



Leisure Sciences

An Interdisciplinary Journal

ISSN: (Print) (Online) Journal homepage: <https://www.tandfonline.com/loi/ulsc20>

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To cite this article: Charlotte I. M. Brockington, Tavi Murray, Fiona Buttrey, David Charlesworth, Sofia Consuegra & Carlos Garcia de Leaniz (14 Oct 2023): Understanding and Reducing Conflict over the Recreational Use of Rivers, Leisure Sciences, DOI: [10.1080/01490400.2023.2267529](https://doi.org/10.1080/01490400.2023.2267529)

To link to this article: <https://doi.org/10.1080/01490400.2023.2267529>



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Published online: 14 Oct 2023.



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Understanding and Reducing Conflict over the Recreational Use of Rivers

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ABSTRACT

The societal benefits of having greater access to rivers are numerous, but conflict sometimes ensues between recreational users. Using Wales as a case example, we conducted a survey to better understand the underlying beliefs and emotions of different river users in relation to river access. Sixty per cent of respondents felt there was conflict over river access, but perceptions differed with age and river usage. Most boaters wanted greater access to rivers, in stark contrast to anglers. Greater dialogue was highlighted as a necessary step to reduce conflict, but support for specific management actions such as usage tariffs, spatial or temporal zoning, or limiting the number of users were much less popular. River users differed in cooperativeness and assertiveness but consistently flagged water pollution as the most important factor detracting from their enjoyment of rivers. Sentiment analysis indicated that “trust” was the dominant emotion shared by all river users.

ARTICLE HISTORY

Received 6 April 2023
Accepted 19 September 2023


KEYWORDS

Angling; canoeing; conflict resolution; people and nature; river use

1. Introduction

The recreational use of rivers has increased in recent decades (Jacobsen et al., 2014) as the benefits of natural blue spaces for wellbeing and mental health are becoming increasingly apparent (Arnberger et al., 2018; Buckley, 2019; Gascon et al., 2017; Hines, 2017; Lackey et al., 2021; McManus et al., 2011; Poulsen et al., 2022; Völker & Kistemann, 2011; White et al., 2020, 2021). For example, in the USA paddle boarding increased by ~62% and kayaking by 15% from 2013 to 2016 (Stott, 2019). However, the increasing use of rivers has also increased conflict over ownership and access rights (Welsh Government, 2019). In the UK, there are disputed public rights for recreational access to inland rivers and it has been estimated that only 3% of rivers are freely accessible to the public (Horton, 2022; Stanford, 2021; Welsh Government, 2019; Wynn-Davies, 2021). Conflict has often revolved around competing uses of rivers and has at times led to heated discussions and physical altercations (Church & Ravenscroft, 2006). Many anglers believe that boats disturb fish and ruin their sport,

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 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/01490400.2023.2267529>.

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while boaters feel that there is no basis for such assertion, and argue that they should be able to access rivers freely without being harassed (Wynn-Davies, 2021). In the UK, boaters have no clear rights for the free use of rivers, despite campaigns for the public right of navigation (Dudley, 2017) which have often invoked the common law and the Magna Carta (Church & Ravenscroft, 2006, 2011; Church et al., 2007; Dudley, 2017; Horton, 2022) However, such disputes have no simple solution (Dudley, 2017) as access to rivers is often through private land, which makes resolutions even more difficult (Penning-Rowsell, 1994; Wynn-Davies, 2021).

Unlike most other river uses, angling is heavily regulated. Anglers typically pay for the right to fish, and need to comply with strict rules regarding how, when, and where they catch fish, in addition to how many fish they can harvest (Dudley, 2017). The reason for this is to avoid the overexploitation or degradation of a common resource (Feeny et al., 1990). However, no such restrictions exist with regards to most other recreational river uses, such as wild swimming, walking or boating.

Conflict in outdoor recreation arises when there is goal interference caused by other people's behaviors (Jacob & Schreyer, 1980). One reason why resolving such conflicts is often difficult lies in a misunderstanding among stakeholders on the values and perceptions of other groups' goals and priorities (Gigliotti & Peyton, 1993; Hostmann et al., 2005; Vining & Ebreo, 1991; Walker et al., 2006). For example, in Wales the Government stance has been to promote voluntary access agreements to rivers, to be developed between riparian owners and recreational users (National Assembly for Wales Commission, 2010), but little or no progress has so far been made (Church & Ravenscroft, 2011). Surveys have often revealed profound differences in values and opinions between river users (National Assembly for Wales Commission, 2010; Penning-Rowsell, 1994), but the degree of consensus and underlying reasons for such differences typically remain hidden.

Using Wales as a case example, we conducted an online survey to assess how people use rivers for recreation, and employed consensus modeling (Stone-Jovicich et al., 2011) and sentiment analysis (Mäntylä et al., 2018) to better understand the underlying beliefs and emotions of different river users. We explored potential solutions to alleviate conflict over river access by considering the five A's in conflict management (Borisoff & Victor, 1989) and by mapping the cooperativeness and assertiveness of different river users to identify the underlying Thomas-Kilmann conflict resolution styles (Kilmann & Thomas, 1975; Swatuk et al., 2008).

