightly better than the paper mode in reducing nonresponse bias and improving coverage.

4.3 Implication of nonresponse bias for economic impact analysis: an example

Since a key variable of interest in this survey is the location of residence, it is important to understand how the number of email follow-ups to reduce

nonresponse bias might affect different types of economic analyses. One type of economic analysis often used by park agencies is economic impact analysis (Crompton, 2006). This type of analysis is used to identify the economic spinoffs, such as tax revenues and employment, of different park investments (Turco & Kelsey, 1992). Typically, this type of analysis involves identifying park operational expenditures and park visitor expenditures and then using an input/output model (Miernyk, 1965) to estimate the economic benefits of a park investment decision. While information about park operational expenditures and revenues often comes from park agency budget information, park visitor expenditure information is typically obtained from survey data.[53]

Two key survey variables for estimating total park visitor expenditures are the average expenditure per party and the proportion of visitors that are BC residents and non-BC residents. A key measure for this analysis is the amount of expenditures spent by non-residents because this is "new" money coming into the economy (Crompton, 2006). While sometimes this analysis is used for an entire park system (Ministry of Water, Lands and Air Protection, 2001), in other situations it may be used on an individual park basis.

[53]It is recognized that actual camping fee revenues for a park agency are often used rather than the stated fee recorded by the respondent. For the sake of simplicity, in this example the camping fees are based on survey data.

Table 7 provides an illustration of how the number of email follow-ups can affect estimates of park visitor expenditures for Goldstream provincial park campground. These estimates of park visitor expenditures for Goldstream are based on multiplying the average party expenditure by the number of parties for both BC residents and non-BC residents. Since the average party expenditures were not obtained in this survey, this average party expenditure was inflated from a previous estimate in 1999 dollars to 2010 dollars by the BC Consumer Price Index.[54] The average expenditure per party used in this example is $121 for BC residents and $134 for non-BC residents. The total number of camping parties is based on the BC Parks attendance system. The proportion of BC residents and non-BC residents is based on the onsite interviews (both respondents and nonrespondents) and on the respondents obtained in this study.

This table indicates that if no follow-ups were undertaken the total visitor expenditures for non-BC residents would have been underestimated by about $179,000 or 29%. If one follow-up would have been undertaken, total visitor expenditures would have been underestimated by about 17%. With three follow-ups, there would have been a slight overestimate of total visitor expenditures for

[54]In the South Coast Region, the average expenditure per party in 1999 dollars was $100.41 for BC residents and $111.30 for non-BC residents (BC Parks, 2000). Average expenditure per party includes groceries, transportation, entertainment, camping fees and other expenditures. These average expenditures were inflated by the BC CPI from 1999 to 2010 (e.g., 2010 BC CPI =113.8 and 1999 BC CPI =94.4; 113.8/94.4 x $100.41 ~$121).

Table 7. An example of the effect of follow-ups on estimates of non-BC resident visitor expenditures at Goldstream, 2010

Attendance and Expenditures by Location of Residence	Number of Follow-ups							
	None		One		Two		Three	
	Resp. & NonR	Resp.	Resp. & NonR.	Resp.	Resp. & NonR.	Resp.	Resp. & NonR.	Resp.
Total Parties[a]	16,996	16,996	16,996	16,996	16,996	16,996	16,996	16,996
BC resident								
Proportion of total parties[b]	0.72	0.80	0.65	0.71	0.73	0.77	0.69	0.67
Estimated Parties	12,237	13,597	11,047	12,067	12,407	13,087	11,727	11,387
Average exp. per party[c]	121	121	121	121	121	121	121	121
Total Expenditures	1,480,692	1,645,213	1,336,735	1,460,126	1,501,257	1,583,517	1,418,996	1,377,866
Non BC resident								
Proportion of total parties[b]	0.28	0.20	0.35	0.29	0.27	0.23	0.31	0.33
Estimated Parties	4,759	3,399	5,949	4,929	4,589	3,909	5,269	5,609
Average exp. per party	134	134	134	134	134	134	134	134
Total Expenditures	637,690	455,493	797,112	660,465	614,915	523,817	706,014	751,563
Difference in total non-B.C. resident expenditures		-179,179		-134,384		-89,589		44,795
Percent difference		-29		-17		-15		6

[a]Based on BC Parks Attendance System.
[b]Respondent and non-respondents come from interviews; respondent comes from online returns.

non-BC residents. In essence, the use of follow-ups for location of residence tended to decrease the estimated visitor expenditures by BC residents and increase the estimated expenditures for non-BC residents. This finding is consistent with the results obtained by Hunt and Dalton (1983) who examined the effect of a second follow-up on visitor expenditures of skiers in Utah in 1980-81.

4.4 Data quality and comparability

The fourth criterion was to determine if the data quality and responses were similar between the two mixed-mode approaches. One measure of data quality is the completeness of returns or item nonresponse. Table 8 provides a comparison of the average item nonresponse for 20 items where an answer was not forced between the paper and web response modes.[55] Of the 20 items, four items were from behavioural questions, eleven items were from attitude questions and five items were from factual questions.[56] As expected, the overall average item

[55]Three items in the web questionnaire had required answers. One item was party size. If respondents left this question blank, it would be difficult to interpret the answer, whether a blank referred to zero (an impossibility) or a blank. A second item, the number of people 17 years or younger, was conditional on answering the question party size. If respondents did not answer the question about party size, they could not answer the question about number of people who were 17 years or older. A third item was the nights spent in any provincial park campground. Again, a blank answer would be difficult to interpret, whether it referred to a zero or a blank. In the paper survey, it was not possible to control the answers to these three items. Thus, these three items are not included in the item nonresponse table.

[56]The four behavioural items were: use of reservation system; used park before; type of camping shelter used (multiple responses); and average length of stay. Six attitude items were satisfaction ratings with cleanliness of restrooms, cleanliness of grounds, condition of facilities, sense of security, control of noise and ease of making reservation. Another five attitude items were preferences for playgrounds, playfields, availability of Internet service, shower and flush toilet

nonresponse was low and similar between the paper response (1.4%) and the web response (1.0%). Slight differences existed between the two modes for different types of questions, but these differences were all less than 1%. This low overall item nonresponse rate may have been influenced by the unimode construction of the paper and web questionnaires which attempted to minimize differences between the modes as much as possible. The low overall item nonresponse found in this study is consistent with other recent comparisons between paper and web surveys (Messer, 2009; Lesser et al., 2012; Dillman, 2012). The findings from this study suggest that item nonresponse is likely to be low if a web mode is used for this survey.

Table 8. Item nonresponse by type of question for paper and web modes at Goldstream

Type of Question	Paper	Web	Diff.
	Average percent who provided no answer or left blank		
Behavioural (4 items)	0.2	0.5	-0.3
Attitude (11 items)	1.7	0.8	+0.9
Factual (5 items)	1.4	1.9	-0.5
Total	1.4	1.0	+0.4

building and electrical hook-ups for campsites. The five factual items were: availability of shower building in campground, location of residence, provision of postal code, age of respondent and gender of respondent.

Another measure of data quality used in this study is nondifferentiation. An important question in the BC Parks visitor survey is the satisfaction ratings of five park services. In evaluating the face-to-face/paper and face-to-face/web modes, it is important to understand if the respondents would differentiate in a similar manner between these two mixed modes.

Table 9 provides a comparison of the percentage ratings for each scale point and the rho statistic for the two mixed-modes. This comparison is based only on those who answered all five questions. Based on a t-test of the average of individual rho statistics (.39 for paper and .37 for web) for five satisfaction ratings, no statistical difference was found between the paper and web modes. Unlike the study by Heerwegh and Loosveldt (2008) that included a comparison between the face-to-face (presence of interviewer) and web (absence of interviewer) modes, both modes in this experiment were self-administered (no interviewer). The results from this study suggest that respondents seem to differentiate in a similar manner between a paper and web mode.

An important goal of this experiment was to determine whether or not the paper and web modes would provide responses that were similar. It was expected that if

Table 9. Differentiation of responses on a rating scale for paper and web modes at Goldstream

		Rating Scale						Measure[a]			t-test	
Mode		Poor	Below Average	Average	Above Average	Excellent	Total	Mean	S.D.	P_d	t	P
	n	1	2	3	4	5	%					
Paper	214	1	2	17	33	47	100	4.24	0.845	0.39		
Web	149	1	2	15	33	49	100	4.28	0.844	0.37	0.417	0.6772

[a] S.D. is the Standard Deviation and P_d is the Rho statistic

the questionnaires for the two modes were made to look similar, then there would be few differences in the responses. Table 10 presents the comparison of 20 items. Out of these 20 items, 19 items were close-ended and one item was open-ended. A Pearson chi-square test for 18 items was based on 2 x 2 tables (one degree of freedom) because this is how BC Parks staff normally examine the results (e.g., percent excellent and above average for satisfaction ratings). The other two items, average length of stay and average age of respondent, were based on a two-sided t-test.

Only one significant difference (or about 5%) of the 20 comparisons was found in the responses between the two modes (p-value is bolded). This difference was that the paper survey mode (60%) tended to be completed by a significantly higher percentage of women than the web survey (50%). While not quite statistically different at the 95% confidence level, the average length of stay tended to be slightly higher among those completing a web survey than those completing a paper survey. The small number of differences in this experiment is similar to the results obtained by Lesser et al. (2011) in a comparison of paper and web modes for a hunter survey. These results suggest that there is very little difference in the responses between these two modes.

Table 10. Summary of comparison of responses for paper and web modes at Goldstream

Items	Paper		Web		Difference in percent or means (%)[b]	χ^2 or t	p-value	Effect size[d] (Phi or Cohen's d')
	N	Percent or Mean	N	Percent or Mean				
Behavioural								
Used reservation system – no	240	53	166	45	8	2.35	0.1254	0.0761
Used park before – yes	240	56	166	54	2	0.16	0.6853	-0.0201
Camping shelter used –tent	239	49	166	52	-3	0.47	0.4939	-0.0340
Average length of stay – nights	239	3.0	163	3.4	13	1.92	0.0562	-0.2000
Opinion (excellent and above average)								
Cleanliness of restrooms	231	71	157	79	-8	3.12	0.0776	-0.0896
Cleanliness of grounds	239	90	166	91	-1	0.04	0.8420	-0.0099
Condition of facilities	229	89	160	84	5	1.95	0.1626	-0.0708
Sense of security	236	84	166	85	-1	0.08	0.7773	-0.0141
Control of noise	230	67	160	74	-7	2.06	0.1508	-0.0727
Ease of making reservation[a]	136	75	108	73	2	0.11	0.7427	-0.0210
Preference for services and facilities (essential and desirable)								
Playgrounds	236	59	165	52	8	2.40	0.1211	-0.0774
Playfields	237	51	162	46	5	1.11	0.2914	-0.0528

Availability of Internet service	237	37	164	45	-7	2.20	0.1382	0.0740
Shower and flush toilet building	227	96	164	92	4	2.13	0.1442	-0.0739
Electrical hook-ups	237	51	164	53	-2	0.23	0.6341	0.0238
Factual								
Shower available (skip) – yes	237	97	165	94	4	3.17	0.0750	-0.0888
Location of residence – BC	240	67	166	73	-6	1.78	0.1816	-0.0663
Provision of postal code – yes	240	98	166	98	1	0.28	0.5964	0.0263
Average age of respondent	235	44	158	45	2	0.06	0.8078	0.0382
Gender or respondent – female	235	60	163	50	11	4.50	**0.0339**	-0.1063
Percent of items with difference of 10% or more					10			
Mean percentage point difference					5			

[a]Based on only those who made a reservation.
[b] Percents are rounded.
[c] Based on Vaske (2008), the labels for Phi (all except average length of stay and average age) are: 0.1 = minimal relationship; 0.5 = typical relationship and 0.8= substantial relationship. The labels for Cohen's d' (average length of stay and average age) are: .20= minimal relationship; .50 = typical relationship; and .80= substantial relationship (Vaske, 2008).

4.5 Cost of data collection

The fifth criterion was to determine which mixed-mode approach was cheaper. Costs for surveys are often not conveyed because of the competitive nature for contracts (Hochstim, 1967).

Specific costs can also vary from one survey to the next depending on what is included in the cost estimate. The primary focus of this experiment was on data collection costs because the costs for sampling, questionnaire design and analysis are usually fixed costs and may not vary much between face-to-face/paper and face-to-face/web approaches. The major data collection cost items included for this experiment were:

Supplies - For the paper survey, the cost per package for 400 questionnaires was slightly over $4.00 per package. These printing costs included an eight page booklet (fully coloured, stapled, numbered), cover letters, outer envelopes, return envelopes, golf pencil and packaging costs. The packaging costs involved stuffing the envelopes in a manner designed to be effective in mail surveys (Dillman,1978, pg. 181). By comparison, the cost of printing the postcard for the web survey was about $0.20 each.

Data Processing - For the paper survey, this category included costs for postage paid returns (i.e. about 25% of all paper returns) and data entry ($1.30 per return) of the questionnaire.[57] The web programming costs for Goldstream were averaged for two years (i.e., 2010 and 2011) because there were considerable start-up costs in the first year and for 13 campgrounds to obtain a cost per campground.[58] The costs for data entry of the Interview Form were about $0.82 per record. [59]

Field Work and Monitoring - While the author undertook the interviews and recorded hours of interviewing for each day, it seemed more appropriate for this cost comparison to use an estimated hourly rate of park operators who would normally be required to undertake this task. [60] The cost for reviewing interview forms, monitoring online returns and undertaking follow-ups was based on a rate

[57]The data entry was done by the author. The data entry costs here are based on previous actual costs of data entry for double entry.

