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Research

Who Benefits from Recreational Use of Protected Areas?

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ABSTRACT. Public support for protected areas depends, in part, upon clear demonstrations of the importance of the ecosystem services provided by these areas. However, only a limited number of studies have examined the value of protected areas in providing these services, and even less work has assessed how equitably these benefits are distributed across society. We used on-site surveys to characterize people who derived recreational benefit from a set of areas in the United Kingdom that were originally protected for their conservation value. We found that an unrepresentative subset of society enjoyed this benefit. Site visitor populations were biased towards older people and men, and minority groups were starkly underrepresented, comprising only 1% of overall visitors. When the characteristics of visitors were examined, the more privileged sectors of society were found to have received disproportionate benefits. These biases persisted across weekday and weekend visits and whether sites were considered altogether or individually. Conservation goals will only be met if broad public support for the natural environment is engaged and maintained, for example, through nature recreation. However, our results suggest that at present a worrying disconnect exists between public conservation efforts and much of society.

Key Words: *Ecosystem services; protected areas; recreation; recreational benefits; Sites of Special Scientific Interest; SSSI; social inclusion; surveys*

INTRODUCTION

Protected areas are central to efforts to conserve biodiversity. In addition, these areas provide diverse benefits to people (Ingraham and Foster 2008, Eigenbrod et al. 2009). Measuring the ecosystem service benefits (Millennium Ecosystem Assessment 2005) provided by protected areas has been identified as a question of immediate policy concern (Sutherland et al. 2006, National Audit Office 2008).

Over 100,000 protected areas worldwide cover more than 12% of the Earth's land surface (Brooks et al. 2004, Chape et al. 2005). Areas originally protected to meet narrow conservation objectives are now expected to fulfill a much wider variety of ecological, economic, and social functions (Holdgate 1992). For example, areas in the United Kingdom (UK) originally protected because they contained specific species or habitats of conservation interest are now being evaluated based not only on their ecological success but also on their ability to provide recreation services, educational opportunities, and other means of resource utilization (Gaston et al. 2006). Conversely, areas in the United States originally designated for recreation because of their scenery and landscape are now being evaluated for their ability to support biodiversity conservation (Dunk et al. 2006).

Although ecosystem services from protected areas possess some degree of public-good characteristics (namely non-rivalry and non-excludability; Kolstad 2000), many of these benefits are spatially localized. Therefore, just as for public schools, public swimming pools, and other spatially localized public goods, some sectors of society potentially enjoy greater benefits from protected areas (Tiebout 1956, Oates 2006) because they have more ready access (either they live nearer or they have better access to private vehicles). To date, assessments of the performance of protected areas have emphasized aggregate measures of value such as total recreational access (Hein et al. 2006, Önal and Yanprechaset 2007) or overall economic value

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(Scarpa et al. 2000, Naidoo and Ricketts 2006, Troy and Wilson 2006). However, people experience ecosystem services over different spatial and temporal scales. When valuing such services, it is essential to consider how the benefits are distributed and whether this distribution is equitable across society. Such topics have thus far received little attention (Tarrant and Cordell 1999, Floyd and Johnson 2002). Valuation estimates for ecosystem services have also been found to differ between stakeholder groups. For example, Bowker and Leeworthy (1998) noted differences in the preferences of various ethnic groups for outdoor recreation, and Fa et al. (2002) showed that ethnicity was a factor in determining preferences in bushmeat consumption on Bioko Island in Equatorial Guinea.

Understanding who benefits from protected areas and who does not is the first step to widening participation and engagement with nature conservation across society; obstacles that prevent people from enjoying these benefits can then be identified and removed (Lee and Scott 2001, Wesely and Gaarder 2004). In the face of changing social preferences, proactive measures to engage society in conservation are needed if we are to maintain broad support for protected areas (Pergams and Zaradic 2006). Such support is particularly important given that most protected areas are funded at least in part by the public purse, through either direct investment or foregone tax revenue.

To determine how evenly ecosystem services from protected areas are distributed, we focused on recreation. Recreation is a direct-use value of an ecosystem (Hein et al. 2006). Recent efforts to incorporate recreation benefits into conservation planning have focused on access-based measures (Ruliffson et al. 2002, Chan et al. 2006, Önal and Yanprechaset 2007). However, we have instead used on-site surveys to examine the actual uptake of recreation opportunities. Our surveys focused on the lowest of institutional scales: the individual, household, or family/group level (Hein et al. 2006). We assessed who was deriving recreation benefit from protected areas and how representative these visitors were of the wider society over local, regional, and national scales.

METHODS

Data collection

We have surveyed visitors to a sample of the Sites of Special Scientific Interest (SSSIs) in England as a case study. The SSSI network is a central component of UK conservation policy, consisting of over 4100 sites covering in excess of a million hectares or over 7% of England's land area (English Nature 2003). SSSIs are under diverse ownership but have nonetheless been designated by the UK government to protect their floral, faunal, geological, or physiographical features of particular conservation interest (Bishop et al. 1997). While SSSIs were originally designated purely for conservation purposes, these areas are increasingly seen as vehicles for delivering public benefits from the countryside. For example, the core objectives of the agency responsible for overseeing the conservation of these sites, Natural England, include increasing the number, diversity, and frequency of people enjoying the natural environment (Natural England 2006).

We conducted on-site paper-based questionnaire surveys with visitors to 13 of the best visited SSSIs in the Yorkshire and Humberside regions of England. The questionnaire was previously piloted on three separate occasions in a protected area away from the main study region. Any questions that received a low response rate or that people found difficult to answer were removed or altered. Sites varied in size, location, and habitat, thus giving a cross-section of the SSSIs in the study region (Table 1). Sites also varied in their proximity to urban areas: some were on the edges of large towns (e.g., Doncaster) whereas others were more rural. We administered questionnaires on weekdays and weekends (days varied from site to site) from June through to September 2006, but only during daylight hours and in fair weather (38 survey days in total). Questionnaires were administered at entry/exit points to the sites. People were approached as they left the site; after one survey was finished, the interviewer would approach the next potential interviewee. A total of five interviewers were employed, with a consistent procedure being used for both approaching people and administering the questionnaires. Visitors were guided through the questions by the interviewer, with the survey taking between five and ten minutes to complete. Each

Table 1. Survey sites, numbers of individuals involved, numbers of questionnaires returned, site areas, and 25th and 50th percentiles of distances traveled.

