Inferred Valuation as a Tool to Alleviate Social Desirability Bias: Testing the Systematic Influence of Individual-Specific Factors

by

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ABSTRACT

Social desirability bias (SDB) is a problem often found in the elicitation of preferences for goods of moral concern, where individuals tend to behave in a way that makes them 'look good' complying with social norms. Inferred valuation has been proposed to overcome this problem in stated preference surveys by asking individuals to predict others' behavior instead of their own. However, the validity of the method is still a matter of discussion. In this research, we examine potential systematic differences between preferences captured with direct and inferred valuation questions, as well as potential systematic effects of several individual-specific characteristics on those differences. For this purpose, we use survey data from four previous stated preference studies which focused on the elicitation of preferences for passive-use values of public goods. We estimated logit and multinomial logit models of choice behavior as a function of alternative and individual specific variables including age, gender, income, education, and involvement in environmental conservation. In addition, conditional logit models of preferences were estimated to analyze differences between valuation approaches by the inclusion of interactions of alternative specific variables with a valuation method dummy and with the socio-demographic factors. Statistically significant differences between the probabilities of voting yes with direct and inferred questions suggested the presence of SDB in all four valuation studies. Older respondents appeared more prone to exhibit SDB in their answers given that the effects of age are significant and consistent across the four studies, with similar conclusions for female respondents in two studies. In line with previous literature, our results provide additional evidence for the assessment of inferred valuation's validity as a promising tool to alleviate social desirability bias in non-market valuation of public goods.

DEDICATION

This work is dedicated to my sister María Gracia. Thank you for inspiring me to give my best in everything I do, and for always cheering me up despite the distance, with just one smile.

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1. INTRODUCTION

The information collected through surveys has contributed to the development of knowledge about individuals' behavior, preferences, and perceptions in a wide variety of fields (Fisher 1993; Carlsson, Daruvala and Jaldell 2010). Data from surveys is one of the most common sources of information used for estimating the economic value of goods that are not traded in formal markets. However, the veracity of this information is often questioned when individuals have economic, social or moral motivations to provide answers that differ from their true preferences (Carlsson et al. 2010). The validity of the economic values estimated from surveys is crucial for making decisions that affect the provision of nonmarket goods, with an impact across different economic and social groups.

Environmental resources are nonmarket goods, which not only provide society with inputs for production processes, ecological services needed to sustain life, and recreational amenities (all considered as direct and indirect use values) but also other benefits that people obtain from nonmarket goods, independent of any observable use they can make from them (also known as passive use values) (Champ, Boyle and Brown 2003). Consequently, in order to implement welfare maximizing decisions, their value must be included in the assessment of policy trade-offs related to their use or protection (Champ et al. 2003). Yet, due to their public nature, these goods are not directly linked to markets, precluding them from proper regulation and allocation (Champ et al. 2003). Environmental economics addresses this issue from an anthropocentric perspective[1] (Champ et al. 2003) using economic valuation to obtain welfare measures, which are monetary values associated with the utility that people gain from a change in the environment (Grafton et al. 2004). To achieve this purpose, economic valuation procedures involve two approaches: the use of revealed preference or stated preference methods (Champ et al. 2003).

When the use of an environmental good is related to the use of other market exchanged goods, it is possible to observe individuals' behavior towards its consumption through actual transactions. The monetary amounts spent travelling to access a natural

[1] The value of a good, in Economics, is defined in terms of its contribution to human well-being. (Champ et al. 2003). That is, people's welfare is the goal and center of the economic analysis, and value is assigned to goods that add to the achievement of that goal. In the case of natural resources, this view is opposite to that of Ecologists, who consider nature having an intrinsic value, not derived from its utility (Champ et al. 2003).

recreation site can be considered a measure of the price paid for the use of this recreational amenity. The economic valuation methods relying on this kind of information are known as revealed preference (RP) methods (Grafton et al. 2004). However, the absence of observable behavior related to the use of the nonmarket good, or the complexity in its identification, led to the development of stated preference (SP) methods (Grafton et al. 2004). Under this approach, carefully structured surveys are administered to individuals to ask them how much they are willing to pay for a change in the quality or quantity of an environmental good, or how they would vote for or against the implementation of the change in a hypothetical referendum (particularly in the case of a public good).

Contingent valuation and choice experiments (also referred to as attribute-based methods) are the main two categories of stated preference methods (Grafton et al. 2004; Fifer, Rose and Greaves 2014) widely used in different fields. These valuation techniques have a great number of applications in marketing, transportation, environmental and health economics, among others (Fifer et al. 2014; Carson 2000; Adamowicz 2004; Johnston et al. 2017). However, their limitations are still being debated. Contingent valuation attempts to elicit the welfare that respondents experience from a change in a non-market good as a whole, while choice experiments attempt to decompose the change in a list of relevant attributes, estimating welfare from changes in each of them (Grafton et al. 2004). Since its first applications in the early 1960s (Champ et al. 2003), the welfare measures derived from Contingent Valuation have gained importance in assisting policy decisions and damage assessments (Carson 2000; Carson et al. 2003) consequently making not only Contingent Valuation, but also Choice Experiments, a subject of strict scrutiny (Fifer et al. 2014; Carson and Groves 2007; Johnston et al. 2017). The attention has focused on the hypothetical nature of the stated preference survey and its implications (Johnston et al. 2017; Carlsson, Frykblom and Lagerkvist 2005).

1.1 Hypothetical bias

It is argued that the preferences respondents report in an SP survey will differ from what their actual behavior would be since the scenario presented in the former is hypothetical. Carson and Groves (2007) and Harrison and Rutström (2008) argued that in stated preference

surveys, respondents do not report their true values as they perceive their answers not linked to real consequences. Hausman (2012) claimed that in a stated preference survey, respondents must construct their preferences for a good they have no market experience with, leading them to provide untruthful responses. This potential preference distortion is known as hypothetical bias. Its presence affects the veracity of answers, and therefore, the validity of welfare measures. As a result of these concerns, the Blue-Ribbon Panel created by the National Oceanic and Atmospheric Administration (NOAA) evaluated the Contingent Valuation method in the litigation of the Exxon Valdez oil spill occurred in 1989. From this evaluation, the Panel issued a formal report about the validity of the method to measure passive-use values, including several guidelines for its design and application. Nowadays, nonmarket valuation practitioners try to follow these guidelines to ensure the accuracy of their results and have added new improvements and recommendations to the literature, based on their analysis and experience (Carson 2000; Johnston et al. 2017).

The use of referendum formats to elicit WTP, follow-up questions, and binding payment mechanisms are some of the recommendations of the Blue-Ribbon Panel. In the case of public goods, the use of a referendum question is highly recommended to interject a degree of perceived consequentiality[2] and incentive compatibility[3] (Carson and Groves 2007; Johnston et al. 2017), which serves to alleviate hypothetical bias. Indeed, respondents are asked to vote, as if in a real referendum, for a policy that affects the provision of the public good with a certain cost; or to vote for the alternative of no government intervention with no monetary implications (Carson and Groves 2007). Other well-documented tools to address hypothetical bias include: a) cheap talk scripts[4] which appeal to respondents' consciousness that hypothetical bias has been identified in the past, encouraging them to provide honest answers (Carlsson et al. 2005; List 2001; Johnston et al. 2017); b) the inclusion of certainty questions for the posterior treatment of the information (Fifer et al. 2014); and c) clear and objective depictions of baseline scenario, environmental change implementation, and binding

[2] Survey questions are considered consequential when they meet two criteria: They must be perceived by respondents to have an influence in an institution's actions or decisions, and those actions must be of interest for the respondents. As a result, they will provide an answer aligned to economic theory in order to maximize their welfare (Carson and Groves 2007).

[3] Carson and Groves (2007) refer to incentive compatibility as the characteristic of a survey question for which providing a truthful answer is the respondent's optimal strategy.

[4] The name refers to the "[…] costless of transmission of signals and information (i.e., cheap talk does not directly affect the payoffs of players in a game [or experiment])" (Cummings and Taylor 1999)

payment mechanisms (Johnston et al. 2017). However, as the debate about the presence of hypothetical bias and its effects on the validity of stated preference methods remains, there is a growing body of literature oriented to the identification and mitigation of this and other potential issues related to it.

1.2 Social Desirability Bias

One of the problems that may arise in the application of stated preference surveys regarding their hypothetical nature is Social Desirability Bias (SDB) (Fisher 1993), which has also been documented in the elicitation of preferences in markets, social experiments, psychological studies, and electoral polls (Johansson-Stenman and Svedsäter 2012; Lusk and Norwood 2010; Norwood and Lusk 2011; Blumenthal et al. 2017; Enns, Lagodny and Schuldt 2017). In general, SDB is found in controversial situations and cases of social concern, where individuals tend to behave in a way that enhances their self-image or makes them 'look good' complying with social and moral rules (Fisher 1993). The existence of scrutiny and anonymity, the context in which people make choices, and the existence of social norms related to their behavior (as in the case of stating their preferences for environmental conservation), among other factors, can jointly determine the degree of SDB that people exhibit in their actions (Levitt and List 2007).

Research in social psychology demonstrates that individuals experience a necessity to be identified as part of a group, which is linked to basic human needs and is powerful in prompting behavior (Ray and Hall 1995; Beekman, Stock and Marcus 2016). To gain social acceptance and appreciation, people try to show that their moral principles, preferences, and interests are aligned with those of the *society* or a specific group, even though it may not be true. For example, when interacting with supporters of a certain political party, an individual may pretend to share the same political position to gain their acceptance; thus, obtaining networking, personal relationships and leadership opportunities (Delmas and Lessem 2014). In addition, as stated by Johansson-Stenman and Martinsson (2006) and Lusk and Norwood (2009) individuals may also have an interest in proving to *themselves* that they are consistent with their personal norms and principles. This encourages them to have an improved positive self-image disregarding others' presence (Johansson-Stenman and Martinsson 2006). For

instance, in a community where recycling is an important socially responsible action, individuals may not only state they comply with this action but also that they recycle more often and better than others (see also Epley and Dunning 2000). These self-presentation and self-image enhancing behaviors might influence peoples' decisions and statements in survey situations. Hence, survey information should be treated and interpreted cautiously, even when it is considered anonymous to the respondents (Johansson-Stenman and Martinsson 2006).

SDB has been studied mainly in psychology and consumer research (Fisher 1993; Epley and Dunning 2000; Lusk and Norwood 2009; Soubelet and Salthouse 2011); however, economic implications have also been addressed in the literature and have attracted the attention of scholars. Adam Smith and several economists after him discussed the impact that the moral implications of individuals' actions, in addition to wealth, can have in their utility (Levitt and List 2007; Johansson-Stenman and Martinsson 2006). Connecting that idea to economic experiments, Levitt and List (2007) argued that the conditions of the lab may cause the difference in behavior between controlled and real environments, making experimental outcomes not generalizable. They explored this premise by analyzing the influence of factors such as scrutiny, anonymity, the size of stakes, and context (social norms, past experiences, and relational situations) on individuals' behavior. For the purpose of their research, they defined a utility function that included a moral component, in addition to a wealth component, associated with the individual's action (see Levitt and List 2007). Their findings, which supported their initial hypothesis, and the framework used to develop their discussion, entail an important contribution to economic studies beyond experimental economics.

In the context of nonmarket valuation, specifically in stated preference methods applied to public goods, SDB combined with hypothetical bias could lead to overstatements of willingness to pay in the survey with respect to real payments (Johansson-Stenman and Svedsäter 2012). It has been found that respondents report a higher willingness to pay for a 'moral' good than what they would actually pay for it in a real transaction (Murphy et al. 2005; Harrison and Rutström 2008; Carlsson et al. 2010; Johansson-Stenman and Svedsäter 2012). That is, having no real cost associated with their answers in a hypothetical scenario, individuals overstate their support or financial contribution to enhance their image (Johansson-Stenman and Svedsäter 2012; Carlsson et al. 2010). Thus, SDB together with

weak or absent conditions needed to mitigate hypothetical bias may be one of the reasons why willingness to pay values have been found to be larger than real payments in studies where a good with social or moral importance is the object of valuation.

1.3 Inferred valuation: A proposed solution to alleviate Social Desirability Bias

In search of a solution to SDB, the theoretical model used by Levitt and List (2007) was slightly modified by Lusk and Norwood (2009) to examine the feasibility of an indirect questioning approach to mitigate the problem in nonmarket valuation studies. They labeled this approach *inferred valuation* and involves asking individuals to predict others' behavior in the hypothetical situation presented in the survey, instead of their own.

Since inferred valuation does not ask respondents to report their willingness to pay, it is claimed to remove them from the spotlight and to alleviate social desirability bias. This approach is not completely new. The inferred valuation method is linked to Robert Fisher's indirect questioning, proposed in 1993 to elicit preferences and behavior in consumer research. Fisher (1993) defined indirect questioning as a projective technique where respondents are asked to predict the answer of another individual or group (Fisher 1993). Based on the concept that indirect questioning will allow respondents to project their own preferences, feelings, and attitudes on others (Fisher 1993), the technique is thought to remove personal incentives for self-enhancement. This has been found particularly true when respondents are more familiar with the person or group they are inferring behavior for (Carlsson et al. 2010). Fisher analyzed the validity of indirect questioning to reduce SDB in the elicitation of consumer's preferences for a new private good with personal and social implications, and his results were consistent with the theory of the approach. That is, the method proved to mitigate SDB in variables that were sensitive to social expectations.

Numerous studies have compared self and predicted behavior with outcomes that support the theory behind the method. Epley and Dunning (2000) performed several experiments with university students, who predicted themselves more likely to participate in pro-social or altruistic activities than the average individual. However, the authors found that students' predicted actions of others were a better proxy of their own behavior (Epley and Dunning 2000). In a similar line of research, the findings of Pronin et al. (2001) suggest that

individuals consider having a greater interpersonal knowledge (understanding of others' behavior) as well as intrapersonal knowledge (understanding of their own behavior) than the rest. They discussed self-enhancement bias as one possible explanation for these results (Pronin et al. 2001).

Other investigations of social desirability bias and behavior projection have focused on economic decisions, as well as the role played by some socio-demographic characteristics. Johansson-Stenman and Martinsson (2006) examined differences between the answers that respondents reported for themselves and their neighbors related to car purchases, and they also examined how some individual-specific characteristics could explain those answers. The authors found that people derive utility from self-enhancement when stating their concern for the status and environmental performance of the car. Their results are consistent with the social desirability bias concept, and the idea that respondents' prediction of others' behavior better resembles that of their own. In addition, researchers have also assessed the effects of respondents' culture in self-enhancing behavior. Balcetis, Dunning, and Miller (2008) compared predictions about self and others' actions focusing on the differences across respondents from individualist and collectivist cultural backgrounds. Their results indicate that participants from individualist cultures are more prone to self-enhancement statements than those from collectivist cultures; although both groups of people made more accurate predictions about the behavior of their peers (Balcetis et al. 2008).

Altogether, these studies suggest that respondents project their own true preferences on another person or group (and even in their future self), as it has been postulated in support of indirect questioning. Taking this into account, Lusk and Norwood (2009) proposed that inferred valuation has the potential to obtain a more accurate value of the utility people gain when consuming a nonmarket good, rather than the usual direct referendum question applied in Contingent Valuation. According to them, the usual self-reported or direct answers may lead to overestimations of value by counting the utility obtained from saying what is socially expected[5].

To evaluate the validity of their proposal, Lusk and Norwood examined the performance of inferred valuation both analytically and empirically. Based on the utility

[5] According to Lusk and Norwood, the 'utility of saying' an individual may obtain in a hypothetical survey is not attributed specifically to self-presentation or self-image effects. In they conceptual analysis, they do not distinguish between these two different forms of preference deviation due to the presence of a social norm.

model developed by Levitt and List (2007), Lusk and Norwood included weights for the wealth and moral additive components of an individual's utility function. Using this model, they derived willingness to pay measures in three scenarios: (1) a real or non-hypothetical scenario where respondents' decision to support the provision of the good gives them both a moral and financial utility; (2) a hypothetical scenario with a referendum question where the individual obtains utility only from saying the 'moral' answer; and (3) a hypothetical scenario with an inferred question where the individual no longer gets any benefit from stating a quantity (Lusk and Norwood 2009). Their analytical results suggest that in a hypothetical setting, individuals' willingness to pay is inflated, as previously found in the literature. On the contrary, using an inferred valuation approach the estimated value should be less than or equal to the individuals' willingness to pay in a real transaction. Consistent with their theoretical model, the results of their empirical examination of respondents' preferences for the actions taken on a unique plant indicated that inferred valuation performs as good as, or even better than, a non-hypothetical experiment with real monetary and social outcomes (Lusk and Norwood 2009).

After the work of Lusk and Norwood in 2009, new studies assessing the applicability and validity of inferred valuation have been developed. Carlsson, Daruvala, and Jaldell (2010) tested the effectiveness of cheap talk scripts and inferred valuation to mitigate hypothetical bias. Contrary to the theory of the method, they found lower values of marginal willingness to pay with inferred valuation in comparison to non-hypothetical payments (Carlsson et al. 2010). Lusk and Norwood (2010) examined the validity of the method in a telephone survey that elicited people's concern for farm animal welfare in food purchases. According to their expectations, respondents considered themselves more concerned for animal welfare than the average American. The authors also found small positive correlations between self and inferred behavior (which eliminates a potential egocentric bias[6]), as well as larger levels of changes in concern for animal welfare by vegetarian and female respondents. Their findings indicated that the difference between answers to direct and indirect questions

[6] The term makes reference to the distortion in the predicted behavior of other people when respondents think others act overly similar to themselves. That is, individuals may predict that other people will fall into the same biases they do; therefore, not reflecting respondents' true preferences. This is also known as the 'false consensus effect' where "observers perceive a false consensus with respect to the relative commonness of their own responses" (Lusk and Norwood 2010).

was mainly SDB, and that inferred valuation had the potential to alleviate it. A subsequent study by Lusk and Norwood (2011), which elicited people's preferences for private goods with socially desirable characteristics (e.g. organic production processes) led to similar results.

More recently, Yadav et al. (2013) analyzed the performance of inferred valuation in a choice experiment to value normative attributes of a good, that were not obvious to the respondent. They found inferred valuation effective at capturing different levels of SDB. However, Torres-Miralles et al. (2017) applied the method to value conservation of olive-crops within a natural reserve in Spain, finding opposite results. It can be seen from these multiple analyses, that inferred valuation as a tool to alleviate SDB is still in a stage of investigation and improvement, rather than implementation.

An interesting question regarding the validity of inferred valuation to mitigate SDB is how well the method performs for different groups of people. Women have been found more prone to socially desirable actions (Chung and Monroe 2003, Johansson-Stenman and Martinsson 2006, Lusk and Norwood 2010, Kamas and Preston 2015), and more likely to think in an inclusive manner than men, when it comes to moral dilemmas (Brown and Taylor 2000). For instance, Johansson-Stenman and Martinsson (2006) found that women and older people considered themselves more concerned with environmental performance and less concerned about status than their neighbors when buying a car. Considering similar findings from earlier studies that suggested women being more susceptible to exhibiting SDB than men, Lusk and Norwood (2010) examined whether the change in the level of concern for animal welfare between direct and inferred valuation would be greater for women, which they interpreted as evidence in favor of inferred valuation to mitigate SDB. Their results were consistent with those previous studies when controlling for other demographic variables (Lusk and Norwood 2010).

Earlier, Brown and Taylor (2000) evaluated whether hypothetical bias differed by gender in several experimental sessions that asked for financial contributions to rainforest protection. According to Lusk and Norwood, individuals obtaining utility from 'saying' they are willing to pay for a specific good, may be related to both hypothetical and social desirability bias. Brown and Taylor (2000) found no significant difference in the proportion of men and women who supported the program, but from those who chose to donate in the

hypothetical setting, the stated contributions were 3 times larger for males, indicating they could be more prone to hypothetical bias than females. Carlsson et al. (2010) also investigated whether the gap between stated donations to charity (using cheap talk scripts and indirect questions) and real payments varied for women and men, yet their results contradicted those of Brown and Taylor.

Although several articles have assessed differences in hypothetical bias or social desirability bias by gender, mainly in experimental settings, the results are mixed and inconclusive. The reason for contradictory results may be the specific conditions of each individual study[7], which makes comparability and generalization inappropriate. In addition, experimental data is usually collected from a sample of respondents who are assigned to a hypothetical and/or a real treatment group. However, as many authors note, the real or non-hypothetical setting can introduce bias itself as participants know they are part of an experiment. Furthermore, not much attention has been put on the influence of other individual-specific characteristics in social desirability bias and how inferred valuation performs when such characteristics are considered.

1.4 Purpose of the research

To address the mentioned gap in the literature and to contribute to the discussion about the validity of inferred valuation, two research topics in the comparison of direct and inferred valuation are addressed in this study: First, we evaluate the extent to which inferred valuation generates systematic differences in preferences for public goods, relative to the standard stated preference question(s). Under the assumption that supporting environmental conservation is the norm and that inferred valuation better reflects respondents' true preferences, any difference between information elicited with both methods is attributed to SDB. Second, we examine the potential systematic effects of multiple individual-specific characteristics in the differences in preferences between both valuation questions. Such an analysis has not been performed before, as far as we know. For that purpose, the present

[7] These specific conditions include the use of experiments, telephone surveys, mailed surveys, as well as different settings for the analysis: within-subject or between-subject.

research will include four stated preference valuation studies, which collected information from online surveys to value preferences for environmental goods.

In that sense, the work of Lusk and Norwood (2010) and Johansson-Stenman and Martinsson (2006) are the closest to ours. These authors, respectively, focused on gender differences in social desirability bias for farm animal welfare in meat consumption, and environmental concern in car purchases (although they indirectly examined other demographic variables). Both studies implemented within-subject analyses of survey data to compare self and predicted statements towards the importance of moral goods in the purchase of private goods. Both studies used ordered probit models to estimate the effects of gender on the difference between self and inferred rankings. From these investigations, females were found to be more concerned with the environmental performance of cars and animal well-being in meat consumption. Older respondents appeared to be more prone to social desirability when it came to environmental and status concern but less affected by social expectations in the case of farm animal welfare. Highly educated respondents were found more likely affected by social desirability bias when valuing the importance of animal well-being, but less concerned about environmental performance and status in car purchasing decisions. Taken together, the impact of socio-demographic characteristics on the social desirability exhibited seems to vary by the specific context and conditions of the two studies.

1.5 Contribution

The outcomes of the present investigation will provide evidence to support or refute the use of indirect questioning in nonmarket valuation. The consistency of the results with previous studies in social psychology and environmental economics, about the tendency of certain groups to make decisions based on social norms will aid in the assessment of inferred valuation's validity on its function of alleviating SDB and providing willingness to pay values that are a better representation of respondents' true preferences. Nevertheless, the application of surveys to elicit people's perceptions in general, and to estimate the value of nonmarket goods in particular, is not restricted to environmental conservation. Therefore, it is expected that our findings contribute to the applicability of the method in a wide variety of fields.

1.6 Thesis structure

After a description of the multiple data sets and methodologies employed (Sections 2 and 3), we test the statistical significance of any difference between both questioning techniques, and the potential for differences to be systematic across studies. Within the framework of random utility models, this objective is undertaken by means of conditional logit estimations, interactions, and likelihood ratio tests, which are presented and analyzed in Section 4. Consequently, we focus on the effects of individual-specific characteristics in explaining any differences found between direct and inferred valuation, and if such effects are systematic across the multiple studies as well. The results of this analysis are described in Section 5. Section 6 summarizes our findings and presents the conclusions derived from them, as well as their possible implications for the validity of inferred valuation. Finally, Section 7 acknowledges the study's limitations and provides some guidelines for future research.

2. THE DATASETS

2.1 Data selection and general structure

The information used in this research involves data collected for the economic valuation of four public goods in Canada. A summary of the most relevant information about them can be found in Table 1.

The studies were primarily selected based on the inclusion of inferred valuation questions in the survey instruments, and on the public nature of the goods they valued. The inferred valuation information collected from these surveys has not been analyzed in these previous investigations. Suitability, survey design and implementation, as well as the researchers involved also played an important role in the selection of the studies. Each of the four surveys was administered online to internet panels. Two of them had a provincial target population while the other two had a national target population. All four studies had a very similar survey design, which included multiple valuation tasks. In addition, each of the studies was conducted under the leadership of the same two researchers in nonmarket valuation. Two of the studies were published in 2011 and 2015 respectively, while the other two were performed as part of larger projects, and their specific results have not been published in refereed journals.

In the present research, a potential authorship effect could play both a positive or negative role in the analysis of results. In meta-analyses, the inclusion of several studies performed by the same author/s can be problematic. Authors can apply similar criteria and similar survey designs in the sequential studies they work on. Therefore, having the same author in most of the studies considered in a meta-analysis can cause a large proportion of the information collected from them, to be influenced by design factors (Brouwer et al. 1999). In this research, however, having studies with the contribution of the same authors in all of them could be a way of controlling for the influence they may have in the design and implementation of the surveys when making across-studies comparisons. However, it could also be that using similar criteria in each and all of the surveys lead to similar variations in the preferences shown between questioning methods. In other words, we acknowledge the

fact that variations found in the results of the present study across datasets may or may not be affected by an 'authorship effect'.

In general, the survey instruments in each of the four studies had a similar structure consisting of three segments. First, respondents were provided with blocks of information and context to get them more familiar with the good being valued. In this segment of the survey, respondents were able to express their levels of concern for other public issues that deserve government attention, as well as for the good of interest. Additionally, they were asked questions about their understanding and previous knowledge of the topic. Then, respondents were presented with multiple valuation tasks comprised of direct stated preference questions in referendum format and inferred valuation questions, where they had to vote for the maintenance of the current situation at no cost, or a proposed policy alternative with an annual household tax increase. Finally, they faced several debriefing questions which were used to examine the reasons for incomplete surveys or the influence of their attitudes in their votes, and they were requested to provide socio-demographic information.

In the four studies, the use of a referendum format for the direct valuation of the public goods helped guarantee incentive compatibility. In addition, the inclusion of cheap talk scripts, certainty questions, debriefing questions and binding payment vehicles intended to ensure perceived consequentiality, and mitigate the potential presence of hypothetical bias, which contributed to the validity of the valuation exercises.

2.2 Survey-specific characteristics

The purpose of the first study was to estimate the economic value of wetland retention and restoration in Manitoba (Pattison, Boxall and Adamowicz 2011). To that end, an internet panel survey collected information from 1980 Manitobans, who after going through the blocks of background questions, answered 5 referendum questions, each followed by an inferred valuation task. The survey design implied the construction of 6 scenarios: The current situation with no cost and no action to maintain or increase the wetland area (resulting in continued decline), 1 retention scenario which would maintain existing wetland areas, and 4 different restoration scenarios which would increase wetland areas (Pattison et al. 2011).

With respect to the current situation, each proposed scenario entailed a higher number of wetland acres available in Manitoba by 2020, with a proportional increase in the ecological goods or services derived from wetland existence. These ecological services were presented to the respondents as attributes of the current and proposed policy alternative in measurable and comparable numbers (Pattison et al. 2011). However, to avoid collinearity issues, the total number of wetland acres predicted to exist by 2020 is the only attribute of this study considered for the present analysis.

As is common practice, the order of the questions and the costs attached to the proposed alternatives were randomized, and several mechanisms to tackle hypothetical bias were implemented. The annual household tax increase associated with the implementation of the proposed scenario, supposed to be paid for 5 years, ranged from $25 to $600 and was randomly assigned to each of the five referendum questions. The valuation exercise can be found in the survey presented in Appendix A1. The order of presentation of the valuation questions was also randomized to avoid potential ordering effects and to perform tests of scope. To mitigate a possible hypothetical bias, three mechanisms were used: a short cheap talk script before the valuation task, a certainty question immediately after each referendum question, and posterior debriefing questions.

The second study involves a stated preference questionnaire administered in 2012 to an internet panel of Saskatchewan residents to estimate the value of wildlife conservation benefits in the Milk River Watershed (Adamowicz, Boxall, Entem and Simpson 2012). This area is located in the south-west of Saskatchewan. The results of the study were part of a cost-benefit analysis for the assessment of the South of the Divide Action Plan, which was proposed by the federal and provincial governments to protect animal species, at risk of extirpation in the area. Thus, four conservation strategies were designed: the current situation, which implied no change in the risk of extirpation from the region of five selected species in 30 years, and 3 conservation strategies (Light, Moderate, and Heavy) with associated levels of risk reductions for the wildlife species (see Adamowicz et al. 2012). The payment vehicle for the implementation of a proposed strategy consisted of an annual household tax increase for the next 30 years, selected at random from four amounts that ranged between $5 and $350 (see Table 1).

Information was gathered from 327 respondents who voted 4 times. Each referendum vote presented the current and a proposed strategy, immediately followed by a certainty question and an inferred valuation question (see Appendix A2). The certainty questions, a short cheap talk script, and consequentiality questions (presented after all the valuation tasks) were included to treat hypothetical bias. Ordering effects were mitigated with the randomized presentation of the four valuation tasks to the respondents.

Studies three and four focused on estimating the economic value placed by Canadians for the protection and recovery of the population levels of two fish species: A representative Pacific Ocean Rockfish species and a Lake Sturgeon species. Both fish conservation studies were performed as part of a large project using a very similar survey instrument (see Appendix A3 and A4), which was administered to different samples of 1242 and 1235 Canadian residents respectively, although only the Pacific rockfish study has been published to date (Forbes, Boxall, Adamowicz, and De Maio Sukic 2015).

The Pacific rockfish species live in salt-waters in the west coast of Canada (Forbes et al. 2015) while Lake Sturgeon is a freshwater fish found in inland lakes and rivers from western Alberta to Quebec (COSEWIC 2006). Lake Sturgeon species are divided into 8 designatable units[8] according to their location and genetics (COSEWIC 2006). However, the Lake Sturgeon survey focused on designatable unit 8 (DU8), found in the Great Lakes and Western St. Lawrence River (see Appendix B). In these surveys, the current management practices, without additional management intervention or monetary cost, were projected to cause the fish species to be endangered in 40 years for the Pacific Rockfish and 30 years for Lake Sturgeon DU8. Respondents were asked to vote three times to maintain this scenario or to implement a new management program (see Appendix A3 and A4). Thus, every respondent was presented three alternative management options designed for these surveys,

[8] A designatable unit (DU) is a biologically-based species unit defined as that with conservation purposes (Ontario Ministry of Natural Resources 2009). According to he Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2006), there exist 24 Lake Sturgeon species which are classified in 8 designatable units, based in species varieties, as well as genetic and bio-geographical distinctions where they can be found. The 8 Lake Sturgeon designatable units are: Western Hudson Bay (DU1); Saskatchewan River (DU2); Nelson River (DU3); Red–Assiniboine Rivers – Lake Winnipeg (DU4); Winnipeg River – English River (DU5); Lake of the Woods – Rainy River (DU6); Southern Hudson Bay – James Bay (DU7); and Great Lakes – Upper St. Lawrence (DU8).

where each of them projected a different positive change in the trend of the relevant fish populations, and therefore, in their risk status (Threatened, Special concern, and Not at risk status relative to Endangered status) (Forbes et al. 2015). The proposed programs were tied to an increase in the respondents' annual household tax for the next 10 years, randomly assigned from six monetary values that ranged between $1 to $600 (see Table 1).

Hypothetical bias was addressed in the Rockfish and Lake Sturgeon surveys by the inclusion of a cheap talk script, certainty questions that followed each referendum question, and posterior debriefing questions for further treatment of data quality. Similar to the other two studies, an inferred valuation task was presented after each referendum valuation question.

Regarding the purpose of the present research, a characteristic of interest in the four studies is the survey design process and the way in which the inferred valuation question was worded. Following standard practice, the construction of the survey instruments involved advice of experts, focus groups and pilot tests, in which accuracy and bid ranges were tested. Additionally, during the implementation of each survey, the representativeness of the target population was ensured. In each study, the inferred valuation question asked respondents to predict the percentage of the respective target population that would support the proposed policy alternative when faced with the preceding question in a referendum (see Appendix A1, A2, A3 and A4). Thus, the order in which the two questioning approaches were presented was the same in all the surveys as well.

For convenience, we will refer to the four studies by their valuation purpose: Wetland restoration, Species at risk conservation, Rockfish conservation, and Lake Sturgeon conservation.

Table 1. Information summary of the four studies used for the present research

Characteristics of the study	1. Wetland restoration	2. Species at risk conservation	3. Rockfish conservation	4. Lake sturgeon conservation
Authors	Pattison J. Boxall P.C. Adamowicz W.L.	Adamowicz W.L. Boxall P.C. Entem A. Simpson S.	Forbes K. Boxall P.C. Adamowicz W.L. De Maio Sukic A.	Forbes K. Boxall P.C. Adamowicz W.L. De Maio Sukic A.
Population target	Manitoba	Saskatchewan	Canada	Canada
Study year	2011	2012	2015	2015
Type of publication	Journal article (CJAE)	Consultancy report (Unpublished)	Journal article (FMS)	(Unpublished)
Implementation	Internet panel	Internet panel	Internet panel	Internet panel
Choice framework	Referendum	Referendum	Referendum	Referendum
Number of respondents	1980	327	1242	1235
Number of observations	9900	1308	3726	3705
Number of choice tasks	5	4	3	3
Number of attributes	1	3	3	3
Levels of the attributes of the proposed policy	Number of restored or retained wetland acres by 2020	Heavy strategy Moderate strategy Light strategy	Threatened risk Special concern risk No risk status	Threatened risk Special concern risk No risk status
Payment vehicle	Annual household tax increase over 5 years	Annual household tax increase over 30 years	Annual household tax increase over 10 years	Annual household tax increase over 10 years
Range of bids ($)	25, 100, 200, 350, 600	5, 40, 150, 350	1, 10, 50, 150, 300, 600	1, 10, 50, 150, 300, 600

Source: *Wetland restoration study* (Pattison et al. 2011)*, Species at risk conservation* (Adamowicz et al. 2012)*, Rockfish conservation* (Forbes et al. 2015)*, and Lake Sturgeon conservation studies.*

2.3 Data treatment and cleaning

One of the first steps for data treatment involved the standardization of the variables across studies. Each survey asked respondents to locate their annual household income level in one of several intervals. Therefore, to be able to make comparisons and simplify model estimation and interpretation, two categories were created in each dataset: below and above $100,000 represented by the variable *High income*[9] (which takes the value of 1 for people above the threshold and 0 otherwise). Similarly, information about their level of education and their involvement in organizations related to environmental conservation was standardized across datasets. Respondents that reported to have attained at least some post-secondary education level were categorized as having a higher level of education in comparison to those who did not. In addition, a dummy variable (*Environmental organization)* was created to take the value of 1 when an individual reported belonging to a fishing, hunting, nature watching, or outdoor recreation club, as well as any other environmental conservation group.

Yea-sayers and observations with missing information were identified for data cleaning. Yea-sayers[10] were defined in the surveys as those individuals who supported the proposed policy alternative in every referendum question presented to them, and who considered the proposed policy should be implemented regardless of the cost, according to their answers in debriefing questions. The votes from these respondents, as well as the observations that had missing socio-demographic information, were excluded from the analysis. There was no information available in the Wetland restoration dataset to identify

[9] According to Statistics Canada (2011 NHS, Statistics Canada Catalogue no. 99-014-X2011047), the average total income of census family households in the country (households that contain at least one census family, that is, a married couple with or without children, a couple living common law with or without children, or a lone parent living with one or more children) was around $95000 per year in 2010. Noting that the four studies were performed between 2011 and 2015, we assume such number didn't suffer considerable variations through the period 2010-2015 and we used a round threshold of $100000 to classify households with a total income level above average.

[10] Following Champ, Boyle and Brown (2003), yea-sayers are respondents who answer yes to any-bid amount presented to them; therefore, not considering those amounts as a referent of price or quality.

and eliminate observations from protesters[11]; therefore, such treatment was not applied to the other three studies either.

The uncertain votes from the referendum question approach and the inferred percentage answers had to be recoded to proceed with the investigation. As mentioned in the first chapter of the thesis, one of the ways in which hypothetical bias can be treated is using uncertainty questions to identify yes votes in which individuals were not sure about their preferences. Accordingly, in all datasets, the supportive votes that were somewhat or highly uncertain in the direct referendum question were recoded as "no" votes. In addition, the inferred percentage of supportive votes that respondents provided was converted into a yes/no answer. That is, when respondents predicted that more than 50% of the population would support the proposed program, a new binary variable was set up to take the value of 1, and in the case of a percentage that was less than or equal to 50%, it would take the value of zero. In this way, statistical comparisons between the direct and inferred votes, and the influence of socio-demographics in such answers could be examined.

2.4 Descriptive statistics

Table 2 summarizes information of the socio-demographic variables in the total samples. The proportion of male respondents is very similar across datasets, oscillating between 45% and 50%, and the average age is 48 years old in all of them. The percentage of individuals in the two income categories are also similar for the two national surveys. The lowest proportion of respondents (16%) with a household income of above $100,000 can be found in the Manitoban sample while the highest (34%) is found in the Saskatchewan provincial sample. The main economic activities and conditions of each province may explain the variation in the income distribution between them. The proportion of respondents who reported to have attained a post-secondary education was approximately 62%, apart from the Saskatchewan dataset in which 80% of respondents did. A priori, this information

[11] Protesters are respondents who report a zero value for the good subject of valuation (or a "no" vote, against the proposed program) because they reject one or several elements of the valuation task (Champ et al. 2003). For example, they may not agree with the payment vehicle or the institution in charge of implementing the proposed policy.

suggests a potential high correlation between income and education levels; however, the actual value of correlation was between 0.12 and 0.18 for these two variables across the four datasets[12]. Finally, the number of people who belonged to a club or organization that depends on environmental conservation, represented less than 20% of the samples in all cases, with a lower proportion for the first dataset. No more than 5% of the individuals in the samples were identified as yea-sayers.

Table 2. Comparison of socio-demographic characteristics between the four samples

	Wetland restoration	**Species at risk conservation**	**Rockfish conservation**	**Lake Sturgeon conservation**
Male (%)	48	45	50	49
Average age (std. dev)	48 (15.07)	47.85 (14.65)	48.23 (14.48)	47.79 (14.44)
Household income (%)				
Less than $100,000	84	66	75	76
$100,000 or more	16	34	25	24
Post-secondary education (%)	63	80	62	59
Members of environmental organizations (%)	6	12	17	16
Yea-sayers in the sample (%)	5	1	3	4
Number of respondents	1980	327	1242	1235
Number of votes (observations)	9900	1308	3726	3705
Number of votes after removal of yea-sayers	9450	1296	3627	3561

Source: *data from the Wetland restoration, Species at risk conservation, Rockfish conservation, and Lake Sturgeon conservation studies.*

Omitting the votes from yea-sayers, the proportion of votes in support of the proposed policy ("yes" votes) was higher with the direct referendum question than with the inferred valuation question in all datasets (Figure 1). In fact, the percentages of yes votes were close by questioning approach, ranging between 47.2% to 54.5% with the direct question, and between 32.4% and 39.7% with the inferred question. A priori, these results suggest a possible overestimation of values with the direct valuation question if it is assumed that inferred valuation is capturing respondents' true preferences.

[12] The pair-wise correlations among the five socio-demographic variables were less than 0.22 in absolute value in all four datasets (see Appendix C)

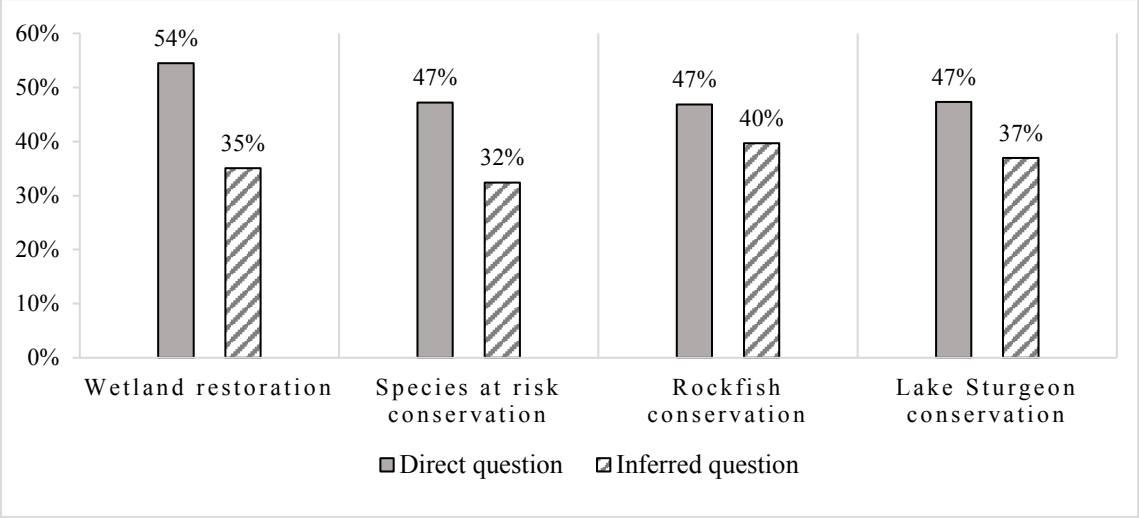

Figure 1. *Proportion of votes in favor of the proposed alternative in each dataset, by questioning approach.*

A descriptive analysis of the distribution of the vote proportions by socio-demographic variables can be found in Figures 2 to 6. Within male and female subsamples, women have a higher proportion of yes-votes with direct valuation in the two provincial studies, while the opposite can be seen for the national fish conservation studies. With inferred valuation, the proportion of yes-votes is higher within the male subsamples in all four studies. A priori, this suggests that women possibly present themselves as more supportive of the proposed policy with the direct valuation approach, but less supportive with the inferred valuation approach, indicating a tendency to SDB. These results will need to be confirmed with econometric analysis.

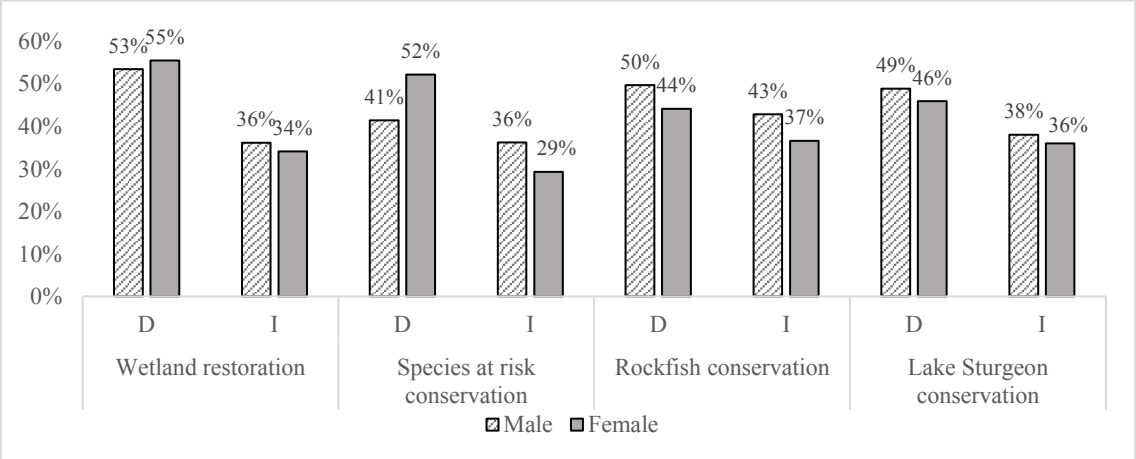

Figure 2. *Comparison of the distribution of yes votes by gender, between direct and inferred valuation methods. (D = Direct or referendum question, I= Inferred valuation question)*

The direct votes from older respondents tend to be more supportive compared to the those of younger respondents, contrasting with the behavior observed from inferred votes. In all four studies, the proportion of votes in favor of the proposed alternative is higher for people that are 48 years old or more, with direct valuation. The opposite is found with inferred valuation in three of the four studies[13]. These descriptive statistics suggest that older respondents may have an increased tendency to vote in support of the public policy when stating their preferences than when predicting others', which suggests a direct relationship between age and SDB. Once again, statistical inference is needed to test these outcomes after controlling for other potential descriptive factors.

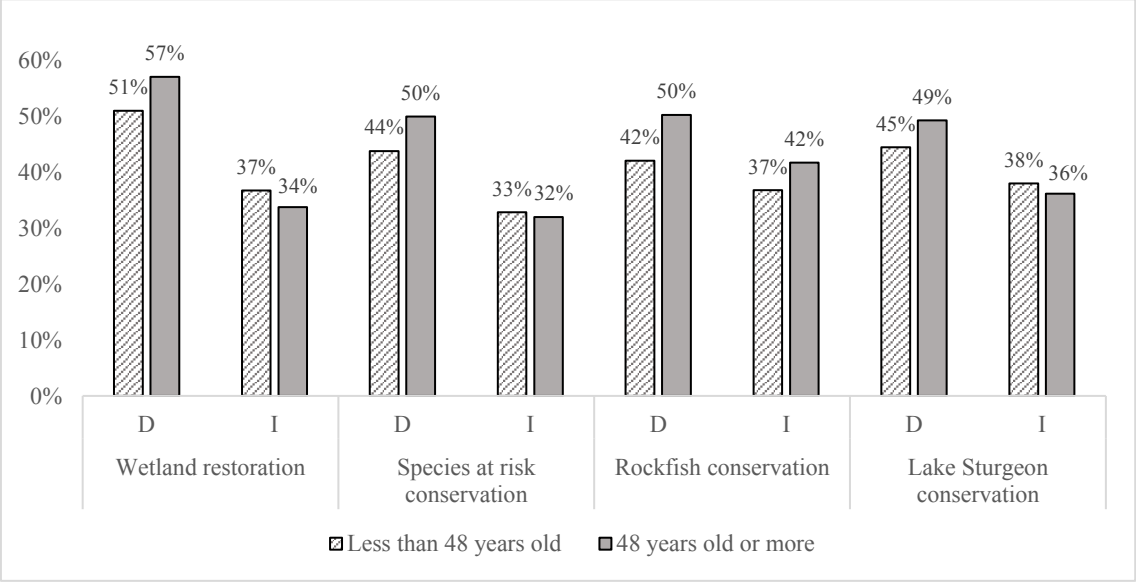

***Figure 3**. Comparison of the distribution of yes votes by age (above and below the mean), between direct and inferred valuation methods. (D = Direct or referendum question, I= Inferred valuation question)*

High-income respondents appear to support the proposed policy more than low-income respondents when voting with a direct valuation question (Figure 4). When examining the yes votes by the household-income level of the respondents, a higher proportion of support is found within individuals with household annual income above

[13] More detailed information can be found in Appendix C. Histograms of age per study show a high number of respondents in the samples around 50 years old and small representation of people 70 years old and more. Considering that distribution, scatter plots of the probability of voting yes per age level show an increasing trend with the direct valuation approach and slightly decreasing trend with inferred valuation, in three of the studies.

$100,000 in three studies with direct valuation. The proportions turn to be similar or opposite with inferred valuation. This graph suggests that people with a household income level above the threshold are generally more supportive of the proposed policies and may have a higher tendency to switch their votes from yes to no between direct and inferred valuation questions.

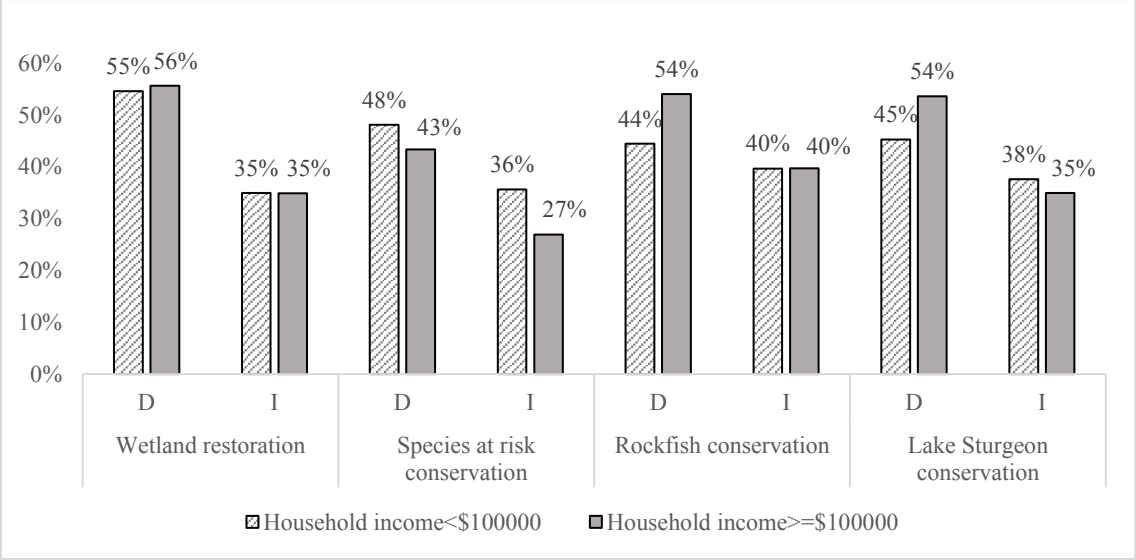

Figure 4. *Comparison of the distribution of yes votes by income categories, between direct and inferred valuation methods. (D = Direct or referendum question, I= Inferred valuation question)*

Across questioning methods, a larger proportion of yes votes is found for people with a higher level of education with direct valuation, and equal or lower proportion for the same individuals with inferred valuation (Figure 5). Within the subsample of respondents with post-secondary education, around 50% of the votes were yes, with direct valuation, which was greater than the percentage of supportive votes observed within individuals with secondary or lower education attainment. The opposite is found with inferred valuation, in two cases (Wetland restoration and Species at Risk conservation), where the support from respondents with post-secondary education shows a major decrease relative to the proportion obtained with direct valuation, in comparison to the secondary or lower education category. In the case of Rockfish and Lake Sturgeon conservation, the percentage of supportive votes is almost the same with inferred valuation in both education groups.