[58]It should be noted that web programming costs can vary greatly depending on whether an available software package is used or a programmer is hired and whether the survey is used one-time or a number of times. In an initial pilot study conducted in 2009, a software package called Cogix purchased by the Ministry of Environment was used. This package, however, was difficult to develop the layout required for this survey (e.g., graphic symbols for camping equipment). The company also charged an additional fee as the number of returns increased. In 2010, a web programmer was hired to prepare the layout of the survey using cascading style sheets and HTML (hypertext markup language) tables. The programming costs were $7,245 in 2010 and $3,000 in 2011 for an average cost of $5,123 per year. The average cost per campground, based on 13 campgrounds, was nearly $400.

[59]This was based on a contract with Simon Fraser University.

[60]In 1999/2000 BC Parks undertook a study to estimate the economic benefits of BC provincial parks. This involved a regional inventory of all hours and total value of contracts. The overall weighted average for all regions was $12.45 per hour. This was inflated by the BC Consumer Price Index from 1999 to 2010 to obtain an hourly rate of $15.00 per hour in 2010 (i.e., 2010 BC CPI =113.8 and 1999 BC CPI =94.4; 113.8/94.4 x $12.45 = $15.00). Travel costs are not included in these interviewer costs because many park facility operators are on-site or live nearby.

of $20 per hour.[61] It should also be noted there are no interviewer training costs because the author undertook the interviews.

A cost comparison of the two approaches is presented in Table 11. On a cost per completed return that includes interviewing costs, the face-to-face/web approach ($12.74) was about 9% lower than the face-to-face/paper approach ($13.95). A factor that contributed to the higher cost per return for the paper survey was the printing and packaging cost for the paper questionnaire (i.e., about 49% of the total cost for the paper mode compared to about 4% for the web mode). The paper questionnaire was printed in full colour to ensure it would look the same as the web questionnaire. Clearly, the cost of preparing postcards represents a considerable cost savings compared to printing coloured questionnaires. If the printing of the paper questionnaire would be in black and white, the cost savings are likely to be lower.

The data processing costs were similar between the two modes ($697 for paper compared to $739 for web). While the data entry costs of the Interview Form were relatively the same for the two modes, the web programming costs were higher than data entry costs of the paper questionnaire. These web programming costs,

[61]BC Parks hired a co-op student to assist with this survey and other tasks during the summer of 2010. The hourly rate, including vacation benefits, was about $20 per hour.

Table 11. Comparison of data collection costs for two approaches at Goldstream, 2010

Cost Items	Face-to-face/paper		Face-to-face/web	
	Number	Cost ($)	Number	Cost ($)
A. Supplies				
Printing	400	1,375	0	0
Packaging	400	252	0	0
Postcards			400	80
B. Data Processing				
Postage - Business reply	59	50		
Data Entry - Paper Questionnaires	240	312	0	0
Data Entry - Interview Forms	408	335	413	339
Web Programming				400
C. Field work and Monitoring				
Onsite Interviews	63	945	64	960
Monitoring returns	4	80	17	336
Total returns/ Total Costs	240	3,349	166	2,115
Average cost per questionnaire		*13.95*		*12.74*
Average cost per questionnaire without interview costs		*10.02*		*6.96*

however, assume a similar survey would have been used for two years rather than just on a one-time basis. If the web programming costs were only done on a one-time basis, the web programming costs would be much higher. This suggests that if the cost of web programming is kept similar after an initial development, the average cost per year for web programming is likely to be quite similar.

The cost of monitoring returns was considerably higher for the web survey than for monitoring returns for the paper survey (about $336 for web compared to $80 for paper). While the monitoring of returns for the paper survey did not include any follow-ups as occurred in the web survey, it should be noted that the task of monitoring and conducting follow-ups for this survey involved considerable effort in checking whether access codes and email addresses were correct and responding to both telephone and email enquiries from online respondents trying to gain access to the web survey. Web surveys are very exacting and if one character is incorrect in an email address, a bounceback can occur with an attempted email follow-up. If an access code has been incorrectly entered during data entry, then respondents may not be able to complete the survey. For this monitoring, there may be "hidden" supervisory costs that are not included in the direct labour costs or contracts. While these hidden costs do not represent "out-of-pocket" costs (i.e., contract costs or receipts), they can prevent in-house staff from focusing on other projects.

The costs of interviewing were similar between the paper and web modes. If interviewer costs are excluded, as may occur in some situations where interviews are conducted as part of park staff or park contractors' responsibilities, the average cost per return was $10.02 for the face-to-face/paper mode and $6.96 for the face-to-face/web mode. Under these conditions, the cost per return for the web mode was about 30% cheaper than the paper mode.

4.6 Summary

One key purpose of the total survey error approach is to compare survey errors and practical constraints for two or more survey approaches. This comparison can help to facilitate the selection of the most optimal survey design (Biemer, 2010) or evaluate the implications of shifting from one survey approach to another approach (Hochstim, 1967).

The intent of this experiment was to evaluate two mixed-mode approaches for several sources of survey errors and costs. One criterion was the potential for coverage error. The non-use Internet rate at this campground was very low. While non-use Internet visitors tend to be older and have a smaller group size than Internet visitors, the potential for coverage bias is low. If similar non-use Internet rates are obtained in other campgrounds throughout the British Columbia, then the

use of a web mode may only keep a very small proportion of park visitors from completing the web survey.

A second criterion was the response rates. While both modes had low refusal rates and the web mode had a high email collection rate, the response rate was considerably higher for the paper mode than the web mode. With email follow-ups, however, return rates for the web mode increased steadily until the second email follow-up and then tapered off in the third follow-up. The return rate for the web mode with three follow-ups was similar to the paper mode with no follow-ups.

A third criterion was the potential for nonresponse error. For the location of residence, the nonresponse relative bias decreased consistently with increased follow-ups. The use of three email follow-ups produced similar levels of nonresponse bias and coverage as the paper mode with no follow-ups. For other variables in the web mode, the effect of increasing follow-ups on nonresponse bias was less clear and consistent suggesting there may be measurement errors or other factors affecting this bias. For other variables in paper mode, the relative biases were around 3% with the exception of gender (26%) and the nights spent in previous year (11%).

A fourth criterion was data quality and comparability. Based on nearly all questions, the average item nonresponse was very low for both modes. For the satisfaction ratings of five park services, respondents also differentiated in a similar manner for both modes. A comparison of the responses between the two modes indicated few differences. A key difference was proportion of females, but the nonresponse bias for this variable tended to be much higher in the paper mode (26.1%) than in the web mode with three follow-ups (-8.0%).

A fifth criterion was the costs of data collection. In terms of data collection costs, the web mode provides about a 9% cost saving if the costs of interviewing are included in the data collection costs and a 30% cost saving if interviewer costs are not included in these costs. Even though there are likely to be hidden costs, over time the web survey is likely to reduce the overall costs of the project. If these cost savings are maintained over five years, then the use of face-to-face/web mode is likely to provide a considerable cost savings over the face-to-face/paper mode.

Overall, in comparing these two mixed-mode approaches for survey errors and costs, this experiment suggests the potential of coverage error is low for the web mode at this campground, the data quality and responses for many variables is similar between the two modes and the cost per return is slightly lower for the

web mode. It also suggests that if a key variable of interest is the location of residence, a web mode with three follow-ups is slightly more effective than the paper mode in reducing nonresponse error and improving coverage. Finally, it suggests that measurement error for other demographic variables (e.g., party size) needs to be examined more closely if the use of the web mode for this survey is continued.

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CHAPTER FIVE

RESULTS FOR EXPERIMENT AT TWELVE INDIVIDUAL CAMPGROUNDS

A second purpose of using the total survey error paradigm is to examine several sources of survey error for a given survey design to facilitate the best allocation of limited resources. The first three criteria used in the Goldstream experiment were also used to assess the potential sources of error for the face-to-face/web approach in this experiment.

5.1 Response and coverage

The first criterion was the response rate. Table 12 indicates that out of 3,865 eligible contacts, 1,544 completed a web questionnaire for a combined response rate of 40%, with the range being 30% to 51%. Using the personalized delivery/paper approach, the mean response rate for the 21 U.S. National Parks from 1988 to 1990 was about 75%, with a range from 63% to 85% (Dillman et al., 1995a). The response rates for the 12 campgrounds, however, are based on returns from about one-quarter of potential respondents receiving no email follow-ups, one-quarter receiving one email follow-up, one-quarter receiving two email follow-ups and one-quarter receiving three email follow-ups while in the U.S. National Park visitor surveys potential respondents received two to three follow-ups (i.e., there was not an experimental design where one-quarter received no follow-ups, etc.). The combined response rate for the 12 campgrounds was the

Table 12. Response and non-use Internet rate at 12 individual campgrounds

Region/Campgrounds	(1) Number of groups contacted	(2) Refusal rate (%)	(3) Number of groups interviewed	(4) Non-use Internet rate (%)	(5) Number of groups who accepted question-naires/ postcard	(6) Email collection rate (%)	(7) Number of returns	(8) Return rate (col 7/ col 5)	(9) Response rate (col 7/col 1)
South Coast									
Englishman R.	386	1	382	2	371	93	162	44	42
Little Qual.	400	7	373	2	366	98	195	53	49
China Beach	286	6	268	4	208	80	99	48	35
Ralph River	296	13	257	2	244	47	104	43	35
Porteau Cove	258	1	255	2	230	97	132	57	51
Southern Interior									
Monck	360	1	357	4	302	99	141	47	39
Gladstone	268	9	244	4	229	99	121	53	45
Okanagan Lk.	389	2	381	12	267	92	123	46	32
Moyie Lake	365	1	363	1	359	59	110	31	30
MacDonald Cr.	293	3	285	3	265	97	133	50	45
Nothern BC									
Kinaskan Lk.	260	1	257	1	250	98	119	48	46
Lac La Hache	304	7	282	15	222	97	105	47	35
Combined	3,865	4	3,704	4	3,313	88	1,544	47	40

same as the response rate obtained for the web mode in the Goldstream experiment (i.e., 40%).

The combined refusal rate for the 12 campgrounds was about 4% ranging from 1% to 13%. By comparison, the range of refusal rates for the 21 U.S. National Park visitor surveys from 1988 to1990 ranged from 2% to 15% (Dillman et al., 1995). The combined refusal rate for the 12 campgrounds was similar to the refusal rate at Goldstream (i.e., 4%) and further indicates that a short interview can be effective at obtaining some information about visitor characteristics for both respondents and nonrespondents.

The combined email collection rate for the twelve campgrounds was 88% which was about 11 percentage points lower than the Goldstream email collection rate. Three campgrounds had considerably lower email collection rate (i.e., Ralph River in Strathcona Provincial Park, 47%; Moyie Lake, 59%; China Beach, 80%) than the other nine campgrounds (i.e., 92% or higher). The reasons for the lower email collection rates at these three campgrounds may have been influenced by several factors.

One factor may be the personal attitudes of interviewers against obtaining email addresses from respondents (e.g., I wouldn't give my personal email address to the government so I would not expect respondents to provide their email address). Some recent research on evaluating interviewer performance, for example, suggests that some interviewers may follow the maxim "do as you would be done by" (Blom & Korbmacher, 2013) and thus may have higher item non-response. At these campgrounds, some interviewers may not have made much effort at persuading respondents to provide their email address because they themselves would not provide this information.[62]

A second factor may be a lack of social skills, such as being a poor conversationalist or being unfriendly, when interacting with potential respondents (Morton-Williams, 1993). For example, some interviewers may have had more difficulty in probing and understanding the reasons why some respondents were reluctant to provide their email address and lacked the skill to adroitly reduce concerns about providing this information. During the monitoring of forms, an attempt was made to provide step-by-step guidance in getting a "yes" for obtaining an email address. At the same time, it was not possible for the author to

[62]Margaret Littlejohn also suggests that a similar situation can occur when asking a respondent's age. If the interviewer feels this is an inappropriate question, they may be less likely to ask or refuse to ask this question (personal communication on October 14, 2009).

be on-site to observe interviewers at these campgrounds or to permit interviewers to observe the author undertaking interviewers due to budget constraints (i.e., role playing; Patterson, Grenny, Maxfield, McMillan, & Switzler, 2008). While the email collection rates at Goldstream and at the nine individual campgrounds suggest it is possible to obtain email addresses from a high proportion of park visitors, the lower email collection rates at three campgrounds suggests this is a challenging task for some interviewers.[63]

The second criterion was the non-use Internet rate. The combined non-use Internet rate at the 12 campgrounds was about 4% with a range from 1% to 15%. Two particular campgrounds that had high non-use Internet rates were Okanagan Lake (12%) located in the southern interior region of British Columbia and Lac La Hache (15%) located in the northern region of British Columbia. While the combined non-use Internet rate suggests that the potential for coverage error is low, there seems to be some campgrounds where coverage bias could occur.

To better understand the potential of this bias, characteristics for non-use Internet visitors and Internet visitors were examined (Table 13). This comparison indicates

[63]The two factors suggested here are based on a feedback form completed by park facility operators after the survey, on-going communication with these operators during the implementation of the survey and some of the literature on interviewer behaviour and characteristics. Further emphasis on training would likely help to improve the email collection rates.

