INTRODUCTION

Recreational fishing for Atlantic salmon Salmo salar L. has been and still is a popular recreational activity in rivers around the North Atlantic (Stensland et al., 2017). Further, it creates income for local communities, landowners and fishing tourism actors (Andersen et al., 2019; Stensland, 2010; and the activity itself educates stewards and advocates for stock protection (Granek et al., 2008). Worldwide, salmon stocks have dwindled and are at an all-time low, much due to anthropogenic impacts (Gayeski et al., 2018). Consequently, rivers have been closed for fishing, seasons have been shortened or catch restrictions have been imposed to protect spawning stocks. In Norway, which has a high proportion of salmon stocks with more than 400 salmon rivers, stricter regulations were imposed on a general scale after 2009 due to new spawning escapement goals demanding more fish and a general decline in returns from the ocean.

Such changes in any fishery typically impact harvest levels, angler participation (Stensland et al., 2017), their satisfaction (Oh et al., 2005) and recreational value (Layman et al., 1996; Stoll & Ditton, 2006). Anglers accordingly need to adapt to such new measures, which ultimately impact their recreational value from fishing. For some anglers, new regulation scenarios potentially increase their recreational value, while it decreases the recreational value for other anglers. Information about changes in anglers’ recreational value of fishing under different fishing regulations is important when considering policy changes and management actions (Prayaga, Rolfe, & Stoeckl, 2010). To assess how anglers value marginal changes in recreational angling, economically...
stated preference (SP) methods like contingent valuation (CV) are often used (Navrud, 2001). CV uses surveys with a constructed hypothetical market containing policy-relevant scenarios (Mitchell & Carson, 1989).

The main objectives of this study were to determine the recreational value of salmon fishing, evaluate how it has changed and will change with different regulations, and identify the factors explaining these changes in net economic value of sport fishing. This was achieved by conducting a CV survey asking anglers to value their recreational experience in the Verdal River in Norway between 2007 and 2012 when regulations changed, and then asked them to value a new regulation scenario to be implemented in the following seasons implying a longer fishing season but a stricter harvest quota.

This study combines both willingness-to-pay (WTP) and willingness-to-accept (WTA) questions to estimate the net economic loss or gain in recreational value due to stricter regulations of Atlantic salmon sport fishing. It adds to the paucity of CV literature that applies WTA questions.

2 | SALMON ANGLING IN NORWAY

Salmon angling in Norway is a private property right and belongs to the property owning land adjacent to the river (Stensland, 2010). Landowners are typically small scale, with parts of their income from their farm and/or forest. Landowners can choose to rent out fishing on their property by selling permits to anglers, usually averaging €20-70/angler/day. Some landowners also offer accommodation, meal services and guiding on their property. The fishing right is managed on an individual property basis, although landowners could choose to collaborate with other landowners to offer longer fishing stretches to the anglers. The fish stocks on the other hand are co-managed by a landowner organisation (where all landowners are members) within the framework set by the central government (Stensland, 2010).

The salmon fishing season in Norway typically runs from 1 June to 31 August. Every year, 65–70,000 anglers, of which 15–20% are foreigners, fish on average 12 days for salmon, sea trout Salmo trutta L. and sea run Arctic char Salvelinus alpinus L. in Norwegian rivers (Stensland et al., 2015). From 2012 to 2019, these anglers caught 147,000–197,000 fish annually (two-thirds were salmon). In the last five years, about 20% were released alive. Anglers spend approximately NOK 1.3–1.7 billion a year in the riverside communities (Andersen & Dervo, 2019). (1 NOK =0.09 € as of July 2020). However, with dwindling catches in the last 10–15 years and stricter regulations (quotas, shortened seasons, closed rivers) after 2009, the number of active anglers in Norwegian rivers has declined. Stensland et al. (2015) found that salmon anglers in Norway on average fished fewer days and were less satisfied with their angling experiences during the period 2013–2014 than in 2007–2009. The Trondheim Fjord rivers, which includes the Verdal River, also experienced lower catches in 2013 and 2014 and a declining number of anglers (Stensland et al. 2015).

