Extending the Validity Assessment in Contingent Valuation Studies - Incorporating Social Psychological Variables in a Structural Model

Dugstad, A. [a]

[a] *School of Economics and Business, Norwegian University of Life Sciences (NMBU), Ås Norway*

Abstract

The contingent valuation method is utilized to determine the consumer surplus among Atlantic salmon anglers in the Verdal River in Norway. Structural equation modelling (SEM) and the social psychological latent constructs of place attachment, leisure motivation and catch-and-release attitudes are used to extend the assessment of construct validity in a contingent valuation study and to assess the convergent validity of using consumer surplus as an observable measure of leisure satisfaction. SEM has previously not been used in contingent valuation studies. The literature argues that determining and incorporating latent constructs simultaneously in structural models leads to efficiency, while using attitudinal items to explain latent constructs could lead to endogeneity bias. Thus, SEM can improve the efficiency of the results and prevent endogeneity bias.

In compliance with social psychological theory, the study finds that consumer surplus increases significantly with place dependency and positive catch-and-release attitudes. The results strengthen the convergent validity of using consumer surplus as a measure for leisure satisfaction. Social psychological constructs allow economists to understand more about individuals' behavior and choices. The paper thus recommends using SEM to incorporate latent constructs in structural models in contingent valuation studies. This is useful to assess the construct validity of elicited values.

Keywords: Contingent valuation, Validity, Structural Equation Modelling, Consumer Surplus, Leisure Satisfaction, Place attachment

Abbreviations

Catch-and-release – C&R, Confirmatory factor analysis – CFA; Consumer surplus – CS; Contingent valuation – CV; Structural equation modelling – SEM; Willingness-to-pay – WT

1. Introduction

The Contingent Valuation (CV) method, along with the Travel Cost (TC) method[1], can be used to determine individuals' consumer surplus (CS) of performing a leisure activity, such as recreational salmon angling (Navrud & Mungatana, 1994).[2] The CV method elicits individuals' willingness to pay for a marginal change in environmental goods and ecosystem services (Freeman et al., 2014).

Validity assessment in CV studies is necessary (Johnston et al., 2017). There are three validity frameworks in CV studies: construct, content and criterion validity. The study discusses and extends construct validity assessment in CV studies. Construct validity examines whether results and prior expectations coincide (Johnston et al., 2017). It further consist of convergent validity, where one evaluates whether two measures represent the same construct (Mitchell & Carson, 1989).

The study contributes to extend the validity assessment in Contingent valuation (CV) studies by utilizing social psychological theory. The first objective of the study is to evaluate the convergent validity of using CS as a measure of leisure satisfaction. Within social psychology, several studies address the relationship between social psychological constructs and leisure satisfaction, where satisfaction is an unobservable latent construct (See Chen et al., 2013; Lee, 2009; Yuksel et al., 2010; Yoon & Uysal, 2003; Hwang et al., 2005; Prayag & Ryan, 2012). However, CS of a recreational activity can be defined as an economic measure of experience satisfaction of 'purchasing' the respective activity (Marshall 2009, p:103)[3].

The convergent validity of using CS as a measure of leisure satisfaction is closely related to construct validity in CV studies, where one assesses whether results of a CV study are consistent with economic theory (Johnston et al., 2017). Intuitively, individuals' characteristics and preferences should affect CS according to economic theory. We further argue that if relations between CS and social psychological constructs coincide with social psychological theory, it indicates convergent validity of using CS as a measure of leisure satisfaction.

The second objective of the study is to extend the assessment of construct validity in CV studies. Environmental economists have in general used socioeconomic variables and attitudinal questions to explain individuals' characteristics and behavior (Hailu et al., 2005, Hess and Beharry-Borg, 2012; Boxall & Mcfarlane, 2005; Stensland, 2010). However, understanding individuals' beliefs and understanding of changes in an environmental good are becoming more important among environmental economists (Hoyos et al., 2015). Heberlein et al. (2005) argues that if individuals have well-formed attitudes toward an environmental good, their elicited WTP values are more likely to be valid.

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[1] A revealed preference method.

[2] The CS of recreational salmon angling is defined as the difference between a choke price and an angler's actual fishing expenditures (Navrud, 2001)

[3] Marshall (2009, p:103) defined CS as: "[the individual] derives from a purchase a surplus of satisfaction. The excess of the price which he would be willing to pay rather than go without the thing, over that which he actually does pay, is the economic measure of this surplus of satisfaction. It may be called consumer's surplus."

However, attitudinal items have been interpreted as latent variables (Hess & Beharry-Borg, 2012). This is problematic as such attitudinal items are not separately explaining a latent construct, but only combined. Additionally, only including attitudinal items in structural models could lead to endogeneity bias, as the items could be correlated with unobserved factors in the error term (Hess & Beharry-Borg, 2012; Hoyos et al., 2015). Structural equation modelling (SEM) can be used to define and incorporate latent variables in structural models simultaneously. In comparison, a sequential model where one estimate latent variables for then to be incorporated in structural models is less efficient (Hess & Beharry-Borg, 2012).

Social psychological latent variables are useful to understand individuals' choices, attitudes and behavior toward an environmental good (Hailu et al., 2005; Chen et al., 2013; Smith & Moore, 2012). Inclusion of social psychological variables in structural models can be used to extend the assessment of the construct validity of a CV study. The relationship between the social psychological variables and leisure satisfaction, measured as CS, should coincide with social psychological theory. Additionally, incorporating social psychological variables using SEM could prevent a potential endogeneity bias of using attitudinal items as latent constructs.

The study evaluates the relationship between CS of recreational wild Atlantic salmon (Salmo salar) angling and the social psychological variables of place attachment, leisure motivation and positive C&R attitudes. The study utilizes SEM to simultaneously determine and include social psychological latent variables in structural models. SEM has previously not been utilized in CV studies and thus this is an important contribution.

Social psychological theory suggests that place attachment, which describes individuals' bond with an environment, increases the satisfaction level of a recreational activity (Hwang et al., 2005; Prayag & Ryan, 2012; Yuksel et al., 2010; Hailu et al., 2005; Ramkissoon et al., 2013). Further, social psychological theory suggests that experience satisfaction is increasing with leisure motivation (Yoon & Uysal, 2005; Chen et al., 2013; Ryan & Deci, 2002; Iso-Ahola, 1982) and that positive catch-and-release (C&R) behavior increases the experience satisfaction of recreational angling (Sutton & Ditton, 2001).