2. Methods and materials

2.1. Survey design and distribution

We designed an online questionnaire in *SurveyMonkey* consisting of 13 questions (Supplementary Material Table S1) to determine how people use rivers in Wales and what their views are in relation to conflict. The first four questions were designed to obtain information on river usage, demographics, and mobility. The next four questions identified how often users accessed rivers, the time of year, the time of day and the river flow they preferred the most, this was used to determine the extent of spatial and temporal overlap between river users. The last five questions focused on opinions

and solutions for better management of recreational activities in rivers. The questions consisted of a mixture of binary questions (yes/no), single select questions and 5-point Likert-type questions. Respondents were also invited to enter free-text comments, which were used for sentiment analysis.

The questionnaire was sent to all angling groups listed in Welsh Angling Club Directory, and distributed to members of Canoe Wales and wild swimming clubs. It was also posted in the Facebook and Twitter pages of the Center of Sustainable Aquatic Research at Swansea University and ~10 other media pages. The online questionnaire followed the principles outlined in the Declaration of Helsinki and was approved by Swansea University Ethics Committee with permit SU- 151121/4734.

2.2. Survey validation

As with other social surveys on the use of water resources (Dopico et al., 2022), we designed our questionnaire with the help of representatives from each of main stakeholder groups (anglers, boaters, river managers and other users in our case) and pilot trialed it first on a small sample of individuals ($n=7$). We undertook a test-retest strategy to assess the degree of internal consistency by calculating the intra-class correlation coefficient (ICC) between some questions using the *psych* R package, and used the *agrrmt* package (Ruedin & Aeppli, 2021) to assess the extent of agreement between respondents.

2.3. Statistical analysis

Data was analyzed using R version 4.0.2 (R Core Team, 2020) and the Ecological Methodology software package (Krebs, 1999). Likert-type responses were converted to a 5-point score (i.e. 1—strongly disagree to 5—strongly agree) and the effect of binned predictors (such as age or number of river visits per year) modeled using the mid-interval points (Hout, 2004). We used Fisher's exact test and log-linear models to analyze the frequency of responses, and mosaic plots and inspection of standardized residuals (i.e. the standardized difference between observed and expected frequencies) to identify significant deviations from random expectations using the *vcd* and *questionr* R packages.

Niche overlap between river users (i.e. their shared use of the river space) was calculated using the percentage overlap method (Krebs, 1999), taken into account the location, season, time of day, and flow preferences of respondents. Stressors and management actions were mapped along two axes (support and consensus) to visually identify differences between user groups. Support was defined as the percentage of respondents who agreed or strongly agreed with the statements being asked.

For each of the three main stakeholder group, we calculated the degree of assertiveness as the difference between the response to questions Q11 and Q10, i.e. the extent to which respondents felt that their use of the river detracted from other people's enjoyment of rivers more or less than other people's activities detracted from their own enjoyment. We used the willingness to dialogue (Q13) as an indication of cooperativeness. Results were centered and scaled to 0–1 and the mapping of median values of cooperativeness vs. assertiveness was used to identify the negotiation styles according to a Kilmann-Thomas model of conflict resolution (Kilmann & Thomas, 1975; Swatuk et al., 2008).

Sentiment analysis (Misuraca et al., 2020) was carried out on the free-text entered in response to Q13 ($n=64$). All text was converted to lower case and all numbers and punctuations were removed. Common English stop words such as *a*, *like*, *the*, *and*, *what*, etc, were also removed using the R source “smart.” Words were then manually stemmed so that similar terms were analyzed as one (for example, *boat canoe* and *kayak*, or *fishing* and *angling* were treated as equivalent). The *syuzhet* R package (Jockers, 2017) was used to match the free text entered by respondents against a database of 10,748 English words and derive sentiment scores according to eight emotions (joy, trust, fear, surprise, sadness, disgust, anger, and anticipation). Word networks were constructed based on the number of times different words were used by each user group and their correlations.

3. Results

We received 230 responses between 14th October 2021 and 26th January 2022 and combined river users into three main groups: anglers ($n=87$; 38%), boaters (including kayakers, canoeists and paddle boarders; $n=97$; 42%) and “others” (including cyclists, swimmers and walkers; $n=46$; 20%).

3.1. Demography of respondents

River users differed significantly in age structure (Kruskal–Wallis test, $\chi^2 = 11.734$, degrees of freedom [df]=2, $p=0.003$) with the group “other” (mean = 43.4 yrs, Standard Deviation [SD]=13.7) and boaters (mean = 47.3 yrs, SD = 14.3) being significantly younger than anglers (mean = 52.1 yrs, SD = 12.8).

3.2. Spatial zoning and river use

Respondents used 40 different rivers located across Wales, although most of them accessed rivers in the South East (32%) and the South West (24%). River use varied significantly between the 6 regions considered (South, South East, South West, North, North East, North West), indicating the existence of spatial zoning (Fisher’s exact test, $p=0.008$). Inspection of standardized residuals indicated that respondents who accessed rivers for “other” uses (i.e. walking, swimming, cycling) were more common in rivers of the South West than one would have expected by chance alone ($p=0.02$). The number of rivers visited varied from 1 to 14 rivers and was significantly influenced by user age ($t=-2.443$, $p=0.015$), user group (t for “other” = -2.739 , $p=0.007$) and their interaction (t for “other” x age = 2.743 , $p=0.007$; Generalized Linear Model fitted with quasi-poisson link). Anglers and boaters tended to access fewer rivers as they became older but the opposite was true for the “others” user group (including swimmers and walkers). Boaters were the most mobile group and visited significantly more different rivers (mean = 4.8 different rivers/yr) than anglers (mean = 3.6 different rivers/yr) and other users (mean = 3.5 different rivers/yr; $\chi^2 = 13.08$, df = 2, $p=0.001$).

