# Does respondent's perceived knowledge of the status quo affect attribute attendance and WTP in choice experiments? Evidence from the Karapiro Catchment Freshwater streams

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# Does respondent's perceived knowledge of the status quo affect attribute attendance and WTP in choice experiments? Evidence from the Karapiro Catchment Freshwater streams.

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## Abstract

In environmental valuation studies with stated preference methods researchers often provide descriptions of status quo conditions which may differ from those perceived by respondents. Ignoring this difference in utility baselines may affect the way attributes are attended to in choice tasks and further affect the magnitude of utility changes and hence bias the implied estimates of benefits from the proposed environmental policies. We investigate this issue using data from a choice experiment on a community's willingness to pay for water quality improvements in streams. About 60% of respondents perceived the description of the quality of water in streams to be better than the one we provided in our scenario. Our results show some differences in serial attribute non-attendance between respondents who were provided with our baseline description of the status quo and those who used their own perceived baselines. The results further reveal some differences in attribute non-attendance in the two split samples within respondents who used their own descriptions of the status quo conditions. Generally we note that non-attendance to cost was higher in respondents who reported lower levels of water quality than those who perceived water quality to be higher. However, we find mixed results in terms of the willingness to pay for water quality improvements.

**Keywords**: Choice experiments, Fixed status quo, People's perceived status quo, Willingness to pay.

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## 1.0 Introduction

Since their advent by Louviere & Hensher (1982) and Louviere & Woodworth (1983) choice experiments have become the most popular non-market valuation techniques in various disciplines including environmental valuation. Choice experiments is an attribute based technique in which respondents are presented with different alternatives defined in terms of product attributes and are asked to select their preferred one. In making their choices, respondents are assumed to trade-off between all attributes presented to them in a choice task.

On contrary, evidence from a number studies indicate that some respondents do not attend to all attributes in choice tasks, a phenomenon generally referred to as attribute non-attendance (AN-A) (e.g. Hensher *et al.*, 2005a; Carlsson *et al.*, 2008; Hensher & Rose, 2009; Scarpa *et al.*, 2009; Campbell *et al.*, 2010). Failure to attend to all attributes in a choice set signifies a departure from some of the standard economic assumptions that govern how people make choices in the face of several alternatives, more specifically the continuity axiom. As stipulated by Campbell *et al* (2010 p.2), "…without continuity, there is no trade-off between two different attributes. [...] without trade-off, there is no computable marginal rate of substitution and crucially for non-market valuation, no computable relative implicit price." The effects of AN-A on willingness to pay (WTP) have been investigated empirically. Generally, there is a consensus among researchers that AN-A may bias welfare estimates (e.g. Campbell & Lorimer, 2009; Hensher & Rose, 2009; Carlsson *et al.*, 2010).

A number of explanations for AN-A have been provided in the literature including the simplification of choice task complexity, irrelevance of some attributes to some respondents and the possibility of the perceived costs outweighing the benefits of evaluating an attribute (DeShazo & Fermo, 2004; Hensher et al., 2005a; Ryan *et al.*, 2009). Similarly, the effects of social economic covariates on AN-A have been investigated (e.g. Scarpa et al., 2009). However, one area that have received little attention is whether the respondents' prior perceptions of the status quo (SQ) conditions can have implications on how attributes are attended to in choice tasks.

We contribute to the on-going debate on AN-A by investigating the effect of respondents' perceptions of SQ conditions on the subject. Typically, the standard practice in environmental valuation choice experiment literature is to provided respondents with the SQ alternative described based on the average measures of environmental quality plus some other change alternatives (see Hess & Rose, (2009) for a discussion on reference alternatives). This approach however, may be put into question in cases were respondents' perceptions of the SQ conditions differ from the one provided to them.

We use choice experiment data on streams in the Karapiro Catchment to investigate whether respondents' perceptions agree with our chosen description of the SQ alternative (an average measure of stream quality in the catchment), which we provided to them. The work by Cameron *et al* (2007) and Kataria *et al* (2009) represents some of the pioneering work into an investigation of whether respondents believe in scenarios presented to them in choice tasks. We advance this investigation further by asking respondents to state their perceived SQ conditions of streams if they disagreed with our description of the current conditions of streams. Only those respondents who were unable to give their own assessment were given 'the average assessment of the current condition of streams in the catchment', labelled henceforth as *SQ-provided*. Respondents who were able to assess current water quality used their own SQ in the choice experiments, or *SQ-perceived*. We investigate the effect of these two alternative formats for the SQ alternative on attribute attendance and non-attendance. Additionally, using split samples within the *SQ-perceived* group, we investigate the effect of different perceptions of the SQ conditions on AN-A and WTP.