3 | METHODS

3.1 | Study area – The Verdal River Fishery

The Trondheim Fjord region of mid-Norway has six major rivers and around 30 middle and small-sized salmon streams, making it a very important region for wild Atlantic salmon. The Orkla, Gaula, Stjørdal and Verdal rivers are the top four salmon rivers in the Trondheim Fjord region, all within 2 hours driving travel of each other. For the period 1997–2007, the Gaula and Orkla were among the top five Norwegian rivers in terms of numbers of salmon caught per year, whereas the Stjørdal and Verdal were among the top 20 and top 25, respectively.

While the three best salmon rivers in the region have a 100-year history of fishing tourism, the Verdal River first gained attention as an angling destination 30–40 years ago. The 52 km of the Verdal River are split between 147 landowners. The main stem of the river receives the bulk of the fishing effort. The few kilometres nearest the sea and the very upper parts of the river get less attention from anglers.

The Verdal River was subject to a dramatic change in season length, catch and quotas after 2009, but fishing regulations and catches in the other Trondheim Fjord rivers stayed roughly the same the following years (except for 2013 & 2014). Fishing regulations have become stricter in the Verdal over time (see Appendix S1 for a comparison of the Verdal and Orkla river catches and regulations for 1985–2014). In 2009, the Verdal River season lasted two and a half months with an annual quota per angler of ten salmon/sea trout. Between 2010 and 2012, the fishing season lasted one month with no take of sea trout and an annual quota per angler of two to three salmon (only two if the weight of the salmon was above 3 kg). Accordingly, total catches and salmon killed in the Verdal River decreased significantly, and C&R went up from virtually zero to 30–60% of catches.

Because of lower catches and stricter regulations, both the number of anglers and their average number of fishing days in the Verdal River have dropped over time. The number of angler days in the Verdal River was estimated based on annual permit sale numbers from the Verdal Hunting and Fishing Association (VJFF – Verdal Jeger- og Fiskerforening), and figures from a national salmon angler survey (Stensland et al., 2015). The average annual number of anglers for the period 2007–2009 was 1025, which yielded 7688–9610 angler days (Appendix S1).

3.2 | Data collection and survey design

As in most Norwegian rivers, the Verdal River has no central register of anglers since fishing permits are sold by multiple landowners who do not necessarily keep a complete customer contact list. To contact anglers, a list of 643 unique anglers was compiled based on: (i) anglers registered on the mandatory catch report website available for
the period 2008–2012 (only catches need to be reported; zero catch anglers are not registered here) \( n = 390 \); (ii) mandatory disinfectant certificates \( n = 60 \); (iii) landowners \( n = 75 \); and (iv) fishing permit paper copies for 2012 from VJFF, which administers fishing for many landowners \( n = 118 \). (Note: contact information for all anglers on the list could not be found). People below 16 years of age were excluded. The final valid sample consisted of 432 anglers with correct contact information in terms of e-mail \( n = 291 \) or postal address \( n = 141 \). The mail survey followed the recommendations of Dillman, Smyth and Christians (2009, pp. 65-150), and was sent out with a pre-notification letter/e-mail, main send-out and three reminders during the Spring/Summer 2013. Thus, the questions related to their angling in 2012 or earlier. A total of 214 responses were received, giving an overall response rate of 49.5%. The sample ideally represented anglers in the Verdal River. However, sample selection bias cannot be ruled out as anglers who stopped fishing in the river prior to the survey might have been harder to contact. Thus, the results should be interpreted with this in mind.

### 3.3 Survey questions

In the survey questionnaire (see Appendix S1), questions were adapted from other studies on recreational fishing. Most questions were answered on a seven-point scale with only endpoints given verbal labels. First, respondents were asked questions about their experience with salmon angling in Norway and other countries. The second part consisted of specific questions about their salmon angling in the Verdal River. Questions about fishing motivation were from Beardmore et al. (2013), and place attachment statements from Williams and Vaske (2003).

In parts three and four, respondents were informed about the status of salmon and sea trout stocks, regulations and management. Questions asked about preferences of specified fishing regulations, satisfaction with the 2013 fishing regulations, attitudes towards keeping one big salmon as a part of the quota and releasing one big salmon as part of the quota, and statements about C&R of fish in the Verdal River (Skullerud & Stensland, 2013). Part five contained questions about management actions and future fish stock trends.