The number of annual visits to rivers varied between 1 and 31 with a mean of 19.4 visits per year (SD = 10.45) and a median of 20 visits. There was no significant

difference in the frequency of river visits between user groups ($p=0.168$), user age ($p=0.520$), or region ($p=0.633$; Generalized Linear Model fitted with quasi-poisson link).

3.3. Temporal zoning

Different user groups accessed the rivers at different times of the year (Fisher's exact test, $p<0.001$), revealing the existence of a strong temporal zoning. Anglers were less likely to access rivers during the winter months, while boaters were less likely to access rivers during the summer and more likely to access during the winter than one would expect by chance alone. Temporal zoning was affected by river flows, as different users preferred different flows for their activities (Fisher's exact test, $p<0.001$). High flows were only preferred by boaters while "other users" (including swimmers) were more likely to access rivers at low flows. River use also varied significantly according to time of day (Fisher's exact test, $p<0.001$), in particular with respect to twilight and night conditions, which was strongly associated with angling (Fisher's exact test, $p=0.001$).

3.4. Niche overlap

The three types of river users used river resources differently along the four niche axes examined (location, seasonality, time of day and flow). Spatial overlap (region of access) was greater between anglers and boaters (overlap = 84%) than it was between anglers and other users (69%). Seasonal overlap was greater between anglers and other users (overlap = 95%) than it was between anglers and boaters (overlap = 60%). Boaters were the dominant users during the winter (84%), whereas anglers were the dominant users during the summer (49%).

Overlap on time of access was similar between anglers and boaters (overlap = 80%) as it was between anglers and other users (overlap = 81%), reflecting the fact that all river users preferred to access the rivers during the day (86% of use). However, those anglers that fished during the night or at twilight (26% of use) were the dominant users at that time of the day (79%).

3.5. Perception of conflict

Overall, 60% of respondents felt there was conflict over access to rivers, 25% did not think there was conflict and 15% were unsure. However, such perception varied significantly among user groups (Fisher's exact test, $p=0.003$). Perception of conflict was strongest among anglers (70%; 95 Confidence Interval CI = 59.4–78.2%), followed by boaters (58%; 95CI = 49.2–67.1%), and was lowest among other users (36%; 95CI = 20.7–54.2%). Log-linear modeling indicated the existence of a three-way interaction between user group, season and conflict (Likelihood Ratio test, $\chi^2 = 28.48$, $df = 12$, $p=0.005$). Anglers who fished the rivers in spring and summer were more likely to feel that there was conflict with boaters than those who fished in the winter, whereas the opposite was true for boaters, who felt that conflict was more likely to occur in winter and less likely in the spring and summer.

Respondent age also shaped user views on perception of conflict. The belief that there was conflict was not only more common among anglers than other river user (deviance_{2,191} = 6.42, $p=0.04$) but also became stronger with age (deviance_{2,189} = 8.20, $p=0.02$). Older anglers were more likely to think there was conflict than younger anglers, but the opposite was found among boaters and other river users (Figure 1).

3.6. Views on greater access to rivers

The majority of respondents (63%) favored a greater access to rivers but there were profound differences between user groups (Fischer exact test, $p<0.001$). Thus, while 91% of boaters and 74% of other users supported greater access to rivers, only 28% of anglers did so. Inspection of Pearson residuals indicated that the views of anglers and boaters are almost exactly the opposite with respect to this question: the enthusiasm of boaters for greater access to rivers was almost perfectly matched by the opposition of anglers.

3.7. Rater effects

Responses to the questionnaire differed significantly depending on the question being considered (type III analysis of deviance, $\chi^2 = 752.7$, $df = 11$, $p<0.001$), the user group ($\chi^2 = 60.3$, $df = 2$, $p<0.001$), their perception of conflict ($\chi^2 = 31.2$, $df = 1$, $p<0.001$) and, to a lesser extent, the season when they typically accessed rivers ($\chi^2 = 13.8$, $df = 3$, $p=0.003$). The analysis reveals that the responses of boaters (estimate = -0.76, z -score = -6.15, $p<0.001$) and other users (estimate = -0.45, z -score = -2.51, $p=0.012$) contrasts with that of anglers, as does the response of those who perceive that there is conflict in river usage compared to those who think there is no conflict (estimate = 0.52, z -score = 4.12, $p<0.001$). When asked if their own use of rivers detracts from the enjoyment of other river users, the “yes” and “no” answers were roughly the same, and did not differ from the random expectation (estimate = -0.30, z -score = -1.73, $p=0.084$). The intra-class correlation coefficient between Q10 and Q11 (where we

