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# Video panorama assessment of beach landscape aesthetics on the coast of Wales

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**Abstract.** 70 beaches in Wales, UK, were investigated with regard to the quality of beach scenery using video panoramas. Beaches were given a score from zero to 20 by a panel of 24 coastal managers (National Park and Heritage Coast Wardens, etc.) and 42 final year Degree or Master of Science students specializing in environmental sciences.Mean scores of coastal managers ranged from 16.1 (Broadhaven, S. Pembrokeshire; 80 %) to 3.8 (Prestatyn, North Wales; 19 %), while scores of students ranged from 16.0 (Barafundle, S. Pembrokeshire; 80%) to 6.1 (Trecco Bay, Porthcawl; 31%).Wave height, number of people present on the beach and position on the final videotape did not have significant effects on mean scores generated by either group.With both groups a strong preference was observed for undeveloped beaches over those where anthropogenic structures were prominent ($p$ = 0.00), but beach commercialization level had an independent effect only on scores from the student group ($p$ = 0.02).Cloud cover at time of filming had a significant effect ($p$ = 0.00) on scoring, so a correction was applied for final score calculation and ranking.The findings contribute to management of coastal aesthetic resources by providing a quantitative evaluation scheme.It is proposed to use these scores for beach scenery/aesthetic quality in a novel, comprehensive beach rating system.

**Keywords:** Coastal Landscape; Landscape assessment; Management; Scenery.

## Introduction

Concern about conserving coastal landscape quality in Britain can be traced back to the 1940s and the work of J.A. Steers of Cambridge University (Steers 1948). Steers toured the British coastline and subjectively selected areas of natural beauty which led directly to the setting up of Heritage Coasts. During the last three decades, public awareness of coastal landscape quality has given rise to an increasing demand for planning techniques which can evaluate coastal scenery, with the aim of conserving its quality (Williams & Lavalle 1990).Carls (1979), considered that sound ecological management of the coastal zone is also good management for sustained recreational use and the preservation of aesthetic quality.

A huge literature exists concerning the philosophical and sociological aspects of landscape and it has been argued that landscape evaluation should play a role in the formulation of landscape protection policies (Laurie 1975). However, only a limited amount of information has been published with regard to assessment of coastal landscape scenery. Evaluation of the beach landscape could be utilized for landscape preservation (identifying the value to society of particular areas/views), landscape protection (identifying high quality landscapes and controlling development), landscape improvements (to identify components that may detract from views) and to guide recreational policy by the identification of areas of high landscape quality (Williams & Lavalle 1990).It has been considered that landscape beauty derives from components such as vegetation, land forms, presence of built structures and other overt signs of human activity, but cannot be equated to the sum of these individual components (Appleton 1975a, b).

Dearden (1980) argued that landscape value can be attributed to its potential in terms of three aspects:

1. Recreation. The appearance and perception of the landscape has been considered to be the most common aspect of public enjoyment of the outdoor environment (Williams & Lavalle 1990).
2. Spiritual refuge.Humans have a spiritual and emotional need for beautiful surroundings (Zube 1987).
3. Historical resource.In a changing world a need exists to preserve historical aspects of the landscape that formed an important part of the environment for our ancestors (Williams & Lavalle 1990).

With regard to national and cultural differences in landscape preference and appreciation, various workers have reached a range of conclusions.Generally however, literature on this subject is sparse (Shafer & Tooby 1973; Zube & Pitt 1981; Buhyoff et al. 1983), especially with regard to coastal landscapes and illustrates a lack of consensus.Eleftheriadis et al. (1990) found agreement between European nationality groups with regard to the

most and least preferred coastal landscapes, but also many significant differences; this was attributed to cultural differences and familiarity with home environment scenes.Fines (1968), Kaplan et al. (1972) and Zube (1973) have found natural landscapes to be perceived as more distinguished and spectacular, more preferred and more scenic, respectively, among culturally homogeneous participants.A number of workers have demonstrated a similarity in landscape preference between groups of different nationalities but broadly similar cultures (e.g. Shafer & Tooby 1973; Ulrich 1977; Zube 1984).Buhyoff et al. (1983) found evidence for moderate differences between national landscape preferences within Europe.Zube & Pitt (1981), found that not all cultures share the perception that landscapes containing man-made structures are necessarily less scenic than natural landscapes and suggested that we may be explicitly taught, or implicitly led to believe that scenic beauty is primarily an attribute of unmodified landscapes.

Several studies (e.g. Zube & Pitt 1981) have suggested that environmental experience and landscape familiarity can be important factors in shaping perceptions of valued landscapes.An analysis by Wellman & Buhyoff (1979) on the other hand, indicated no regional familiarity effect.