The remainder of the paper is organized as follows. Section 2 gives an outline of the survey and experimental design. The methods used for data analysis are described in section 3. Results and discussions are presented in section 4, and finally, conclusions and implications of the study are presented in section 5.

## 2.0 Survey and experimental design

The study area for this research (the 'Karapiro catchment') stretches over 155,303 hectares and covers the lower part the Upper Waikato catchment from Lake Arapuni to the Karapiro dam including contributing tributaries. Land use is predominantly for dairy (34%), pastoral (13%) and forestry (48%) production. It has already been identified as requiring high priority for nutrient management (Broadnax, 2006). However, much of the area now used for commercial pine forestry could potentially be converted to dairy. The Waikato Regional Council – Environment Waikato (EW) is seriously concerned that recent and planned land use changes in the catchment between Karapiro Dam and Taupo gates will lead to increasing levels of nitrogen and phosphorus in the Waikato River and its tributaries.

The amount of nitrogen and phosphorus reaching waterways in the catchment has generally been increasing and is expected to continue to rise because of intensification and conversion of land from forestry to dairy. Even with good farm management practices it is expected that the streams and rivers in the catchment will support more algae, clarity will fall and ecological health may decline. Levels of Ecoli may also increase.

Four focus groups were held to derive an understanding of people's views on water quality in the catchment and to identify attributes for inclusion in the choice experiment. These sessions were also used to test early versions of the questionnaire and to discuss the appropriate range of values for the payment variable. Procedures for running the focus groups were developed drawing on Krueger (1994) and on more specific New Zealand experience from Bell (2004) and Kerr and Swaffield (2007).

Focus group discussions highlighted the increasing number of fences on farms restricting livestock access to streams and creeks, and hence livestock pollution. This was recognized as an improvement and many participants thought that stream water quality was improving, especially when streams were protected by fenced areas of bush, which create a natural filter. Focus group participants from different areas had different perceptions of the quality of their local streams. For example, while some streams experienced by participants at the Karapiro focus group were perceived as with poor water quality, participants at the Waotu group reported high quality streams with trout the water from which was used as a supply of domestic drinking water. Further details on focus group procedures can be found in Marsh and Baskaran (2009).

Questionnaire development and improvement took place over an extended period. Testing started using focus group participants and was followed by a pilot survey using two groups of six participants and a pre-test of 21 questionnaires. The water attributes identified by focus groups participants were supplemented by literature review and discussions with experts in the field. The attributes eventually selected for the final study were:

- Suitability for swimming (percentage of readings that are satisfactory for swimming)
- Ecology (percentage of excellent readings)
- Native, fish and eels (presence of)
- Trout (presence of)
- Water Clarity (Can you usually see the bottom?)

Suitability for swimming and ecological quality were defined by reference to criteria already defined by EW whereby water is assessed as being suitable for swimming (or not) and ecological health is assessed as being excellent, satisfactory or not satisfactory. The suitability for swimming attribute aligns with the proposed national policy statement for freshwater management that aimed to ensure that appropriate Freshwater Resources reach or exceed a swimmable standard. This attribute is also intended as a 'catch all' that enables respondents to state their preference for water that is safe for all forms of contact recreation (swimming, paddling, fishing, eeling etc).

The ecology attribute aligns with data collected by Environment Waikato (EW) on the ecological health of waterways in the catchment. Based on 100 monitoring sites across the region, EW reports that ecological health readings for undeveloped catchments range from 23% to 100% excellent, but for developed catchments the percentage of excellent readings is between 0 and 25%. The Karapiro catchment falls under the lower Waikato catchment zone where 68% of ecological health readings are reported to be unsatisfactory with only 2% excellent. The ecological health and 'native fish and eels' attributes are assumed to vary together, for example poor water quality results in 'only small eels being found in most catchment streams' while high water quality leads to 'large eels, bullies and smelt being found'.

The ecology of rivers and streams in the catchment has been adversely affected by clearance of forests and riverside vegetation, habitat loss and creation of barriers to fish passage (including dams). Aquatic plants and animals have also been affected by reduced water quality, changes to flow regimes, habitat loss (due to drainage and changes in land use) and introduced species that compete with or eat native fish (Environment Waikato, 2010).