A CV survey was used to determine CS among salmon anglers in the Verdal River, located in the middle of Norway. Structural equation modeling (SEM) was then used to determine and evaluate how the latent constructs and standard economic variables affect CS. Results indicate that social psychological variables can improve and extend the assessment of construct validity in a CV study. Resultantly, the convergent validity of using CS as a measure of leisure satisfaction is strong.

The paper is structured as following. In the first part, a conceptual model determined by economic and social psychological theory is presented. In the second part, we present the methods used in the study. Then, results are presented and discussed. The final part of the paper provides a conclusion.

2. Theory

We use consumer demand theory to derive angler' CS of salmon fishing in the Verdal River. Anglers are assumed to maximize their utility subject to their monetary and time budget constraint (Freeman et al., 2014). The utility function depends on visits to the Verdal River, place attachment, motivation factors and preferences regarding C&R, denoted as x, a, m and c, respectively (Whitehead, 2006). The utility function of angler i defined in Equation (1).

$$u_i = u(x, a, m, c) \tag{1}$$

From the maximization problem, we obtain the Marshallian demand function for the number of visits to the Verdal River.

$$x^* = f(p, a, m, c, y) \tag{2}$$

In Equation 2, p is angler i's fishing expenditures, while y is the angler's disposable fishing budget. Angler i's CS is defined as the integral of the demand function within the interval p_0 and p_C, where p_0 is the angler's actual fishing expenditures, while p_C is how much expenditures the individual must have to be indifference between fishing and not fishing (Bockstael et al., 1991). This is also known as the choke price.

$$\text{CS} = \int_{p_0}^{p_c} f(p, a, m, c, y) \, dp \tag{3}$$

The CS can then be written as a log-linear function of the already defined variables (Ziemer et al., 1980).

$$\ln(\text{CS}) = \alpha + \beta_1 x + \beta_2 p + \beta_3 a + \beta_4 c + \beta_5 y \tag{4}$$

Based on Equation (4), we present in Figure 1 a conceptual model. From social psychological theory, we define five latent constructs and discuss how they are related to CS. The latent constructs place identity, place dependency, mastery, escape and C&R.
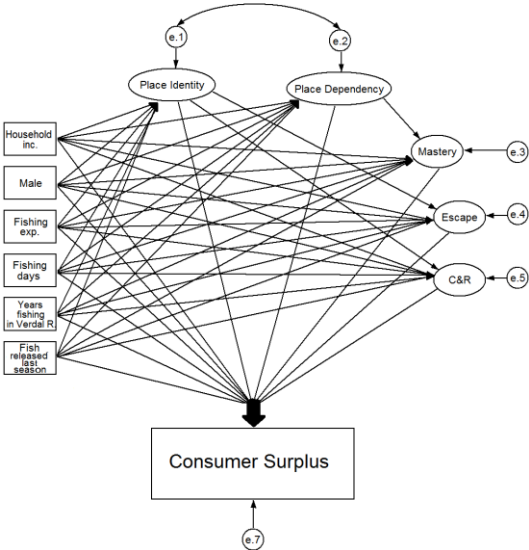

Fig. 1 – Conceptual model

2.1 Place Attachment

Place attachment is an environmental psychological variable that describes an individual's bonding with an environment (Scannell & Gifford, 2010; Hallak et al., 2012). The bond between an individual and an environment makes the individual obtain sense of belonging (Bricker & Kersetter). In social psychological research, place attachment consists of several dimensions (Bicker & Kersetter, 2000; Moore & Graph, 1994; Scannel & Gifford, 2010; Hailu et al., 2005; Proshansky et al., 1983; Hallak et al., 2012). Bricker & Kersetter (2000) defines place attachment in two dimensions. The first dimension is place dependency. Place dependency measures how functional a site is in terms of recreational activities. Individuals partly make a comparison of the functionality between different places (Bricker & Kersetter, 2000). If a place has high recreational functionality, an individual's place dependency will be higher.

The second dimension of place attachment is place identity. Place identity is related to individuals' emotional attachment to a site. (Proshansky et al., 2010; Bricker & Kersetter, 2002; Hallak et al., 2012). Proshansky et al. (1983) defines place identity in terms of norms, rules, behaviors and regulations to a specific place. Place identity is important for an individual's attitudes, behavior and social identity (Hallak et al., 2012). Moore & Graefe (1994) argues that place identify to a recreational site grows over time. Thus, an individual's emotional tie to a place develops with the number of visitations and spend-time (Moore & Graefe, 1994; Hailu et al., 2005; Bricker & Kersetter, 2002). We utilize items from Bricker & Kersetter (2000) to the define the latent constructs of place dependency and place identity.

Overall, place attachment develops over time (Hailu et al., 2005; Bricker & Kersetter, 2002). Anglers who have fished in the Verdal River several seasons and have spent much time there are believed to have higher emotional ties to the river. Further, if the anglers find that the Verdal River has a high degree of functionality related to fishing, their dependency to the site is in theory higher compared to other salmon rivers. The anglers have then most likely experienced high fishing quality at the river (Hailu et al., 2005). It is also more likely that the anglers have higher willingness to pay to fish at a specific site.

There exist limited research on the relationship between place attachment and leisure satisfaction of angling. However, research finds a positive relationship between place attachment and satisfaction of visitation to a site (Hwang et al., 2005; Prayag & Ryan, 2012; Yuksel et al., 2010; Ramkissoon et al., 2013). Prayag & Ryan (2012) argues that satisfactory experience of numerous visits to a place increases the place attachment, and thus affects future behavior. Their results show that tourists' place attachment to Mauritius is positively related to overall satisfaction. Hwang et al. (2005) finds a positive relationship between place attachment and interpretation satisfaction of national parks in Taiwan. Yuksel et al. (2010) concludes that place attachment is positively related to satisfaction of holiday experience. In addition, Ramkissoon et al.'s (2013) results indicate that visitors who were more attached to Dandenong Ranges National Park in Australia were more satisfied with the visit.

As we use CS as an economic measure of leisure satisfaction, we hypothesize that CS is increasing with place attachment, in terms of both place identity and place dependency. From the conceptual model, we define the following hypotheses:

H1   Place Identity is positively related to CS
H2   Place dependency is positively related to CS

2.2 Leisure Motivation

Leisure motivation has rarely been addressed stated preference studies. Here, leisure is related to recreational activities (Chen et al., 2013).