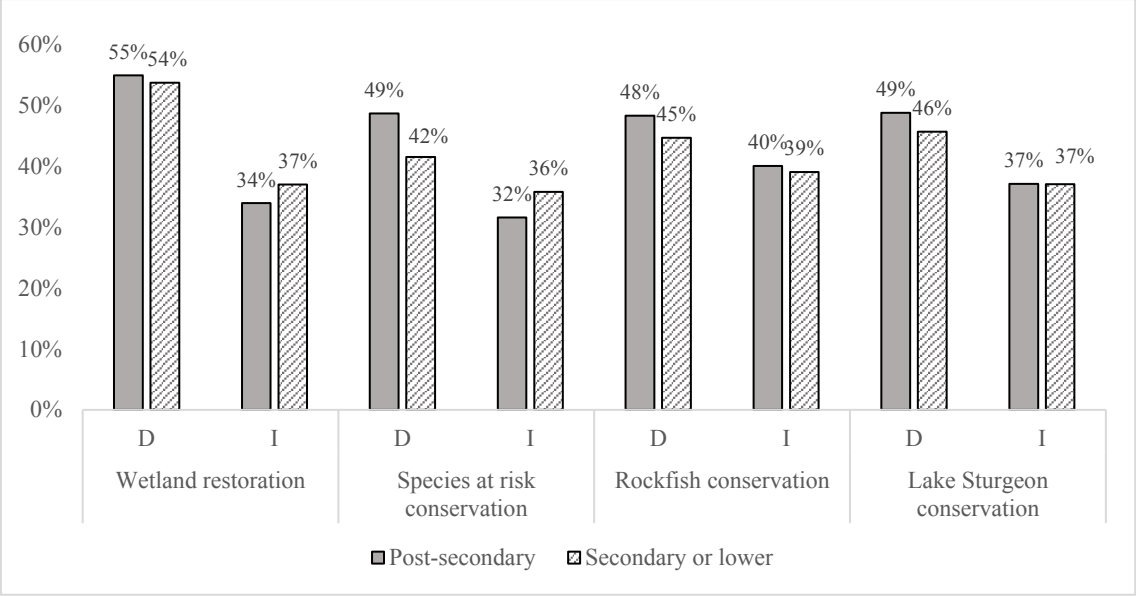

Figure 5. *Comparison of the distribution of yes votes by education attainment, between direct and inferred valuation methods. (D = Direct or referendum question, I= Inferred valuation question)*

Finally, belonging to an organization or club related to environmental conservation leads to more support of the public environmental goods being valued, which seems not to change across questioning approaches. According to the answers from the direct questions, the proportion of votes in favor of a proposed policy is greater within the group of respondents who belong to organizations related to environmental conservation, relative to those who do not, in all studies. The use of inferred valuation does not affect this result in three of the datasets. Only in the case of the Species at risk conservation study, respondents who report not belonging to environmental organizations seem to be more supportive with inferred valuation. Regarding this exploratory graph, whether or not respondents have a membership to an environmental organization may not generate an important difference in their answers across valuation questions (Figure 6), an outcome that will be statistically analyzed in the following sections.

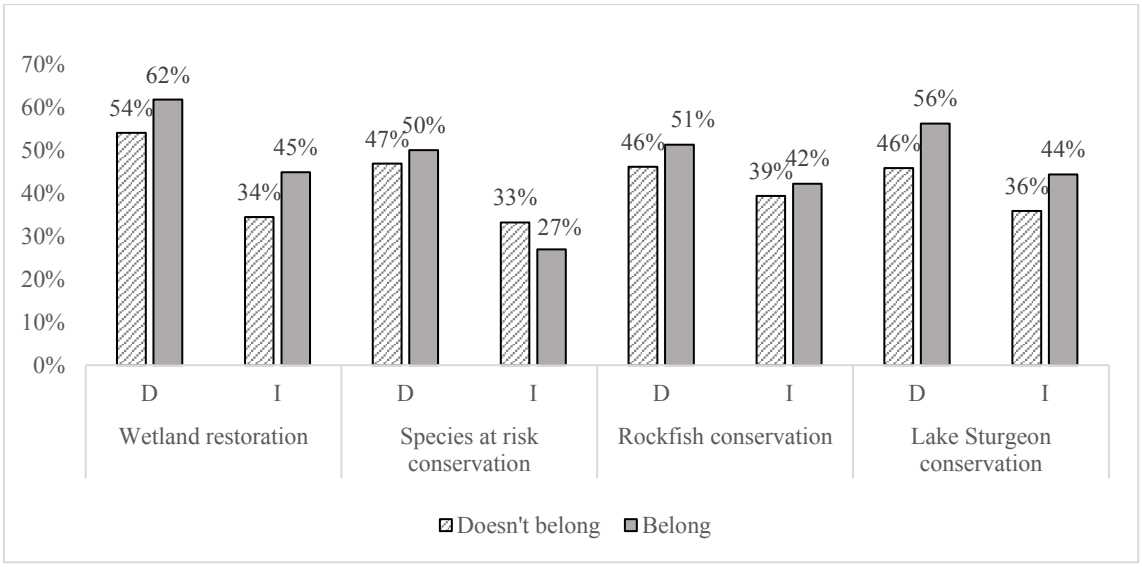

Figure 6. *Comparison of the distribution of yes votes by environmental membership, between direct and inferred valuation methods. (D = Direct or referendum question, I= Inferred valuation question)*

For the completion of the thesis' objectives and the performance of the econometric analysis, each of the datasets was restructured as if each respondent had been part of two different treatments (using direct and inferred valuation approaches). In such way, a dummy variable was created to identify the questioning method used in each treatment, and to examine the effects of interactions of the method dummy with explanatory variables in the estimation of conditional logit models. A detailed explanation of the estimation approach will be presented in Section 3.

3. THEORETICAL AND METHODOLOGICAL FRAMEWORK

3.1 The Random Utility Model and the Conditional Logit Model

According to microeconomic theory, individuals base their decisions on the maximization of their utility (Ben-Akiva et al. 1994; Bockstael and McConnell 2007). In other words, when faced with several alternatives or goods for consumption, they select the combination of goods that provides them with the highest level of satisfaction regarding their budget constraint. Solving this optimization problem, it is possible to find the indirect utility of individuals in monetary terms as a function of prices and income (Gravelle and Rees 1981). Within the framework of discrete choices, people must select one out of two or more alternatives, with several quality characteristics each (Bockstael and McConnell 2007). The indirect utility individuals gain in this context is conditioned on the alternative they pick (Bockstael and McConell, 2007) and therefore labeled as conditional indirect utility. The Random Utility Model (RUM) proposed by Daniel McFadden in 1974 and adapted by Michael Hanemann in 1984 uses the conditional indirect utility function for the analysis of discrete choices (Haab and McConnell 2002) such as voting for or against an environmental policy, which is the basis of this study.

In the RUM, the conditional indirect utility function is assumed to be well known by individuals and consist of a deterministic and a random component. This premise implies that people have well known, predetermined and stable preferences, and are assumed to behave rationally according to them (Bockstael and McConnell 2007). In addition, it suggests that researchers can only observe part of the preference determinants (Holmes, Adamowicz and Carlsson 2014). For instance, the analysis of the data collected from a sample of people could reveal that their utility increases when having a lower cost for an alternative or a larger amount of a certain attribute. However, part of the individuals' utility can be influenced by factors that are known by them but unobserved by the researcher (Holmes et al. 2014). For example, unlisted or unintended characteristics or consequences of policy alternatives. Considering these assumptions, the indirect utility obtained by individual i conditioned on choosing j from a set of alternatives C, can be defined as follows (Holmes et al. 2014):

$$V_{ij} = v_{ij}(Z_j, M_i - p_j) + \varepsilon_{ij} \quad \forall j \in C \qquad (1)$$

Where v_{ij} is the systematic or observable component defined as a function of alternative attributes Z_j, the income level of the individual M_i, and the cost that must be paid to implement or purchase the alternative, p_j. The term ε_{ij} is the random component that captures unobserved elements of indirect utility that cause variation across individuals and alternatives (Swait and Louviere 1993). Individuals are assumed to make their decisions by comparing the utility of the different alternatives in the choice set *C*. Therefore, they will prefer alternative *j* if the utility derived from it is greater than the one obtained from any other alternative *k* (Holmes et al. 2014):

$$v_{ij}(Z_j, M_i - p_j) + \varepsilon_{ij} > v_{ik}(Z_k, M_i - p_k) + \varepsilon_{ik} \qquad (2)$$

The presence of a random component in the indirect utility function leads to model preferences in probabilistic terms since the value that the indirect utility function will take for a particular individual and an alternative with known attributes, will depend on the value taken by the unobserved component (Bockstael and McConnell 2007; Holmes et al. 2014). Hence, the probability that individual *i* prefers alternative *j* is represented by (Bockstael and McConnell 2007; Haab and McConnell 2002):

$$Prob_i(j) = Prob\{v_{ij}(Z_j, M_i - p_j) + \varepsilon_{ij} > v_{ik}(Z_k, M_i - p_k) + \varepsilon_{ik}\} \qquad (3)$$

$$\forall k \in C \; and \; k \neq j$$

Defining $\varepsilon_i = \varepsilon_{ik} - \varepsilon_{ij}$, equation 3 can be re-written as:

$$Prob_i(j) = Prob\{\varepsilon_i < v_{ij}(z_j, M_i - p_j) - v_{ik}(z_k, M_i - p_k)\} \quad \forall k \in C \; and \; k \neq j \; (4)$$

Equation 4 indicates how the probability of choosing alternative *j* depends on the difference of indirect utilities. As explained by Holmes et al. (2014) this allows one to include alternative-specific constants (ASC) to account for intangible attributes of the alternatives that may influence choices[14] but leaves the factors that are common across alternatives out of

[14] Individuals could derive utility from unobserved attributes related to the label that an alternative is given (Holmes et al. 2014). If so, the effect of these unlisted attributes can be captured with the inclusion of ASC's in the model (Holmes et al. 2014). "If the average consumer views option *j* as having desirable unmeasured attributes, it will have a positive ASC" (Fiebig et al. 2010). In addition, ASC's help testing a potential status

the model. The errors ε_{ij} of the indirect utility function are assumed to be independently and identically distributed (i.i.d.)[15] following a Type I Extreme Value (also called Weibull or Gumble) probability distribution (Haab and McConnell 2002; Bockstael and McConnell 2007; Holmes et al. 2014). As a result, the term ε_i in equation 4 follows a logistic distribution, and the probability that individual *i* prefers alternative *j* is defined by equation 5, which corresponds to the Conditional or Multinomial Logit model (MNL) that can be estimated using maximum likelihood procedures (Grafton et al. 2004; Bockstael and McConnell 2007):

$$Prob_i(j) = \frac{\exp(\mu V_{ij})}{\sum_{k=1}^{c} \exp(\mu V_{ik})} \ \forall j, k \in C \ \ and \ k \neq j \qquad (5)$$

In equation 5, μ represents the scale parameter that arises from the density function of the Type - I Extreme Value distribution, and it is inversely related to the variance of the random element in the utility function[16] (Swait and Louviere 1993; Haab and McConnell 2002). The scale parameter determines the importance of the observed and unobserved components in the preference structure. A scale parameter of zero ($\mu = 0$) implies an infinite variance of the error term which supposes all choices are random, while an infinite scale parameter implies that the variance is zero and all choices are deterministic (Swait and Louviere 1993; Holmes et al. 2014). The role of the scale parameter in our study will be addressed later in this Chapter.

If the systematic component of the conditional indirect utility function is assumed to be linear, and an alternative-specific constant α_j is included, then V_{ij} can be represented by equation 6, where α_j, λ, and β are preference parameters of the systematic component of V_{ij}. (Holmes et al. 2014):

$$V_{ij} = \alpha_j + \lambda Z_{ij} + \beta\left(M_i - p_j\right) + \varepsilon_{ij} \qquad \forall j \in C \qquad (6)$$

quo bias which occurs when respondents prefer the current situation disregarding the characteristics that both alternatives offer (Holmes et al. 2014).

[15] Together with the assumption that preference parameters don't vary across individuals, the i.i.d. assumption of the error term, implies the independence of irrelevant alternatives property in the Conditional or Multinomial Logit model (Keane and Wasi 2013).

[16] Since the error term is assumed to follow a Type-I extreme value distribution, it has variance $Var(\varepsilon_{ij}) = \pi/6\mu^2$; therefore, as the scale parameter increases, the variance of the error decreases and vice versa (Haab and McConnell 2002).

More specifically:

$\alpha_j =$ Impact of the alternative-specific constant (ASC) of alternative *j* on its indirect utility.

$\lambda =$ Vector of preference parameters of non-monetary attributes Z_{ij} on the indirect utility of *j*

$\beta =$ Impact of a variation in the cost of the alternative *j* on its indirect utility; therefore, it reflects the marginal utility of money.

The stated preference surveys used for the present research provided respondents with *state-of-the-world* choice tasks, where they were given the option to vote for a current policy with zero cost or a proposed alternative policy with an environmental improvement linked to a hypothetical payment. In addition, the alternatives listed several attributes to be considered by the respondents when making their decision. Therefore, the indirect utility obtained by voting in favor of a public policy, disregarding the specific good being valued, can be written as:

$$V_{ij} = \alpha_j + \lambda Z_{ij} + \beta\left(M_i - p_j\right) + \varepsilon_{ij} \qquad \forall j \in \{0,1\} \qquad (7)$$

$$where \begin{cases} 0 \equiv current\ situation \\ 1 \equiv proposed\ \ policy \end{cases}$$

In this state of the world referendum context, individuals would vote in favor of the proposed policy if the difference between the indirect utilities is positive, or they will vote against it otherwise. This behavior is represented in equations 8 and 9, where Y_i is the vote reported by respondents in the survey, recoded as a binary variable:

$$V_i^* = V_{i1} - V_{i0} = \alpha_1 + \lambda(Z_{i1} - Z_{i0}) - \beta p_1 + \varepsilon_i \qquad (8)$$

$$Y_i = \begin{cases} 1 \equiv vote\ for\ the\ proposed\ policy & if\ V_i^* > 0 \\ 0 \equiv vote\ for\ the\ current\ situation & if\ V_i^* \leq 0 \end{cases} \qquad (9)$$

Thus, the variation in utility (V_i^*) is a latent variable for which data cannot be collected, and the information used as the dependent variable in the empirical estimation of

the Conditional Logit model is the choice that respondents made (Y_i), as expressed in equation 10:

$$Prob_i(Y_i = 1) = \frac{\exp(\mu V_{i1})}{\exp(\mu V_{i0}) + \exp(\mu V_{i1})} \quad (10)$$

3.2 Limitations of the Conditional Logit Model

The MNL imposes strict limitations on the determination of choices. The model supposes that preference parameters α_j, λ, and β are homogenous across individuals, meaning that people have the same tastes in costs and attributes. (Holmes et al. 2014). In addition, the scale parameter μ is assumed to be equal to 1 since it is confounded with the preference parameters when they are estimated (Swait and Louviere 1993; Holmes et al. 2014). Considering that the scale parameter reflects the importance the random and systematic components have in the indirect utility function (Swait and Adamowicz 2001), giving it a fixed value imposes the restriction that both observed and unobserved elements influence preferences in the same degree across observations. These assumptions may not apply to a specific sample, and they can be relaxed by the use of model extensions (Holmes et al. 2014).

3.2.1 Model extensions for addressing preference heterogeneity

Heterogeneity in the systematic part of the indirect utility function can be addressed using interactions between parameters in the econometric estimation. Preference variation across specific groups of people cannot be captured by including individual-specific characteristics directly in the model since these variables would not vary among alternatives (Holmes et al. 2014). In this situation, a straightforward procedure is to interact individual-specific variables with the alternative-specific variables in the model (Holmes et al. 2014). The parameter obtained from the interaction of a categorical individual-specific variable (e.g. education level) with an alternative-specific variable, represents the difference in the effect of the latter on the indirect utility between people in one of the categories with respect to the

base. On the other hand, the parameter obtained from the interaction of a continuous individual-specific variable (e.g. age) and an alternative-specific variable informs which direction the effect of the latter would take when the individual-specific characteristic varies. Thus, the use of interactions is very informative when comparing the influence of socio-demographic factors on people's discrete choices, but using too many of them could cause collinearity problems in the estimation of parameters (Holmes et al. 2014).

Advanced econometric models that address preference heterogeneity include the Random Parameter Logit (also known as Mixed Logit) and the Latent Class Logit model (Holmes et al. 2014). The former allows the researcher to assume that certain preference parameters are randomly distributed in the systematic component of the indirect utility. Subsequently, the statistical significance of their associated parameters on standard deviations informs the researcher about the presence of preference heterogeneity in the choices. If statistical significance is not rejected, the model will be a better representation of individuals' preferences with respect to the MNL (Holmes et al. 2014). However, the Random Parameter Logit model does not inform which individual-specific factors influence preference heterogeneity if standard deviation preference parameters are found to be statistically significant. On the other hand, the Latent Class Logit model allows one to estimate the joint probability that individuals belong to one of a fixed number of segments depending on individual-specific characteristics, and that they choose an alternative depending on membership to each of those segments (Boxall and Adamowicz 2002; Holmes et al. 2014). From the estimation, it is possible to compare and assess how preference parameters vary across segments. Both models require an *a-priori* selection of variables that are suspected to be affected by preference heterogeneity in one case and be the cause of it in the other (Boxall and Adamowicz 2002) and they continue to assume the error term is i.i.d. (Keane and Wasi 2013).

3.2.2 Model extensions for addressing scale heterogeneity

The assumption of a fixed scale can also be relaxed by means of econometric extensions, but the interpretation of the scale parameter and the other coefficients obtained

with these models needs to be done with caution. As a standard practice in discrete choice modeling, the scale parameter is assumed constant and equal to 1, meaning that it is the same across all observations, although the role played by the random component in the preference structure can also vary across individuals, alternatives, or across questioning approaches. The potential variation of the scale parameter across observations is defined as scale heterogeneity (Scarpa, Thiene and Train 2008; Train and Weeks 2005). The Scale Multinomial Logit and the Generalized Multinomial logit are two econometric improvements to the basic Conditional and Random Parameter Logit models developed to include scale heterogeneity in the preference structure. In the Scale Multinomial Logit Model (SMNL) preference parameters are proportionally scaled across individuals by an individual-specific scale parameter (see Fiebig et al. 2010 for more information) However, to evaluate the possibility that the questioning approach or individual-specific characteristics influence the variations in the scale parameter, it could be more appropriate to use the Generalized Multinomial Logit (GMNL) model developed in 2010 by Denzil G. Fiebig, which is briefly described in the next section. However, it is worth noting that the identification of the scale parameter in the SMNL and GMNL models does not necessarily denote presence of scale heterogeneity. Since the scale parameter reflects the importance of the observed elements of the indirect utility relative to those unobserved to the researcher, variations in the scale parameter (or scale heterogeneity) are associated with same-degree variations in all the coefficients of the observed factors. Thus, Stephane Hess and Kenneth Train (2017) consider scale heterogeneity a particular form of correlation among all preference parameters. Both SMNL and GMNL models assume that the scale parameter captures only such source of correlation; nonetheless, Hess and Train (2017) explain how the scale parameter specified in these models captures the combined impact of any sources of correlation present across the coefficients of the systematic elements of the indirect utility.

3.2.3 The Generalized Multinomial Logit model (GMNL) and scale heterogeneity

It is assumed that the GMNL accommodates both preference and scale heterogeneity by nesting a Random Parameter Logit and a Scale Multinomial Logit model in a single

expression (Gu, Hole and Knox 2013). These two models were considered able of separately addressing both sources of heterogeneity in the utility function; until Fiebig et al (2010) analyzed the possibility that heterogeneity in tastes and scale can be jointly present in the preference structure. Fiebig et al (2010) examined whether the inclusion of scale heterogeneity (assumed to be the only source of correlation captured by the scale parameter) significantly improved model fit in a sample, compared to an estimation that accounted for preference heterogeneity only (Fiebig et al. 2010). In their study, they found that the specification of scale heterogeneity using a GMNL performed better than a Random Parameter Logit in 7 out of 10 applications on choice experiment datasets, and concluded that the GMNL better captures the behavior of individuals who make highly random choices (Fiebig et al. 2010). However, as mentioned before, Hess and Train (2017) suggest that is not always the case. In the GMNL, the probability that individual *i* prefers alternative *j* is given by:

$$Pr_{ij} = \frac{\exp(\omega_i Z_{ij})}{\sum_{k=1}^{c} \exp(\omega_i Z_{ik})} \qquad (11)$$

$$\omega_i = \mu_i \omega + [\gamma + \mu_i(1-\gamma)]\eta_i$$

In equation 11, ω_i represents individual-specific preference parameters, μ_i is the individual-specific scale parameter, ω is a constant vector (the mean of the preference parameters ω_i), η_i is the individual specific deviation of ω_i from the mean (also called residual preference heterogeneity), and γ is a scalar restricted to vary between 0 and 1 (Fiebig et al. 2010). As shown in equation 12, If $\gamma = 1$, the standard deviation of η_i is independent of the scaling of ω, giving place to a GMNL-I model as defined by Fiebig et al. (2010). On the other extreme, if $\gamma = 0$ the standard deviation of η_i is proportional to the scaling of ω, which is known as the GMNL-II model (Fiebig et al. 2010)[17].

$$\begin{cases} \gamma = 1 \rightarrow \ \omega_i = \mu_i \omega + \eta_i \\ \gamma = 0 \rightarrow \ \omega_i = \mu_i \omega + \mu_i \eta_i \end{cases} \qquad (12)$$

[17] Keane and Wasi (2013) suggest the parameter γ can be allowed to take values that are lower than 0 or greater than 1, with a valid interpretation about respondents' behavior. An approach followed by Gu et al. (2013).

The GMNL model can collapse into three simpler models depending on the value that the scale parameter takes (Gu and Hole 2013):

- When $\mu_i = 1$, $\omega_i = \omega + \eta_i$, which corresponds to a Random Parameter Logit model.
- When $Var(\eta_i) = 0$, $\omega_i = \mu_i \omega$, which corresponds to a Scale Multinomial Logit model.
- When $\mu_i = 1$ and $Var(\eta_i) = 0$, $\omega_i = \omega$, leading to a basic Multinomial Logit model.

As previously mentioned, the GMNL model includes a specification of the scale parameter that allows explaining scale heterogeneity as a function of selected factors.

$$\mu_i \sim LN(\bar{\mu} + \theta h_i, \tau) \qquad (13)$$

The individual-specific scale parameter μ_i is assumed to follow a log-normal distribution with standard deviation τ, and mean $\bar{\mu} + \theta h_i$. In such definition, the parameter τ is directly related to μ_i, reflecting the level of scale heterogeneity in the sample (Fiebig et al. 2010) while h_i represents a vector of variables that could explain the variation in μ_i relative to the fixed value $\bar{\mu}$ (The standard assumption is that $\bar{\mu} = 1$) (Fiebig et al. 2010). This element of the GMNL model specification could be used for analyzing the impact of individual-specific factors and the use of an inferred questioning approach on differences in scale, highlighting the possibility that scale heterogeneity may not be the only source of correlation among all the variables included in the indirect utility model.

3.3 Testing the difference between direct and inferred votes

Considering that the purpose of the present research is to examine any systematic differences between the direct and inferred valuation approaches, the use of interactions is an important step in the analysis. To this end, the datasets were restructured as shown in Figure 7, such that they consisted of two blocks of stacked data representing the votes made with one of the two questioning methods, and a dummy variable (*INF*) identifying the inferred approach. In this way, it is possible to examine how the same individuals responded

to valuation tasks with the same characteristics through the direct and inferred valuation questions.

$$\begin{matrix} Vote\ (Y_i) \\ \begin{bmatrix} Direct\ vote \\ . \\ . \end{bmatrix} \\ \begin{bmatrix} Inferred\ vote \\ . \\ . \end{bmatrix} \end{matrix} \quad \begin{matrix} ASC\ (\alpha_j) \\ \begin{bmatrix} ASC_j \\ . \\ . \end{bmatrix} \\ \begin{bmatrix} ASC_j \\ . \\ . \end{bmatrix} \end{matrix} \quad \begin{matrix} Attributes \\ \begin{bmatrix} Z_{ij} \\ . \\ . \end{bmatrix} \\ \begin{bmatrix} Z_{ij} \\ . \\ . \end{bmatrix} \end{matrix} \quad \begin{matrix} INF \\ \begin{bmatrix} 0 \\ . \\ . \end{bmatrix} \\ \begin{bmatrix} 1 \\ . \\ . \end{bmatrix} \end{matrix}$$

Figure 7. *Scheme of a restructured dataset where the votes from the direct and inferred valuation questions and the duplicated individual and alternative specific variables are stacked.*

The basic analysis starts with comparisons within datasets across questioning approaches. Likelihood ratio tests are used to compare if the probability of voting yes with the direct or inferred valuation questions can be treated as equal (without including any dummy for differentiation). In addition, the dummy variable (*INF*) will be interacted with the alternative specific constant, and the alternative attributes including the cost (as shown in equation 14) to assess how the effects of these variables vary by method.

$$V_{ij} = \alpha_j + \lambda Z_{ij} + \beta\left(M_i - p_j\right) + \alpha_j^* INF + \lambda^* Z_{ij} INF + \beta^*\left(M_i - p_j\right) INF + \varepsilon_{ij} \quad (14)$$

$$\forall j \in \{0,1\}\ where \begin{cases} 0 \equiv current\ situation \\ 1 \equiv proposed\ \ policy \end{cases}$$

The difference in the indirect utility that includes interactions with the valuation approach for a state-of-the-world choice can be written as:

$$V_i^* = V_{i1} - V_{i0} = \alpha_1 + \lambda(Z_{i1} - Z_{i0}) - \beta p_1 + \alpha_1^* INF + \lambda^*(Z_{i1} - Z_{i0}) INF - \beta^* p_1 INF + \varepsilon_{ij} \quad (15)$$

where the alternative specific constant α_0 is normalized to zero, income is factored out, and there is no payment associated to the current situation or status quo alternative ($p_0 = 0$). In equation 15, the parameters α_1^*, λ^*, and β^* capture the deviation in preferences

that respondents show when using the inferred valuation question with respect to the direct question, for the same alternatives presented in a choice task. Hence, to know the final effect of an alternative-specific factor on the choice made with the inferred valuation question, keeping the rest of the variables constant, the two parameters related to that factor should be added. That is, the effect of a one-unit increase of Z_{i1} in the latent indirect utility of choosing V_{i1} made with the direct (D) and inferred (I) valuation questions respectively are:

$$\lambda_D = \lambda \tag{16}$$

$$\lambda_I = \lambda + \lambda^* \tag{17}$$

3.4 Testing the influence of individual-specific characteristics

The influence of individual-specific variables on the difference between direct and inferred votes can be examined using a similar procedure. We interact socio-demographic characteristics (X_i) with the terms in equation 14, according to equation 18, and we assess the signs and statistical significance of the parameters related to the interaction terms.

$$V_{ij} = \beta\left(M_i - p_j\right) + \alpha_j + \lambda Z_{ij} + \alpha_j^* INF + \lambda^* Z_{ij} INF + \beta^*\left(M_i - p_j\right) INF + \alpha_j' X_i + \lambda_j' Z_{ij} X_i + \tilde{\alpha_j} INF X_i + \tilde{\lambda} Z_{ij} INF X_i + \varepsilon_{ij} \tag{18}$$

$$\forall j \in \{0,1\} \quad \text{and} \quad j = \begin{cases} 0 \equiv current\ situation \\ 1 \equiv proposed\ \ policy \end{cases}$$

where:

$\alpha_j' =$ is a vector of parameters capturing the difference in preferences for ASC (holding all other attributes constant) between an individual-specific characteristic category and the base category (or due to an increase in a continuous individual-specific factor), in votes stated with direct valuation.

$\lambda_j' =$ is a vector of parameters that capture the difference in the effect of the attribute Z_{ij} between an individual-specific characteristic category and the base category, in votes stated with direct valuation.

$\widetilde{\alpha_j} =$ is a vector of parameters that capture the difference in preferences for the ASC (holding all other attributes constant) between an individual-specific characteristic category and the base category (or due to an increase in a continuous individual-specific factor), in preferences stated with the inferred valuation approach with respect to the direct approach.

$\tilde{\lambda} =$ is a vector of parameters that capture the difference in the effect of the attribute Z_{ij} between an individual-specific characteristic category and the base category (or due to an increase in a continuous individual-specific factor), in preferences stated with the inferred valuation approach with respect to the direct approach.

Since one of our objectives is to evaluate whether the effects of socio-demographic variables are systematic across demographic groups of people and data sets, comparisons between coefficients should be made with caution. Since the scale parameter is confounded with the estimated preference parameters of the indirect utility, it is not possible to compare them across datasets in terms of magnitudes (Swait and Louviere 1993) but in terms of signs. The values of marginal willingness to pay, where the scale parameter is canceled out (Holmes et al. 2014), assuming a linear specification for the indirect utility function, could be more informative in this case. The marginal willingness to pay represents the amount of money individuals are willing to pay for one more unit of a quantitative attribute or for the presence of a qualitative attribute in a proposed alternative. Following Holmes et al. (2014), marginal willingness to pay can be obtained as the ratio of the attribute's coefficient and the marginal utility of money given by the cost parameter. However, all attributes except cost are different across the studies used for the present research, which is why willingness to pay values are not going to be used. Comparisons will be made in terms of directions and statistical significance.

In summary, although there are several methods available to assess the presence of heterogeneity among valuation methods, individuals, and observations, our approach in this study will be simpler in terms of model specification. In this chapter we have mentioned the potential of Random Parameter Logits and Latent class models to address heterogeneity in preferences parameters, as well as the use of the generalized multinomial logit to evaluate differences in scale. Nonetheless, our approach involves the estimation of conditional logit models that allow the inclusion of an alternative specific constant to model voting behavior,

and the assessment of differences in voting preferences using interactions, as detailed in sections 3.3 and 3.4. Advanced model extensions, as the ones already described are left for future analysis of preference and scale heterogeneity caused by different valuation methods and individual-specific factors.

4. TESTING THE STATISTICAL DIFFERENCE OF VOTING WITH THE DIRECT AND INFERRED VALUATION QUESTIONS

The prior three sections provided background information and a literature review related to the objectives of the present study, a description of the survey datasets employed, as well as a theoretical and methodological framework for the development of the research. This section focuses on the empirical analysis of the differences between answers from the direct and inferred questioning methods. We start with descriptive statistics of direct, inferred and switching votes, and continue with the estimation of Conditional Logit Models and statistical tests. Using the predicted votes from the estimated models, we graphically analyze respondent's behavior towards voting yes at different cost levels, regarding the public good being valued and the province in which the survey was implemented. Finally, we include a model extension using interactions among parameters to test how each questioning method affects preferences for different attributes. The chapter ends with a summary of the findings and an overall discussion.

4.1 Descriptive analysis of vote consistency through questioning methods

Before comparing votes from the direct and inferred valuation approaches, it is worth emphasizing how inferred votes were constructed. Inferred votes resulted from recoding the percentage of the population that respondents predicted would support the proposed policy, when faced with the same hypothetical referendum task. If their prediction was less than or equal to 50%, we considered it as an inferred "no" vote, and if it was greater than 50%, their prediction was recoded as a "yes" vote. Table 3 summarizes these recoded data. Excluding yea-sayers, respondents predicted on average that 44% of Manitoban residents would vote yes for a wetland restoration program; 41% of Saskatchewan residents for a species at risk conservation strategy; 46% of Canadians for a program that involved conservation of the Pacific Rockfish; and 45% of Canadians for the conservation of the Lake Sturgeon DU8 species. Mean values were close to median values in all four studies, and the standard deviation of the predicted percentage of yes-votes was also similar across datasets reaching

approximately 25 percentage points. In general, these statistics suggest that, independently of the specific public good being valued, respondents tended to predict that between 41% and 46% of the study population would support the proposed environmental policy. In addition, the mean of the inferred proportion of support per cost level shows a decreasing trend in all cases, where respondents predict on average more than 50% of the respective population would vote yes at the lowest bid, and less than 35% at the highest, in all four studies (See Appendix D).

In comparison with direct votes, the recoded inferred votes show respondents have less preference for the proposed alternative. The average proportion of supportive votes across studies is 49% with the direct question and 36% with the inferred valuation question, which *a priori* indicates presence of SDB in the surveys, although it doesn't reflect individual behavior.

Table 3. Comparison of descriptive statistics for yes-votes from direct and inferred valuation questions

Study	Statistics	Direct yes votes	Inferred yes votes	Inferred proportion of the population would vote yes	Total number of votes*
Wetland restoration	% of total	54.47%	35.07%		9450
	Mean			44.00	
	Median			45.00	
	Std. Deviation			23.41	
Species at risk conservation	% of total	47.22%	32.41%		1,296
	Mean			40.67	
	Median			40.00	
	Std. Deviation			26.52	
Rockfish conservation	% of total	46.84%	39.67%		3,627
	Mean			45.60	
	Median			50.00	
	Std. Deviation			25.72	
Lake Sturgeon conservation	% of total	47.32%	36.96%		3,561
	Mean			44.52	
	Median			44.00	
	Std. Deviation			26.60	

Notes:
**Votes from yea-sayers are excluded*
Inferred proportion of the population that would vote yes, per cost level can be found in Appendix D.

The proportion of votes that switched from yes to no between the direct and inferred valuation methods provide a first insight into potential systematic effects of the method in respondent's answers. Since most previous articles have found overstatements of willingness to pay in direct valuation questions and lower values that are closer to real payments in indirect questions (Johansson-Stenman and Svedsäter 2012), it is our expectation that most respondents would tend to vote yes (in support of a positive environmental change) with the direct question and no with the inferred question in most of their valuation tasks. Such behavior could lead to a higher percentage of switching votes from yes to no in valuation studies focused on environmental conservation, with variation across studies potentially attributed to the differences in the public goods being valued. Table 4 classifies the votes from the four datasets, based on whether they matched or switched within individual and valuation task, between direct and inferred questions. Interestingly, around 66% of the votes were consistent while around 34% switched. Positive matching votes ($Y_D \rightarrow Y_I$) range between 24% and 27%. Negative matching votes ($N_D \rightarrow N_I$) oscillate between 36% and 44%. The percentage of yes-to-no switching votes ($Y_D \rightarrow N_I$) are similar across studies, remaining between 20% and 29% in what seems consistent with the SDB concept while no-to-yes switching votes ($N_D \rightarrow Y_I$) remain below 14% of the total in all four datasets opposite to our SDB expectations. These results suggest the existence of a potential systematic pattern in the difference between direct and inferred votes, which needs to be statistically tested. However, a shift in preferences between both valuation methods (from yes to no, and no to yes) in each observation may result from the combination of alternative attributes presented in each valuation task, as well as the respondent's characteristics, and attitudes towards the scenarios presented. Indeed, the important proportion of no-to-yes switching votes may be signaling the presence of other factors beyond social desirability in some of individual's answers.

Table 4. The proportion of matching and switching votes from direct and inferred valuation questions

Category	Wetland restoration		Species at risk conservation		Rockfish conservation		Lake Sturgeon conservation	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
$Y_D \rightarrow Y_I$	2,370	25	307	24	968	27	934	26
$N_D \rightarrow N_I$	3,359	36	571	44	1,457	40	1,494	42
$Y_D \rightarrow N_I$	2,777	29	305	24	731	20	751	21
$N_D \rightarrow Y_I$	944	10	113	9	471	13	382	11
Total number of votes*	**9,450**	**100**	**1,296**	**100**	**3,627**	**100**	**3,561**	**100**

Notes:
**Votes from yea-sayers are excluded*
Y_D *= Vote in support of the proposed alternative vs. the current situation stated in the direct question*
Y_I *= Vote, in support of the proposed alternative vs. the current situation, stated in the inferred valuation question.*
N_D *= Vote against the proposed alternative in favor of the current situation stated in the direct question*
N_I *= Vote against the proposed alternative in favor of the current situation stated in the inferred valuation question*

4.2 Conditional logit models using pooled and separate votes from direct and inferred valuation questions – Likelihood ratio test results

A simple way to test the difference between direct and inferred voting behavior is the performance of likelihood ratio tests comparing joint and composite conditional logit models. As mentioned in Chapter 3 (equation 5), conditional logit models are used in the present research to estimate the probability of voting for the public policy proposed in any of the four studies. Such probability depends on the difference of indirect utilities. Thus, the indirect utility individuals obtain from voting "yes" was modeled as a linear function of an alternative-specific constant (ASC) capturing utility obtained from unlisted attributes of the current situation or potential status quo bias, the cost of the proposed policy which is a household tax increase, and alternative-specific attributes (e.g. the number of wetland acres projected for 2020 in the Wetland restoration study, environmental conservation strategies for the species at risk conservation study, and extirpation risk status to be achieved for the fish species in the last two studies). The coefficients estimated from such specification are interpreted as the effects of the variables on the latent propensity of individuals to choose the proposed policy with respect to the current situation, in any specific case.

For each dataset, we estimated a joint or restricted Conditional Logit model, in which the votes made in the direct and inferred valuation tasks were pooled, assuming they are equally determined (equality of parameters), independently of the questioning method used. This is the null hypothesis that is tested through the performance of likelihood ratio tests. In addition, two models were estimated with separate samples: In one of them, only the votes made with the direct question were considered, while the other model used only the votes recoded from the inferred valuation question. The results of the estimations using votes from direct, inferred, and pooled votes are presented in Table 5.

The likelihood ratio tests reject the null hypothesis of parameter equality between the preference estimations from direct and indirect questions in each study. The values obtained for the likelihood ratio statistics from the pooled-vote model and the composite estimation of the two separate models were greater than the values from a Chi-Square distribution with the degrees of freedom that correspond in each case. This is reflected in the p-values that are below 0.05. Subsequently, the pooled-vote models do not fit the datasets better than the two separate estimations. Hence, the tests indicate the existence of a statistical difference in the probability of voting yes in support of the proposed alternative generated by the questioning approach employed, across the four valuation studies. The subsamples of votes obtained from direct and inferred valuation questions must be analyzed separately or should be differentiated using dummy variables.

As expected, the estimated parameters suggest that, when answering a direct question, respondents prefer a proposed policy alternative over the current situation. The coefficient of *ASC current situation* in the model using direct votes is negative and statistically significant in all datasets, indicating that voting for the current situation decreases respondents' indirect utility. However, using inferred votes only, *ASC current situation* is mainly positive but not statistically significant, which suggest the unlisted attributes it captures may not influence respondents' prediction of others' behavior (or may not influence respondents' true preferences if inferred valuation is assumed to capture them). As a result, respondents are against the current situation independent of the listed attributes, and therefore driven to choose a proposed policy alternative over the default in every study when answering the referendum question while this is not observed with inferred valuation. Such behavior may

be indicating presence of SDB in the surveys. The negative and statistically significant parameter of *Cost* (in hundreds of CAD) in all models implies that individuals have a positive marginal utility of money following a rational economic behavior. In other words, they prefer alternatives linked to lower tax increases for their households over more expensive ones, regardless of the question format.

Table 5. Joint and separate basic Conditional Logit models – Likelihood ratio tests (Clustered standard errors in parenthesis)

	Wetland restoration			Species at risk conservation			Rockfish conservation			Lake sturgeon conservation		
	Direct vote	**Inferred vote**	**Pooled votes**	**Direct vote**	**Inferred vote**	**Pooled votes**	**Direct vote**	**Inferred vote**	**Pooled votes**	**Direct vote**	**Inferred vote**	**Pooled votes**
ASC current situation	-0.773***	0.086	-0.329***	-1.078***	-0.102	-0.574***	-0.880***	0.092	-0.368***	-0.584***	0.089	-0.241***
	(0.056)	(0.057)	(0.042)	(0.130)	(0.123)	(0.096)	(0.072)	(0.067)	(0.053)	(0.067)	(0.066)	(0.053)
Cost (100's of $)	-0.278***	-0.244***	-0.252***	-0.714***	-0.780***	-0.717***	-0.530***	-0.210***	-0.353***	-0.534***	-0.309***	-0.415***
	(0.013)	(0.015)	(0.010)	(0.051)	(0.072)	(0.044)	(0.032)	(0.021)	(0.019)	(0.031)	(0.024)	(0.021)
Wetland acres (100000's)	0.053***	0.021	0.036***									
	(0.015)	(0.015)	(0.011)									
Moderate strategy				-0.387***	-0.138	-0.258***						
				(0.126)	(0.128)	(0.091)						
Light strategy				-0.473***	0.172	-0.158						
				(0.153)	(0.166)	(0.122)						
Threatened status							-0.373***	0.041	-0.150***	0.381***	0.161**	0.261***
							(0.073)	(0.066)	(0.053)	(0.077)	(0.065)	(0.056)
Special concern							-0.100	0.056	-0.017	0.066	-0.029	0.016
							(0.071)	(0.065)	(0.052)	(0.070)	(0.066)	(0.054)
Number of votes	9450	9450	9450	1296	1296	1,296	3627	3627	3627	3561	3561	3561
Log-likelihood	-6156	-5889	-12433	-773.9	-711.7	-1526	-2122	-2360	-4570	-2077	-2204	-4353
Pseudo-R2	0.0602	0.101	0.0510	0.139	0.208	0.151	0.156	0.0611	0.0910	0.158	0.107	0.118
Likelihood ratio test (statistic)		775.68			80.28			175.99			144.16	
Likelihood ratio test (p-value)		0.00			0.00			0.00			0.00	

Notes:

**** p<0.01, ** p<0.05, * p<0.1*

-Moderate and Light strategies in the Species at risk conservation dataset are interpreted with respect to a Heavy conservation strategy, which implied a lower risk status for the animal species.

-Threatened and Special concern status in the Rockfish and Lake Sturgeon conservation datasets are interpreted with respect to the Not-at-Risk status of the fish species.

The coefficients on the attribute variables suggest that higher levels of positive attributes are preferred with the referendum question, except for the Lake Sturgeon study. The estimated parameter on *Wetland Acres* from the direct yes-vote model suggests a proposed policy is preferred with the direct approach when it promises to retain a higher number of wetland acres by the year 2020 in Manitoba, consistent with Forbes et al. (2015). In the Species at Risk conservation study, the *Moderate strategy and Light strategy* dummy variables present negative and significant coefficients, meaning that respondents' indirect utility decreases when the proposed alternative in the referendum question has the characteristics of these strategies with respect to the *Heavy strategy*. That is, they are more likely to vote "yes" with the direct question, in support of the proposed policy, if it entails a higher reduction in the extirpation risk of the five species considered in the survey. Similar behavior is found in the Rockfish conservation study where the *Threatened status* dummy presents a negative and significant coefficient. Indeed, respondents are less likely to choose a proposed alternative that involves changing the Pacific Rockfish risk status from Endangered to Threatened in 40 years with respect to one that would eliminate its regional extinction risk. However, the estimated parameter on *Special Concern* is negative but not statistically different from zero, meaning that Canadians are indifferent between a proposed alternative that offers reducing Rockfish extirpation risk from Endangered to Special Concern and one that would reduce it to a Not-at-Risk status.

Interestingly, with a direct valuation approach, the attribute coefficients in the Lake Sturgeon conservation study imply opposite preferences to those of the Rockfish conservation study. The coefficient on *Threatened status* is statistically significant but positive, meaning that respondents are more likely to vote for the proposed alternative in the referendum question when it involves changing Lake Sturgeon's listing from Endangered to Threatened in 30 years, rather than from Endangered to Not at Risk. Such an outcome contradicts our expectations of a socially desirable behavior; however, these results can be related to the survey design.

Although both aquatic surveys were very similar in structure, the Pacific Rockfish survey presented three policy alternatives that reduced the fish extirpation risk through restrictions in commercial fishing and related industries; while the Lake Sturgeon survey

presented respondents with proposed policies that affected different human activities and required public investments in infrastructure. Changing Lake Sturgeon status from Endangered to Threatened in 30 years was linked to restrictions in fishing activities and the fishing industry. Reaching a Special concern status implied adding stocking procedures and habitat improvements, which would potentially affect access to waterways by farmers, hydro-electric companies, fishermen, boaters, and Aboriginal people. Reaching a Not-at-Risk status included the construction of fish ladders on dams (which is described as one of the largest costs of recovering funded by taxes), in addition to the already mentioned restrictions. This information could have led most respondents in the sample to prefer the proposed alternative that would reduce the extirpation risk of Lake Sturgeon with the lower negative implications for human activities (that is the *Threatened status* scenario). Nonetheless, when the model was estimated for provincial subsamples, the coefficient on *Threatened status* was not statistically significant in the cases of Manitoba and Ontario (where a higher number of Lake Sturgeon designatable units[18] are found). This suggests that respondents from these provinces are willing to support a proposed policy with the direct question, disregarding the specific scenario presented, as they may perceive higher social expectations placed on them to protect this fish species. On the other hand, the coefficient on *Special concern status,* in the model that used direct votes, is also positive but not significant. Such an outcome suggests respondents from across Canada are indifferent between management practices that will cause Lake Sturgeon to be listed as Special Concern or Not at Risk in 30 years.

The estimated parameters from the conditional logit models using inferred votes suggest that respondents' answers in the inferred valuation task may only be influenced by the cost of the proposed alternative, in three of the studies. Neither the *ASC* nor other alternative-specific attributes had a statistically significant impact on the indirect utility respondents obtain when predicting more than half of the population to support the public policy. Only in the Lake Sturgeon conservation study, *Threatened status* was significant but still positive. The estimated parameter for *Cost* was negative and statistically significant in every case, aligning to economic expectations. On the other hand, the sign and significance

[18] Lake Sturgeon's designatable units were explained and listed in Section 2.

of the coefficients in the four pooled-vote models reflect similar results to those of the estimation that employed the direct votes from the referendum question.

4.3 Exploratory analysis of the probabilities of voting yes by method and cost level.

It is now appropriate to examine whether the statistical difference in voting behavior found between the methods is consistent with previous research and can be interpreted as social desirability bias. As rational agents, respondents are expected to be less supportive when the taxes linked to the proposed alternatives increase. Yet, if respondents act in a socially desirable manner mitigated by inferred valuation, as is suggested by the literature, they should also be more supportive with the direct rather than the inferred valuation question. To examine this premise, the separate models in Table 5 are used to obtain the predicted probabilities of voting "yes" with a direct and inferred valuation method, at the different cost levels used in each survey. A graphic representation of this information can be found in Figure 8. In all datasets, the probabilities from direct and inferred votes decrease as the price rises according to economic expectations, and the probability of voting yes with inferred valuation is below 0.5 at any cost amount, in all datasets. These exploratory graphs are consistent with theory behind inferred valuation and SDB for the Wetland and Species at Risk studies; however, they show partially opposite results for the two fish conservation studies.

Effectively, the predicted probability of voting yes with the referendum question is higher than the one obtained with the inferred question in the Wetland and Species at Risk studies; although the gap tends to narrow as the cost goes up. These results are in accordance with our expectations based on the literature, discussed in Section 1. However, the potential convergence between answers from the two methods at higher taxes is worthy of further discussion and could have two explanations. First, it may indicate that respondents fall in a self-enhancement behavior when their vote is elicited through a referendum question, but they may also be conscious that as the cost of the proposed policy rises, being over-supportive starts to be less credible; hence, making their direct answers closer to their inferred answers (assumed to better reflect true preferences).