Site	No. of individuals		No. of questionnaires		Area (ha)	Distances traveled (km)	
	Weekdays	Weekends	Weekdays	Weekends		25^{th} percentile	50^{th} percentile
Brockadale	41	32	19	18	59	5.3	6.1
Cow and Calf Rocks	64	77	21	24	230	8.9	15.9
Denaby Ings	26	40	17	21	25	4.7	6.3
Fairburn and Newton Ings	26	41	17	18	174	6.9	12.1
Filey Brigg	38	49	20	20	28	55.0	101.7
Flamborough Head	60	82	19	26	327	42.0	94.8
Forge Valley Woods	31	49	16	20	89	4.7	5.8
Potteric Carr	21	42	14	19	118	3.7	6.1
Sandall Beat	33	31	17	20	66	1.9	2.4
Skipwith Common	27	45	15	18	295	3.9	6.0
Sprotbrough Flash	32	28	16	14	81	2.3	4.8
Spurn Head	66	78	23	26	157	70.0	112.7
Tophill Low	0	36	0	17	35	11.1	18.0
Totals	465	630	214	261	—	—	—

survey included 20 closed-form questions. However, this paper analyzes only the subset of the questions concerning visitor age, gender, ethnicity, and home postcodes (equivalent to full U.S. zip codes). A sample questionnaire is presented in Appendix 1. Our results do not depend on the imposition of a particular economic valuation model for recreation, but they would be particularly compatible with travel-cost or stated-preference approaches, relying as they do upon on-site visitor surveys.

Reference populations

We examined whether visitors to these 13 sites were representative of society at large using four reference populations spanning a range of spatial scales. First, we compared the diversity of visitors to the populations of Yorkshire and the UK. Then, because many individuals had not travelled far to visit the sites, we compared the visitors at each individual site to the local population in the surrounding area. We identified local reference

populations by drawing circular buffers around each site. As the distances travelled to each site varied substantially, we defined our local reference population based on the 25th and 50th percentiles of distances travelled by individuals to get to the site (Table 1).

We collated data from the 2001 UK Population Census for each of the four reference populations to establish the age, gender, and ethnicity of wider populations across local, regional, and UK scales.

To determine how representative visitors were of the diversity of UK households more generally, we used Mosaic UK (Experian UK, http://www.experian.co.uk/business-strategies/mosaic-uk-2009.html), a commercially available geodemographic database (Harris et al. 2005). This database identifies broad types of households that make up UK society. The version of Mosaic UK used in this analysis applied a hierarchical cluster analysis to 430 social, economic, and demographic variables that describe households, with variables being chosen for their explanatory power (Webber 2004). Fifty-four per cent of the variables entered into this cluster analysis were derived from the 2001 UK Population Census; the remainder came from a number of other sources, including Experian's own lifestyle surveys, the edited electoral roll, consumer credit activity, and house price data. The classification assigns each household to one of 11 groups and 61 subclasses that share similar characteristics; however, we used only the group-level classifications for our analyses. The results of the clustering analyses have been ground-truthed with over 15,000 visits to UK neighborhoods. Experian has also collected additional independent survey data on the identified categories of households (concerning, for example, their likelihood to undertake outdoor recreation) that are independent of the data used to inform the initial clustering. In our study, we used a single classification for each full UK postcode (around 15-20 households) and used postcodes to associate visitors with one of the 11 Mosaic groups. Of course, not every household within a postcode will conform to the broad categorization provided by Mosaic. However, geodemographic databases like Mosaic not only provide much greater resolution than that available in the UK Census data but also give a summary of multidimensional information on household characteristics that would have been too time consuming to obtain and analyze through direct questions in our own survey. Mosaic has previously been used in diverse applications both in public policy design and in the private sector (Webber 1985, Farr and Webber 2001, Williamson et al. 2005). However, such geodemographic tools have not often been applied to environmental problems (but see Barbosa et al. 2007 and Fuller et al. 2008 for applications in an urban context).

Data analysis

First, we analyzed the sample of visitors from all sites combined to establish how representative visitors were of regional and UK populations. We carried out one-way chi square tests for gender (male/female) and ethnicity (white/black and ethnic minority). Although ethnicity data were collected based upon census data groups, the lack of people describing themselves as belonging to black and ethnic minorities meant we could categorize the data into just two groups for analyses. We also analyzed the representativeness of the sample at all sites by age and household type using chi square tests and correlation coefficients. Then we analyzed the age, ethnicity, gender, and household type of visitors to individual sites and compared this with the local reference populations (25th and 50th percentiles of distance traveled as previously described) and to the populations of Yorkshire and the UK using chi square tests, t-tests, and correlations. For all analyses, we transformed any data that did not meet assumptions of normality. Whenever this transformed data did not meet assumptions of normality, nonparametric tests were used on the untransformed data.

RESULTS

In total, 475 questionnaires covering 1095 people were completed across the 13 sites (Table 1), and we collected 471 postcodes that could be mapped to Mosaic data. The discrepancy in the numbers of postcodes collected and questionnaires completed resulted from a combination of incorrect postcodes, multiple postcodes on a single questionnaire (when people from different households were in the same car), and no postcodes (when people declined to provide the information).

People were also asked what they intended to do while visiting the SSSI (see Appendix 1). Some people gave more than one activity (e.g., walking as well as having a picnic), resulting in 619

responses for the 475 questionnaires. Walking was the most popular activity, with 40% of respondents choosing this option. Twenty-six per cent of visitors stated that they were walking their dog and 19% that they were birdwatching (as a number of the sites are good for birding or have bird blinds). A further 4% of visitors were having picnics, and less than 1% were there to cycle. The remaining 11% of visitors (the "Other" responses) were undertaking activities such as photography, rock climbing, or fishing. Although the activities recorded in the survey likely vary in their compatibility with the ecological goals of site protection, even low levels and intensities of recreation use have been known to damage such sites (Reed and Merenlender 2008). Encouraging the recreational use of sites involves trade-offs: for a discussion of the trade-offs between the short-term ecological costs due to damaging recreational activities and the long-term ecological gains resulting from reconnecting society with nature, see Booth et al. (2009).

All sites conbined

Those enjoying recreation benefits from our focal protected areas were not representative of the wider Yorkshire and UK populations along any of the four axes of social diversity (Table 2). We found a significant bias towards male visitors compared to both the regional and national populations. For ethnicity, we found a strong bias towards whites when compared to the ethnic mix of the population. Indeed, only nine of the individuals surveyed (0.008%) described themselves as being from black or ethnic minorities.