Yoon & Uysal (2005) describe motivation as psychological needs and wants individuals hold. Such needs can be related to a specific activity, like recreational salmon fishing. A psychological construct that can explain such needs and wants is intrinsic motivation (Ryan & Deci, 2002; Yoon & Uysal, 2005). Intrinsic motivation makes individuals explore and learn from challenges (Ryan & Deci, 2002). It can be decomposed into several constructs, such as mastery, assimilation and exploration (Ryan & Deci, 2002; Yoon & Uysal, 2005). Intrinsic motivation can explain individuals' motivation to perform leisure activities (Yoon & Uysal, 2005), which is theorized by Iso-Ahola (1982).

To define the motivation constructs, we adopt Iso-Ahola's (1982) social psychological model of tourism and leisure motivation. Individuals obtain satisfaction of leisure activities and tourism. As individuals are aware of this satisfaction, motivation constructs are developed (Iso-Ahola, 1982). Iso-Ahola's (1982) distinguishes between two motivation forces related to expected satisfaction of a leisure activity, namely i) seek and ii) escape. Individuals perform leisure activities to seek intrinsic and personal rewards. Individuals seek to feel they are mastering an activity and challenges related to it, which can be explained as mastery (Yoon & Uysal, 2005; Chen et al., 2013; Ryan & Deci, 2002; Iso-Ahola, 1982; Beardmore et al., 2011), where mastery is a construct of intrinsic motivation (Ryan & Deci, 2002). Mastery can thus partially explain why anglers are motivated to angle for salmon.

Further, individuals can be motivated to perform leisure activities to escape, in other words to obtain the feeling of "going away" (Yoon & Uysal, 2005; Iso-Ahola, 1982). Yoon & Uysal (2005) distinguishes between pull and push motivations for travelling to a destination. They describe push motivations inter alia as the desire for escape, rest, adventure and family togetherness. Pull motivations is related to attractiveness of a place, for instance recreational opportunities and natural scenery (Yoon & Uysal, 2005). Based on Yoon & Uysal (2005) and Iso-Ahola's (1982), we define a latent construct related to the motivation among anglers to escape the everyday life and to get the feeling of going away. We define the latent construct as "escape".

As mentioned, Iso-Aholas (1982) argues that individuals obtain satisfaction of leisure activities and tourism, and thus motivation of performing leisure activity should increase the experience satisfaction. In addition, research suggests a positive relationship between leisure motivation and satisfaction (Chen et al., 2013; Chen, 2005; Yoon & Uysal, 2005, Iso-Ahola, 1982).

We thus hypothesize that motivation, in terms of both mastery and escape, is positively related to anglers' CS.

Further, as both mastery and place dependency are directly related to fishing as an activity, we hypothesize that the feeling of mastering the activity is positively related to place dependency. If a place has a high degree of angling functionality, anglers are believed to be more motivated to obtain intrinsic rewards. Thus, we thus allow for an indirect effect of place dependency, mediated by mastery, on CS. In addition, we hypothesize that if an angler has a strong emotional connection to the place, their motivation to "escape" to that place is high. Thus, we also allow for an indirect effect of place identity, mediated by escape, on CS. From the conceptual model, we define the following hypotheses:

H3   **Mastery is positively related to CS**
H4   **Escape is positively related to CS**
H5   **Mastery is positively related to place dependency**
H6   **Escape is positively related to place identity**

2.3 Attitudes toward Catch-and-release
Catch-and-release (C&R) is considered as a popular conservation strategy (Cooke & Suski, 2004). The behavior toward deliberately catching a fish for then to release it is increasing in Norway (Stensland et al., 2013). Anglers' decision to voluntarily release caught fish can be explained by norms, ethical concerns, bycatch and awareness of consequences of C&R (Stensland et al., 2013; Cooke & Suski, 2004).

The literature of how attitudes and norms of C&R affect the CS is limited. Thus, a theoretical explanation of the respective relationship is lacking. However, there exist theories on how C&R behavior affects satisfaction of angling. Sutten & Ditton (2001) put forward a theory that explains C&R behavior, where it can be explained by two components, i) commitment to the sport and ii) consumptive orientation. First, a high degree of commitment to angling most likely makes the anglers willing to devote more time and income to the recreational activity (Sutten & Ditton, 2001)..

Sutten & Ditton (2001) argue that committed anglers should perceive the C&R philosophy in a more positive manner. Committed anglers will have more information about management and fishery resources. Norms toward angling will play a more important part and ethics around fish species conservation. The committed anglers will have higher noncatch-related motives (Sutton & Ditton, 2001).

As committed anglers are believed to perceive the C&R philosophy in a more positive manner and social psychological theory suggests that more experience with a place increases individuals' intentions to protect the place (Ramkissoon et al., 2013), we allow for an indirect effect of place identity, mediated by C&R, on CS. We hypothesize that there is a positive relation between place identity and positive attitudes toward C&R.

Sutten & Ditton (2001) further argues that the consumptive orientation of angling can also explain C&R behavior. Consumptive orientation is related to anglers' satisfaction of the activity. The satisfaction level among anglers who value the importance of catching fish less tends to be higher. The respective anglers value other aspects of fishing, such as experiencing nature, and thus are believed to be more welcoming to the C&R philosophy (Sutton & Ditton, 2001). Hence, as the satisfaction level is higher among anglers who are more welcoming to the C&R philosophy, we hypothesize that positive C&R attitudes is positively related to CS of fishing in the Verdal River. From the conceptual model, we define the following hypotheses.

H7   Positive C&R attitude is increases anglers' place identity
H8   Positive C&R attitude is increases anglers' CS

3. Methods and Data Collection
3.1 Contingent Valuation and Survey Design

The contingent valuation (CV) method was utilized to determine the anglers' CS of salmon fishing in the Verdal River. CV is a stated preference approach that, through a survey, is applicable to elicit people's value of non-market goods (Mitchell & Carson, 1989, p:2). In a survey, a hypothetical market is constructed with policy relevant scenarios. Respondents are asked how much they are willing to pay for or to avoid the specified policy scenarios (Navrud & Mungatana, 1994).

A mail survey was sent out to anglers who previously have fished in the Verdal River. The response rate was 34%, and the final sample consists of 214 respondents.[4] The survey was constructed as following. In the first part, respondents were asked questions related to their relationship to salmon angling in Norway and other countries.

In the second part, statements related to motivation to fish in the Verdal River and place attachment were provided. The survey had several motivation statements. A Likert's scale was applied to assess if the respondents agreed to the statements. On the Likert's scale one represented to 'not at all important' while seven was equal to 'very important' for the motivation statements. Statements of place attachment were provided to the respondents. Here, one represented 'fully disagree' while seven was equal to 'strongly agree'.