In part six, respondents were asked to value their recreational experience of sport fishing in the Verdal River under different fishing regulations, first, under fishing regulations for the season 2009, then for 2010–2012 and finally 2013. Four questions were formulated to determine the initial recreational value of salmon fishing in the Verdal River, and how it is affected by regulations. First, the respondents were asked to state their Verdal River fishing expenditures during the last season they fished there. Second, respondents were asked to state the maximum increase in these annual expenditures they would accept before stopping fishing in this river: “Consider what it was worth to you to be able to fish the Verdal River the last season you fished there. 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?” This question was asked to determine the anglers’ initial recreational value of salmon fishing in their last season on the Verdal River (see also Toivonen et al., 2004). Respondents could choose from a list of amounts from NOK 0 to NOK 18,000 in a payment card (PC). A “don’t know” option was also provided to the respondents (Johnston et al., 2017). A PC was used instead of a dichotomous choice (DC) format (i.e. asking the anglers to say “yes” or “no” to paying pre-specified amounts), as DC requires larger samples than was possible from the relatively small population of anglers on the Verdal River (Boyle, 2017).

To evaluate how the recreational value changed with different regulations, a policy-relevant regulation scenario was introduced to the respondents. Note that it was not possible to differentiate the effect of regulations from effect of stock decline. Stock decline causes stricter fishing regulations, while the stricter regulations will in time yield stock increase. A quota regulation sets a limit how much fish that can be caught and is such a stronger catch constraint than stock decline that would allow status quo effort and total catch if not combined by restrictions.

The new regulation implied that the fishing season would span 10 June – 31 July, with a quota of two salmon per angler annually. This would be implemented from 2013 to 2016, and the regulation was similar to the one for the upcoming 2013 season. This regulation scenario extended the length of the season by 3 weeks, although reduced the annual salmon quota from three to two fish. Some anglers might have obtained higher recreational value with this regulation scenario, while it might have reduced the recreational value for other anglers. Therefore, the respondents were asked whether the coming seasons in the Verdal River with new regulations were worth more or less than their last fishing season: “Consider your expenses the last season you fished the Verdal River (cf. question 32). If the season length is June 10–July 31, and the annual quota is 2 fish per angler for 2013–2016: Will fishing the Verdal River one of these coming seasons be worth more, the same or less to you than the expenses you had the last season you fished there?”

The anglers who obtained increased recreational value with the regulation scenario were asked their WTP in terms of the increased annual expenditures they were willing to pay to get the regulations: Consider what it is worth to you to be able to fish the Verdal River with a season length June 10–July 31, and an annual quota of 2 fish per angler. Compared to the expenses you had the last season you fished the Verdal River (cf. question 32). What is the largest increase in your annual expenses for fishing the Verdal River you can accept before you would have stopped fishing there?”.

A WTA question in terms of their willingness-to-accept compensation in terms of reduced annual fishing expenditures was asked of anglers who experienced lower recreational value with the new regulations: “Consider what it is worth to you to be able to fish the Verdal River with a season length 10 June–31 July, and an annual quota of 2 fish per angler. Compared to the expenses you had the last season you fished the Verdal River (cf. question 32). What is the smallest reduction in your annual expenses for fishing the Verdal
River you can accept and still fish there?" The same PC as described above was used for both WTP and WTA questions.

Although theoretically correct, WTA questions are usually avoided in CV surveys due to empirical difficulties, such as respondents protesting about the question about required compensation because they do not feel they have the property right to the resource in question and can demand compensation, or they are offended by being "bribed" by monetary compensation (Arrow et al., 1993). Thus, there are few CV studies that ask respondents for their WTA compensation. Guidance in stated preference methods (Johnston et al., 2017 recommendation # 7) states: "However, WTP estimation should not always be considered the default, and WTA estimation should be applied when it is appropriate and feasible". In this study, the regulatory change implied property rights and respondents logical reference conditions all point in the direction of WTA being the appropriate welfare measure for anglers experiencing a welfare loss due to the new regulation. For anglers that experienced a welfare gain by the new regulations, the appropriate way to measure this is still by a WTP question. As the conditions for a successful application of WTA were considered to be fulfilled, the CV question could be differentiated and tailored to these two groups of anglers.

Respondents not willing to accept any changes (positive or negative) in their annual expenses for fishing in the Verdal River were asked why. Different reply options were offered. If a respondent chose "The season should not be extended before the number of spawners has increased" or "I don't believe the fishing in the Verdal River will be as good as it used to be," the angler was identified as a "protest zero" respondent. Questions regarding socio-economic characteristics were asked at the end of the survey, as recommended by Johnston et al., (2017).