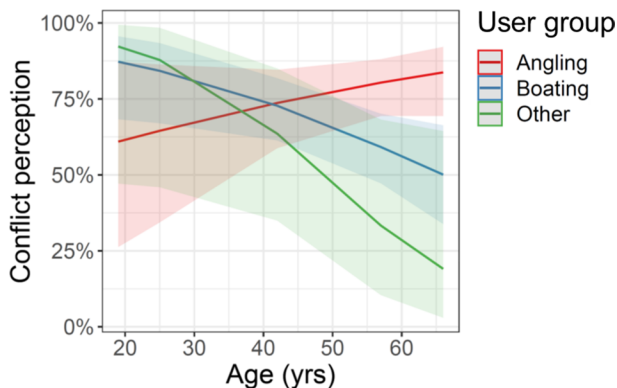


Figure 1. Effect of respondent age on views on conflict for the three river groups (angling, boating, other). the lines represent the predicted proportion of respondents that believe there is conflict accessing rivers and the shading the 95% confidence interval envelopes.

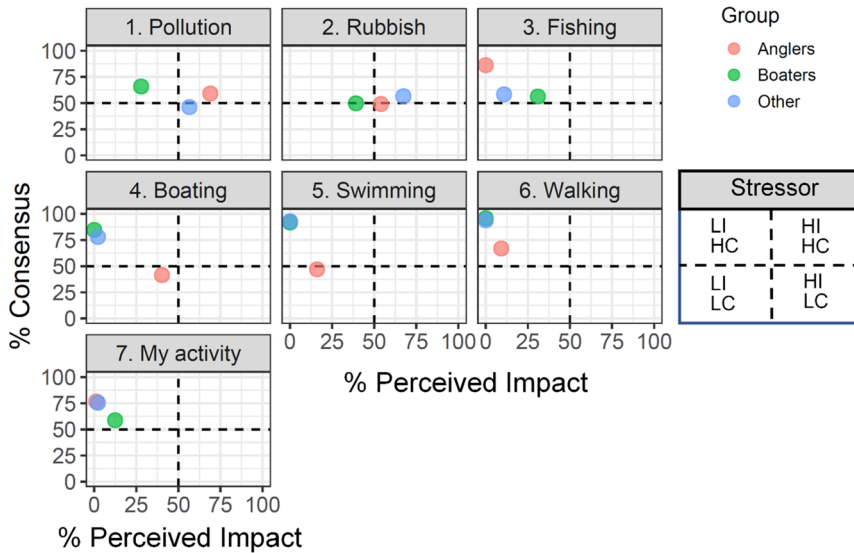


Figure 2. Mapping of stressors along the perceived impact and the extent of consensus within river users. The four response quadrants are Low impact with High consensus (LI, HC); Low impact with Low consensus (LI, LC); High impact with High consensus (HI, HC); and High impact with Low consensus (HI, LC).

asked participants to assess the impact of their own river use) was low (ICC2 for random raters = 0.26), but it was significantly different from zero ($F_{1,229} = 119$, $p < 0.001$) indicating there was some internal consistency.

3.8. Views on stressors and management actions

Among the stressors (i.e. factors that detract from the enjoyment of rivers), respondents signaled water pollution as the most important one (estimate = 2.12, z-score = 11.95, $p < 0.001$), followed by the presence of rubbish (estimate = 2.05, z-score = 11.46, $p < 0.001$). In contrast, the perceived impact of swimmers (estimate = -1.11, z-score = -5.94, $p < 0.001$) and walkers (estimate = -1.82, z-score = -9.02, $p < 0.001$) was significantly lower than expected, while the impact of boaters (estimate = -0.24, z-score = -1.37, $p = 0.170$) was not significantly different from the impact of anglers. Mapping the river stressors along their perceived impact and the degree of consensus (Figure 2) reveals contrasting views between river users. In general anglers tend to score stressors higher than other river users but with less consensus.

Among the management measures proposed, greater dialogue received the strongest support (estimate = 3.11, z-score = 16.45, $p < 0.001$), followed by introducing charges for river usage (estimate = 0.38, z-score = 2.11, $p = 0.034$) and limiting the number of users (estimate = 0.35, z-score = 1.98, $p = 0.048$). Support for spatial or temporal zoning was not significant ($p = 0.45$ and $p = 0.43$, respectively). Mapping the management actions along their perceived benefit and the degree of consensus (Figure 3) reveals also contrasting views between river users. In general anglers tend to support management actions more than other river users but with less consensus. Limiting users