The age of visitors showed great disparity when compared with the regional and national populations (Table 2). The 56-65 age group was greatly overrepresented among site visitors, whereas only very low numbers of visitors were in the 16-25 age group. Consequently, the correlations between the age distribution of the sample of visitors and the wider populations of Yorkshire and the UK were not significant and explained little of the variation in the sample (Yorkshire: $r = 0.067$, $P > 0.05$; UK: $r = 0.078$, $P > 0.05$).

Visitors to SSSIs were also unrepresentative of the wider population when analyzed in terms of broader household characteristics using the Mosaic data, which integrate diverse social, economic, and demographic variables. The basic trend in the analysis of our survey was that the more affluent groups within society benefited disproportionately from recreational use of protected areas, while the less affluent groups were generally underrepresented (Table 2). Again, these biases meant that the proportions of each Mosaic grouping among visitors were poorly correlated with their prevalence in the wider population (Yorkshire: $r = 0.34$, $P > 0.05$; UK: $r = 0.05$, $P > 0.05$). Additional information collected by Experian on household characteristics (identified by the clustering analysis) enabled us to characterize further the living circumstances of households that benefit disproportionately from recreational use. The tendency to participate in recreation in protected areas is negatively correlated with overall deprivation; i.e., the more deprived households are underrepresented (Yorkshire: $r = -0.66$, $P = 0.027$; UK: $r = -0.96$, $P < 0.001$). In addition, the under- or overrepresentation observed in Mosaic groups correlated with the average number of private cars per household (Yorkshire: $r = 0.71$, $P = 0.014$; UK: $r = 0.88$, $P < 0.001$) and the percentage of households that enjoy recreational hiking and walking (Yorkshire: $r = 0.65$, $P = 0.03$; UK: $r = 0.88$, $P < 0.001$).

It is possible that some of these biases could have resulted from the aggregation of weekday and weekend visitors, because some sectors of society (such as retirees) may have more leisure time during weekdays than those of working age. To explore this possibility, we repeated all of the above analyses separately for weekday and weekend visitors. Similar biases were found in the gender, ethnicity, age, and socioeconomic characteristics of recreational visitors to protected areas (Table 2). Both the weekday and weekend samples were biased in terms of gender and ethnicity, although this bias was weaker than in the aggregated sample. Biases in age were similarly less marked than in the aggregated sample; however, the weekend data displayed greater evidence of bias than that of weekdays. The results for socioeconomic characteristics also showed greater bias for weekends than weekdays. Overall, the weekend data showed a much stronger bias towards the more privileged groups. Consequently, correlations of age and socioeconomic characteristics had weak explanatory power and were not statistically significant for the aggregrated results.

Table 2. Chi square tests on the sample population vs. the populations of Yorkshire and of the UK. Data for all the sites were analyzed for all days combined, for weekends, and for weekdays. One-way tests were performed for ethnicity and gender.

		All days combined				Weekend				Weekdays			
		Yorkshire		UK		Yorkshire		UK		Yorkshire		UK	
	d.f.	χ^2	*P*	χ^2	*P*	χ^2	*P*	χ^2	*P*	χ^2	*P*	χ^2	*P*
Gender (male)	1	12.1	<0.001	11.3	<0.001	5.8	<0.05	5.4	<0.05	6.27	<0.05	5.89	<0.05
Ethnicity (ethnic minority)	1	55.4	<0.001	70.2	<0.001	42.2	<0.001	50.8	<0.001	31.24	<0.001	37.58	<0.001
Age	6	217.0	<0.001	231.0	<0.001	151.4	<0.001	156.4	<0.001	109.2	<0.001	109.2	<0.001
Socioeconomic status	10	49.9	<0.001	55.1	<0.001	161.2	<0.001	136.5	<0.001	23.6	<0.01	34.8	<0.001

Individual sites

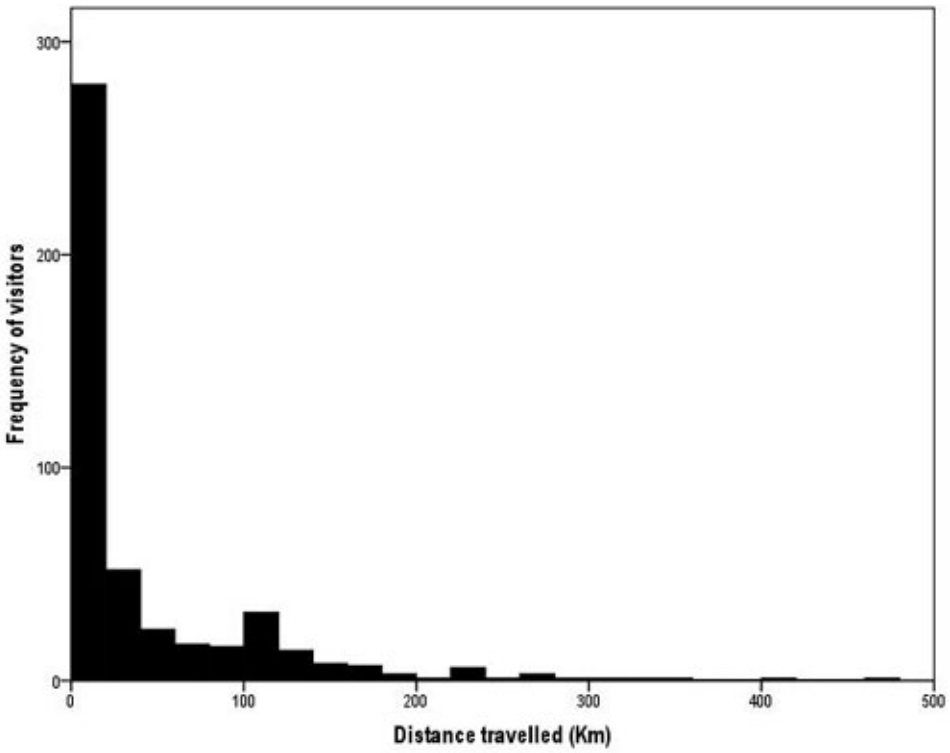
The majority of visitors travelled only very short distances to sites (Fig. 1), with 55% travelling less than 16 km (10 miles). It is therefore possible that while visitors to these sites were not representative of the populations of Yorkshire and the UK, they may have been representative of the local populations surrounding the individual sites. We tested this possibility for all four axes of social diversity, carrying out four comparisons for each site (visitors to the site against the 25th percentile local population, the 50th percentile local population, the Yorkshire population, and the UK population). With such analyses of gender and ethnicity, the issue of statistical power must be considered. Sample sizes at the individual site level ranged from 36 to 144 individuals (Table 1), which gave varying degrees of power for the analyses.