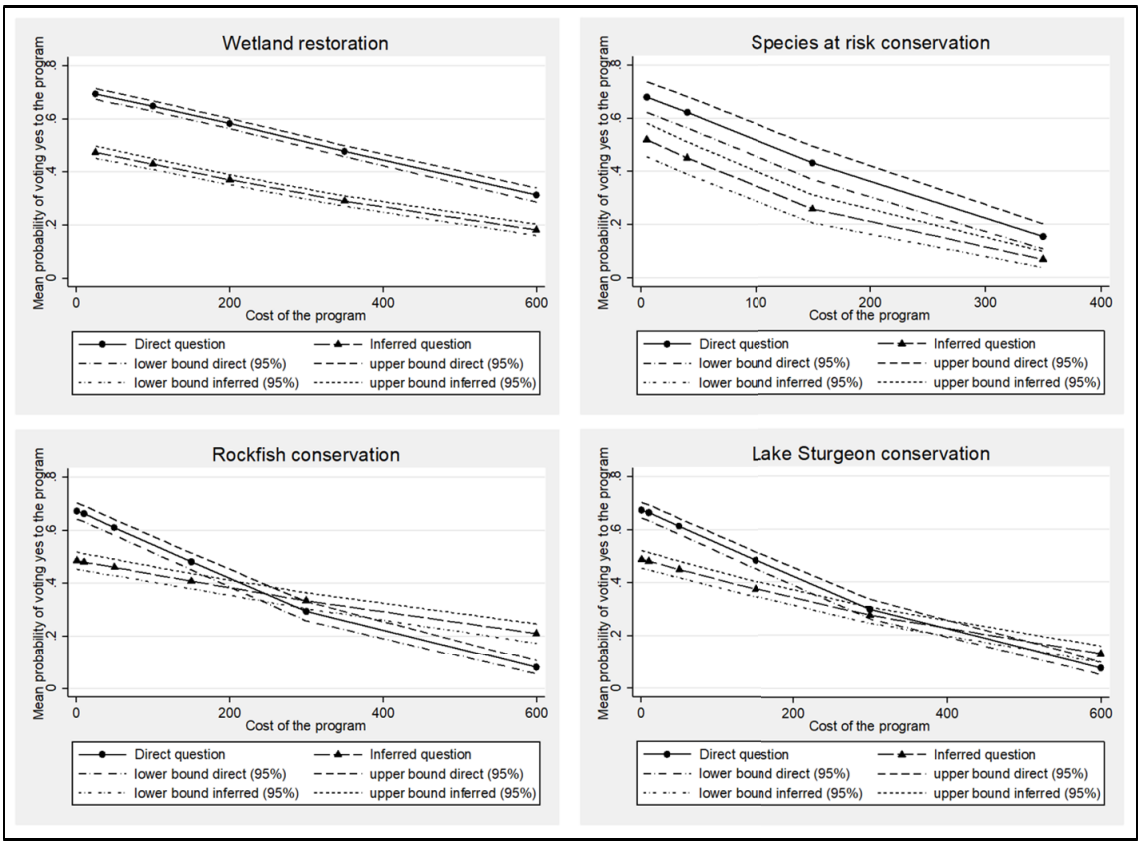

Figure 8. *Mean predicted probability of voting yes with direct and inferred question by cost level, in the four datasets, including 95% confidence intervals*.

A second explanation for the reduction in the gap at higher costs could be the existence of stronger egocentric behavior and the tendency to a 'false consensus effect' (Carlsson et al. 2010; Lusk and Norwood 2010). In other words, respondents may predict that the rest of the population is more likely to vote in the same way they did with the direct question when the tax associated with the proposed alternative considerably increases. Such behavior would make their inferred answers closer to their direct answers. If that is the case, respondents would not longer project their own true preferences on others when they consider the cost is too high. Nonetheless, considering that the gap reduction at higher costs is visibly small in our graphs, the predicted probabilities of voting yes in the Wetland and Species at Risk conservation studies per cost level support the existence of SDB in those surveys, under the premise that inferred answers are a better representation of actual answers.

On the other hand, the graphs in Figure 8 suggest the presence of a partially opposite or honest behavior for the Rockfish and Lake Sturgeon conservation studies, at higher tax levels. The predicted probability of voting yes decreases as the cost of the proposed alternative goes up with any of the two questioning approaches, and it is higher with the direct approach at lower costs. However, after a certain monetary amount, the models predict a probability of voting yes with inferred valuation higher than the one obtained using direct valuation for the Rockfish conservation study, and not statistically different for the Lake Sturgeon conservation study. Individuals' perceptions of what society expects from them could help explain these outcomes. In accordance with the concept of SDB, respondents may deviate from their true preferences when answering the referendum questions, stating a higher support for the conservation of the fish species at lower taxes. Nevertheless, since these were national surveys and the fish species cannot be found in all provinces in Canada, there may be a monetary threshold after which respondents may no longer engage in a socially desirable behavior. After that threshold, they could be more likely to provide an honest answer about their own preferences, and their beliefs about the preferences of other Canadians. Some of the factors that could determine this behavior in addition to the payment of the proposed policy, could be the degree of familiarity, closeness, or ownership that respondents may have for the public good, and their perceived social responsibility to support its conservation in comparison to the rest of the population.

If the interpretation in the previous paragraph is true, respondents could be adjusting both their direct and inferred answers in an honest behavior, depending on the familiarity they have with the public good, what they consider is socially desirable to do, and the cost level. When respondents consider the cost of the proposed alternative is excessively high, and they are not truly concerned about social desirability on the protection of the fish species, they may vote according to their true preferences in the direct question and use inferred valuation to predict what they believe others would really do. Such explanation aligns with the theoretical models of Johansson-Stenmann and Martinsson (2006) as well as Lusk and Norwood (2009), who included honesty as a determinant of the utility that individuals obtain from fulfilling social norms. Considering that a socially desirable behavior has diminishing returns (Norwood and Lusk 2011) and "there is a limit to self-deception" (Johansson-Stenman and Martinsson 2006), an honesty term is included in the utility model employed

for inferred valuation theoretical assessment, to condition individuals' motivation for showing SDB. As a result, when respondents are truly indifferent about what others expect them to say, they do not obtain any utility from providing a biased answer with any of the two questioning approaches. In the case of these two fish species, this could imply that at higher costs, the indirect utility most individuals obtain from being honest is greater than the one derived from saying what is 'right', leading to null or trivial bias in the direct question and no social projection in the inferred question.

Overall, the graphical exploratory analysis performed suggest that the familiarity of respondents with the public good, their perception of what is morally expected from them by their community, and the cost of the proposed conservation policy may determine their decision between engaging in a socially desirable behavior or being honest. If they obtain greater utility from providing an honest answer, the theory behind inferred valuation (which states that respondents reflect their own preferences in their prediction of others) may not apply. In that case, they may be honestly predicting what they consider others would do. However, without additional information from an increased number of studies, larger provincial samples and diversity in terms of public goods, investigating the cost bands at which individuals may change from SDB to an honest answer are topics that are left for future research[19].

4.4 Empirical estimation of conditional logit models including interactions

Table 6 shows the results for the estimation of the Conditional Logit Models performed for the four datasets, including interaction terms of the *INF* dummy with all the alternative-specific variables (equation 14, Section 3.3). The coefficients in the upper panel of the table represent the effects of the variables on the preferences that the average respondent stated for the proposed policy alternative with the referendum valuation question. These results are the same as those presented in Table 5, obtained from the use of direct votes

[19] The predicted probabilities of voting yes per cost level presented in Figure 8 were replicated for the provincial subsamples of Rockfish and Lake Sturgeon conservation studies. Since several of those subsamples were relatively small, the graphs show wide confidence intervals (See Appendix G).

only; therefore, they will not be interpreted again in this section. The coefficients in the lower panel of Table 6 however, represent the difference in each of the variables' effects caused by the use of the inferred approach with respect to the direct approach. The interpretations in the following paragraphs assume that inferred valuation better reflects respondents' true preferences for the goods being valued. Alternatively, the interaction terms can be interpreted as the difference between respondents' predicted preferences for others with respect to their own.

The results displayed in table 6 show strong evidence of a change in preferences between the proposed and current situation alternatives, caused by the indirect questioning approach. In the four datasets, the positive and significant coefficients on *ASC*INF* imply that the use of the inferred valuation method increases preference for the current situation (holding all other attributes constant) with respect to the use of a direct question, in a magnitude that seems very similar across datasets (except for the Lake Sturgeon study) although cannot be directly compared. Interestingly, the estimations also suggest a change in the sensitivity of respondents to cost variations. In three of the four datasets, the use of the inferred valuation question appears to lessen the disutility that respondents experience from increases in the cost of a proposed alternative, as the coefficients on *Cost*INF* are statistically significant and positive. Such effects contradict our expectations that individuals would show themselves less concerned with the cost with the direct valuation question rather than with the indirect question, due to SDB. Nonetheless, these results could also be generated by respondents considering support for an increase in taxes as an answer that opposes social norms. In that sense, respondents could be presenting themselves as less supportive of a program that entails a tax increase with the direct valuation question relative to the inferred valuation question, indicating they care more than others about the economic impact that implementing the program will generate. This potential anti-tax behavior in a stated preference survey was one of the topics discussed in the selection of the survey administration mode in the Deepwater Horizon oil spill damage assessment, regarding potential presence of social desirability bias (Total Value Team 2016).

When it comes to the effects of the attributes on respondents' preferences, the use of the inferred valuation method may not result in significant changes with respect to the direct

approach for all cases. First, for the Wetland restoration study, the estimated parameter on *Wetland acres*INF* is significant at a 10% level but very small (considering that the variable *Wetland acres* was rescaled to 100,000s), suggesting that respondents do not essentially change their stated preferences for this attribute between the two valuation tasks. In the Species at Risk conservation study, the significance of the strategy coefficients interacted with the method dummy implies that the indirect utility respondents obtain from a *Moderate conservation strategy* with respect to a *Heavy strategy* does not change when the valuation method used is an indirect question. However, preferences significantly change for a *Light strategy* alternative. In other words, respondents are more likely to vote for a *Heavy strategy* alternative over the other two, when framed in a direct (referendum) format, but when asked an indirect question their preference for the heavy strategy over the light strategy decreases. This behavior seems to be in accordance with the concept of social desirability bias; therefore, it would suggest that the inferred valuation method is mitigating this problem in the survey.

In the case of the Rockfish and Lake Sturgeon conservation studies, the estimated parameters on *Threatened*INF* are statistically significant. This suggests that the preference for a Threatened risk status of the species changes slightly with the inferred valuation method with respect to the direct valuation question. The change is positive for Rockfish and negative for the Lake Sturgeon study, which complies with SDB theory for Rockfish conservation although is opposite for Lake Sturgeon. In the case of the Pacific Rockfish, the results suggest that in the direct question individuals state their preference for a proposed policy that promises a *Not-at-risk* status, when in fact they prefer one that offers the *Threatened status* and project their actual preference on others. Finally, the indifference respondents revealed between the *Special concern* alternative and the *Not-at-Risk* alternative in the direct question is not significantly affected using an inferred valuation question.

Table 6. Conditional Logit Models including interactions of alternative-specific variables with the *INF* dummy (Clustered standard errors in parenthesis)

	Wetland restoration	Species conservation	Rockfish conservation	Lake sturgeon conservation
Direct valuation				
ASC current situation	-0.773***	-1.078***	-0.880***	-0.584***
	(0.056)	(0.130)	(0.072)	(0.067)
Cost (100's of $)	-0.278***	-0.714***	-0.530***	-0.534***
	(0.013)	(0.051)	(0.032)	(0.031)
Wetland acres (100,000's)	0.053***			
	(0.015)			
Moderate strategy		-0.387***		
		(0.126)		
Light strategy		-0.473***		
		(0.153)		
Threatened status			-0.373***	0.381***
			(0.073)	(0.077)
Special concern status			-0.100	0.066
			(0.071)	(0.070)
Difference from inferred valuation with respect to direct valuation				
ASC*INF	0.859***	0.976***	0.971***	0.673***
	(0.070)	(0.151)	(0.085)	(0.078)
Cost*INF	0.035**	-0.066	0.320***	0.224***
	(0.018)	(0.078)	(0.033)	(0.034)
Wetland acres*INF	-0.032*			
	(0.019)			
Moderate strategy*INF		0.248		
		(0.169)		
Light strategy*INF		0.645***		
		(0.196)		
Threatened status*INF			0.414***	-0.220***
			(0.087)	(0.084)
Special concern status*INF			0.156*	-0.095
			(0.084)	(0.078)
Number of votes	*9450*	*1296*	*3627*	*3561*
Log-likelihood	*-12045*	*-1486*	*-4482*	*-4281*
Pseudo-R2	*0.081*	*0.173*	*0.109*	*0.133*

Notes:

**** p<0.01, ** p<0.05, * p<0.1*

-Moderate and Light strategies in the Species at Risk dataset are interpreted with respect to a Heavy conservation strategy.

-Threatened and Special concern status in the Rockfish and Lake Sturgeon conservation datasets are interpreted with respect to Not-at-Risk status.

4.5 Conditional logit models: Final effects of the alternative-specific variables by valuation method

Table 7 presents the final effects of the variables (according to Equation 17 in Section 3.3) on the indirect utility respondents obtain from the proposed policy alternative in each study. Although the use of an indirect question generates significant differences in preferences for the current situation with respect to the direct question, the final effect on *ASC current situation I* is not statistically different from zero. That is, in the inferred valuation task, the answer provided was not influenced by the unlisted attributes of the current situation alternative (holding all other attributes constant); such attributes did not significantly increase nor decrease respondent's indirect utility. In the case of the marginal utility of money, although the use of the inferred valuation approach significantly reduces disutility from a tax increase, it does not alter its direction. Respondents still get more utility from lower household taxes, but they are slightly less concerned about them when predicting other's answers, which could reflect an anti-tax behavior as discussed previously. Table 7 shows no absolute influence of the alternatives' attributes in respondent's inferred votes, except for Lake Sturgeon conservation (possibly related to the perception of the effects respondents have for *Threatened status)*. In general, these results suggest that when predicting other's behavior, respondents may only take cost of the alternatives into account (consistent with the findings from Table 5) which would imply that although reporting preference for higher levels of environmental conservation with the referendum question, they are only concerned about the monetary implications of their actual decisions.

Table 7. Final effects of the variables in the indirect utility of the proposed alternative (Clustered standard errors in parenthesis)

	Wetland restoration	Species conservation	Rockfish recovering	Lake sturgeon recovering
ASC current situation D	-0.773***	-1.078***	-0.880***	-0.584***
	(0.056)	(0.130)	(0.072)	(0.067)
ASC current situation I	0.086	-0.102	0.092	0.089
	(0.057)	(0.123)	(0.067)	(0.066)
Cost (100's of $) D	-0.278***	-0.714***	-0.530***	-0.534***
	(0.013)	(0.051)	(0.032)	(0.031)
Cost (100's of $) I	-0.244***	-0.780***	-0.210***	-0.309***
	(0.015)	(0.072)	(0.021)	(0.024)
Wetland acres (100,000s) D	0.053***			
	(0.015)			
Wetland acres (100,000s) I	0.021			
	(0.015)			
Moderate strategy D		-0.387***		
		(0.126)		
Moderate strategy I		-0.138		
		(0.128)		
Light strategy D		-0.473***		
		(0.153)		
Light strategy I		0.172		
		(0.166)		
Threatened status D			-0.373***	0.381***
			(0.073)	(0.077)
Threatened status I			0.041	0.161**
			(0.066)	(0.065)
Special concern D			-0.100	0.066
			(0.071)	(0.070)
Special concern I			0.056	-0.029
			(0.065)	(0.066)
Observations	*37,800*	*5,184*	*14,508*	*14,244*
Log-likelihood	*-12045*	*-1486*	*-4482*	*-4281*
Pseudo-R2	*0.0806*	*0.173*	*0.109*	*0.133*

Notes:
**** p<0.01, ** p<0.05, * p<0.1*
D = Final effect of the variable with direct valuation.
I = Final effect of the variable with inferred valuation.
-Moderate and Light strategies in SK dataset are interpreted with respect to a Heavy conservation strategy.
-Threatened and Special concern risk status in RF and LS datasets are interpreted with respect to Not-at-Risk status of the fish species.

4.6 Summary of the findings

Table 8 presents a summary of the findings from the models that have been estimated in this Section indicating the direction and significance of the parameters, by questioning method. First, the likelihood ratio tests provided evidence that the vectors of parameters explaining the probabilities of voting yes with the direct and inferred valuation questions are statistically different. The tests' results reject the null hypothesis that a model with pooled votes, without differentiation, fits the data better than using them separately, in all datasets. This suggests that direct and inferred votes cannot be treated as equal. In addition to the mentioned results, graphic comparisons of the probabilities of voting yes by method and cost level suggested that in the national surveys, self-enhancing behavior at higher costs could be determined by factors such as familiarity and perceived social expectations that respondents have about the public good object of valuation.

Our estimations indicate that when votes are elicited with a direct referendum question, respondents show preference for the proposed alternative over the current situation as the unlisted attributes of the latter decrease their indirect utility. They also prefer lower taxes and generally greater quantities or levels of environmentally positive attributes in an improved scenario, except for the case of the Lake Sturgeon study where they also show concern for the impacts that a more environmentally focused policy could have in other human activities of social importance (such as recreation, farming, public investment in infrastructure).

When using an inferred valuation approach, we found that the factor that significantly determines individuals' answers to be the cost of a proposed policy. Considering that respondents use their own true preferences to predict others' votes, this suggests that neither the current situation of the public good nor the characteristics of the proposed policy end up influencing individuals' actual votes for an environmental cause. However, when comparing one method with respect to the other, the inferred valuation approach causes a significant reduction in the marginal utility of money with respect to the direct referendum question in three of the four studies. An anti-tax behavior where respondents perceive supporting increases in taxes as socially undesirable could explain these results. The inferred valuation

approach also causes an important increase in preference for the current situation relative to the direct question, in all datasets.

Regarding the specific attributes of the proposed alternatives, the inferred valuation method reveals a shift in preferences for at least one of the attributes compared to the direct question, in three of the studies. However, in most cases, attribute preferences do not change depending on the questioning method used. Altogether, our results indicate the presence of a difference between the probabilities of voting yes with direct and inferred valuation questions in the four studies, consistent with the concept of SDB, with statistically significant differences between preferences for tax increases and the unlisted attributes of the current situation alternative (disregarding its listed attributes).

Table 8. Summary of findings from basic Conditional Logit Models, and interactions with a valuation method dummy

From baseline models	**Wetland restoration**	**Species conservation**	**Rockfish conservation**	**Lake sturgeon conservation**
Likelihood ratio tests: Statistic (joint vs. separate votes)	775.68	80.28	175.99	144.16
P-value	0.000	0.000	0.000	0.000
Direct Vote (a)				
ASC current situation	Significant (-)	Significant (-)	Significant (-)	Significant (-)
Cost	Significant (-)	Significant (-)	Significant (-)	Significant (-)
Attributes	Significant (+)	Significant (-)	Significant for one program (-)	Significant for one program (+)
Inferred vote (b)				
ASC current situation	Not significant (+)	Not significant (-)	Not significant (+)	Not significant (+)
Cost	Significant (-)	Significant (-)	Significant (-)	Significant (-)
Attributes	Not significant (+)	Not significant (-,+)	Not significant (+)	Significant for one program (+,-)
Difference between direct and inferred method				
Difference in ASC	Significant (+)	Significant (+)	Significant (+)	Significant (+)
Difference in cost	Significant (+)	Not significant (-)	Significant (+)	Significant (+)
Difference in attributes	Significant for acre (-)	Significant for one strategy (+)	Significant for one program (+)	Significant for one program (-)

Notes:

(+) indicates an increase in indirect utility, (-) indicates a decrease in the indirect utility from voting for the proposed policy or strategy.

(a) Effect of direct valuation method on preferences. Also obtained by adding coefficients from single and interacted variables.

(b) Effect of inferred valuation on preferences. Also obtained by adding coefficients from single and interacted variables.

(c) Interactions with INF dummy = 1 if the vote comes from an inferred question. Results show a change in preferences with INF with respect to the direct question

5. TESTING THE SYSTEMATIC INFLUENCE OF INDIVIDUAL-SPECIFIC CHARACTERISTICS ON THE DIFFERENCE BETWEEN DIRECT AND INFERRED VOTES

After finding evidence of a statistical difference between the votes from direct and inferred valuation methods, we focus on analyzing whether such difference is explained by individual-specific variables. Three approaches are used for this purpose in the present section. First, we use multinomial logit models to analyze the influence of socio-demographic factors on the probability of respondents' votes to match or switch across questioning methods. Then, regarding the number of yes-to-no switching votes that respondents have, we model their probability of engaging in a socially desirable behavior in all questions presented to them, as a function of their socio-demographic characteristics. Finally, focusing on the effect of such characteristics on preferences stated by direct and inferred approaches, we use simple logit and conditional logit models including interactions to analyze preference directions by socio-demographic groups of people and perform likelihood ratio tests. The chapter ends with an overall summary of the findings.

5.1 Multinomial logit models for the analysis of switching votes by individual-specific factors

As shown in Section 3, between 20% and 30% of the votes in the four datasets went from 'yes' in the direct question to 'no' in the inferred valuation question within respondents, a behavior that could potentially be generated by SDB. How socio-demographic factors, in addition to alternative-specific attributes, influence such behavior was examined using a multinomial logit model, which estimates the probability of respondents' votes to be consistent (for or against the proposed policy) or reflect a shift in preferences (from yes to no and from no to yes) across questioning methods. The socio-demographic variables considered were gender, age, annual household income (above $100,000), post-secondary education, and membership to an organization linked to environmental conservation. These were the individual-specific variables present in all four data sets considered. Table 9

presents the marginal effects at the means after the multinomial logit estimation included in Appendix F. The results in Table 9 are interpreted as the effect of a variation in the respective explanatory variable (a marginal change in the case of continuous variables, or a discrete change from the base level in the case of categorical variables) on the probability of a vote to be classified as a positive match ($Y_D \rightarrow Y_I$), a negative match ($N_D \rightarrow N_I$), a yes-to-no switch ($Y_D \rightarrow N_I$) which we will label as an SDB vote in the remainder of this section, and a no-to-yes switch ($N_D \rightarrow Y_I$) between valuation approaches. In addition to yea-sayers, respondents with missing demographic information were left out of the estimations[20].

In all four studies, higher costs significantly increase the probability of observing consistently negative votes across direct and inferred valuation questions. The results in Table 9 indicate that when all independent variables are evaluated at the means, a marginal increase in the payment associated with the proposed policy significantly increase the probability of a vote to be consistently negative across questioning approaches, reducing in the probability of it to be consistently supportive. The unitary increase in C*ost* significantly increases the probabilities of observing a no-to-yes switch and reduces the probabilities of a yes-to-no switch in votes from direct and inferred questions. As mentioned in previous sections, this behavior present in all studies could be reflecting an anti-tax bias that may or may not be related to social desirability.

Lower levels of environmental improvements have significant effects on the probabilities of observing SDB and no-to-yes switching votes in three cases. In the Wetland restoration study, having a hundred thousand more *Wetland acres* restored by the year 2020 in Manitoba significantly increases the probability of a consistently supportive vote in 1 percentage point when other variables in the estimation are at their means. Such variation in *Wetland acres* reduces the probabilities of observing a no-to-no and no-to-yes vote in 0.7 and 0.6 percentage points respectively, and it does not significantly vary the probability of an SDB vote. Hence, a change in the environmental attribute presented in the survey of the first

[20]In the Wetland restoration study and Species at Risk conservation study, 82 and 62 respondents respectively didn't report their annual household income while in the Rockfish and Lake Sturgeon conservation studies 25 and 13 respondents respectively didn't inform about their environmental organization membership. Additionally, in the Rockfish and Lake Sturgeon surveys, 13 and 6 individuals respectively didn't provide information on their attained level of education. Some of the respondents with missing information were also classified as yea-sayers which is why deducting these individuals from the total sample does not necessarily match the total observations reported in the table.

study has a significant but very small impact on voting behavior across both valuation methods.

In the Species at risk conservation study, being offered the less intensive environmental conservation strategy as part of the proposed policy reduces the probability of a yes-to no vote. When the average respondent (in terms of socio-demographic characteristics) is faced with the lowest level of environmental change (*Light strategy*) relative to the highest (*Heavy strategy*) at the average cost, it significantly reduces the probability of displaying an SDB vote, increasing the probability of a no-to-yes switching vote in almost the same amount. It does not significantly affect the probabilities of consistently supportive or opposite votes across valuation methods. Under a similar analysis, having a *Moderate strategy* relative to the *Heavy strategy* significantly increases the probability of observing a consistently negative vote, also reducing the probability of observing an SDB vote at a 10% confidence level.

In the third study, lower progress in reducing Rockfish extirpation risk in comparison to the *Not-at-Risk* scenario significantly diminishes the probability of observing an SDB vote. When the average respondent is offered a *Threatened risk* status for the Pacific Rockfish in 40 years relative to the *Not-at risk status*, at the average cost, the probability of an SDB vote falls in 5.4 percentage points, and so does the probability of a consistently supportive vote with a 3.6 percentage point decrease. In the same scenario, being offered a *Threatened status* generates a 4.3 percentage points rise in the probability of a consistently negative vote and a 4.7 percentage point rise in the probability of a vote to switch from no to yes between valuation approaches. The biggest impact is negative on the yes-to-no (SDB) category. Therefore, a vote is more likely to switch from no to yes, and from no to no in this case. In a similar way, if the alternative presented is the *Special concern* status relative to the *Not-at-risk status* for the Pacific Rockfish at the average cost, the vote from the average respondent is less likely to be an SDB vote, without significant variations in the probabilities of the other three voting categories.

In the Lake Sturgeon conservation study, having a proposed alternative with lower environmental improvements in comparison to the highest increases the chance of observing an SDB vote between questioning approaches. Having a scenario where Lake Sturgeon risk

status changes from *Endangered* to *Threatened* rather than to *Not at Risk* in 30 years generates a statistically significant rise of 9 percentage points in the probability of a yes-to-no (SDB) switch, reduces the probability of a consistently negative vote in 13.8 percentage points, and the probability of a no to yes switch in 3.7 percentage points. Having a scenario where the risk status achieved is *Special concern* in comparison to *Not at risk* for Lake Sturgeon significantly increases the probability of observing an SDB vote in 4 percentage points, reducing the probability of a consistently negative vote in the same amount, with no significant impacts in the other vote categories. Taken together, higher levels of environmental or socially desirable characteristics of the proposed policy seem to be associated with an increased probability of observing an SDB vote.

From the coefficients of the socio-demographic variables, *Age* has more significant and consistent effects on the probability of observing a yes-to-no vote than the other individual-specific factors. Per each additional year of age, the probability of voting yes with direct valuation and no with inferred valuation significantly rises in all four studies in very similar amounts, when all other variables are evaluated at their means. A marginal increase in *Age* also reduces the probabilities of consistently negative votes and no-to-yes switching votes in three of the four studies. These results suggest that the votes from average respondents faced with alternatives of average characteristics are more likely to switch from yes (with direct question) to no (with inferred valuation) when their age increases, consistently across all the studies examined.

Gender and household income have consistent significant effects on the probability of a vote to switch from yes to no, in two of the four studies. In all four cases, the signs of the marginal effects of *Male* on the probability of observing an SDB vote suggest that an average male respondent is less likely to show SDB than an average female respondent. However, those effects are statistically significant in the two provincial studies only. In the Wetland Restoration study, being male reduces the probability of observing an SDB vote in 4.2 percentage points relative to a female respondent and increases the probability of a no-to-yes switching vote in 2.9 percentage points. In the Species at Risk conservation study, being male reduces the probability of an SDB vote in 15.6 percentage points relative to being female and reduces the probability of a no to yes switch between direct and inferred valuation

questions in 6.8 percentage points. Men are more likely than women to state a consistently supporting vote in the Rockfish conservation study between direct and inferred questions while being male has no significant effects in the Lake Sturgeon conservation study.

On the other hand, the votes from respondents with a household annual income above $100,000 relative to those below the threshold have a significantly higher probability of switching from yes to no in the two fish conservation studies. Being in the higher income category also reduces the probability of stating a consistently negative vote in the same two national surveys while diminishing the probability of a vote to be consistently supportive only in the Species at Risk conservation study. The outcomes suggest that high-income respondents are more likely to engage in a socially desirable behavior in the two national cases.

Finally, the variables *Post-secondary education* and *Environmental organization membership* do not significantly affect the probability of a vote to be classified as one denoting SDB. Nonetheless, belonging to an organization or club related to environmental conservation significantly increases the probability of stating consistently supportive votes in around 9 percentage points with respect to not being part of those organizations, in two of the four studies. Consequently, a vote stated by a respondent with this characteristic shows a strong reduction in the probability of being consistently negative. Such a reduction takes a value of around 11 percentage points in the Wetland restoration and Lake Sturgeon conservation studies, as well as a value of 5.8 percentage points in the Rockfish conservation study. The probability of a vote to switch from yes to no is higher when it belongs to a respondent with post-secondary education, only in the Wetland restoration study, with no significant effects in the other voting categories. These findings suggest that education level and environmental conservation involvement of respondents may not influence the presence of social desirability bias in the preferences they report with both direct and inferred questioning methods.

In summary, our results indicate that in a given valuation task and between direct and inferred valuation questions, a vote is more likely to switch from yes to no and less likely to switch from no-to-yes when it is being made by a female, older and wealthier respondent, where age has the most consistent results across studies. In other words, these demographic

groups of people may have higher tendencies to vote in support of a proposed policy with a direct question and, through the projection of their own preferences on others, vote against it in the inferred valuation question - a behavior interpreted as social desirability bias in this case. However, these results are not completely robust across all four studies for the variables gender and annual household income. Moreover, this estimation doesn't consider whether several switching votes belong to different respondents with similar characteristics or the same respondents present SDB votes in all the valuation questions of the survey. The repetition of SDB behavior through all the valuation tasks presented to a respondent as a function of individual-specific factors is thus assessed in Section 5.2 below.

Table 9. Marginal effects at means, after multinomial logit estimation of the probability of respondents' votes to match against the proposed policy (no-no), to switch from yes to no, and to switch from no to yes, relative to a supportive match (yes – yes) across the two questioning methods. (Clustered standard errors in parenthesis)

	Wetland restoration				**Species at risk conservation**				**Rockfish conservation**				**Lake Sturgeon conservation**			
	$Y_D \rightarrow Y_I$	$N_D \rightarrow N_I$	$Y_D \rightarrow N_I$	$N_D \rightarrow Y_I$	$Y_D \rightarrow Y_I$	$N_D \rightarrow N_I$	$Y_D \rightarrow N_I$	$N_D \rightarrow Y_I$	$Y_D \rightarrow Y_I$	$N_D \rightarrow N_I$	$Y_D \rightarrow N_I$	$N_D \rightarrow Y_I$	$Y_D \rightarrow Y_I$	$N_D \rightarrow N_I$	$Y_D \rightarrow N_I$	$N_D \rightarrow Y_I$
Cost (100's)	-0.065***	0.066***	-0.008**	0.007***	-0.159***	0.191***	-0.029**	-0.004	-0.092***	0.106***	-0.044***	0.030***	-0.095***	0.122***	-0.042***	0.015***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.011)	(0.014)	(0.013)	(0.008)	(0.006)	(0.006)	(0.005)	(0.003)	(0.006)	(0.007)	(0.005)	(0.003)
Male	0.001	0.012	-0.042**	0.029***	0.012	0.076	-0.156***	0.068***	0.060***	-0.031	-0.017	-0.012	0.009	-0.028	0.005	0.014
	(0.015)	(0.018)	(0.016)	(0.011)	(0.028)	(0.050)	(0.042)	(0.025)	(0.019)	(0.025)	(0.019)	(0.017)	(0.019)	(0.025)	(0.019)	(0.016)
Age (Years)	-0.000	-0.002***	0.003***	-0.001***	-0.001	-0.001	0.003**	-0.001**	0.001*	-0.003***	0.001**	0.000	0.000	-0.002**	0.003***	-0.001**
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Post secondary education	-0.023	0.001	0.035**	-0.014	0.021	-0.010	0.023	-0.034	0.009	-0.027	0.017	0.002	0.008	-0.017	0.023	-0.013
	(0.016)	(0.019)	(0.017)	(0.012)	(0.032)	(0.059)	(0.049)	(0.033)	(0.019)	(0.026)	(0.019)	(0.017)	(0.019)	(0.025)	(0.019)	(0.017)
High income (> $100,000)	0.006	-0.017	0.007	0.003	-0.074***	0.048	0.034	-0.008	0.023	-0.054*	0.063***	-0.032*	0.003	-0.115***	0.122***	-0.009
	(0.019)	(0.024)	(0.021)	(0.015)	(0.029)	(0.053)	(0.046)	(0.027)	(0.022)	(0.028)	(0.022)	(0.018)	(0.022)	(0.028)	(0.024)	(0.018)
Env. Organization	0.090***	-0.117***	0.001	0.026	-0.039	-0.059	0.081	0.017	0.028	-0.058*	0.026	0.004	0.085***	-0.111***	0.025	0.001
	(0.033)	(0.029)	(0.032)	(0.021)	(0.040)	(0.087)	(0.075)	(0.049)	(0.026)	(0.033)	(0.026)	(0.020)	(0.030)	(0.034)	(0.027)	(0.022)
Wetland acres (100,000s)	0.010***	-0.007**	0.003	-0.006**												
	(0.003)	(0.004)	(0.004)	(0.002)												
Light strategy					-0.025	0.020	-0.069**	0.074***								
					(0.026)	(0.044)	(0.035)	(0.029)								
Moderate strategy					-0.020	0.089**	-0.057*	-0.012								
					(0.018)	(0.037)	(0.031)	(0.024)								
Threatened status									-0.036***	0.043**	-0.054***	0.047***	0.011	-0.138***	0.090***	0.037***
									(0.014)	(0.018)	(0.014)	(0.013)	(0.014)	(0.019)	(0.016)	(0.012)
Special concern status									0.008	0.019	-0.028**	0.001	-0.016	-0.040**	0.040**	0.017
									(0.014)	(0.017)	(0.014)	(0.012)	(0.013)	(0.017)	(0.016)	(0.011)
Votes	*9055*				*1048*				*3531*				*3507*			

Notes:

*Votes from yea-sayers and respondents with missing demographic information are excluded. Standard errors have been clustered to account for correlations across the votes of each respondent. Significance levels: *** p<0.01, ** p<0.05, * p<0.1*

Y_D = *Vote in support of the proposed alternative vs. the current situation, stated with the direct question.*

Y_I = *Vote in support of the proposed alternative vs. the current situation, stated with the inferred valuation question.*

N_D = *Vote against the proposed alternative in favor of the current situation, stated with the direct question.*

N_I = *Vote against the proposed alternative in favor of the current situation, stated with the inferred valuation question.*

5.2 Logit models for the analysis of respondents with repeated SDB behavior

The next step to analyze the influence of socio-demographic variables on SDB consisted of modeling the probability of respondents to have at least one or all their reported votes switched from yes-to-no across questioning approaches (SDB votes). A logit model with *Male*, *Age*, *High household income (above $100,000), Post-secondary education,* and *Environmental conservation membership* as explanatory variables was estimated for that purpose. According to Table 10, in the first study 318 respondents (16.83% of the sample) presented one SDB vote out of the five votes in the survey. Thus, between 40% and 60% of respondents in all four datasets had at least one vote classified as an SDB vote, and between 4.6% and 7.6% of respondents presented *all* their votes classified as such. Two dummy variables were generated to take the value of 1 if a respondent had *at least one* SDB vote or *all* SDB votes respectively. Having all their votes switched from yes to no across direct and inferred valuation questions could be a clear indication of SDB present in respondents' answers, although it may also be influenced by the specific combination of cost and attributes presented to them in each valuation task, which cannot be included in this estimation.

Table 10. Frequency and proportion of respondents in the sample per number of reported votes switched from yes to no across questioning methods

SDB votes in survey, per respondent	Wetland restoration		Species at risk conservation		Rockfish conservation		Lake Sturgeon conservation	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
0	801	42.38	153	47.22	740	61.21	713	60.07
1	318	16.83	90	27.78	275	22.75	260	21.9
2	284	15.03	43	13.27	126	10.42	151	12.72
3	200	10.58	23	7.1	68	5.62	63	5.31
4	144	7.62	15	4.63	N/A	N/A	N/A	N/A
5	143	7.57	N/A	N/A	N/A	N/A	N/A	N/A
Number of respondents	**1,890**	**100**	**324**	**100**	**1,209**	**100**	**1,187**	**100**

Notes:
Yea-sayers are excluded

Table 11 presents the logit estimates of the probability of respondents to show SDB repeatedly in the surveys explained by the five socio-demographic variables already mentioned. In three of the four studies, being male reduces the probability of a respondent to have at least one vote or all their votes switched from yes to no with respect to women,

although the coefficients are not statistically significant in all four studies. Once again, these results are in line with previous research where women were found to be more prone to display social desirability bias and hypothetical bias in support of goods with moral implications. The exception is the Lake Sturgeon data where the effect of gender is positive, indicating an increased SDB behavior in males rather than in females but it is neither significant nor considerably relevant in magnitude.

The effect of *Age* is consistently positive across the four different studies and being older significantly increases the probability of a respondent to have all their votes switched from yes to no. An increase in individuals' age raises their probability of showing an SDB voting behavior at least once in the Wetland Restoration and Lake Sturgeon conservation studies, and at all valuation tasks in all four studies. In the case of the Species at Risk conservation and Rockfish conservation cases, older respondents are more likely to have all their votes classified as SDB votes; yet younger or older respondents are equally likely to have at least one of them switching in these two studies. Taken together, these outcomes provide evidence of the strong influence of age on the presence of SDB in multiple valuation tasks comprised of direct and inferred questions.

The variables *Post-secondary education, High income, and Environmental Organization membership* have effects that are not as consistently significant as *Male* and *Age*, across studies. Although the coefficients of *Post-secondary education* are mainly positive, they are not statistically significant in most of the cases. However, highly educated people are more likely to have switched at least one vote in the Wetland Restoration study, and all their votes switched in the Rockfish conservation dataset, with a 10% significance level. In addition, being part of a household with an income of more than $100,000 significantly increases respondents' propensity to present at least one SDB vote in the Rockfish and Lake Sturgeon conservation datasets and all their votes in the Rockfish study. Finally, being part of an organization related to environmental conservation has mainly positive but not significant effects on the probability of SDB behavior across studies.

The findings from this section match those from section 5.1 in providing evidence that age and gender could be important determinants of the potential SDB bias observed in respondents' answers. In this case, the probability of a respondent switching all votes in the

survey from yes to no between the direct and inferred valuation questions, which we consider a strong indicator of SDB, is greater when the respondent is a woman and/or when the respondent's age increases. Nonetheless, similar to the multinomial estimation from the previous section, there are no completely consistent or systematic effects from socio-demographic factors across the four considered studies, except for age.

Table 11. Logit estimation of the probability of respondents to have at least one vote and all their votes switched from yes to no across the two questioning methods (Standard errors in parentheses)

Variables	Wetland restoration		Species at risk conservation		Rockfish conservation		Lake Sturgeon conservation	
	At least one SDB vote	All SDB votes	At least one SDB vote	All SDB votes	At least one SDB vote	All SDB votes	At least one SDB vote	All SDB votes
Male	-0.224**	-0.289	-1.048***	-1.517**	-0.107	-0.529**	0.001	0.061
	(0.098)	(0.185)	(0.264)	(0.706)	(0.123)	(0.264)	(0.123)	(0.263)
Age (years)	0.010***	0.032***	0.005	0.059**	0.004	0.024**	0.012***	0.029***
	(0.003)	(0.007)	(0.009)	(0.026)	(0.004)	(0.010)	(0.004)	(0.010)
Post-secondary education	0.320***	0.123	0.101	0.267	0.077	0.535*	0.184	-0.044
	(0.103)	(0.196)	(0.315)	(0.823)	(0.127)	(0.295)	(0.126)	(0.269)
High income (>$100,000)	0.034	-0.059	0.243	0.953	0.403***	0.636**	0.659***	0.368
	(0.133)	(0.253)	(0.276)	(0.642)	(0.139)	(0.263)	(0.139)	(0.283)
Environmental organization membership	0.127	0.194	0.009	1.099	0.014	0.173	-0.074	0.333
	(0.202)	(0.349)	(0.406)	(0.763)	(0.162)	(0.317)	(0.166)	(0.325)
Constant	0.267	-4.090***	0.157	-6.336***	-0.745***	-4.374***	-1.257***	-4.497***
	(0.172)	(0.379)	(0.527)	(1.698)	(0.227)	(0.554)	(0.241)	(0.596)
Number of respondents[1]	*1,811*	*1,811*	*262*	*262*	*1,177*	*1,177*	*1,169*	*1,169*
Log-likelihood	*-1221*	*-471.5*	*-173.1*	*-42.19*	*-780*	*-246.3*	*-770.1*	*-239.2*
Pseudo-R2	*0.00912*	*0.0285*	*0.0468*	*0.134*	*0.00736*	*0.0418*	*0.0223*	*0.0249*

Notes:

(1) Respondents who didn't report information for at least one of the socio-demographic variables are dropped out of the models.

*Significance levels: *** p<0.01, ** p<0.05, * p<0.1*

5.3 Logit estimation of the probability of voting in support of the proposed policy including individual-specific variables

Sections 5.1 and 5.2 examined the factors that influenced votes to switch from yes to no across questioning methods and the frequency of such votes in the surveys. Moving forward into the estimation of respondents' preferences for a proposed policy, with the inclusion of socio-demographic characteristics, the results from the two previous sections remain consistent. We estimated simple logit models for both direct and inferred samples in each study, including a constant, cost, and alternative-specific attributes as well as the five socio-demographic variables common in the four datasets. Within studies, we compare the effects of each of the variables on respondents' preferences reported with direct and inferred approaches. Then, we examine if a similar effect is present across all four studies in terms of signs only since the scale parameter is confounded with preference parameters. Table 12 presents coefficients and standard errors from the logit estimation.

The coefficients of the alternative-specific attributes are similar to those obtained in the basic conditional logit model discussed in Section 4. *Cost* strongly and significantly determines preferences for the proposed policy in all cases and with both valuation approaches. The use of the inferred valuation method seems to diminish the disutility respondents experience from tax increases in three of the studies (it heightens it in the Species at risk study). The attribute coefficients in each study display the expected signs and statistical significance with the direct valuation method although they generally do not affect respondents' preferences in predicting other's behavior. Once again, the significant positive coefficient on *Threatened status* with respect to *Not-at-risk status,* in Lake Sturgeon study can be attributed to the impacts that the latter may have on other human activities, according to the survey.

Table 12. Logit estimation of the probability of voting in favor of the proposed policy with separate direct and inferred method samples (Clustered standard errors in parenthesis)

	Wetland restoration		Species at risk		Rockfish conservation		Lake sturgeon conservation	
	Direct vote	**Inferred vote**	**Direct vote**	**Inferred vote**	**Direct vote**	**Inferred vote**	**Direct vote**	**Inferred vote**
Constant	-0.298	0.065	0.720*	0.657	0.091	-0.516***	-0.258	0.054
	(0.228)	(0.229)	(0.419)	(0.404)	(0.194)	(0.187)	(0.192)	(0.195)
Cost (100's)	-0.283***	-0.248***	-0.732***	-0.803***	-0.548***	-0.208***	-0.548***	-0.306***
	(0.014)	(0.015)	(0.060)	(0.080)	(0.032)	(0.021)	(0.031)	(0.024)
Wetland acres (100,000's)	0.054***	0.021						
	(0.016)	(0.016)						
Moderate strategy			-0.315**	-0.138				
			(0.139)	(0.145)				
Light strategy			-0.419**	0.212				
			(0.176)	(0.193)				
Threatened status					-0.372***	0.054	0.388***	0.156**
					(0.075)	(0.067)	(0.080)	(0.066)
Special concern status					-0.082	0.052	0.080	-0.021
					(0.073)	(0.066)	(0.072)	(0.066)
Male	-0.163**	0.137*	-0.559***	0.428**	0.183*	0.212**	0.053	0.091
	(0.075)	(0.078)	(0.213)	(0.191)	(0.101)	(0.097)	(0.098)	(0.100)
Age (years)	0.013***	-0.007***	0.01	-0.011*	0.011***	0.006*	0.012***	-0.004
	(0.002)	(0.003)	(0.007)	(0.007)	(0.004)	(0.003)	(0.003)	(0.003)
High income (>$100,000)	0.052	0.040	-0.229	-0.498**	0.346***	-0.057	0.491***	-0.075
	(0.098)	(0.104)	(0.22)	(0.207)	(0.115)	(0.110)	(0.117)	(0.118)
Post-secondary education	0.050	-0.164**	0.211	-0.047	0.099	0.029	0.120	-0.029
	(0.080)	(0.082)	(0.247)	(0.235)	(0.104)	(0.100)	(0.101)	(0.103)
Env. organization membership	0.377***	0.490***	0.092	-0.190	0.221	0.127	0.445***	0.350***
	(0.144)	(0.146)	(0.361)	(0.352)	(0.138)	(0.124)	(0.146)	(0.134)
Number of votes[1]	*9,055*	*9,055*	*1048*	*1048*	*3,531*	*3,531*	*3,507*	*3,507*
Log-likelihood	*-5842*	*-5598*	*-614.6*	*-564.6*	*-2024*	*-2290*	*-2008*	*-2169*
Pseudo-R2	*0.063*	*0.044*	*0.151*	*0.147*	*0.171*	*0.035*	*0.172*	*0.064*

Notes:

(1) In addition to yea-sayers, respondents who didn't report information for at least one of the socio-demographic variables are dropped out of the models.
Standard errors have been clustered to account for correlations across the votes of each respondent.
*Significance levels: *** p<0.01, ** p<0.05, * p<0.1*

The results in table 12 suggest that female, older, and high-income respondents may have a higher tendency to change the direction of their preferences across questioning approaches. In two of the four studies, being male reduces the latent propensity to support the proposed policy (in comparison to women) with the direct question and increases it with the inferred valuation question. The coefficients on the variable *Age* are all positive with direct valuation, although statistically significant only in three of the studies[21]. Whereas, with inferred valuation, an increase in *Age* has a negative effect on preferences in three of the datasets, which are statistically significant in two of them (at a 10% significance level in the Species at risk conservation study). For *High income*, we observe strongly significant and positive impacts in two of the studies with direct valuation while negative impacts in three studies with inferred valuation, only significant in one of them. For *Post-secondary education*, in three studies the coefficients shift from positive with the referendum question to negative with inferred valuation; however, almost all coefficients are not statistically different from zero. Finally, in two of the studies, being part of an organization related to environmental conservation increases the propensity to vote yes with both methods, while it seems to have no significant effect in the other two. In summary, although the outcomes of the logit estimation of preferences for the proposed policy are not totally consistent across all studies, they suggest age may have a greater influence in the way respondents vote in both questions, regarding a socially desirable behavior, compared to the other socio-demographic variables that were examined.

5.4 Conditional Logit models including interactions with individual-specific variables

In this section, we extend the conditional logit model estimated in Section 4 (Table 6) to test the statistical significance of the difference between direct and inferred valuation methods across socio-demographic groups using interaction terms. This is a complementary

[21] To address potential non-linearity of Age in the estimation of preferences with both methods, the same models were estimated including Age squared as an additional explanatory variable; however, the coefficients on this term were not statistically significant in all studies, with the exception of Lake Sturgeon study where it was significant with direct valuation but almost null.

analysis to the logit model presented in section 5.3. We started estimating two conditional logit models per study and per socio-demographic variable, which included the interactions of the alternative-specific variables with the method dummy (*INF*) and interactions of a single socio-demographic variable at a time with the *ASC* terms (See Appendix F, Table 24). With this estimation, we test whether there is a shift in preferences for the status quo reported with direct and inferred questions by demographic groups of people. For example, a conditional logit model with and without the interaction of *ASC*INF* with the variable *Male* allows examining whether the preferences of female and male respondents for the current situation alternative (holding all attributes constant) can be considered equal in each study across questioning approaches, by observing which model fits the data better. The comparison is made by means of likelihood ratio tests, where p-values below 0.05 indicate that the model including socio-demographic effects is a better representation of the voting behavior observed in the sample, as the data is more likely with such specification. Additionally, Akaike and Bayesian information criteria (AIC and BIC) are used to contrast the tests' results.

Table 13 reports the outcomes of the likelihood ratio tests performed for pairs of conditional logit models with and without interactions of the *ASC* terms with the method dummy *INF* and each of the individual-specific factors considered (one at a time)[22]. According to the p-values of the tests, the age of the respondents influences the difference in preferences for the status quo across questioning methods, in three of the four studies. The inclusion of the interaction *Male*ASC*INF* fits the data better in the Wetland restoration and Species at risk conservation studies, similar to the results for *Post-secondary education*. The inclusion of *High-income* improved model fit in the two fish conservation studies while the tests for *Environmental organization membership* resulted in p-values below 0.005 in none of the four studies. In summary, the likelihood ratio tests suggest that age, followed by gender, household income, and education attainment may contribute to explain the difference

[22] The likelihood ratio tests reported here were performed for each of the variables separately. Hence, a potential high correlation between variables such as age, income, and education should not influence these results. Nonetheless, the correlations between all socio-demographics were below 0.22 in absolute value, as shown in Appendix C.

in preferences for the current situation alternative across questioning approaches in at least two of the four datasets.