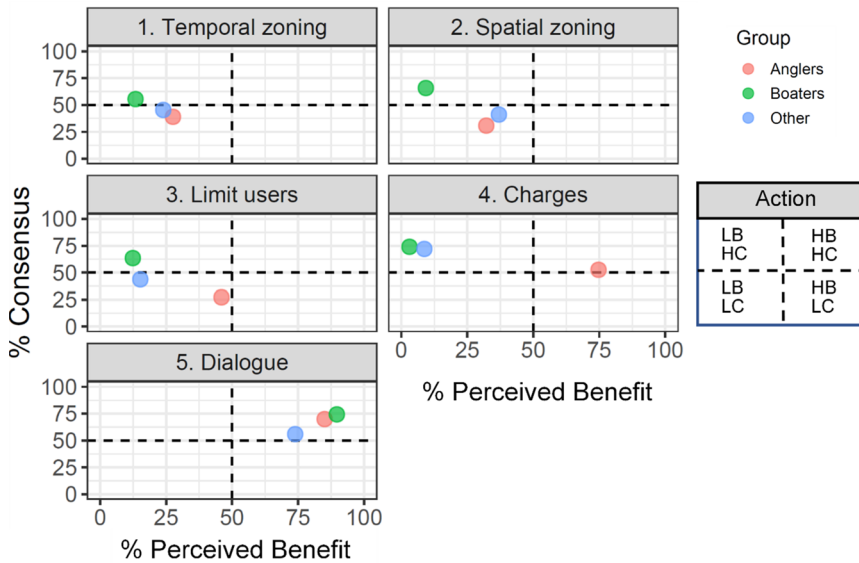


Figure 3. Mapping of management actions along the perceived Benefit and the extent of consensus within river users. The four response quadrants are Low Benefit with High consensus (LB, HC); Low Benefit with Low consensus (LB, LC); High Benefit with High consensus (HB, HC); and High Benefit with Low consensus (HB, LC).

and, specially, introducing charges are much supported by anglers, but strongly opposed by other river users.

3.9. Conflict resolution styles

River users differed significantly in cooperativeness (as measured by their willingness to dialogue, Kruskal–Wallis, $\chi^2 = 7.92$, $df = 2$, $p = 0.02$) and assertiveness (as measured by their views on other people’s impacts on their enjoyment of rivers compared to their own impacts, Kruskal–Wallis, $\chi^2 = 44.5$, $df = 2$, $p < 0.001$). Anglers were the most assertive group (post-hoc Dunn-test, $p < 0.001$) and boaters the most cooperative group (post-hoc Dunn-test, $p = 0.02$). Mapping of conflict resolution styles indicated that anglers were more likely to adopt a “collaborating” negotiation style i.e. the belief that there are win-win solutions, while boaters and other users were more likely to adopt a “compromising” negotiation style, i.e. the belief that all parties would have to win and lose something (Figure 4).

3.10. Sentiment analysis & Word networks

The number of respondents that provided free-text comments (amenable to sentiment analysis, described below) was 64 (28% of the total) and did not differ significantly between user groups (Fisher’s exact test, $p = 0.241$), indicating that they were broadly representative of different user views. However, respondents who left comments were more likely to believe that there was conflict among users than expected by chance, although the effect was marginal (Fisher’s exact test, $p = 0.045$).

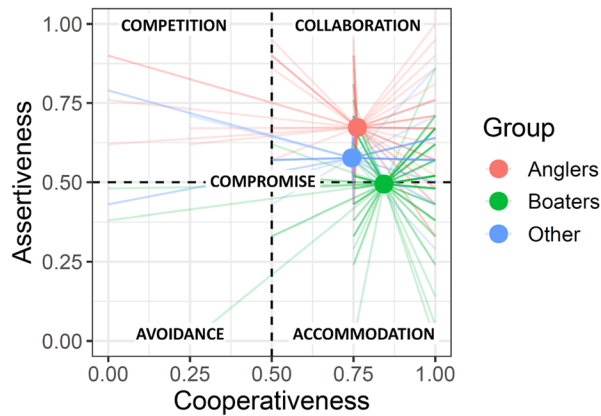


Figure 4. Underlying conflict resolution styles of river users inferred from their cooperativeness and assertiveness. The results show the median centroids for each group and the dispersion of individual responses.

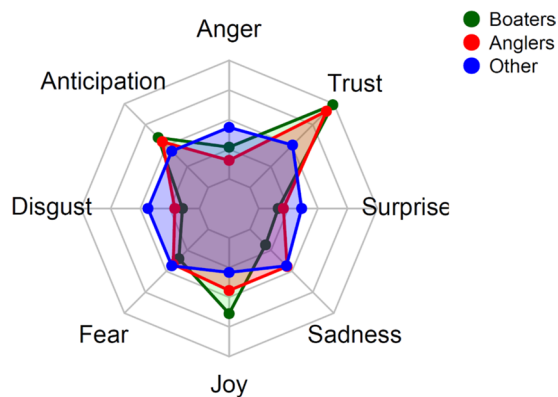


Figure 5. Sentiment analysis of the free text used by respondents in the online questionnaire. The radar plot shows the emotional profile of river users according to the eight emotions considered in the *syuzhet* lexicon.

Emotional profiling using the *syuzhet* lexicon revealed similar use of words between river users, with “trust” being the most common emotion, followed by “anticipation” and “joy.” Although boaters and anglers made a greater use of words associated with “trust” than other river users (Figure 5), the results are not statistically significant (Fisher’s exact test, $p=0.073$). The most common overall sentiment was positive (50%), followed by neutral (28%) and negative (22%). No significant difference in the relative use of neutral, positive and negative words was found between river users (Fisher’s exact test, $p=0.246$).