For gender, a clear bias towards male visitors was found at the aggregated site level, but this signal was not as marked when individual sites were examined. Indeed, this bias was only marginally significant for all the sites except one (Denaby Ings), which gave significant results for gender across all four reference populations (Appendix 2). These results would indicate either that larger sample sizes are needed at the site level or that there is no effect locally.

In terms of ethnicity, 11 of the 13 sites (all but Cow and Calf Rocks and Tophill Low) showed significant differences when compared with the Yorkshire and UK populations (Appendix 3). However, such differences were not found at the more localized 25th and 50th percentile levels of distance traveled for the majority of sites. This disparity is likely to be a result of the more localized populations having fewer members of black and ethnic minorities than the regional and UK populations. The local reference populations of the sites that received visitors from the surrounding area naturally reflect the ethnic makeup of those areas, whereas those sites that attracted people from long distances gave either significant or marginally significant results when compared with the 50th percentile. Spurn Head illustrates this general result, with the local reference population being ethnically the most similar to the sample collected on site and the UK population the most dissimilar (percentages of black and ethnic minorities on site, 0.69%; 25th percentile, 2.6%; 50th percentile, 4.15%; in Yorkshire, 6.52%; UK, 7.88%).

When comparing the ages of visitors at the individual sites with the reference populations, no consistent improvement was found in the representativeness of those enjoying recreation benefits. Correlations gave a mixture of positive and negative results, but none were statistically

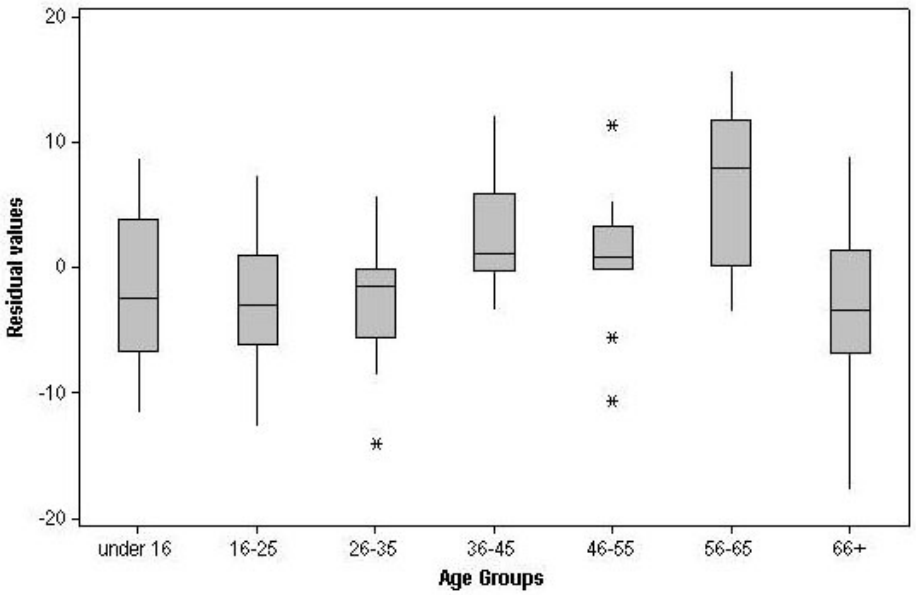
Fig. 1. Histogram showing frequency of individual visits vs. distance traveled per visit for all 13 sites.



significant and the r^2 values were generally low. Figs. 2-5 are box and whisker plots showing the distributions of residuals of age (i.e., observed minus expected values based on the reference population) across the sites in each age class for each of the four reference populations (25th percentile, 50th percentile, Yorkshire, and the UK). Positive values indicate that a given group is overrepresented at that site relative to their presence in the reference population. Negative values indicate underrepresentation. Interquartile ranges are indicated in the plot for each age group, and asterisks indicate outliers in the data. Across all sites and reference population choices, the 56-65 age group was consistently overrepresented (25th percentile $t_{(11)} = 3.82$, $P = 0.002$; 50th percentile $t_{(11)} = 4.40$, $P = 0.001$; Yorkshire $t_{(11)} = 4.25$, $P = 0.001$; UK $t_{(11)} = 4.35$, $P = 0.001$), and the 16-25 age group was always underrepresented (25th percentile $t_{(11)} = –1.76$, $P = 0.103$; 50th percentile $t_{(11)} = –2.89$, $P = 0.013$; Yorkshire $t_{(11)} = –4.12$, $P = 0.001$; UK $t_{(11)} = –3.96$, $P = 0.002$). However, the latter effect was less evident at the most local scale. This overall bias in ages, which persisted across all scales of analysis, explains why correlations with the reference populations remained weak.

All correlations of visitor numbers with proportions of each Mosaic group in the four reference populations were positive, but only some were statistically significant (Table 3). Fig. 6 illustrates the outcomes of these correlations. For each individual site, we have graphed the minimum explanatory power (r^2) of the various correlations of visitors with the local reference populations (i.e., populations living within the 25th and 50th percentiles of distances traveled) against the maximum r^2 value of the analogous correlations of site visitors with the regional and national populations. For ease of reference, we have also marked on the vertical axis the equivalent maximum obtained when pooling the visitor samples from all sites and comparing the pooled value to that of Yorkshire and the UK. Only 11 of the 13 site data