Table 13. Comparison of conditional logit models with and without the interaction of each socio-demographic factor with ASC terms and INF dummy

Individual-specific variables	P-values from likelihood ratio tests for each socio-demographic and study			
	Wetland restoration	Species conservation	Rockfish conservation	Lake sturgeon conservation
Male	0.003	0.000	0.688	0.718
Age	0.000	0.007	0.142	0.000
High income	0.583	0.320	0.000	0.000
Post-secondary education	0.002	0.014	0.268	0.181
Env. Organization membership	0.337	0.059	0.457	0.547

Notes:
Each test was performed for each socio-demographic variable separately.
A complete report of the conditional logit estimations used for the performance of these tests can be found in Appendix F.

According to the values of the Akaike and Bayesian information criteria, the inclusion of Age interacted with *ASC* and *INF*, improves the model specification in all four studies. A model including *Age*ASC*INF* is better than one which does not in all four studies according to the comparison of AIC values, and in two studies according to BIC. Gender interacted with *INF* improve model fit in two of the studies, similar to *High income*. On the other hand, *Post-secondary education*, and *Environmental organization membership* do not contribute to the improvement of the model specification in any study, regarding BIC values (see Appendix F). These results are close to those from likelihood ratio tests suggesting that age increases the goodness of fit in explaining the difference in preferences for the status quo between direct and inferred valuation questions, more consistently than the other socio-demographic variables.

The next step is to control for the effects of the five socio-demographic variables on the difference in preferences for the status quo alternative by estimating a single model per study. Employing the stacked data structure described in Section 3.3, we estimate conditional logit models including the interaction of the alternative specific constants with the method dummy and the five socio-demographic variables considered in this research. Preferences for the cost and the proposed policy attributes are only examined across questioning methods (interacted with *INF* dummy); thus, they are assumed not to vary across demographic groups.

As the interaction terms capture preference heterogeneity across subsamples, this model specification allows examining the statistical difference in preferences for the status quo (against any proposed policy) holding all other attributes constant, across the two questioning methods and across the demographic characteristics specified. Table 14 summarizes the outcomes of the estimation, in which the standard errors are clustered to account for potential correlation among the multiple votes of an individual.

The estimated parameters for *ASC, Cost* and the respective policy scenarios allow making similar interpretations to those presented in Section 4. In these models, the coefficient on the *ASC* current situation is capturing preferences for the status quo alternative independent of other attributes (a potential status quo bias) with the direct question, for all the base levels of the categorical demographic variables. Default preferences for the status quo alternative with the direct question are not statistically different from zero, except for the Species at risk conservation study, at a 10% significance level. This suggests that the utility from respondents that fall in all base categories is not significantly affected by the unlisted characteristics of the current situation policy; or that they have no significant tendency to a status quo bias with direct valuation. However, this may be caused by having many different demographic categories for which *ASC* is capturing preferences. The difference in the status quo bias captured with inferred valuation relative to direct valuation is statistically significant in the Rockfish conservation at a 1% significance level. The use of inferred valuation significantly diminishes the disutility respondents obtain from tax increases in three of the four studies (which may be linked to an anti-tax bias) (Total Value Team 2016) and shows a reduction in preferences for higher levels of environmental conservation with respect to the direct question.

Table 14. Conditional logit models of the probability of voting yes, including interactions of alternative-specific variables with the method dummy, and ASC terms with individual-specific characteristics (Clustered standard errors in parenthesis)

Variables	Wetland restoration	Species at risk conservation	Rockfish conservation	Lake Sturgeon conservation
ASC current situation	-0.210	-0.720*	-0.091	0.258
	(0.139)	(0.419)	(0.194)	(0.192)
ASC*INF	-0.053	0.064	0.607***	-0.312
	(0.166)	(0.467)	(0.214)	(0.225)
Cost (100's)	-0.283***	-0.732***	-0.548***	-0.548***
	(0.014)	(0.060)	(0.032)	(0.031)
Cost*INF	0.035*	-0.071	0.340***	0.241***
	(0.018)	(0.089)	(0.034)	(0.034)
Wetland acres (100,000's)	0.054***			
	(0.016)			
Wetland acres*INF	-0.033*			
	(0.020)			
Moderate strategy		-0.315**		
		(0.139)		
Light strategy		-0.419**		
		(0.176)		
Moderate *INF		0.176		
		(0.186)		
Light*INF		0.630***		
		(0.232)		
Threatened strategy			-0.372***	0.388***
			(0.075)	(0.080)
Special concern strategy			-0.082	0.080
			(0.073)	(0.072)
Threatened*INF			0.425***	-0.233***
			(0.090)	(0.086)
Special concern*INF			0.134	-0.101
			(0.086)	(0.080)
Male*(ASC)	0.163**	0.559***	-0.183*	-0.053
	(0.075)	(0.213)	(0.101)	(0.098)
Male*(ASC)*INF	-0.300***	-0.986***	-0.030	-0.037
	(0.096)	(0.240)	(0.119)	(0.120)
Age*ASC	-0.013***	-0.010	-0.011***	-0.012***
	(0.002)	(0.007)	(0.004)	(0.003)
Age*ASC*INF	0.020***	0.021***	0.005	0.016***
	(0.003)	(0.008)	(0.004)	(0.004)
High income*ASC	-0.052	0.229	-0.346***	-0.491***
	(0.098)	(0.220)	(0.115)	(0.117)
High income*ASC*INF	0.012	0.269	0.403***	0.566***
	(0.127)	(0.262)	(0.133)	(0.146)
Post-secondary education*ASC	-0.050	-0.211	-0.099	-0.120
	(0.080)	(0.247)	(0.104)	(0.101)
Post-secondary education*ASC*INF	0.214**	0.258	0.070	0.150
	(0.099)	(0.294)	(0.122)	(0.124)
Env.organization membership*ASC	-0.377***	-0.092	-0.221	-0.445***
	(0.144)	(0.361)	(0.138)	(0.146)

Variables	Wetland restoration	Species at risk conservation	Rockfish conservation	Lake Sturgeon conservation
Env. organization membership *ASC*INF	-0.113	0.282	0.093	0.095
	(0.185)	(0.458)	(0.154)	(0.167)
Number of votes	*9055*	*1048*	*3531*	*3507*
Log-likelihood	*-11438.28*	*-1179.15*	*-4314.06*	*-4177.66*
Pseudo R2	*0.089*	*0.188*	*0.119*	*0.141*

*Significance levels: *** p<0.01, ** p<0.05, * p<0.1*

The estimated parameters of the second panel in Table 14 are consistent with our previous findings on the effects of gender on the difference between answers from both valuation methods. In two of the four studies, the coefficient on *Male*ASC* is positive and significant at the 5% level. Positive signs indicate increased preference for the unlisted or unobserved characteristics of the status quo alternative or reduced preference for the proposed policy, when other attributes remain unchanged. This particular result indicates that being male increases preference for the status quo alternative, holding other attributes constant, in comparison to women (or that women prefer any proposed policy more than men) with the direct question. On the other hand, the coefficients on *Male*ASC*INF* are negative in all studies and strongly significant in the first two. For those two cases (Wetland and Species at risk conservation studies), the results suggest that being male and voting with inferred valuation significantly reduces preference for the current situation alternative independent of other attributes (women prefer less any proposed policy over status quo, with inferred valuation) in comparison to direct valuation. However, in the case of the Rockfish conservation study, the coefficient on *Male*ASC* is negative and significant at the 10% level suggesting that females may prefer status quo less than men with the direct question while their answers are not statistically different with inferred valuation. In the case of the Lake Sturgeon conservation study, gender doesn't have an impact on the difference in preferences for the current situation (independent of other attributes), between the votes elicited with direct and inferred methods.

The coefficients on *Age* are consistent across all studies in providing evidence that older respondents are more supportive of any proposed policy over status quo (when other attributes do not vary) with the direct question, and less supportive with inferred valuation.

In terms of directions, an increase in the age of the respondent reduces preferences for the unlisted attributes of the status quo alternative with the direct question and increases them with inferred valuation across all four studies. However, such effects are statistically significant in three datasets with direct valuation, and three with inferred valuation. Nonetheless, *Age* appears to have a stronger systematic effect than gender and other individual-specific characteristics on default preferences for or against the current situation, in all four studies.

The estimated parameters on *High income* suggest that wealthier respondents may be more prone to exhibit social desirability bias when reporting preferences for or against the status quo holding other attributes constant, in the two national surveys. *High income*ASC* has negative significant coefficients in the Rockfish and Lake Sturgeon conservation studies, while *High income*ASC*INF* ha*s* significant positive effects in the same surveys. These results suggest that in the two national studies, wealthier respondents have significantly different voting behavior between valuation questions relative to respondents in the lower income category, with an increased tendency to support any proposed policy presented to them (holding all alternative-specific attributes constant) in a direct valuation question, that is diminished with inferred valuation.

Post-secondary education and *Environmental organization membership* have generally not statistically significant impacts on the difference between direct and inferred preferences, across all studies, although their signs are as expected. Having attained a post-secondary education does not have a significant effect on the preferences for status quo elicited with a direct question; although in all studies the coefficients on *Post-secondary education*ASC* are negative. The opposite is found when using inferred valuation (*Post-secondary education*ASC*INF*), where respondents with a post-secondary education level show more support for the current situation scenario than those in the base category, in the Wetland restoration survey. Finally, the presence of a status quo bias is reduced for respondents who report belonging to an environmental organization, with the referendum question, in comparison to those who do not. The results are strongly significant in two of the four studies. Generally, opposite signs are found for members of environmental organizations when they answer inferred valuation tasks although the estimated parameters

are not statistically significant. Such an outcome indicates that for this group of respondents the valuation method does not significantly affect their preference against the current situation (holding all other attributes constant).

Overall, according to the results of the conditional logit models including interactions, age may be the main factor determining the presence of social desirability bias in the four stated preference surveys considered. *Age* has the most consistent effects (in terms of signs) in the difference in preferences for the current situation alternative when all other attributes remain unchanged, across questioning methods, followed by gender, and household income. As the age of respondents increase, they are more supportive of any proposed policy against the status quo with a referendum question, while they turn less supportive with inferred valuation; that is, assuming their prediction of other's votes is a projection of their true preferences. A similar interpretation can be made for women and for individuals with annual household income above $100,000, although less consistently across datasets.

5.5 Summary of the findings

Altogether, the different models and specifications estimated in Section 5 suggest that female, older and wealthier respondents may be more concerned with the image they project of themselves when answering a referendum question in these environmental conservation surveys, although none of the variables presented completely consistent effects across studies. According to our results, these groups of people are more likely to support a proposed policy as opposed to the status quo alternative with a direct referendum question rather than with an inferred referendum question, which was also reflected in a higher probability to have one or all their votes switched from yes to no across questioning approaches. However, as described at the beginning of the thesis, the fact that women and older individuals have a higher tendency to engage in self-enhancement has been documented in different fields.

Our results align with those of Johansson-Stenman and Martinsson (2006), Lusk and Norwood (2010), Carlsson, Daruvala and Jaldell (2010) and Kamas and Preston (2015), who found women to be more inclined to show social desirability bias and hypothetical bias in stated preference survey. Regarding the influence of age in SDB, Johansson-Stenman and

Martinsson (2006) found older respondents to be more concerned with environmental performance and less concerned with status in car purchases; while Lusk and Norwood (2010) found the opposite in relation to concern for animal welfare in meat consumption. In addition, the psychological study performed by Soubelet and Salthouse (2011) found higher levels of social desirability in self-reported personality traits when the age of the participants was increased, noting that social desirability was determined in their research based on scale tests. These previous studies have found similar results for age and gender in their relation to social desirability bias with different contexts, theoretical specifications, methodologies of analysis and survey implementation. Although applied to four different public goods, the fact that we found a similar tendency in a within-individual analysis of preferences stated with direct and inferred questions, provides positive evidence in favor of the latter valuation technique.

6. CONCLUSIONS

In the absence of observable behavior, stated preference methods of economic valuation are probably the best current alternative for the inclusion of nonmarket goods in policy analysis, by directly eliciting the value people place on them. Given their purpose, it is not surprising that the efficiency of stated preference methods in accurately providing such delicate information has been under constant scrutiny since their initial applications. Nonetheless, there is ongoing research focused on improving the performance of stated preference surveys and finding solutions to the already identified problems that affect them, such as hypothetical bias and social desirability bias. Inferred valuation is one of the recent methods proposed to mitigate social desirability bias in the elicitation of preferences for goods of social or moral importance. However, its application and accuracy are still a matter of discussion. Since earlier studies have often found lower values of willingness to pay with the inferred valuation method relative to the standard stated preference question, the present study attempted to examine the possible presence of systematic differences between preferences captured with direct and inferred valuation questions, as well as the potential systematic effects of several socio-demographic characteristics on social desirability bias. The analysis was performed as a contribution to the growing body of literature that focuses on the assessment of inferred valuation's performance.

The initial exploratory analysis of the information collected from four stated preference surveys suggested the presence of social desirability bias (as a difference between direct and inferred responses) in each of them, particularly from female, older, highly educated and wealthier respondents. The proportion of votes in favor of a positive environmental change for each of the four public goods considered was greater with the standard referendum (direct) question than with an inferred valuation question. In addition, the illustration of vote proportions by individual-specific factors suggested that women may support the proposed policy more frequently than men with the direct question, although there may not be a difference across these two gender groups using inferred valuation. Similar results were found for individuals older than the average in each sample, and for those with a higher level of annual household income and post-secondary education. The supportive votes from respondents who are members of environmental conservation groups

were higher in proportion than those of non-members, disregarding the questioning method used. The main implications of this descriptive analysis were the potential existence of social desirability bias in the surveys, and the possible ability of four of the five individual-specific variables to explain it.

We found statistically significant differences between the probabilities of voting yes with direct and inferred questions, in the four valuation studies, generally consistent with the theory behind social desirability bias and inferred valuation. Through the performance of likelihood ratio tests, the equality of parameters for determining direct and inferred votes in support of a proposed policy was rejected. This implied the existence of significant differences across questioning methods, in all four studies. Moreover, graphic comparisons of the mean predicted probabilities of voting yes per cost level suggested that the differences between questioning methods could be interpreted as social desirability bias, which tended to reduce or disappear when higher payments were involved. Indeed, the graphic analysis in Section 4 provided insights that in addition to the payments associated to the proposed alternatives, the perception of what is socially desirable for respondents in each sample, as well as the familiarity (or closeness) they feel for the good being valued may influence their choice to display a socially desirable or honest behavior. However, it is important to note that a combination of several other factors and not only social desirability could be influencing preferences and contributing to the observed differences between answers from both valuation questions.

From the estimation of conditional logit models including interactions between parameters, we found that respondents show preference for higher positive environmental changes using a direct question. On the other hand, only the payments associated with the changes appear statistically significant in inferred valuation, in all four studies. Also, we found strong and significant differences in preferences for the current situation holding other attributes constant, systematically consistent with the concept of social desirability bias. However, significant but opposite results were found for the cost variable. The interesting systematic effect of cost may be reflecting an anti tax-bias, according to which individuals could consider support for a program that entails higher taxes as socially undesirable (Total Value Team 2016), in opposition to the social norm of supporting environmental

conservation. In summary, the econometric analysis performed confirms the presence of a difference in preferences consistent with social desirability bias in some cases and opposed to it in others, on the usual contingent valuation tasks of the considered surveys. Under the premise that inferred valuation captures true preferences, our results suggested that respondents' actual concern for policies with environmental purposes may be mainly monetary.

Assessing the influence of individual-specific factors, we found strong evidence that age, followed by gender, systematically influenced voting behavior interpreted as social desirability bias in the considered studies. The votes from older respondents were more likely to switch from yes to no between questioning approaches across all four studies. Similar results were obtained in two of the studies for the votes of women, and individuals with a household income of more than $100,000. In addition, the inclusion of age, gender, income, and education in the estimation of preferences for the proposed policies fit the data better than excluding them in at least two of the studies, according to likelihood ratio tests and information criteria. Lastly, from the estimation of logit and conditional logit models with interactions, we can conclude that a one-year increase in age and being female (in comparison to being male) significantly reduces respondent's preferences stated with direct valuation for the status quo alternative when all other attributes remain unchanged (increases preferences for a proposed policy) while such effect is diminished with inferred valuation. Hence, the different econometric analyses performed suggested that older and female respondents are more likely to engage in social desirable behavior when voting for the conservation of environmental goods, with the standard referendum question. Yet, these groups of respondents are more likely to predict a minority of the population to be as environmentally concerned as them.

Our findings line up with earlier studies on the differences in social desirability bias across demographics groups of people, supporting the validity of inferred valuation to alleviate the issue. Several studies in social psychology and economics have found women to be more prone than men to incur in self-enhancement (Johansson-Stenman and Martinsson (2006), Lusk and Norwood (2010), Carlsson, Daruvala and Jaldell (2010) and Kamas and Preston (2015)). Fewer studies have directly or indirectly addressed the relationship between

age, education and income levels with self-enhancement in survey implementation (Johansson-Stenman and Martinsson 2006, Lusk and Norwood 2010, Soubelet and Salthouse 2011, Heerwig and McCabe 2009) Altogether, their results suggest that older, wealthier, and highly educated people may be more likely to exhibit socially desirability bias. Following Lusk and Norwood (2011), the present study assumed inferred valuation better reflected respondents' true preferences, meaning that the difference between direct and inferred votes was attributed purely to SDB although given the complexity of individuals' behavior, we acknowledge the fact that a combination of other elements could be generating that difference[23]. Nonetheless, since we found women and older individuals to behave as the literature suggested, by comparing direct and inferred valuation questions in more than one study, the assumption placed on inferred valuation seems to hold. By capturing preferences of female and older respondents for four different public goods with environmental connotations, that align to previous studies, the results lead to the conclusion that inferred valuation may actually be a promising tool to better reflect truthful responses.

The findings of this study are relevant for researchers, economic valuation practitioners, and policymakers. The results highlight the role of age over gender and other individual-specific factors in determining the tendency of individuals to adopt a socially desirable behavior in economic valuation for environmental goods. In addition, the results show a consistent effect on preferences for tax increases given by inferred valuation that could be explained by an anti-tax bias. Therefore, this study could encourage new research in the field of environmental economics towards a deeper understanding of age and other demographic differences in strategic behavior. In addition, our research provide an stylized fact on the difference in preferences for increased costs of the proposed policy. The results show a consistent diminished disutility from tax increases with inferred valuation relative to direct questions, that could be explained by an anti-tax bias. Economic valuation practitioners will find this study informative when estimating welfare measures for public goods in specific populations, using stated preference methods. The results reported here suggest that inferred valuation could provide more accurate values than the standard referendum question,

[23] Other attitudinal factors and survey design characteristics such as the degree of consequentiality, incentive compatibility, and anonymity of the survey perceived by respondents could have influenced the answers collected with both valuation questions, and thus, the difference between them.

especially when the population target is conformed mainly by women or older people. Similar implications on the use of inferred valuation can be derived for decision-makers in both public and private sectors. Given our findings, policymakers and firm managers may have increased interest in applying inferred valuation to elicit preferences for new public policies, beyond environmental purposes, and new private goods with moral liability. Consequently, the present research widens the scope of analysis and application of inferred valuation, in search of more accurate estimates of value and better-informed decisions related to non-market goods.

7. LIMITATIONS AND GUIDELINES FOR FUTURE RESEARCH

The number of studies considered, as well as their population targets, sample sizes, and the effectiveness of the techniques used to ensure consequentiality place some limitations in the generalizability of our conclusions. Only four contingent valuation studies with common survey design, authorship, socio-demographic and attitudinal variables were employed for the development of this thesis. In the different econometric analyses performed, gender had statistically significant effects on respondents' voting behavior in two out of the four studies, particularly those with provincial population targets. A higher number of valuation studies for environmental goods could have been more informative regarding the influence of gender on social desirability bias. Furthermore, the two fish conservation studies with national coverage had small sample sizes for several provinces. The inclusion of new studies with larger provincial samples could lead to more conclusive results on the effects of gender and the other socio-demographic variables, across provinces. The results reported in this research correspond to Canadian populations only; making the conclusions not necessarily applicable in other areas with different economic, cultural, and social structures. More variability in terms of authorship, with its implications on differences in survey design, could also help ensure robustness of the outcomes. In addition, the tools included in the surveys to ensure consequentiality and incentive compatibility could have an impact on both direct and inferred answers. The differences between preferences reported with both questioning approaches may vary depending on the degree of consequentiality respondents believed their votes had.

The present investigation was restricted to the assessment of five individual-specific factors, some of which were standardized across datasets. The individual-specific factors considered for the analysis were selected regarding their presence in all four valuation studies. There are other socio-demographic variables present in some but not all of them, which were not included in the estimations although could have an important influence on respondents' choices. Additionally, the categories of annual household income, education attainment, and respondents' involvement in environmental conservation were recoded in each dataset to make comparisons feasible across studies. However, the implicit differences in the original information collected through multiple categories could have affected the

significance of the estimations on these variables. Although the recoding process was cautiously performed to reduce this potential issue, the findings reported in this research for the four recoded categorical variables are not considered strongly conclusive.

Further research can address several topics built upon the criteria considered for the present study. A similar analysis of multiple surveys using inferred valuation can be performed to examine the effects of other socio-demographic variables in social desirability bias. This is a feasible investigation that adds to the literature on the potential causes of the problem and the efficiency of inferred valuation to solve it. Also, the yes-votes stated in the referendum question were recoded for uncertainty, and the inferred yes-votes were obtained from recoding the inferred percentage of the population using a threshold of 50%. Another topic of interest is the difference in preferences captured with inferred valuation in other locations outside of Canada, which also contributes to assessing the consistency of our results across geographical areas and cultural backgrounds. The use of different criteria for the mentioned conditions offers interesting opportunities for the extension of the present study.

Three other aspects were out of the scope of this research: the possible endogeneity of *Environmental organization membership* and other demographic variables, ordering effects in both valuation questions, and a deeper understanding of the potential relationship between the tax amounts and respondents' decision to engage in social desirability bias. Other factors not captured in the indirect utility function could influence respondents' choice to support a proposed policy and participate in environmental conservation organizations at the same time. Such a possibility could be present with other demographic factors as well, generating endogeneity issues, which may affect the significance of the estimated parameters and the conclusions based on them. Also, the inferred valuation question is usually presented after the standard referendum question in all studies where the former is applied. Experimental design to test ordering effects of the questions on preferences and social desirability bias, across socio-demographic groups, would be an important contribution to the literature. Future investigations could also focus on additional alternative-specific and attitudinal variables that determine respondents' choices to engage in social desirability bias or provide honest answers. As suggested by our findings, some of these factors could be the joint influence of the levels of monetary payments associated with the implementation of the

proposed policy and the perceived social expectations to support it. Examining the cost intervals at which individuals exhibit social desirability for the conservation of moral goods in large populations could have significant implications for future stated preference applications.

Finally, new research for the assessment of inferred valuation's validity could also include a comparison of stated direct and inferred values with actual payments, and experimental analysis to test the effect of other survey elements in respondent's answers. Ideally, individuals' behavior stated in surveys using direct and inferred valuation questions with respect to preferences for public goods could be compared to actual behavior in the field. Such an investigation may entail several difficulties to address in terms of information availability, as well as context and temporal factors, but would provide critical evidence in favour of or against inferred valuation criterion validity. Lastly, economic experiments would contribute to the assessment of the method by testing the influence of other factors related to survey design, such as bias due to the payment vehicle (anti-tax bias), perceived consequentiality, and the inclusion of alternatives with both positive and negative social implications on direct, inferred and non-hypothetical behavior.

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APPENDIX A. THE SURVEYS

APPENDIX A1. THE WETLAND RESTORATION SURVEY

Wetland Restoration and Retention in Manitoba Survey

The Manitoba government, Ducks Unlimited Canada and the Federal Government are seeking information regarding wetlands in Manitoba. We are seeking your opinion on investing public funds for the retention and restoration of wetlands in the prairie pothole region in southern Manitoba. Your feedback is important for the management of wetlands in accordance with the will of the public of Manitoba.

Thank you for spending your time to complete this survey. Please try to answer all the questions. It should take no longer than 20-25 minutes.

All information you provide is strictly confidential. Your name or any personal information will never appear with your answers. Only a summary of the results will be made public.

Your feedback is important and we appreciate your help with this project.

To contact the researchers:

John Pattison (Graduate Student)	Dr. Peter Boxall	Dr. Vic Adamowicz
E-mail: johnp@ualberta.ca	Peter.boxall@ualberta.ca	Vic.adamowicz@ualberta.ca
(780) 492-4603	(780) 492-4603	(780) 492-4603

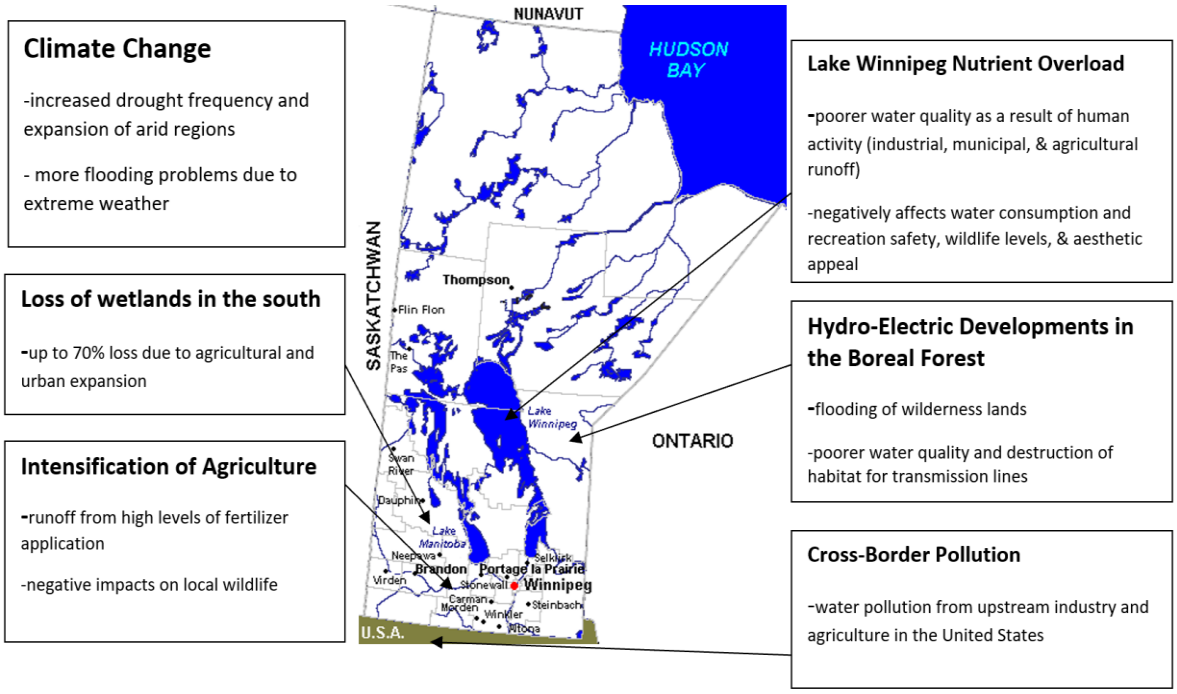
Department of Rural Economy
515 GSB
University of Alberta
Edmonton, Alberta T6G 2H1

Question 1. Consider the following list of current issues facing Manitobans today. Please rate the level of effort government should be allocating to each issue compared to what is currently done in Manitoba.

Government Program in Manitoba	Do a lot less	Do less	Do about the same	Do more	Do a lot more
Improving roads and highways					
Supporting the arts					
Improving education					
Encouraging economic growth					
Reducing crime					
Increasing job opportunities in rural communities					
Protecting the natural environment					
Lowering taxes					
Improving health care					

Environmental Issues in Manitoba

Manitoba is Canada's 6th largest province and has some of the most pristine wilderness areas in the country. The southern portion of the province contains most of the provincial population and agricultural land, leaving the northern portions of the province relatively untouched. Manitoba has large freshwater lakes, some relatively untouched watersheds, the most southern herd of woodland caribou, wild rivers, the Hudson Bay coastline with associated Arctic wildlife, and is on the migratory pathway for thousands of waterfowl. Despite these assets, however, there are a variety of environmental issues facing residents of Manitoba that will need to be addressed in the near future:



Major environmental issues in Manitoba. [24]

Question 2. *How familiar were you with these current environmental issues in Manitoba prior to participating in this survey?*

Environmental Issue	Not Familiar	Slightly Familiar	Familiar	Quite Familiar	Very familiar
Nutrient Overload in Lake Winnipeg					
Climate Change					
Hydroelectric Dams					
Intensification of Agriculture					
Wetland Loss					
Cross-Border Pollution					

The remainder of this survey will deal with the conservation of wetlands in Manitoba

[24] Map of Manitoba created by Earl Andrew. Obtained from the internet site http://en.wikipedia.org/wiki/Image:Manmap.PNG

What are wetlands?

Wetlands are areas that hold water for short or long durations, where a close relationship exists between water and land organisms. Intact natural wetlands have many types of plants that can only live on the unique aquatic soils. Wetlands contain a large diversity of living things.

Examples of wetlands

Wetland Benefits

Wetlands are important ecosystems that provide an array of environmental benefits to humans. Some of these benefits are:

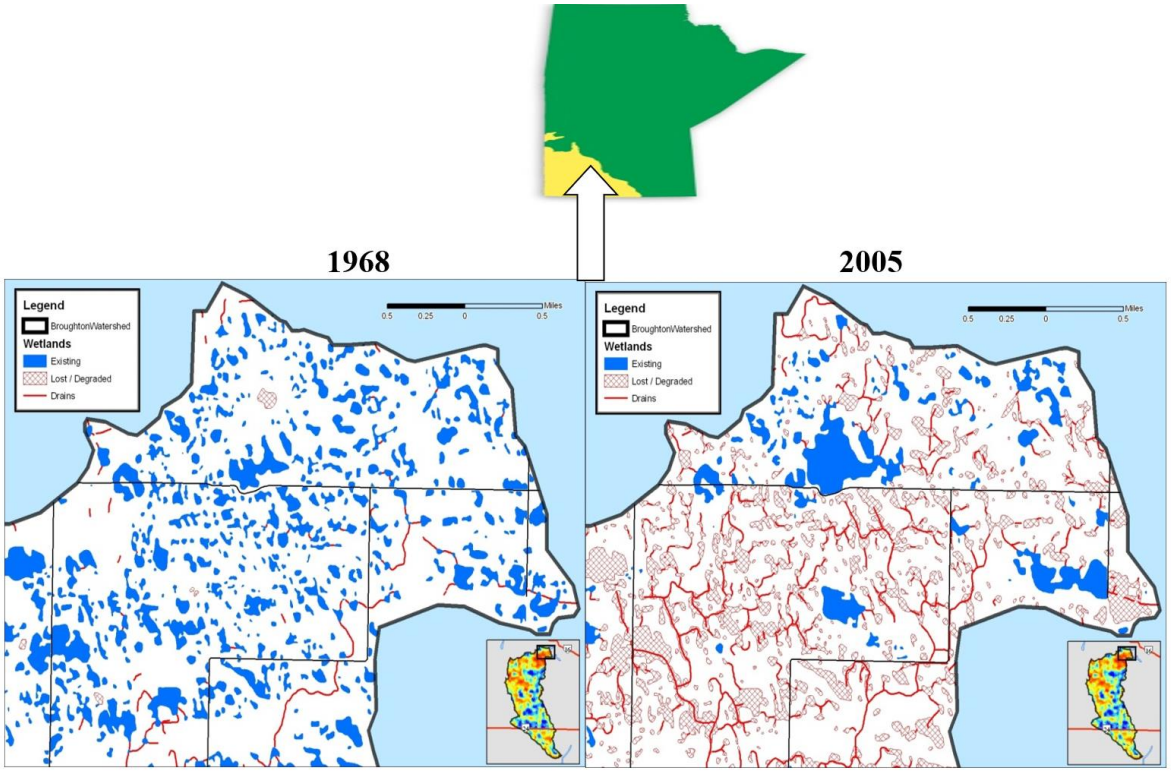
- Wetlands are **natural filters that improve water quality**. Wetlands remove nutrients and contaminants such as phosphorus and nitrogen from water that flows into lakes, streams and rivers, and groundwater.
- Wetlands can **recharge levels of groundwater** in rural areas that some residents rely on for household water uses.
- Wetlands help **control floods** by storing large amounts of water. When wetlands are destroyed, the probability of rainfall causing flooding and floodwater damage increases.
- Wetlands **control soil erosion** by slowing movement of water
- Wetlands **remove and store** carbon from the Earth's atmosphere and can slow climate change.
- Wetlands also **provide habitat for over 600 species of wildlife** – including more than one-third of the species Canada currently assesses at risk of loss (extinction).

Thus, losing wetlands increases contaminants entering lakes in Manitoba, such as Lake Winnipeg, and would significantly increase costs for drinking water treatment. Wetland loss would also mean less recreational use, diminished levels of wildlife, higher levels of soil erosion, and reduced flood control.

Wetland areas are declining

A significant loss in wetland area has occurred since the late 1800's. Most of this loss is directly attributed to human activity such as expansion of urban areas, agriculture, and various industries. It is estimated that up to 70% of wetlands in the southern prairie pothole region of Manitoba have been lost or degraded.

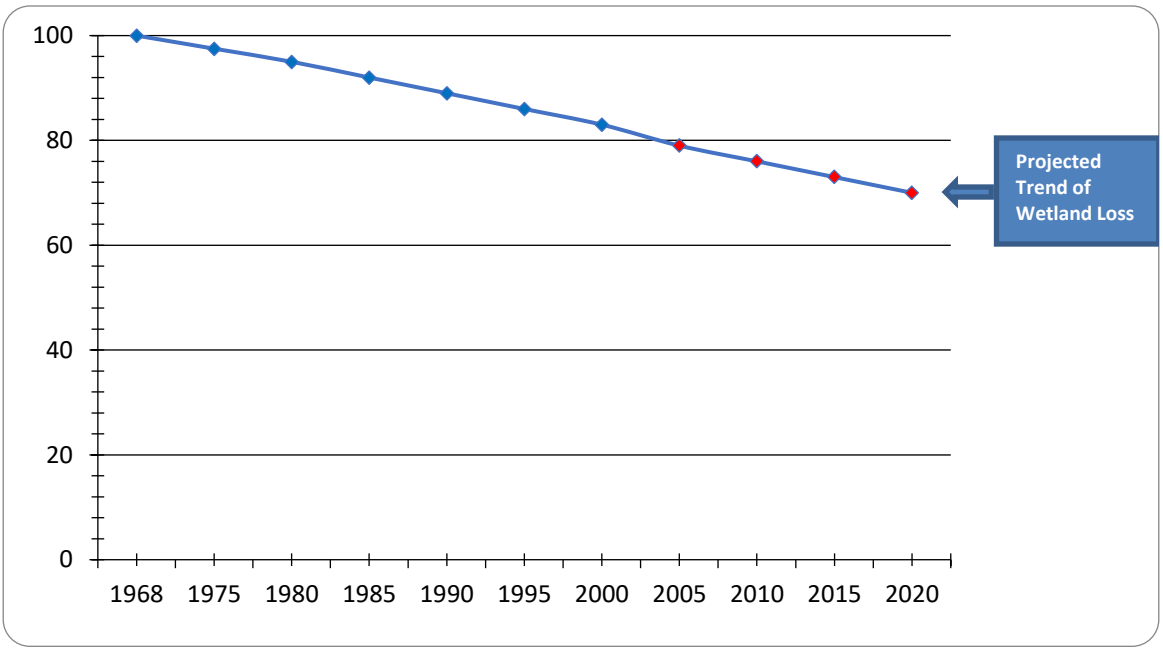
While much has been lost or degraded, accurate information on wetlands area has only been available in recent years. Accurate air photos and measurements of wetland loss became available in the 1960s. In 1968 approximately 1,350,000 acres of the southern prairie pothole region in Manitoba were considered wetlands. By 2005 wetland area had dropped to about 1,000,000 acres, or about 77% of what existed in 1968.



An illustration of changes in existing wetlands in a **representative watershed** of the southern Prairie Pothole Region of Manitoba between 1968 and 2005[25]

Scientists estimate the loss of wetlands in this region is continuing at a rate of 0.57% annually. If this trend continues, there could be as little as 70% of the wetland areas in southern Manitoba that existed in 1968 remaining by 2020.

[25] Ducks Unlimited Canada, 2005



Actual and projected wetland loss trend in the Prairie Pothole Region of Manitoba since 1968

Why wetlands are declining

There are various factors contributing to the loss and degradation of wetlands, such as growing cities and the construction of highways. A major contributor, however, is agricultural expansion.

As the fourth largest sector in the Manitoban economy, agriculture has contributed to approximately 85% of the loss and degradation of wetlands in Manitoba's prairie pothole region. The expansion of agriculture occurred in response to expanding human populations which demand more food. At the same time, real incomes for farmers remained basically the same or even declined. These issues resulted in government response with policies and programs that promoted drainage of wetlands to **increase cultivated land areas, food production and farm incomes**.

An illustration of the drainage of wetlands an agricultural watershed in the prairie pothole region of Manitoba [26]

[26] Ducks Unlimited Canada, 2005

Question 3. *How concerned are you about the loss of wetlands in Manitoba?*

Very concerned	*Somewhat concerned*	*Not concerned*

Reasons to Drain Wetlands

Currently policies that promote wetland drainage are being withdrawn. A major issue, however, is that the prices farmers are paid to produce agricultural products do not cover the costs that farmers must bear to maintain wetlands on their farms. Thus, even though farmers may be good stewards of the land, they may choose to drain wetlands for financial reasons. Some of these reasons are:

- Wetlands can be costly for farmers to maintain in terms of **increased fuel** and time taken to manoeuvre machinery around them during seeding and harvesting. The presence of wetlands can also lead to **double application** of seeds or fertilisers in some areas of their fields, leading to higher costs to the farmer.
- Price increases for agricultural products have increased the value of agricultural land. Draining wetlands **increases cultivated acreage** allowing for increases in the production of crops and increased profits for the farmer.
- Wetlands attract waterfowl that often eat young plants or un-harvested grain, decreasing yields.

In addition, many other businesses and industries rely on agriculture. Restoring wetlands and decreasing cultivated acres could indirectly affect businesses such as equipment dealerships, hardwear stores and fertilizer dealerships.

Question 4*. How much financial responsibility should private landowners, such as farmers, have to preserve wetlands on their property?*

No Responsibility ☐ Some Responsibility ☐ All Responsibility ☐

Results of Decline in Wetlands

Current research efforts estimate that the annual 0.57% decline in wetlands that has been experienced in the southern prairie pothole region of Manitoba has resulted in:

- an *additional* 330 tonnes of nitrogen and 70 tons of phosphorous added to the southern regions watersheds annually (equivalent to 45 semi-truck loads of fertilizer)
- an increase of 9 million cubic meters of flood water annually
- 50,000 tonnes of soil lost due to erosion annually
- loss of 500 breeding pairs of ducks annually, an indicator for other living species
- release of an *additional* 30,000 tonnes of carbon annually - equivalent to carbon emissions from 6,000 cars on provincial roads[27]

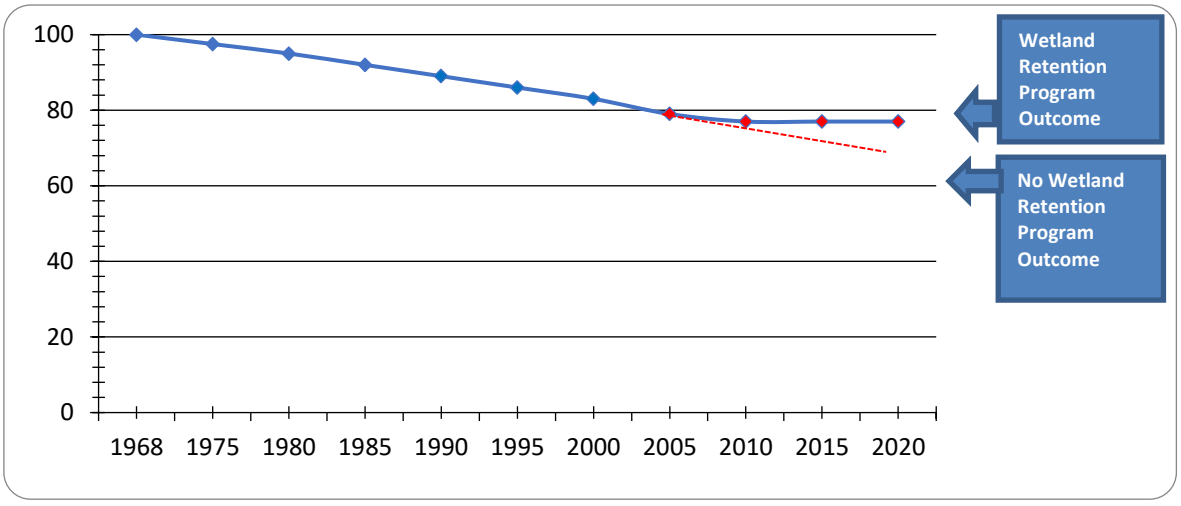
[27] Based upon a mid-sized vehicle emitting 5 tonnes/year

Stopping the Loss of Wetlands in Manitoba

Farmers and other landowners maintain wetlands at a personal cost, while society at large benefits from having wetlands on the landscape. In response to this issue governments and nongovernmental organizations have included wetland retention and restoration in a number of programs to assist private landowners in maintaining wetlands.

Wetland Retention

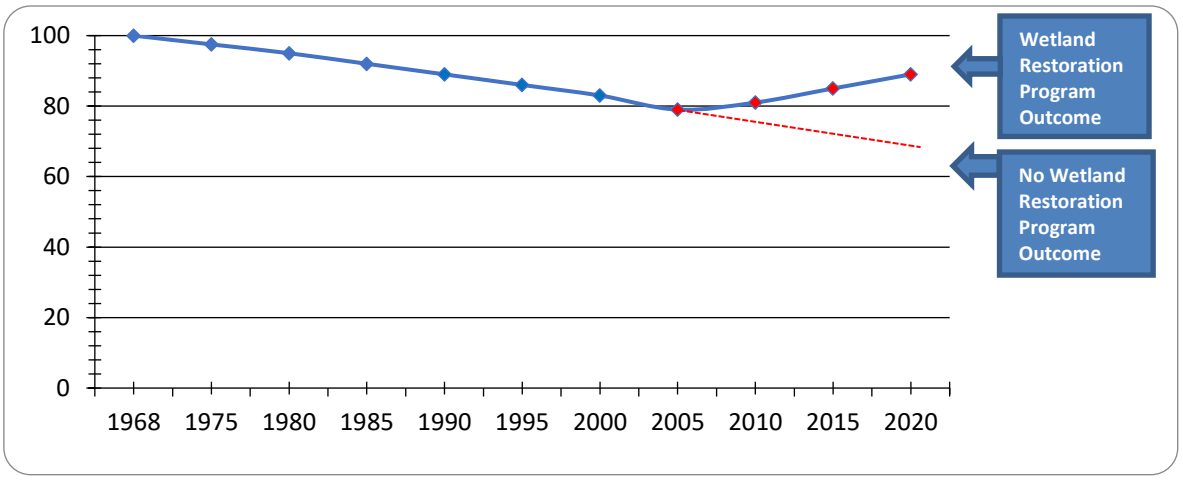
Wetland retention programs could prevent further loss of wetlands and maintain wetland areas at their current levels in the prairie pothole region. This requires landowners to stop any further drainage of wetlands on their property – a financially difficult decision given high grain prices today.



An illustration of wetland retention program outcomes in Manitoba

Reversing the Loss and Degradation of Wetlands in Manitoba

Beyond stopping the loss and maintaining wetlands at the levels we see today, programs are being developed to *restore* many of the wetlands that have been lost. Increasing the acres of wetlands will enhance the values that wetlands provide to society. However, these programs may negatively impact farmers in southern Manitoba – cropping areas will be reduced and the costs of farming around restored wetlands will increase.



An illustration of a possible wetland restoration program outcomes in Manitoba.

Tough Choices!

Wetland conservation programs, if developed, would stop or reverse the trend of wetland loss and increase the area of wetlands in the province. It should be noted that even if significant restoration programs are implemented, the total increase would not restore all the wetlands that have been lost due to the fact that some of these wetlands simply cannot be restored.

Decisions about the future of Manitoba's wetlands are not easy to make. While wetland retention and restoration programs will enhance the values that wetlands provide society, these activities will not be free.

So who should pay for wetland conservation - private landowners or the taxpayer?

Should the costs be shared?

If wetland conservation is left in the hands of private landowners it is likely that few wetlands will be retained and that little restoration will occur. **Existing estimates of the costs of retaining and restoring wetlands range from about $700 to $1300 per wetland acre**.[28] Without changes to existing policies, if wetland numbers are to increase, then the costs of wetland conservation will continue to be born by landowners, most of whom are farmers. If government funds are used for wetland conservation, there may be less money available for other environmental and social programs including health care, infrastructure development, and education. It is a tough choice.

[28] Depending on assumptions relating to lost crop revenues for the lands that were drained.

Question 5. *If programs were developed to share the cost of wetland restoration and retention, approximately what financial share would you expect the following groups to contribute?*

	Under 25%	**25-50%**	**50-75%**	**75-100%**
Government (taxpayers)				
Private Landowner				
Conservation Organisations (Nature Conservancy, Ducks Unlimited, etc)				

The Future of Manitoba's Wetlands

We want to know the amount of public funds you believe should be spent on retaining and restoring wetlands in the Manitoba prairie pothole region. In the next section, you will be asked to vote on policies representing various hypothetical situations regarding the future amount of wetlands in the province.

For each scenario, you will be asked to choose between two different alternatives:

1. **The Current Trend:** where Manitoba will continue to experience the current trend of 0.57% annual wetland degradation and loss. Our estimates suggest that by 2020 wetlands will further decline from the current level of 77% (1,000,000 acres) to about 70% (950,000 acres) of their 1968 levels. Each voting scenario will describe the net impacts by 2020.

2. **A Proposed Program**: The program presented will be one of two possibilities: a *retention* program which will stabilize southern Manitoba's wetlands at their current level, or a *retention* ***and*** *restoration* program in which wetland loss will be halted and wetlands will increase by some amount greater than the current level.

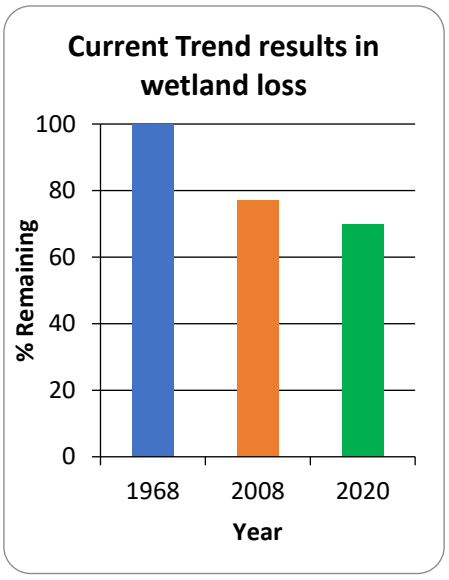
The scenarios will be described by three characteristics:

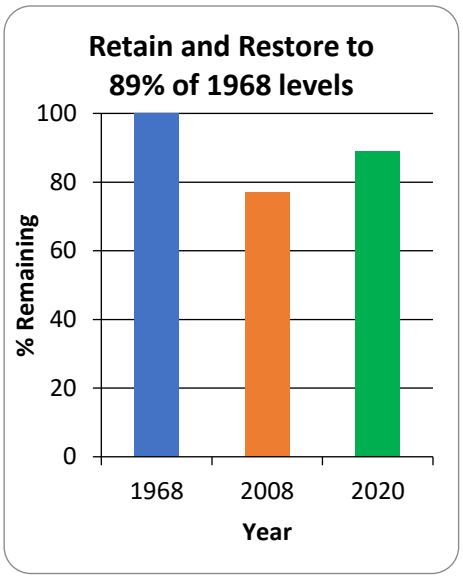
1. Wetland area targets.
2. Description of the estimated impacts of the program.
3. Annual investment of public funds.