Boaters use a richer, more complex language than anglers as revealed by the larger use of common terms (boaters, $n=14$ terms; anglers, $n=11$ terms) and the larger number of connections per term (boaters = 4.2 connections/term, $SD = 1.72$; anglers = 3.0 connections/term, $SD = 1.34$; Figure 6). Of the 14 terms commonly used by boaters, 7 were shared by anglers and 7 were unique to boaters, including terms like

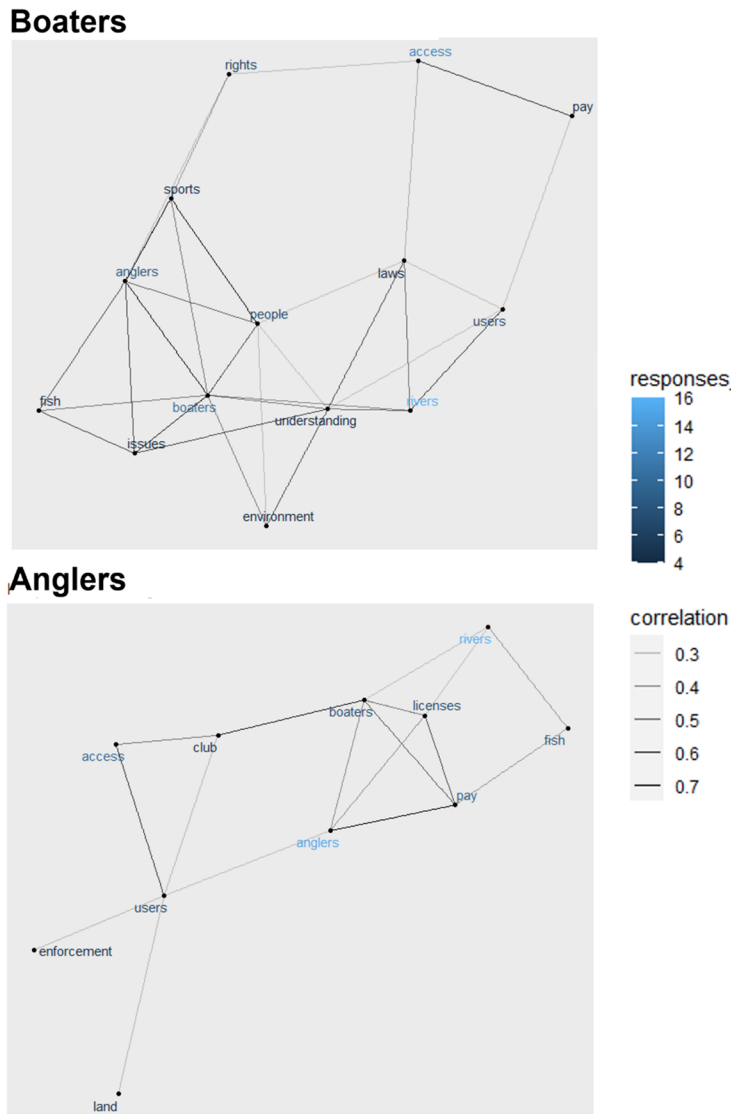


Figure 6. Network analysis of the terms most commonly used by boaters and anglers, showing the strength of the associations.

“environment,” “understanding,” “people” and “rights.” In contrast, words privative to anglers included terms like “land,” “enforcement” and “licences” (Table 1).

4. Discussion

Half of the population of England and Wales live within 5 miles of a waterway (Waterway Conservation & Regeneration Group, 2003), but only ~7% are able to enjoy them (Anon, 2017). Having access to blue spaces has been recognized as a key element to achieve several of the UN Sustainable Development Goals (SDGs). Many studies have demonstrated the importance of facilitating access to clean waters and high quality

Table 1. The most common terms shared by the two main river user groups and the terms unique to them in the free-text box of the questionnaire.

Term	User group	
	Boaters	Anglers
Shared		
"Fish"	✓	✓
"Boaters"	✓	✓
"Rivers"	✓	✓
"Users"	✓	✓
"Anglers"	✓	✓
"Access"	✓	✓
"Pay"	✓	✓
Unique		
"Issues"	✓	
"Environment"	✓	
"Understanding"	✓	
"Laws"	✓	
"People"	✓	
"Sports"	✓	
"Rights"	✓	
"Land"		✓
"Enforcement"		✓
"Club"		✓
"Licenses"		✓

blue spaces in relation to SDG3 (Good Health and Well-being), as this contributes to improving health and well-being (Bray et al., 2022), reducing several types of stress-related and mental illnesses (Dzhambov et al., 2021) and the risk of premature deaths (Akinsete et al., 2019; Bergou et al., 2022; Kaiser et al., 2021).

Our results indicate that having access to rivers is also important to people in Wales, but views differ widely on how access should be regulated. The vast majority of boaters (91%) favored free access, but only 28% of anglers did so. These results mirror to some extent those obtained from a previous, face-to-face questionnaire, which found that 73% of boaters wanted new legislation to regulate access to rivers while only 12% of anglers were in favor of it (National Assembly for Wales Commission, 2010). Unlike most places in Europe, England and Wales have disputed rights for accessing rivers for recreation (National Assembly for Wales Commission, 2010). Over 71% of the river length in Wales is used for recreation, but only 3% is freely accessible to the public (Church et al., 2008; Horton, 2022; Stanford, 2021; Welsh Government, 2019; Wynn-Davies, 2021), which may explain why many sectors of the public feel some legislative changes are needed.