Table 13. Characteristics by non-use Internet visitor and Internet visitor at twelve campgrounds

Visitor Characteristics	Non-Use Internet Visitor	Internet Visitor	χ^2 or t	p-value	Effect Size[a] (Phi or Cohen's d')
Location of residence					
British Columbia (%)	76	70			
Outside B.C. (%)	24	30			
Total respondents	154	3540	2.15	0.1425	-0.0241
Gender of respondent					
Female (%)	53	45			
Male (%)	47	56			
Total respondents	154	3542	3.08	0.0791	0.0289
Group Size					
1 – 2 people (%)	82	54			
3 – 4 people (%)	11	31			
5 – 6 people (%)	5	11			
7 – 10 people (%)	2	4			
Total respondents	152	3533			
Mean (s.e.)	2.3 (.09)	3.1 (.03)	7.30	0.0000	-0.5246
Age of respondent					
18 - 34 years (%)	12	22			
35 - 54 years (%)	22	49			
55 years & older (%)	66	29			
Total respondents	156	3498			
Mean (s.e.)	57 (1.29)	46 (.23)	8.30	0.0000	0.7293

Nights Previous Year					
0 Nights	30	29			
1 - 5 nights (%)	24	23			
6 - 10 nights (%)	18	23			
Over 10 nights (%)	28	25			
Total respondents	149	3486			
Mean (s.e.)	8.2 (.87)	7.5 (.15)	0.78	0.4366	0.0714

[a]Based on Vaske (2008), the labels for Phi (location of residence, gender) are: 0.1 = minimal relationship; 0.5 = typical relationship and 0.8= substantial relationship. The labels and Cohen's d' (average group size, average age and average nights spent in previous year) are: .20= minimal relationship; .50 = typical relationship; and .80= substantial relationship (Vaske, 2008).

that non-use Internet visitors tended to be older and have a smaller party size. These results are quite similar to the results obtained at Goldstream. The effect size for these variables at the 12 campgrounds also suggests there is a stronger relationship between age and Internet use than the relationship between average party size and Internet use. While the combined non-use Internet rate at the 12 campgrounds is low, these results suggest that the use of a web only mode could keep some older campers and smaller parties from responding to the survey. If a campground attracts many older campers and smaller parties who do not use the Internet, the use of this mode could contribute to coverage bias.

5.2 Effect of follow-ups on return rates and nonresponse error

The third criterion was to determine the effect of each follow-up on return rates and nonresponse error. This effect was examined at both the combined level and the individual park level. At the combined level, the Cochran-Mantel-Haenszel (C-M-H) general association test (Table 14) indicated statistically higher return rates with each follow-up (i.e., 27% for no follow-up; 45% for one follow-up; 53% for two follow-ups; and 62% for three follow-ups). The pattern of increasing return rates with each follow-up is similar to Goldstream except there tended to be a higher number of returns in the first follow-up and third follow-ups (i.e., at Goldstream the return rates were 25% for no follow-ups; 32% with one follow-up, 53% for two follow-ups; and 59%

Table 14. Effect of follow-ups on return rates at 12 campgrounds

Campgrounds	No follow-up (Card A) N	Return rate (%)	One follow-up (Card B) N	Return rate (%)	Two follow-ups (Card C) N	Return rate (%)	Three follow-up (Card D) n	Return rate (%)	Chi-Square Test χ^2	P	J.T. test[a] p-value
Englishman River	95	23	92	48	94	40	90	64	33.1	<.0001	0.0000
Little Qualicum	92	34	94	54	90	60	90	66	21.3	<.0001	0.0000
China Beach	49	31	55	36	51	57	53	66	17.4	0.0006	0.0001
Ralph River	59	37	62	45	62	52	61	36	4.0	0.2646	0.9366
Porteau Cove	58	28	58	66	56	64	58	72	29.1	<.0001	0.0000
Monck	77	19	76	46	74	55	75	67	37.2	<.0001	0.0000
Gladstone	57	35	59	47	58	69	55	60	15.1	0.0018	0.0011
Okanagan Lake	66	32	65	45	68	46	68	62	12.2	0.0067	0.0009
Moyie Lake	90	17	87	31	92	33	90	41	13.3	0.0040	0.0005
MacDonald Creek	67	24	67	39	65	62	66	78	44.7	<.0001	0.0000
Kinaskan Lake	64	25	64	45	62	56	60	65	22.5	<.0001	0.0000
Lac La Hache	58	22	53	42	55	56	56	70	28.2	<.0001	0.0000
Combined	832	27	832	45	827	53	822	62	226.0	0.0001[b]	

[a] Jonckheere- Terpstra test for ordered alternatives
[b] Based on Cochran-Mantel-Haenszel general association test with campgrounds as the stratification variable.

with three follow-ups). On the individual campground basis, the Jonckheere-Terpstra test of ordered alternatives revealed that return rates increased as the number of follow-ups increased for eleven of the twelve campgrounds.[64]

Nonresponse bias was also examined for five visitor characteristics at 12 individual campgrounds (Table 15). For the proportion of campers from British Columbia, the relative bias decreased sharply from no follow-ups (16.6%) to one follow-up (3.2%) and two follow-ups (3.3%), but then rose again for three follow-ups (6.5%). Coverage levels also improved from no follow-ups to one and two follow-ups, but dropped for the third follow-up. While the direction of reducing relative bias and improving coverage for this variable at the 12 campgrounds is similar to the one found at Goldstream, it is not as clear and consistent as occurred at Goldstream (i.e., the relative bias was 11.1% for no follow-ups; 8.7% for one follow-up; 4.8% for two follow-ups: and -2.2% for three follow-ups). While the third follow-up in the 12 campgrounds increased the overall sample size from two follow-ups for the proportion of campers from BC (i.e., from 438 respondents in the second follow-up to 506 respondents in the third follow-up), it seemed to work disproportionately better on campers from British Columbia than campers from outside British Columbia. This finding of overrepresentation of a specific

[64]There is no equivalent statistical test for the Jonckheere-Trepstra test for examining more than one campground at a time.

group is similar to the one found by Moore and Tarnai (2002) in their study of family and pediatric physicians. They found that a 24 week follow-up by priority mail accentuated or overrepresented the proportion of family physicians when compared to the sampling frame.

For the average age of the respondent at the 12 campgrounds, the relative biases also decreased slightly with increasing follow-ups, but not in a consistent declining manner with each follow-up (6.4% with no follow-ups; 4.1% with one follow-up; 5.8% with two follow-ups; and 3.6% with three follow-ups). The range of relative biases for this variable, however, is similar to Goldstream (i.e., 0.9% with one follow-up to 6.0% with two follow-ups). The coverage at Goldstream (ranging from 70% to 95%), however, is much higher than at the 12 individual campgrounds (ranging from 1% to 18%). A primary reason for the lower coverage level at the 12 campgrounds is that the standard errors are reduced because of the larger sample sizes. So, while increasing the sample size provides more precise estimates, the estimates will be incorrect because of the bias. While the specific reason(s) for the higher positive bias for average age (i.e., up to three years older for respondents) is difficult to determine from the data, it may not be influenced by using a web mode because Internet users who responded tended to be older not younger.

Table 15. Nonresponse bias for selected visitor characteristics at 12 campgrounds

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Respondents		All[a]		Measures[b]			
Visitor Characteristics	N	Proportion or Mean	s.e.	n	Proportion or Mean	Bias as (col 2 - col 5)	Relative bias (%) (col 6/col 5)*100	Bias/s.e. (col 6/ col 3)	Coverage (%) of nominal 95% confidence interval (col 2) due to bias (col 8)
From BC (%)									
Web (0 follow-ups)	222	0.80	0.03	832	0.69	0.11	16.6	4.3	1
Web (1 follow-up)	377	0.72	0.02	832	0.70	0.02	3.1	0.9	84
Web (2 follow-ups)	438	0.74	0.02	827	0.72	0.02	3.3	1.1	79
Web (3 follow-ups)	506	0.76	0.02	821	0.71	0.05	6.4	2.4	33
Female (%)									
Web (0 follow-ups)	216	0.55	0.03	832	0.45	0.10	21.3	2.9	19
Web (1 follow-up)	375	0.57	0.03	832	0.48	0.09	19.3	3.6	5
Web (2 follow-ups)	430	0.54	0.02	827	0.45	0.09	19.9	3.7	4
Web (3 follow-ups)	505	0.53	0.02	822	0.44	0.09	20.0	4.0	2
Age of respondent (Mean)									
Web (0 follow-ups)	217	49.7	0.87	824	46.7	3.0	6.4	3.4	7
Web (1 follow-up)	370	47.3	0.63	821	45.4	1.9	4.1	3.0	15
Web (2 follow-ups)	420	49.2	0.64	822	46.5	2.7	5.8	4.2	1
Web (3 follow-ups)	496	48.7	0.59	813	47.0	1.7	3.6	2.9	18
Group size (Mean)									
Web (0 follow-ups)	214	3.4	0.13	827	3.0	0.4	11.7	2.8	21
Web (1 follow-up)	366	3.5	0.10	831	3.2	0.4	12.5	3.8	3
Web (2 follow-ups)	423	3.4	0.09	826	3.1	0.3	9.3	3.0	14
Web (3 follow-ups)	489	3.3	0.08	821	3.0	0.3	12.0	4.4	1

Nights Previous Year (Mean)									
Web (0 follow-ups)	219	9.7	0.54	824	7.4	2.3	30.3	4.2	2
Web (1 follow-up)	369	9.6	0.46	821	7.8	1.9	23.9	4.0	2
Web (2 follow-ups)	433	9.7	0.46	811	7.3	2.4	32.4	5.1	0
Web (3 follow-ups)	502	9.5	0.37	810	7.9	1.6	19.8	4.2	1

[a] All includes both respondents and nonrespondents
[b] Computation for column 9 based on equation 3 (Bethlehem, 2009, pg. 224).

For average party size at the 12 campgrounds, the relative bias ranged from about 9% to 13%. When relative biases for average party size at the 12 campgrounds were examined by number of follow-ups, there was little variation in the relative bias. The lack of an effect of follow-ups for this variable was expected, but it was not expected that the relative bias would be high because party size is often required for security reasons and is placed on the camping fee receipt that campers receive (i.e, the McBee permit). As with the Goldstream experiment, it is likely that the pattern of higher and consistent relative positive bias in average party size is due to measurement error.

For the proportion of women, there was about a 20% relative positive bias for each follow-up. Increasing the number of follow-ups had no effect on reducing the relative bias for the proportion of women. One factor which may be affecting this relative bias for proportion of women is the use of the most recent birthday method for respondent selection. Recent research suggests that women are overrepresented in mail surveys when a birthday method is used (Battaglia, Link, Frankel, Osborn, & Osborn, 2008). This study does not specify why women are overrepresented, but it does indicate some of the reasons respondents do not adhere to the request for a certain respondent to complete the questionnaire. Some the reasons were that the respondent does not want do it (29%), does not have time (9%) or is away (8%). In addition, when asked how it was decided who

should complete the questionnaire, they found that a number of respondents indicated one adult always fills out the forms and does the paperwork (13%) and the person selected does not complete surveys and forms (12%). While it is difficult to determine whether or not these reasons are contributing to overrepresentation of women at the 12 campgrounds, one possible way to help reduce this bias may be for interviewers to emphasize the person completing the interview should also complete the web survey.

For the average number of nights spent in any BC provincial park campground in the previous year, the relative biases ranged from 20% to 32%. The effect of follow-ups again did not show a consistent pattern in reducing the relative biases. This inconsistent and high bias is likely due to the difficulty of recalling exactly the number of nights spent in any BC provincial park campground about a year later.[65]

[65]Two factors may have influenced the accuracy of this recall and the bias in the answer to this question. One factor is the presence of an interviewer for the onsite interview and the absence of an interviewer for the web survey. For the onsite interview, interviewers may have helped respondents distinguish between a provincial park campgrounds and other campgrounds by knowing the names of provincial park campgrounds (i.e., compared to names of forestry campsites, National Park campgrounds). By contrast, the web survey had no interviewer and no aids, like a drop down list of provincial park campgrounds, to help respondents distinguish between different types of campgrounds and the number of nights spent in each type of campground (Schwarz, 2011). A second factor is the question order. For the onsite interview, this was the first question. Given that this was the first question of the onsite interview and with the assistance of the interviewer, the respondent may have taken more time to think to carefully and thoughtfully to consider this question before answering it (e.g., at Golstream, for example, some respondents would name a campground, ask the interviewer if it was a provincial park campground and consult with others in the party about number of nights spent there and then repeat the process for each campground before finally giving an answer to the question). By

In summary, these results about nonresponse indicate that increasing the number of follow-ups worked fairly well for one variable (i.e., the proportion of BC residents). For this variable, it was expected the use of follow-ups would draw in more non-BC residents because they may be less likely to return to camp next year in a BC provincial park campground and the post incentive (e.g., an opportunity to win two nights of free camping in 2011) would have little appeal for them. These results indicate the use of one to two follow-ups reduced the relative bias considerably for this variable. This pattern also emerged in the Goldstream experiment. Thus, if location of residence is required for economic impact analysis, providing one to two follow-ups will reduce nonresponse bias.