Under each vote the proposed program will carry a price tag that represents your household's annual share of the investment towards wetlands in Manitoba over the next 5 years. **Collected funds will be used to compensate landowners for the retention and restoration of wetlands in the province of Manitoba.**

THE RELATIVE SIZE OF WETLAND AREAS

Graphs will be used to indicate the size of the wetland conservation program. For example, the policy below would restore wetlands in southern Manitoba to 89% of their 1968 levels:



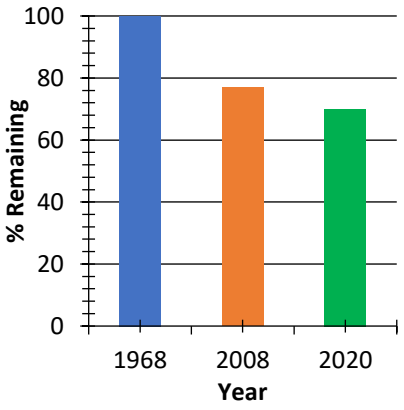
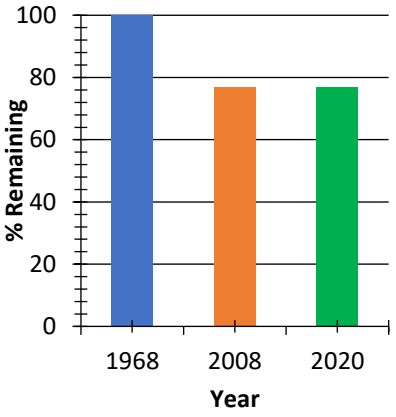


PLEASE NOTE: Research has shown that how people vote on a survey is often not a reliable indication of how people would actually vote at the polls. In surveys, some people ignore the monetary and other sacrifices they would really have to make if their vote won a majority and became law. We call this **hypothetical bias**. In surveys that ask people if they would pay more for certain services, research has found that people may say that they would pay 50% more than they actually will in real transactions.

It is very important that you "vote" as if this were a real vote. You need to imagine that you actually have to dig into your household budget and pay the additional costs.

You will now vote 5 times:
• Assume that the options on EACH SCREEN are the ONLY ones available
• Each time, please vote independently from the other votes - do not compare options on different screens

PLEASE TREAT EACH VOTE INDEPENDENTLY FROM OTHER VOTES. IN OTHER WORDS, NO OTHER WETLAND CONSERVATION PROGRAM IS BEING CONSIDERED.

Vote	The Current Trend	A Proposed Program
Wetland Area Targets	Results in further wetland loss: 77% of 1968 wetlands currently remain in southern Manitoba, but this will decline to 70% (950,000 acres) by 2020. 	**Maintain** wetlands at their current level through 2020, which is **77%** (1,000,000 acres) of 1968 levels in southern Manitoba 
Water Quality *By 2020 wetlands will annually filter the equivalent of about:*	4500 semi-truck loads of fertilizer	5000 semi-truck loads of fertilizer
Flood Control *By 2020 wetlands will annually control about:*	1.1 billion cubic meters of water	1.2 billion cubic meters of water
Soil Erosion *By 2020 wetlands will annually control about:*	6 million tonnes of soil from being eroded	6.8 million tonnes of soil from being eroded
Wildlife Habitat *By 2020 wetlands will annually provide habitat for about:*	58,000 breeding pairs of ducks	63,000 breeding pairs of ducks
Carbon Capture and Storage *By 2020 wetlands will annually store carbon equivalent to the emissions of about:*	740,000 cars	800,000 cars
Your household's annual share investment paid through tax increases for the next 5 years, 2008-2012	$0 annually for 5 years	$ annually for 5 years

Question X. Please carefully compare the two alternatives presented in the table above. If you had to vote on these two options, which one would you choose?

Please treat independently from all other votes. Please mark one box only.

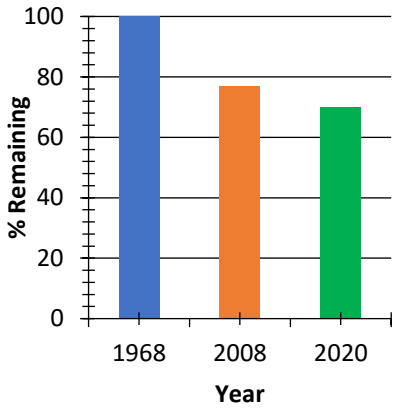
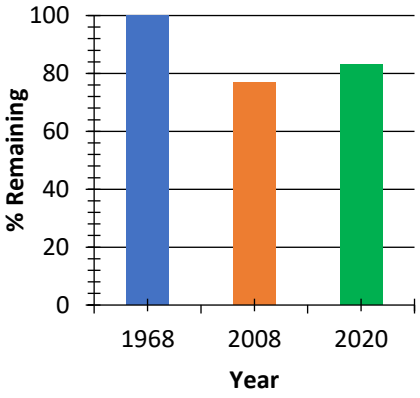
Current Trend ☐ ***Proposed Program*** ☐

Question X. How confident are you that this is the choice you would make if this was an actual referendum? *Circle one only.*

1. Very uncertain 2. Somewhat uncertain 3. Somewhat certain 4. Very certain

Question X. If this really was a referendum, what percentage of Manitobans do you think would vote FOR the proposed program? ☐

PLEASE TREAT EACH VOTE INDEPENDENTLY FROM OTHER VOTES. IN OTHER WORDS, NO OTHER WETLAND CONSERVATION PROGRAM IS BEING CONSIDERED.

Vote	The Current Trend	A Proposed Program
Wetland Area Targets	Results in further wetland loss: 77% of 1968 wetlands currently remain in southern Manitoba, but this will decline to 70% (950,000 acres) by 2020. 	**Restore** wetlands in southern Manitoba to **83%** (1,122,000 acres) of 1968 levels by 2020 
Water Quality *By 2020 wetlands will annually filter the equivalent of about:*	4500 semi-truck loads of fertilizer	5300 semi-truck loads of fertilizer
Flood Control *By 2020 wetlands will annually control about:*	1.1 billion cubic meters of water	1.4 billion cubic meters of water
Soil Erosion *By 2020 wetlands will annually control about:*	6 million tonnes of soil from being eroded	7 million tonnes of soil from being eroded
Wildlife Habitat *By 2020 wetlands will annually provide habitat for about:*	58,000 breeding pairs of ducks	67,000 breeding pairs of ducks
Carbon Capture and Storage *By 2020 wetlands will annually store carbon equivalent to the emissions of about:*	740,000 cars	875,000 cars
Your household's annual share investment paid through tax increases for the next 5 years, 2008-2012	$0 annually for 5 years	$ annually for 5 years

Question X. Please carefully compare the two alternatives presented in the table above. If you had to vote on these two options, which one would you choose?

Please treat independently from all other votes. Please mark one box only.

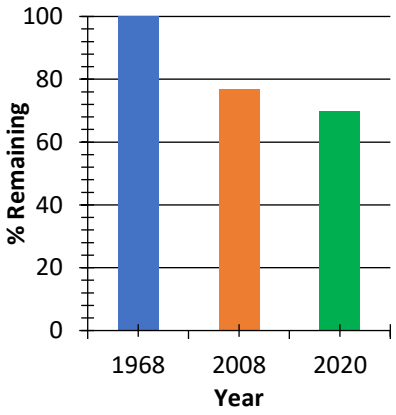
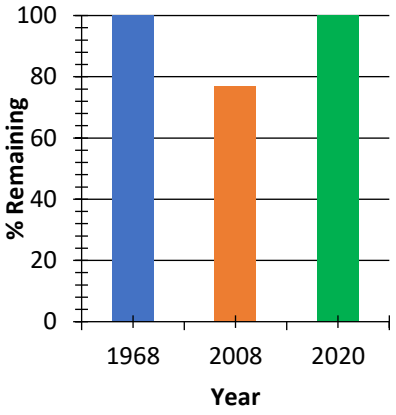
Current Trend ☐ ***Proposed Program*** ☐

Question X. How confident are you that this is the choice you would make if this was an actual referendum? *Circle one only.*

1. Very uncertain 2. Somewhat uncertain 3. Somewhat certain 4. Very certain

Question X. If this really was a referendum, what percentage of Manitobans do you think would vote FOR the proposed program? ☐

PLEASE TREAT EACH VOTE INDEPENDENTLY FROM OTHER VOTES. IN OTHER WORDS, NO OTHER WETLAND CONSERVATION PROGRAM IS BEING CONSIDERED.

Vote	The Current Trend	A Proposed Program
Wetland Area Targets	Results in further wetland loss: 77% of 1968 wetlands currently remain in southern Manitoba, but this will decline to 70% (950,000 acres) by 2020. 	**Restore** wetlands in southern Manitoba to **100%** (1,350,000 acres) of 1968 levels by 2020 
Water Quality *By 2020 wetlands will annually filter the equivalent of about:*	4500 semi-truck loads of fertilizer	6400 semi-truck loads of fertilizer
Flood Control *By 2020 wetlands will annually control about:*	1.1 billion cubic meters of water	1.6 billion cubic meters of water
Soil Erosion *By 2020 wetlands will annually control about:*	6 million tonnes of soil from being eroded	8.8 million tonnes of soil from being eroded
Wildlife Habitat *By 2020 wetlands will annually provide habitat for about:*	58,000 breeding pairs of ducks	81,000 breeding pairs of ducks
Carbon Capture and Storage *By 2020 wetlands will annually store carbon equivalent to the emissions of about:*	740,000 cars	1,000,000 cars
Your household's annual share investment paid through tax increases for the next 5 years, 2008-2012	$0 annually for 5 years	$ annually for 5 years

Question X. Please carefully compare the two alternatives presented in the table above. If you had to vote on these two options, which one would you choose?

Please treat independently from all other votes. Please mark one box only.

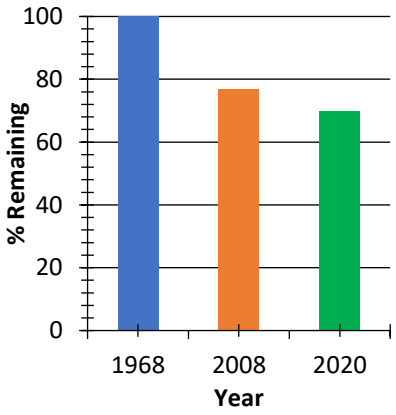
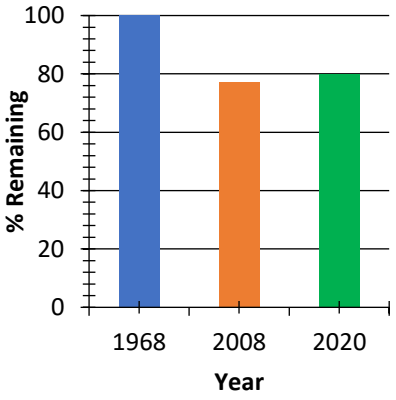
Current Trend ☐ ***Proposed Program*** ☐

Question X. How confident are you that this is the choice you would make if this was an actual referendum? *Circle one only.*

1. Very uncertain 2. Somewhat uncertain 3. Somewhat certain 4. Very certain

Question X. If this really was a referendum, what percentage of Manitobans do you think would vote FOR the proposed program? ☐

PLEASE TREAT EACH VOTE INDEPENDENTLY FROM OTHER VOTES. IN OTHER WORDS, NO OTHER WETLAND CONSERVATION PROGRAM IS BEING CONSIDERED.

Vote	The Current Trend	A Proposed Program
Wetland Area Targets	Results in further wetland loss: 77% of 1968 wetlands currently remain in southern Manitoba, but this will decline to 70% (950,000 acres) by 2020. 	**Restore** wetlands in southern Manitoba to **80%** (1,008,000 acres) of 1968 levels by 2020 
Water Quality *By 2020 wetlands will annually filter the equivalent of about:*	4500 semi-truck loads of fertilizer	5100 semi-truck loads of fertilizer
Flood Control *By 2020 wetlands will annually control about:*	1.1 billion cubic meters of water	1.3 billion cubic meters of water
Soil Erosion *By 2020 wetlands will annually control about:*	6 million tonnes of soil from being eroded	7 million tonnes of soil from being eroded
Wildlife Habitat *By 2020 wetlands will annually provide habitat for about:*	58,000 breeding pairs of ducks	65,000 breeding pairs of ducks
Carbon Capture and Storage *By 2020 wetlands will annually store carbon equivalent to the emissions of about:*	740,000 cars	840,000 cars
Your household's annual share investment paid through tax increases for the next 5 years, 2008-2012	$0 annually for 5 years	$ annually for 5 years

Question X. Please carefully compare the two alternatives presented in the table above. If you had to vote on these two options, which one would you choose?

Please treat independently from all other votes. Please mark one box only.

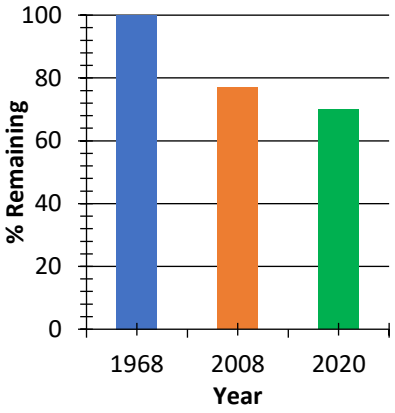
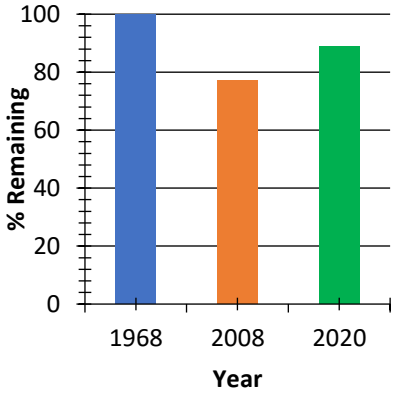
Current Trend ☐ ***Proposed Program*** ☐

Question X. How confident are you that this is the choice you would make if this was an actual referendum? *Circle one only.*

1. Very uncertain 2. Somewhat uncertain 3. Somewhat certain 4. Very certain

Question X. If this really was a referendum, what percentage of Manitobans do you think would vote FOR the proposed program? ☐

PLEASE TREAT EACH VOTE INDEPENDENTLY FROM OTHER VOTES. IN OTHER WORDS, NO OTHER WETLAND CONSERVATION PROGRAM IS BEING CONSIDERED.

Vote	The Current Trend	A Proposed Program
Wetland Area Targets	Results in further wetland loss: 77% of 1968 wetlands currently remain in southern Manitoba, but this will decline to 70% (950,000 acres) by 2020. 	**Restore** wetlands in southern Manitoba to **89%** (1,200,000 acres) of 1968 levels by 2020 
Water Quality *By 2020 wetlands will annually filter the equivalent of about:*	4500 semi-truck loads of fertilizer	5600 semi-truck loads of fertilizer
Flood Control *By 2020 wetlands will annually control about:*	1.1 billion cubic meters of water	1.5 billion cubic meters of water
Soil Erosion *By 2020 wetlands will annually control about:*	6 million tonnes of soil from being eroded	7.8 million tonnes of soil from being eroded
Wildlife Habitat *By 2020 wetlands will annually provide habitat for about:*	58,000 breeding pairs of ducks	72,000 breeding pairs of ducks
Carbon Capture and Storage *By 2020 wetlands will annually store carbon equivalent to the emissions of about:*	740,000 cars	940,000 cars
Your household's annual share investment paid through tax increases for the next 5 years, 2008-2012	$0 annually for 5 years	$ annually for 5 years

Question X. Please carefully compare the two alternatives presented in the table above. If you had to vote on these two options, which one would you choose?

Please treat independently from all other votes. Please mark one box only.

Current Trend ☐ ***Proposed Program*** ☐

Question X. How confident are you that this is the choice you would make if this was an actual referendum? *Circle one only.*

1. Very uncertain 2. Somewhat uncertain 3. Somewhat certain 4. Very certain

Question X. If this really was a referendum, what percentage of Manitobans do you think would vote FOR the proposed program? ☐

END OF VOTING SCENARIOS

Question 6. When voting, how important was each of the following characteristics to you?

Characteristic	**Not important**	**Slightly Important**	**Very Important**	**Extremely Important**
Size of wetland expansion				
Water quality				
Flood control				
Soil erosion				
Wildlife habitat				
Carbon capture and storage				
Additional annual cost to your household in taxes				

Question 7. If you voted for the CURRENT TREND, it was because:
In the first column, please check all the reasons that apply. In the second column, of those selected, please check the MOST IMPORTANT REASON by marking one box only.

REASON	**Please check all that apply**	**Of those selected, please check the most important reason**
I do not believe the programs presented will actually benefit the environment		
I think tax money could be better spent on other issues		
I do not have enough information to make this decision		
I felt the wetland targets would be reached too late		
I felt the wetland targets were reached too soon		
I thought the total size of the proposed wetland expansion was too small		
I thought the total size of the proposed wetland expansion was too large		
The tax increase was too high		
I do not think wetland loss is an important issue		

Question 8. If you voted yes for any of the PROPOSED PROGRAMS it was because:
In the first column, please check all the reasons that apply. In the second column, of those selected, please check the MOST IMPORTANT REASON by marking one box only.

REASON	**Please check all that apply**	**Of those selected, please check the most important reason**
I think that this is a small amount to pay for the benefits received		
I think we should protect wetlands regardless of the cost		
I feel it is the "right" thing to do		
It is important to invest in protecting wetlands for future generations		
The program is important but I don't really think it will cost me directly		
I might be affected by the loss of wetlands directly		
I think that our government does not do enough to protect our water and wetland resources		

Thank you for participating in this survey.

APPENDIX A2. THE SPECIES AT RISK CONSERVATION SURVEY

Some environmental issues in Southern Saskatchewan: What are your opinions?

Thank you for agreeing to take part in our survey!

Note: All species images in this survey are sourced from:

Government of Canada (2011). Species at Risk Public Registry.

http://www.sararegistry.gc.ca/default_e.cfm

PUBLIC POLICY AND YOUR OPINON

1. The box below lists some of the investments that can be made by the government and that are paid for mostly by your taxes. Please let us know how important each of these areas of investment is to you by indicating whether you feel the government should "invest less", or "invest more" in each area.

*Please circle **one** number for each statement.*

Area of investment	Invest less		Invest the same		Invest more
Environmental protection	1	2	3	4	5
Food and prescription drug safety	1	2	3	4	5
Health care	1	2	3	4	5
International aid and assistance	1	2	3	4	5
National defence	1	2	3	4	5
Policing and public safety	1	2	3	4	5
Post-secondary education	1	2	3	4	5
Primary education	1	2	3	4	5
Public infrastructure (e.g. roads, bridges)	1	2	3	4	5

2. The box below lists several statements about environmental and development goals. Please indicate the degree to which you agree or disagree with each statement.

*Please circle **one** number for each statement.*

Statement	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Not sure
Long term environmental improvements are more important than immediate environmental benefits	1	2	3	4	5	6
No environmental improvement program that is harmful to a business should be carried out	1	2	3	4	5	6
Environmental improvements are fine as long as they do not increase taxes	1	2	3	4	5	6
Environmental issues should be solved by experts and the public should only be educated and informed of decisions	1	2	3	4	5	6
Humans will someday be able to understand and control most natural environmental processes	1	2	3	4	5	6
Technology, rather than the environment, is the only limiting factor to continued human development	1	2	3	4	5	6

SPECIES AT RISK

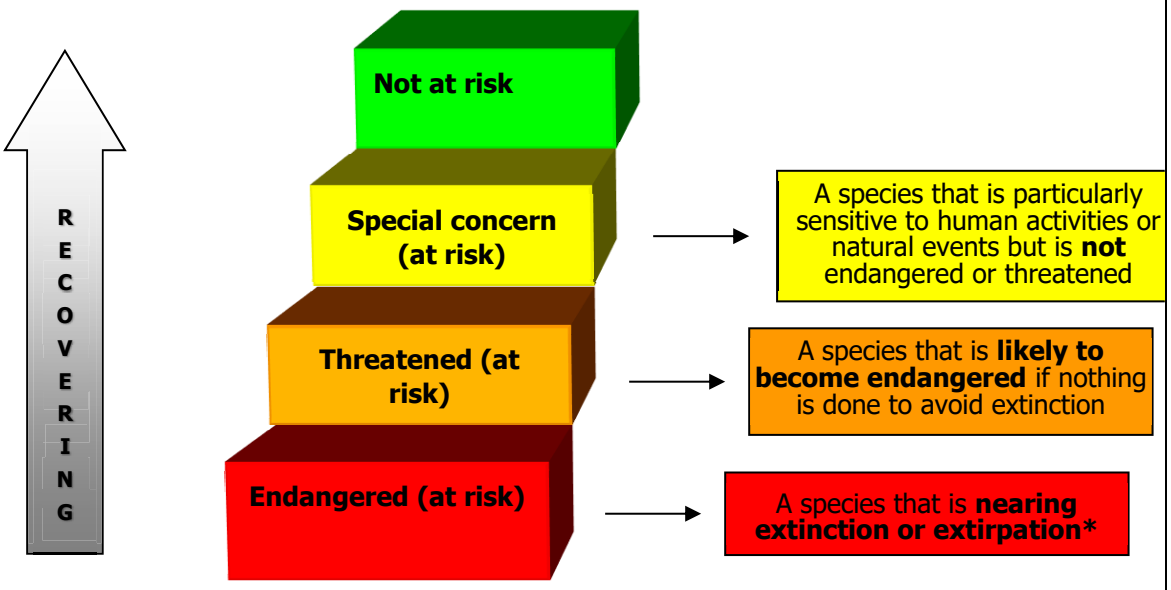
This survey will focus on one area of public policy: protecting species at risk of disappearing from south-western Saskatchewan's grasslands region. Specifically, we will focus on an area within this region known as the Milk River Watershed.

Canada's species at risk legislation, the *Species at Risk Act* (SARA), categorizes species based on their risk of extinction. Under SARA, species are listed in one of four risk categories. These categories, from lowest to highest risk of extinction, are as follows: **not at risk**, **special concern**, **threatened** and **endangered**.

The figure below defines each of the listing status categories used in SARA and provides examples of species already listed in each category.

SPECIES AT RISK

According to SARA, a species is considered to be "recovering" if it moves from its current risk status to a status indicating a lower risk of extinction. For example, as indicated in the diagram below, a species is "**recovering**" as it moves from **endangered** to **threatened**, **endangered** to **special concern**, **endangered** to **not at risk**, **threatened** to **special concern**, etc.



* A species is extirpated when it is no longer found in the wild in Canada but is found in the wild elsewhere in the world.

Species and their Listing Status: Examples			
Not at risk	**Special Concern (at risk)**	**Threatened (at risk)**	**Endangered (at risk)**
White-tailed Deer 	**Northern Leopard Frog** 	**Woodland Caribou** 	**Whooping Crane** 

3. Before today, how familiar were you with the Species at Risk Act (SARA)?

*Please select **one** response from the options below.*

- ○ I was not at all familiar with SARA
- ○ I was somewhat familiar with SARA
- ○ I was very familiar with SARA

4. How important is it to you personally that every possible effort be made to protect all species that are currently at risk?

*Please select **one** response from the options below.*

- ○ Not at all important
- ○ A little important
- ○ Moderately important
- ○ Very important
- ○ Extremely important
- ○ Not sure

5. How concerned are you that efforts to protect species at risk will affect the economy?

*Please select **one** response from the options below.*

- ○ Not at all concerned
- ○ A little concerned
- ○ Moderately concerned
- ○ Very concerned
- ○ Extremely concerned
- ○ Not sure

GRASSLAND SPECIES AT RISK

We would now like to focus on some grassland species in Saskatchewan's Milk River Watershed. We are interested in your opinions on various options for conserving these species.

Saskatchewan's Milk River Watershed

Some facts about the Milk River Watershed

- The Milk River Watershed contains a substantial amount of undeveloped native prairie.
- This native prairie provides habitat and breeding grounds for a high diversity of species, including birds, mammals and reptiles, many of which are not found outside the prairies.
- Areas of native prairie in the Milk River Watershed provide habitat that is required for the survival and recovery of a number of at-risk species.

6. Have you ever visited, heard of or read about the Milk River Watershed?

*Please select **one** response from the options below.*

- ○ Yes, I have visited the Milk River Watershed
- ○ Yes, I have heard of or read about, but not visited, the Milk River Watershed
- ○ No, I have not visited, heard of or read about the Milk River Watershed

GRASSLAND SPECIES IN SASKATCHEWAN'S MILK RIVER WATERSHED

Saskatchewan's Milk River Watershed is home to 23 grassland species that are listed as being at risk. Pictures and the SARA listing status for some of these species are provided below.

7. Before today, were you aware that the Milk River Watershed was a habitat for these grassland species?

*Please select **one** response from the options below.*

- ○ Yes
- ○ No
- ○ Not sure

8. Before today, were you aware that several grassland species present in Saskatchewan's Milk River Watershed are at risk?

*Please select **one** response from the options below.*

- ○ Yes
- ○ No
- ○ Not sure

9. Have you ***personally*** observed in nature any of the grassland species shown in the pictures above?

*Please select **one** response from the options below.*

- ○ Yes
- ○ No
- ○ Not sure

THREATS TO GRASSLAND SPECIES AT RISK

A variety of factors may cause species to become "at risk". These factors, and the ways in which they impact species, are wide ranging. Some of the factors that may impact grassland species are outlined below.

- **Disease** –Natural or newly-introduced diseases may afflict species' populations and may consequently cause their numbers to decline.
- **Environmental contaminants** – Herbicides, insecticides, and rodenticides may threaten the health and reproductive success of species.
- **Habitat loss or degradation** – The decline in quantity or quality of species' habitat, due to agricultural activities, oil and gas activities, or infrastructure development, reduces species' numbers.
- **Infrastructure** – Man-made structures associated with communications, transportation, and other networks that help support human activity adversely impact species' populations.
- **Invasive species** – Species that do not come from or are not typically found in a region may, when introduced to that region, cause native species' populations to decline.
- **Loss of prey** – The decline in prey population numbers that are eaten by the species in question, due to pesticide use, loss of prey habitat, and fluctuations in climate, may impact species' survival.
- **Natural decline** – Normal life cycle changes may cause species' numbers to decline.
- **Over-predation** – An increase in the number, or hunting efficiency, of predators may cause population numbers to decline.
- **Shooting, poisoning, and trapping** – Human activities meant to control species' populations may harm at risk species.
- **Small population size** – Small population numbers and limited genetic variation limit a species' ability to adapt and survive natural environmental disturbances.
- **Threats to species while outside of Saskatchewan –** Human activities that occur on wintering and migration areas while the species are outside of Canada and Saskatchewan may threaten some migratory species.

10. Using the box below, please indicate whether you were aware or unaware that each of the factors listed above could cause declines in grassland species populations in southern Saskatchewan.

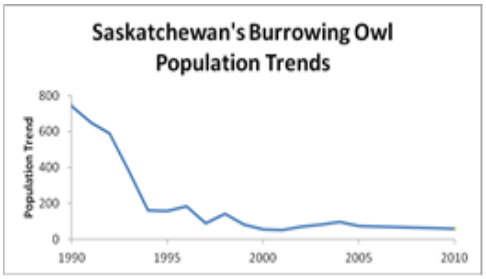
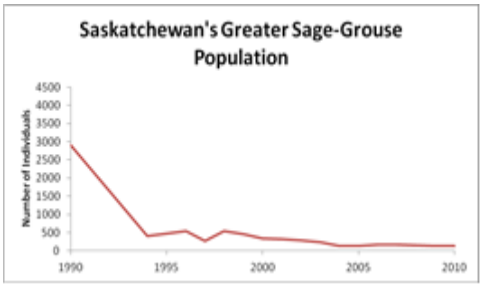
*Please circle **one** number for each factor.*

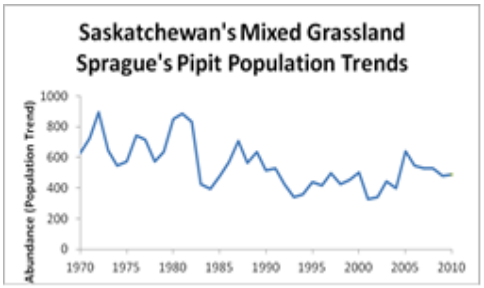
Factor	Aware	Unaware	Not Sure
Disease	1	2	3
Environmental contaminants	1	2	3
Habitat loss or degradation	1	2	3
Infrastructure	1	2	3
Invasive species	1	2	3
Loss of prey	1	2	3
Natural decline	1	2	3
Over-predation	1	2	3
Shooting, poisoning, trapping	1	2	3
Small population size	1	2	3
Threats while outside Saskatchewan	1	2	3

REPRESENTATIVE GRASSLAND SPECIES AT RISK

Today's survey will focus on five representative at-risk grassland species that are found in Saskatchewan's Milk River Watershed. These five species are **Burrowing Owls, Greater Sage-Grouse, Loggerhead Shrikes, Sprague's Pipits, and Swift Foxes**. These species are considered to be representative because, as a group, their habitat needs encompass the habitat needs of the majority of other grassland species at risk in the Milk River Watershed.

Currently, population numbers for the five representative species are significantly below historic levels. While population decreases have not been dramatic over the past decade, the species numbers have not stabilized to a point where they could be considered "*not* at risk" and some species such as sage grouse have reached such low numbers that they are in imminent danger of disappearing from Canada. Experts believe that intervention is required if these species are to recover to more stable numbers. The table below provides graphs depicting recent population trends for each of the five species, along with a list of current threats to their existence in the region.

Species	Population trends	Main threats
Burrowing Owl  **ENDANGERED**		• Habitat loss – Loss of burrows/prairie dogs, and other burrowing mammals – Agricultural and oil and gas activities • Loss of prey • Over-predation • Collisions with motor vehicles • Environmental contaminants
Greater Sage-Grouse  **ENDANGERED**		• Habitat loss – Cultivation of sage-brush grassland • Habitat degradation – Agricultural, oil and gas, general infrastructure • Disease – West Nile Virus • Small population size
Loggerhead Shrike  **THREATENED**		• Habitat loss – Agricultural activities • Habitat degradation – Agricultural activities • Environmental contaminants • Collisions with motor vehicles • Over-predation

Sprague's Pipit  **THREATENED**		• Habitat loss – Agricultural activities • Habitat degradation – Agricultural and oil and gas activities • Invasive species
Swift Fox  **ENDANGERED**		• Habitat loss – Agricultural and oil and gas activities • Habitat degradation – Agricultural and oil and gas activities • Over-predation • Collisions with motor vehicles • Disease • Poisoning and trapping (historical threats that resulted in extirpation in the 1980s) • Environmental contaminants

11. After looking at the information in the table above, please indicate the degree to which you agree with the following statements.

*Please circle **one** number for each statement.*

	Strongly disagree	**Somewhat disagree**	**Neither agree nor disagree**	**Somewhat agree**	**Strongly agree**	**Not sure**
It matters to me personally that the Burrowing Owl, Greater Sage-Grouse, Loggerhead Shrike, Sprague's Pipit and Swift Fox populations **in Saskatchewan** recover to stable levels within the province	1	2	3	4	5	6
It matters to me personally that the **other** Burrowing Owl, Greater Sage-Grouse, Loggerhead Shrike, Sprague's Pipit and Swift Fox populations **in Canada** recover to stable levels within the country	1	2	3	4	5	6

MEASURES TO PROTECT THE FIVE REPRESENTATIVE GRASSLAND SPECIES AT RISK IN SASKATCHEWAN'S MILK RIVER WATERSHED

As soon as a species is listed under SARA, the federal government is required to take several measures to protect those species and their dwellings, as well as to develop and implement plans to take further actions to ensure the survival and recovery of species populations. This is often done through the protection of species' habitat. With regard to the five representative grassland species, the government has developed but not implemented further actions to protect species and their habitat. Outlined below are the measures currently being undertaken (Existing Measures) as well as the additional measures that could be implemented (Potential Additional Measures).

EXISTING MEASURES

Currently, there are a number of measures in place designed to protect the five representative grassland species at risk. These existing measures include:

- Making it illegal to kill or harm species at risk on federal (non-private) lands,
- Making it illegal to damage the dwellings or homes of species at risk on federal (non-private) lands,
- Recovery strategies that develop action plans to conserve and improve habitat and populations on federal and private lands,
- Voluntary agreements with private landowners and individuals who manage land to help protect species at risk habitat and populations,
- Protecting habitat within Saskatchewan's Grasslands National Park,
- A federal protection order under the Species at Risk Act.

POTENTIAL ADDITIONAL MEASURES

The government has the option of implementing additional measures to further protect the five representative grassland species at risk. Potential measures include:

- Conservation of habitat outside of Saskatchewan's Grasslands National Park, through:
  - Minimization of disturbances from agricultural and oil and gas development.
- Restoration of habitat selected for conservation, via:
  - Restoration of native grassland vegetation,
  - Introduction of additional individuals to the region (e.g., Greater Sage-Grouse, Black-footed Ferret),
  - Creation of artificial species residences (e.g., burrows for Burrowing Owls).

Habitat selected for conservation outside of Grasslands National Park would be chosen with the input of species' experts. Protecting this additional habitat would improve the chance of species survival and recovery and would affect the industries operating in the region, namely agriculture and oil and gas.

IMPACTS ASSOCIATED WITH CONSERVATION AND RESTORATION MEASURES

If the government chooses conservation and restoration measures in the Milk River Watershed, these measures would be implemented on parcels of land that are important to the survival and recovery of the five-representative species at risk. Associated with these measures are both costs and benefits. **Costs may include:**

- Government spending to support conservation and restoration measures,
- The decrease in industry taxes and royalties received by the government as a result of restrictions placed on industry.

The table below lists the potential additional measures to protect species' habitat, as well as the potential impacts (or costs) of those measures, on the main industries operating within the Milk River Watershed. Additional direct costs would result from activities associated with the reintroduction of species individuals into the watershed, as well as from the administration and monitoring of the additional measures. Relative to the costs on industry, these additional costs would be very low.

Potential economic impacts of conservation and restoration measures on industries operating in Saskatchewan's Milk River Watershed		
Industry	Conservation and Restoration Measures	Impact of the Measures on the Economy of the Watershed Region*
Agriculture	Changes to grazing practices (i.e., stock cattle at recommended rates on native grasslands)	Very Low
	Conservation easements on privately-owned land (i.e., land-use restrictions)	Low
	Restoration of hay and crop fields to native grasslands	Moderate
	Government acquisition of agricultural land	Moderate
Oil and Gas	Increased regulation for new development (max. 4 wells per section)	Low
	No new oil and gas development, except on existing sites	Moderate
	Halting of existing and future oil and gas activities	Moderate
*Impacts consider the implementation of conservation measures (i.e., the loss of production from restrictions placed on industries) and restoration measures in the Milk River Watershed. Costs of these various impacts would be distributed between government and industry, with the particular distribution dependent on the measure.		

IMPACTS ASSOCIATED WITH CONSERVATION AND RESTORATION MEASURES

The benefits of the conservation and restoration measures may include:

- Improved chance of species' survival and recovery,
- Increased recreational opportunities in Saskatchewan's Milk River Watershed as a result of increased species' habitat and population numbers,
- The government meeting its provincial and federal obligations as well as its international agreements,
- The protection of up to 18 additional grassland species at risk.

The table below provides 30-year projections of the five species' risk of extirpation in the Milk River Watershed under two different conservation scenarios, using input from species' experts. Note that this table indicates only the risk of the species' disappearing from the Milk River Watershed and not from all of Canada.

30-year projections of species' risk of extirpation under two conservation and restoration programs

	Current Program*	Best-Possible Program**
Burrowing Owl	Moderate risk	Low risk
Greater Sage-Grouse	High risk	Low risk
Loggerhead Shrike	Moderate risk	Moderate risk
Sprague's Pipit	Low risk	No risk
Swift Fox	Low risk	No risk

*This scenario provides an estimate of species' risk of extirpation in Saskatchewan's Milk River Watershed, assuming current activities and regulations are maintained over the next 30 years.
**This scenario provides an estimate of species' risk of extirpation in Saskatchewan's Milk River Watershed, assuming a highly successful package of conservation and restoration measures are implemented and maintained over the next 30 years.
If conservation and restoration measures are implemented and maintained at a level lower than the best case scenario, species' risk of extirpation will fall between the current and best-possible program estimates.

12. Overall, when you think about the idea of **conservation and restoration measures in the Milk River Watershed** as a means to protect grassland species at risk, would you say your reaction is:

*Please select **one** response from the options below.*

- ○ Negative
- ○ Indifferent
- ○ Positive

THE CHOICE IS YOURS

Next we would like your opinion on how to proceed with conservation and restoration in the Milk River Watershed. You will be presented with four provincial referendum vote scenarios. For each vote, you will be asked to choose between two programs: the "current program", which maintains existing measures in the Watershed, and the "proposed program", which implements new measures in the Watershed in addition to the existing measures. Each of the four vote scenarios you complete will vary in terms of the following characteristics:

- The risk of the five representative grassland species disappearing from the Milk River Watershed within the next 30 years.
- Impacts on the agricultural and oil and gas industries.
- Costs in the form of annual, per-household taxes to help fund each program.

As we saw earlier, there are a number of conservation measures that can be implemented in the watershed. Each measure produces a particular level of species' improvement and comes with a particular cost and a particular impact on agriculture and oil and gas. Proposed programs are made up of a group of these measures, meaning that there are multiple ways to package measures into programs. Because the costs and impacts of an individual measure are not necessarily directly related to the measure's effectiveness in improving species outcomes, it is possible to have programs with different costs and impacts that nevertheless result in the same species improvements.

For each vote scenario, you will be asked to **vote** to either maintain the "current program" or implement the "proposed program". Please consider carefully the differences between the current program and the proposed program before voting.

Please also treat each of the four vote scenarios separately. The options within each vote scenario should not be compared with options in other vote scenarios, and the choice you make in one scenario should not impact the choice you make in another.

PLEASE NOTE: Studies have shown that, when casting votes in a survey context, people may vote differently than they would in real life. In the survey context, people tend to say they are willing to pay a higher price for a program than they would if the vote was real. Many researchers believe that this is because, in the survey context, people may not consider the impact of the program's cost on their household budget to the same extent that they would in a real voting context.

In this survey, we would like you to carefully consider the choices you make. Please take your time to decide whether you would really pay for the proposed program. Think of the program costs as real dollars that will come out of your household budget. In order to pay those costs, you will have to give up other things that you are spending money on or saving for.

Once you have determined whether or not you would pay for the proposed program if the costs were real, please cast your vote!

You will now vote four times.

Choose only one program in each vote scenario

Assume that the two programs in each vote scenario are the only options available.

Treat each vote scenario independently from other votes – do not compare programs between different vote scenarios.

VOTE 1: Please indicate which option program you would vote for if this were a provincial referendum on the choice of management options.

	CURRENT PROGRAM	PROPOSED PROGRAM
	Risk of species disappearing from the Milk River Watershed in 30 years	
Burrowing Owl	**Moderate Risk**	**Low Risk**
Greater Sage-Grouse	**High Risk**	**Moderate Risk**
Loggerhead Shrike	**Moderate Risk**	**Moderate Risk**
Sprague's Pipit	**Low Risk**	**Low Risk**
Swift Fox	**Low Risk**	**No Risk**
	Impact on Industry in the Milk River Watershed	
Agriculture	**Low Impact**	**Low Impact**
Oil and Gas	**Low Impact**	**Moderate Impact**
	ADDITIONAL annual cost to your household:	
ADDITIONAL income taxes every year for the next 30 years	**$0**	**$25**

1A. Please carefully compare the two alternatives presented in the table above. If you had to VOTE for one these two programs, which one would you vote for?

*Please select **one** response from the options below.*

- ○ CURRENT program
- ○ PROPOSED program

1B. How certain are you that this is the choice you would make if this was a real referendum?

*Please select **one** response from the options below.*

- ○ Very uncertain
- ○ Somewhat uncertain
- ○ Somewhat certain
- ○ Very certain

1C. Considering the proposed program outlined above, what percentage of *Saskatchewan residents* do you believe would vote in favour of this program in a *real referendum*? ____ %

VOTE 2: Please indicate which program you would vote for if this were a provincial referendum on the choice of management options. Please treat this vote <u>independently</u> from the previous vote.

	CURRENT PROGRAM	PROPOSED PROGRAM
	Risk of species disappearing from the Milk River Watershed in 30 years	
Burrowing Owl	**Moderate Risk**	**Low Risk**
Greater Sage-Grouse	**High Risk**	**High Risk**
Loggerhead Shrike	**Moderate Risk**	**Moderate Risk**
Sprague's Pipit	**Low Risk**	**Low Risk**
Swift Fox	**Low Risk**	**No Risk**
	Impact on Industry in the Milk River Watershed	
Agriculture	**Low Impact**	**Moderate Impact**
Oil and Gas	**Low Impact**	**Low Impact**
	ADDITIONAL annual <u>cost</u> to <u>your household</u>:	
ADDITIONAL income taxes every year for the next 30 years	**$0**	**$100**

2A. Please carefully compare the two alternatives presented in the table above. If you had to VOTE for one these two programs, which one would you vote for?

*Please select **one** response from the options below.*

- ○ CURRENT program
- ○ PROPOSED program

2B. How certain are you that this is the choice you would make if this was a real referendum?

*Please select **one** response from the options below.*

- ○ Very uncertain
- ○ Somewhat uncertain
- ○ Somewhat certain
- ○ Very certain

2C. Considering the proposed program outlined above, what percentage of *Saskatchewan residents* do you believe would vote in favour of this program in a *real referendum*? ____ %

VOTE 3: Please indicate which program you would vote for if this were a provincial referendum on the choice of management options. Please treat this vote <u>independently</u> from the previous votes.

	CURRENT PROGRAM	PROPOSED PROGRAM
	Risk of species disappearing from the Milk River Watershed in 30 years	
Burrowing Owl	**Moderate Risk**	**Low Risk**
Greater Sage-Grouse	**High Risk**	**Moderate Risk**
Loggerhead Shrike	**Moderate Risk**	**Moderate Risk**
Sprague's Pipit	**Low Risk**	**Low Risk**
Swift Fox	**Low Risk**	**No Risk**
	Impact on Industry in the Milk River Watershed	
Agriculture	**Low Impact**	**Moderate Impact**
Oil and Gas	**Low Impact**	**Moderate Impact**
	ADDITIONAL annual <u>cost</u> to <u>your household</u>:	
ADDITIONAL income taxes every year for the next 30 years	**$0**	**$25**

3A. Please carefully compare the two alternatives presented in the table above. If you had to VOTE for one these two programs, which one would you vote for?

*Please select **one** response from the options below.*

- ○ CURRENT program
- ○ PROPOSED program

3B. How certain are you that this is the choice you would make if this was a real referendum?

*Please select **one** response from the options below.*

- ○ Very uncertain
- ○ Somewhat uncertain
- ○ Somewhat certain
- ○ Very certain

3C. Considering the proposed program outlined above, what percentage of *Saskatchewan residents* do you believe would vote in favour of this program in a *real referendum*? ____ %

VOTE 4: Please indicate which program you would vote for if this were a provincial referendum on the choice of management options. Please treat this vote <u>independently</u> from the previous votes.

	CURRENT PROGRAM	PROPOSED PROGRAM
	Risk of species disappearing from the Milk River Watershed in 30 years	
Burrowing Owl	**Moderate Risk**	**Low Risk**
Greater Sage-Grouse	**High Risk**	**High Risk**
Loggerhead Shrike	**Moderate Risk**	**Moderate Risk**
Sprague's Pipit	**Low Risk**	**Low Risk**
Swift Fox	**Low Risk**	**No Risk**
	Impact on Industry in the Milk River Watershed	
Agriculture	**Low Impact**	**Low Impact**
Oil and Gas	**Low Impact**	**Moderate Impact**
	ADDITIONAL annual <u>cost</u> to <u>your household</u>:	
ADDITIONAL income taxes every year for the next 30 years	**$0**	**$50**

4A. Please carefully compare the two alternatives presented in the table above. If you had to VOTE for one these two programs, which one would you vote for?

*Please select **one** response from the options below.*

- ○ CURRENT program
- ○ PROPOSED program

4B. How certain are you that this is the choice you would make if this was a real referendum?

*Please select **one** response from the options below.*

- ○ Very uncertain
- ○ Somewhat uncertain
- ○ Somewhat certain
- ○ Very certain

4C. Considering the proposed program outlined above, what percentage of *Saskatchewan residents* do you believe would vote in favour of this program in a *real referendum*? ____ %

The next question will ask you to make a prediction about the responses of your fellow survey participants. If your prediction is within 5% of the correct answer (above or below), you will receive $10 in Insightrix Points! If you have won the prize, you will be notified several days after completing the survey.

4D. A representative sample of Saskatchewan residents has been asked to complete this very same survey. What percentage of *this representative sample* do you believe "voted" in favour of the proposed program *when they completed the same "vote" question that you just completed*?

_____ %

13. Do you think that is likely or unlikely that your choices on these surveys will be used to help design conservation policies?

*Please select **one** response from the options below.*

- ○ Likely
- ○ Unlikely

14. When choosing between the CURRENT program and the PROPOSED program, how important was each of the following factors to you?

*Please circle **one** number for each statement.*

Factor	Not at all important	Somewhat important	Moderately important	Very important	Extremely important	Not sure
Change in Burrowing Owl population	1	2	3	4	5	6
Change in Greater Sage-Grouse population	1	2	3	4	5	6
Change in Loggerhead Shrike population	1	2	3	4	5	6
Change in Sprague's Pipit population	1	2	3	4	5	6
Change in Swift Fox population	1	2	3	4	5	6
Impact on agricultural industry	1	2	3	4	5	6
Impact on oil and gas industry	1	2	3	4	5	6
Cost of proposed program	1	2	3	4	5	6

15. If you voted to maintain the **current program** in any of the vote scenarios above, please indicate which of the factors below contributed to your decision to vote this way.

*Please **circle all that apply**.*

A. The cost of the proposed program was too high.
B. **I do not believe that the proposed program would actually work to reduce the chance of species extirpation**. I do not feel it is my responsibility to pay to protect species with those characteristics.
C. Protecting species is not a priority for me.
D. I do not want to pay additional taxes.
E. I do not trust the government to run the proposed program effectively.
F. I need more information before I can make a decision.
G. I cannot afford to pay the specified amount associated with the proposed program.
H. Other (*please specify*):

_____
_____
_____

16. Which factor listed in Question 15 was most important to you?

*Please **record the appropriate letter in the box below**.*

☐

17. If you voted to accept the **proposed program** in any of the vote scenarios above, please indicate which of the factors below contributed to your decision to vote this way.

*Please **check all that apply**.*

A. These programs are a good use of public funds.
B. The benefits of species protection are worth the increase in taxes.
C. Species at risk should be protected at any price.
D. No species should be allowed to become extinct.
E. Protecting species with those characteristics is important to me.
F. I am more concerned with the overall ecosystem benefits of saving the species rather than with saving the specific species themselves.
G. Other (*please specify*):

_____
_____
_____

18. Which factor listed in Question 17 was most important to you?

*Please **record the appropriate letter in the box below**.*

☐

19. How certain do you think experts are about the ability of conservation measures to protect grassland species at risk?

*Please select **one** response from the options below.*

- ○ Very uncertain
- ○ Somewhat uncertain
- ○ Neither certain nor uncertain
- ○ Somewhat certain
- ○ Very certain

20. How certain do you think experts are about the listing status of grassland species populations (endangered, threatened, special concern, not at risk)?

*Please select **one** response from the options below.*

- ○ Very uncertain
- ○ Somewhat uncertain
- ○ Neither certain nor uncertain
- ○ Somewhat certain
- ○ Very certain

DEMOGRAPHIC INFORMATION

We would now like to ask you a few final questions. Please be assured that the information you provide will be kept confidential and is completely anonymous. We will only use this information to compare groups of people. Your identity will not be linked to your responses in any way.

21. Please indicate your gender.

*Please select **one** response from the options below.*

- ○ Male
- ○ Female

22. In what year were you born?

☐ (YYYY)

23. What is the highest level of education you have completed?

*Please select **one** response from the options below.*

- ○ Grade school or some high school
- ○ High school diploma
- ○ Post-secondary technical school
- ○ Some college or university
- ○ College degree or diploma
- ○ University undergraduate degree
- ○ University graduate degree (Masters or PhD)

24. What is your current employment status?

*Please select **one** response from the options below.*

- ○ Working full-time
- ○ Working part-time
- ○ Homemaker
- ○ Student
- ○ Retired
- ○ Unemployed

25. If you are employed, which sector are you employed in?

*Please select **one** response from the options below.*

- ○ Agriculture
- ○ Forestry, fishing, mining, oil and gas
- ○ Utilities, construction and manufacturing
- ○ Transportation and warehousing
- ○ Finance, insurance, real estate and leasing
- ○ Educational services
- ○ Health care and social assistance
- ○ Information, culture and recreation
- ○ Accommodation and food services
- ○ Public administration
- ○ Other (91)

26. What category best represents your household income before taxes for 2011?

*Please select **one** response from the options below.*

- ○ Less than $20,000
- ○ $20,000 to $39,999
- ○ $40,000 to $59,999
- ○ $60,000 to $79,999
- ○ $80,000 to $99,999
- ○ $100,000 to $119,999
- ○ $120,000 to $139,999
- ○ $140,000 to $159,999
- ○ Greater than $160,000

27. In which of the following activities have you participated in the past 12 months?

*Please **check all that apply**.*

- ☐ Swimming or other beach activities
- ☐ Hiking
- ☐ Canoeing, kayaking, rafting or sailing
- ☐ Power-boating
- ☐ Cross-country or downhill skiing
- ☐ Bird-watching
- ☐ Fishing

- ☐ Wildlife viewing
- ☐ Mountain biking
- ☐ Hunting
- ☐ Photographing nature
- ☐ Whale watching
- ☐ ATV-ing or dirt-biking

28. Do you belong to any of the following organizations?

*Please **check all that apply**.*

- ☐ Fishing or hunting club
- ☐ Natural history or bird-watching club
- ☐ Environmental or conservation organization
- ☐ Outdoor recreation club

APPENDIX A3. THE PACIFIC ROCKFISH CONSERVATION SURVEY

DEPARTMENT OF FISHERIES AND OCEANS
Canadian Policy Preferences – Pacific Rockfish Survey

FINAL: February 28, 2011

Introduction at Site

[INSERT STANDARD PANEL INTRODUCTION]

Screening

S1. What is your age?