Native fish populations in the Waikato Region are documented in Joy (2005). These species are highly affected by the Waikato dams which prevent fish migration. The population of eels depends on recruitment (which has been falling steadily in recent years) and the number of elvers transported over the hydro dams. Shortfin eels (Anguilla australis) are very tolerant of poor water quality and may even increase with rising levels of N and P. In poor conditions these eels would mainly be 30 to 40 cms in length. If water quality increases (and sufficient numbers are moved over the hydro dams), then the population of longfin eels (Anguilla dieffenbachia) should increase. This species is far less tolerant of poor water quality and can grow to 2 metres in length. Native bullies and smelt should be migratory but landlocked populations exist in Lake Taupo. Numbers of these species may be expected to increase with better water quality.

During the survey respondents were asked for their assessment of the condition of streams in the catchment based on the attributes and levels used for the choice cards. Respondents who indicated that they had 'no idea' of the quality of the streams in the catchment were presented with the SQ defined as 'our assessment of the current overall condition of streams in the catchment' (see Table 1).

Respondents who felt able to make their own assessment of stream quality used their perceived quality assessment as the status quo. In this case attribute levels were entered onto a transparent overlay and placed on top of each page of choice cards to make it easy for respondents to compare their perceived status quo with the alternative levels offered in each choice card. Overall 41% were provided with our description of the SQ conditions and 58% of the respondents used their own perceived SQ condition of water quality. Of the 58%, 21% of respondents reported medium and low levels of attributes only, 14% reported high levels for all attributes and 65% reported a mix of high, medium and low levels of attributes. We hence forth categorize respondents within the *SQ-Perceived* group into two sub-samples depending on the reported attribute levels namely; *SQ-perceived medium-low* and *SQ-perceived high-medium-low*. The latter split sample combines respondents who reported high levels for all attributes and those who reported a mix of high, medium and low attributes. Further details pertaining to the perceived SQ conditions of the streams for respondents' in the *SQ-perceived* group broken down into three geographical strata are presented in Tables A1 and A2.

Attributes, attribute levels and labels used in the survey are defined in Table 1. Choice cards were based on an orthogonal design of 72 choice sets, with each respondent completing six choice tasks.

**Table 1: Attribute Levels and Labels**

| Attribute | Current Situation | Improvement Levels | | |
|---|---|---|---|---|
| Suitability for Swimming *(% of readings rated as satisfactory for swimming)* | | | | |
| | 30% | 50% | 70% | 90% |
| *Variables* | | SWIM50 | SWIM70 | SWIM90 |
| Ecology *(% of readings rated as excellent)* | | | | |
| | <40% | 40-70% | >70% | |
| | Only small eels | Small eels, bullies and smelt | Large eels, bullies and smelt | |
| *Variables* | | ECOM | ECOH | |
| Trout | *No* Trout | Trout *are* found (TROUT) | | |
| Water Clarity | Usually you *cannot* see the bottom | Usually you *can* see the bottom (CLARITY) | | |
| Cost to Household *$ per year for the next 10 years* (COST) | | | | |
| | $0 | $50, $100, $200 | | |

| Labels | |
|---|---|
| ASC | fixed SQ specific constant which is equal to 1 for the SQ and 0 for the other alternatives |
| $\sigma_{\varepsilon}$ | error component capturing the extra variance associated with the experimentally designed alternatives. |
| mlo | denotes attributes pertaining to the *SQ – perceived medium-low* group |
| hml | denotes attributes pertaining to the *SQ – perceived high-medium-low* group |

### 3.0 Methods for inferring attribute non-attendance

Commonly, information on AN-A can either be collected by asking respondents to state the attributes which they did not pay attention to in a choice task or by inferring from the observed choices made. Since in our case no statements on AN-A were collected during the survey we adopt the latter approach. Furthermore, strategies for inferring AN-A have been developed including the use of the coefficient of variation obtained from individual specific means and variances in the random parameter logit model as championed by Hess & Hensher (2010) and the constrained latent class models by Scarpa et al (2009). We employ the latter approach to infer serial AN-A. In this application three types of classes are considered, complete attendance, complete AN-A and AN-A for a single attribute. Since we have a total of eight attributes, a total 10 classes are considered, 1 class each for complete attendance and AN-A, and 8 classes for each of the attributes in the data set. The estimated results from a constrained latent class model for serial AN-A are presented Figure 1. The results were estimated in Nlogit 4.0 software.