For the other four variables (average age of respondent, average group size, proportion of women respondents, average number of nights spent in any BC provincial park campground in the 2009), the use of follow-ups was not effective at reducing nonresponse bias. For these four variables, it likely would be more prudent to use cognitive interviews with potential respondents to gain a better understanding of the difference between the results obtained in the interview and in the web questionnaire and then to redesign the question.

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contrast, this was the last question in the web survey. Some respondents may have been multitasking (Heerwegh & Loosveldt, 2008) and may have been in a hurry to complete the survey. Thus, they may have given less time and careful thought in answering this question on the web survey.

These results about nonresponse bias also raise an important question for survey designers and users. What is an acceptable level of bias? Even though some statisticians have suggested that the bias should be less than 1/10 of the standard deviation (Cochran, 1977, pg. 14) the answer to a large extent depends on the particular use of a survey or a specific question in the survey (Biemer & Lyberg, 2003). For example, if the survey results indicate that the average age of a respondent is three years higher than what it should be, then this likely would not have practical importance for park management purposes. On the other hand, a relatively small change in proportion of BC residents can have a considerable effect on the estimates of total expenditures of visitors from outside of British Columbia.

5.3 Time constraints

In trying to reduce survey errors, many survey researchers are faced with time constraints (Weisberg, 2005). A key factor which can affect this constraint is the length of the data collection period. While the speed of response to an initial contact or to a follow-up for a web survey is usually faster than a paper surveys (Dillman et al., 2009; Israel, 2010), the data collection period for this survey lasted a total of 191 days (May 24 to November 30, 2010) or slightly more than half a year. A question that arises is what would have happened to the results if

the data collection period was shortened? To help address this question, two approaches and their effect on survey quality are examined.

One approach to shorten the data collection period is to reduce the number of days the web survey is left open or "live". Table 16 presents the number of cumulative returns and the return rate for each type of follow-up by five different time periods: (a) prior to the first follow-up period; (b) the first follow-up period; (c) period between the first and second follow-up; (d) the second follow-up period; and (e) the period between the second follow-up and the close of the survey. Each of the two follow-up periods includes three follow-ups with each lasting about a week. The first day of each follow-up indicates the date when an email follow-up was sent to nonrespondents.

This table reveals several patterns of reducing the data collection period. First, for the group with no follow-ups, the return rate prior to any follow-ups (i.e., August 17) is about 16% and then increases to about 25% or 208 cumulative returns by September 10. By this date, which is five days after the end of the field interviews, the cumulative online returns for this group would account for about 94% of all the completed returns. If the survey contained no email follow-ups and the cut-off date for accepting online returns was September 10, the data collection period could be reduced by nearly three months. This reduction in the data

Table 16. Cumulative returns and return rate by date at 12 campgrounds

Time Periods	Days After Start of Survey	Number of Email Follow-ups: None Cum Returns	None Return Rate %	One Cum Returns	One Return Rate %	Two Cum Returns	Two Return Rate %	Three Cum Returns	Three Return Rate %
Total returns			833		832		827		822
A. Prior to Followups									
May 24 to Aug. 16[a]	1 - 85	137	16	135	16	119	14	117	14
B. First Follow-up Period									
First - Aug. 17 – 24	86 - 93	159	19	193	23	191	23	177	22
Second - Aug. 25 - Sept. 2	94 - 102	189	23	221	27	235	28	241	29
Third - Sept. 3 -10	103 - 110	208	25	238	29	252	30	281	34
C. Between First and Second Follow-up Period									
Sept 11 to Oct. 11	111 - 141	219	26	257	31	271	33	298	36
D. Second Follow-up Period									
First - Oct. 12 – 19	142 - 149	219	26	306	37	325	39	344	42
Second - Oct. 20 – 27	150 - 157	221	27	374	45	427	52	459	56
Third - Oct. 28 - Nov. 4	158 - 165	222	27	376	45	431	52	502	61
E. After Second Follow-up Period									
Nov 5 - Nov. 30	166 - 191	222	27	377	45	438	53	507	62

[a] Cumulative returns and return rates for each period based on last day of period (e.g., Aug. 16)

collection period, however, would lead to results being based on a much smaller sample size, a lower return rate and potentially higher nonresponse bias for some visitor characteristics (e.g., a relative bias of around 16% for proportion of BC residents).

Second, by the end of November 4 or about 2 months after the end of field interviews nearly all the online returns were obtained for all four options (100% for no follow-ups; 99% for one- follow-up; 98% for two follow-ups; 99% for three follow-ups). Thus, it seems that the survey could have been closed nearly a month earlier without affecting the precision of the estimates and nonresponse bias to any great degree.

A second way to reduce the data collection period would be to reduce the number of follow-ups. While in the previous section (5.2) nonresponse bias could be determined for five visitor characteristics by number of follow-ups, it could not be determined for the substantive results (e.g., satisfaction with visitor services, preferences for services). These substantive results are an important part of the survey. As a beginning step in considering the potential effect of reducing the number of follow-ups on the results, it is important to understand if there are any differences in the types of questions and specific variables for the substantive results by number of follow-ups (Crompton & Tian-Cole, 2001).

To examine the potential differences, 102 statistical tests (either t-tests or Pearson chi square tests) were undertaken (Table 17). Two findings emerge from this analysis. First, out of the total number of tests, only two significant differences (2%) were found (in bold print in Table 17) and this occurred with only one variable (i.e., the percentage of tent only campers). There were no other significant differences in factual/behavioural questions and there were no significant differences in any of the opinion items.

Second, no significant differences were found in any of the comparisons between two follow-ups and three follow-ups. While this does not suggest there is no nonresponse bias in these variables, it does imply a third follow-up would not affect the substantive results for nearly all the questions. The exception is the percent of tent campers which was significantly higher in one follow-up (38%) than in two follow-ups (31%) and three follow-ups (32%). No difference, however, was found between the second follow-up and third follow-up for this variable. To determine if nonresponse bias exists for this question, it may be possible to add another question to the interview form. When Table 16 is examined, it suggests that reducing the number of follow-ups from three to two could reduce the data collection period by several weeks.

Table 17. Camper characteristics and opinions by follow-ups for 12 campgrounds

Items	Follow-ups (percent or mean)				p-values[a]					
	A = None	B = One	C = Two	D = Three	A vs B	A vs C	A vs D	B vs C	B vs D	C vs D
Factual/Behavioural										
Used reservation system – no	59	55	58	57	0.2981	0.7840	0.5367	0.3507	0.5731	0.6770
Used park before – yes	45	47	51	52	0.5345	0.1058	0.0630	0.2499	0.1529	0.8015
Camping shelter used - tent only	30	38	31	32	0.0585	0.7861	0.7555	**0.0476**	**0.0442**	0.9668
Average length of stay – nights	3.8	3.9	3.6	3.7	0.5099	0.6511	0.7028	0.2056	0.2206	0.9149
Shower available (skip) – yes	27	33	29	30	0.1181	0.5532	0.3035	0.2298	0.4638	0.5978
Provision of postal code – yes	98	98	98	99	0.5608	0.7100	0.2760	0.7969	0.6041	0.4145
Opinion (excellent and above average)										
Cleanliness of restrooms	73	73	69	70	0.8864	0.3081	0.5327	0.1681	0.3557	0.5959
Cleanliness of grounds	94	92	91	93	0.5201	0.1722	0.6291	0.3865	0.8167	0.2375
Condition of facilities	79	81	78	80	0.6026	0.6655	0.7996	0.2615	0.7303	0.3904
Sense of security	86	86	84	84	0.9662	0.4261	0.4649	0.3745	0.4141	0.9166
Control of noise	78	80	77	79	0.6771	0.7332	0.8228	0.3679	0.8003	0.4777
Ease of making reservation	52	56	56	56	0.5123	0.5082	0.4797	0.9959	0.9853	0.9804

Preference for services and facilities (essential and desirable)										
Playgrounds	39	43	45	45	0.3460	0.1489	0.1461	0.5754	0.5814	0.9780
Playfields	43	44	45	44	0.8227	0.5976	0.7628	0.7272	0.9373	0.7695
Availability of Internet service	32	28	31	33	0.4210	0.9922	0.6094	0.3418	0.1113	0.5206
Showers and flush toilet building	76	75	76	77	0.7122	0.9436	0.8193	0.5975	0.4654	0.8480
Electrical hook-ups	48	50	52	48	0.6091	0.3491	0.9913	0.6309	0.5338	0.2428

[a] p-values not adjusted for multiple testing (i.e., no Benferroni correction or similar multiple comparison adjustment)

5.4 Summary

A key purpose of the total survey error paradigm is to gain a better understanding of the different sources of survey error within a selected survey design to help determine how limited resources might be best allocated. A practical constraint affecting the reduction of survey errors is the length of time available for the survey.

The primary intent of this experiment was to assess several sources of error for the face-to-face/web mode on a broader geographical basis. One criterion was the potential for coverage error. This experiment indicates that the non-use Internet rate, at the combined level, was very low at 12 campgrounds located throughout British Columbia and suggests that the potential of coverage error is low. At the same time, two of the 12 campgrounds had somewhat higher non-use Internet rates (i.e., 12% for Okanagan Lake and 15% for Lac La Hache). Campers who do not use the Internet tend to be older and have a smaller group size than campers who use the Internet. Thus, for campgrounds which attract many older people and small groups (i.e., two people), the use of only a web mode at these campgrounds could have some coverage bias.

A second criterion was the response rate. At the combined level, the response rate was about 40% and the return rate for the third follow-up was about 62%. At the

individual campground level, increasing the number of follow-ups led to increasing return rates in 11 of 12 campgrounds. A key aspect of conducting follow-ups is obtaining email addresses. While nine of the twelve campgrounds had high email collection rates (i.e., over 90%), three campgrounds had email collection rates below this level. This suggests that obtaining email addresses is a more difficult task for some interviewers than others and needs to be given high priority during interviewer training.

A third criterion was the potential for nonresponse error. For the location of residence, the use of one to two follow-ups was effective at sharply reducing the relative bias and improving coverage. But the effect of increasing follow-ups on nonresponse bias was not as clear and consistent as occurred for the web mode at Goldstream. Even though the use of a third follow-up at the 12 campgrounds increased the sample size, it seems to have accentuated the representation of respondents from British Columbia. For the average group size and average nights spent in any provincial park in 2009, the relative bias is quite high and the use of follow-ups did not reveal a consistent pattern of reducing relative bias. The high and fairly consistent relative bias across follow-ups for these two variables suggests that measurement error may be affecting this bias. The relative bias for gender was considerably higher than for the average age of the respondent. While it is difficult to determine why the relative bias for the proportion of women is

high, it may be that some respondents are not complying with the request of the person selected to complete the survey.

Another purpose of this experiment was to examine the potential effect of shortening the data collection period on the survey quality because survey designers are often faced with time constraints for providing the results. One possible way to shorten the data collection period is to reduce the total number of days the survey is live or open. A review of the number of cumulative returns and return rates by day suggests that closing the survey 30 days earlier is likely to have little effect on the sample size and the return rates. This analysis also suggests that if no follow-ups were undertaken there would be a reduction of about 90 days, but the results would be based on a much smaller sample size, a lower return rate and potentially higher nonresponse bias for some visitor characteristics (e.g., a relative bias of about 16% for proportion of BC residents).

A second way to shorten the data collection period would be to reduce the number of follow-ups. In this study nonresponse bias by number of follow-ups could be examined for five visitor characteristics, but this was not possible for many of the other variables or the substantive results. Comparing results by follow-ups does not remove the potential of nonresponse bias for the substantive results, but it can indicate if follow-ups could affect specific types of questions or variables. In

comparing the substantive results by follow-ups, only two significant differences out of 102 comparisons were found (about 2%). Both of these differences were found in behavioural characteristics (i.e., percent of tent campers) and no differences were found in any of the opinion-related questions. In addition, no differences were found in the substantive results between the second and third follow-up. While this does not suggest there is no nonresponse bias in the substantive results, it does suggest that decreasing the number of follow-ups from three to two will likely not affect the substantive results for nearly all the variables.

Overall, in comparing the two potential sources of error of the face-to-face/web approach for this camper survey, it seems that the potential of nonresponse error is a greater issue than the potential for coverage error. While the use of one or two follow-ups is effective in reducing nonresponse bias and coverage for one variable, more attention needs to be given at understanding the measurement error of the other four variables. In terms of time constraints, it seems the number of days the survey is left open could be reduced by about a month without affecting the sample size (and sampling error) and return rates. It also seems that reducing the survey from three follow-ups to two follow-ups would likely not affect many of the substantive results.

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CHAPTER SIX

DISCUSSION AND CONCLUSION

6.1 Major findings

Park and resource management agencies often depend on sample surveys to facilitate policy and resource management decisions, but are now looking for more cost-effective ways to implement these surveys. One way to help reduce costs of these surveys may be the use of the web. While use of this mode by itself is appropriate for certain populations (e.g., university students, employees), it is usually considered inappropriate for probability-based household or park visitor surveys because of sampling difficulties and the potential for a number of survey errors (e.g., coverage, nonresponse) that threaten the sample validity and reliability. To help address these methodological challenges, mixed-mode approaches are now becoming more popular (de Leeuw, 2005). Little research, however, has been done on developing and evaluating a mixed-mode approach using the web for park visitor surveys (Sexton et al., 2011).