### 3.4 Data analyses and variables

Interval censored regressions (Cameron & Huppert, 1989) were used to determine the expected mean of the anglers’ recreational value last season and with different fishing regulations. The expected mean is given by:

$$E(RV) = E(RV_{RV > 0}) \cdot \text{Prob}(RV > 0)$$

In addition, interval censored regressions were used to evaluate how relevant exogenous variables explain the variation in recreational values (Woolridge, 2013). As this was a split-sample survey asking some respondents a WTP question and others a WTA question, a logit model was also used to evaluate how angler and socio-economic characteristics explained whether they preferred the regulation scenario or not. Zero-responses were not included in the regression analyses for WTP, WTA and initial recreational value with the regulation scenario. This was because it is not possible to distinguish true zero respondents for WTP, WTA, and missing values. Overall, 4% of the sample was identified as protest zeroes. Protest zeroes were excluded from the analysis.

Because of linearity concerns, binary variables of statements believed, through theory and reasoning, to be important in explaining the variation in the recreational values were generated. A 7-point scale was used for most statement. The binary variables were coded as 1 if the respondents chose 5 or higher on the scale, and 0 otherwise. Table 1 gives a description of the variables used in the analyses.

### 4 RESULTS

#### 4.1 Sample characteristics

Ninety-four percent of the respondents were males (Table 2). The average age was 51 years (range 16 to 79). The annual mean household income was NOK 765 612 (all values adjusted to 2019 prices). The sample consists of both foreign (24%) and domestic anglers (76%). The anglers’ mean annual salmon fishing expenditures (including other rivers as well) in their last fishing season were NOK 4630. On average, anglers fished for salmon on 17 days in total during their last season, and caught and kept two fish each. They fished on average in eight Norwegian rivers and in two non-Norwegian rivers during their lifetime. Twelve and a half per cent of anglers last fished in Verdal River between 2007 and 2009, when the fishing regulations were more liberal. The rest had their last season on the Verdal River during the period 2010-2012. On average, anglers fished 17 seasons in the Verdal River.

#### 4.2 Initial recreational value

The expected mean recreational value of the last fishing season in the Verdal River was NOK 3911 (Table 3). Overall, 61.7% of the surveyed anglers had positive recreational value, 21% had zero recreational value and 17.3% stated ‘don’t know’. The mean annual recreational value per angler that fished in the Verdal River the last time between 2007 and 2009 was NOK 6017 (Table 3). In comparison, the mean annual recreational value for anglers who last fished between 2010 and 2012 (with stricter regulations) was lower, at NOK 3960 per angler. Assuming 1025 anglers and 7688–9610 angler days per year during 2007–2009, this yields an average of 7.5–9.4 days per angler per year on the Verdal River. The total recreational value for the period was NOK 6.17 million annually, and NOK 640–803 per angler day. The period 2010–2012 had on average 399 anglers and 2994–3743 angler days, and an average of 7.5–9.4 days per angler with a recreational value of NOK 3960 per angler. This yields a total annual recreational value of NOK 1.58 million and NOK 421–528 per angler day.

### 4.3 Recreational value in the new regulation scenario

The majority (64%) considered the upcoming seasons with the new regulation scenario to be worth the same or more as their last
fishing season in the Verdal River and was asked the WTP question (Table 3). Thirty-two per cent of the respondents did not know whether the upcoming seasons were worth less, the same or more as their last season. Mean annual WTP to get the regulation scenario was NOK 3821 per angler (Table 3). If the anglers last fished between 2010 and 2012, mean annual WTP was NOK 3384, while if they last fished between 2007 and 2009 mean, WTP was NOK 2686. Whether these means are significantly different was not confirmed, as few respondents had their last fishing season in the Verdal River between 2007 and 2009.

Mean annual WTA compensation to have the regulation scenario was NOK 2304 (Table 3). Respondents who last fished in the Verdal River between 2007 and 2009 had a mean annual WTA compensation of NOK 6755 (n = 3). On the other hand, mean WTA was NOK 1663 for the 27 respondents having their last fishing season in the Verdal River between 2010 and 2012.

A t-test of mean difference showed WTP to be significantly (at the 5% level) higher than WTA. The overall mean annual recreational value with the regulation scenario was NOK 2598 per angler. When calculating this value, WTP values were positive, while WTA values were negative. The mean annual recreational value with the regulation scenario of NOK 2598 was significantly lower than the initial annual recreational value per angler of 3911 NOK.