### 3.1 Methods for investigating preferences and WTP for stream water quality improvements

We employ a mixed logit specification that combines both the random parameter and error component interpretation. This specification is considered to be the most appropriate when the SQ alternative is included in the choice sets. Within this modelling framework, the SQ effect on the systematic component of utility can be measured by the ASC, while the effect on the stochastic component of utility can be captured by introducing a common error component shared by the utilities associated with alternatives different from the SQ, which takes account of the correlation patterns and increased error variance due to the conjectural nature of the experimentally designed alternatives (Scarpa *et al.*, 2005; Scarpa *et al.*, 2007; Hess & Rose, 2009; Hu *et al.*, 2009).

In the case of this study, the choice tasks consisted of two experimentally designed alternatives and the SQ alternative. We therefore, define the following utility structure:

$$U(a_1) = \bar{\beta} x_{a1} + \varepsilon + \mu_{a1} \quad (1)$$

$$U(a_2) = \bar{\beta} x_{a2} + \varepsilon + \mu_{a2} \quad (2)$$

$$U(sq) = \beta x_{sq} + \mu_{sq} \quad (3)$$

Where $\tilde{\beta}$ denotes the random preference parameters for different water quality attributes used in this study; $\beta_{sq}$ is a fixed SQ specific constant which in our case takes a value of 1 for the SQ and 0 for the other alternatives; $x$ is a vector of attributes describing the alternatives as well as selected respondents' characteristics; $\mu_{a1}$, $\mu_{a2}$ and $\mu_{sq}$ depict the unobserved component of utility and are assumed to be i.i.d. Gumbel-distributed. Instead, the error component $\varepsilon$ is distributed $N(0,\sigma^2)$. The $\sigma^2$ adds to the Gumbel variance of $\mu_{a1}$ and $\mu_{a2}$.

Assuming a balanced panel of discrete choices, with *T* choices made by each individual *n*, the joint probability of a sequence of choices $(y_1, y_2, \ldots, y_T)$ made by an individual is given by:

$$P(y_1, y_2, \ldots, y_T) = \int_\beta \int_\varepsilon \prod_{t=1}^{T} \frac{\exp(\tilde{\beta} x_{ti} + \varepsilon_i)}{\sum_{j=a1,a2,sq} \exp(\tilde{\beta} x_{tj} + \varepsilon_j)} \varphi(\varepsilon|\sigma^2) f(\beta|\theta)\, dtdt \qquad (4)$$

Where $\varepsilon_j$ is equal to zero when $j = sq$.

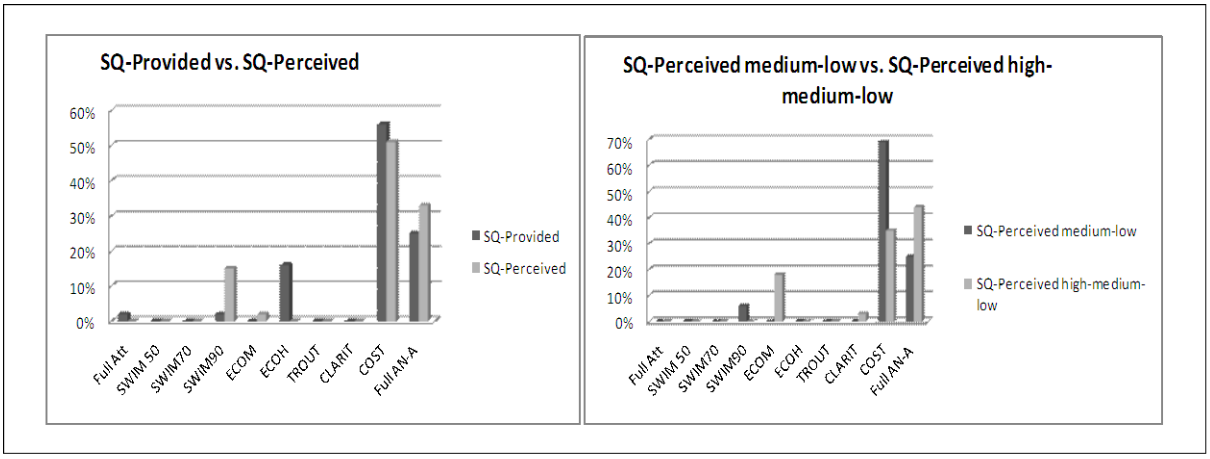
Since the integral in equation (4) has no closed-form, it is approximated in the log-likelihood function by numerical simulation, in our case by using quasi-random Halton draws (Hensher *et al.*, 2005b; Train, 1998).