The aim of this study was to develop a face-to-face/web approach for a provincial camper survey in British Columbia and to test this approach through two experiments. The first experiment examines the potential of coverage error, nonresponse error and measurement error and the costs for two mixed-mode

approaches (i.e., face-to-face/paper vs. face-to-face/web) in one Provincial Park campground located near Victoria, British Columbia. The second experiment examines the potential for coverage error and nonresponse error at 12 campgrounds located throughout the Province.

In testing this approach, one research question was to ask what percentage of potential respondents would be prevented from completing the web survey because they do not use the Internet? No previous studies appear to identify non-use Internet rates in park visitor surveys. The results from both experiments suggest that non-use Internet rates are low among campers using 13 BC provincial park campgrounds located throughout British Columbia (i.e., about 4%). These rates are similar to levels of no telephone coverage in British Columbia in the early 1980's.[66] The low non-use Internet rates found in this study suggest the potential for coverage bias may be low in a number of campgrounds in British Columbia. At the same time, non-use Internet visitors tend to be older and have a smaller group size than Internet visitors. The finding that non-use Internet visitors are older is consistent with other studies (Israel, 2009; 2010; Lesser et al., 2011; Smyth et al., 2010). If some campgrounds attract a high proportion of older

[66]In 1983, British Columbia was serviced by three main telephone companies: BC Telephone, Prince Rupert Tel and Northwestel. During this year, BC Parks undertook a province-wide telephone survey. With the assistance of three telephone companies and BC Stats, it was estimated that about 2% of households did not have telephones.

campers, it is likely that the use of only a web mode would lead to some coverage bias. In these situations, it may be appropriate to provide a paper questionnaire as a last resort (mail/web and then mail as a last resort) similar to the approach used in household surveys (Holmberg et al., 2010; Messer & Dillman, 2011).

The second research question was to ask what percentage of potential respondents would provide their email address to permit email follow-ups? In mail surveys, one of the most effective techniques for improving response rates and reducing the potential for nonresponse error is the use of multiple and varied follow-ups (Dillman et al., 2009; Heberlein & Baumgartner, 1978). At the same time, the use of follow-ups in mail surveys is potentially one of the most costly steps of implementing mail surveys (Crompton & Tian-Cole, 2001). Undertaking email follow-ups by contrast is considerably less costly due to the cost savings of printing, postage and data entry. However, comprehensive lists of email addresses for park visitors are usually not available. No previous studies have attempted to obtain email addresses from campers for park visitor surveys (Graefe et al., 2011; Vaske, 2011).

In this study, the email collection rate for 10 of 13 campgrounds was over 90%. This email collection rate suggests that if interviewing procedures are followed in the appropriate order (i.e., not presenting postcard till after the email address is obtained), done smoothly and tailored to potential concerns of respondents similar to face-to-face interviews in household surveys (Dillman, 1978),[67] it is possible to obtain a high email collection rate. While not specifically tested in this study, two keys for securing email addresses were emphasizing the usefulness of the results (i.e., the social utility argument) and trying to alleviate security and privacy concerns potential respondents might have about providing their email address (e.g., indicating that the web survey was on a government or special BC Parks website, the access code was unique or no one else had it, the survey could not be "googled", the email address would only be used for this study, contact information was available). Even though the email collection rate was high at most of the campgrounds, 3 of the 13 campgrounds had email collection rates at

[67]Dillman (1978, pg. 182) suggests that successful interviewer behaviour does not hinge on giving the "entire sales pitch" all at once. Rather, the interview moves from introducing oneself, the reason for being there and politely asking for permission to begin the interview which may take less than a minute. If there is resistance, it is important for the interviewer to provide more reasons why the study is important and why the respondent is essential to the study success. And finally if still more resistance occurs, to ask for a personal favour that will "help me get paid". In essence, attempts of persuasion by the interviewer are sometimes minimal and sometimes great often building to a crucial and decisive conclusion. During the interview phase of the face-to-face/web approach, two key decisions of the respondent are willingness to do the interview and willingness to provide an email address at the end of interview. Obtaining a "yes" for the latter decision is probably the interviewer's most difficult task because of potential security and privacy concerns for some potential respondents.

80% or lower. These low email collection rates suggest that priority needs to be given to obtaining email addresses during interviewer training sessions.

The third research question was to determine what effect increasing the number of email follow-ups would have on return rates and nonresponse bias. In mail surveys, multiple and varied follow-ups have been shown to be effective at improving response rates (Dillman et al., 199b; Heberlien & Baumgartner, 1978) and reducing nonresponse bias (Filion,1976; Hunt & Dalton, 1983). There has been some controversy, however, about the number of follow-ups required in park visitor surveys because some populations may be homogeneous and follow-ups are costly and increase the amount of time it takes to obtain the results (Crompton & Tian-Cole, 2001). In web surveys, little experimental research has been conducted on the optimal number of email follow-ups (Couper, 2008; Dillman et al., 2009) and the effect that each follow-up can have on the return rate (Kittleson, 1997) and nonresponse bias.

This study demonstrates the effect that each follow-up can have on return rates. In comparing two mixed-mode approaches at Goldstream, the return rate for the paper mode with no follow-ups and the response rate for the web survey with

three follow-ups were nearly the same (i.e., close to 60%). Both at Goldstream and at the 12 individual campgrounds, the return rate after two follow-ups was nearly double the return rate with no follow-ups. After two follow-ups, the number of returns began to taper off. A psychological concept which may help to explain this effect is habituation. It suggests that with repeated stimulations (or follow-ups) there are decreasing decrements in responding to a request because it is no longer novel.

It further demonstrates that with two follow-ups nonresponse bias can be reduced for a key variable (i.e., location of residence) and improve coverage or confidence levels of the statistical estimates. This is particularly important in studies that use statistical estimates from sample surveys in economic impact analyses. This study also provides evidence that increasing the number of follow-ups will not be effective in reducing nonresponse bias if there are measurement errors such as inadequate wording or recall issues (Biermer & Lyberg, 2003). The findings about nonresponse bias in this study suggests that survey researchers need to consider carefully the type of question being asked, if the results for this question are likely to be biased by nonresponse and what strategy (e.g., the number and variation in type of follow-ups) might be most effective in reducing this bias (Crompton & Tian-Cole, 2001). While the focus of this study was on the use of follow-ups,

other studies have shown that the use of prepaid incentives, which usually invokes the norm of reciprocity (Couper, 2011), can be effective in reducing nonresponse bias (Groves et al., 2006; Lesser et al., 2001).

The fourth research question was whether or not the face-to-face/paper and face-to-face/web modes would provide similar data quality and results. The issue of data quality and comparability is important for park agencies that conduct annual surveys and generate trend information. If an agency switches to another survey mode and data are not comparable, trend information may be lost and a new starting benchmark would need to be established. While some studies have shown there are considerable differences in responses between paper and web modes (Duda & Nobile, 2010; Gigliotti, 2011; Rookey et al., 2008), other studies have shown few differences in the responses between these two modes (Graefe et al., 2011; Lesser et al., 2011). Some recent studies have also shown that item nonresponse is very low between these two modes (Dillman, 2012; Lesser et al., 2012). This study provides additional evidence that in comparing these two mixed modes overall item nonresponse was low (i.e., 1.4% for paper vs. 1.0% for web), differentiation for satisfaction ratings was similar and the results were not statistically different for nearly all items. One item that was statistically different between these two approaches was that the proportion of women respondents (i.e.,

60% for the paper mode vs. 50% for the web mode). However, the proportion of women completing the web survey was closer to the proportion of women obtained in the interviews (i.e., 52% with three follow-ups) suggesting that the web response may reduce the potential gender bias in the results.

A fifth research question was which of the two mixed modes – face-to-face/web or face-to-face/paper approach – would be cheaper. If interviewer costs are included, it is estimated there may be about a 9% cost saving in using the face-to-face/web mode. If interviewer costs are not included, it is estimated there may be about a 30% cost saving in using the face-to-face/web mode. It should be kept in mind that this study was conducted through a government agency and does not include "hidden" costs such as supervision. While the out-of-pocket costs seem lower for a web survey, the hidden costs usually prevent in-house research staff from working on other projects.

In addition to the practical constraint of direct costs for data collection, the possibility of reducing the time for data collection for the face-to-face/web approach was examined for 12 campgrounds. One of the decisions that affect this time constraint is the length of the data collection period which, in turn, is

affected by the number of follow-ups and the length of time the survey is left open. This study suggests that if no follow-ups are used, the survey could be closed about three months earlier. However, this would reduce the sample size and the return rate and potentially increase the nonresponse bias. If three follow-ups are used, the length of time the survey is left open could be reduced by about a month without affecting the sample size and return rates. This study also found very few differences in the substantive results by follow-ups and no differences between the second and third follow-up. While this does not suggest there is no nonresponse bias in the substantive results, it does suggest reducing the number of follow-ups from three to two will likely not affect the substantive results.

In conclusion, this study provides some evidence that the face-to-face/web approach seems to be a viable alternative to a face-to-face/paper approach for some Provincial Park campgrounds in British Columbia. While it suggests the potential of coverage error is low among campers who use some Provincial Park campgrounds in British Columbia, a key challenge of using the face-to-face/web approach is reducing the potential for nonresponse error for specific variables. Two techniques survey researchers often use in dealing with nonresponse are weighting procedures after the data has been collected to improve the representativeness of the sample or trying to prevent this error during the data

collection phase through the use of different procedures such as the use of follow-ups (Couper, 2011). For this study, no population data was available for weighting the results. The primary focus of this study was to minimize nonresponse through the use of email follow-ups. This study provides some evidence that the use of one or two email follow-ups can be effective at reducing nonresponse bias for some statistics. If measurement error exists, however, increasing the number of email follow-ups will not remove this bias (Biemer & Lyberg, 2003). For survey researchers planning to implement a web survey, this study suggests that it is important to ask if a specific statistic is likely to be affected by nonresponse bias and if so to try to build a way of assessing the potential for nonresponse bias in the survey design. A key benefit of the face-to-face/web approach, similar to the face-to-face/paper approach, is the capability to assess the potential of nonresponse bias. Understanding both the magnitude and direction of this bias is useful in considering the application of the results to park management decisions.

6.2 Some future research directions

From this study, several research questions emerge. First, could this methodology be applied to other recreation settings such as day use areas, marine parks or wilderness areas in British Columbia or other jurisdictions (e.g., National Parks)? Even though this mixed-mode approach may not be appropriate in countries,

regions or communities where Internet access is low, it would be useful to have a better understanding of the incidence of non-use Internet rates among park visitors and determine if this mixed-mode approach can be successfully applied in other park and recreation settings.

Second, in park and recreation settings where the incidence of non-use Internet rates is high, could the face-to-face/web approach be modified and still provide some cost savings? In this study, an attempt was made to provide potential respondents, who did not use the Internet at home or who were not willing to complete the web survey, an opportunity to complete a paper questionnaire (i.e., switchovers). A similar type of strategy (i.e., mail/web and as a last resort a paper response) has been developed for household surveys (Millar & Dillman, 2011). Even though the number of switchovers in the Goldstream experiment was not large enough for analysis, it would be useful to test this approach to determine the effect of offering the paper questionnaire as last resort on data quality (e.g., reduce nonresponse bias) and its cost-effectiveness.

Finally, in regards to this particular provincial camper survey, could measurement errors for selected visitor characteristics be reduced? For example, the use of

focus groups or cognitive interviews may provide insights about how well respondents interpret the question about party size, how they derive estimates of average numbers of nights spent in provincial park campgrounds the previous year and whether or not they adhere to the respondent selection technique. This qualitative approach may provide new insight about the way respondents process these questions and facilitate the redesign of the questions and respondent selection technique.

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APPENDIX A

Survey materials and email Follow-up letters

GOLDSTREAM INTERVIEW FORM, 2010

Hello. My name is _____. BC Parks is conducting a short survey – about 3 to 4 minutes - to help plan future services and facilities at this campground. **Would you be willing to participate**? I also need to speak to an adult who last had a birthday (at least 18 years of age) and is here now.

IF "NO" (done one already or refuse) IF DONE BEFORE, SAY: Thank you. **IF REFUSE**, Try find out and record in Q10

IF "YES": Okay. Let me begin.

1) First, about how many nights, in total, did you spend in <u>any</u> BC provincial park campground in 2009? (Just your best estimate is fine.)
2) And where is your home located? Is it in …(READ) B.C, Alberta, Other parts of Canada, the United States or Abroad (outside Can and U.S.)?
3) What is your postal or zip code? This tells us the city or town of your home
4) How many people, in total, are in your group today?
5) May I ask how old you were on your last birthday?
6) Gender: By OBSERVATION. DO NOT ASK

7) During the past 12 months, did you use the internet from your home?
IF NO: Ask question 8B. **IF YES**: Ask question 8

8) We'd also like to get your views about services and facilities in this park and are planning future services and facilities throughout BC. Before building a new facility, it is often useful to first ask people if they are interested in using it. Would you be willing to fill in….**(ASK ONLY ONE of the following; ALTERNATE)**

A. A short on-line survey after you get home from your trip?
B. A paper survey which you can return in a drop-off box before you leave the park or in a postage-paid envelope?

It will take about 5 to 10 minutes <u>and</u> for all those who complete a questionnaire we are offering a draw to win 1 of 5 free 2 night camping trips in 2011.

<u>For online</u>: IF NO – Would you please tell me why? (Q10 & Q8B, end) **IF YES**: Ask Q **9a**

<u>For mail</u>: IF NO That's all. Thank you. **IF YES**: Give package & record Quest# in **9b**

9a) (So BC Parks can send you a reminder and contact the prize winner) May I have **your first name and e-mail address**? Do the following.