Landscape evaluation techniques may be divided into two groups:

1. Component-based methods.Such methods attempt to be objective by giving precise numerical values to components of the landscape such as area of vegetation, relative relief, number of buildings, width of beach, etc.Appleton (1980) has argued that it is incorrect to add together figures which measure different parameters when no mathematical relationship has been established between them.Component-based methods have also been criticised by Kaplan (1975), Penning-Rowsell (1982) and Bourassa (1991). Moreover, it has been argued that with regard to perception and preference, objective measurement is, in any case, misplaced (Williams & Lavalle 1990).
2. Integrated techniques, based on field visits, motion photography or still photographs.Field-based methods suffer specifically from problems relating to logistics which can make comparison of large numbers of locations impracticable.

Bearing in mind the criticisms of Kaplan (1975), Appleton (1980), Penning-Rowsell (1982) and Bourassa (1991), it was felt that the landscape and aesthetic quality of beach areas could not be adequately assessed using component-based methods, in terms of the presence/absence of various ÔdetractorsÕ (e.g. factories, sea walls), relative relief, visibility of vegetation, etc., which could be included in a practicable checklist.

Photographic representation of scenery was highlighted by Robinson et al. (1976) as a means of increasing the number of observers whose opinion could be obtained.Evidence reviewed by Shuttleworth (1980), Nassauer (1982), Zube et al. (1987) and Bosselmann & Craik (1989) has shown that judgements from photographs are highly correlated with on-site judgements of the same areas.Group-to-group reliability within populations and test-retest reliability have also been found to be generally high (e.g. Daniel & Boster 1976; Jackson & Hudman 1978; Brown & Daniel 1984; Hull & Stewart 1992).Clamp (1976) identified three main types of technique for assessing landscape via photographic media:

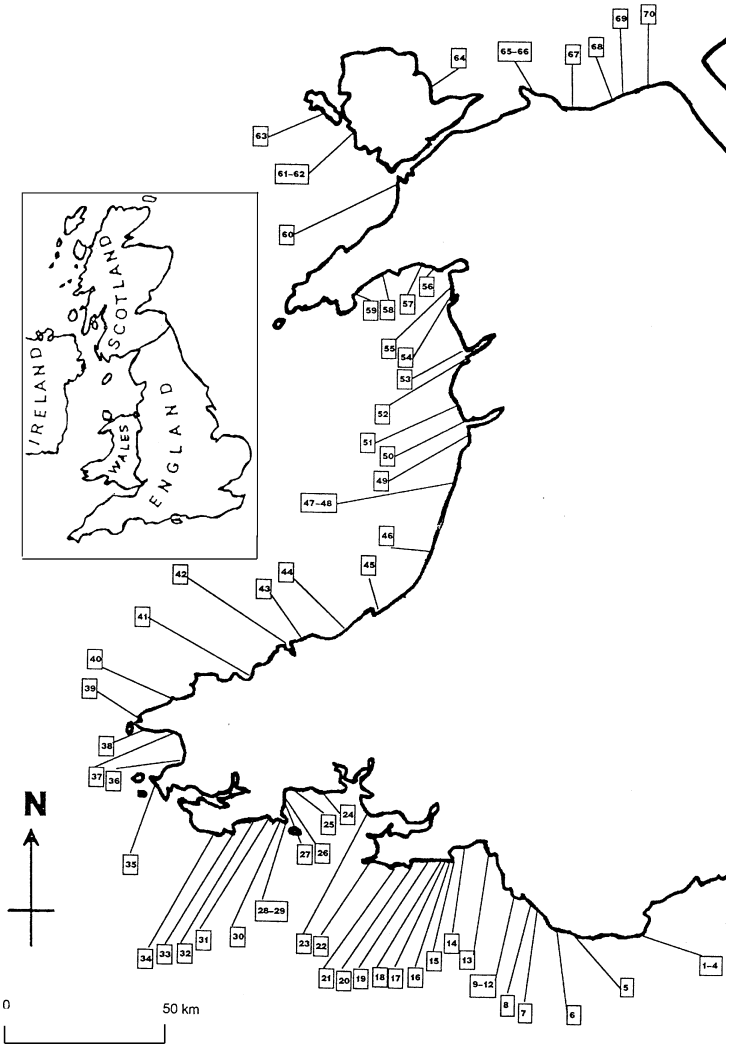
1. The direct unstructured method where raters assess views using their own personal criteria for good or bad landscape.
2. The direct structured method where raters are given a list of features to look for.The landscape rating is then derived from the presence or absence of these features according to a formula devised by a landscape ÔexpertÕ.
3. The calibrated method.Raters assess views using their own criteria.Features or characteristics of the views are measured and weighted from the ratersÕ assessments.