## 4.0 Estimation results

*Attribute Non-Attendance and the effect of respondents' prior perception of the SQ conditions on the probability of AN-A.*

The number of respondents who reported serial AN-A for the *SQ-Provided group* (darker shade) and *SQ-Perceived group* (light shade) are provided in Figure 1. In general, lower and medium levels of the swimming attributes (SWIM50 and SWIM70 respectively), trout and clarity attributes were well attended to by both groups of respondents. However, there are some substantial differences in the two treatments in term of non-attendance. For instance, while high suitability for swimming (SWIM90) was ignored in up to 15% of the respondents in the *SQ-Perceived group*, it was ignored by only about 2% of respondents in the *SQ-Provided group*.

**Figure 1: Serial Attribute Non-Attendance (AN-A)**




The attribute for high ecological conditions (ECOH) is serially not attended to by up to 16% of respondents from the *SQ-Provided group* while it's almost zero in the case of the *SQ-Perceived group*. Results further reveal that the probability of not attending to the cost attribute is slightly higher in the *SQ-Provided group* than their counterpart. In general, the cost attribute is the most ignored but this is not surprising since results from a number of other hypothetical choice data studies indicate the same. This might be taken as an indication of either people preferring better water quality irrespective of the cost or a protest against paying for better water quality.

We cannot ascertain whether AN-A in this study was due the simplification of choice task complexity or irrelevance of some attributes to some respondents or to other possible reasons stated in the literature. We can, however, draw some inferences on the link between the probability of AN-A and the reported SQ conditions using split samples within the *SQ-Perceived group*. Inferences on serial AN-A between respondents who reported medium and low attribute levels of water quality (SQ-Perceived medium-low) and those who reported a mixture of high, medium and low attribute levels (SQ-Perceived high-medium-low) are presented in Figure 1 above (right panel). Results demonstrate some substantial differences in non-attendance to medium ecology (ECOM) and cost attributes. The ecology medium is ignored in up to about 18% of respondents in the SQ-Perceived high-medium-low group while non-attendance to this attribute is almost zero in the case of their counterparts. On the other hand, 69% of respondents who reported medium and low attributes levels of water quality ignored the cost attribute compared to 35% in the case of those who reported that at least one attribute was high. We attribute high non-attendance to cost in the former group to the fact that since in general water quality was perceived to be lower, this group of respondents might have preferred water quality improvements regardless of the cost. However, this might also taken as an indication that respondents in this group were not willing to pay for the proposed improvements in water quality. The results also further reveal that the percentage of respondents not fully attending to all attributes in their choice sets is higher in respondents who reported that at least one attribute was high than their counterpart. This can be attributes to the fact that some attributes might have been irrelevant to some individual especially those who reported high attribute levels only.

*Preferences and WTP for stream water quality improvements: SQ-perceived medium-low vs. SQ-perceived high-medium-low groups*

The effects of providing the status quo description of streams versus the use of respondents' perceptions on WTP for water quality improvements using this data set have already been investigated in the work by Marsh *et al* (2010). In this application, we investigate whether differences in the perceived knowledge of the SQ conditions of streams could have an impact on the preferences and WTP using two split samples within the *SQ-perceived group.* The estimated results based upon the random parameter error component model are presented in Table 2. Models 1 consist of respondents who reported medium and low attributes of water quality (*SQ-perceived medium-low*) while Model 2 consist of respondents who reported that at least one attribute was high (*SQ-perceived high-medium-low*).

The models were estimated in NLOGIT 4.0 by maximum simulated likelihood using 350 Halton draws. The random parameters were assumed to be independent and normally distributed, except for the cost attribute which was assumed to follow a triangular distribution constrained to have the scale parameter equal to the median. Such distribution was used for the cost parameter so as to ensure non-negative willingness to pay values (Hensher et al., 2005b). Attributes with parameters which were repeatedly found to show insignificant standard deviation estimates were eventually specified as non-random.

Both models show estimates of utility weights with the expected signs for all attributes. The alternative specific constant (ASC) is negative and insignificant in Model 1 implying, preference for a change from the status quo, while it is positive and significant at 5% level Model 2. The positive ASC reveals that respondents in this category are inclined to remain with the status quo. Since the SQ alternative in model 2 was better than that of Model 1 the bias towards the status quo might be taken as a confirmation of the loss aversion hypothesis by Kahneman & Tversky (1979).

In terms of preferences for water quality, results indicate that all water quality attributes are highly significant at the 1% level in Model 2. On the other hand, the results indicate that respondents who reported medium and low level attributes only (Model 1) have very strong preferences for water quality that is suitable for swimming (SWIM 70, SWIM90) and where trout is found. The clarity and ecology attributes are insignificant in this model. In addition, while clarity and trout attributes are random in model 2 these attributes are fixed in model 1. The COST attribute is negative and highly significant in both models, in accordance with expectations.