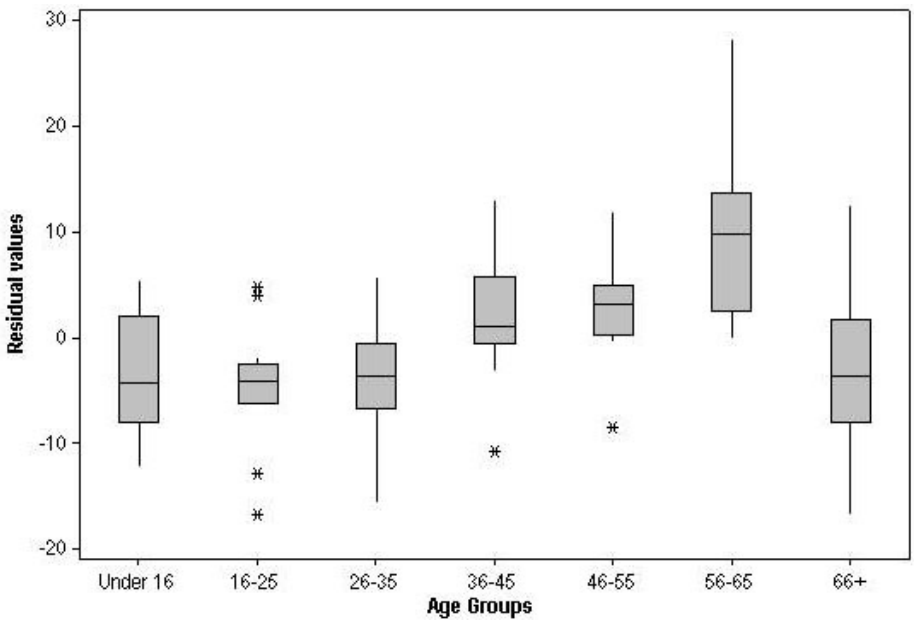
Fig. 2. Residuals of age groups for the 25th percentiles of distance traveled.



points are graphed in Fig. 6: the remaining two sites were omitted here because they were analyzed using Spearman's Rank correlation (since their data were not normally distributed even when transformed; Table 2). When comparing the socioeconomic composition of visitors at individual sites to that of the populations of Yorkshire and the UK, the explanatory power of correlations was increased from that obtained by pooling the samples of visitors at all sites. This suggests that pooling samples from across the diverse protected areas masked the correlations that were evident at the site level. As seen in Fig. 6, the explanatory power of correlations of all individual sites against Yorkshire and the UK was greater than that obtained when pooling visitors across the sites; i.e., the values for most of the individual sites fell further up the vertical axis than the value for all sites combined (shown on the axis itself).

As most visitors did not travel far, we might expect that for a given site the distribution of household types within the sample would more closely match that of the surrounding area than of the regional or national population. Were we to apply this logic strictly, we would expect that the explanatory power for the sample would be most representative of (a) the closest reference population (25th percentile of distance travelled), then (b) the next nearest (50th percentile of distance travelled), then (c) the Yorkshire population, and finally least representative of (d) the UK as a whole (i.e., a>b>c>d). Only two sites, Skipwith Common and Denaby Ings, fit this pattern (Table 3). A less stringent definition would be that the explanatory power for both the 25th and 50th percentile reference populations would be greater than that for Yorkshire and the UK (i.e., a, b>c,d). Only one additional site meets this criterion: Sandall Beat. This localization criterion is equivalent to asking which sites fall below the 45 degree line in Fig. 6. Those sites not showing evidence of localization (those falling above the 45 degree line) include the coastal sites Flamborough Cliffs, Spurn Head, and Filey Brigg, all of which attract visitors from across a broad area (Table 1) and by our definitions encompass a very large populace.

Fig. 3. Residuals of age groups for the 50th percentiles of distance traveled.



DISCUSSION

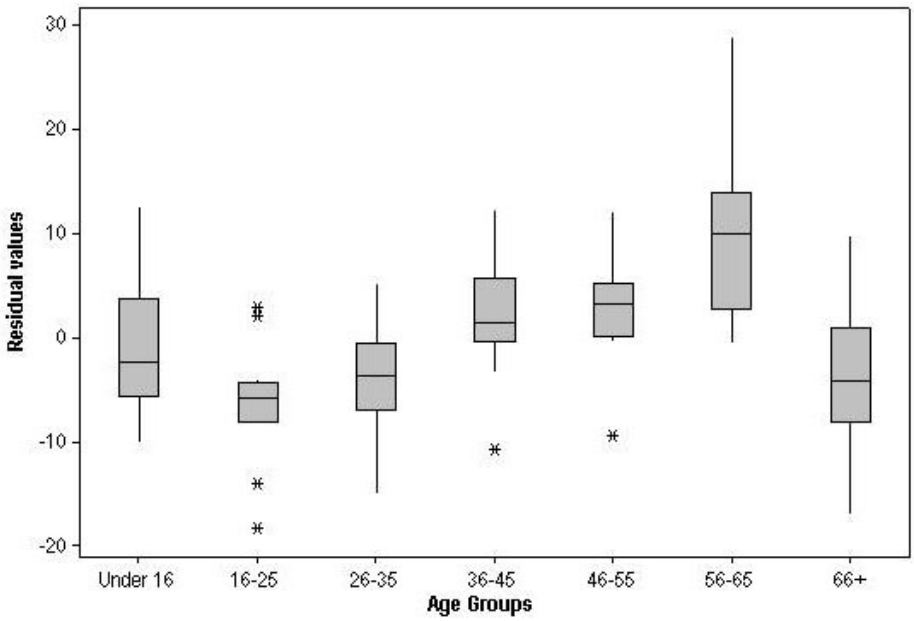
The need for further research into the valuation of ecosystem services has been widely recognized (Balmford et al. 2002, Carpenter et al. 2006), but studies examining who actually benefits from ecosystem services and whether these benefits are distributed equitably across society lag even further behind. Without knowing who experiences benefits from protected areas, it is not possible to gain accurate estimates of the value of these services or to resolve conflicts concerning their usage. We addressed this question in the particular context of legally protected areas and focused on recreation services. Repeating the exercise for other ecosystem services that have local public good characteristics, such as managing upstream habitats to mitigate flood effects on downstream households, would also be worthwhile. However, ecosystem services vary in the scales over which they are experienced, and some services, such as the contributions to climate regulation from carbon sequestration, are much more diffusely distributed.

Our results revealed striking biases in who enjoys recreation benefits from SSSIs across all four dimensions of social diversity as well as across local, regional, and national scales. Visitors to the protected areas were not representative of wider society in terms of gender, ethnicity, age, or socioeconomic characteristics.

The underrepresentation of women recreationalists visiting our sites corresponds with the results of visitor surveys conducted in other locations, although many of those were conducted in an urban context (e.g., Ho et al. 2005). Concerns about security and personal safety are common reasons for women being underrepresented among outdoor recreationalists in both urban and wilderness contexts (Shaw 1994, Mehta and Bondi 1999, Krenichyn 2006, Shores et al. 2007). The protected areas we studied vary in their degrees of isolation, and security concerns would certainly be important at some sites; indeed, it is perhaps telling that single male visitors were overrepresented in our sample compared to single female visitors.