Most respondents in our study (60%) thought conflict over access to rivers was an important issue, but perhaps not unexpectedly, perception of conflict differed widely among river users and was inversely related to views on free access. Those who favored free access (boaters and other river users) were less likely to think there was conflict than those who opposed it (anglers). Perception of conflict and views on access, however, seem to be colored by age. Older anglers were less positive about free access to rivers and more inclined to believe there was conflict over river access than younger ones, but the opposite was true for boaters and other users. A recent study across Europe has shown that older people (>55 years old) are less positive about green spaces and biodiversity than younger ones (Fischer et al., 2020) and our

study suggests that the same phenomenon may apply regarding blue spaces. Attitudes to flood risk and river conservation also vary with age and older people are more likely to feel their opinions are not properly taken into account in river management (Scaini et al., 2021); it has been suggested that age and gender differences (although the latter was not investigated in our study) need to be considered in the decision making process to resolve conflict over the use of shared blue spaces (Begg et al., 2018).

We can only speculate as to why age seems to affect the perception of conflict differently depending on river use, increasing with age among anglers but decreasing with age among boaters and other users. One reason might lie in the different nature of the activities being considered: canoeing (particularly in white waters) is physically demanding and younger users are perhaps more invested and make fuller use of fast currents (which are few and in much demand) than older canoeists. Angling, in contrast, is less physical and values experience more, and this perhaps makes older anglers more sensitive to crowding. This is an area worth investigating further, as the interaction between user age and river use seems to color the perception of conflict and may have implications for management. Clearly, to properly understand (and resolve) conflict over access to rivers, demographic parameters must be taken into account when interpreting people's views on river usage. River users are not a homogeneous group, they differ in age structure, but also in other demographic parameters, and enjoy rivers in different ways (Anon, 2017; Penning-Rowsell, 1994). However, our study shows that all river users were united in flagging water pollution and presence of rubbish as the two most important reasons that detract from their enjoyment of rivers. This finding is in agreement with a recent valuation study across 14 counties in Europe that revealed a strong positive relationship between changes in water quality and number of visits to blue spaces, including rivers, canals and lakes (Börger et al., 2021).

There are, however, several caveats to our analysis. As with any other social survey, there is always the question as to whether the responses are representative of the views held by the community under study, or whether there are some subjacent biases (Baumgartner & Steenkamp, 2006). To overcome the prescriptive nature of traditional structured questionnaires (Baumgartner & Steenkamp, 2006), we employed text mining (Silge & Robinson, 2017) and sentiment analysis (Mäntylä et al., 2018) to obtain further insights into river users' views and their underlying emotions. One bias common to most online questionnaires is self-selection bias, whereby people with strong views or more vested interests are more likely to participate (Brown et al., 2012). We found that people who left free-text comments were more likely to believe that conflict was a major problem than those who did not leave any comments. However, this bias was small and only marginally significant. Another potential source of bias might occur when the consultation time is too short, although our questionnaire was available for 3.5 months which exceeds the 3–4 week minimum duration time recommended for web-based questionnaires (Archer, 2007). This gave people ample opportunities to participate, as shown by the fact that over 50% of responses were received within the first 30 days. Although our sample size was relatively modest ($N=230$), it was larger than the recommended minimum size of 100–150 in many social surveys (Alreck & Settle, 2013; Tran et al., 2016) and similar to that of a previous study on recreational conflict in a Welsh river (Penning-Rowsell, 1994). The number of respondents was similar between the two main user groups and representative of people living in different parts

of the country, as evidenced by the large number of different rivers ($n=40$) that were accessed by respondents in different parts of Wales. We are thus confident that our results are reasonably robust although further insights might be gained by examining gender differences, and by securing a larger sample size, particularly of people who enjoy river walks, who are the main recreational users of rivers in Wales (Anon, 2017).

It has been suggested that conflicts can be better resolved by taking five steps, represented by 5 A's (Borisoff & Victor, 1989): Assessment, Acknowledgement, Attitude, Action, and Analysis. The results of our study can help resolve conflict over access to rivers by providing new insights into the nature of the problem (Assessment) and by acknowledging the contrasting views of different stakeholders (Attitude). Our assessment indicates that over 85% of boaters and other users felt that regulatory agencies should be promoting greater access to rivers, but only 28% of anglers felt the same way. Acknowledging such profound differences in the views and emotions of different stakeholders is paramount to resolving conflict. In this sense, results from social surveys like ours might be complemented by stakeholder analysis (Reed et al., 2009) and the use of "mental maps" (Gray et al., 2015) to identify the "diversity of perceived truths," as these have proved useful in resolving conflict in resource management (Levin et al., 2020).

Our study shed some light on the underlying conflict negotiation styles *sensu* (Kilman & Thomas, 1975) of different river users, which can help address the third step in the conflict resolution process, attitude. Anglers were the most assertive group while boaters were the most cooperative one. The responses of most anglers was consistent with a "collaborating" negotiation style which believes in win-win solutions, whereas boaters and other users were more accommodating and appeared more inclined to adopt a "compromising" negotiation style and believed there would inevitably be wins, as well as losses. These conclusions are merely indicative and must be interpreted with caution as a full analysis of conflict resolution styles (Swatuk et al., 2008; Wood & Bell, 2008) involves a different (and much longer) questionnaire that was beyond the scope of our study. Sentiment analysis of free-text revealed that the most common emotion of river users was that of "trust" and that all river users highlighted greater dialogue as an important step for reducing conflict over river access.