In the next part, respondents were asked questions of whether they strongly disagree or vice versa with suggested and enforced fishing regulations. The regulations varied in severity. In a different question, respondents were provided statements on how they perceive C&R. Both positive and negative statements towards C&R were provided, such as "Release of fish I could have kept is wasting food" and "To release fish contributes to protecting the fish stocks in the

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[4] The sample was collected by sending out the survey by mail to anglers who between 2008 and 2012 registered their catch and disinfection of fishing equipment (mandatory) on the Verdal River website. Combined, this was 450 anglers. Additionally, landowners and anglers with fishing permit from "Verdal Jeger- og Fiskerforening" were sampled. Combined, this was 193 anglers. Thus, in total 634 anglers received the survey either my e-mail or postal mail. As the final sample consists of 214 respondents, the response rate was 34%.

Verdal River". A seven level Likert scale was still applied for fishing regulation and C&R statements.

Further, the respondents were asked in an open question to specify their annual expenditures related to their last active fishing season in the Verdal River. The expenditures were divided into transportation, accommodation, fishing permit and other expenditures. The total expenditure is the actual price the anglers' paid for recreational salmon fishing last season. To determine their CS, we next asked the respondents "What is the largest increase in your annual expenses for fishing the Verdal River that year, you could accept before you would have stopped fishing there?" The difference between willingness to pay (WTP) and actual expenditures is then the respondents' CS of salmon fishing in the Verdal River.

A payment card (PC) was used as a payment vehicle, where respondents could choose an amount between NOK 0 to NOK 18 000. As recommended, a 'don't know' option was also provided (Arrow et al., 1993). The literature recommends to utilize a response format that limits the possibility for strategic behavior, such as a discrete dichotomous question (Johnston et al, 2017; Arrow et al., 1993). However, as our sample was relatively small, such a question provides limited information. A PC was therefore applied, which serves as the best alternative for small samples (Boyle, 2017, p:107).

3.2 Structural Equation Modelling

Structural Equation Modelling (SEM) is a well-established but relatively new causal quantitative method (Hair Jr. et al., 2014A). SEM is used to explain the relationships between multiple variables by simultaneously combining factor analysis and multiple regression analysis (Hair Jr. et al., 2014A). A model set up should be coherent with underlying theory. The confirmatory factor analysis (CFA) determines theoretically justified latent constructs, which are known as the measurement models (Hair Jr. et al., 2014A). The latent constructs are measurable variables that represent the unobserved psychological factors. The multiple regressions represent the structural model, where the statistical relationship between latent constructs and observable variables are determined (Hair Jr. et al., 2014A). SEM relies on multivariate normality where maximum likelihood estimation is commonly utilized. However, there exist estimators where one can relax this assumption (Hair Jr. et al., 2014A). The following equations correspond to the SEM and the measurement models defined in this study.

$$y = \Lambda_y \eta + e.y \qquad (5)$$
$$x = \Lambda_x \xi + e.x \qquad (6)$$
$$Y = BZ + \Gamma X + \zeta \qquad (7)$$

Equation (5) and Equation (6) defines the measurement models, where x is a vector of observable variables that defines the vector ξ of latent independent variables, while y is a vector of observable variables that defines the vector η of latent dependent variables.[5] $e.x$ and $e.y$ are the error variables of Equation (5) and Equation (6), respectively. Λ_y and Λ_x are vectors of factor loadings

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[5]Note that in SEM, dependent and independent variables are often referred to as endogenous and exogenous variables, respectively. Here, we use the former expressions.

of the measurement models of the latent constructs η and ξ, respectively. Lastly, Equation (7) defines the structural model, where Y is a vector of dependent latent and observable variables, while Z is a vector of independent observable variables. B is a vector of coefficient that explains the relationship between Y and Z. X is a vector of independent latent variables with a coefficient vector Γ. Lastly, ζ is the error term in the structural model.

4. Results

The following section discusses the results of the SEM and the CFA. Fit statistics are used to assess the validity of the SEM analysis. A discussion of the results is provided in Section 5.

Description of Variables

Table 1 displays descriptive statistics of the variables used in the SEM analysis and items that defines the latent constructs. Each item was measured on a seven-point Likert scale.

Table 1. Description of Variables in SEM

Variable	Description	Mean	SD
CS	Consumer Surplus per year in NOK[6]	2885.6	4146.7
hhinc	Household income (gross)[7] in NOK	652368	291061
male	=1 if male, 0 otherwise	0.939	0.239
FC	Fishing expenditures last season in VR in NOK	3943.38	4547.7
fishdays	Total fishing days last season (from 2007-12)	6.512	17.264
yVR	Active years of fishing in VR (in years)	16.514	13.155
caughtfish	Number of fish caught last season in VR (from 2007-12)	3.04	7.251
relfish	Number of released fish last season in VR (from 2007-12)	0.976	2.780
pid1	The Verdal R. means a lot to me (a)	5.428	1.634
pid2	I am very attached to the Verdal R. (a)	5.038	1.803
pid3	The Verdal R. feels like a part of me (a)	4.111	2.025
pdep1	The Verdal R. is the best salmon fishing river for my type of fishing (a)	4.137	1.760
pdep2	Salmon fishing in the Verdal R. is more important to me than salmon fishing any other place (a)	4.212	2.084
pdep3	I would NOT replace fishing in the Verdal R. with any other salmon river (a)	3.597	2.211
rcand1	Release of fish I could have kept is wasting food (reversed) (a)	4.947	2.180
rcand2	Release of fish is cruelty to animals (reversed) (a)	4.356	2.230
cand3	To release fish contributes to protecting the fish stocks in Verdal R. (a)	4.900	2.042
rcand4	I should keep all the legal fish I catch in the Verdal R. (reversed) (a)	3.873	2.280
m1	Master angling-related challenges (b)	3.835	1.895
m2	Have a challenging fight with the fish (b)	5.405	1.647
m3	Outwit difficult-to-catch fish (b)	4.546	1.713
e1	Experience nature (b)	4.898	1.669

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[6]The midpoint value of respondents' chosen number and the next higher value on the payment card was used as a proxy of their true CS.

[7]As respondents' where asked to choose the interval where their household's gross income lies, we use the midpoint in the interval as a proxy.

e2	Enjoy solitude (b)						4.092	1.907

Note: (a) is specified if the item had 1 = Strongly disagree and 7 = Strongly agree. (b) is specified if the item had 1 = Not at all important and 7 = Very important. rcand1, rcand2, rcand5 were reversed to represent positive C&R items.