### 4.4 Regression model of initial recreational value

The recreational value decreased with the total number of fishing days in all salmon rivers they fished, being female, and higher importance of catching fish to generate a supply in the freezer (Table 4). Initial recreational value increased with increasing number of years the respondents have fished in the Verdal River, increased fishing expenditures, having last fished the Verdal River during 2007–2009, increased number of released fish in the Verdal River, agreeing that they should release their catch, and agreeing that the Verdal River is the best salmon river for them.

| Variable            | Description                                           | Mean (SD)       |
|---------------------|-------------------------------------------------------|-----------------|
| Hhinc               | Annual household income (gross), in NOK               | 652,368 (291,061) |
| Male                | 1 if male, 0 otherwise                                | 0.94 (0.24)     |
| Higheduc            | 1 if finished 3 years or more at University, 0 otherwise | 0.29 (0.46)   |
| FishExp             | Fishing expenditures last season in VR in NOK        | 3940 (455)      |
| Fishdays            | Total fishing days last season fished in Verdal River (VR). (from 2007–12) | 6.5 (17.2) |
| YearsVR             | Active years of fishing in VR (in years)             | 16.5 (13.2)     |
| Season2007-09       | 1 if last season fished in VR was during 2007–09, 0 otherwise | 0.11 (0.32) |
| TotalFish           | Number of fish caught last season fished in VR (from 2007–12) | 3.0 (7.3) |
| FishKept            | Number of fish caught and kept last season in VR (from 2007–12) | 1.5 (3.3) |
| ReleasedFish        | Number of released fish last season in VR (from 2007–12) | 0.98 (2.78) |
| ZeroFish            | 1 if caught zero fish last season, 0 if caught at least one fish | 0.39 (0.49) |
| FreezeFish          | 1 if (very) important to "generate a supply of fish in the freezer" | 0.10 (0.29) |
| OutwitFish          | 1 if (very) important to "outwit difficult-to-catch fish," 0 otherwise | 0.58 (0.50) |
| Friends&Family      | 1 if (very) important to "be with friends/family," 0 otherwise | 0.66 (0.47) |
| MasterAngling       | 1 if (very) important to "master angling-related challenges," 0 otherwise | 0.40 (0.49) |
| VerdalBestRiver     | 1 if (strongly) agree "Verdal R. is the best salmon fishing river for my type of fishing," 0 otherwise | 0.48 (0.50) |
| Landowner           | 1 if landowner in Verdal R., 0 otherwise             | 0.06 (0.23)     |
| Norway              | 1 if from Norway, 0 otherwise                         | 0.76 (0.43)     |
| SatisfiedFishing     | 1 if (extremely) satisfied with fishing in Verdal R. 2007–2012, 0 otherwise | 0.33 (0.47) |
| SatisfiedNewRegulations | 1 if (extremely) satisfied with 2013 fishing regulations in Verdal R., 0 otherwise | 0.35 (0.48) |
| ShorterSeason        | 1 if (strongly) agree that the fishing season should be shorter, 0 otherwise | 0.19 (0.39) |
| C&R                 | 1 if (strongly) agree "should release all caught fish," 0 otherwise | 0.25 (0.44) |
| EatFish             | 1 if (strongly) agree "I usually eat the fish I catch," 0 otherwise | 0.76 (0.43) |
| SatisfactionOtherRivers | 1 if (strongly) agree "Other rivers give me the same satisfaction as fishing in the Verdal R.," 0 otherwise | 0.52 (0.50) |
| VRMeansAlot         | 1 if (strongly) agree "Verdal R. means a lot to me," 0 otherwise | 0.75 (0.44) |

*Midpoint in the response option interval used as a proxy.*
4.5 | Regression models for recreational value with regulation scenario

The net income elasticity of WTP after the regulation scenario was 0.4 (model 1, Table 5). WTP increased with household income, age, fishing expenditures, importance to outwit difficult-to-catch fish, satisfaction level of fishing seasons in the Verdal 2007–2012, and if the Verdal River meant a lot to them. WTP was lower if other rivers provided the same satisfaction as fishing in the Verdal River.

Willingness-to-accept the regulation scenario increased with age, fishing expenditures, education level and satisfaction level of fishing seasons in the Verdal 2007–2012 (model 2, Table 5). WTA decreased with the amount of fish caught and kept last season, agreement that the season should be shorter than what the regulation scenario entailed, and agreement that they fished in the Verdal River to outwit difficult-to-catch fish.