The distribution of recreation benefits from our sites is also very clearly biased with respect to ethnicity. It has been recognized that ethnic groups are underrepresented in the British countryside (e.g., Black Environment Network 2003), and a number of agencies and organizations have been striving to

Fig. 4. Residuals of age groups for Yorkshire.

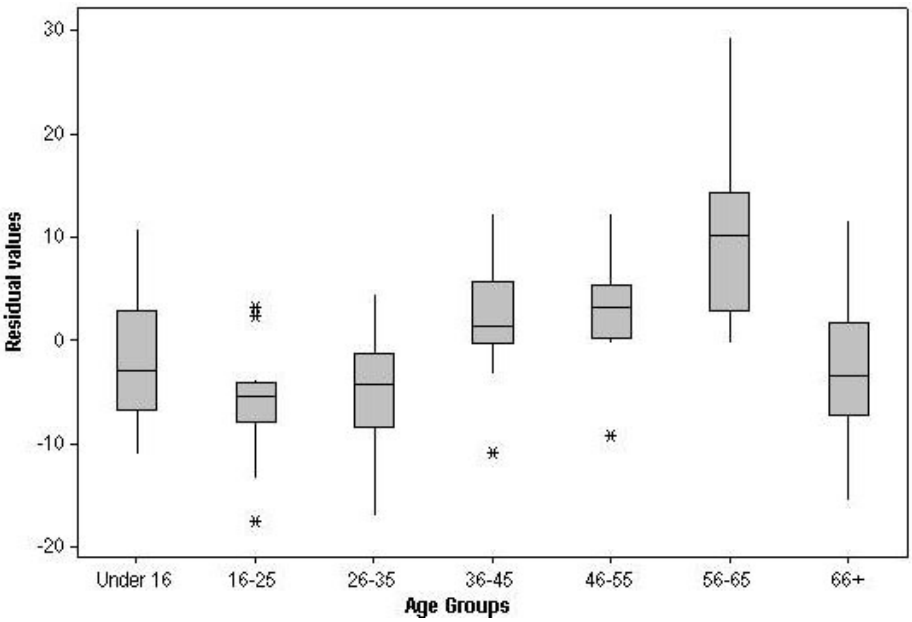


remedy this situation. However, we found that less than 1% of visitors in our survey were from black and ethnic minority groups (a lower percentage than that found by an earlier study [Countryside Agency 2005]), even though these groups constitute much larger percentages of the local, regional, and national populations. These minority individuals were effectively visiting just two sites: Spurn Head, which attracts people from a wide area, and Cow and Calf Rocks, which is near centers of very diverse populations. Site by site analysis showed that although some sites had visitor distributions that were similar to local populations in terms of ethnicity, the visitors to all but these two sites were significantly different from regional and national populations. In the past, it has been assumed that those from ethnic minorities simply had no interest in the countryside (Black Environment Network 2003), but studies conducted in both the UK and the USA have found that ethnic minorities face multiple constraints to outdoor recreation, including lack of income, familiarity, opportunity, and transportation as well as fear of discrimination (Gómez 2002, Edwards and Weldon 2006, Shores et al. 2007). It is also clear that different ethnic groups have differing preferences in terms of outdoor recreation spaces, with some ethnic minorities preferring more developed recreation areas (with toilet facilities, for example) but white visitors preferring wilder areas (Virden and Walker 1999, Ho et al. 2005).

In terms of broader household characteristics, our protected areas provide disproportionate recreation benefits to the more affluent and less deprived social groups. We observed some improvement in the representativeness of visitors in terms of their Mosaic classification when we moved to the individual site scale, but clear biases persisted for many sites. This pattern of the more deprived groups missing out on protected area benefits may be partly attributable to access constraints, because social groups that have the use of private cars are more likely to visit remote sites. In a related study in the nearby city of Sheffield, Barbosa et al. (2007) found that access to public and private green spaces within cities also showed strong associations with the household characteristics surveyed by Mosaic.

Finally, our results demonstrate a strong age bias in the visitors across all sites and all scales. Young adults (16-25) are disproportionately underrepresented, whereas those in the 56-65 age group are overrepresented. This bias could be symptomatic of young people being disengaged with outdoor

Fig. 5. Residuals of age groups for the UK.



recreation and the natural environment (Pergams and Zaradic 2006) or of the 56-65 age group having greater leisure time and disposable income than younger groups as well as better health than the 66+ age group (Payne et al. 2002). This bias in outdoor visitation rates applies over and above the existing trend towards an aging rural population in the UK (Carpenter 2005, Commission for Rural Communities 2007), because it persists when studying the residuals (observed minus expected values) and accounting for the composition of the local population.

Currently, just one third of adults visit the countryside in England (Natural England 2006). Given that protected areas in the UK do not appear to be benefiting a broad sector of society in terms of recreational usage, the critical policy question becomes what steps, if any, need to be taken to improve the distribution of this direct-use benefit. The government agency responsible for managing these protected areas has committed to engaging more of the population in countryside recreation and, along with other agencies, to broadening the diversity of those visitors (Black Environment Network 2003, Edwards and Weldon 2006).

Various strategies could be employed to increase the diversity of individuals enjoying recreation benefits from protected areas. Efforts to develop equitable access to the environment could favor a location-based strategy aimed at ensuring that protected areas are located sufficiently close to various communities. This strategy could involve establishing additional designated areas, a process that could be guided by a relatively straightforward extension of recent planning tools (Ruliffson et al. 2003, Önal and Yanprechaset 2007) to encompass social diversity indices. However, our results suggest that such an approach on its own would do little to even out the distribution of actual benefits from recreation, because systematic biases still remained when we compared the diversity of visitors at the local scale.

In addition to improving access, we anticipate that a more proactive approach will be required to engage people with protected areas and achieve a broader diversity of beneficiaries. Efforts to attract a greater diversity of people to sites also need to reflect the heterogeneities of different sectors of society, each of which has different recreational preferences, needs, and aspirations for nature (Baas et al. 1993, Payne et al. 2002, Sasidharan 2007).

Table 3. Results of individual site correlations of Mosaic data with reference populations (using Pearson's correlation coefficient and Spearman's rank correlation as appropriate).