Month / Year of birth [NUMERIC FIELD]

[TRACK AGE QUOTAS BASED ON S1]

S2. What is your gender?

Please select one response only

Male
Female

[TRACK GENDER QUOTAS BASED ON S2]

S3. In what country do you live?

Please select one response only

USA
Canada
Australia
United Kingdom
Other

[CONTINUE IF CANADA, ELSE THANK & TERMINATE]

S4. In which of the following provinces or territories do you reside?

Please select one response only

Newfoundland and Labrador
Prince Edward Island

Nova Scotia
New Brunswick
Quebec
Ontario
Manitoba
Saskatchewan
Alberta
British Columbia
Yukon Territory
Northwest Territories
Nunavut
[REGION QUOTAS BASED ON S5]

S6. What was the total income for all members of your **household** before taxes in 2010?

Please select one response only

Less than $20 000
$20,000 to $39,999
$40,000 to $59,999
$60,000 to $79,999
$80,000 to $99,999
$100,000 to $124,999
$125,000 to $149,999
$150,000 or more
[TRACK INCOME QUOTAS BASED ON S6]

PANEL DEMOGRAPHICS [APPEND THE FOLLOWING PANEL INFORMATION]

Age
Gender
FSA
Province
CSD (census subdivision) Name
CMA/CA (Census Metropolitan Area/Census Agglomeration)
Household Income
Education
Employment Status
Occupation (primary panellist)
Own or Rent
Household Size
Number of Children in the Household
Marital Status (primary panellist)

[THIS INFORMATION IS REQUIRED FOR: NON-RESPONDERS, DQs/OVER QUOTA, PARTIAL COMPLETES AND COMPLETES]

Canadian Policy Issues

Welcome!

Thank you for taking the time to complete this survey. This survey is seeking input on public policy issues facing Canadians today. Your responses will provide important input into public policy decisions.

Your participation in this survey is **voluntary** and you may decide to stop participating in the survey at any time. **The information that you provide is important!** We very much appreciate the time and effort you take to complete this survey.

Your answers to the survey will be kept private. Any reports about this study will not identify you in any way. Results will be shown in group form only. None of the personal identifying information you provided to Ipsos when you joined the i-Say panel will be shared with any other individual, organization, or government agency.

Government Priorities

1. To begin, we would like to know your views on various options for investing public funds. What follows is a list of government programs that are partially or fully paid for by your taxes.

In your opinion, how important is it for the Government of Canada to invest in each of the following? Please use a scale of 1 to 5 where **1** means **not at all important** and **5** means **very important**.

Please select one response for each item

[ACROSS TOP OF GRID]

1 – Not at all important

2

3

4

5 – Very important

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

Policing and public safety

Food and drug administration and safety

International aid and assistance

National defence

Health care

Primary education

Post-secondary education

Environmental protection

Public infrastructure (e.g. roads, bridges)

2. Using a scale of 1 to 5 where **1** means **strongly disagree** and **5** means **strongly agree**, please indicate your disagreement or agreement with the following statements regarding environment and development goals.

Please select one response for each item

[ACROSS TOP OF GRID]

1 – Strongly disagree

2

3

4

5 – Strongly agree

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

Environmental improvement programs that would be harmful to business should not be carried out.

Environmental improvements are fine as long as taxes do not increase.

Experts should solve environmental issues. The public should only be educated and informed of the decisions.

New technology will solve most environmental problems.

In the future, humans will be able to understand and control most natural processes.

Human progress does not depend on the environment since it is limited only by technology.

Aquatic Species in Canada

[DISPLAY ON DIRECTLY ABOVE QUESTION] We would now like to focus on the issue of aquatic species in Canada. We are interested in your opinions on the risks to aquatic species and the importance of their conservation. Aquatic species are defined as **fish, reptiles, crustaceans** (crabs, shrimp, etc.), **molluscs** (clams, oysters, etc.), and **marine mammals** (e.g. sea otters, whales, etc.) that live in freshwater, saltwater, or sometimes both.

3. What follows are a number of threats that could or do affect Canadian aquatic species. For each one, please indicate how **much of a threat** you feel each of these is to aquatic species. Please use a scale of 1 to 5 where **1** means **no threat** and **5** means **high threat.**

Please select one response for each item

[ACROSS TOP OF GRID]

1 – No threat

2

3

4

5 – High threat

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

Recreational fishing

Climate change

Water pollution

Large commercial ships

Commercial fishing

Habitat loss or degradation

Barriers such as dams in rivers or streams

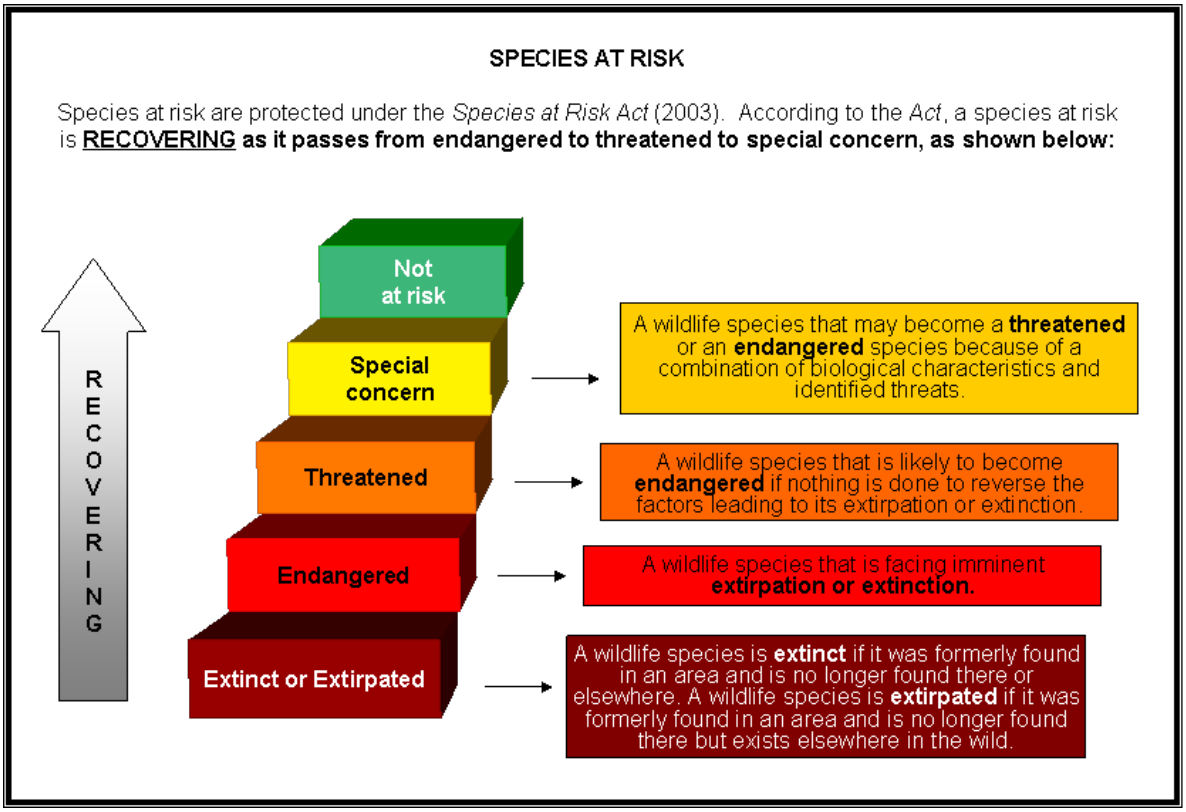
Urban development

Aquaculture operations (e.g. fish farming, oyster farming)

The *Species at Risk Act* (SARA)

A number of aquatic species in Canada are listed as species at risk of extinction. Species at risk are protected under the *Species at Risk Act* (SARA) (2003). SARA protects not only the species themselves but also their habitat. According to this Act, a species becomes more at risk as it passes from **Not At Risk** to **Special Concern** to **Threatened** to **Endangered**.

The figure below defines each of the terms used in SARA.



Due to the many ways that people can be affected by species protection, public values are very important. Under SARA, the government must complete a social and economic impact analysis for each species it lists. This means they need to look at how the species affects people, their lifestyles, the economy, industry, companies, and their day-to-day activities.

Pictures and more information about the species listed under SARA are available from http://www.sararegistry.gc.ca/sar/index/default_e.cfm **[ENSURE HYPERLINK OPENS IN A NEW WINDOW]**

4. Before starting this survey, how familiar were you with the ***Species at Risk Act*** **(SARA)**?

Please select one response only

Very familiar

Somewhat familiar

Not familiar

Fisheries Management Concepts

This survey deals with aquatic species that are affected by fishing. In order to understand the fisheries, certain management concepts need to be discussed.

Stock – the number of fish in a certain area

Directed fishery – government regulated commercial harvesting of an aquatic species

Incidental catch – marine species that are caught while fishing for another species

Total allowable catch (TAC) – the maximum amount of a species which can be legally caught in a given time period (often a year)

Individual transferrable quota (ITQ) – this is a fisheries management tool. The total allowable catch (TAC) is divided among all participating fish harvesters (each one receives a quota), and they then have the ability to buy or trade part or their entire quota.

[DISPLAY QUESTION ON SAME SCREEN AS INFORMATION ABOVE]

5. Before starting this survey, had you heard of these concepts?

Please select one response for each item

[ACROSS TOP OF GRID]

Yes

No

[DOWN SIDE OF GRID]

Stock

Incidental catch

Directed fishery

Total allowable catch

Individual transferrable quota (ITQ)

Pacific Rockfish in Canada

The remainder of the survey will focus on a species of **Pacific Rockfish**.

"Pacific rockfish" describes a number of rockfish species living in British Columbia waters. There are 39 species of them. One of them is shown above.
Pacific Rockfish can also be known as Rock Cod, Red Snapper, and just Rockfish.
There are also Atlantic varieties (although they are not being considered in this survey).
They are found from Alaska to northern Mexico.
They are typically between 74 – 91 cm (29"-36") in length and the maximum recorded weight is 6.8 kg (15lbs).

This survey deals with one of these species which is being considered for listing under SARA.

Picture and map from http://www.pac.dfo-mpo.gc.ca and http://www.fishbase.com/Summary/SpeciesSummary.php?genusname=Sebastes&speciesname=pinniger **[DISPLAY CREDITS BUT NO HYPERLINK NECESSARY]**

[DISPLAY QUESTION ON SAME SCREEN AS INFORMATION ABOVE]

6. Had you heard of any species of Pacific Rockfish prior to this survey?

Please select one response only

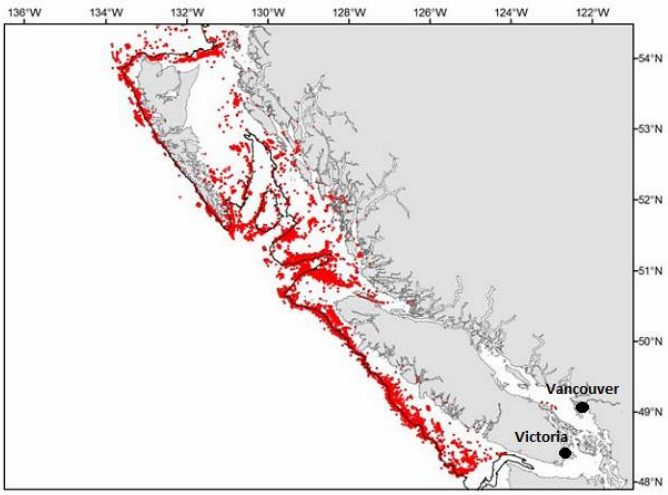
Yes

No

Pacific Rockfish in Canada

[FOR ALL UNDERLINED ITEMS BELOW, INSERT HYPERLINK TO DEFINITIONS – ENSURE IT OPENS IN A NEW WINDOW]

The Rockfish species considered for listing is located in Canadian waters as shown in the map below by the red areas.



Some things to keep in mind about this Pacific rockfish are:

- **Commercial fishing** is the main cause of population decline.
- **Natural predation** (being eaten by other animals) is an additional threat.
- **Population** may have dropped by as much as 95% between 1980 and 2000.
    - In southern U.S. waters, populations may have dropped by as much as 99%.
- Fish from **Canadian** **stocks** mix with fish from **U.S.** **stocks**. This makes control of the fishery difficult.
- **Total allowable catch (TAC)** has been varied in order to better manage this fishery.
- **Limited knowledge and research** exist for this species.

[DISPLAY QUESTION 7 ON SAME SCREEN AS INFORMATION ABOVE]

7. Please indicate your disagreement or agreement with the following statements using a scale of 1 to 5 where **1** means **strongly disagree** and **5** means **strongly agree**,

Please select one response for each item

[ACROSS TOP OF GRID]

1 – Strongly disagree

2

3

4

5 – Strongly agree

Don’t know

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

More research should be done on this Pacific Rockfish species to inform management decisions.

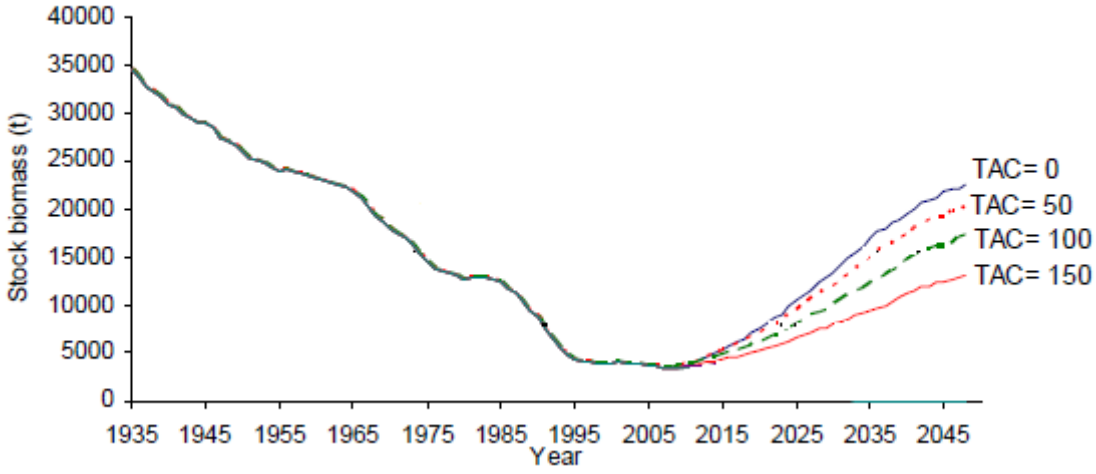
The mix of fish with U.S. stocks makes cooperation with the United States important for managing the stock.

Varying the total allowable catch is a good way to manage the fishery.

Recovering the Species

[FOR ALL UNDERLINED ITEMS BELOW, INSERT HYPERLINK TO DEFINITIONS – ENSURE IT OPENS IN A NEW WINDOW]

If this Pacific Rockfish were to be listed under SARA, a recovery strategy would need to be created. This recovery strategy would place limits on current fishing through controls on direct fishing and on incidental catch.



The above graph shows a trend for the stock (i.e. population size) of this Pacific Rockfish over time. Historical levels and forecasts are shown on the graph.

- Biomass refers to the combined weight of all fish of this species in Canadian waters.
- Current stock levels seem to be increasing at a very slow rate with a TAC of 150
- The lower the total allowable catch (**TAC**) the higher the predicted population growth.
- Catches in the United States may have some impact on Canadian stock levels but it is not known to what degree.

Graph adapted from: Stanley, R.D., M. McAllister, P. Starr and N. Olsen. 2009. DFO Can. Sci. Advis. Sec. Res. Doc.

[DISPLAY QUESTION ON SAME SCREEN AS INFORMATION ABOVE]

8. Based on the information above, how concerned are you about **stock levels of this Pacific Rockfish species**?

Please select one response only

1 – Not at all concerned

2

3

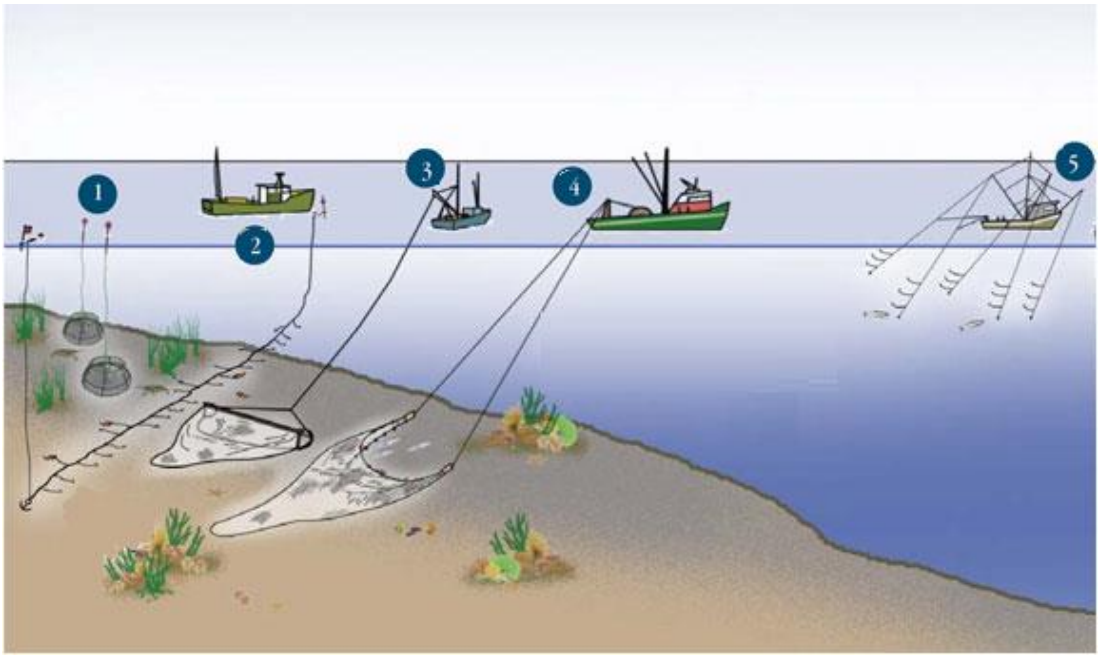
4

5 – Very concerned

Don’t know

Fisheries Affecting the Species

Pacific Rockfish are caught in a variety of fisheries. Despite this, they make up a small portion of the western Canadian fishing industry.



- Pacific Rockfish, including this species, can be caught in a variety of ways including traps (1), longline (2), trawling (3 and 4), hook and line (5), and salmon gill net (not shown above).
- Groundfish trawl (4) accounts for the majority of harvest of this species.
- The species is also caught in recreational and First Nations fisheries.

Picture adapted from: http://www.livingoceans.org/programs/sustainable_fisheries/gears/

[DISPLAY QUESTION ON SAME SCREEN AS INFORMATION ABOVE]

9. Had you heard of these different types of fishing before completing this survey?

Please select one response for each item

[ACROSS TOP OF GRID]

Yes

No

[DOWN SIDE OF GRID]

Longline

Hook and line

Trawling

Groundfish in Canada

Most of **British Columbia's groundfish** is sold or exported to the United States. Groundfish (including this Pacific rockfish species) live close to the ocean floor and are often caught in the same fishery**.** Most **Pacific rockfish** are considered close substitutes to each other in the commercial fishing industry.

Recreational and Aboriginal harvests of this species are small in comparison to the commercial harvest. It is important to note that if the species were listed under SARA:

- There are 71 commercial Aboriginal groundfish licences. These license owners would be affected.
- Any Aboriginal catch for food, social and ceremonial purposes would not be affected.

A complete **monitoring system** (100% coverage) occurs both on the fishing boat and on the dock during offloading. Fishermen are required to have permits for the fish they catch. They are also allowed to trade these permits (or ITQ) **INSERT HYPERLINK TO DEFINITION – ENSURE IT OPENS IN A NEW WINDOW]** if their catch is greater or less than their allowable limit.

Many **smaller communities** along the coast are dependent upon the fisheries. A reduction in fish catches and processing would impact these regional economies.

[DISPLAY QUESTION ON SAME SCREEN AS INFORMATION ABOVE]

10. How concerned are you about the following? Please use a scale of 1 to 5 where **1** means **not at all concerned** and **5** means **very concerned**.

Please select one response for each item

[ACROSS TOP OF GRID]

1 – Not at all concerned

2

3

4

5 – Very concerned

Don't know

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

The impact on the species caused by recreational harvesting

The impact on the species caused by Aboriginal harvesting

The ability of the program to monitor catch rates

The economic impacts on smaller communities dependent on this Pacific Rockfish

Management of the Pacific Rockfish Species

[FOR ALL UNDERLINED ITEMS BELOW, INSERT HYPERLINK TO DEFINITIONS – ENSURE IT OPENS IN A NEW WINDOW]

Pacific rockfish caught as **incidental catch** are recorded and the monitoring programs for trawling have 100% coverage. Harvesters are accountable for the fish they catch.

The use of incidental catch has some interesting **impacts**:

- It still allows other fishing industries to **continue** despite one species being at risk.
- This Pacific rockfish cannot be **bought or sold** after being listed on SARA. This means any of this species caught as incidental catch would have to be discarded.
- The **mortality rate** of incidental catch is very close to 100%. That means much of the discarded fish will be dead.

The **current harvest level** (in the short term) is not expected to put the species in additional peril. Despite this, longer term predictions suggest that a reduction in harvest is required to help the population recover.

[DISPLAY QUESTION ON SAME SCREEN AS INFORMATION ABOVE]

11. How concerned are you about the following? Please use a scale of 1 to 5 where **1** means **not at all concerned** and **5** means **very concerned**.

Please select one response for each item

[ACROSS TOP OF GRID]

1 – Not at all concerned

2

3

4

5 – Very concerned

Don't know

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

The impact on industry of lowering incidental catch

Discarding the incidental catch

The impact on the species of current harvest levels

Management of the Pacific Rockfish Species

[FOR ALL UNDERLINED ITEMS BELOW, INSERT HYPERLINK TO DEFINITIONS – ENSURE IT OPENS IN A NEW WINDOW]

The primary **management measure** to protect this Pacific roskfish would be to lower the total amount of the species that is allowed to be caught (TAC).

Sales of the species would be **prohibited**. No direct fishing for this species would be allowed. The concept of **incidental catch** would allow a certain amount of this species to be caught in other fishing industries.

The program explained above will **affect people** in a variety of ways:

- Reduce the **fishing** of this Pacific rockfish species
- Reduce the fishing in **other fisheries** because of incidental catch
- The income of some companies and people in both fishing and processing sectors will be **reduced**
- There are no communities whose economies rely solely on this Pacific rockfish

Understanding the importance that a variety of people assign to the protection of this Pacific rockfish will provide a good basis from which to make public policy.

[FOR ALL UNDERLINED ITEMS BELOW, INSERT HYPERLINK TO DEFINITIONS – ENSURE IT OPENS IN A NEW WINDOW]

* Total Allowable Catch (TAC)

** incidental catch

[DISPLAY QUESTION ON SAME SCREEN AS INFORMATION ABOVE]

12. How much do the following impacts concern you? Please use a scale of 1 to 5 where **1** means **not at all concerned** and **5** means **very concerned**.

Please select one response for each item

[ACROSS TOP OF GRID]

1 – Not at all concerned

2

3

4

5 – Very concerned

Don’t know

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

Not being able to sell Pacific Rockfish on the market

The impacts on small communities

The impacts on British Columbia as a whole

Potential impacts on the employment sector

Potential impacts on the processing sector

What Should be Done?

Next, we would like your opinion on **what should be done toward protecting this Pacific Rockfish**. Because the options involve public resources and spending public money, we are seeking your opinion. You will be presented with various scenarios for recovery of this Pacific Rockfish. **Each option will be compared to the situation that will likely exist in 40 years if no recovery plan is put in place.**

Option A – maintaining the current management situation for this Pacific Rockfish; this option describes what the species will be like in 40 years if the current situation continues.

Option B – a scenario made up of different combinations of actions that will increase populations of this Pacific Rockfish; what the species will be like in 40 years if these actions are put in place.

Each alternative will indicate:

1. ***the Species at Risk Act listing status of this*** Pacific ***Rockfish 40 years from now***
2. ***the program chosen to protect this*** Pacific ***Rockfish***
3. ***the probability of recovery of the species***
4. ***the cost to your household***

You will be asked to choose one option or the other. Please consider each question separately from the previous question. They are to be viewed as completely different choices with no connections between any of them.

What Should be Done?

Previous surveys involving people's choices about paying for government programs ran into some problems.

- It has been found that people provide responses that are not what they would choose in real life.
- Instead people often say they will act one way but in reality act a different way.

In this survey, we would like you to consider the choices carefully. **Please think as though the monetary amounts were real dollars to be added to your taxes.** Remember, in order to do this, you would have to give up other things that you currently spend money on.

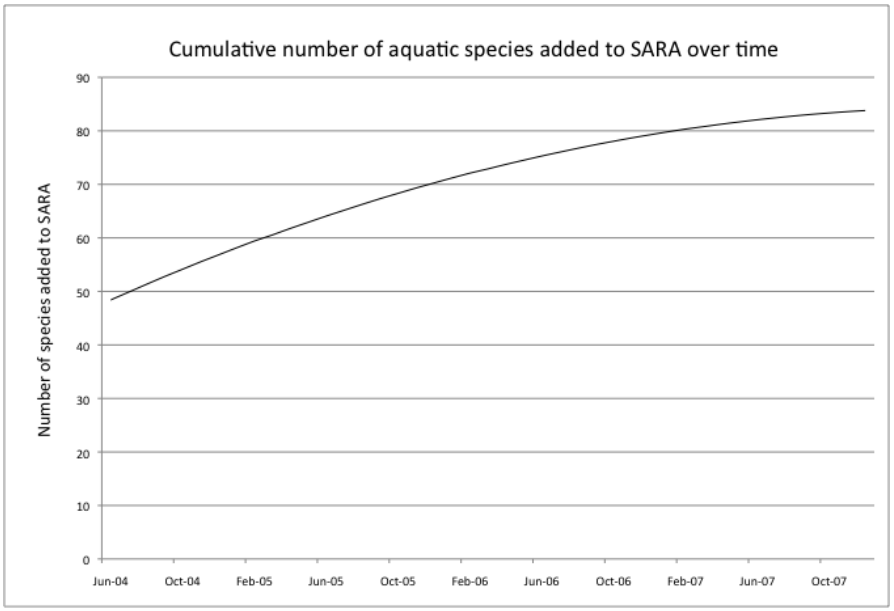
[NEW SCREEN]

What Should be Done?

Also, please keep in mind that the government has a limited amount of funds.

- It cannot protect all species to the same extent.
- By protecting one species, another species in need of protection may not receive all the funding it requires.

The graph below shows the total number of aquatic species listed under SARA over time. Each new species under SARA requires a recovery plan and more money to be spent. **Please understand that money will NOT be able to be spent on another species unless more money is obtained through taxes.** You will be making a trade-off by paying for the protection of this Pacific Rockfish.



Referendum Questions

The questions will be presented as if a national vote (referendum) is being held. You will need to vote for your most preferred program.

Please treat each situation or vote independently. That is, consider each case as if it was the only one that you are voting on.

YOU WILL NOW VOTE 3 TIMES

PROGRAMMER NOTES:

- **RANDOMIZE THE ORDER VOTE 1, VOTE 2 AND VOTE 3**
- **THE COST FOR THE PROPOSED PROGRAM WILL NEED TO BE RANDOMLY SELECTED FOR EACH VOTE**
- **THE DATA FILE MUST CLEARLY INDICATE THE RESPONSE TO EACH VOTE, THE ORDER OF THE VOTES FOR EACH RESPONDENT AND THE TAX LEVEL ASSIGNED TO EACH RESPONDENT**

VOTE 1

Please indicate which option you would vote for if there was a national vote (referendum) on managing this Pacific Rockfish. [ONLY INSERT FOR THE SECOND AND THIRD VOTES THE RESPONDENT SEES: Please consider this choice separately from any other.]

	CURRENT *Management Option*	***PROPOSED*** *Management Option*
Strategy for protection	**No new regulations**	**Program 1** - *This Pacific Rockfish is still allowed to be caught through incidental catch* - *Catch level stays the same* - *Catch levels of other species in the trawl and hook and line fleets will be reduced by 5%* - *A small amount of jobs and income will be affected – those affected will have access to a variety of support programs that are provided through separate processes*
Listing status (in 40 years)	*In 40 years, the listing status for this Pacific Rockfish will be:* **Endangered**	*In 40 years, the listing status for this Pacific Rockfish will be:* **Threatened**
Probability of extinction (in 40 years)	**Very high**	**High**
Increased cost to your household in extra taxes every year for 10 years	**$0**	**[INSERT RANDOMLY SELECTED AMOUNT: $1, $10, $50, $150, $300, $600]** annually for 10 years
The increased taxes would be used to monitor and enforce fishermen's and businesses' compliance with the recovery programs.		

VOTE1. Please carefully review the two alternatives presented in the table above. If you had to vote on these two options, which one would you choose? Please consider your household budget, and what you would have to give up to pay the additional amount.

PLEASE SELECT ONE RESPONSE ONLY

CURRENT Management Option
PROPOSED Management Option

[DISPLAY VOTE1A AND VOTE1B ON THE SAME SCREEN]

VOTE1A. How certain are you that your response accurately reflects how you would vote if this was a real referendum?

Please select one response only

Very Certain

Somewhat Certain

Somewhat Uncertain

Very Uncertain

VOTE1B. What percentage of Canadian voters do you think would support the PROPOSED management option (Program 1)?

Please provide your best estimate. Please enter a whole number from 0 to 100.

[NUMERIC RESPONSE]% [RANGE: O TO 100]

[ASK VOTE1C IF CURRENT MANAGEMENT OPTION SELECTED IN VOTE1. ASK VOTE1D IF PROPOSED MANAGEMENT OPTION SELECTED IN VOTE1]
VOTE1C. You voted to accept the **current management option** on the previous screen. Could you please tell us why?

*Please select **all** reasons that factored into your decision making process*

[RANDOMIZE ORDER EXCEPT FOR OTHER AND DK]

The cost listed in the proposed management option was too much.

I do not believe that the proposed management option would actually work to increase population numbers.

I do not feel it is my responsibility to pay to protect this species.

There are other kinds of Pacific Rockfish in Canada that are at more imminent risk than this one.

I believe the status quo (current management option) does not accurately reflect current population information.

Protecting this Pacific Rockfish is not a priority for me.

I don't want more tax added on to what I currently pay.

I do not trust the government to effectively run the program.

I need more information before I can make this choice.

I cannot afford to pay the amount.

Other (Please specify)

I don't know.

[IF DON'T KNOW TO VOTE1C, SKIP TO NEXT VOTE. IF ONLY ONE RESPONSE SELECTED AT VOTE1C, AUTOFILL VOTE1C2 AND SKIP TO NEXT VOTE. ALL OTHERS CONITNUE WITH VOTE1C2]

VOTE1C2. What was the **most important** reason you would not vote for the program?

Please select one response only

[INSERT ITEMS SELECTED IN VOTE1C IN THE SAME ORDER OF PRESENTATION]

I don't know.

VOTE1D. You voted to accept the **proposed management option** on the previous screen. Could you please tell us why?

*Please select **all** reasons that factored into your decision making process*

[RANDOMIZE ORDER EXCEPT FOR OTHER AND DK]

I feel that a species at risk should be protected at any cost.

The management options seemed to be quite reasonable and effective.

No species should be allowed to reach critical levels.

Protecting this Pacific Rockfish is a high priority for me.

It is important to preserve the cultural, historical, and environmental significance embodied in this Pacific Rockfish.

This particular area of the ocean is very important to me.

I am more or as concerned with the overall ecosystem benefits of saving the species rather than the species itself.

Other (Please specify)

I don't know.

[IF DON'T KNOW TO VOTE1D, SKIP TO NEXT VOTE. IF ONLY ONE RESPONSE SELECTED AT VOTE1D, AUTOFILL VOTE1D2 AND SKIP TO NEXT VOTE. ALL OTHERS CONITNUE WITH VOTE1D2]

VOTE1D2. What was the **most important** reason you would vote for the program?

Please select one response only

[INSERT ITEMS SELECTED IN VOTE1D IN THE SAME ORDER OF PRESENTATION]

I don't know.

VOTE 2

Please indicate which option you would vote for if there was a national vote (referendum) on managing this Pacific Rockfish. [ONLY INSERT FOR THE SECOND AND THIRD VOTES THE RESPONDENT SEES: Please consider this choice separately from any other.]

	CURRENT *Management Option*	***PROPOSED*** *Management Option*
Strategy for protection	**No new regulations**	**Program 2** - *This Pacific Rockfish is still allowed to be caught through incidental catch* - *Catch level would be reduced by 33%* - *Catch levels of other species in the trawl and hook and line fleets will be reduced by 20%* - *A moderate amount of jobs and income will be affected – those affected will have access a variety of programs that are provided through separate processes*
Listing status (in 40 years)	*In 40 years, the listing status for this Pacific Rockfish will be:* **Endangered**	*In 40 years, the listing status for this Pacific Rockfish will be:* **Special Concern**
Probability of extinction (in 40 years)	**Very high**	**Moderate/Uncertain**
Increased cost to your household in extra taxes every year for 10 years	**$0**	**[INSERT RANDOMLY SELECTED AMOUNT: $1, $10, $50, $150, $300, $600]** annually for 10 years
The increased taxes would be used to monitor and enforce fishermen's and businesses' compliance with the recovery program.		

VOTE2. Please carefully review the two alternatives presented in the table above. If you had to vote on these two options, which one would you choose? Please consider your household budget, and what you would have to give up to pay the additional amount.

PLEASE SELECT ONE RESPONSE ONLY

CURRENT Management Option
PROPOSED Management Option

[DISPLAY VOTE2A AND VOTE2B ON THE SAME SCREEN]

VOTE2A. How certain are you that your response accurately reflects how you would vote if this was a real referendum?

Please select one response only

Very Certain

Somewhat Certain

Somewhat Uncertain

Very Uncertain

VOTE2B. What percentage of Canadian voters do you think would support the PROPOSED management option (Program 2)?

Please provide your best estimate. Please enter a whole number from 0 to 100.

[NUMERIC RESPONSE]% [RANGE: O TO 100]

[ASK VOTE2C IF CURRENT MANAGEMENT OPTION SELECTED IN VOTE2. ASK VOTE2D IF PROPOSED MANAGEMENT OPTION SELECTED IN VOTE2]
VOTE2C. You voted to accept the **current management option** on the previous screen. Could you please tell us why?

*Please select **all** reasons that factored into your decision making process*

[RANDOMIZE ORDER EXCEPT FOR OTHER AND DK]

The cost listed in the proposed management option was too much.

I do not believe that the proposed management option would actually work to increase population numbers.

I do not feel it is my responsibility to pay to protect this species.

There are other kinds of Pacific Rockfish in Canada that are at more imminent risk than this one.

I believe the status quo (current management option) does not accurately reflect current population information.

Protecting this Pacific Rockfish is not a priority for me.

I don't want more tax added on to what I currently pay.

I do not trust the government to effectively run the program.

I need more information before I can make this choice.

I cannot afford to pay the amount.

Other (Please specify)

I don't know.

[IF DON'T KNOW TO VOTE2C, SKIP TO NEXT VOTE. IF ONLY ONE RESPONSE SELECTED AT VOTE2C, AUTOFILL VOTE2C2 AND SKIP TO NEXT VOTE. ALL OTHERS CONITNUE WITH VOTE2C2]

VOTE2C2. What was the **most important** reason you would not vote for the program?

Please select one response only

[INSERT ITEMS SELECTED IN VOTE1C IN THE SAME ORDER OF PRESENTATION]

I don't know.

VOTE2D. You voted to accept the **proposed management option** on the previous screen. Could you please tell us why?

*Please select **all** reasons that factored into your decision making process*

[RANDOMIZE ORDER EXCEPT FOR OTHER AND DK]

I feel that a species at risk should be protected at any cost.

The management options seemed to be quite reasonable and effective.

No species should be allowed to reach critical levels.

Protecting this Pacific Rockfish is a high priority for me.

It is important to preserve the cultural, historical, and environmental significance embodied in this Pacific Rockfish.

This particular area of the ocean is very important to me.

I am more or as concerned with the overall ecosystem benefits of saving the species rather than the species itself.

Other (Please specify)

I don't know.

[IF DON'T KNOW TO VOTE2D, SKIP TO NEXT VOTE. IF ONLY ONE RESPONSE SELECTED AT VOTE2D, AUTOFILL VOTE2D2 AND SKIP TO NEXT VOTE. ALL OTHERS CONITNUE WITH VOTE2D2]

VOTE2D2. What was the **most important** reason you would vote for the program?

Please select one response only

[INSERT ITEMS SELECTED IN VOTE1D IN THE SAME ORDER OF PRESENTATION]

I don't know.

VOTE 3

Please indicate which option you would vote for if there was a national vote (referendum) on managing this Pacific Rockfish. [ONLY INSERT FOR THE SECOND AND THIRD VOTES THE RESPONDENT SEES: Please consider this choice separately from any other.]

	CURRENT *Management Option*	***PROPOSED*** *Management Option*
Strategy for protection	**No new regulations**	**Program 3** - *This Pacific Rockfish is still allowed to be caught through incidental catch* - *Catch level would be reduced by 66%* - *Catch levels of other species in the trawl and hook and line fleets will be reduced by 45%* - *A large amount of jobs and income will be affected those affected will have access a variety of programs that are provided through separate processes*
Listing status (in 40 years)	*In 40 years, the listing status for this Pacific Rockfish will be:* **Endangered**	*In 40 years, the listing status for this Pacific Rockfish will be:* **Not at risk**
Probability of extinction (in 40 years)	**Very high**	**None**
Increased cost to your household in extra taxes every year for 10 years	**$0**	**[INSERT RANDOMLY SELECTED AMOUNT: $1, $10, $50, $150, $300, $600]** annually for 10 years
The increased taxes would be used to monitor and enforce fishermen's and businesses' compliance with the recovery program.		

VOTE3. Please carefully review the two alternatives presented in the table above. If you had to vote on these two options, which one would you choose? Please consider your household budget, and what you would have to give up to pay the additional amount.

PLEASE SELECT ONE RESPONSE ONLY

CURRENT Management Option
PROPOSED Management Option

[DISPLAY VOTE3A AND VOTE3B ON THE SAME SCREEN]

VOTE3A. How certain are you that your response accurately reflects how you would vote if this was a real referendum?

Please select one response only

Very Certain

Somewhat Certain

Somewhat Uncertain

Very Uncertain

VOTE3B. What percentage of Canadian voters do you think would support the PROPOSED management option (Program 3)?

Please provide your best estimate. Please enter a whole number from 0 to 100.

[NUMERIC RESPONSE]% [RANGE: O TO 100]

[ASK VOTE3C IF CURRENT MANAGEMENT OPTION SELECTED IN VOTE3. ASK VOTE3D IF PROPOSED MANAGEMENT OPTION SELECTED IN VOTE3]
VOTE3C. You voted to accept the **current management option** on the previous screen. Could you please tell us why?

*Please select **all** reasons that factored into your decision making process*

[RANDOMIZE ORDER EXCEPT FOR OTHER AND DK]

The cost listed in the proposed management option was too much.

I do not believe that the proposed management option would actually work to increase population numbers.

I do not feel it is my responsibility to pay to protect this species.

There are other kinds of Pacific Rockfish in Canada that are at more imminent risk than this one.

I believe the status quo (current management option) does not accurately reflect current population information.

Protecting this Pacific Rockfish is not a priority for me.

I don't want more tax added on to what I currently pay.

I do not trust the government to effectively run the program.

I need more information before I can make this choice.

I cannot afford to pay the amount.

Other (Please specify)

I don't know.

[IF DON'T KNOW TO VOTE3C, SKIP TO Q13. IF ONLY ONE RESPONSE SELECTED AT VOTE3C, AUTOFILL VOTE3C2 AND SKIP TO Q13. ALL OTHERS CONITNUE WITH VOTE3C2]

VOTE3C2. What was the **most important** reason you would not vote for the program?

Please select one response only

[INSERT ITEMS SELECTED IN VOTE1C IN THE SAME ORDER OF PRESENTATION]

I don't know.

VOTE3D. You voted to accept the **proposed management option** on the previous screen. Could you please tell us why?

*Please select **all** reasons that factored into your decision making process*

[RANDOMIZE ORDER EXCEPT FOR OTHER AND DK]

I feel that a species at risk should be protected at any cost.

The management options seemed to be quite reasonable and effective.

No species should be allowed to reach critical levels.

Protecting this Pacific Rockfish is a high priority for me.

It is important to preserve the cultural, historical, and environmental significance embodied in this Pacific Rockfish.

This particular area of the ocean is very important to me.

I am more or as concerned with the overall ecosystem benefits of saving the species rather than the species itself.

Other (Please specify)

I don't know.

[IF DON'T KNOW TO VOTE3D, SKIP TO Q13. IF ONLY ONE RESPONSE SELECTED AT VOTE2D, AUTOFILL VOTE2D2 AND SKIP TO Q13. ALL OTHERS CONITNUE WITH VOTE3D2]

VOTE3D2. What was the **most important** reason you would vote for the program?

Please select one response only

[INSERT ITEMS SELECTED IN VOTE1D IN THE SAME ORDER OF PRESENTATION]

I don't know.

14. Were you able to consider each of the referendum (vote) questions separately, or did information from earlier votes affect your later choices?

I was able to consider each of the referendum (vote) questions separately

Information from earlier votes affected later choices

15. To what degree do you think your votes in this survey will influence the management programs chosen for this Pacific Rockfish?

Please select one response only

1 – No influence at all

2

3

4

5 – Very strong influence

Activity Profile

16. Which of the following activities do you participate in?

Please select all that apply

Swimming/beach activities

Hiking

Canoeing/kayaking/rafting/sailing

Power boating

Skiing

Snowmobiling

Bird watching

Recreational fishing/angling

Wildlife viewing

Mountain biking

Hunting

Photographing nature

Ecotourism

Whale watching

ATVing or dirt biking

Camping

None of the above

Prefer not to answer

17. To which of the following types of organizations do you belong?

Please select all that apply

Fishing or hunting club

Natural history or bird watching club

Other environmental or conservation organization

Outdoor recreation or fitness club

None of the above

Prefer not to answer

18. Have you or do you – or any members of your household – work in any of the following industries?

Please select all that apply

Processing plant for aquatic species
Recreational fishing charters/tours
Commercial fishing or harvesting

None of the above

Prefer not to answer

Demographics

The final few questions are for statistical calculations. Please be assured all information will be kept completely confidential.

19. Which of the following best describes where you live?

Please select one response only

Acreage, ranch or farm
Town of less than 10,000 people
City with 10,000 to 50,000 people
City of more than 50,000 people
Prefer not to answer

20. For how many years have you lived in Canada?

Please select one response only

Born and raised
More than 20 years
11 to 20 years
6 to 10 years
3 to 5 years
1 or 2 years
Less than one year
Prefer not to answer

[IF BORN AND RAISED IN CANADA OR DECLINE TO RESPOND IN Q20, SKIP TO Q22]

21. How old were you when you left your country of birth?

Please select one response only

Under the age of 12
12 to 17
18 or older
Prefer not to answer

22. As you know, we all live in Canada, but our ancestors come from many different ethnic backgrounds. What is the **main** ethnic background of your ancestors?

Please select one response only

South Asian (from India, Pakistan, Sri Lanka, Bangladesh, or other)

Southeast Asian (from Philippines, Vietnam, Malaysia, Indonesia, Cambodia or other)

East Asian (from China, Hong Kong, Korea, Japan or other)

West Asian or Middle Eastern (from Iran, Afghanistan, Iraq, Lebanon, Israel, Saudi Arabia, United Arab Emirates, Syria, Kazakhstan, or other)

Northern European (from the United Kingdom, Ireland or Scandinavia)

Southern European (from Italy, Greece, Portugal, Spain, Albania, Croatia, Bosnia, Serbia, or other)

Western European (from Germany, Netherlands, Austria, France, Belgium, or other)

Eastern European (from Poland, Romania, former Soviet Republics, Hungary, Czech Republic, Slovakia, or other))

African

Central or South American (from Mexico, El Salvador, Guatemala, Guyana, Colombia, Argentina, Brazil, or other)

Caribbean (from Jamaica, Trinidad and Tobago, Barbados, Granada, or other)

Canadian

Aboriginal/First Nations/Métis

Other (Please specify)

Prefer not to answer

23. What is the highest level of education you have attained?

Please select one response only

Grade school or some high school

High school diploma

Post-secondary technical school

Some college or university

College degree or diploma

University undergraduate degree

University graduate degree

Prefer not to answer

24. Which of the following best describes your employment status?

Please select all that apply

Working full time (35 hours a week or more)

Working part time (less than 35 hours a week)

Student

Homemaker

Retired

Unemployed

Other

Prefer not to answer

25. How many people aged 18 years of age or older contributed to your total household income in 2010?

Please select one response only

One

Two

Three

Four

Five

Six or more

Prefer not to answer

[SURVEY CONSIDERED COMPLETE]

26. What are the first three digits of your postal code of your residential address?

*Please enter in **letter number letter** format with no spaces*

TEXT BOX **[ENSURE INPUT IS ALPHA-NUMERIC-ALPHA FORMAT]**

Prefer not to answer

27. Do you have any other comments about this survey or the *Species at Risk Act* that you would like to share with us? If so, please use the space below. **[DO NOT MAKE MANDATORY]**

[VERBATIM RESPONSE]

You've now finished the survey - thanks very much for your help!

APPENDIX A4. THE LAKE STURGEON CONSERVATION SURVEY

DEPARTMENT OF FISHERIES AND OCEANS
Canadian Policy Preferences – Lake Sturgeon Survey

FINAL: March 2, 2011

Introduction at Site

[INSERT STANDARD PANEL INTRODUCTION]

Screening

S1. What is your age?

Month / Year of birth [NUMERIC FIELD]

[TRACK AGE QUOTAS BASED ON S1]

S2. What is your gender?

Please select one response only

Male
Female

[TRACK GENDER QUOTAS BASED ON S2]

S3. In what country do you live?

Please select one response only

USA
Canada
Australia
United Kingdom
Other

[CONTINUE IF CANADA, ELSE THANK & TERMINATE]

S4. In which of the following provinces or territories do you reside?

Please select one response only

Newfoundland and Labrador
Prince Edward Island
Nova Scotia
New Brunswick
Quebec

Ontario
Manitoba
Saskatchewan
Alberta
British Columbia
Yukon Territory
Northwest Territories
Nunavut

[TRACK REGION QUOTAS BASED ON S5]

S6. What was the total income for all members of your **household** before taxes in 2010?

Please select one response only

Less than $20 000

$20,000 to $39,999

$40,000 to $59,999

$60,000 to $79,999

$80,000 to $99,999

$100,000 to $124,999

$125,000 to $149,999

$150,000 or more

[TRACK INCOME QUOTAS BASED ON S6]

PANEL DEMOGRAPHICS [APPEND THE FOLLOWING PANEL INFORMATION]

Age
Gender
FSA
Province
CSD (census subdivision) Name
CMA/CA (Census Metropolitan Area/Census Agglomeration)
Household Income
Education
Employment Status
Occupation (primary panellist)
Own or Rent
Household Size
Number of Children in the Household
Marital Status (primary panellist)

[THIS INFORMATION IS REQUIRED FOR: NON-RESPONDERS, DQs/OVER QUOTA, PARTIAL COMPLETES AND COMPLETES]

Canadian Policy Issues

Welcome!

Thank you for taking the time to complete this survey. This survey is seeking input on public policy issues facing Canadians today. Your responses will provide important input into public policy decisions.

Your participation in this survey is **voluntary** and you may decide to stop participating in the survey at any time. **The information that you provide is important!** We very much appreciate the time and effort you take to complete this survey.

Your answers to the survey will be kept private. Any reports about this study will not identify you in any way. Results will be shown in group form only. None of the personal identifying information you provided to Ipsos when you joined the i-Say panel will be shared with any other individual, organization, or government agency.