In model 3, WTP was defined as positive values, and WTA as negative values. The recreational value increased with importance of mastering angling-related challenges and outwit difficult-to-catch fish, satisfaction with the 2013 fishing regulations, and satisfaction with each of the seasons 2007–2012. The recreational value decreased with increasing fishing expenditures, importance of eating the catch, and having 2007–2009 as last season.

4.6 | Logit-model for WTP versus WTA

In the logit model (Table 6), the dependent variable took the value one for respondents who were asked a WTP question (n = 73) and zero for respondents who were asked a WTA question (n = 41). The McFadden’s adjusted $R^2$ was reasonably high. Several goodness of fit tests were performed, and all tests indicated a good fit. The model correctly classified 86% as $y = 1$ and 76% as $y = 0$. The likelihood of experiencing increased recreational value with the regulation scenario increased with household income, if an angler caught zero fish or released fish last season in the Verdal River, being satisfied with...
the 2013 fishing regulations, satisfaction with each of the seasons 2007–2012, and to master angling-related challenges. Recreational value decreased with motivation to eat fish, having 2007–2009 as last season, and with having higher education.

### Discussion

Annual recreational value per angler (for their last season fishing in Verdal River) for anglers who last fished the Verdal River between 2010 and 2012 (NOK 3960) was about 2/3 of the annual value for those who last fished before stricter regulations were introduced in 2010 (NOK 6017). This indicates that the recreational value of salmon fishing decreased with stricter fishing regulation such as shorter season length and lower quotas. This is in line with Stensland et al. (2017), who showed that quotas and shorter season reduced salmon angling participation in general in Norwegian rivers.

Furthermore, the mean annual recreational value per angler with the regulation scenario (NOK 2598) was about 2/3 of the mean annual recreational value (NOK 3911) before the new regulations in 2013. The regulation scenario implies a stricter salmon quota, but a longer fishing season. Even though the majority considered the upcoming seasons (2013–2016) to be worth more or as much as before the new regulation scenario, the scenario decreased the overall mean recreational value because some anglers experienced a lowered recreational value with the new regulations. This implies that the average angler does not exist (Shafer, 1969), and that a change in fishing regulations will affect angler groups differently depending on the regulations and actual fishery (Layman et al., 1996; Stensland et al., 2017; Stoll & Ditton, 2006). A shorter season is considered to lower the annual recreational

### Table 3

| Last Season       | Mean initial RV | 95% CI | Mean WTA for new reg. | 95% CI | N  | 7 |
|-------------------|----------------|--------|-----------------------|--------|----|---|
| 2007-2009         | 6017           | 5755   | 3746                  | 4025   | 4  | 3 |
| 2010-2012         | 3960           | 3970   | 3369                  | 3351   | 84 | 84|
| Overall           | 3911           | 3960   | 3369                  | 3351   | 84 | 84|

Note: Confidence interval was estimated by using the Delta method. Numbers in NOK. €1 = NOK 10, PPP-adjusted, to equalise price levels.

### Table 4

| Variables          | Mean (SE) | 95% CI |
|--------------------|-----------|--------|
| Lnhhinc            | 0.28 (0.37)|        |
| Male               | 2.63 (1.24)|        |
| LnFishdays         | -0.64 (0.24)|        |
| InFishExp          | 0.38 (0.18)|        |
| Season2007-09      | 1.53 (0.75)|        |
| ReleasedFish       | 0.19 (0.049)|       |
| FreezeBillFish     | -4.36 (1.14)|       |
| C&R                | 1.16 (0.47)|        |
| YearsVR            | 0.039 (0.018)|      |
| VerdalBestRiver    | 0.88 (0.50)|        |
| Constant           | -3.05 (5.36)|      |
| Log Likelihood     | -504.3     |        |
| McFadden's Adj. $R^2$ | 0.02     |        |
| Observations       | 160       |        |

Abbreviation: SE, standard errors of the coefficients. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. N = 164.
value for fishermen as the number of possible angling days would decrease. A lower harvest quota would limit angling participation by consumption-oriented salmon anglers (Stensland et al., 2017), and thus lower their recreational value per angling day. Anglers are a diverse group, hence factors impacting participation work on a constraint-facilitator continuum (Kuehn et al., 2013; Raymore, 2002). A factor such as stricter quotas would be a constraint to some anglers, whereas for conservation minded, less harvest-oriented, and more C&R prone anglers, a lowered quota could be viewed as a sign of responsible fishery management and facilitate participation, as Stensland et al. (2017) showed for salmon anglers in Norway, and indicated here.