Confirmatory Factor Analyses

Stata 14 was used to estimate the SEM. First, a measurement model for each individual latent construct from the conceptual model was estimated. Second, a combined CFA with each construct was estimated. As in the conceptual model, we specified covariance between the place attachment constructs and between the motivation constructs. Table 2 displays the fit statistics of the separate and the combined measurement model.

Table 2 – Confirmatory Factor Analysis

Latent construct	χ^2	df	p	CFI	TLI	RMSEA	SRMR
Place Attachment	21.36	8	0.01	0.99	0.98	0.09	0.03
Leisure Motivation	11.39	4	0.03	0.96	0.90	0.10	0.04
Catch-and-release	3.42	2	0.18	0.99	0.99	0.06	0.02
Overall	159.38	88	0.00	0.95	0.94	0.06	0.15

Note: Place attachment includes the two latent constructs place dependency and place identity. Motivation includes the two latent constructs mastery and escape. CFI = Comparative Fit Index, TLI = Tucker Lewis Index, RMSEA = Root-Mean-Square Error of Approximation, Standardized Root-Mean-Square Residual = SRMR.

The Chi-square value is derived by a likelihood ratio test between the fitted and the saturated model. Failing to reject the null hypothesis indicates a good fit. However, the test depends on sample size. Therefore, a conclusion that a model is not fit due to rejection of the null hypothesis can be misleading (Hallak et al., 2012). In the results above, we fail to reject the null hypothesis at the 18% level in the CFA of C&R and at the 1% and 3% level in the CFA of leisure motivation and place attachment, respectively.

In a model with good fit, the Comparative Fit Index (CFI) and the Tucker Lewis Index (TLI) should be greater than 0.9, ideally above 0.95. In addition, the Root-Mean-Square Error of Approximation (RMSEA) and the Standardized Root-Mean-Square Residual (SRMR) should be less than 0.06 and 0.08, respectively (Hu & Bentler, 1999). The models presented in Table 2 seem to fit relatively well. Each model has CFI and TLI greater or equal to 0.9. The RMSEA is 0.1 for leisure motivation, which indicates bad fit. However, in a 95% confidence interval, the RMSEA ranges from 0.03 to 0.16. Each model has a SRMR equal to or below 0.05, except the overall CFA.

Best Fitting SEM

After estimating the CFA, the overall SEM model of the conceptual model was estimated. The resulting fit statistics were not befitting [$\chi^2(157) = 258.98$, p-value = 0.00, CFI = 0.93, TLI = 0.90, RMSEA = 0.07, SRMR = 0.07]. To improve the fit of the model, modification indices was used and recommended to specify covariance between the motivation constructs. This would reduce the Chi square value by 28, which significantly improves the fit of the model. The

modification indices is a helpful tool as long as the suggested alterations are in line with theory, which they were in this case. The respective alternations improved the model fit [$\chi^2(156) = 224.92$, p-value = 0.00, CFI = 0.95, TLI = 0.93, RMSEA = 0.05, SRMR = 0.05]. Further, due to low standardized loadings in the measurement model, m1 was removed. This further improved the model fit.
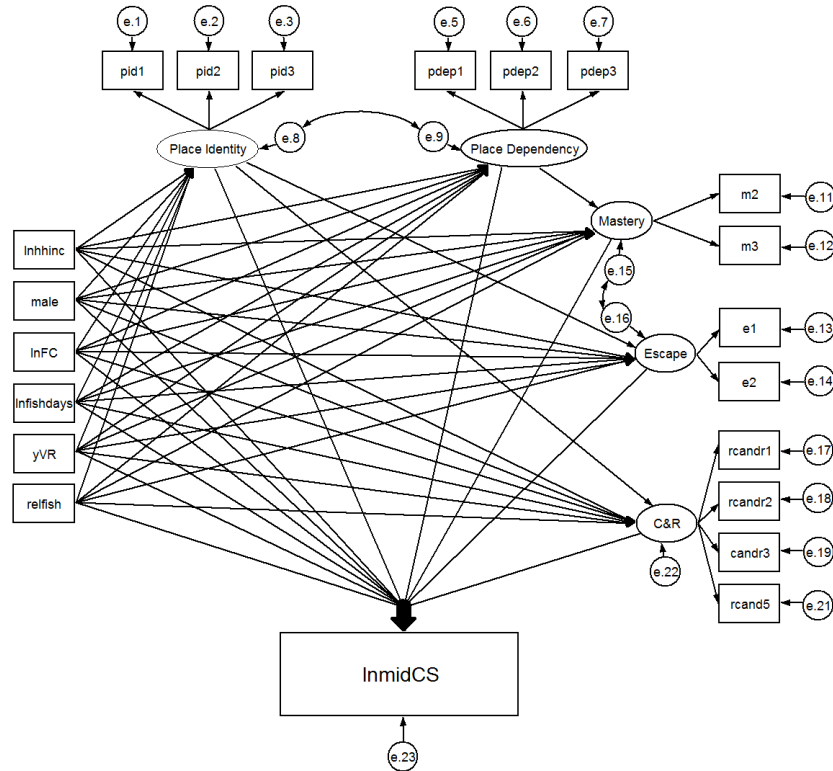

Fig. 2 – Best-fitting SEM

The final best fitting model, depicted in Figure 2, was then estimated by performing the defined alternations. An interesting feature in SEM is that one can specify expected measurement error of the observable dependent variable. As a payment card was used as response format, we do not observe the respondents' true CS. We only know that it lies between the chosen amount on the payment card and the next higher amount. Often, one assumes, as we have done in this study, that the respondents' true CS can be approximated by the midpoint in the interval (Cameron & Huppert, 1989). Then, one estimate a linear regression with the midpoint CS as dependent variable. However, Cameron & Huppert (1989) showed that this yields biased estimates, as an OLS regression does not consider that the expected CS is uncertain. Instead, one should estimate an interval censored regression model with maximum likelihood estimates (Cameron & Huppert, 1989). Alternatively, in SEM we suggest specifying measurement error in CS to consider the uncertainty. Thus, we specified that the logarithm of CS should have a measurement error of 15%, as previously used by Hailu et al., (2005).[8]

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[8] Currently, there is no general agreement on the size of the specified measurement error in stated preference studies using SEM. However, Hailu et al. (2005) suggested to use 15% measurement error in a travel cost method analysis.

The fit statistics of the final model indicate a good model fit [$\chi^2(136) = 200.56$, p-value = 0.00, CFI = 0.95, TLI = 0.93, RMSEA = 0.06, SRMR = 0.05]. Each fit statistic satisfies the established practices, except that we can reject the null hypothesis in the likelihood ratio test. The results of the measurement models and the structural models are separated in two tables. Table 3 displays the measurement models, while Table A1 displays the structural models.