The variance of the error component in both models is highly significant indicating that the inclusion of the SQ alternative had a significant effect on the stochastic component of the utility structure of the experimentally designed alternatives. The total variance associated with the unobserved component of utility pertaining to experimentally designed alternatives in Model 1 is given by $2.54^2 + \pi^2/6 \approx 8.09$; where $\pi^2/6 \approx 1.645$ is the Gumbel error variance. Similarly, the total variance in Model 2 is equal 13.62. These results demonstrate that respondents in the *SQ-perceived high-medium-low* group seem to have had relatively high valuation errors compared to their counterparts in Model 1.

**Table 2 Estimated Results**

| | Model 1 | | Model 2 | |
|---|---|---|---|---|
| | *SQ-Perceived Medium-low* | | *SQ-Perceived High-medium-low* | |
| *Variable* | *Coefficient* | \|*t-value*\| | *Coefficient* | \|*t-value*\| |
| *Fixed Parameters* | | | | |
| ASC | -0.56 | 0.80 | 0.97 | 2.36 |
| SWIM50 | 0.76 | 2.04 | 0.45 | 2.03 |
| SWIM70 | 1.33 | 3.20 | 0.81 | 3.33 |
| ECOM | 0.13 | 0.39 | 1.07 | 5.25 |
| TROUT | 0.96 | 2.99 | | |
| CLARITY | 0.48 | 1.53 | | |
| *Random Parameters* | | | | |
| SWIM90 | 1.89 | 2.95 | 1.17 | 4.30 |
| ECOH | 0.61 | 1.26 | 1.36 | 5.51 |
| TROUT | | | 1.13 | 4.50 |
| CLARITY | | | 0.96 | 4.60 |
| COST | -0.016 | 3.99 | -0.018 | 6.97 |
| *Error Component* | | | | |
| $\sigma_\varepsilon$ | 2.54 | 4.15 | 3.46 | 6.67 |
| *Summary Statistics* | | | | |
| Log L | | -290.03 | | -557.36 |
| AIC | | 1.415 | | 1.176 |
| BIC | | 1.420 | | 1.246 |
| $R^2$ (McFadden) | | 0.397 | | 0.478 |
| N (Observations) | | 264 | | 972 |

Further comparison is made between the respondents' WTP for water quality improvements in the two models. The simulated population mean and median WTP values for the different attributes are presented in Table 3 below, as derived from the estimated random parameter models. Population moments were simulated in R-Console using 50,000 random draws to obtain WTP distributions for each non-monetary attribute in the two models.

**Table 3: Mean and Median WTP Values in NZ$/Year**

| | Model 1 | | Model 2 | | |
|---|---|---|---|---|---|
| | *SQ-Perceived Medium-low* | | *SQ-Perceived High-medium-low* | | |
| *Attribute* | *Median* | *Mean* | *Median* | *Mean* | *d-statistic* |
| SWIM50 | 57.70 | 80.25 | 25.14 | 34.9 | 0.6302*** |
| SWIM70 | 90.06 | 125.52 | 41.15 | 57.18 | 0.5296*** |
| SWIM90 | 130.65 | 182.20 | 65.82 | 91.49 | 0.2841*** |
| ECOM | 14.27 | 20.09 | 61.52 | 85.34 | 0.6493*** |
| ECOH | 40.15 | 56.24 | 73.56 | 102.33 | 0.2684*** |
| TROUT | 62.04 | 86.0 | 58.12 | 80.84 | 0.3139*** |
| CLARITY | 34.81 | 48.59 | 53.46 | 74.33 | 0.2553*** |

*** denotes significance at P<0.001

The results reveal that respondents who reported medium and low attributes levels have higher mean and median WTP values for water quality that is suitable for swimming and for presence of trout than their counterparts in model 2. Whereas, the mean and median WTP for ecology and clarity attributes is generally higher for respondents in Model 2 than respondents in Model 1. The median WTP values are less than the mean WTP values in both models for all attributes indicating that the distributions are highly skewed upwards. In general the differences in WTP values between the two treatments appear to be quite substantial.