With these restrictions, imposed recreational fisheries could see a change in the composition of the angler population with more consumption-oriented anglers leaving the fishery (Øian et al., 2017) or adjusting their behaviour through various substitution strategies (Shelby & Vaske, 1991; Stensland et al., 2017). Angler behaviour and preferences will also depend on available substitution sites and activities (Shelby & Vaske, 1991), commitment to angling and place attachment (Beardmore et al., 2013).

### TABLE 5 Interval censored regression models (1–3) for recreation value with the salmon fishing regulation scenario

| Independent variables | WTP (1)     | WTA (2)     | RV (3)    |
|-----------------------|-------------|-------------|-----------|
| lnhhinc               | 0.40* (0.21)| 1.50 (1.03) |           |
| Age                   | 0.02*** (0.01)| 0.02** (0.01)| 0.07 (0.05)|
| lnFishExp             | 0.29*** (0.07)| 0.72*** (0.13)| −1.02** (0.45)|
| Higheduc              |             | 0.53** (0.21) |           |
| OutwitFish            | 0.36* (0.22)| −0.52*** (0.19)| 2.07* (1.25)|
| SatisfiedFishing      | 0.45*** (0.21)| 0.61*** (0.25)| 2.89*** (1.37)|
| ZeroFish              | 0.16 (0.22) |             | 2.79*** (1.33)|
| SatisfactionOtherRivers| −0.37 (0.21)|            |            |
| VRMeansAlot           |             | 0.49*** (0.25) |           |
| FishKept              | −0.03 (0.02)|             |           |
| ShorterSeason         |             | −0.68* (0.29) |           |
| EatFish               |             | −4.36*** (1.36)|           |
| MasterAngling         |             | 3.88*** (1.23) |           |
| Season2007-09         |             | −6.94*** (3.32)|           |
| SatisfiedNewRegulations|          | 2.89*** (1.34)|           |
| Constant              | −1.63 (3.02)| 0.80 (1.04) | −15.06 (14.51)|
| Log Likelihood        | −123.02 | −49.478 | −355.08 |
| McFadden's Adj R²     | 0.05 | 0.13 | 0.03 |
| Observations          | 60 | 30 | 89 |

Notes: Parentheses indicate standard errors of the coefficients. In Model (3), recreational value (RV) is defined by positive WTP (willingness-to-pay) values and negative WTA (willingness-to-accept) values.

***p < 0.01, **p < 0.05, *p < 0.1 See Table 2 for a description of the variables.

### TABLE 6 Logistic Regression for WTP vs WTA

| Variables                | WTP vs WTA Mean (SE) |
|--------------------------|----------------------|
| lnhhinc                  | 1.74*** (0.70)       |
| lnFishExp                | −0.15 (0.21)         |
| EatFish                  | −3.45*** (1.26)      |
| SatisfiedNewRegulations  | 2.06*** (0.86)       |
| MasterAngling            | 2.01*** (0.70)       |
| ZeroFish                 | 2.70*** (0.82)       |
| Season2007-09            | −3.49*** (1.55)      |
| SatisfiedFishing         | 1.47*** (0.75)       |
| Higheduc                 | −1.43* (0.85)        |
| ReleasedFish             | 1.02*** (0.38)       |
| Constant                 | −21.10*** (9.39)     |
| Log likelihood           | −38.46               |
| McFadden's Adj R²        | 0.29                 |
| Average Prob.            | 0.65*** (0.03)       |
| n                        | 108                  |

Abbreviation: SE, standard errors of the coefficients.

***p < 0.01, **p < 0.05, *p < 0.1.
2010–2012 with the introduction of stricter regulations (lower quota and shorter season). The findings of recreational value per angler day of respectively NOK 640–803 (before regulations) and NOK 421–528 (during regulations) confirmed that stricter regulations affect anglers’ recreational value negatively. The recreational values per day also correspond well with recreation value estimates from other salmon rivers in Norway, although they are somewhat lower than in one of the very best salmon rivers – Gaula River – but higher than in acidified salmon and sea trout rivers even with the stricter fishing regulations in Verdal river (Navrud, 2001).