Table 3 - Standardized Factor Loadings of Measurement Models

	Place Identity	Place Dependency	Mastery	Escape	C&R
pid1	0.8787*** (0.0199)				
pid2	0.9747*** (0.0118)				
pid3	0.8647*** (0.0227)				
pdep1		0.8844*** (0.0241)			
pdep2		0.8859*** (0.0242)			
pdep3		0.8498*** (0.0276)			
m2			0.7929*** (0.0746)		
m3			0.6494*** (0.0715)		
e1				0.6659*** (0.0869)	
e2				0.6527*** (0.0862)	
rcandr1					0.7752*** (0.0410)
rcandr2					0.8176*** (0.0374)
candr3					0.6587*** (0.0523)
rcandr5					0.7287*** (0.0459)
Average	0.9060	0.8734	0.7211	0.6593	0.7450
AVE	0.8368	0.7866	0.6030	0.5384	0.6278

Note: AVE = The average variance extracted

Table 3 allows use to evaluate the construct validity of the SEM. Construct validity is referred to as how well the items describe its theoretical latent construct (Hair et al., 2014B). A part of the construct validity is convergent validity. The size of the standardized factor loadings is often used to evaluate the convergent validity. The rule of thumb is that the loadings should exceed 0.5, ideally 0.7 (Hair et al., 2014B). Each standardized loading is above 0.5 in the measurement models. The two items in "escape" have loadings below 0.7 but above 0.5. The average variance extracted (AVE) is also used to evaluate the convergent validity. A rule of thumb is that AVE should be

greater than 0.5 (Hair et al., 2014B). From Table 3, we can see that each construct has AVE above 0.5. Overall, this indicates convergent validity.

The second part of construct validity is discriminant validity, which is whether the latent constructs measure different psychological phenomenon (Hair et al., 2014B). Discriminant validity can be assessed by examining the correlation between the constructs. A rule of thumb is that the correlation between two latent constructs should not exceed 0.85 (Yuksel et al., 2010). The results indicate discriminant validity, as correlation between any latent constructs did not exceed this threshold. The highest correlation (0.73) was between place dependency and place identity. The correlation matrix is displayed in Table A2 in Appendix I.

Even though structural equation modelling relies on the assumptions of multivariate normal distribution and linearity, such models are relatively insensitive to wrong model specifications and non-normality (Hailu et al., 2005; Olsson et al., 2000). The robust distribution free Satorra-Bentler estimator was utilized to evaluate the robustness of the results. The choice of estimator did not change the findings and conclusion in this paper. However, a higher sample size would have improved the validity of the results.[9]

The results of the structural models are presented in Table A1. The table displays the six structural models of the best fitting SEM. A discussion of the size and signs of the coefficients is presented in Section 5.

5. Discussion

The following section provides a discussion of the results in Table A1. The results in Table A1 are used to discuss the two main objectives of the study. In addition, the mean CS is calculated and discussed.

Consumer Surplus

In structural model (1), results show that CS significantly increases with fishing expenditures. Toivonen, et al. (2004) also found a positive relationship between CS of recreational fishing and fishing expenditures in Norway.

Males have significantly higher CS compared to females. Surprisingly, if fishing days increases, CS decreases significantly. As suggested by economic theory, we would expect a positive relationship between fishing days and CS, as the marginal value of an addition fishing day is expected to be positive (Toivonen et al., 2004). However, a possible explanation is that the variable for fishing days is not strictly related to fishing days in the Verdal River. It only describes anglers' total number of fishing days last season, irrespectively of where the anglers fished.

CS increases significantly with the number of years the anglers have fished in the Verdal River. The relationship can weakly explain that place attachment is positively related to CS, as place attachment depends on time spent and the number of visits to a site. In addition, it

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[9] As SEM assumes normality, we specified CS in log-form.

corresponds well to economic theory, as economic theory suggests that increased consumption of a good yields higher utility and thus higher economic value (Heberlein et al., 2005).

CS increases significantly with place dependency. This corresponds to H2. Social psychological theory suggests that place attachment increases individuals' experience satisfaction of a recreational activity. Anglers with high place dependency have most likely experienced high fishing quality at the river and have thus higher CS (Hailu et al., 2005).. Place dependency is thus important for explaining variation in CS and leisure satisfaction.

We hypothesized a positive indirect effect of place dependency on CS, mediated by mastery. However, we fail to prove this hypothesis. The coefficient of the indirect effect is 0.1668, while it is not significant. On the other hand, the total effect of place dependency on CS is significant. The coefficient is 1.1668. Neither place identity nor the motivation constructs significantly affect CS.[10] Thus, we are not able to prove H1, H3 and H4. Interestingly, Chen et al. (2013) hypothesized a positive relationship between leisure motivation and leisure satisfaction, while Yusul & Usyal (2003) hypothesized a positive relationship between motivations constructs and travel satisfaction. However, the two studies were not able to find a positive and significant relationship between satisfaction and motivation. This is consistent with our results.

There is no significant mediation effect of place identity on CS, through escape and through C&R. However, our results suggest that place dependency is more important for the recreational value of fishing than place identity. This is not surprising, as place dependency is directly related to the activity, while place identity is potentially indirectly related to the activity.

Further, CS increases significantly with positive C&R attitudes. This corresponds to H8. As found and theorized by Sutten & Ditton (2001), the satisfaction level among anglers who value the importance of catching fish less tends to be higher. Consistently, CS increases significantly with the number of released fish last season. The more fish an angler releases, the higher CS the angler has.

Overall, both C&R attitudes and place dependency increase significantly with CS. The result illustrates that social psychological theory of leisure satisfaction and the latent construct of place dependenc and C&R attitudes hold when satisfaction is measured as CS. We can use social psychological theory to explain the underlying relationship. The results also show that social psychological variables are important for explaining variation in CS. As the literature states, exclusion of relevant latent variables or using items to explain the respective variables could lead to endogeneity bias (Hess & Beharry-Borg, 2012; Hoyos et al., 2015).