IF NO:1. Code as **Ref in 9a** and put Access Code in **9b**; 2. Give PostCard.3 Thank them.

IF YES:1 Hand R E-mail Form & obtain first name and email; 2; Pull out postcard & record A.Code on E-mail Form or **9b**.4. Give R PC(Picture first; next web address).5.Thx

Questions:[do Interview] [1] [2] [3] [4] [5] [6] [7] [8] [9a] [9b] […10 …]

<u>Date:</u> Month /day (05/31) Start time End time	Camp site # (#89)	1 = no, done before 2 = yes 8 = ref	Total nights in 2009 (#) 88 = ref 98 = DK	1 = BC 2 = Alb 3 = Oth Can 4 = U.S. 5 = Abroad 8 = ref	Your postal or zip code Or Name of town/city 8 = refuse	Group Size (#) 88= refuse	Age on last birthday (years) 8 = ref	Gender 1 = female 2 = male 8= refuse	Internet at home 1 = no 2 = yes 8 = ref	<u>Online?</u> 1=no 2= yes <u>Paper?</u> 3 = no 4 = yes	Only online 1 = First name 2= e-mail 3 = both 8 = ref	Either: Access code: OR Mail Quest. id #	**Why? (Anything else?)** 1 = computer virus 2 = online scam 3 = lack computer knowledge./need help 4 = No interest in prize 5= Other

2010 Email Form

Campground name: _____ **Date:**_____

1 **Please Print** Date:_____ Campsite #:_____ Access Code:_____ First name: _____ E-address:_____	6 **Please Print** Date:_____ Campsite #:_____ Access Code:_____ First name: _____ E-address:_____
2 **Please Print** Date:_____ Campsite #:_____ Access Code:_____ First name: _____ E-address:_____	7 **Please Print** Date:_____ Campsite #:_____ Access Code:_____ First name: _____ E-address:_____
3 **Please Print** Date:_____ Campsite #:_____ Access Code:_____ First name: _____ E-address:_____	8 **Please Print** Date:_____ Campsite #:_____ Access Code:_____ First name: _____ E-address:_____
4 **Please Print** Date:_____ Campsite #:_____ Access Code:_____ First name: _____ E-address:_____	9 **Please Print** Date:_____ Campsite #:_____ Access Code:_____ First name: _____ E-address:_____
5 **Please Print** Date:_____ Campsite #:_____ Access Code:_____ First name: _____ E-address:_____	10 **Please Print** Date:_____ Campsite #:_____ Access Code:_____ First name: _____ E-address:_____

2010 Postcard and Cover Letter for Mail Package

Dear Visitor,

May 17, 2010

Thank you for visiting Englishman River Falls provincial park campground. Our goal is to provide you with a safe and enjoyable visit.

Park visitors are one of the best sources for helping us know how well we are meeting this goal. We would really appreciate you taking about 5 to 10 minutes to tell us what is working well and what needs to be improved.

Please go to the website below and enter your personal access code to complete a short survey:

Website: **www.surveybcparks.gov.bc.ca** Your access code: **D11 499**

If you have any questions about the survey, please contact us at surveybcparks@gov.bc.ca or at (250) 387-4504. Your answers will assist us in our efforts to better manage this park. Thank you for giving us your feedback.

Jon Kittmer
Project Manager, BC Parks

P.S. All those who complete a survey will be entered into a draw to win one of five prizes for two-nights of free camping in any provincial park in 2011. The draw will be on November 1, 2010.

BCParks
2975 Jutland Road
Victoria, B.C.
V8W 9M1

May 24, 2010

Dear Park Visitor,

Thank you for visiting Goldstream provincial park campground. Our goal is to provide you with a safe and enjoyable visit.

Park visitors are one of the best sources for helping us know how well we are meeting this goal. We would really appreciate you taking about 5 to 10 minutes to tell us what is working well and what needs to improved.

Please return your completed questionnaire to us before you leave the park in the **"DROP-OFF BOX"** in the campground or mail it to us in the postage paid, self-addressed envelope that is provided.

Your participation is voluntary. If you come to a question you prefer not to answer please skip it and go to the next question. The answers you provide will be combined with others to prepare summaries. Your name or email address will not be associated to your answers in any report.

If you have any questions about the survey, please contact us by phone at 250-387-4504 or email: surveybcparks@gov.bc.ca. Your answers will assist us in our efforts to better manage this park.

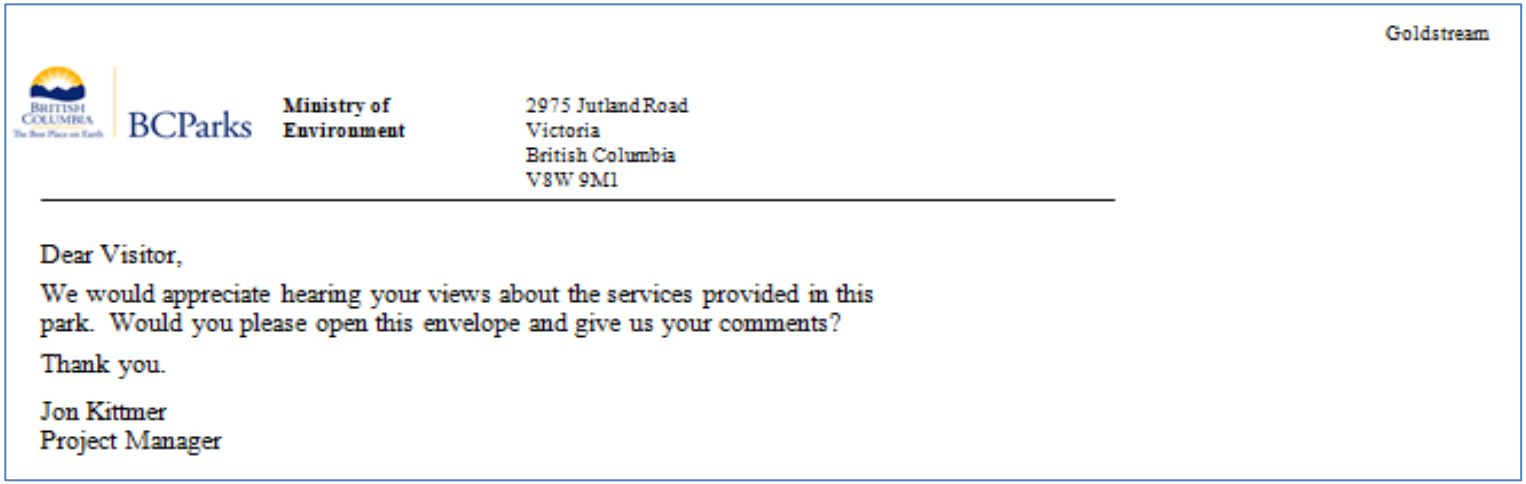
Thank you for giving us your feedback.

Sincerely,

Jon Kittmer
Project Manager

P.S. All those who complete a survey will be entered into a draw to win one of five prizes for two free nights of camping in any provincial park campground in 2011. The draw will be on November 1, 2011.

Outer Envelope (#10) and Postage Paid Return Envelope (# 9) For Mail Package



Goldstream

BCParks **Ministry of Environment**

2975 Jutland Road
Victoria
British Columbia
V8W 9M1

Dear Visitor,

We would appreciate hearing your views about the services provided in this park. Would you please open this envelope and give us your comments?

Thank you.

Jon Kittmer
Project Manager

CANADA POST / POSTES CANADA
Postage paid if mailed in Canada / Port payé si posté au Canada
Business Reply Mail / Correspondance-réponse d'affaires
0001291661 02

1000010099-V8W9W9-BR02

LC 37028
BC PARKS VISITOR STUDY – MINISTRY OF ENVIRONMENT
PO BOX 9999 STN PROV GOVT
VICTORIA BC V8W 9Z9

Ethics Posture Put On Goldstream Gatehouse

BC Parks Visitor Survey

A student will be undertaking a short survey in this campground during the summer.

The information will be used for a University Assignment and will benefit the student and BC Parks.

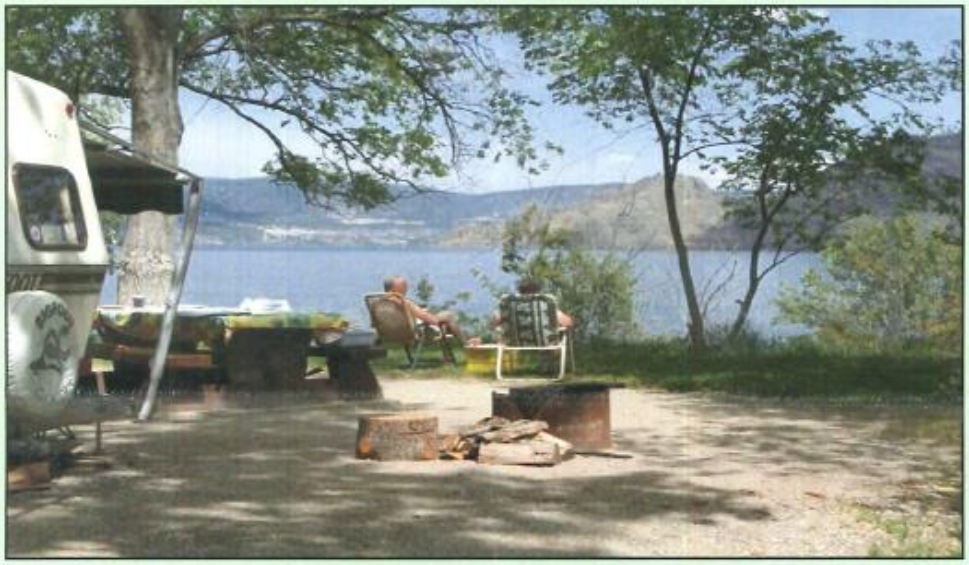
If you prefer not to participate or not answer a question, just let him know. Thank you.

BRITISH COLUMBIA
The Best Place on Earth
BCParks

2010 Paper Booklet Questionnaire

16754

BC Parks
Camper Survey



Please complete and return
to the "Drop-Off Box" before leaving the park
or in the postage paid return envelope.

Jon Kittmer
Project Manager
BC Parks
2975 Jutland Road
Victoria, B.C. V8W 9M1
250 387-4504

BRITISH COLUMBIA
The Best Place on Earth

BCParks

First, we have a few questions about your trip.

1. **Campsite reservations for some BC provincial park campgrounds can be made through the Discover Camping reservation system. Did you happen to make a reservation for your stay in this campground? (*Choose only one*)**

   ○ No
   ○ Yes, made by telephone
   ○ Yes, made online

2. **Have you ever stayed overnight in this campground before? (*Choose only one*)**

   ○ No (this is my first time)
   ○ Yes (stayed here before)

   ○ Not sure

3. **Which of the following <u>best</u> describes the camping shelter(s) you used during your stay in this campground? (*Check ALL that apply,* ☑)**

   ☐  Tent (any kind, any size)
   ☐  Travel trailer/5th Wheeler
   ☐  Tent trailer (folding)
   ☐  Motor home
   ☐  Truck camper
   ☐  Van

   ☐ Other (specify) _____

4. **How many nights, in total, did you stay in this campground on this trip?** ***(Please provide your answer using either one or two digits)***

   ____ Total nights

Next, we'd like to know your views about services and facilities.

5. **Thinking back to your stay in this campground, how would you rate each of the following services? (*Choose only one per service; if you didn't use the service, please indicate Did not Use*)**

Services	Poor	Below Average	Average	Above Average	Excellent	Did not Use
A. Cleanliness of restrooms ..	○	○	○	○	○	○
B. Cleanliness of grounds (lack of litter).....	○	○	○	○	○	○
C. Condition of facilities (buildings, trails).....	○	○	○	○	○	○
D. Your sense of security (feeling safe from crime)...	○	○	○	○	○	○
E. Control of noise.....	○	○	○	○	○	○
F. Ease of making advance reservation.....	○	○	○	○	○	○

6. **What improvements in services or facilities, if any, would you most like to see in this campground? (*Please be specific*)**

   Improvement #1

   Improvement #2

7. **Did the campground you stayed in on this trip have a shower and flush toilet building? (Choose only one)**

   ○ No → (If no, go to question 8)
   ○ Yes → (If yes, go to question 10)

   ○ Not sure → (If not sure, go to question 8)

8. **If you were to stay in this campground again in the next few years, would you like to see a shower and flush toilet building in this campground? *(Choose only one)***

   ○ Definitely no
   ○ Probably no
   ○ Not sure
   ○ Probably yes
   ○ Definitely yes

9a. What is the main reason you <u>would</u> like to see a shower and flush toilet building in this campground?

9b. What is the main reason you <u>would not</u> like to see a shower and flush toilet building in this campground?

10. If you were to use BC provincial park campgrounds in the next few years, would you consider each of the following to be not acceptable, undesirable, desirable or essential?

Facilities	Not acceptable	Undesirable	Don't care	Desirable	Essential
A. Playground.....	○	○	○	○	○
B. Playfield or open areas (volleyball, etc.).....	○	○	○	○	○
C. A place for visitors to use the internet.....	○	○	○	○	○
D. A shower/flush toilet building.....	○	○	○	○	○
E. Campsites with electrical hookups.....	○	○	○	○	○

11a. What facilities or services, if any, would you <u>most</u> like to see in provincial park campgrounds? (*Please be specific.*)

11b. What facilities or services, if any, would you <u>least</u> like to see in provincial park campgrounds? *(Please be specific)*

Finally, we have a few questions to help us know if we've heard from all different kinds of people who use provincial park campgrounds.