Anglers who scored high on experiencing nature mastered angling-related challenges and outwitted difficult fish scored higher recreational value with the regulation scenario. This is reasonable as the regulation scenario entails a longer season, which means the anglers have more time to practice and master angling-related challenges and outwit difficult fish.

The results also show that place attachment is important in explaining variations in anglers’ recreational value, both for the angling they have undertaken, and for their stated change in recreational value with stricter fishing regulations. The recreational value was higher among anglers who (strongly) agreed that Verdal River is the best salmon fishing river for their type of fishing. In addition, the recreational value of the fishing they had undertaken increased with the number of seasons in the Verdal River. If an angler has spent multiple seasons at a specific river, one would expect that place attachment could explain their returns to the same river. Place attachment to a site evolves over time and depends on spending time at the site (Hailu et al., 2005). WTP for the regulation scenario increased if the anglers felt attached to the Verdal River, and anglers with high place identity thus have higher recreational value. Correspondingly, WTP decreased if anglers agreed that other rivers were perfect substitutes (i.e. provided the same satisfaction) for the Verdal River. Overall, recreational value increases with place attachment, and these anglers are less likely to leave the river if new and stricter management regulations are imposed. For some, quitting salmon angling and doing another activity might be an alternative or perfect substitute for going to another salmon river (Stensland et al., 2015).

The results above are in accordance with previous studies that showed anglers to score such non-catch-related motives higher than catch-related motives as reasons for going fishing; although catch was important for satisfaction with the trip (Beardmore et al., 2011).

With regards to catch motives, the results showed that both consumptive orientation and C&R attitudes/behaviour affect the anglers’ recreational value. Consumptive anglers had lower recreational value both with their initial and the new regulation scenario, probably as a result of fewer salmon to harvest in the latter. The recreational value was higher for anglers agreeing with or doing C&R. This seems reasonable as C&R is often part of a strict management scheme, and accepting C&R means that these anglers probably see the current and future management regimes as relatively less restrictive than anglers not doing and/or not accepting C&R. In a discrete choice experiment, Ropars-Collet and Le Goffe (2020) found great heterogeneity in anglers’ valuation of mandatory C&R, where 25% of the binary attribute was on the positive side. On the other hand, Olaussen (2016) found that mandatory C&R can reduce anglers’ utility by up to 80%.

5.1 | Implications for management

Do stricter regulations harm all angler groups? That probably depends on the restrictions imposed. The tested scenario was a mixture of reduced season and stricter quotas, and no attempt was made to differentiate between the two. Irrespective, the scenario reduced the overall welfare of salmon anglers in the Verdal River. Both the consumptive anglers and the C&R anglers were likely affected by the scenario, but the latter group less so. They are more likely to adapt, keep on fishing in the river, and not leave for other (nearby) rivers with higher quotas (Stensland et al., 2017). Some groups of anglers would, however, benefit from the changes, typically the “elite/C&R anglers” in Øian et al., (2017), while others like the “folkfishing/harvesters” face reduced recreational value and would be the ones that leave the river. If stricter regulations remain over time, one would likely see an initial conflict (Øian et al., 2017) followed by a permanent transformation of the angler population to being younger, less harvest-oriented, or more of C&R and fly fishing (Stensland et al., 2015). To what extent this has happened in the Verdal River is not known as there are no data on, for example, age and psychographics of the angler population after this 2013-study. Catch reports do, however, give some support for the assumption as angler behaviour has changed. C&R has grown from 33–42% of total catch for 2010–2012 to 61–66% for the 2018–2020 seasons. For the latter period, 70–78% of the salmon was caught on fly, while for the first period, no such numbers exist.

5.2 | Further research

Overall, this Contingent Valuation (CV) study showed that both the WTA and WTP questions can be successfully applied in a CV survey of anglers to estimate the recreational value of fisheries under different regulatory regimes. The split-sample approach of WTP and WTA to assess changes in the value of recreational activities caused by external factors should be further explored in CV studies. The study also finds that both fishing motivations and place attachment are useful in explaining anglers’ recreational value of salmon fishing. Thus, the study demonstrated that including socio-psychological statements in a CV survey can be useful. However, more research is needed to understand the importance of social–psychology variables in CV studies.

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**DATA AVAILABILITY STATEMENT**

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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