Place Attachment
Both place dependency and place attachment significantly increase with the number of years fished in the Verdal River, see model (2) and (3). This is consistent with social psychological theory,

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[10] Note: Stata automatically constrained the coefficient of place dependency to one in the structural model of CS. However, the model was also estimated by constraining mastery to one instead, while unconstraining place dependency. In this case, place dependency didsignificantly affect CS at the 5% level. The standardized coefficients were not automatically constrained by Stata, and here place dependency significantly affect CS at the 10% level.

where place attachment develops over time and depends on the amount of visits and spend-time at a place (Hailu et al., 2005; Ramkissoon et al. 2013; Moore & Graefe, 1994). Neither of the other endogenous variables significantly affect place dependency. However, we can see that place identity increases with the number of legally caught and released fish. Intuitively, anglers who released legally caught fish perceive the C&R philosophy positively. Early place theories demonstrate that the more experience an individual have with a place, the higher intentions the individual has to protect the place (Ramkissoon et al., 2013). Thus, we would according to social psychological theory expect a positive relationship between the number of legally caught and released fish and place identity. It could also imply that anglers with high place identity care about fisheries management and the total salmon stock in the Verdal River.

Leisure Motivation
H5 stated that mastery is positively related to place dependency. If a river has a high degree of functionality to fish, anglers were believed to be more motivated to obtain intrinsic rewards. The results support H5 as mastery significantly increases with place dependency in model (4). The standardized coefficient of place dependency is 0. 3725, which indicates a strong relationship. Further, mastery significantly decreases with years fished in the Verdal River. This indicates that anglers with more fishing experience in the respective river have potentially other motivation incentives than mastering angling as an activity. The mediation effect of years fished in the Verdal River on mastery, through place dependency, is positive and significant, whereas the total effect is insignificant.

H6 suggested that Escape is positively related to place identity. We argued that if an angler has a strong emotional connection to the place, their motivation to escape to that place increases. As our results in model (5) indicate, escape increases significantly with place identity. The standardized coefficient of place identity is 0. 21145. Thus, we fail to reject H6. The direct relationship between years fished in the Verdal River and escape is not significant. However, results suggest significant mediation and total effect through place identity on escape. The medication effect is 0. 0119, whereas the total effect is 0. 0172.

C&R Attitudes
In model (6), positive C&R attitudes increases significantly with the number of fishing days last season. As discussed by Sutten & Dittion (2001), committed anglers are believed to be positive towards the C&R philosophy. Committed anglers are well informed about fisheries management and fish stocks. Also, they have additional noncatch-related motives (Sutton & Ditton, 2001). Commitment to angling could be explained by the amount of fishing days in a year. The mediation effect of fishing days on C&R attitudes, through place identity, is insignificant. However, the total effect is positive and significant with a coefficient of 0. 2961. Contrary, positive C&R attitudes decreases significantly with the number of years an angler has fished in the Verdal River. Here, we would expect a positive relationship, as social psychological theory suggests that increased experienced with a place yields higher intentions to protect the place.

As expected, there is a positive relationship between the amount of caught and released legally sized fish and positive C&R attitudes. Intuitively, one would expect anglers with positive C&R attitudes to release the fish they catch. The mediation effect of released fish on C&R, through place identity is not significant. However, the total effect is positive and significant with a coefficient of 0.0869. Contrary to our expectations, place identity does not significantly affect positive C&R attitudes.

Table 4 –Evaluation of Hypotheses

Hypothesis		Supported
H1	**Place Identity is positively related to CS**	☒
H2	**Place dependency is positively related to CS**	☑
H3	**Mastery is positively related to CS**	☒
H4	**Escape is positively related to CS**	☒
H5	**Mastery is positively related to place dependency**	☑
H6	**Escape is positively related to place identity**	☑
H7	**Positive C&R attitude is increases anglers' place identity**	☒
H8	**Positive C&R attitude is increases anglers' CS**	☑

Mean Consumer Surplus

Interval censored regressions with maximum likelihood estimates are often used to determine the mean WTP or CS when a payment card is used as response format. Interval censored regression models assume that the error term is normally distributed with mean 0 and variance equal to σ^2. The log likelihood function of n independent observations is defined as (Cameron & Trivedi, 2005, p:534):

$$\ell(\beta, \sigma) = \sum_{i=1}^{n} \ln \left[\frac{1}{\sqrt{2\pi\sigma^2}} \exp \left\{ -\frac{(y - x_i\beta)^2}{2\sigma^2} \right\} + \Phi\left(\frac{a_{j+1} - x_i\beta}{\sigma} \right) - \Phi\left(\frac{a_j - x_i\beta}{\sigma} \right) \right] \quad (8)$$

Here, y is an observed data point of CS, x_i is a vector of independent variables, β is a vector of coefficients explaining how independent variables affect WTP, a_j is the respondent i's chosen CS on the PC, while a_{j+1} is the next higher number on the PC. Φ is cumulative distribution function of the standard normal distribution. The unconditional censored mean CS is derived by excluding

independent variables. An interval censored regression model excluding independent variables was estimated. The unconditional censored mean CS was found to be NOK 3912 (€271) per year.[11]

Validity

There are three validity frameworks in CV studies: content validity, construct validity and criterion validity. Content validity addresses validity of a CV study and its survey. Criterion validity assesses whether hypothetical elicited CV values correspond to real market values (Johnston et al., 2017). Discriminant validity has not been addressed in CV studies. However, as reported this study, future CV studies that uses SEM are recommended to assess the discriminant validity of the analysis.

The results strengthen the convergent validity of using CS as an observable measure of leisure satisfaction. In accordance with social psychological theory, leisure satisfaction, measured as CS, increases with place attachment and positive C&R attitudes. In essence, the advantage of using CS instead of measuring leisure satisfaction is that the mean CS is an informative policy parameter. The mean can be used to determine the total recreational value among the anglers. The total recreational value is of relevance in a cost-benefit (CB) analysis of fisheries management (Navrud, 2001). In a CB analysis of fisheries management, the total economic value (TEV) of a fish stock of interest must be determined in order to weight the benefits against the costs of different management schemes. The TEV of a fish stock is the economic value of a marginal change in the stock (Navrud, 2001).

Further, the results show that social psychological theory and variables are useful to assess the construct validity of a CV study. Social psychological theory can be used to explain the underlying relationship between elicited CV values and social psychological latent variables. As most results correspond well with what we expect from social psychological theory, it overall strengthens the construct validity of the study. Implicitly, inclusion of social psychological constructs allows us to expand and improve the assessment of construct validity in a CV study and allow environmental economists to better understand individuals' choices, attitudes and behavior toward an environmental good.