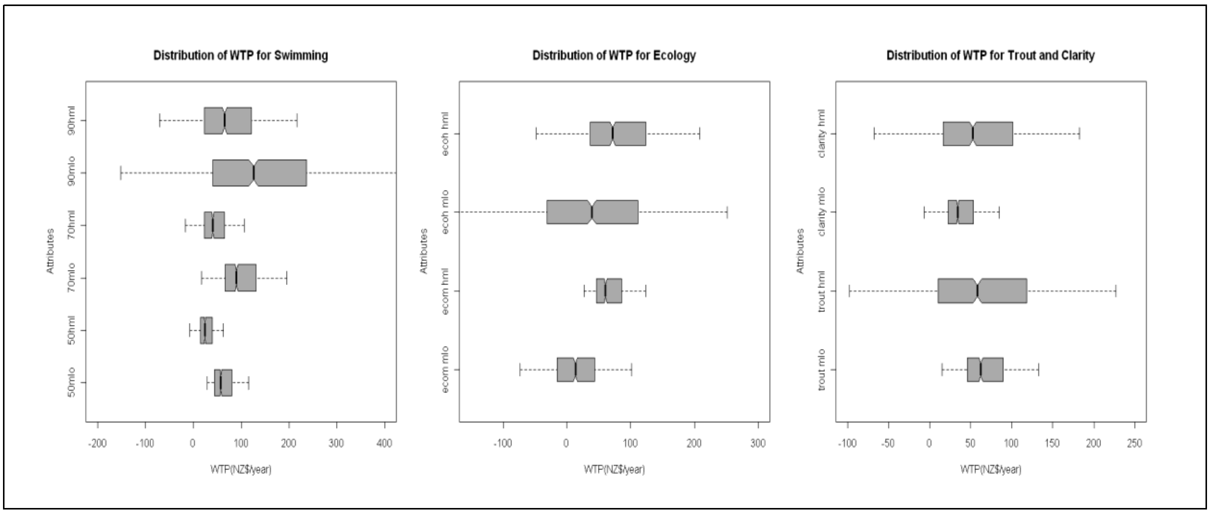
The Kolmogorov-Smirnov test (*d-statistic*) is used to test if the distributions of WTP values from the two models are statistically different from each other. The hypothesis of equal distribution in WTP values is rejected for all attributes at less than 1% significance level.

Although, the study results have shown that the distributions of WTP values between the two treatments are significantly different from each other, Poe et al. (1994, p. 911) states that:

> "Differences in estimated WTP distributions do not necessarily imply that the means derived from these distributions are different. For instance, it is possible that two significantly different distributions can cross and have identical means."

To graphically explore the differences in the simulated measures of central tendency between the two treatments, the quartiles of the distributions of WTP are compared using box plots see Tukey (1977) and reported in Figures 2. The box plots display the upper and the lower limits of the cumulative distributions, and the inter-quartile range showing the first quartile, the median and the third quartile. Given that, the distributions of WTP are highly skewed, the median is used as a basis of comparison as opposed to the mean, since the latter can be influenced by extreme values. Specifically, the notches in the box plots signify the 95% confidence interval for the median. According to Chambers *et al.* (1983), if the notches do not overlap, the null hypothesis of equal medians is rejected.

**Figure 2 Box Plots showing the Quartile Distribution of WTP for Models 1 and 2**




Inspection of the box plots demonstrate that the notches do not overlap in any stream water quality attributes except for the trout attribute in which the hypothesis of equal medians cannot be rejected. The median WTP for ecology and clarity is higher in respondents who reported that at least one attribute was high than those who reported medium and low attributes levels for the SQ conditions, while the median WTP for all the SWIM attributes is higher in the latter group than the former.

## 5 Conclusion and implications of the study

The main objective of this research was to assess the effect of respondents' prior knowledge of the SQ conditions of streams on attribute attendance and WTP for stream water quality improvements. The study revealed that about 58% of respondents had their own perceived baseline condition of water quality and that they could map it into the framework of attributes and levels proposed in the survey. On the other hand, 41% of respondents were provided with a SQ description by researchers because these respondents either had little or no prior knowledge of the prevailing conditions of water quality in streams or they had this knowledge but could not map it into the proposed framework. Of the 58% of respondents who had their own perceived baseline conditions, about 21% reported medium and low levels of attributes only, 14% reported high levels for all attributes and 65% reported a mixture of high, medium and low attribute levels. Our objectives in this paper were two fold; Firstly to investigate the nature of attribute attendance and AN-A between respondents who were provided with the SQ description of the baseline and those that had their own descriptions. In line with this objective the results from this study reveal that non-attendance to the cost attribute was substantially higher in respondents who were provided with the description of the baseline conditions of water quality than their counterpart. While non-attendance to the cost attribute might be taken as indication of preference for water quality improvements regardless of the cost, it might as well signify that respondents in the SQ-Provided group were less interested in paying for water quality improvements. Findings from a study by Marsh et al (2010) in which respondents in this category revealed lower WTP for all attributes than their counterpart might be considered as supportive evidence to validate this claim. The results also indicate some differences in non-attendance to the high suitability for swimming and high ecology attributes between the two groups.