In terms of actions, spatial and temporal zoning were not favored by users as a means of reducing conflict, despite the fact that some spatial and temporal zoning already exists. For example, many boaters preferred to access rivers during the winter and at high flows, conditions which were less attractive to anglers. In contrast, few boaters accessed rivers at night or during twilight, conditions which were favored by many anglers, particularly those who fish for sea-trout (Evans et al., 1994; Harris & Milner, 2004). Limiting the number of users and introducing charges for the use of rivers were favored by 75% of anglers but only by 5% of boaters and other users. In England and Wales, boaters associated to Canoe Wales and British Canoeing contribute toward a Waterways License that is required to paddle some canals, rivers and waterways, although this covers at present only a few rivers. Licensing all unpowered craft operating in inland waters has been recommended before (National Assembly for Wales Commission, 2010) but it is clear from our study that this a contentious issue with limited support outside the angling community. The same study found a clear division of opinions with regards to voluntary access agreements (VAA), which was favored by 78% of anglers but only by 22% of boaters.

5. Conclusions and recommendations

Our study demonstrates the value of combining statistical modeling of survey data with text mining and sentiment analysis to facilitate understanding of people's emotions and perceptions of conflict over river use. Nearly 80% of Europeans live in cities that will become substantially hotter and more arid before the end of the century (Zhao et al., 2021) and which will require access to green-blue infrastructures to combat dangerously high levels of heat stress. Having greater access to nearby rivers will therefore become critical for the well-being of city dwellers and rural communities alike (Bray et al., 2022). However, to improve access to rivers and reduce conflict over river use a good understanding of the values, goals and views of river users is needed.

Based on the findings of our study we offer the following practical recommendations that can serve to build a roadmap to reduce conflict over river use:

1. **Facilitate greater dialogue.** The value of dialogue was highlighted by all river users. Given their different perceptions and negotiation styles, the use of a facilitator might be useful to promote greater dialogue between river users, and to scope solutions designed to achieve greater access to rivers without causing more conflict. Facilitation and mediation have been found useful in the past to resolve disputes over watershed resources (Tyler, 1999) and river basin management (Mostert et al., 2007; Swatuk et al., 2008) and the same approach could help resolve disputes over river access.
2. **Foster commonalities.** River users in Wales were first and foremost concerned about river pollution, not about crowding or interference from other river users; they wanted better, cleaner rivers and shared more commonalities than differences, and this was reflected in their willingness to collaborate and compromise, the two most common underlying conflict resolution styles and their shared sentiment of "trust." Therefore, fostering commonalities, for example standing together against water pollution (Anon, 2021; Water UK, 2023) or against river fragmentation (Getzner, 2015), might be a good strategy to reduce conflict over river use and achieve the common vision of better, healthier rivers, something that 88% of citizens regard as being important (Anon, 2021) and expect regulators to deliver. Battling a common enemy (pollution) and working toward a common goal (better rivers) could strengthen group cohesion, generate trust, and reduce conflict between users (Wear, 2019).
3. **Identify conflict hotspots.** Not all rivers are suitable for all activities all of the time. For example, many boaters (particularly white water canoeists) prefer high flows and specific river reaches and operate only during the day. Some anglers, in contrast, may only fish during the night and many exploit river reaches that are simply too shallow or otherwise unsuitable for boaters. Spatial and temporal segregation means that in many places there is little or no scope for interference. A spatio-temporal mapping of river activities could help identify those times and river reaches where there is potential for interference, so that solutions could be tailored where and when they are really needed.
4. **Consider pilot-trialling consensual management measures.** Several management measures designed to resolve conflict over river access were explored in our study (Church & Ravenscroft, 2006, 2011; Church et al., 2007; Penning-Rowsell, 1994). These included spatial and temporal zoning, limiting the number of users,

licensing unpowered boats in inland waters, introducing river usage charges, and implementing voluntary access agreements. As in previous studies (National Assembly for Wales Commission, 2010; Penning-Rowell, 1994), support for such measures was limited and varied widely among river users, but if these were formally discussed (as part of point 1 above) and agreed, perhaps some could be trialed in those conflict hot-spots identified in point 3 above. Such an adaptive approach would ensure that the problem was formally addressed and some potential solutions tested. If nothing is done, there is a risk that antagonism between river users might become engrained, and conflict grow.

Acknowledgements

We are grateful to Peter Gough for instigating this project. This paper is dedicated to the memory of Leonard Powell, former secretary of the Afan Valley Angling and Conservation Club, whose help is gratefully acknowledged.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Brockington: Conceptualization, Writing – Original draft preparation, Visualization, Investigation, Methodology.

Murray: Conceptualization, Writing – Reviewing and Editing, Funding acquisition.

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Consuegra: Conceptualization, Writing – Reviewing and Editing, Supervision, Project administration.

Garcia de Leaniz: Conceptualization, Writing - Original draft preparation, Analysis, Visualization, Supervision, Project administration, Funding acquisition, Data Curation, Methodology.

Ethics statement

The online questionnaire followed the principles outlined in the Declaration of Helsinki and was approved by Swansea University Ethics Committee with permit SU- 151121/4734.

Funding

Financial support was provided by a KESS-II West Wales scholarship to CIMB, supported by Natural Resources Wales and Canoe Wales.

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