We thus argue that, when possible, social-psychological theory and latent variables should be addressed and included in CV studies to assess a study's construct validity. This improves the evaluation of the validity of elicited CV values. In the environmental economics literature, few or no studies simultaneously determine and incorporate latent variables in structural models. As discussed in the literature, a simultaneous approach yields more efficient results. Additionally, including attitudinal items in structural models to explain underlying latent constructs could lead to endogeneity bias. SEM makes it possible to simultaneously incorporate latent variables in structural models and can thus improve the efficiency and validity of CV results. SEM should thus

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[11] A 95% CI of the unconditional censored mean CS was estimated by using the Delta-method. The lower bound was NOK 3369 (€233), while the upper bound was NOK 4456 (€304). Note that the CS estimates are controlled for changes in price level by using the CPI index. In addition, to convert CS from NOK to Euro, we used PPP-adjusted exchange rate.

be further explored with different response formats in CV studies that incorporates attitudinal items to define latent variables.

6. Conclusion

The CV method was utilized to determine the consumer surplus among Atlantic salmon anglers in the Verdal River. A conceptual model based on social psychological and economic theory was presented. In contrast with theoretical models of satisfaction one often finds in social psychological literature, the conceptual model utilized CS as an alternative observable measure of leisure satisfaction. Social psychological theory and empirical results suggest that place attachment, leisure motivation and positive C&R attitudes are positively related to leisure satisfaction. Thus, the conceptual model hypothesized that CS of Atlantic salmon angling increases with the three latent constructs.

The first objective of the study is to assess the convergent validity of using CS as an observable economic measure of leisure satisfaction. The second objective is to examine how social psychological variables can improve the assessment of construct validity in CV studies. Results indicate that CS increases significantly with place dependency and positive C&R attitudes. This coincides well with social psychological theory and it indicates social psychological and economic theory can be incorporative. Thus, the results strengthen the convergent validity of using CS as a measure for leisure satisfaction. The benefit of using CS as a measure for leisure satisfaction is of its relevance in cost-benefit analyses of fisheries management.

Social psychological variables have been neglected in CV studies or attitudinal items have been used to explain underlying latent constructs. The study shows that incorporating social psychological variables utilizing SEM can improve the construct validity assessment of a CV study. Social psychological variables have an important predictive power on CS and they allow economists to understand more about individuals' choices, attitudes and behavior toward an environmental good. We can use social psychological theory to explain these underlying relationships. This information is useful to assess the construct validity of the elicited CV values. Additionally, incorporating social psychological variables utilizing SEM can improve the efficiency of the modelling results and prevent endogeneity bias. Thus, a recommendation for future CV studies is to address and include social psychological theory and latent variables to assess a study's construct validity. Defining and incorporating the latent constructs in structural models should be done simultaneously using SEM.

Acknowledgement

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Appendix

Table A1 - Structural Models of Best-fitting SEM

	(1)		(2)		(3)		(4)		(5)		(6)	
	lnCS		Place Identity		Place Dependency		Mastery		Escape		Catch & Release	
	Coeff.	St. Coeff	Coeff.	St. Coeff	Coeff	St. Coeff	Coeff.	St. Coeff	Coeff.	St. Coeff.	Coeff.	St. Coeff.
lnhhinc1	0.0747	0.0119	-0.1727	-0.0679	-0.0574	-0.0321	0.1669	0.0682	-0.1868	-0.0895	0.2567	0.0857
	(0.5151)	(0.0824)	(0.1813)	(0.0711)	(0.1494)	(0.0820)	(0.2305)	(0.0939)	(0.2263)	(0.1057)	(0.2200)	(0.0728)
male	2.2410*	0.1350*	-0.4657	-0.0690	-0.2753	-0.0581	0.2594	0.0399	-0.0245	-0.0044	0.1093	0.0137
	(1.2790)	(0.0761)	(0.4754)	(0.0702)	(0.4069)	(0.0806)	(0.6069)	(0.0931)	(0.5703)	(0.1029)	(0.5746)	(0.0722)
lnFC	0.2979	0.1243	0.0810	0.0832	0.0492	0.0719	0.1465*	0.1562*	0.0887	0.1110	0.0800	0.0697
	(0.1908)	(0.0788)	(0.0696)	(0.0711)	(0.0611)	(0.0816)	(0.0917)	(0.0939)	(0.0892)	(0.1072)	(0.0844)	(0.0732)
lnfishdays	-0.7551***	-0.2023***	0.2082**	0.1372**	0.1127	0.1057	0.1388	0.0950	0.1186	0.0952	0.3109**	0.1738**
	(0.3039)	(0.0788)	(0.1095)	(0.0710)	(0.1036)	(0.0813)	(0.1384)	(0.0944)	(0.1335)	(0.1051)	(0.1341)	(0.0728)
yVR	0.0694**	0.2520**	0.0562***	0.5020***	0.0286***	0.3637***	-0.0283***	-0.2627***	0.0053	0.0581	-0.0768***	-0.5818***
	(0.0334)	(0.1169)	(0.0080)	(0.0564)	(0.0156)	(0.0716)	(0.0110)	(0.0953)	(0.0108)	(0.1165)	(0.0118)	(0.0702)
relfish	0.1743**	0.1541**	0.0605*	0.1316*	0.0067	0.0208	-0.0001	-0.0001	-0.0249	-0.0659	0.0912**	0.1683**
	(0.0905)	(0.0790)	(0.0323)	(0.0693)	(0.0261)	(0.0802)	(0.0440)	(0.0994)	(0.0424)	(0.1095)	(0.0399)	(0.0718)
PDEP	1	0.2856*					0.5105***	0.3725***				
		(0.1613)					(0.2930)	(0.0993)				
PID	-0.3689	-0.1500							0.2115***	0.2576***	-0.0709	-0.0602
	(0.3430)	(0.1379)							(0.0998)	(0.1248)	(0.1036)	(0.0877)
Mastery	0.3268	0.1279										
	(0.4351)	(0.1673)										
Escape	-0.2301	-0.0768										
	(0.5237)	(0.1725)										
CandR	0.5150**	0.2467**										
	(0.2447)	(0.1120)										
Constant	-2.7285	-0.7913										
	(6.8788)	(1.9895)										
Obs	151	151	151	151	151	151	151	151	151	151	151	151
LL	-5811.605	-5811.605	-5811.605	-5811.605	-5811.605	-5811.605	-5811.605	-5811.605	-5811.605	-5811.605	-5811.605	-5811.605

Note: *p<0.10, **p<0. 05, ***p<0.01.

Table A2 – Correlation Matrix of Latent Constructs

	PDEP	PID	mastery	escape	CandR
PDEP	1				
PID	0.73446	1			
mastery	0.30792	0.20786	1		
escape	0.25153	0.32915	0.59868	1	
CandR	-0.26450	-0.32702	0.10234	-0.11263	1

Note: PDEP = Place dependency, PID = Place identity, CandR = positive Catch-and-release attitudes