Government Priorities

13. To begin, we would like to know your views on various options for investing public funds. What follows is a list of government programs that are partially or fully paid for by your taxes.

In your opinion, how important is it for the Government of Canada to invest in each of the following? Please use a scale of 1 to 5 where **1** means **not at all important** and **5** means **very important**.

Please select one response for each item

[ACROSS TOP OF GRID]

1 – Not at all important

2

3

4

5 – Very important

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

Policing and public safety

Food and drug administration and safety

International aid and assistance

National defence

Health care

Primary education

Post-secondary education

Environmental protection

Public infrastructure (e.g. roads, bridges)

14. Using a scale of 1 to 5 where **1** means **strongly disagree** and **5** means **strongly agree**, please indicate your disagreement or agreement with the following statements regarding environment and development goals.

Please select one response for each item

[ACROSS TOP OF GRID]

1 – Strongly disagree

2

3

4

5 – Strongly agree

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

Environmental improvement programs that would be harmful to business should not be carried out.

Environmental improvements are fine as long as taxes do not increase.

Experts should solve environmental issues. The public should only be educated and informed of the decisions.

New technology will solve most environmental problems.

In the future, humans will be able to understand and control most natural processes.

Human progress does not depend on the environment since it is limited only by technology.

Aquatic Species in Canada

[DISPLAY ON DIRECTLY ABOVE QUESTION] We would now like to focus on the issue of aquatic species in Canada. We are interested in your opinions on the risks to aquatic species and the importance of their conservation. **Aquatic species are defined as fish, reptiles, crustaceans (crabs, shrimp, etc.), molluscs** (clams, oysters, etc.), and **marine mammals** (e.g. sea otters, whales, etc.) that live in freshwater, saltwater, or sometimes both.

15. What follows are a number of threats that could or do affect Canadian aquatic species. For each one, please indicate how **much of a threat** you feel each of these is to aquatic species. Please use a scale of 1 to 5 where **1** means **no threat** and **5** means **high threat.**

Please select one response for each item

[ACROSS TOP OF GRID]

1 – No threat

2

3

4

5 – High threat

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

Recreational fishing

Climate change

Water pollution

Large commercial ships

Commercial fishing

Habitat loss or degradation

Barriers such as dams in rivers or streams

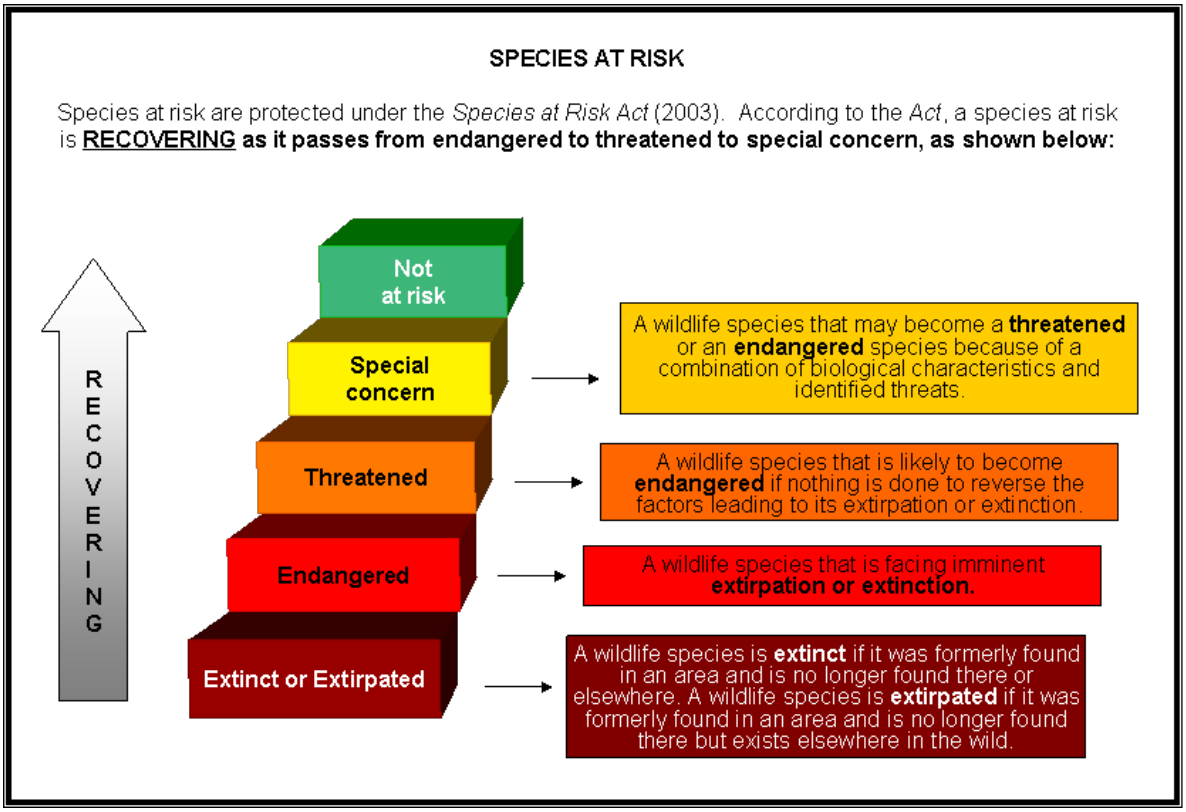
Urban development

Aquaculture operations (e.g. fish farming, oyster farming)

The *Species at Risk Act* (SARA)

A number of aquatic species in Canada are listed as species at risk of extinction. Species at risk are protected under the *Species at Risk Act* (SARA) (2003). SARA protects not only the species themselves but also their habitat. According to this Act, a species becomes more at risk as it passes from **Not At Risk** to **Special Concern** to **Threatened** to **Endangered**.

The figure below defines each of the terms used in SARA.



Due to the many ways that people can be affected by species protection, public values are very important. Under SARA, the government must complete a social and economic impact analysis for each species it lists. This means they need to look at how the species affects people, their lifestyles, the economy, industry, companies, and their day-to-day activities.

Pictures and more information about the species listed under SARA are available from http://www.sararegistry.gc.ca/sar/index/default_e.cfm **[ENSURE HYPERLINK OPENS IN A NEW WINDOW]**

16. Before starting this survey, how familiar were you with the ***Species at Risk Act*** **(SARA)**?

Please select one response only

Very familiar

Somewhat familiar

Not familiar

Fisheries Management Concepts

This survey deals with aquatic species that are affected by fishing. In order to understand the fisheries, certain management concepts need to be discussed.

Designatable units (DUs) – A DU is a group of of fish of one species found in a specific area. Many populations can make up one group.

- For example, there may be several DUs of salmon that live within one area of the ocean,
- Since each DU is distinct, harvesting fish from one DU will not affect fish harvested in a different DU.
- Because DUs are distinct some DUs may be open to fishing while other DUs of the same species may be closed to fishing (because the species are listed under SARA).

Directed fishery – government regulated commercial harvesting of an aquatic species

---

[DISPLAY QUESTION ON SAME SCREEN AS INFORMATION ABOVE]

17. Before starting this survey, had you heard of the concepts of Designatable units or Directed fisheries?

Please select one response for each item

[ACROSS TOP OF GRID]

Yes

No

[DOWN SIDE OF GRID]

Designatable unit

Directed fishery

Lake Sturgeon in Canada

This survey focuses on one species of fish called Lake Sturgeon.

Lake Sturgeon
(Acipenser fulvescens)

Lake Sturgeon is a freshwater fish, meaning it is only found in lakes and rivers inland.
Lake Sturgeon is also known as Rock Sturgeon, Common Sturgeon, Shell-backed Sturgeon, Dog Face Sturgeon, and Great Lakes Sturgeon.
The largest individual caught was 180 kg and 3m long and the oldest individual caught was about 154 years old.
They are considered to be living fossils, meaning they have not changed much from their ancestors in the Devonian period (some 350 million years ago).
This species is now found in the north-eastern United States and east of the Rocky Mountains in Canada.

Picture from http://www.dfo-mpo.gc.ca/species-especes/species-especes/sturgeon8-esturgeon-eng.htm **[ENSURE HYPERLINK OPENS IN A NEW WINDOW]**

[DISPLAY QUESTION ON SAME SCREEN AS INFORMATION ABOVE]

18. Had you heard of the Lake Sturgeon prior to this survey?

Please select one response only

Yes

No

[NEW SCREEN]

[ASK Q7 IF YES TO Q6]

19. Were you aware of any of the following prior to this survey?

Please select one response for each item

[ACROSS TOP OF GRID]

Yes

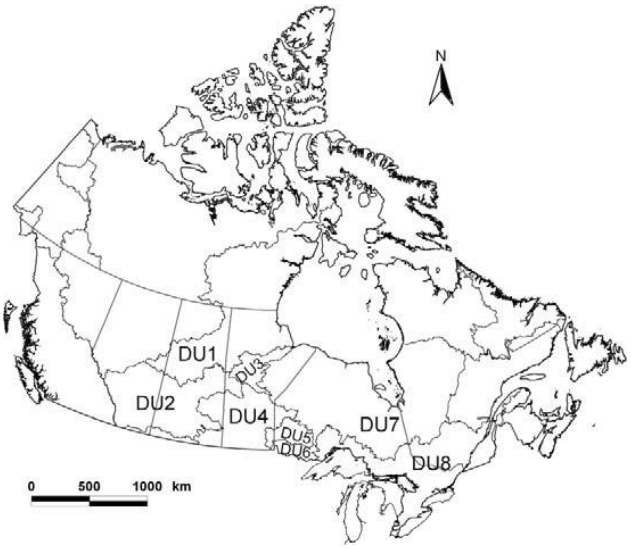
No

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

Lake Sturgeon are freshwater fish
Lake Sturgeon are also known as Rock Sturgeon and Common Sturgeon
Lake Sturgeon are considered living fossils
The largest Lake Sturgeon caught was 180 kg
Lake Sturgeon are found throughout much of Canada and the United States

Lake Sturgeon in Canada

There are 8 separate designatable units of Lake Sturgeon as defined by government scientists. The one we will look at in this survey is that of the Great Lakes and Western St. Lawrence River – also called designatable unit 8 (DU8) **[INSERT LINK TO DEFINITION – ENSURE IT OPENS IN A NEW WINDOW]**. There are many populations of Lake Sturgeon that make up DU8.



Lake Sturgeon populations are at about 1% of their historical levels.

- In the early 20th century, the numbers of Lake Sturgeon were notably reduced due to heavy commercial fishing. No population has fully recovered from this.
- They were sold for their meat and their caviar.
- More recently, threats to the Lake Sturgeon include habitat loss, poaching, and dams. These factors have played a key role in altering Lake Sturgeon habitat and keeping the populations at low numbers.
- In the Great Lakes, directed fisheries **[INSERT LINK TO DEFINITION – ENSURE IT OPENS IN A NEW WINDOW]** have been closed down although some are still operating in the St. Lawrence River.

Map from http://afsjournals.org/doi/pdf/10.1577/M08-034.1 **[ENSURE HYPERLINK OPENS IN A NEW WINDOW]**

[DISPLAY QUESTION ON SAME SCREEN AS INFORMATION ABOVE]

20. After reading the information above, please indicate your disagreement or agreement with the following statements using a scale of 1 to 5 where **1** means **strongly disagree** and **5** means **strongly agree**,

Please select one response for each item

[ACROSS TOP OF GRID]

1 – Strongly disagree

2

3

4

5 – Strongly agree

Don't know

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

It matters to me that Lake Sturgeon populations were depleted.

It matters to me that the Lake Sturgeon populations have not been able to recover in DU8 (the Great Lakes and Western St. Lawrence River).

Lake Sturgeon in Canada

Estimates of population numbers for Lake Sturgeon (within DU8 itself) vary widely. In some areas, experts know very little about how many Lake Sturgeon there actually are. This makes it hard to know how the designatable unit **[INSERT LINK TO DEFINITION – ENSURE IT OPENS IN A NEW WINDOW]** as a whole is doing. However experts believe most populations are declining and the numbers of fish in DU8 are quite low.

This species is important for a number of reasons, including:
Cultural
Lake Sturgeon is important to many Aboriginal peoples. Aboriginal fisheries may catch large numbers of Lake Sturgeon. Exact numbers are not known
Environmental
The health of the Lake Sturgeon populations signal the health of the water system. This is because these fish need a very specific environment in order to survive.
Historical
Lake Sturgeon is the largest freshwater fish species in Canada. It is also a living fossil (meaning that it has changed very little from prehistoric times).

[DISPLAY QUESTION ON SAME SCREEN AS INFORMATION ABOVE]

21. After reading the information above, how concerned are you about the following? Please use a scale of 1 to 5 where **1** means **not at all concerned** and **5** means **very concerned**,

Please select one response for each item

[ACROSS TOP OF GRID]

1 – Not at all concerned

2

3

4

5 – Very concerned

Don't know

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

All populations of Lake Sturgeon within DU8 (Great Lakes – Western St. Lawrence River)

Specific populations of Lake Sturgeon in DU8

The loss of cultural significance due to a decline in Lake Sturgeon numbers

The loss of indicator species for the environment due to a decline in Lake Sturgeon numbers

The loss of a living fossil due to a decline in Lake Sturgeon numbers

Recovering Lake Sturgeon in Canada

Lake Sturgeon makes up a very small part of the Canadian fishing industry.

- Commercial fishing for Lake Sturgeon is closed in the Great Lakes region with tight restrictions on catches made for sport.
- In the St. Lawrence River area, commercial fisheries have shut down in a few areas.
- In some parts of Quebec, Lake Sturgeon is still commercially important.

Habitat recovery is a key part of Lake Sturgeon population growth. Some vital aspects that scientists are concerned about are:

- water conditions (flow rate, depth, quality)
- soil conditions
- plant life

In order to protect or improve habitat, some human activities will need to be **restricted**. This will affect many people that use the waterways including farmers, hydro-electric companies, fishermen, boaters, and Aboriginal people. The activities include those that directly use the waterways as well as those that only involve the banks and shores. Access to banks of rivers or streams may be closed.

[DISPLAY QUESTION ON SAME SCREEN AS INFORMATION ABOVE]

22. Based on the information above, how concerned are you about the following due to increased restrictions or regulations to protect Lake Sturgeon? Please use a scale of 1 to 5 where **1** means **not at all concerned** and **5** means **very concerned**.

Please select one response for each item

[ACROSS TOP OF GRID]

1 – Not at all concerned

2

3

4

5 – Very concerned

Don't know

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

The potential impact on commercial fisheries

The potential impact on recreational fisheries

The potential impact on human activities that use waterways, banks, and shores

Recovering Lake Sturgeon in Canada

Stocking is a tool used to increase the number of Lake Sturgeon.

- Fish populations need to be stocked when their numbers become low due to such things as human recreational impacts, overfishing, changes in habitat, invasive species, increased predators, changes in water quality, and dams.

Here are the steps involved in stocking:

1) The process begins in a hatchery (pictured), where eggs are hatched and they grow into young fish.
2) Young fish are then transferred to the body of water to add to the existing population.

For Lake Sturgeon, the most effective way of stocking would be using streamside trailers.

- The fish hatched and raised in these trailers are then released directly into the stream or river.

Picture from http://www.dfo-mpo.gc.ca/aquaculture/multimedia/fig34.jpg

[DISPLAY QUESTION ON SAME SCREEN AS INFORMATION ABOVE]

23. Had you heard of stocking prior to this survey?

Please select one response only

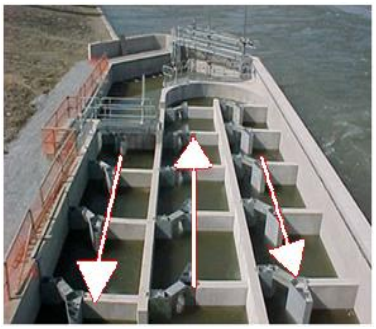
Yes

No

Fish Ladders for Lake Sturgeon in Canada

Hydro-electric dams often prevent fish from moving freely from one area to another.

One way to solve this problem is by installing **fish ladders. [ADD ROLLOVER OR INSERT HYPERLINK AND ENSURE INFORMATION POPS-UP IN A NEW WINDOW]** The ladders have proven to be very effective in helping fish to migrate.



Fish ladders are one of the largest costs associated with helping Lake Sturgeon populations. The costs are extremely variable and include any building costs as well as research, monitoring, operation, and maintenance.

Funding for these costs would be provided mainly through tax dollars because many existing dams are considered to be part of public infrastructure and some of the dams are quite old.

Picture from http://www.slv2000.qc.ca/divers/parcs_canada/saint_ours_accueil_a.htm and supplied by the DFO.

[INFORMATION FOR ROLLOVER OR POP-UP: Fish ladders are built on the sides of dams. They allow the fish to slowly gain elevation by jumping or swimming through a series of steps.]

[DISPLAY QUESTION ON SAME SCREEN AS INFORMATION ABOVE]

24. Based on the information above, how concerned are you about the following? Please use a scale of 1 to 5 where **1** means **not at all concerned** and **5** means **very concerned**.

Please select one response for each item

[ACROSS TOP OF GRID]

1 – Not at all concerned

2

3

4

5 – Very concerned

Don't know

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

The impact of dams on the Lake Sturgeon populations

The cost of constructing and maintaining the fish ladders

Recovering Lake Sturgeon in Canada

To help the Lake Sturgeon numbers increase, 3 things could be done. They are listed below.

1) Extend fish survival by closing down the directed fishery **[INSERT LINK TO DEFINITION – ENSURE IT OPENS IN A NEW WINDOW]** on adults (young ones are already prohibited from being harvested).
2) Improve habitat and employ stocking.
3) Install fish ladders in dams.

The programs explained above will affect people in a variety of ways:

- Commercial and recreational fishing of the species may be closed. Some income in the fishing industry and/or related companies may be reduced (please remember that they will have access to a variety of support programs).
- Human activities **[INSERT LINK TO DEFINITION – ENSURE IT OPENS IN A NEW WINDOW]** on lakes and rivers in the area may be partially or fully stopped.

Understanding the importance of protecting Lake Sturgeon to Canadians will contribute to building a good basis from which to make public policy.

[POP-UP INFORMATION FOR HUMAN ACTIVITIES: Activities include those that directly use the waterways as well as those that only involve the banks and shores. They will affect farmers, hydro-electric companies, fishermen, boaters, and Aboriginal peoples.**]**

[DISPLAY QUESTION ON SAME SCREEN AS INFORMATION ABOVE]

25. To you personally, how important is the contribution of each aspect of the program to the recovery of the species? Please use a scale of 1 to 5 where **1** means **not at all important** and **5** means **very important**.

Please select one response for each item

[ACROSS TOP OF GRID]

1 – Not at all important

2

3

4

5 – Very important

Don't know

[DOWN SIDE OF GRID] [RANDOMIZE ORDER]

Closing down the fishery

Stocking of lakes and rivers

Habitat improvements

Installing fish ladders in dams

What Should be Done?

Next, we would like your opinion on **what should be done with the Lake Sturgeon of DU8**. Because the options involve spending public money, we are seeking your opinion. You will be presented with various scenarios for recovery of Lake Sturgeon in DU8. **Each option will be compared to the situation that would likely exist in 30 years if no recovery plan is put in place.**

Option A – maintaining the current management situation for Lake Sturgeon; this option describes what the species will be like in 30 years if the current situation continues.

Option B – a scenario made up of different combinations of actions that will increase populations of Lake Sturgeon; what the species will be like in 30 years if these actions are put in place.

Each alternative will indicate:

1. ***the Species at Risk Act listing status of Lake Sturgeon 30 years from now***
2. ***the program chosen to protect Lake Sturgeon***
3. ***the probability of recovery of the species***
4. ***the cost to your household***

You will be asked to choose one option or the other. **Please keep in mind that the costs of the programs are not known with certainty and they will vary**. This is why there may be a less strict program that costs more money.

What Should be Done?

Previous surveys involving people's choices about paying for government programs ran into some problems.

- It has been found that people provide responses that are not what they would choose in real life.
- Instead people often say they will act one way but in reality act a different way.

In this survey, we would like you to consider the choices carefully. **Please think as though the monetary amounts were real dollars to be added to your taxes.** Remember, in order to do this, you would have to give up other things that you currently spend money on.

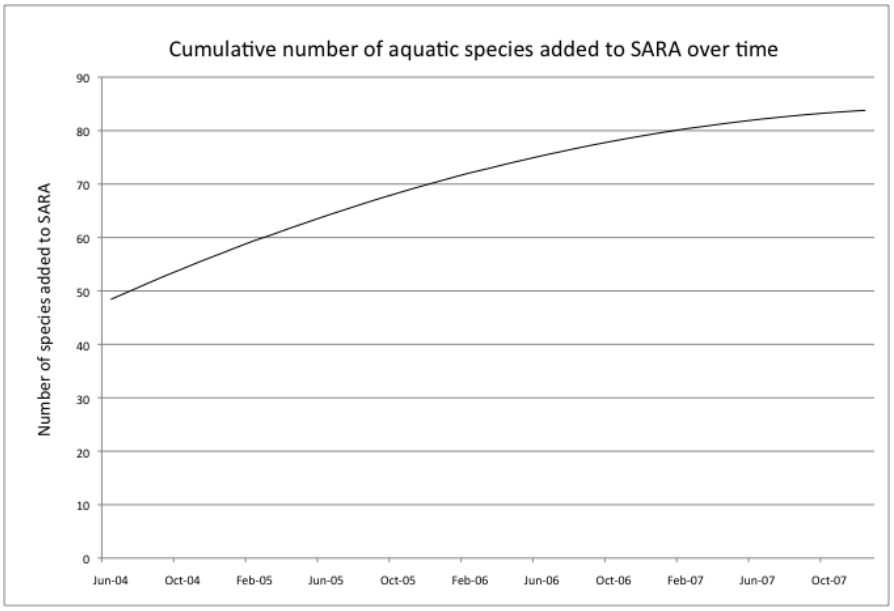
[NEW SCREEN]

What Should be Done?

Also, please keep in mind that the government has a limited amount of funds.

- It cannot protect all species to the same extent.
- By protecting one species, another species in need of protection may not receive all the funding it requires.

The graph below shows the total number of aquatic species listed under SARA over time. Each new species under SARA requires a recovery plan and more money to be spent. **Please understand that money will NOT be able to be spent on another species unless more money is obtained through taxes.** You will be making a trade-off by paying for the protection of Lake Sturgeon.



Referendum Questions

The questions will be presented as if a national vote (referendum) is being held. You will need to vote for your most preferred program.

Please treat each situation or vote independently. That is, consider each case as if it was the only one that you are voting on.

YOU WILL NOW VOTE 3 TIMES

PROGRAMMER NOTES:

- **RANDOMIZE THE ORDER VOTE 1, VOTE 2 AND VOTE 3**
- **THE COST FOR THE PROPOSED PROGRAM WILL NEED TO BE RANDOMLY SELECTED FOR EACH VOTE**
- **THE DATA FILE MUST CLEARLY INDICATE THE RESPONSE TO EACH VOTE, THE ORDER OF THE VOTES FOR EACH RESPONDENT AND THE TAX LEVEL ASSIGNED TO EACH RESPONDENT**

VOTE 1

Please indicate which option you would vote for if there was a national vote (referendum) on managing Lake Sturgeon. [ONLY INSERT FOR THE SECOND AND THIRD VOTES THE RESPONDENT SEES: Please consider this choice separately from any other.]

	CURRENT *Management Option*	***PROPOSED*** *Management Option*
Strategy for protection	**No new program**	**Program 1** *- Adult fish cannot be harvested* *- Some jobs and income will be affected – those affected will have access to a variety of support programs that are provided through separate processes*
Listing status (in 30 years)	*In 30 years, the listing status for Lake Sturgeon will be:* **Endangered**	*In 30 years, the listing status for Lake Sturgeon will be:* **Threatened**
Probability of extinction in region (in 30 years)	**Very high**	**High**
Increased cost to your household in extra taxes every year for 10 years	**$0**	**[INSERT RANDOMLY SELECTED AMOUNT: $1, $10, $50, $150, $300, $600]** annually for 10 years
The increased taxes would be used to: ▪ *Monitor and enforce fishermen's and businesses' compliance with the recovery programs*		

VOTE1. Please carefully review the two alternatives presented in the table above. If you had to vote on these two options, which one would you choose? Please consider your household budget, and what you would have to give up to pay the additional amount.

PLEASE SELECT ONE RESPONSE ONLY

CURRENT Management Option
PROPOSED Management Option

[DISPLAY VOTE1A AND VOTE1B ON THE SAME SCREEN]

VOTE1A. How certain are you that your response accurately reflects how you would vote if this was a real referendum?

Please select one response only

Very Certain

Somewhat Certain

Somewhat Uncertain

Very Uncertain

VOTE1B. What percentage of Canadian voters do you think would support the PROPOSED management option (Program 1)?

Please provide your best estimate. Please enter a whole number from 0 to 100.

[NUMERIC RESPONSE]% [RANGE: O TO 100]

[ASK VOTE1C IF CURRENT MANAGEMENT OPTION SELECTED IN VOTE1. ASK VOTE1D IF PROPOSED MANAGEMENT OPTION SELECTED IN VOTE1]
VOTE1C. You voted to accept the **current management option** on the previous screen. Could you please tell us why?

*Please select **all** reasons that factored into your decision making process*

[RANDOMIZE ORDER EXCEPT FOR OTHER AND DK]

The cost listed in the proposed management option was too much.

I do not believe that the proposed management option would actually work to increase population numbers.

I do not feel it is my responsibility to pay to protect this species.

There are other designatable units of Lake Sturgeon in Canada that are at more imminent risk than this one.

I believe the status quo (current management option) does not accurately reflect current population information.

Protecting Lake Sturgeon is not a priority for me.

I don't want more tax added on to what I currently pay.

I do not trust the government to effectively run the program.

I need more information before I can make this choice.

I cannot afford to pay the amount.

Other (Please specify)

I don't know.

[IF DON'T KNOW TO VOTE1C, SKIP TO NEXT VOTE. IF ONLY ONE RESPONSE SELECTED AT VOTE1C, AUTOFILL VOTE1C2 AND SKIP TO NEXT VOTE. ALL OTHERS CONITNUE WITH VOTE1C2]

VOTE1C2. What was the **most important** reason you would not vote for the program?

Please select one response only

[INSERT ITEMS SELECTED IN VOTE1C IN THE SAME ORDER OF PRESENTATION]

I don't know.

VOTE1D. You voted to accept the **proposed management option** on the previous screen. Could you please tell us why?

*Please select **all** reasons that factored into your decision making process*

[RANDOMIZE ORDER EXCEPT FOR OTHER AND DK]

I feel that a species at risk should be protected at any cost.

The management options seemed to be quite reasonable and effective.

No species should be allowed to reach critically low levels.

Protecting Lake Sturgeon is a high priority for me.

It is important to preserve the cultural, historical, and environmental significance embodied in Lake Sturgeon.

Having sturgeon in this region of Canada is important to me.

I am more concerned with the overall ecosystem benefits of saving the species rather than the species itself.

Other (Please specify)

I don't know.

[IF DON'T KNOW TO VOTE1D, SKIP TO NEXT VOTE. IF ONLY ONE RESPONSE SELECTED AT VOTE1D, AUTOFILL VOTE1D2 AND SKIP TO NEXT VOTE. ALL OTHERS CONITNUE WITH VOTE1D2]

VOTE1D2. What was the **most important** reason you would vote for the program?

Please select one response only

[INSERT ITEMS SELECTED IN VOTE1D IN THE SAME ORDER OF PRESENTATION]

I don't know.

VOTE 2

Please indicate which option you would vote for if there was a national vote (referendum) on managing Lake Sturgeon. [ONLY INSERT FOR THE SECOND AND THIRD VOTES THE RESPONDENT SEES: Please consider this choice separately from any other.]

	CURRENT *Management Option*	***PROPOSED*** *Management Option*
Strategy for protection	**No new program**	**Program 2** - *Adult fish cannot be harvested* - *Some jobs and income will be affected – those affected will have access to a variety of support programs that are provided through separate processes* - *Stocking of lakes and rivers* - *Habitat improvements will be made*
Listing status (in 30 years)	*In 30 years, the listing status for Lake Sturgeon will be:* **Endangered**	*In 30 years, the listing status for Lake Sturgeon will be:* **Special Concern**
Probability of extinction in region (in 30 years)	**Very high**	**Moderate/Uncertain**
Increased cost to your household in extra taxes every year for 10 years	**$0**	**[INSERT RANDOMLY SELECTED AMOUNT: $1, $10, $50, $150, $300, $600]** annually for 10 years
The increased taxes would be used to: ▪ *Monitor and enforce fishermen's and businesses' compliance with the recovery program* ▪ *Fund stocking and habitat improvements*		

VOTE2. Please carefully review the two alternatives presented in the table above. If you had to vote on these two options, which one would you choose? Please consider your household budget, and what you would have to give up to pay the additional amount.

PLEASE SELECT ONE RESPONSE ONLY

CURRENT Management Option
PROPOSED Management Option

[DISPLAY VOTE2A AND VOTE2B ON THE SAME SCREEN]

VOTE2A. How certain are you that your response accurately reflects how you would vote if this was a real referendum?

Please select one response only

Very Certain

Somewhat Certain

Somewhat Uncertain

Very Uncertain

VOTE2B. What percentage of Canadian voters do you think would support the PROPOSED management option (Program 2)?

Please provide your best estimate. Please enter a whole number from 0 to 100.

[NUMERIC RESPONSE]% [RANGE: O TO 100]

[ASK VOTE2C IF CURRENT MANAGEMENT OPTION SELECTED IN VOTE2. ASK VOTE2D IF PROPOSED MANAGEMENT OPTION SELECTED IN VOTE2]
VOTE2C. You voted to accept the **current management option** on the previous screen. Could you please tell us why?

*Please select **all** reasons that factored into your decision making process*

[RANDOMIZE ORDER EXCEPT FOR OTHER AND DK]

The cost listed in the proposed management option was too much.

I do not believe that the proposed management option would actually work to increase population numbers.

I do not feel it is my responsibility to pay to protect this species.

There are other designatable units of Lake Sturgeon in Canada that are at more imminent risk than this one.

I believe the status quo (current management option) does not accurately reflect current population information.

Protecting Lake Sturgeon is not a priority for me.

I don't want more tax added on to what I currently pay.

I do not trust the government to effectively run the program.

I need more information before I can make this choice.

I cannot afford to pay the amount.

Other (Please specify)

I don't know.

[IF DON'T KNOW TO VOTE2C, SKIP TO NEXT VOTE. IF ONLY ONE RESPONSE SELECTED AT VOTE2C, AUTOFILL VOTE2C2 AND SKIP TO NEXT VOTE. ALL OTHERS CONITNUE WITH VOTE2C2]

VOTE2C2. What was the **most important** reason you would not vote for the program?

Please select one response only

[INSERT ITEMS SELECTED IN VOTE1C IN THE SAME ORDER OF PRESENTATION]

I don't know.

VOTE2D. You voted to accept the **proposed management option** on the previous screen. Could you please tell us why?

*Please select **all** reasons that factored into your decision making process*

[RANDOMIZE ORDER EXCEPT FOR OTHER AND DK]

I feel that a species at risk should be protected at any cost.

The management options seemed to be quite reasonable and effective.

No species should be allowed to reach critically low levels.

Protecting Lake Sturgeon is a high priority for me.

It is important to preserve the cultural, historical, and environmental significance embodied in Lake Sturgeon.

Having sturgeon in this region of Canada is important to me.

I am more concerned with the overall ecosystem benefits of saving the species rather than the species itself.

Other (Please specify)

I don't know.

[IF DON'T KNOW TO VOTE2D, SKIP TO NEXT VOTE. IF ONLY ONE RESPONSE SELECTED AT VOTE2D, AUTOFILL VOTE2D2 AND SKIP TO NEXT VOTE. ALL OTHERS CONITNUE WITH VOTE2D2]

VOTE2D2. What was the **most important** reason you would vote for the program?

Please select one response only

[INSERT ITEMS SELECTED IN VOTE1D IN THE SAME ORDER OF PRESENTATION]

I don't know.

VOTE 3

Please indicate which option you would vote for if there was a national vote (referendum) on managing Lake Sturgeon. [ONLY INSERT FOR THE SECOND AND THIRD VOTES THE RESPONDENT SEES: Please consider this choice separately from any other.]

	CURRENT *Management Option*	***PROPOSED*** ***Management Option***
Strategy for protection	**No new program**	**Program 3** - *Adult fish cannot be harvested* - *Some jobs and income will be affected – those affected will have access to a variety of support programs that are provided through separate processes* - *Stocking of lakes and rivers* - *Habitat improvements will be made* - *Fish ladders will be constructed on dams*
Listing status (in 30 years)	*In 30 years, the listing status for Lake Sturgeon will be:* **Endangered**	*In 30 years, the listing status for Lake Sturgeon will be:* **Not at risk**
Probability of extinction in region (in 30 years)	**Very high**	**None**
Increased cost to your household in extra taxes every year for 10 years	**$0**	**[INSERT RANDOMLY SELECTED AMOUNT: $1, $10, $50, $150, $300, $600]** annually for 10 years
The increased taxes would be used to: ▪ *Monitor and enforce fishermen's and businesses' compliance with the recovery program* ▪ *Fund stocking and habitat improvements* ▪ *Build and install fish ladders*		

VOTE3. Please carefully review the two alternatives presented in the table above. If you had to vote on these two options, which one would you choose? Please consider your household budget, and what you would have to give up to pay the additional amount.

PLEASE SELECT ONE RESPONSE ONLY

CURRENT Management Option
PROPOSED Management Option

[DISPLAY VOTE3A AND VOTE3B ON THE SAME SCREEN]

VOTE3A. How certain are you that your response accurately reflects how you would vote if this was a real referendum?

Please select one response only

Very Certain

Somewhat Certain

Somewhat Uncertain

Very Uncertain

VOTE3B. What percentage of Canadian voters do you think would support the PROPOSED management option (Program 3)?

Please provide your best estimate. Please enter a whole number from 0 to 100.

[NUMERIC RESPONSE]% [RANGE: O TO 100]

[ASK VOTE3C IF CURRENT MANAGEMENT OPTION SELECTED IN VOTE3. ASK VOTE3D IF PROPOSED MANAGEMENT OPTION SELECTED IN VOTE3]
VOTE3C. You voted to accept the **current management option** on the previous screen. Could you please tell us why?

*Please select **all** reasons that factored into your decision making process*

[RANDOMIZE ORDER EXCEPT FOR OTHER AND DK]

The cost listed in the proposed management option was too much.

I do not believe that the proposed management option would actually work to increase population numbers.

I do not feel it is my responsibility to pay to protect this species.

There are other designatable units of Lake Sturgeon in Canada that are at more imminent risk than this one.

I believe the status quo (current management option) does not accurately reflect current population information.

Protecting Lake Sturgeon is not a priority for me.

I don't want more tax added on to what I currently pay.

I do not trust the government to effectively run the program.

I need more information before I can make this choice.

I cannot afford to pay the amount.

Other (Please specify)

I don't know.

[IF DON'T KNOW TO VOTE3C, SKIP TO Q14. IF ONLY ONE RESPONSE SELECTED AT VOTE3C, AUTOFILL VOTE3C2 AND SKIP TO Q14. ALL OTHERS CONITNUE WITH VOTE3C2]

VOTE3C2. What was the **most important** reason you would not vote for the program?

Please select one response only

[INSERT ITEMS SELECTED IN VOTE1C IN THE SAME ORDER OF PRESENTATION]

I don't know.

VOTE3D. You voted to accept the **proposed management option** on the previous screen. Could you please tell us why?

*Please select **all** reasons that factored into your decision making process*

[RANDOMIZE ORDER EXCEPT FOR OTHER AND DK]

I feel that a species at risk should be protected at any cost.

The management options seemed to be quite reasonable and effective.

No species should be allowed to reach critically low levels.

Protecting Lake Sturgeon is a high priority for me.

It is important to preserve the cultural, historical, and environmental significance embodied in Lake Sturgeon.

Having sturgeon in this region of Canada is important to me.

I am more concerned with the overall ecosystem benefits of saving the species rather than the species itself.

Other (Please specify)

I don't know.

[IF DON'T KNOW TO VOTE3D, SKIP TO Q14. IF ONLY ONE RESPONSE SELECTED AT VOTE2D, AUTOFILL VOTE2D2 AND SKIP TO Q14. ALL OTHERS CONITNUE WITH VOTE3D2]

VOTE3D2. What was the **most important** reason you would vote for the program?

Please select one response only

[INSERT ITEMS SELECTED IN VOTE1D IN THE SAME ORDER OF PRESENTATION]

I don't know.

26. Were you able to consider each of the referendum (vote) questions separately, or did information from earlier votes affect your later choices?

I was able to consider each of the referendum (vote) questions separately

Information from earlier votes affected later choices

27. To what degree do you think your votes in this survey will influence the management programs chosen for Lake Sturgeon?

Please select one response only

1 – No influence at all

2

3

4

5 – Very strong influence

Activity Profile

28. Which of the following activities do you participate in?

Please select all that apply

Swimming/beach activities

Hiking

Canoeing/kayaking/rafting/sailing

Power boating

Skiing

Snowmobiling

Bird watching

Recreational fishing/angling

Wildlife viewing

Mountain biking

Hunting

Photographing nature

Ecotourism

Whale watching

ATVing or dirt biking

Camping

None of the above

Prefer not to answer

29. To which of the following types of organizations do you belong?

Please select all that apply

Fishing or hunting club

Natural history or bird watching club

Other environmental or conservation organization

Outdoor recreation or fitness club

None of the above

Prefer not to answer

30. Have you or do you – or any members of your household – work in any of the following industries?

Please select all that apply

Processing plant for aquatic species
Recreational fishing charters/tours
Commercial fishing or harvesting

None of the above

Prefer not to answer

Demographics

The final few questions are for statistical calculations. Please be assured all information will be kept completely confidential.

31. Which of the following best describes where you live?

Please select one response only

Acreage, ranch or farm
Town of less than 10,000 people
City with 10,000 to 50,000 people
City of more than 50,000 people
Prefer not to answer

32. For how many years have you lived in Canada?

Please select one response only

Born and raised
More than 20 years
11 to 20 years
6 to 10 years
3 to 5 years
1 or 2 years
Less than one year
Prefer not to answer

[IF BORN AND RAISED IN CANADA OR DECLINE TO RESPOND IN Q20, SKIP TO Q22]

33. How old were you when you left your country of birth?

Please select one response only

Under the age of 12
12 to 17
18 or older
Prefer not to answer

34. As you know, we all live in Canada, but our ancestors come from many different ethnic backgrounds. What is the **main** ethnic background of your ancestors?

Please select one response only

South Asian (from India, Pakistan, Sri Lanka, Bangladesh, or other)

Southeast Asian (from Philippines, Vietnam, Malaysia, Indonesia, Cambodia or other)

East Asian (from China, Hong Kong, Korea, Japan or other)

West Asian or Middle Eastern (from Iran, Afghanistan, Iraq, Lebanon, Israel, Saudi Arabia, United Arab Emirates, Syria, Kazakhstan, or other)

Northern European (from the United Kingdom, Ireland or Scandinavia)

Southern European (from Italy, Greece, Portugal, Spain, Albania, Croatia, Bosnia, Serbia, or other)

Western European (from Germany, Netherlands, Austria, France, Belgium, or other)

Eastern European (from Poland, Romania, former Soviet Republics, Hungary, Czech Republic, Slovakia, or other))

African

Central or South American (from Mexico, El Salvador, Guatemala, Guyana, Colombia, Argentina, Brazil, or other)

Caribbean (from Jamaica, Trinidad and Tobago, Barbados, Granada, or other)

Canadian

Aboriginal/First Nations/Métis

Other (Please specify)

Prefer not to answer

35. What is the highest level of education you have attained?

Please select one response only

Grade school or some high school

High school diploma

Post-secondary technical school

Some college or university

College degree or diploma

University undergraduate degree

University graduate degree

Prefer not to answer

36. Which of the following best describes your employment status?

Please select all that apply

Working full time (35 hours a week or more)

Working part time (less than 35 hours a week)

Student

Homemaker

Retired

Unemployed

Other

Prefer not to answer

37. How many people aged 18 years of age or older contributed to your total household income in 2010?

Please select one response only

One

Two

Three

Four

Five

Six or more

Prefer not to answer

[SURVEY CONSIDERED COMPLETE]

38. What are the first three digits of your postal code of your residential address?

*Please enter in **letter number letter** format with no spaces*

TEXT BOX **[ENSURE INPUT IS ALPHA-NUMERIC-ALPHA FORMAT]**

Prefer not to answer

39. Do you have any other comments about this survey or the *Species at Risk Act* that you would like to share with us? If so, please use the space below. **[DO NOT MAKE MANDATORY]**

[VERBATIM RESPONSE]

You've now finished the survey - thanks very much for your help!

APPENDIX B. LAKE STURGEON DESIGNATABLE UNITS AND PROVINCIAL RISK STATUS

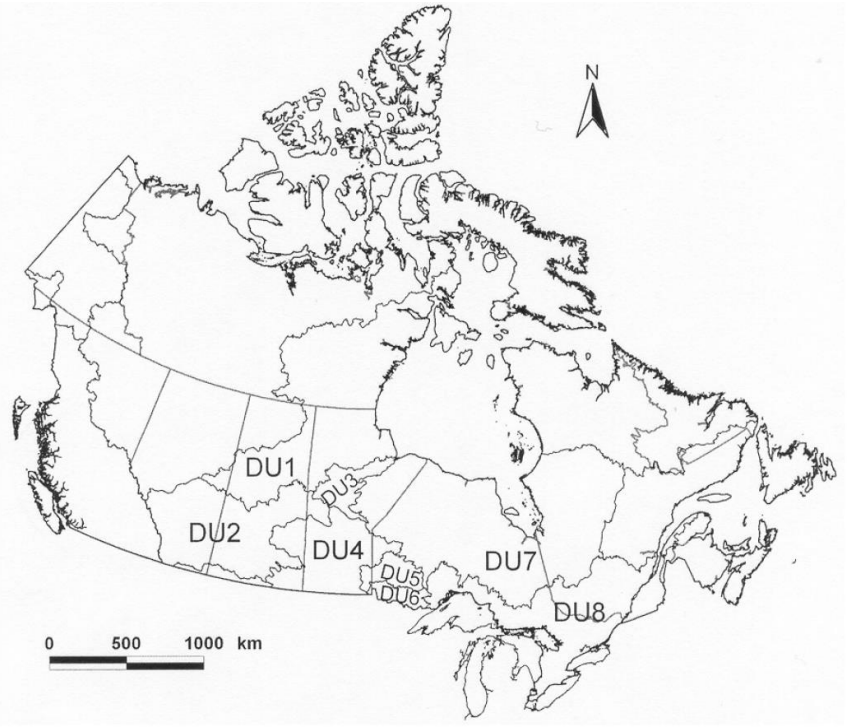


Figure 9. *Ecozones used by COSEWIC (2006) as a criterion to classify Lake Sturgeon into 8 designatable units.*

Source: *COSEWIC (2006)*

Table 15. Lake Sturgeon listing by provincial governments and designatable units

Province	Lake Sturgeon designatable units							
	DU1	DU2	DU3	DU4	DU5	DU6	DU7	DU8
Alberta (AB)		At risk[1] threatened[2]						
British Columbia (BC)								
Manitoba (MB)								
New Brunswick (NB)								
Newfoundland and Labrador (NL)								
Nova Scotia (NS)								
Ontario (ON)					Threatened (Northwestern populations)[3]		Special concern[3]	Threatened[3]
Prince Edward Island (PE)								
Quebec (QC)								Likely to be Designated threatened or vulnerable[4]
Saskatchewan (SK)								

(1) (Alberta Sustainable Resource Development 2002)
(2) (Government of Alberta 2014)
(3) Ontario Endangered Species Act
(4) Quebec biodiversity Atlas (2005)

Table 16. Lake sturgeon listing according to COSEWIC

Province	Lake Sturgeon designatable units							
	DU1	DU2	DU3	DU4	DU5	DU6	DU7	DU8
Alberta (AB)		Endangered						
British Columbia (BC)								
Manitoba (MB)	Endangered	Endangered	Endangered	Endangered	Endangered		Special concern	Threatened
New Brunswick (NB)								
Newfoundland and Labrador (NL)								
Nova Scotia (NS)								
Ontario (ON)				Endangered	Endangered	Special concern	Special concern	Threatened
Prince Edward Island (PE)								
Quebec (QC)							Special concern	Threatened
Saskatchewan (SK)	Endangered	Endangered		Endangered				

Source: *Fisheries and Oceans Canada, (COSEWIC 2006)*

Table 17. Lake sturgeon listing according to the Species at Risk Act (SARA)

Province	Lake Sturgeon designatable units							
	DU1	DU2	DU3	DU4	DU5	DU6	DU7	DU8
Alberta (AB)		No status						
British Columbia (BC)								
Manitoba (MB)	No status	No status	No status	No status	No status		No status	
New Brunswick (NB)								
Newfoundland and Labrador (NL)								
Nova Scotia (NS)								
Ontario (ON)				No status	No status	No status	No status	No status
Prince Edward Island (PE)								
Quebec (QC)							No status	No status
Saskatchewan (SK)	No status	No status		No status				

Source: *Fisheries and Oceans Canada*

APPENDIX C. CORRELATIONS BETWEEN SOCIODEMOGRAPHICS AND DESCRIPTIVE ANALYSIS OF AGE IN THE FOUR VALUATION STUDIES

Table 18. Correlations in the Wetland restoration study (Number of respondents = 1811)

	Male	Age	High income (>$100,000)	Post secondary education	Env. organization membership
Male	1				
Age	0.1216	1			
High income (>$100,000)	-0.0125	-0.0218	1		
Post-secondary education	0.1804	0.0304	0.176	1	
Env. organization membership	0.0259	-0.0167	0.0047	0.0355	1

Table 19. Correlations in the Species at risk conservation (Number of respondents = 262)

	Male	Age	High income (>$100,000)	Post secondary education	Env. organization membership
Male	1				
Age	0.2141	1			
High income (>$100,000)	0.0809	0.0558	1		
Post-secondary education	-0.0119	-0.0814	0.1223	1	
Env. organization membership	0.0082	0.0748	-0.1339	0.0121	1

Table 20. Correlations in the Rockfish conservation (Number of respondents = 1177)

	Male	Age	High income (>$100,000)	Post secondary education	Env. organization membership
Male	1				
Age	0.211	1			
High income (>$100,000)	-0.0052	0.0952	1		
Post-secondary education	0.0431	-0.0306	0.1714	1	
Env. organization membership	0.0018	0.031	0.0459	0.0757	1

Table 21. Correlations in the Lake Sturgeon conservation (Number of respondents= 1169)

	Male	Age	High income (>$100,000)	Post secondary education	Env. organization membership
Male	1				
Age	0.1583	1			
High income (>$100,000)	0.0101	0.0412	1		
Post-secondary education	0.0109	-0.1139	0.1177	1	
Env. organization membership	0.0176	-0.0168	0.0439	0.0584	1