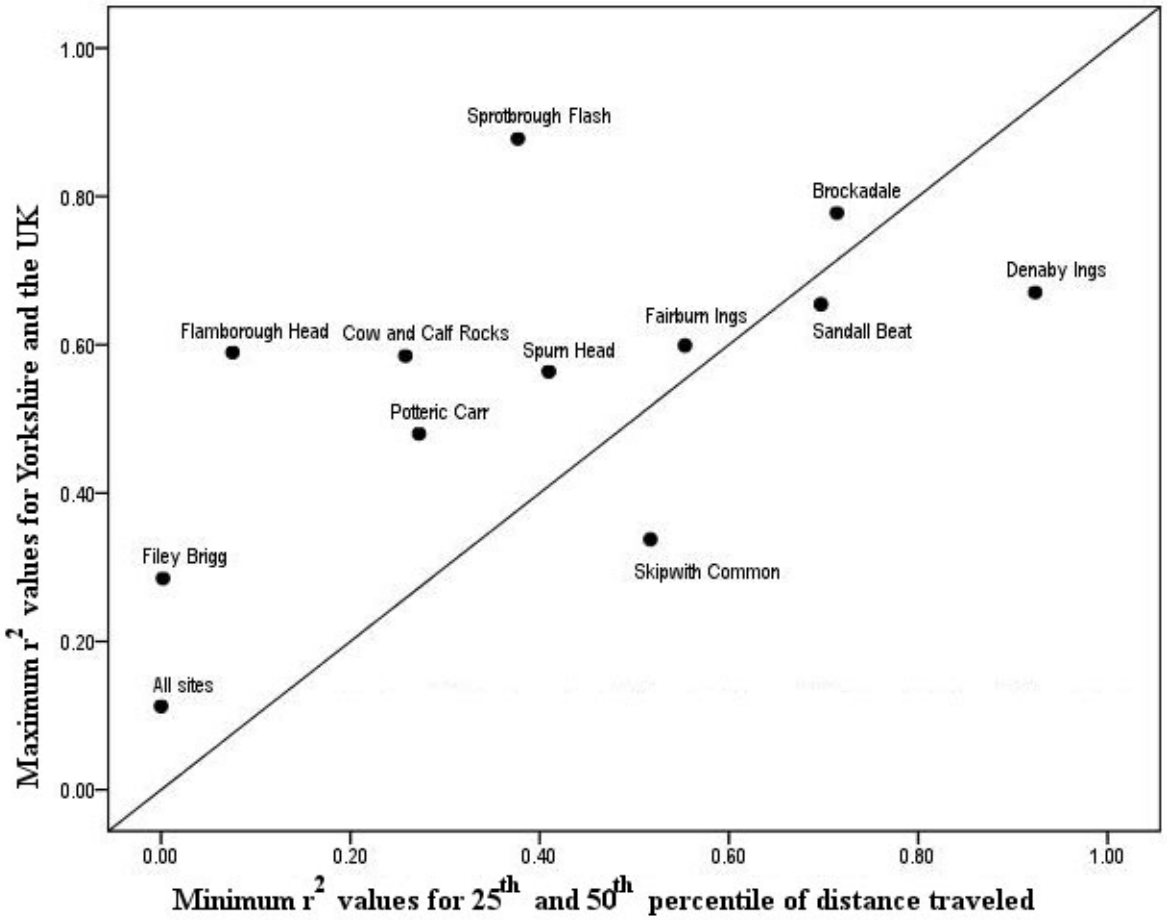
Using Pearson's correlation coefficient for sites where data was normally distributed:

	25th percentile of distance traveled		50th percentile of distance traveled		Yorkshire		UK	
	r^2	*P*	r^2	*P*	r^2	*P*	r^2	*P*
Brockadale	0.77	0.00	0.71	0.00	0.32	0.11	0.78	0.00
Cow and Calf Rocks	0.41	0.03	0.26	0.11	0.59	0.00	0.48	0.02
Denaby Ings	0.94	0.00	0.92	0.00	0.67	0.05	0.59	0.07
Fairburn and Newton Ings	0.55	0.03	0.63	0.02	0.60	0.01	0.42	0.03
Filey Brigg	0.03	0.94	0.00	0.91	0.03	0.66	0.29	0.14
Flamborough Head	0.08	0.47	0.44	0.05	0.59	0.02	0.57	0.02
Potteric Carr	0.27	0.12	0.32	0.09	0.14	0.29	0.48	0.03
Sandall Beat	0.56	0.05	0.70	0.02	0.45	0.10	0.65	0.03
Skipwith Common	0.74	0.01	0.52	0.04	0.34	0.10	0.12	0.36
Sprotbrough Flash	0.38	0.19	0.57	0.05	0.88	0.00	0.79	0.01
Spurn Head	0.41	0.03	0.47	0.02	0.50	0.02	0.56	0.01

Using Spearman's rank correlations for sites where data did not meet assumptions of normality:

	r_s	*P*	r_s	*P*	r_s	*P*	r_s	*P*
Tophill Low	0.63	0.04	0.68	0.02	0.85	0.00	0.41	0.21
Forge Valley Woods	0.65	0.03	0.78	0.01	0.45	0.16	0.48	0.13

Fig. 6. Scatter plot showing minimum r^2 values for Mosaic groups by site (n = 11) for the 25th and 50th percentiles of distance traveled against maximum r^2 values from Yorkshire and the UK. Results of aggregated site correlations against Yorkshire and the UK (all sites) are shown for reference. Sites situated below the line show the effects of localization.



It could be debated whether SSSIs provide a suitable policy vehicle for broadening the diversity of beneficiaries of countryside ecosystem services, given that these SSSI areas were originally designated for very different reasons. However, SSSIs could perhaps always be considered part of the solution in the UK, because these areas are unlikely to be delisted. Indeed, policy makers will instead tend to favor bundled solutions that build on existing conservation efforts and yet can deliver multiple policy goals (e.g., conservation as well as recreation). In addition, nearly 55% of access land in England under the Countryside and Rights of Way (CRoW) Act of 2000 is designated as SSSIs (Bathe 2007). Even before the introduction of CRoW, SSSIs experienced an estimated 370 million visits per annum (Drewitt 2007).

SSSIs are under a mix of public, private, and NGO ownership, and regulatory requirements for these sites are prohibitive rather than proactive. However, conservation payment schemes for landowners (agrienvironment schemes) also fall under the aegis of Natural England, the agency responsible for managing SSSIs. Such schemes are intended to provide incentives for landowners to provide the

types of goods and services from the countryside that the public wish to see, and specific provisions are included for encouraging improved recreational access to sites.