12. Which of the following <u>best</u> describes the region where your home is located? *(Choose one)*

- ○ British Columbia
- ○ Alberta
- ○ Ontario
- ○ Other Canada
- ○ Washington
- ○ Oregon
- ○ California
- ○ Other U.S.A.
- ○ Abroad (outside of Canada and the U.S.A)

13. **What is your postal or zip code?** ***(This tells us the name or town of city you live in).***

14. **Including yourself, how many people were in your group when you stayed in this campground? (*Please provide your answer using one or two digits*)**

Total number of people

15. **How many people were 17 years or younger?** ***(If none, please put 0 in the box).***

Number of people 17 years or younger

16. **May I ask how old you were on your last birthday?**

Years

17. **What is your gender?**

- ○ Female
- ○ Male

18. **About how many nights, in total, did you spend in <u>any</u> BC provincial park campground in 2009?**

Total nights in 2009

If you have any additional thoughts about your visit to the provincial park campground you stayed in, please provide them in this box.

If you would like to enter the draw for two free nights of camping in BC provincial parks in 2011, please enter your first name, telephone number (including the area code) and e-mail address (if you have one) in the boxes below. This will enable us to contact you if you are one of winners.

We want to assure you again that none of this information will be connected to your answers.

First name:

Telephone number:

E-mail address:

Thanks for completing the questionnaire. We greatly appreciate it.

Drop-off Box Attached to Goldstream Gatehouse For Returning Paper Questionnaires

2010 Web Questionnaire

BC Parks

Camper Survey

Thank you for responding to the 2010 BC Parks Camper Survey!

Our goal is to better understand visitors' experiences and their views about the services provided in provincial park campgrounds. This will assist us in our efforts to better manage provincial parks and to serve future park visitors.

As you move through the survey, please use only the gold coloured "**next**", "**back**" and "**submit**" buttons at the bottom of each page.

Your participation is voluntary. If you come to a question you prefer not to answer please skip it and go to the next question. The answers you provide will be combined with others to prepare summaries. Your name or e-mail address will not be associated to your answers in any report.

Please contact us if you have any questions. Thank you.

Sincerely,

Signature Removed

Jon Kittmer
Project Manager

Please enter your Access Code from the post card into the boxes below and then hit submit

First 3 digits (Example: A11) Second 3 digits (Example: 001)

Submit

Contact us: surveybcparks@gov.bc.ca; Telephone: 250 387-4504
BC Parks, 2975 Jutland Road, Victoria, B.C. V8W 9M1

BC Parks

Camper Survey

First, we have a few questions about your trip.

1. **Campsite reservations for some BC provincial park campgrounds can be made through the Discover Camping reservation system. Did you happen to make a reservation for your stay in this campground? (*Choose only one*)**

   - ○ No
   - ○ Yes, made by telephone
   - ○ Yes, made online

2. **Have you ever stayed overnight in this campground before? (*Choose only one*)**

   - ○ No (this is my first time)
   - ○ Yes (stayed here before)
   - ○ Not sure

3. **Which of the following <u>best</u> describes the camping shelter(s) you used during your stay in this campground? (*Check ALL that apply,* ☑)**

   - ☐  Tent (any kind, any size)
   - ☐  Travel trailer/5th Wheeler
   - ☐  Tent trailer (folding)
   - ☐  Motor home
   - ☐  Truck camper
   - ☐  Van
   - ☐ Other (specify) _____

Next »

Contact us: surveybcparks@gov.bc.ca; Telephone: 250 387-4504
BC Parks, 2975 Jutland Road, Victoria, B.C. V8W 9M1

BC Parks

Camper Survey

4. How many nights, in total, did you stay in this campground on this trip? *(Please provide your answer using either one or two digits)*

Total nights

Next, we'd like to know your views about services and facilities.

5. Thinking back to your stay in this campground, how would you rate each of the following services? (*Choose only one per service; if you didn't use the service, please indicate Did not use*)

Services	Poor	Below Average	Average	Above Average	Excellent	Did not Use
A. Cleanliness of restrooms	○	○	○	○	○	○
B. Cleanliness of grounds (lack of litter)	○	○	○	○	○	○
C. Condition of facilities (buildings, trails)	○	○	○	○	○	○
D. Your sense of security (feeling safe from crime)	○	○	○	○	○	○
E. Control of noise	○	○	○	○	○	○
F. Ease of making advance reservation	○	○	○	○	○	○

« Back Next »

Contact us: surveybcparks@gov.bc.ca; Telephone: 250 387-4504
BC Parks, 2975 Jutland Road, Victoria, B.C. V8W 9M1

BC Parks

Camper Survey

6. What improvements in services or facilities, if any, would you most like to see in this campground? (*Please be specific*)

Improvement #1

Improvement #2

7. Did the campground you stayed in on this trip have a shower and flush toilet building? *(Choose only one)*

- No → (If no, go to question 8)
- Yes → (If yes, go to question 10)
- Not sure → (If not sure, go to question 8)

« Back Next »

Contact us: surveybcparks@gov.bc.ca; Telephone: 250 387-4504
BC Parks, 2975 Jutland Road, Victoria, B.C. V8W 9M1

BC Parks

Camper Survey

8. If you were to stay in this campground again in the next few years, would you like to see a shower and flush toilet building in this campground?
(Choose only one)

- Definitely no
- Probably no
- Not sure
- Probably yes
- Definitely yes

9a. What is the main reason you <u>would</u> like to see a shower and flush toilet building in this campground?

9b. What is the main reason you <u>would not</u> like to see shower and flush toilet building in this campground?

« Back Next »

Contact us: surveybcparks@gov.bc.ca; Telephone: 250 387-4504
BC Parks, 2975 Jutland Road, Victoria, B.C. V8W 9M1

BC Parks

Camper Survey

10. If you were to use BC provincial park campgrounds in the next few years, would you consider each of the following to be not acceptable, undesirable, desirable or essential?

Facilities	Not Acceptable	Undesirable	Don't Care	Desirable	Essential
A. Playground	○	○	○	○	○
B. Playfield or open areas (volleyball, etc.)	○	○	○	○	○
C. A place for visitors to use the internet	○	○	○	○	○
D. A shower/flush toilet building	○	○	○	○	○
E. Campsites with electrical hookups	○	○	○	○	○

11a. What facilities or services, if any, would you <u>most</u> like to see in provincial park campgrounds? (*Please be specific*)

11b. What facilities or services, if any, would you <u>least</u> like to see in provincial park campgrounds? (*Please be specific*)

« Back Next »

Contact us: surveybcparks@gov.bc.ca; Telephone: 250 387-4504
BC Parks, 2975 Jutland Road, Victoria, B.C. V8W 9M1

BC Parks

Camper Survey

Finally, we have a few questions to help us know if we've heard from all different kinds of people who use provincial park campgrounds.

12. Which of the following best describes the region where your home is located? ***(Choose one)***

- British Columbia
- Alberta
- Ontario
- Other Canada
- Washington
- Oregon
- California
- Other U.S.A.
- Abroad (outside of Canada and the U.S.A)

13. What is your postal or zip code? ***(This tells us the name or town of city you live in.)***

« Back Next »

Contact us: surveybcparks@gov.bc.ca; Telephone: 250 387-4504
BC Parks, 2975 Jutland Road, Victoria, B.C. V8W 9M1

BC Parks

Camper Survey

14. Including yourself, how many people were in your group when you stayed in this campground? (*Please provide your answer using one or two digits*)

Total number of people

15. How many people were 17 years or younger? *(If none, please put 0 in the box).*

Number of people 17 years or younger

16. May I ask how old you were on your last birthday?

Years

17. What is your gender?

- Female
- Male

18. About how many nights, in total, did you spend in <u>any</u> BC provincial park campground in 2009?

Total nights in 2009

« Back Next »

Contact us: surveybcparks@gov.bc.ca; Telephone: 250 387-4504
BC Parks, 2975 Jutland Road, Victoria, B.C. V8W 9M1

BC Parks

Camper Survey

If you have any additional thoughts about your visit to the provincial park campground you stayed in, please provide them in this box.

This brings us to the end of the survey. Before pressing the "submit" button below to save your answers, we would like to remind you of two things:

1. If you would like to review your answers, please use the "back" button below.
2. If you would like to enter the draw for two free nights of camping in BC provincial parks in 2011, please enter your first name, telephone number (including the area code) and e-mail address in the boxes below. This will enable us to contact you if you are one of winners.

We want to assure you again that none of this information will be connected to your answers.

First name:

Telephone number:

E-mail address:

Please press "**submit**" to save your answers.

Thanks again for completing the survey!

« Back Submit

Contact us: surveybcparks@gov.bc.ca; Telephone: 250 387-4504
BC Parks, 2975 Jutland Road, Victoria, B.C. V8W 9M1

BC Parks

Camper Survey

Your completed questionnaire has been received.

Thanks for your help!

Signature Removed

Jon Kittmer
Project Manager

Close

Contact us: surveybcparks@gov.bc.ca; Telephone: 250 387-4504
BC Parks, 2975 Jutland Road, Victoria, B.C. V8W 9M1

Interview Form For Twelve Individual Campgrounds

Hello. My name is _____. BC Parks is conducting a visitor survey to help plan future services and facilities at this campground. It will take about 5 – 7 minutes. I need to speak to an adult who last had a birthday (at least 18 years of age) and is here now. **Would you be willing to participate?**

IF "NO" (done one already or refuse) SAY: Thank you.

IF "YES": Okay. Let me begin.

1) First, about how many nights, in total, did you spend in any BC provincial park campground in 2009? (Just your best estimate is fine.)
2) And where is your home located? Is it in …(READ) B.C, Alberta, Other parts of Canada, the United States or Abroad (outside Can and U.S.)?
3) What is your postal or zip code? This tells us the city or town of your home
4) How many people, in total, are in your group today?
5) May I ask how old you were on your last birthday?

6) Gender: By OBSERVATION. DO NOT ASK

7) During the past 12 months, did you use the internet from your home?
IF NO: That's all. Thank you. **IF YES**: Ask question 8a

8a) We'd also like to get your views about services for this park. Would you be willing to fill in a short on-line survey after you get home from your trip? **It will take about 5 to 10 minutes and for all those who complete a questionnaire we are offering ad draw to win 1 of 5 free 2 night camping trip in 2011.**
IF NO: That's all. Thank you. **IF YES**: Ask question 8a

8b) So BC Parks can send you a reminder and contact the prize winner, may I have **your first name and e-mail address**? Do the following.
IF NO:1. Code below and put Access Code in 8b; 2. Give Postcard. 3 Thank them.
IF YES:1 Code below and put Access Code in 8b ; 2. Give Postcard and E-mail Form Print Form. 3. Spell out loud first name and email address; 4. Thank them.

Questions:[do Interview] [1] [2] [3] [4] [5] [6] [7] [8a] [.....8b.....]

Date: Month /day (05/31)	Camp site # (#89)	1 = no, done before 2 = yes 8 = ref	Total nights in 2009 (#) 88 = ref 98 = don't know	1 = BC 2 = Alberta 3 = Oth Can 4 = U.S. 5 = Abroad 8 = refuse	Your postal or zip code Or Name of town/city 8 = refuse	Group Size (#) 88= refuse	Age on last birthday (years) 8 = refuse	Gender 1 = female 2 = male 8= refuse	Internet at home 1 = no 2 = yes 8 = refuse	Do online survey 1 = no 2= yes 8 = refuse	1= first name only 2= e-mail only 3= both name and email 8= refuse	Record Access Code

Email Follow-up Letters With Nonrespondents

First e-mail Follow-up

From: Jon Kittmer [Jon.Kittmer@gov.bc.ca]
Sent: August 17, 2010
To: <<email address>>
Subject: Your Recent Visit to BC Parks

Dear <<first name or Visitor merge>>,

Recently, we gave you a postcard when you visited <<campground name merge>> provincial park campground. We asked if you would complete a very brief internet questionnaire to give us your views about the services provided in this campground. The questionnaire is short (18 questions) and it should take about 5 to 10 minutes to complete.

If you have already completed the survey, we appreciate your participation. If you have not yet responded, we would like to encourage you to take a few minutes to complete the survey.

Please click on the link below to go to the survey website (or copy and paste the survey link into your Internet browser) and then enter your personal access code to begin the survey.

Survey Link: www.surveybcparks.gov.bc.ca

Your access code: **A11 100** <<merge>>

Your responses will help us to better understand how well we are doing in meeting the needs of people who use our parks and what improvements, if any, we need to make.

Thanks for taking time to give us your views about the services in this park.

Sincerely,

Jon Kittmer
Project Manager
(250) 387-4504

Second e-mail Follow-up

From: Jon Kittmer [Jon.Kittmer@gov.bc.ca]
Sent: August 25, 2010
To: << email address>>
Subject: Your Recent Visit to BC Parks – Please Help Us

Dear <<first name or Visitor merge>>,

BC Parks provincial park campgrounds provides places for BC residents and tourists to spend their vacations and to enjoy the outdoors. Recently, we sent you an e-mail asking you to complete a brief internet questionnaire to give us your views about the services in <<campground name merge>> provincial park campground. Your views are important to us and will help us to learn how we can improve services in the park.

