

Is Beach Scenic Quality a Function of Habitat Diversity?

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ABSTRACT

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Recently there has been an increasing trend towards coastal scenery quantification and a novel method first introduced a few years ago is finding wide applicability within Europe as an effective classification and management tool. Beaches are assessed using a checklist comprising 18 physical and eight human parameters, selected on the basis of literature searches and a questionnaire survey of experts and beach users, which best delineate coastal scenery. To overcome subjectivity and quantify uncertainty, results are subsequently subjected to a Fuzzy Logic systems approach. In this way, the method calculates a site Evaluation Index (D) which enables beaches to be ranked according to a five-fold classification: Class 1 ($D > 0.85$, an extremely attractive natural site in terms of scenic quality); Class 2 ($0.85 > D > 0.65$); Class 3 ($0.65 > D > 0.4$); Class 4 ($0.4 > D > 0$) and Class 5 ($D < 0$, a very unattractive, developed urban site). Results from scenically diverse UK regions; eastern Scotland, southwest Wales and southwest England, indicate that beach D Values show no statistically significant correlation ($R^2 = 0.0065$) with diversity of habitats present. Most important to beach users are litter free sediment and clean seawater; far more so than richness and diversity of coastal habitats. Furthermore, the award of beach Blue Flag status, so coveted by local authorities, typically does not equate with a naturally attractive, scenic site.

ADDITIONAL INDEX WORDS: *Coastal, Management, Fuzzy Logic*

INTRODUCTION

Tourism is the world's largest growth industry and coastal beach areas attract by far the vast majority of tourist numbers (HOUSTON, 2002). Many surveys (e.g. MICALLEF et al., 1999; UNAL and WILLIAMS, 1999) have demonstrated that high quality scenery is one of the key features sought by tourists. Moreover, it was found in a survey of visitors to beaches of the Gower Peninsula, South Wales, to rank as their number one priority (MORGAN and WILLIAMS, 1995). In the past, most scenic assessments were mainly subjective (e.g. STEERS, 1944), based upon opinion ranging from attractive to unattractive, and little attention is currently paid to coastal scenery in worldwide coastal planning and management (ERGIN et al., 2006). In the UK, Shoreline Management Plans typically do not attempt to assess coastal scenery other than on a subjective basis, if at all.

Given the importance of coastal scenery as part of a coastal landscape inventory available for managers or planners, ERGIN et al. (2004) recognised the need to formalise an evaluation system, which overcame problems of subjectivity. In this methodology, 26 parameters, which delineate coastal scenery, were selected, from the results of literature searches and an extensive questionnaire survey of experts and beach users. These incorporated 18 physical parameters (cliff height, cliff slope, special features, beach type, beach width, beach colour, shore slope, shore extent, shore roughness, dunes, valley, skyline landform, tides, coastal landscape features, vistas, water colour and clarity, natural vegetation cover, vegetation debris) and eight human parameters (noise disturbance, litter, sewage, non-built

environment, built environment, access type, skyline, utilities). These were subsequently weighted according to perceived priority. Consequently, a coastal scenic evaluation checklist comprising the above 26 parameters, based on a five point rating scale from low to high attribute values was established (ERGIN et al., 2004). To overcome subjectivity and to quantify uncertainty, a fuzzy logic systems approach, utilising a mathematical model, was applied to checklist-derived ratings for each parameter. This resulted in a calculated Evaluation Index (D) that enables beaches to be ranked according to a 5-class evaluation system. The higher the D value, the higher the scenic evaluation: Class 1 scenery ($D > 0.85$, extremely attractive natural sites with very high landscape value); Class 2 ($0.85 > D > 0.65$, attractive natural sites with high landscape value); Class 3 ($0.65 > D > 0.4$, mainly natural sites with little outstanding landscape features or urban sites with exceptional scenic characteristics); Class 4 ($0.4 > D > 0$, mainly unattractive urban sites with low landscape value); Class 5 ($D < 0$, very unattractive urban sites with intensive development and low landscape value).

Initially applied to beaches in Turkey, Malta and the UK (specifically Wales), the methodology has now been applied to over 100 worldwide coastal sites (ERGIN et al., 2006) and is being used increasingly in the UK to assess its applicability as a beach classification and management tool (e.g. WILLIAMS et al. 2004; WADHAM, 2006; DUCK et al., 2006, 2008). Within the context of ERGIN et al.'s (2004) methodology, the aim of this investigation is to further explore the underlying rationale of what constitutes

'Class 1' beach scenic quality by addressing the question: Is beach scenic quality a function of habitat diversity?

STUDY AREAS AND METHODOLOGY

A total of 37 beaches (Table 1) within three scenically diverse UK regions were selected for survey by the ERGIN et al. (2004) methodology in this investigation; parts of eastern Scotland, southwest Wales and the Dorset coast of southern England.

Table 1: Beach names, D values, Classes and degree of habitat diversity for three areas chosen for this study; A: eastern Scotland, B: southwest Wales, C: Dorset. Those beaches denoted as (BF) held Blue Flag status at the time of survey (either 2006 or 2007).