In the second of these methods, the values attached to landscape depend upon the judgement of one individual ÔexpertÕ.This has been considered unsatisfactory for two reasons:

(1) one individual cannot be guaranteed to be representative of the population as a whole or even a subgroup of it;
(2) the method depends on the individualsÕ ability to devise a mathematical formula representing his own landscape preferences (Clamp 1976).

For the purposes of this study and bearing in mind the above considerations regarding the questionable validity of deeming a landscape to be directly related to the sum of its visible components, the authors felt that the direct unstructured method was the preferred option.

Clamp (1976) compared evaluations of 17 English landscapes obtained from sets of six colour transparencies, each set of which showed a complete panorama from a single viewpoint, with a filmed panorama during which the camera was rotated through 360 $^{o}$ at a uniform speed and with field visits.Results indicated that both photographic techniques were equally satisfactory.In view of the number of beaches (70) to be assessed in this exercise the authors considered that the use of panoramas made up of transparencies or still photographs (which would total 420 allowing for six per beach), would be impracticable on grounds of viewer fatigue and time usage.Movie film allows the presentation of




Names of the 70 beaches indicated in Fig. 1.

| No. | Beach | No. | Beach |
|---|---|---|---|
| 1 | St. MaryÕs Well Bay | 36 | Broad Haven |
| 2 | Barry (JacksonÕs Bay) | 37 | Newgale Sands |
| 3 | Barry (Whitmore Bay) | 38 | Caerfai Bay |
| 4 | Cold Knap | 39 | Whitesands Bay |
| 5 | Llantwit | 40 | Abereiddi Bay |
| 6 | Nash | 41 | Newport |
| 7 | Southerndown | 42 | Poppit Sands |
| 8 | Ogmore | 43 | Mwnt |
| 9 | Porthcawl (Newton) | 44 | Llangranog |
| 10 | Porthcawl (Trecco Bay) | 45 | New Quay |
| 11 | Porthcawl (Sandy Bay) | 46 | Aberaeron |
| 12 | Porthcawl (Rest Bay) | 47 | Aberystwyth (South) |
| 13 | Aberafan | 48 | Aberystwyth (North) |
| 14 | Swansea Bay | 49 | Borth |
| 15 | Mumbles | 50 | Aberdyfi |
| 16 | Bracelet Bay | 51 | Tywyn |
| 17 | Langland Bay | 52 | Fairbourne |
| 18 | Caswell Bay | 53 | Barmouth |
| 19 | Three Cliffs Bay | 54 | Llandanwg |
| 20 | Oxwich | 55 | Harlech |
| 21 | Port Eynon | 56 | Morfa Bychan |
| 22 | Rhossili | 57 | Criccieth |
| 23 | Pembray | 58 | Pwllheli |
| 24 | Pendine | 59 | Abersoch |
| 25 | Amroth | 60 | Dinas Dinlli |
| 26 | WisemanÕs Bridge | 61 | Rhosneigr (Traeth Llydan) |
| 27 | Saundersfoot | 62 | Rhosneigr (North) |
| 28 | Tenby (North) | 63 | Trearddur Bay |
| 29 | Tenby (South) | 64 | Benllech |
| 30 | Lydstep Haven | 65 | Llandudno (West) |
| 31 | Manorbier | 66 | Llandudno (North) |
| 32 | Freshwater East | 67 | Colwyn Bay |
| 33 | Barafundle | 68 | Kinmel Bay |
| 34 | Broadhaven | 69 | Rhyl |
| 35 | Marloes Sands | 70 | Prestatyn |

an entire landscape view (Nassauer 1982) and largely removes problems of framing and composition inherent in still photography. The cost and convenience disadvantages mentioned by earlier workers (Clamp 1976; Nassauer 1982) are now much less marked than formerly.A video panorama technique based on the techniques of Clamp (1976) and Banerjee (1977) was therefore selected for this investigation.

Kreimer (1977) suggested that sources of preference variation in photographic landscape assessments could result from differences in angle of view, viewpoint, composition, time of day and season.In assessing beaches in macrotidal coastal zones (such as the beaches featured in this study), state of the tide could also be an important factor due to the change in appearance of the seaward view from a large expanse of (usually) sand at low tide, to nearby water with breaking waves at mid/high tide.Indeed at many of the beaches examined, there could be no ÔdryÕ viewpoint for panorama filming in high tide conditions, while at some of the beaches the sea itself would barely be visible from near the landward edge of the beach at low tide.In this study limitations were imposed on these variations as far as reasonably possible by the use of pre-defined viewpoints based where possible on National Rivers Authority (NRA) bathing water sampling points (Anon. 1994a), constraining variations in camera lens focal length (and therefore viewing angle) and as far as logistically possible, season, time of day and tidal state for filming.