Since we have only asked a few people to participate in this survey, it is very important that we hear from all those park visitors who were randomly selected for this survey. The survey is very short and should only take 5 to 10 minutes to complete.

If you have already completed the survey, we appreciate your participation. If you have not yet responded, we would like to urge you to take a few minutes to complete the survey.

Please click on the link below to go to the survey website (or copy and paste the survey link into your Internet browser) and then enter your personal access code to begin the survey.

Survey Link: www.surveybcparks.gov.bc.ca

Your access code: **A11 100** <<merge>>

Thanks for your help.

Sincerely,

Jon Kittmer
Project Manager
(250) 387-4504

Third e-mail Follow-up

From: Jon Kittmer [Jon.Kittmer@gov.bc.ca]
Sent: September 3, 2010
To: <<email address>>
Subject: Your Recent Visit to BC Parks – Final Request

Dear <<first name or Visitor merge>>,

During the last couple of weeks, we have sent you several e-mails about an important study we are conducting on BC provincial park campgrounds. Its purpose is to help us understand how services and facilities could be improved.

We recognize that you may not have had time to complete the on-line questionnaire about your recent visit to <<campground name merge>> provincial park campground. The survey is drawing to a close and this is the last contact that will be made with a random sample of park visitors.

We are sending this final e-mail to you because of our concern that people who may not have responded may have different views than those who have responded. Hearing from everyone in this small province-wide sample helps assure the results are as accurate as possible

If you have already completed the survey, we really appreciate your participation. If you have not yet responded, we would like to urge you to complete the survey.

Please click on the link below to go to the survey website (or copy and paste the survey link into your Internet browser) and then enter your personal access code to begin the survey.

Survey Link: http://www.surveybcparks.gov.bc.ca

Your access code: **A11 100** <<merge>>

Thank you very much.

Sincerely,

Jon Kittmer
Project Manager
(250) 387-4504

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APPENDIX B

A Brief Description of Daily Snapshot Sampling Procedures

For Twelve Campgrounds

BC Parks "Daily Snapshot" Sampling Approach

The primary goal of the BC Parks annual camper survey is obtain information about visitor characteristics, visitor satisfaction with services and visitor views about specific policy issues the agency is facing (e.g., providing new services or facilities). An attempt is made to survey about 30 campgrounds each year and to repeat the survey in these campgrounds every four years (i.e., a four year rotational cycle).

For each campground selected for this survey, BC Parks has for many years used a "daily snapshot" approach. This involves selecting a sample of visitors each day of the operating season (i.e., typically mid-May to early September). This sampling design (Figure B1) permits less sampling when use levels are low (i.e., shoulder season of May, June and September) and more sampling when use levels are higher (i.e., core season of July and August).

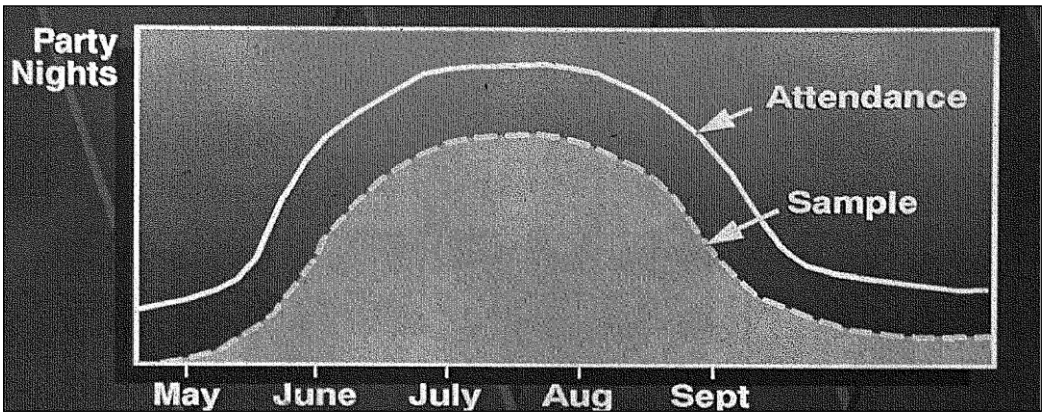

Figure B1. Schemata of daily snapshot sampling approach.

The proportional allocation of the total sample throughout the operating season is based on a number of factors: average five year attendance levels allocated by month (because attendance for a given year is not known in advance); estimated sample size; days in a month; and number of campsites. Table B1 provides an example of the allocation of 300 postcards for Gladstone- Texas Creek by month.

This table is then used as a guide for developing a weekly "daily record" sheet. For example, during the month of June about eight or nine postcards need to be distributed in a given week to meet the total desired returns (i.e., 33 for June). About half of the cards are distributed on weekdays and half on weekends. Figure B2 indicates that for each day of the week, there is a daily target of interviews and random selection of campsites (shaded in red) based on a random start number for each day and a systematic interval. If the selected campsite is not occupied, the next sequential occupied campsite is selected. The use of a systematic interval in this manner helps to ensure that respondents are selected throughout the campground (i.e., not just those located near the lake). Interviewers are then instructed to use the most recent birthday method to randomly select a respondent from a camping party.

Table B1. Sampling allocation of postcards at Gladstone (Texas Creek)

Period	Average Attendance (2005-2009)	Proportion of Nights	Desired Returns	Days in Month	Required Returns Per Day	No. of campsites	Sampling Interval - every nth campsite	Sampling Interval - Rounded Down	Returns Per Week	Returns Over 4 Weekdays (50%)	Returns Over 3 Weekend days (50%)
May 24 - 31	248	0.05	15	8	2	63	34.7	35	7	3	3
June 1 - 30	569	0.11	33	30	1	63	56.7	56	8	4	4
July 1 - 31	1,903	0.37	112	31	4	63	17.5	17	25	13	13
Aug 1 - 31	1,877	0.37	110	31	4	63	17.7	17	25	12	12
Sept 1 - 5	520	0.10	30	5	5	63	10.3	12	36	18	18
Total	**5,117**	**1.00**	**300**	**105**							

Assumptions:

- 50% of use occurs during weekdays (Mon-Thurs); 50% during the weekend (Fri-Sun)
- Full month attendance used when calculating the 2005-2009 average attendance for May – Sept

Gladstone - Texas Creek Record Sheet for 21JUN10 to 27JUN10

Instructions:

Step 1: Each day, select the designated campsites highlighted by red box(es) from the schedule below. If the campsite is not occupied, go to the next occupied campsite.

Step 2: Determine if the party has been interviewed before.

A. Yes: If party HAS BEEN INTERVIEWED BEFORE. DO NOT interview again. Put an X next to campsite number and go to next occupied campsite (Step 1).

B. No: If party HAS NOT BEEN INTERVIEWED BEFORE and AGREES to do interview. Put a Y next to campsite number and begin interview (Step 3).

C. No: If party HAS NOT BEEN INTERVIEWED BEFORE and REFUSES to do interview. Put an R next to campsite number and go to next occupied site (Step 1).

Step 3: Undertake an interview using the **Contact & Interview Form** and record all respondents' answers.

Make sure ALL boxes have an answer or numeric code (i.e. no empty cells).

Step 4: At the end of the week, attach cover sheet and fax both the weekly **Record Sheet** and the **Contact and Front-Interview Form** to (250) 387-5757.

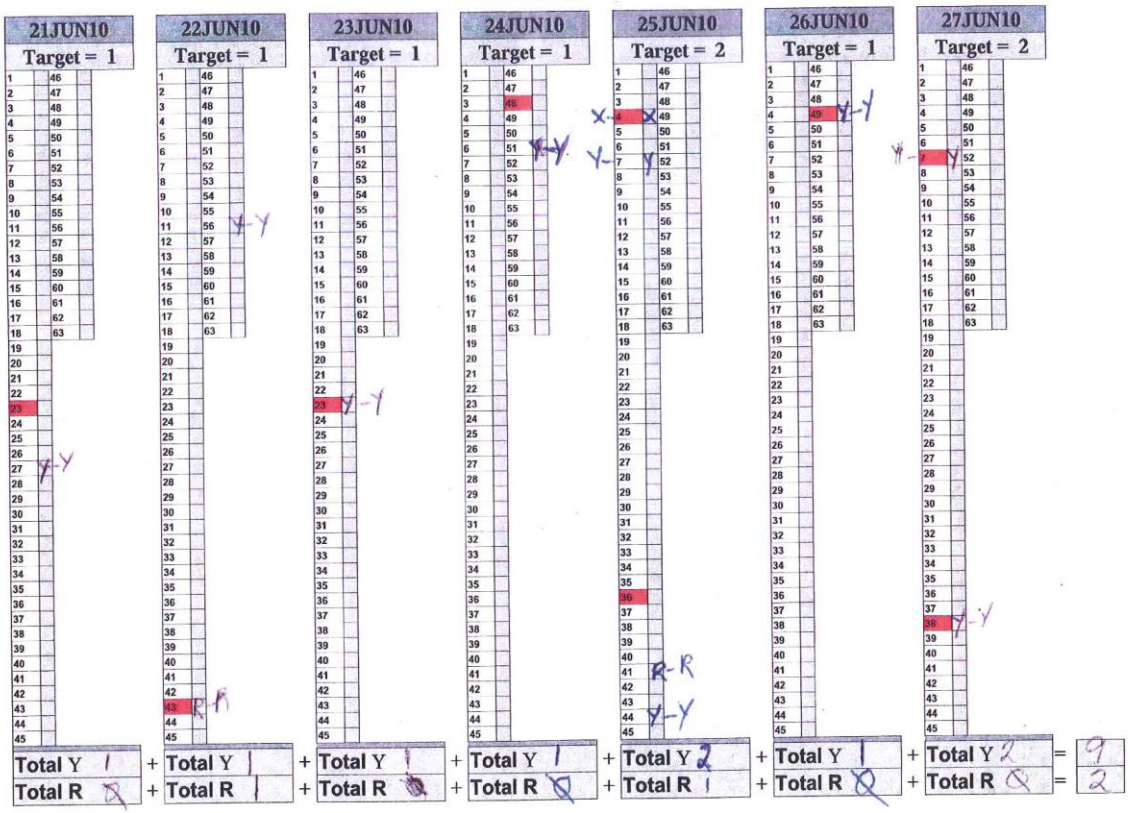

Figure B2. Daily record sheet for Gladstone – Texas Creek

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APPENDIX C

Example of Computation for Coverage When Including Bias

Computation of Coverage or Confidence Level Including Bias

This appendix provides an example of how formula 3 from Bethlehem (2009) was used to determine coverage or the confidence level when bias is included in the computation. It was prepared using Excel 2010 and shows more detailed computations than provided in Table 6 and Table 15. While the z-scores for this table are usually available in an appendix of statistic books (e.g., see Appendix H pg 255-256 in Dorofeew & Grant, 2006), for this study the z scores were obtained using the Excel command NORMDIST (for the appropriate cell).

For convenience, formula 3 is shown again below. Please note that in Table C1 the right side of formula 3 is presented in column 9 and the left side of formula 3 is presented in column 10.

$$P(\bar{Y} \in I_R) = \phi(1.96 - \frac{B_{\bar{y}_R}}{S_{\bar{y}_R}}) - \phi(-1.96 - \frac{B_{\bar{y}_R}}{S_{\bar{y}_R}}) \quad (3)$$

where,

ϕ = the standard normal distribution

$B_{\bar{y}_R}$ = the bias of the estimate (e.g., mean)

$S_{\bar{y}_R}$ = the standard error of the estimate (e.g., mean)

Table C1. Coverage (%) of nominal 95% confidence interval for location of residence at Goldstream: an example

	Respondents			All		Measures			Coverage					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(12)	(13)	(14)	(15)
Visitor Characteristic	n	Proportion	s.e	n	Proportion	Bias (col 2 - col 5)	Relative Bias (col 6/col 5)*100	B/S.E (col 6/col 3)	-1.96 - B/se (from col 8)	1.96 - B/se(from col 8)	z-score for col 9	z-score for col 10	Coverage (col 12 - col 13)	Coverage (or Confidence Level) as % (col 14*100)
Location of Residence (from BC)														
Paper - 0 followup	240	0.67	0.03	399	0.68	-0.02	-2.56	-0.6	-1.3834	2.5366	0.0833	0.9944	0.9111	91
Web - 0 followup	25	0.80	0.08	100	0.72	0.08	11.11	1.0	-2.9600	0.9600	0.0015	0.8315	0.8299	83
Web - 1 followup	31	0.71	0.08	98	0.65	0.06	8.67	0.7	-2.6545	1.2655	0.0040	0.8972	0.8932	89
Web - 2 followup	52	0.77	0.06	98	0.73	0.03	4.70	0.6	-2.5511	1.3689	0.0054	0.9145	0.9091	91
Web - 3 followup	58	0.67	0.06	99	0.69	-0.01	-2.10	-0.2	-1.7254	2.1946	0.0422	0.9859	0.9437	94
Web - all	166	0.73	0.03	395	0.70	0.03	4.32	0.9	-2.8348	1.0852	0.0023	0.8611	0.8588	86

An estimate of standard error (s.e.) for proportions was based on: $\sqrt{(pq/n)}$ where p is the estimated proportion, q= 1-p and n=sample size (U.S. Bureau of Census, 1968). The standard error for the means (not shown in the next table) was obtained from SPSS (version 14) descriptive statistics.