A. Beach Name	D Value	Class	Habitat Diversity
Balcomie Sands	-0.65	5	9
Burntisland	-0.33	5 (BF)	5
Elie East Links	0.04	4	9
Elie Centre	0.04	4 (BF)	5
Shell Bay	0.05	4	11
Largo Bay	-0.58	5	10
Lundin Links	0.21	4 (BF)	7
Roome Bay	-0.33	5	5
Silversands Bay	0.55	3 (BF)	5
Tayport	0.56	3	9
Tentsmuir Point	0.64	3	10
Kinshaldy	0.66	2	7
St Andrews West	0.39	4 (BF)	5
St Andrews East	0.23	4 (BF)	9
Kingsbarns	0.63	3	9
Montrose	0.51	3 (BF)	7
Lunan Bay	0.81	2	11
Arbroath Victoria	-0.02	5	7
Carnoustie	-0.15	5	6
East Haven	0.38	4	8
Barry Sands	0.56	3	11
Monifieth	-0.04	5	6
Broughty Ferry East	0.21	4 (BF)	7
B. Beach Name	D Value	Class	Habitat Diversity
Oxwich	0.24	4	11
Bracelet Bay	0.22	4 (BF)	6
Caswell Bay	0.11	4 (BF)	13
Langland Bay	-0.06	5 (BF)	13
Rest Bay	0.07	4 (BF)	11
Pwll Du	0.53	3	6
Three Cliffs	0.60	3	10
Llantwit Major	0.03	4	13
Merthyr Mawr	0.12	4	11
C. Beach name	D Value	Class	Habitat Diversity
Chesil	0.38	4	12
Church Ope	0.31	4	5
Highcliffe	0.25	4	10
Sandbanks	0.12	4	4
Lulworth Cove	0.63	3	10

The first of these incorporates 23 sites of the coast of Angus and Fife in Scotland, including the mouth of the Tay Estuary and the northern shore of the outer Forth Estuary (see DUCK et al., 2006, 2008). The English and Welsh coastlines in this study have long been recognised for their scenic beauty (ROBINSON and MILLWARD, 1983). Located in the Bristol Channel, which has the second highest tidal range in the world (mean 8.3 m spring tidal range at Gower), the southwest Wales coastline, where nine beaches were surveyed, has numerous conservation designations (PHILLIPS et al, 2006) and the Gower Peninsula was designated as the UK's first Area of Outstanding Natural Beauty (AONB) in 1956. The five beaches of the Dorset coast surveyed are similarly located with an AONB, which has World Heritage Coast status (see PHILLIPS et al, 2006). Twelve of the beaches in the study areas had EU Blue Flag status at the time of their survey, as indicated in Table 1.

Additionally, for this study, an assessment of the diversity of habitats, within each beach unit studied, has been made on the basis of the checklist of 21 habitat types (Table 2) compiled by the former UK Nature Conservancy Council (COUNTRYSIDE COMMISSION, 1969) and expressed as the total number of habitat types present.

Table 2. List of beach habitat types (based on COUNTRYSIDE COMMISSION, 1969).

PERMANENTLY FLOODED

1 Creeks and drainage channels

2 Lagoons

INTERMITTENTLY FLOODED

3 Foreshore mud

4 Foreshore sand

5 Foreshore shingle

6 Foreshore rock

7 Salt marsh and brackish marsh

8 Shingle beach lows

9 Sand dune slacks

TERRESTRIAL

10 Earth and cliff embankment

11 Sand dune and sandy beach

12 Shingle beach

13 Rock-cliff and sea-wall

14 Coniferous plantation

15 Deciduous woodland/scrub

16 Cultivated land

17 Dry heather moor

18 Wet moor (including mire, blanket bog)

19 Grass heath (not on blown sand)

20 Machair

21 Freshwater marsh or swamp

This process has a degree of subjective assessment as a consequence of the issue of scale; if there is, for example, one isolated patch of shingle present on the backshore and it is very small in relation to the total length of beach, then it has been omitted from the checklist. The total number derived for each beach unit provides a guide to habitat richness and variety and, to a degree, the ecological potential of each area (e.g. RITCHIE, 1978). The statistical significance of the relationship between D Value, as a measure of beach scenic quality, and habitat diversity, expressed simply as the number of habitats present, was subsequently explored for the study area beaches in order to address the question posed by the title of the paper.