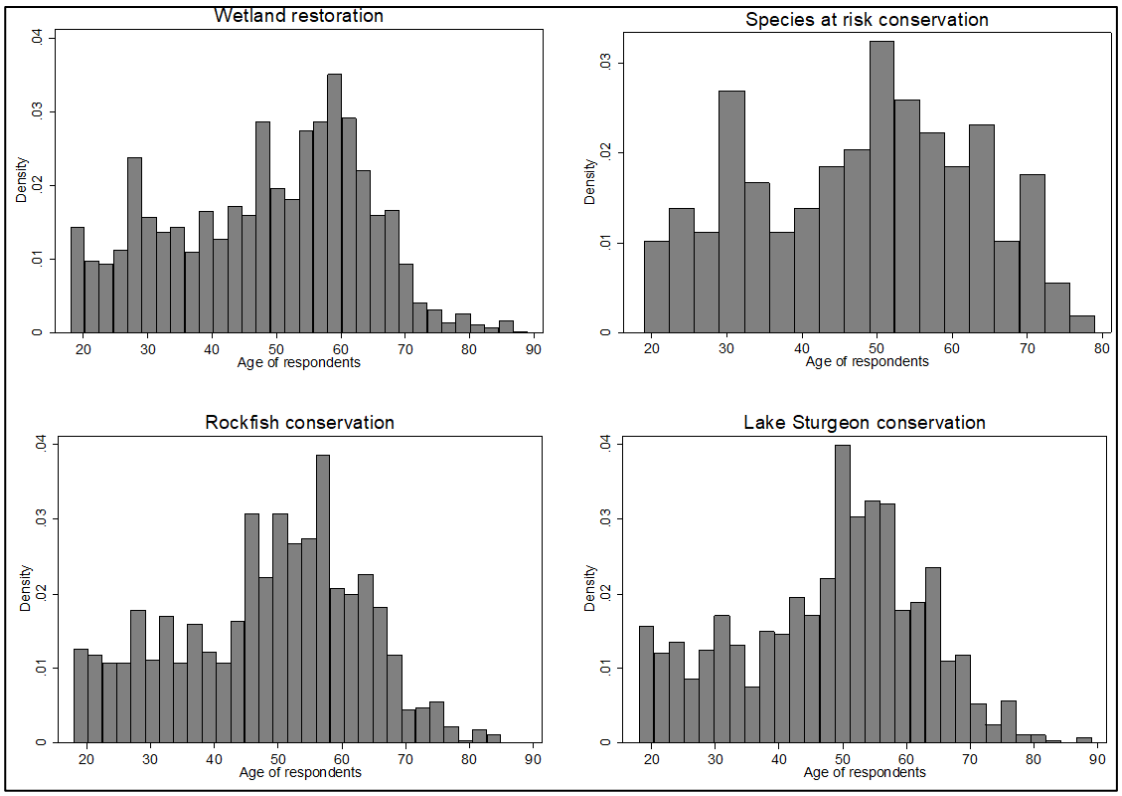


Figure 10. *Histograms of the variable Age in the four valuation studies.*

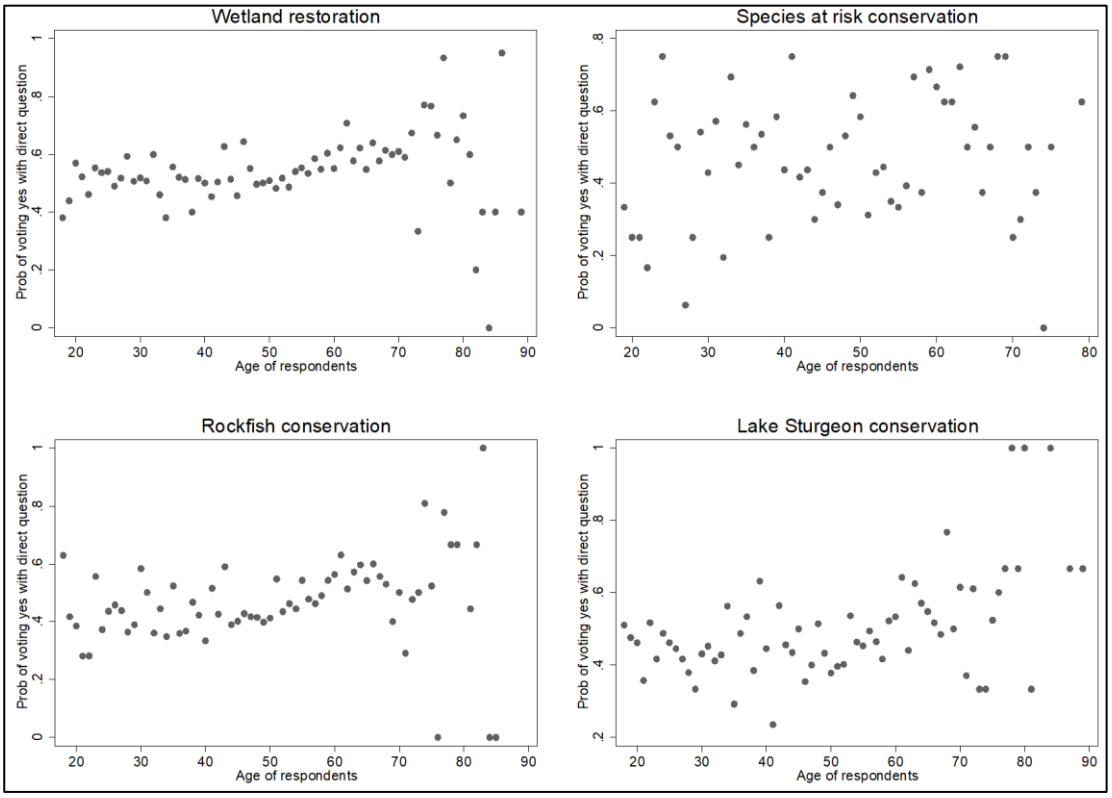


Figure 11. *Probability of voting yes with direct question per years of age, in the four studies*

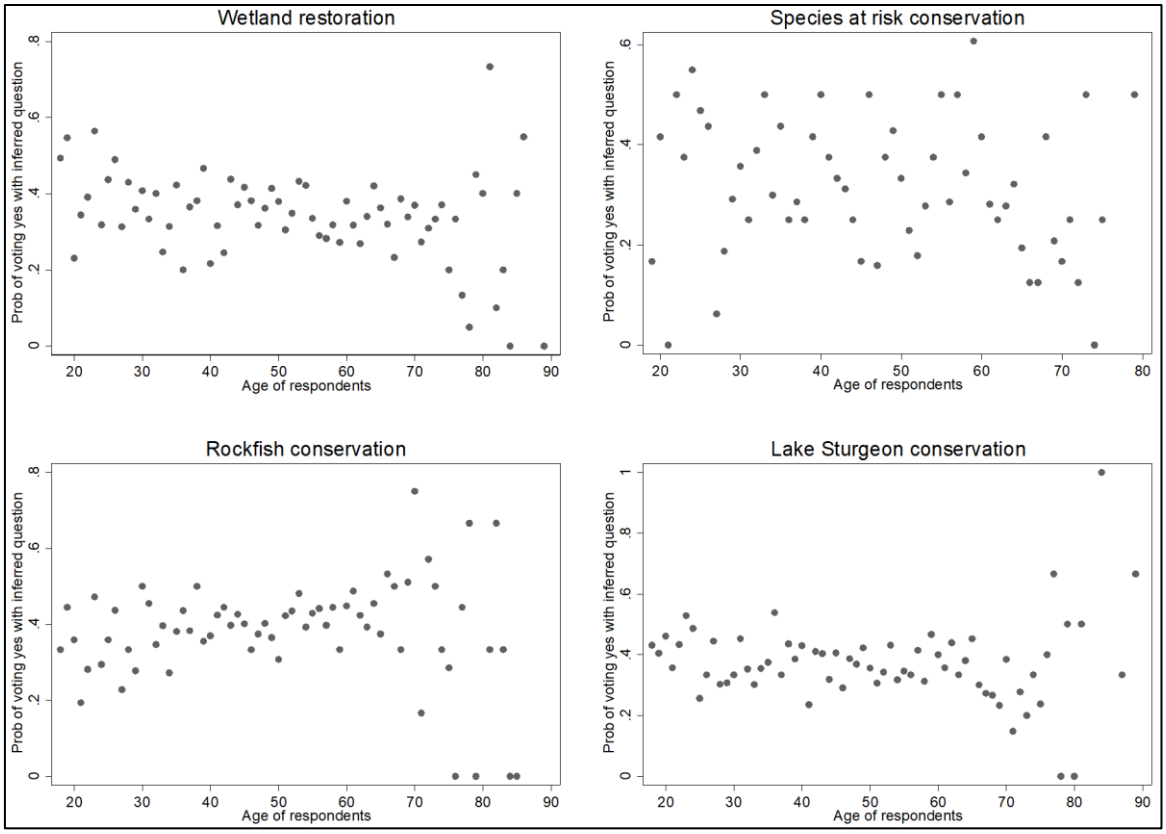


Figure 12. *Probability of voting yes with inferred question per years of age, in the four studies*

APPENDIX D. INFERRED PERCENTAGE OF THE POPULATION THAT RESPONDENTS BELIEVED WOULD VOTE YES, PER COST LEVEL

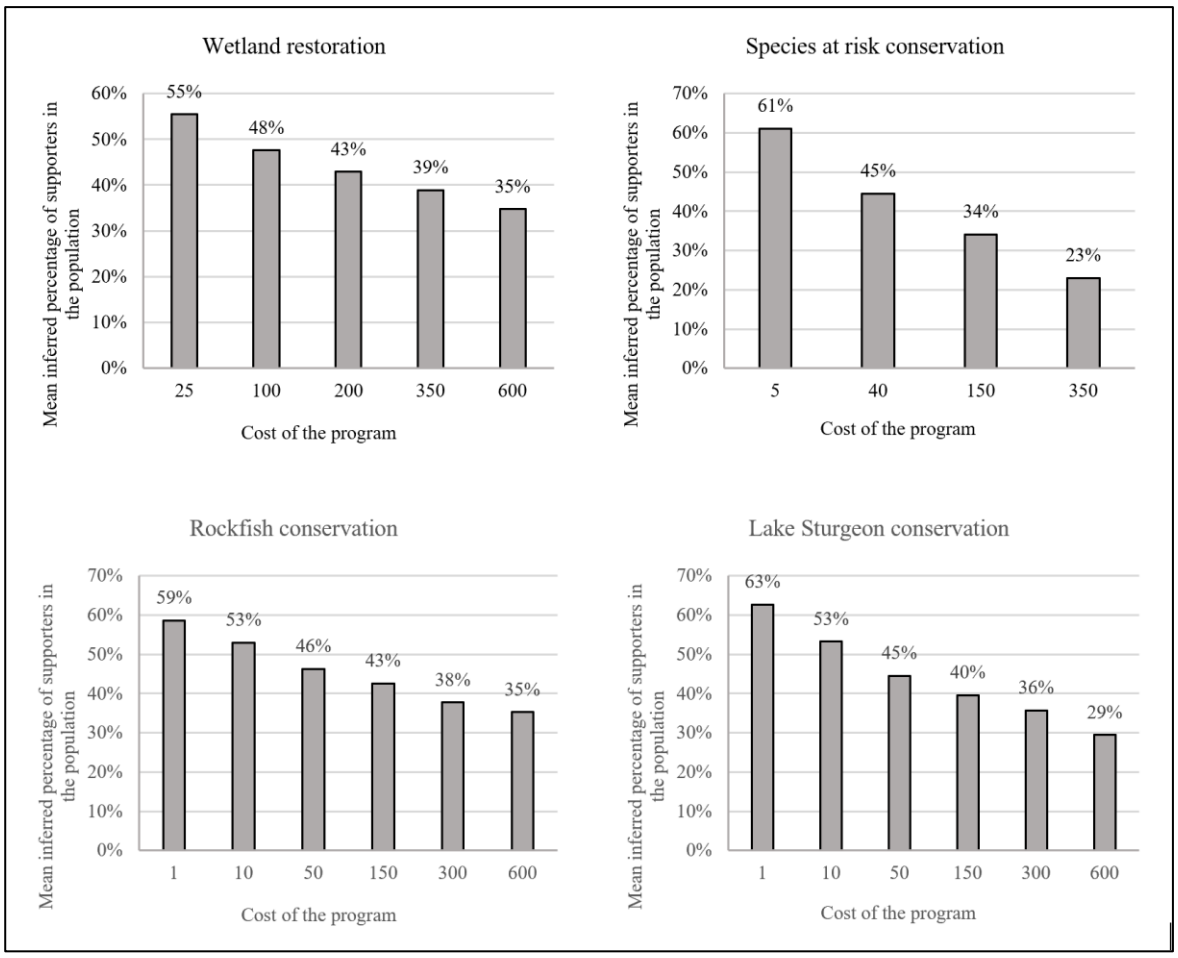


Figure 13. *Mean percentage of the population that respondents believed would vote yes in support of the proposed alternative, in each of the four studies.*

APPENDIX E. NUMBER OF RESPONDENTS PER PROVINCE IN THE ROCKFISH CONSERVATION AND LAKE STURGEON CONSERVATION STUDIES

Table 22. Number and proportion of respondents in the Rockfish and Lake Sturgeon conservation studies per province (after elimination of yeasayers)

Province	Rockfish conservation		Lake sturgeon conservation	
	Number of respondents	Percent	Number of respondents	Percent
Alberta (AB)	120	9.93	117	9.86
British Columbia (BC)	167	13.81	163	13.73
Manitoba (MB)	47	3.89	37	3.12
New Brunswick (NB)	24	1.99	18	1.52
Newfoundland and Labrador (NL)	17	1.41	15	1.26
Nova Scotia (NS)	38	3.14	48	4.04
Ontario (ON)	470	38.88	460	38.75
Prince Edward Island (PE)	5	0.41	5	0.42
Quebec (QC)	293	24.23	286	24.09
Saskatchewan (SK)	28	2.32	38	3.2
Total	1,209	100	1,187	100

Source: *Rockfish recovering* (Forbes et al. 2015) *and Lake Sturgeon recovering studies.*

APPENDIX F. ADDITIONAL ECONOMETRIC ESTIMATIONS

Table 23. Multinomial logit estimation of the probability of respondents' votes to match against the proposed policy (no-no), to switch from yes to no, and to switch from no to yes, relative to a supportive match (yes – yes) across the two questioning methods.

	Wetland restoration			Species at risk conservation			Rockfish conservation			Lake Sturgeon conservation		
	$N_D \rightarrow N_I$	$Y_D \rightarrow N_I$	$N_D \rightarrow Y_I$	$N_D \rightarrow N_I$	$Y_D \rightarrow N_I$	$N_D \rightarrow Y_I$	$N_D \rightarrow N_I$	$Y_D \rightarrow N_I$	$N_D \rightarrow Y_I$	$N_D \rightarrow N_I$	$Y_D \rightarrow N_I$	$N_D \rightarrow Y_I$
Constant	0.189	-0.608**	-0.117	-1.178**	-1.373***	-1.733***	0.277	-0.320	-1.262***	0.083	-1.284***	-1.043***
	(0.295)	(0.303)	(0.410)	(0.542)	(0.500)	(0.626)	(0.247)	(0.261)	(0.289)	(0.241)	(0.280)	(0.303)
Cost (100's)	0.462***	0.254***	0.345***	1.462***	0.965***	1.038***	0.654***	0.189***	0.614***	0.710***	0.234***	0.552***
	(0.022)	(0.023)	(0.027)	(0.166)	(0.160)	(0.184)	(0.050)	(0.055)	(0.053)	(0.051)	(0.055)	(0.055)
Male	0.027	-0.140	0.283**	0.073	-0.687***	0.614*	-0.337***	-0.349***	-0.351**	-0.105	-0.017	0.072
	(0.098)	(0.092)	(0.130)	(0.262)	(0.247)	(0.328)	(0.124)	(0.131)	(0.156)	(0.123)	(0.129)	(0.164)
Age (Years)	-0.004	0.013***	-0.011***	0.001	0.016**	-0.011	-0.013***	0.001	-0.004	-0.006	0.011**	-0.011**
	(0.003)	(0.003)	(0.004)	(0.009)	(0.008)	(0.010)	(0.004)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)
Post secondary education	0.100	0.213**	-0.035	-0.167	-0.058	-0.468	-0.100	0.043	-0.027	-0.075	0.070	-0.139
	(0.105)	(0.098)	(0.136)	(0.315)	(0.298)	(0.372)	(0.129)	(0.135)	(0.158)	(0.126)	(0.134)	(0.167)
High income (above $100,000)	-0.073	-0.003	0.005	0.639**	0.672***	0.457	-0.230	0.188	-0.339*	-0.300*	0.482***	-0.088
	(0.131)	(0.121)	(0.172)	(0.268)	(0.258)	(0.357)	(0.145)	(0.144)	(0.183)	(0.153)	(0.146)	(0.193)
Env. Organization	-0.724***	-0.331*	-0.106	0.165	0.570	0.456	-0.264	0.002	-0.093	-0.623***	-0.231	-0.336
	(0.192)	(0.180)	(0.218)	(0.467)	(0.391)	(0.553)	(0.170)	(0.171)	(0.193)	(0.179)	(0.173)	(0.226)
Wetland acres (100,000's)	-0.065***	-0.035*	-0.102***									
	(0.020)	(0.021)	(0.030)									
Light strategy				0.219	-0.099	0.855***						
				(0.244)	(0.253)	(0.311)						
Moderate strategy				0.315*	-0.089	0.015						
				(0.166)	(0.192)	(0.301)						
Threatened status							0.263***	-0.112	0.474***	-0.389***	0.340***	0.227*
							(0.089)	(0.103)	(0.119)	(0.093)	(0.097)	(0.124)
Special concern status							0.008	-0.177*	-0.026	-0.018	0.253**	0.205*
							(0.086)	(0.098)	(0.120)	(0.086)	(0.105)	(0.117)
Votes		*9,055*			*1,048*			*3,531*			*3,507*	
Loglikelihood		*-11206*			*-1132*			*-4174*			*-4024*	
LRchi2 p-value		*0*			*0*			*0*			*0*	
Pseudo R2		*0.0492*			*0.139*			*0.0963*			*0.109*	

The results are interpreted with respect to the probability of a positive matching vote ($Y_D \rightarrow Y_I$). Votes from yea-sayers and respondents with missing demographic information are excluded.

*Standard errors have been clustered to account for potential correlations across the votes of each respondent. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

Y_D = *Vote in support of the proposed alternative vs. the current situation, stated with the direct question.*

Y_I = *Vote in support of the proposed alternative vs. the current situation, stated with the inferred valuation question*

N_D = *Vote against the proposed alternative in favor of the current situation, stated with the direct question.*

N_I = *Vote against the proposed alternative in favor of the current situation, stated with the inferred valuation question.*

Table 24. Conditional logit models including interactions with one socio-demographic factor at a time, for Wetland restoration study in Manitoba

Variables	Male		Age		High income	
	with ASC only	with ASC and INF	with ASC only	with ASC and INF	with ASC only	with ASC and INF
ASC current situation	-0.735***	-0.778***	-0.600***	-0.177**	-0.747***	-0.743***
	(0.053)	(0.055)	(0.070)	(0.085)	(0.052)	(0.052)
Cost (100s of $)	-0.263***	-0.263***	-0.263***	-0.264***	-0.265***	-0.265***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Wetland acres (100,000's)	0.053***	0.053***	0.053***	0.053***	0.053***	0.053***
	(0.019)	(0.019)	(0.019)	(0.020)	(0.020)	(0.020)
ASC*INF	0.780***	0.869***	0.780***	-0.101	0.801***	0.793***
	(0.067)	(0.073)	(0.067)	(0.119)	(0.068)	(0.070)
Wetland acres *INF	-0.032	-0.032	-0.032	-0.032	-0.032	-0.032
	(0.028)	(0.028)	(0.028)	(0.028)	(0.029)	(0.029)
Male*(ASC)	0.002	0.091**				
	(0.031)	(0.043)				
Male*(ASC)*INF		-0.184***				
		(0.062)				
Age*(ASC)			-0.003***	-0.012***		
			(0.001)	(0.001)		
Age*(ASC)*INF				0.018***		
				(0.002)		
High income*(ASC)					-0.031	-0.054
					(0.043)	(0.059)
High income*(ASC) *INF						0.047
						(0.085)
Observations	9450	9450	9450	9450	9055	9055
LR statistic	8.89		80.08		0.30	
p-value	0.0029		0.0000		0.5830	
AIC	24106.177	24099.284	24098.767	24020.691	23056.633	23058.332
BIC	24157.417	24159.065	24150.007	24080.472	23107.618	23117.813

Standard errors in parenthesis
**** p<0.01, ** p<0.05, * p<0.1*

Table 25. Conditional logit models including interactions with one socio-demographic factor at a time, for Wetland restoration study in Manitoba (continues)

Variables	Education		Env. Organization	
	with ASC only	with ASC and INF	with ASC only	with ASC and INF
ASC current situation	-0.766***	-0.706***	-0.711***	-0.715***
	(0.054)	(0.058)	(0.051)	(0.051)
Cost (100s of $)	-0.263***	-0.263***	-0.264***	-0.264***
	(0.008)	(0.008)	(0.008)	(0.008)
Wetland acres (100,000's)	0.053***	0.053***	0.053***	0.053***
	(0.019)	(0.019)	(0.019)	(0.019)
ASC*INF method	0.780***	0.658***	0.781***	0.789***
	(0.067)	(0.078)	(0.067)	(0.067)
Wetland acres*INF	-0.032	-0.032	-0.032	-0.032
	(0.028)	(0.028)	(0.028)	(0.028)
Male*(ASC)				
Male*(ASC)*INF				
Age*(ASC)				
Age*(ASC)*INF method				
High income*(ASC)				
High income*(ASC)*INF				
Post-secondary education*(ASC)	0.049	-0.045		
	(0.032)	(0.044)		
Post-secondary education*(ASC)*INF		0.194***		
		(0.064)		
Env.org*(ASC)			-0.420***	-0.357***
			(0.064)	(0.092)
Env.org*(ASC)*INF				-0.123
				(0.128)
Observations	9450	9450	9450	9450
LR statistic	9.28		0.92	
p-value	0.0023		0.3365	
AIC	24103.804	24096.527	24063.388	24064.464
BIC	24155.044	24156.307	24114.628	24124.245

Standard errors in parenthesis
**** p<0.01, ** p<0.05, * p<0.1*

Table 26. Conditional logit models including interactions with one socio-demographic factor at a time, for the Species at Risk conservation study in Saskatchewan

Variables	Male		Age		High income	
	with ASC only	with ASC and INF	with ASC only	with ASC and INF	with ASC only	with ASC and INF
ASC current situation	-1.153***	-1.353***	-1.070***	-0.689***	-1.168***	-1.132***
	(0.125)	(0.133)	(0.188)	(0.234)	(0.137)	(0.141)
Cost (100s of $)	-0.741***	-0.748***	-0.740***	-0.743***	-0.750***	-0.749***
	(0.041)	(0.041)	(0.041)	(0.041)	(0.045)	(0.045)
Moder. Strategy	-0.390***	-0.388**	-0.390***	-0.384**	-0.320*	-0.319*
	(0.151)	(0.152)	(0.151)	(0.151)	(0.167)	(0.167)
Light strategy	-0.475***	-0.466***	-0.478***	-0.479***	-0.448***	-0.443***
	(0.151)	(0.152)	(0.151)	(0.152)	(0.170)	(0.170)
ASC*INF	1.042***	1.438***	1.042***	0.248	0.982***	0.909***
	(0.154)	(0.176)	(0.154)	(0.330)	(0.172)	(0.187)
Moderate*INF	0.255	0.244	0.254	0.240	0.196	0.194
	(0.218)	(0.219)	(0.218)	(0.219)	(0.242)	(0.242)
Light*INF	0.649***	0.622***	0.648***	0.650***	0.671***	0.662***
	(0.217)	(0.218)	(0.217)	(0.217)	(0.243)	(0.243)
Male*(ASC)	0.095	0.521***				
	(0.089)	(0.125)				
Male*(ASC)*INF		-0.880***				
		(0.179)				
Age*(ASC)			-0.001	-0.009**		
			(0.003)	(0.004)		
Age*(ASC)*INF				0.017***		
				(0.006)		
High income*(ASC)					0.346***	0.247*
					(0.105)	(0.145)
High income*(ASC)*INF						0.209
						(0.211)
Observations	1296	1296	1296	1296	1048	1048
LR statistic	24.25		7.40		0.99	
p-value	0.0000		0.0065		0.3201	
AIC	2986.736	2964.490	2987.805	2982.408	2406.165	2407.176
BIC	3039.163	3023.470	3040.231	3041.388	2456.892	2464.245

Standard errors in parenthesis
*** p<0.01, ** p<0.05, * p<0.1*

Table 27. Conditional logit models including interactions with one socio-demographic factor at a time, for the Species at Risk conservation study in Saskatchewan (continues)

Variables	Education		Env. Organization	
	with ASC only	with ASC and INF	with ASC only	with ASC and INF
ASC current situation	-1.049***	-0.839***	-1.119***	-1.093***
	(0.148)	(0.170)	(0.119)	(0.120)
Cost (100s of $)	-0.740***	-0.742***	-0.740***	-0.741***
	(0.041)	(0.041)	(0.041)	(0.041)
Moder. Strategy	-0.393***	-0.399***	-0.391***	-0.393***
	(0.151)	(0.151)	(0.151)	(0.151)
Light strategy	-0.475***	-0.468***	-0.476***	-0.482***
	(0.151)	(0.152)	(0.151)	(0.152)
ASC*INF	1.042***	0.605***	1.042***	0.987***
	(0.154)	(0.234)	(0.154)	(0.157)
Moderate*INF	0.255	0.265	0.255	0.259
	(0.218)	(0.218)	(0.218)	(0.218)
Light*INF	0.648***	0.631***	0.648***	0.662***
	(0.217)	(0.217)	(0.217)	(0.217)
Male*(ASC)				
Male*(ASC)*INF				
Age*(ASC)				
Age*(ASC)*INF				
High income*(ASC)				
High income*(ASC)*INF				
Post-secondary education*(ASC)	-0.078	-0.342**		
	(0.111)	(0.154)		
Post-secondary education*(ASC)*INF		0.545**		
		(0.221)		
Env.org*(ASC)			0.074	-0.172
			(0.137)	(0.190)
Env.org*(ASC)*INF				0.522*
				(0.278)
Observations	1296	1296	1296	1296
LR statistic	6.08		3.57	
p-value	0.0137		0.0588	
AIC	2987.388	2983.306	2987.584	2986.012
BIC	3039.814	3042.286	3040.011	3044.992

Standard errors in parenthesis
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 28. Conditional logit models including interactions with one socio-demographic factor at a time, for the Rockfish conservation study in Canada

Variables	Male		Age		High income	
	with ASC only	with ASC and INF	with ASC only	with ASC and INF	with ASC only	with ASC and INF
ASC current situation	-0.505***	-0.515***	-0.132	-0.010	-0.578***	-0.526***
	(0.070)	(0.074)	(0.106)	(0.135)	(0.067)	(0.068)
Cost (100s of $)	-0.355***	-0.355***	-0.355***	-0.355***	-0.355***	-0.355***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Threatened strategy	-0.339***	-0.339***	-0.340***	-0.341***	-0.338***	-0.340***
	(0.087)	(0.087)	(0.087)	(0.087)	(0.087)	(0.087)
Special concern strategy	-0.092	-0.091	-0.092	-0.092	-0.091	-0.090
	(0.087)	(0.087)	(0.087)	(0.087)	(0.086)	(0.087)
ASC*INF method	0.504***	0.524***	0.505***	0.257	0.503***	0.395***
	(0.087)	(0.101)	(0.088)	(0.190)	(0.087)	(0.092)
Threatened*INF method	0.379***	0.379***	0.380***	0.381***	0.379***	0.379***
	(0.123)	(0.123)	(0.123)	(0.123)	(0.123)	(0.123)
Special concern*INF method	0.151	0.151	0.152	0.152	0.151	0.150
	(0.123)	(0.123)	(0.123)	(0.123)	(0.123)	(0.123)
Male*(ASC)	-0.235***	-0.215***				
	(0.050)	(0.071)				
Male*(ASC)*INF		-0.040				
		(0.100)				
Age*(ASC)			-0.010***	-0.013***		
			(0.002)	(0.002)		
Age*(ASC)*INF				0.005		
				(0.003)		
High income*(ASC)					-0.163***	-0.376***
					(0.058)	(0.082)
High income*(ASC)*INF						0.427***
						(0.116)
Observations	3627	3627	3627	3627	3627	3627
LR statistic	0.16		2.16		13.61	
p-value	0.6882		0.1418		0.0002	
AIC	9083.016	9084.855	9071.009	9070.851	9096.825	9085.213
BIC	9143.675	9153.097	9131.668	9139.093	9157.485	9153.455

Standard errors in parenthesis
**** p<0.01, ** p<0.05, * p<0.1*

Table 29. Conditional logit models including interactions with one socio-demographic factor at a time, for the Rockfish conservation study in Canada (continues)

Variables	Education		Env. Organization	
	with ASC only	with ASC and INF	with ASC only	with ASC and INF
ASC current situation	-0.579***	-0.543***	-0.593***	-0.585***
	(0.073)	(0.080)	(0.067)	(0.068)
Cost (100s of $)	-0.356***	-0.356***	-0.359***	-0.359***
	(0.014)	(0.014)	(0.014)	(0.014)
Threatened strategy	-0.341***	-0.341***	-0.331***	-0.331***
	(0.087)	(0.087)	(0.088)	(0.088)
Special concern strategy	-0.090	-0.090	-0.077	-0.078
	(0.087)	(0.087)	(0.087)	(0.087)
ASC*INF method	0.508***	0.436***	0.498***	0.481***
	(0.088)	(0.109)	(0.088)	(0.091)
Threatened*INF method	0.383***	0.384***	0.382***	0.383***
	(0.124)	(0.124)	(0.124)	(0.124)
Special concern*INF method	0.150	0.150	0.131	0.131
	(0.124)	(0.124)	(0.124)	(0.124)
Male*(ASC)				
Male*(ASC)*INF				
Age*(ASC)				
Age*(ASC)*INF				
High income*(ASC)				
High income*(ASC)*INF				
Post-secondary education*(ASC)	-0.079	-0.136*		
	(0.052)	(0.073)		
Post-secondary education*(ASC)*INF		0.116		
		(0.104)		
Env.org*(ASC)			-0.188***	-0.239**
			(0.068)	(0.097)
Env.org*(ASC)*INF				0.102
				(0.137)
Observations	3588	3588	3552	3552
LR statistic	1.23		0.55	
p-value	0.2676		0.4568	
AIC	9002.611	9003.382	8905.606	8907.052
BIC	9063.184	9071.527	8966.098	8975.106

Standard errors in parenthesis
**** p<0.01, ** p<0.05, * p<0.1*

Table 30. Conditional logit models including interactions with one socio-demographic factor at a time, for the Lake Sturgeon conservation study in Canada

Variables	Male		Age		High income	
	with ASC only	with ASC and INF	with ASC only	with ASC and INF	with ASC only	with ASC and INF
ASC current situation	-0.401***	-0.392***	-0.285***	0.064	-0.397***	-0.335***
	(0.070)	(0.075)	(0.108)	(0.137)	(0.067)	(0.069)
Cost (100s of $)	-0.420***	-0.420***	-0.421***	-0.422***	-0.423***	-0.424***
	(0.015)	(0.015)	(0.016)	(0.016)	(0.016)	(0.016)
Threatened strategy	0.352***	0.352***	0.353***	0.355***	0.354***	0.356***
	(0.089)	(0.089)	(0.089)	(0.089)	(0.089)	(0.089)
Special concern strategy	0.055	0.055	0.056	0.056	0.057	0.058
	(0.089)	(0.089)	(0.089)	(0.089)	(0.089)	(0.089)
ASC*INF method	0.403***	0.384***	0.403***	-0.306	0.404***	0.272***
	(0.090)	(0.103)	(0.090)	(0.194)	(0.090)	(0.094)
Threatened*INF method	-0.179	-0.179	-0.179	-0.182	-0.179	-0.182
	(0.126)	(0.126)	(0.126)	(0.126)	(0.126)	(0.127)
Special concern*INF method	-0.080	-0.080	-0.080	-0.080	-0.079	-0.082
	(0.127)	(0.127)	(0.127)	(0.127)	(0.127)	(0.127)
Male*(ASC)	-0.093*	-0.112				
	(0.052)	(0.073)				
Male*(ASC)*INF		0.037				
		(0.103)				
Age*(ASC)			-0.003*	-0.011***		
			(0.002)	(0.003)		
Age*(ASC)*INF				0.015***		
				(0.004)		
High income*(ASC)					-0.214***	-0.482***
					(0.060)	(0.086)
High income*(ASC)*INF						0.540***
						(0.122)
Observations	3561	3561	3561	3561	3561	3561
LR statistic	0.13		17.06		19.79	
p-value	0.7180		0.0000		0.0000	
AIC	8627.452	8629.322	8627.169	8612.113	8618.142	8600.356
BIC	8687.965	8697.398	8687.682	8680.189	8678.655	8668.432

Standard errors in parenthesis
**** p<0.01, ** p<0.05, * p<0.1*

Table 31. Conditional logit models including interactions with one socio-demographic factor at a time, for the Lake Sturgeon conservation study in Canada (continues)

Variables	Education		Env. Organization	
	with ASC only	with ASC and INF	with ASC only	with ASC and INF
ASC current situation	-0.412***	-0.371***	-0.392***	-0.385***
	(0.073)	(0.079)	(0.067)	(0.068)
Cost (100s of $)	-0.419***	-0.419***	-0.420***	-0.421***
	(0.016)	(0.016)	(0.016)	(0.016)
Threatened strategy	0.355***	0.355***	0.345***	0.345***
	(0.089)	(0.089)	(0.090)	(0.090)
Special concern strategy	0.059	0.059	0.062	0.062
	(0.089)	(0.089)	(0.089)	(0.090)
ASC*INF method	0.404***	0.319***	0.401***	0.387***
	(0.090)	(0.110)	(0.090)	(0.093)
Threatened*INF method	-0.180	-0.181	-0.178	-0.179
	(0.127)	(0.127)	(0.127)	(0.127)
Special concern*INF method	-0.080	-0.081	-0.081	-0.081
	(0.127)	(0.127)	(0.128)	(0.128)
Male*(ASC)				
Male*(ASC)*INF				
Age*(ASC)				
Age*(ASC)*INF				
High income*(ASC)				
High income*(ASC)*INF				
Post-secondary education*(ASC)	-0.059	-0.129*		
	(0.053)	(0.074)		
Post-secondary education*(ASC)*INF		0.141		
		(0.105)		
Env.org*(ASC)			-0.404***	-0.447***
			(0.071)	(0.101)
Env.org*(ASC)*INF				0.085
				(0.142)
Observations	3543	3543	3552	3552
LR statistic	1.79		0.36	
p-value	0.1807		0.5466	
AIC	8601.791	8602.000	8507.027	8508.663
BIC	8662.263	8670.031	8567.451	8576.641

Standard errors in parenthesis
**** p<0.01, ** p<0.05, * p<0.1*

APPENDIX G. PROBABILITY OF VOTING YES PER COST LEVEL IN THE TWO NATIONAL STUDIES

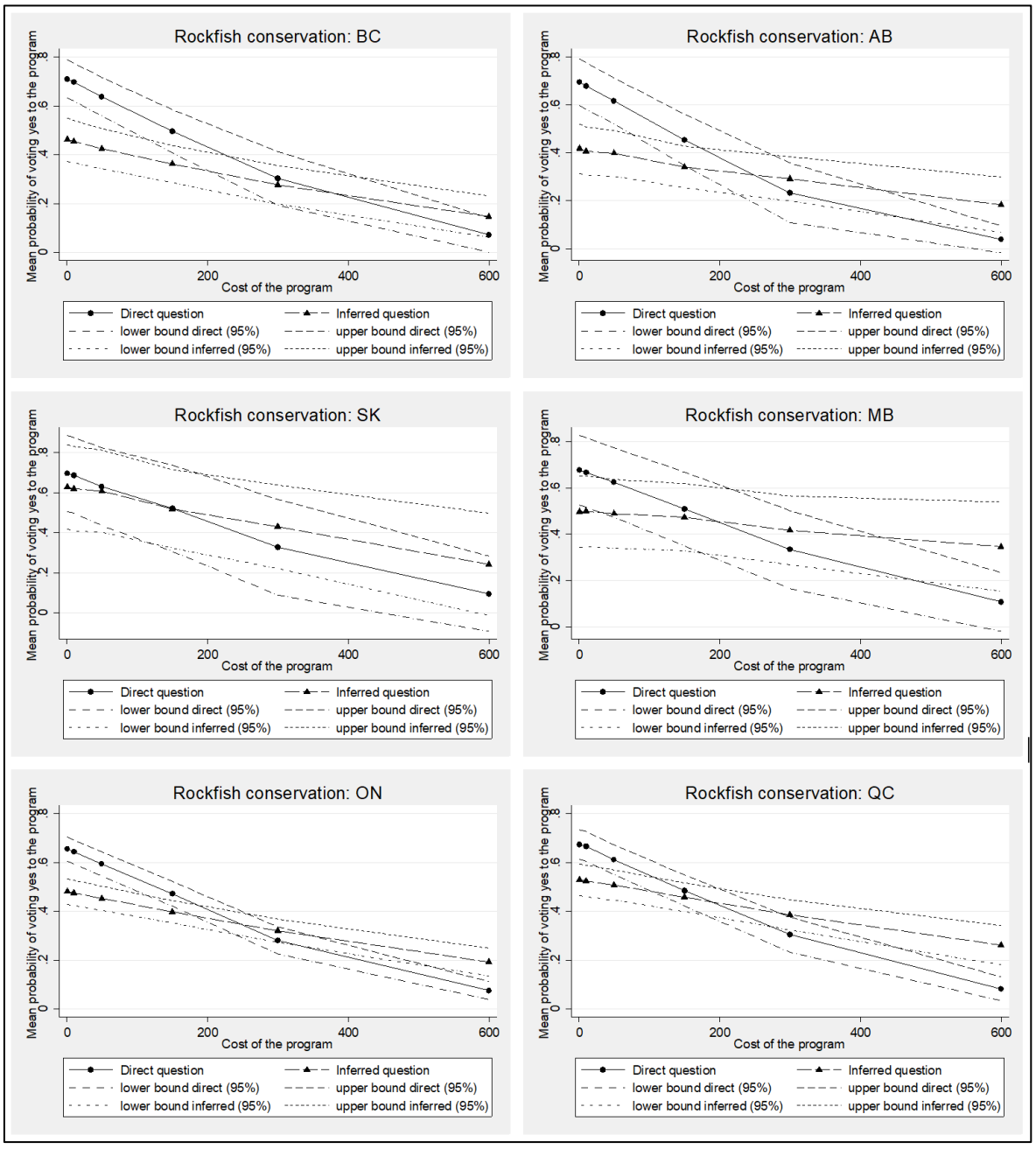


Figure 14. *Mean predicted probability of voting yes with direct and inferred question by cost level, per each province in the Rockfish conservation sample, including 95% confidence intervals.*

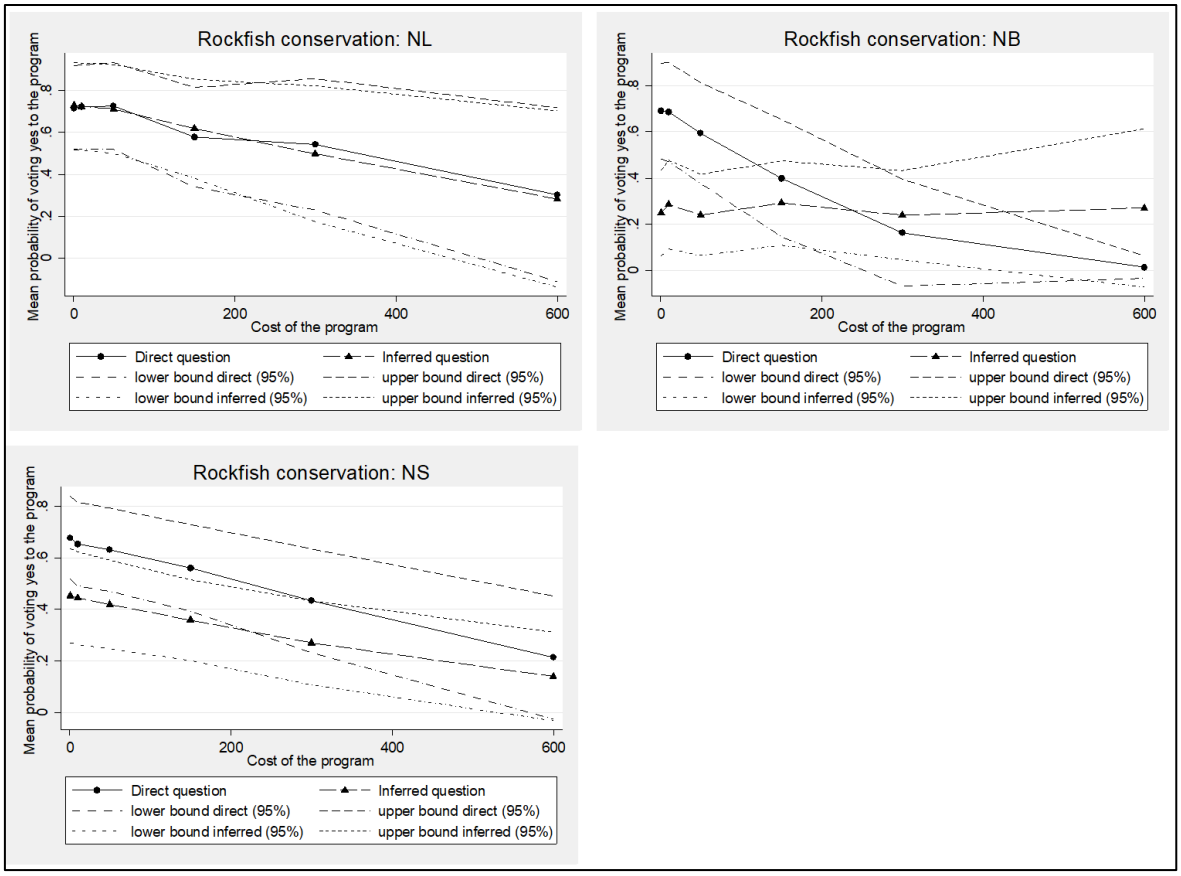


Figure 14. *Mean predicted probability of voting yes with direct and inferred question by cost level, per each province in the Rockfish conservation sample, including 95% confidence intervals (continues).*

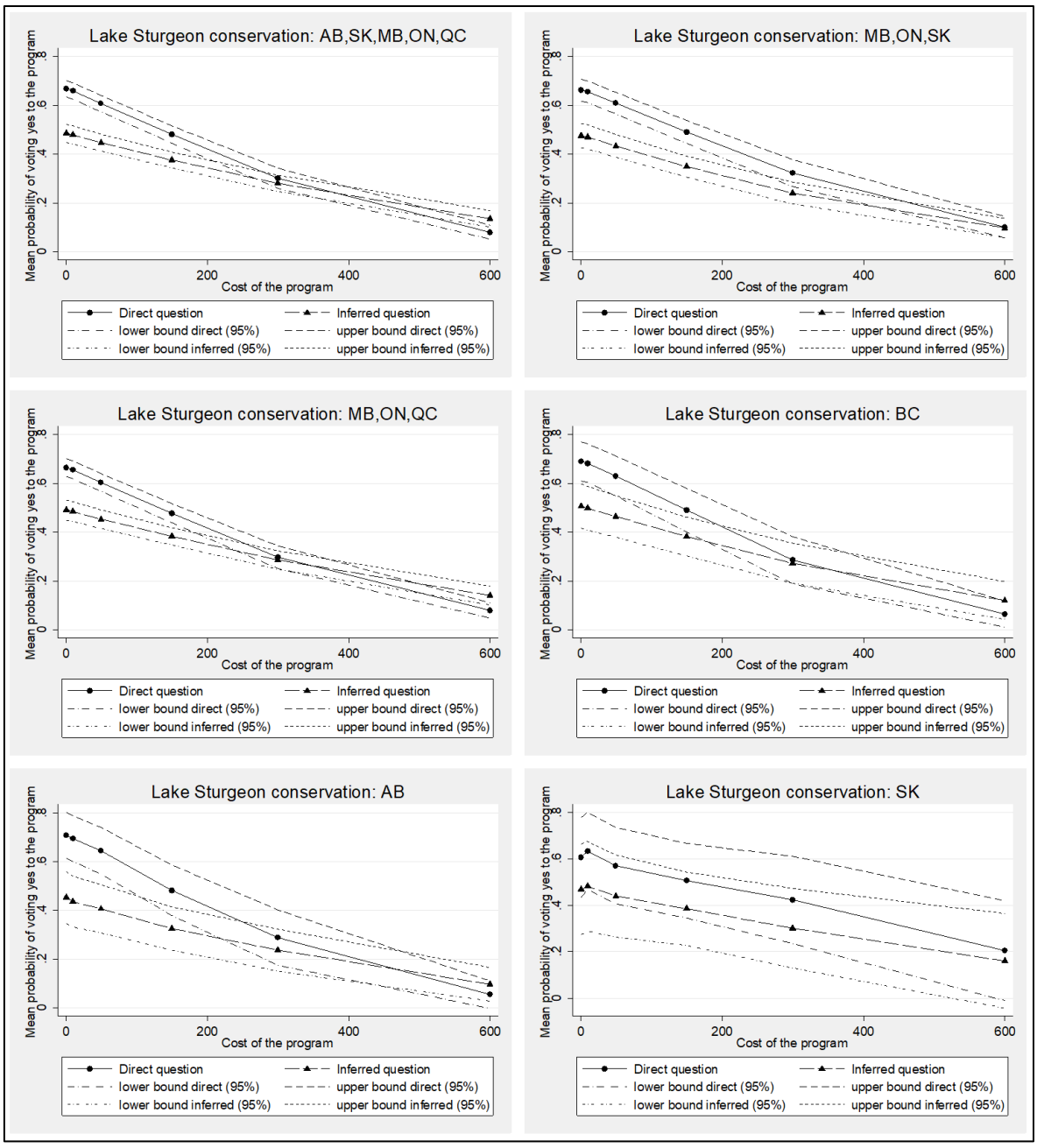


***Figure 15**. Mean predicted probability of voting yes with direct and inferred question by cost level, per each province in the Lake Sturgeon conservation sample, including 95% confidence intervals.*

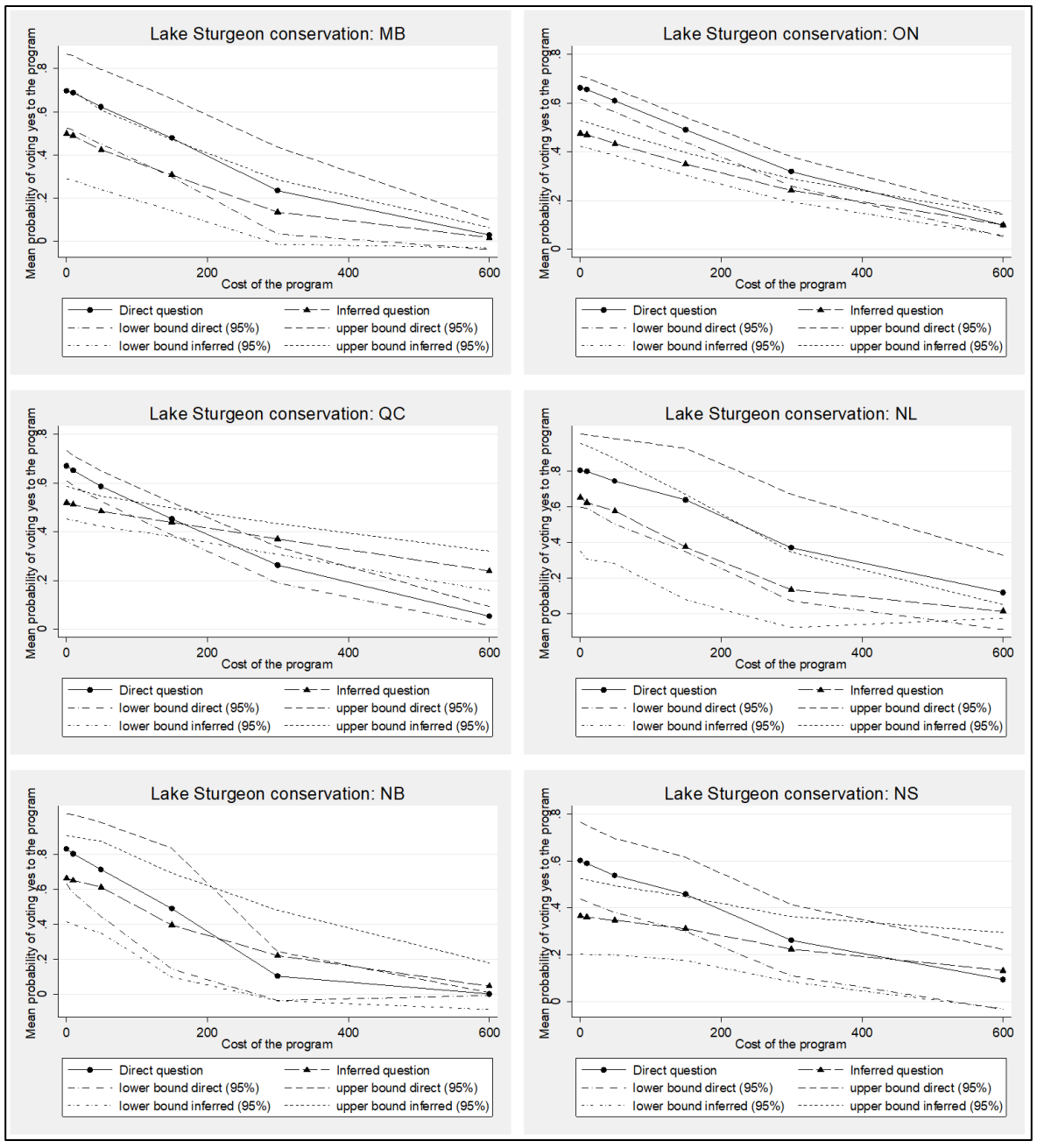


Figure 15. *Mean predicted probability of voting yes with direct and inferred question by cost level, pear each province in the Lake Sturgeon conservation sample, including 95% confidence intervals (continues).*