The second objective was to investigate the effect of respondents' prior perceptions of the baseline conditions of water quality in the *SQ-Perceived group* on AN-A and WTP. In terms of AN-A, the results showed some marked differences in the likelihood of attending to the ecology medium and cost attributes. While respondents who reported that at least one attribute was high were less likely to attend to the ecology medium attribute, they were more likely to attend to the cost attribute. On the other hand, respondents who reported medium and low levels of water quality for all attributes were, more likely to attend to the ecology medium attribute but more likely to ignore the cost attribute. With the exception of the ecology medium and the cost attribute all other attributes were well attended to by both groups of respondents.

There are also some observed differences in WTP between respondents in the *SQ-perceived medium-low group* and *SQ-perceived high-medium-low group*. In the latter group of respondents the perceived quality of the SQ conditions of streams was higher than the one in the former group. Economic theory suggests that marginal WTP should be proportional to the expected improvement and this in turn depends on individual perceptions in each group. In principle then for the *SQ-perceived high-medium-low group* the expected improvement would be perceived as smaller, and so would the associated marginal WTP when compared to that held by the *SQ-perceived medium-low group*. However, this holds only for the WTP for the suitability for swimming attributes in which the median WTP in the *SQ-perceived* *medium-low group* is higher than that of their counterpart. For the ecology and clarity attributes the median WTP is higher in the *SQ-perceived high-medium-low group* than that of the *SQ-perceived medium-low group*. The median WTP for trout is the same in the two groups.

The present study demonstrates the effects of respondents' perceptions of status quo conditions. Our results reveal that respondents' perceptions of the status quo conditions might have implications on the way attributes are attended to in choice tasks as well as welfare estimates.

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**Table A1: Household assessment of the Condition of Streams, Creeks and Small Rivers in the Karapiro catchment – swimming and clarity**

*(including only those able to respond)*

| | Tokoroa | | Put/Tirau | | Rural | | All | |
|---|---|---|---|---|---|---|---|---|
| **Suitability for Swimming** | | | | | | | | |
| High (90%) | 8 | 20% | 11 | 31% | 16 | 33% | 35 | 28% |
| Medium (30-90%) | 13 | 32% | 14 | 39% | 21 | 43% | 48 | 38% |
| Low (30% or less) | 20 | 49% | 11 | 31% | 12 | 24% | 43 | 34% |
| Total | 41 | | 36 | | 49 | | 126 | 100% |
| **Clarity – Able to see the bottom** | | | | | | | | |
| Usually yes | 27 | 60% | 23 | 58% | 33 | 63% | 83 | 61% |
| Usually no | 18 | 40% | 17 | 43% | 19 | 37% | 54 | 39% |
| Total | 45 | | 40 | | 52 | | 137 | 100% |

**Table A2: Household assessment of the Condition of Lakes and Streams in the Karapiro catchment – Ecology, Fish/eels, Trout**

*(including only those able to respond)*

| | Tokoroa | | Put/Tirau | | Rural | | All | |
|---|---|---|---|---|---|---|---|---|
| **Ecology** | | | | | | | | |
| High (70% or more) | 5 | 14% | 10 | 33% | 16 | 36% | 31 | 28% |
| Medium (40-70%) | 15 | 41% | 11 | 37% | 19 | 43% | 45 | 41% |
| Low (40% or less) | 17 | 46% | 9 | 30% | 9 | 20% | 35 | 32% |
| Total | 37 | | 30 | | 44 | | 111 | 101% |
| **Fish/eels** | | | | | | | | |
| Large eels, bullies and smelt found | 12 | 41% | 10 | 34% | 19 | 48% | 41 | 42% |
| Small eels, bullies and smelt found | 7 | 24% | 12 | 41% | 14 | 35% | 33 | 34% |
| Only small eels found | 10 | 34% | 7 | 24% | 7 | 18% | 24 | 24% |
| Total | 29 | | 29 | | 40 | | 98 | 100% |
| **Trout** | | | | | | | | |
| Trout are present | 10 | 28% | 11 | 33% | 9 | 23% | 30 | 28% |
| Trout are absent | 26 | 72% | 22 | 67% | 30 | 77% | 78 | 72% |
| Total | 36 | | 33 | | 39 | | 108 | 100% |