RESULTS

The names of the 37 beaches in the three areas surveyed using the Ergin *et al.* (2004) methodology, the D Values obtained, together with the corresponding classes and habitat diversities present are presented in Table 1. Overall results present a range of D Values from -0.65 (Class 5) to 0.81 Class 2; no Class 1 beaches were recorded in the three study areas. When derived D Values are plotted against the numbers of habitats present at each beach site, in a composite plot incorporating the three areas (Figure 1), there is no statistically significant relationship (Coefficient of Determination, $R^2 = 0.0065$) between the two parameters. Indeed the lack of any significant correlation between D Value, an Evaluation Index of beach scenic quality, and beach habitat diversity is striking.

this study. In a major survey of over 2300 beach users in Wales, TUDOR and WILLIAMS (2006) found that most important, in fact, was litter free sand and clean seawater and that these were the over-riding factors in determining the choice of beach visited. Beach awards, such as Blue Flag, were also found to be minor considerations. It is, furthermore, noteworthy (cf. WADHAM, 2006; DUCK *et al.*, 2006, 2008) that beaches in this study with Blue Flag awards (Table 1) did not achieve the highest D Values (for example Burntisland beach in Fife, Scotland, attained Class 5 status), thus indicating that such awards, in common with habitat diversity, do not necessarily equate with naturally attractive scenic sites. The award of Blue Flag status, so coveted by local authorities, is on the basis of facilities, not scenery. Furthermore, the human parameters necessary to comply with such status reflect negatively on scenic evaluation. According to COOKE and DOORNKAMP (1990), what attracts most visitors to beaches is excellent scenery and WILLIAMS *et al.* (2004) contend that scenic

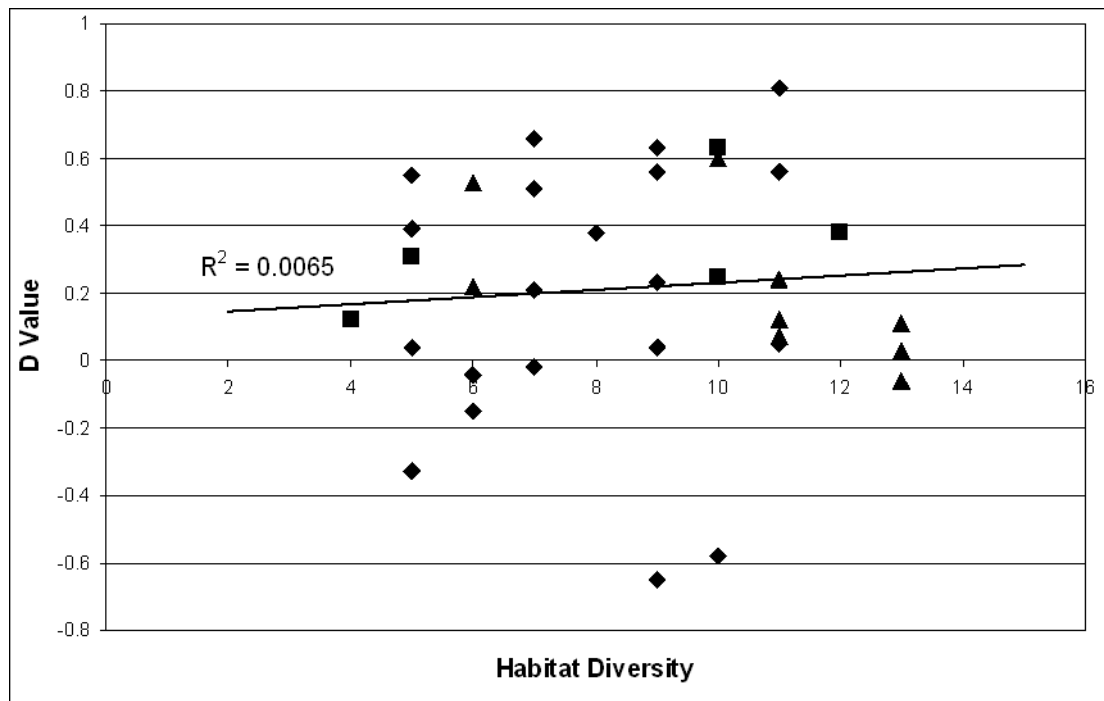


Figure 1. Relationship between D Value and habitat diversity for the 37 beach sites surveyed in this study, within the three scenically diverse geographic regions of the UK: eastern Scotland – diamonds, southwest Wales – triangles, Dorset – squares (Coefficient of Determination, $R^2 = 0.0065$).

DISCUSSION AND CONCLUSIONS

This is the first time that the relationship between beach scenic quality, in terms of the Evaluation Index D Value, and habitat diversity has been investigated. Intuitively a statistically significant, positive correlation between beach scenic quality (D Value) and diversity of habitats present might be expected. The results of this study of scenically and geographically diverse beach types demonstrate unequivocally, however, that this is not the case. Conversely, WILLIAMS *et al.* (2007) found Heritage Coast beaches had significantly higher D values than non-Heritage Coast beaches. Heritage Coast designation is a function of scenic beauty and the understandably significant D value correlation highlights the contrasting nature and gives further reliability to the results of

evaluations, such as the ERGIN *et al.* (2004) method featured in this study, should be an intrinsic part of any coastal zone management strategy. Coastal zone managers are faced with facilitating different beach user needs and coastal scenery should, it is suggested, be one of the most important attributes to conserve, since it is a key driver of the global tourist industry. The striking findings of this study indicate unequivocally that beach scenic quality is not a function of natural habitat diversity, which therefore has important implications for coastal zone conservation and management strategies.

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