Rating scales have often been used to express environmental preferences (e.g. Daniel & Boster 1976; Schroeder & Daniel 1981).Scaling methods differ in complexity and ease of use.Complex methods were applied in many studies of environmental perception (e.g. Schroeder & Daniel 1981; Hull & Buhyoff 1983), while simpler methods were used by others (e.g. Brush 1979).Schroeder (1984) compared several methods for scaling environmental perception data and found that a simple mean rating produced results almost identical to more complicated scaling methods.Schroeder (1984)

found that groups of as few as nine individuals could be adequate, providing inter-group reliability coefficients above 0.9, but researchers of environmental perception have generally considered that a high level of reliability can be achieved with groups of 15 to 25 raters (Craik 1972; Brush 1976; Schroeder & Daniel 1980).

**Methodology**

As part of research into beach rating systems (Williams & Morgan 1995), the landscape was assessed at 70 beaches in Wales, UK (Fig. 1), by the production of a S-VHS video film panorama at each beach. The beaches included 49 identified under the EC Bathing Water Directive (Anon. 1976) and 21 other beaches, mainly in the southern half of Wales.These additional beaches were selected mainly because they had received Tidy Britain Group Seaside or Premier Seaside Awards in 1994 (Williams & Morgan 1995), or had been recommended by the 1994 Good Beach Guide (Anon. 1994b).

Filming was carried out by mounting the camera on a levelled tripod at a point ca. 50m from the landward edge of the beach and adjacent to the NRA (National Rivers Authority, now the Environment Agency) water sampling location where such a location was listed (Anon. 1994), or otherwise at the centre of the most heavily used part of the beach.The camera lensÕ focal length was adjusted so that where possible, all natural and man-made structures of high relative relief (e.g. cliffs, tall buildings), could be included in the field of view, down to the minimum focal length of 8mm (42 ° angle of view).The maximum focal length employed for any beach was limited to 16mm (21 ° angle of view), even where no substantial relative relief was present.This was done in order to limit variation in this factor between beaches and because the use of focal lengths of greater than 16mm, resulted in a high apparent angular velocity of camera panning which made viewing difficult.

The camera was pointed in a seaward direction, activated and smoothly panned through 360° in an anti-clockwise sense over a period of 30 - 35 seconds.In all cases the focal length was kept constant throughout filming of the panorama.Three panoramas per beach were recorded and the best in terms of smoothness of panning was selected for inclusion in the final edited tape.Beaches were filmed between 28 July and 22 September 1994 on days of dry weather.Filming was carried out within 3 hours of local low tide, between 10 a.m. and 5 p.m.Filming was mainly conducted on week days and the most heavily used beaches were filmed outside the peak season, so beach user numbers were generally low.

Beach panoramas were placed in a random order in the final tape.Intervals were left of ca. 10 seconds between each beach panorama to allow judges time to consider their score for the preceding beach.Beaches were identified on the tape by number only and this voice identification was the only soundtrack present on the final tapes produced for rating.Beach panoramas were assessed in a semi-quantitative fashion by observation, in terms of visible wave size, number of people present on the beach and cloud cover to establish the effect of these temporally variable parameters on the rating scores obtained.Prominence of vehicles/man-made structures was also assessed in the same way (Table 1).Rating of the panoramas was carried out by two categories of judges:

(1)24 coastal managers comprising wardens and other officers of the Pembrokeshire Coast National Park, Glamorgan Heritage Coast, Ceredigion Heritage Coast, and other regionally based coastal experts;

(2) 42 university/higher education college students specialising partly or wholly in environmental subjects.

Before the tape was played, judges were told that the purpose of the exercise was to Òjudge the scenic beauty of each video panoramaÓ. The tape was then played, with a short break of 2 - 3 minutes at halfway (after 35 beach panoramas), to lessen the possibility of fatigue.Judges were asked to give each panorama a score between zero and 20.Mean scores for each beach from each judging group were calculated (Table 1).Spearman rank correlation and multiple regression analyses were used to test for relationships between mean beach scores and visible wave size, number of people present, cloud cover, type of beach in terms of level of commercialization and prominence of man-made structures/vehicles, for each group of judges.Data was examined to check for ÔdriftÕ in scoring during the panorama sequence.