Our results have direct implications for those trying to map, evaluate, and plan for the provision of ecosystem services. To date, such studies have tended to emphasize remote data (e.g., Chan et al. 2006) and ecosystem service value flows (e.g., Troy and Wilson 2006). Efforts at assessing recreation benefits using only remote data often default to estimating access measures based simply on household location (Önal and Yanprechaset 2007). However, our results show that such estimates will give an inaccurate picture of recreation benefits, because only a biased subset of individuals and households participate in recreation, and those that do participate will travel very different distances to reach particular sites. Similarly, our sites were found to be heterogeneous in their visitor distributions; some serve very local visitors and others serve populations from much broader areas.

Studies into the interactions of human recreation and protected areas have frequently viewed such contact as a potential threat to biodiversity (e.g., Yalden and Yalden 1990, Taylor and Knight 2003, George and Crooks 2006). However, ecosystem service approaches to conservation are more synergistic (Balvanera et al. 2001). Such approaches recognize that long-term conservation goals will only be met if broad public support can be maintained for habitat conservation measures (such as preserving protected areas). Developing public support requires engaging more people with the natural environment, for example through recreation, and making them aware of the many diverse ways that ecosystems support and enhance their lives. However, our study has shown that the sector of society that currently benefits from protected areas through recreation is unrepresentative of the overall population of the UK.

Evidence from many disciplines, including psychology, biology, ecology, environmental health, medicine, and public health, shows that contact with the natural environment can improve both the physical and the mental health and well-being of the population (Fuller et al. 2007, Pretty et al. 2007). Therefore, increasing the diversity of people visiting protected areas is important not just for conservation and its support but also for the health of the visitors, which creates opportunities for improving public health (St Leger 2007).

To achieve wider societal engagement with protected area conservation and nature in general will require proactive policy measures. These measures should focus on improving accessibility to protected areas and attracting less privileged groups to these sites, where they can experience the considerable benefits that nature recreation can provide (Jackson 2003, Chiesura 2004).

Responses to this article can be read online at:
http://www.ecologyandsociety.org/vol15/iss3/art19/responses/

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APPENDIX 1. Questionnaire used to determine who benefits from recreational use of protected areas (a subset of the full questionnaire).

How many people in your group are in each age category? Please write the number next to the category.

Under 16 16-25 26-35 36-45 46-55 56-65 66+

To help understand where visitors have come from, it is very useful to know your postcode. Please note it will not be used to contact you: each postcode applies to about 20 houses and does not identify you individually.

Postcode: _____

Please give details of your group.

Number of females: _____ Number of males: _____

The ethnic group that best describes you is (please tick a box):

White Indian Chinese

Black – Caribbean Pakistani Other _____

Black – African Bangladeshi Black – other group

Which activities have you done here today?

Walking Dog walking Picnic Other _____

Bird watching Cycling

APPENDIX 2. One-way chi square tests for gender at individual site level vs. four reference populations.

	25th percentile		50th percentile		Yorkshire		UK	
	Male	*P*	Male	*P*	Male	*P*	Male	*P*
Brockadale	3.59	>0.05	4.01	<0.05	3.47	>0.05	3.52	>0.05
Cow and Calf Rocks	1.86	>0.05	1.80	>0.05	1.52	>0.05	1.42	>0.05
Denaby Ings	5.21	<0.05	5.06	<0.05	5.10	<0.05	4.95	<0.05
Fairburn and Newton Ings	2.74	>0.05	2.77	>0.05	2.66	>0.05	2.56	>0.05
Filey Brigg	0.52	>0.05	0.52	>0.05	0.50	>0.05	0.45	>0.05
Flamborough Head	0.01	>0.05	1.12	>0.05	0.00	>0.05	0.00	>0.05
Forge Valley Woods	0.03	>0.05	0.04	>0.05	0.00	>0.05	0.00	>0.05
Potteric Carr	3.44	>0.05	3.48	>0.05	3.43	>0.05	3.32	>0.05
Sandall Beat	2.76	>0.05	2.68	>0.05	2.47	>0.05	2.38	>0.05
Skipwith Common	0.01	>0.05	0.00	>0.05	0.00	>0.05	0.00	>0.05
Spurn Head	0.82	>0.05	0.85	>0.05	0.86	>0.05	0.78	>0.05
Sprotbrough Flash	0.12	>0.05	0.09	>0.05	0.10	>0.05	0.09	>0.05
Tophill Low	1.13	>0.05	1.13	>0.05	1.12	>0.05	1.08	>0.05

APPENDIX 3. One-way chi square tests for ethnicity at individual site level vs. four reference populations.

	25th percentile		50th percentile		Yorkshire		UK	
	Ethnic minority	*P*	Ethnic minority	*P*	Ethnic minority	*P*	Ethnic minority	*P*
Brockadale	0.96	>0.05	1.20	>0.05	4.76	<0.05	5.76	<0.05
Cow and Calf Rocks	0.97	>0.05	12.1	<0.01	0.156	>0.05	0.87	>0.05
Denaby Ings	1.13	>0.05	1.15	>0.05	4.36	<0.05	5.20	<0.05
Fairburn and Newton Ings	1.16	>0.05	1.90	>0.05	4.37	<0.05	5.28	<0.05
Filey Brigg	2.18	>0.05	3.71	>0.05	5.67	<0.05	6.86	<0.01
Flamborough Head	2.39	>0.05	3.99	<0.05	9.25	<0.01	11.20	<0.01
Forge Valley Woods	1.70	>0.05	1.8	>0.05	5.21	<0.05	6.31	<0.05
Potteric Carr	3.67	>0.05	2.76	>0.05	4.11	<0.05	4.97	<0.05
Sandall Beat	2.40	>0.05	2.40	>0.05	4.17	<0.05	5.05	<0.05
Skipwith Common	0.63	>0.05	1.34	>0.05	4.69	<0.05	5.68	<0.05
Spurn Head	3.73	>0.05	5.98	<0.05	7.49	<0.01	9.45	<0.01
Sprotbrough Flash	1.94	>0.05	2.35	>0.05	3.91	<0.05	4.74	<0.05
Tophill Low	0.70	>0.05	0.99	>0.05	2.35	>0.05	2.84	>0.05