**Results**

Cloud cover at time of filming had a significant effect ($p = 0.00$) on scoring for both groups of judges, with higher scores observed for beaches filmed under sunny conditions.This contradicted the finding of Clamp (1976), that response to landscape was largely determined by individual attitude to permanent features in the view presented and was little influenced by effects of weather or lighting.Since weather is a temporally variable aspect of beaches, a correction was applied to calculate a corrected mean score for scenic beauty which might be expected if all the beaches had been filmed in similar weather conditions.

The method of correction was similar to that used to eliminate seasonal variation in time series analysis:

**Fig. 2.** Broadhaven - highest score (80%) from judging group A.

**Fig. 3.** Prestatyn - lowest score (19%) from judging group A.

**Fig. 4.** Barafundle - highest score (80%) from judging group B.

**Fig. 5.** Trecco Bay, Porthcawl - lowest score (31%) from judging group B.

$$S_c = S_r \text{Đ} (x_w \text{Đ} x) \quad (1)$$

where $S_c$ = corrected mean score for beach,
$S_r$ = raw mean score for beach,
$x_w$ = mean of mean scores for beaches filmed in similar weather conditions,
$x$ = mean of mean scores for all beaches.

The corrections applied to the raw mean scores for each beach and judging group, are shown in Table 2.

These corrections were applied for final score calculation and ranking (Table 3) for each group of judges.Wave height, number of people present on the beach and position of filmed panorama on the final tape did not have significant effects on mean scores ($p < 0.05$).Among coastal managers (judging group A), mean scores out of 20 ranged from 16.1: Broadhaven (S. Pembrokeshire) - 80% (Fig. 2), to 3.8: Prestatyn - 19 % (Fig. 3). Mean scores given by students (judging group B), ranged from 16.0: Barafundle-80% (Fig. 4) to 6.1: Trecco Bay, Porthcawl - 31% (Fig. 5).The overall mean of beach scores for the 70 beaches was not significantly different between the two judging groups (mean for group A - 10.55, group B - 10.71).

Analysis of corrected scores by Spearman rank correlation, revealed a strong preference among both groups of judges for beaches with few man-made structures visible in the panorama ($p = 0.00$, Fig. 6).Particularly noteworthy was the fact that the five beaches given the highest corrected scores by Group A judges were in the lowest category (1) for prominence of man-made structures, while the three beaches with the lowest corrected scores were in the highest such category (5; Table 3).

For group B judges, four of the five highest scoring beaches were in the lowest category for prominence of structures and the four beaches with the lowest mean corrected scores, were in the highest such category.There was also a clear correlation ($p = 0.00$), between beach type in terms of level of commercialization and corrected score, with less commercialized beaches scoring more highly.

**Table 1.** Assessment of the study beaches. See key at the bottom of the table.

| Beach | Judges' Raw Scores (means) | | Semi-quantitative assessment of beach parameters (see key below) | | | | |
|---|---|---|---|---|---|---|---|
| | | | Prominence of structures | Beach comm. level | Weather (cloud cover) | Visible wave size | No. of people present |
| | Group A | Group B | | | | | |
| St. MaryÕs Well Bay | 11.04 | 10.33 | 1 | 2 | 3 | 1 | 1 |
| Barry (JacksonÕs Bay) | 10.54 | 10.48 | 2 | 4 | 3 | 2 | 1 |
| Barry (Whitmore Bay) | 6.17 | 7.67 | 4 | 4 | 3 | 1 | 2 |
| Cold Knap | 8.33 | 9.05 | 3 | 2 | 3 | 2 | 1 |
| Llantwit | 10.08 | 9.26 | 3 | 3 | 2 | 2 | 2 |
| Nash | 12.96 | 11.71 | 1 | 2 | 2 | 2 | 1 |
| Southerndown | 13.75 | 12.67 | 2 | 3 | 2 | 3 | 2 |
| Ogmore | 11.25 | 0.71 | 3 | 3 | 2 | 3 | 2 |
| Porthcawl (Newton) | 9.08 | 8.33 | 3 | 2 | 2 | 1 | 1 |
| Porthcawl (Trecco Bay) | 5.96 | 6.95 | 3 | 4 | 2 | 2 | 2 |
| Porthcawl (Sandy Bay) | 5.75 | 8.24 | 5 | 4 | 2 | 2 | 3 |
| Porthcawl (Rest Bay) | 10.75 | 11.69 | 3 | 1 | 2 | 2 | 3 |
| Aberafan | 5.75 | 7.57 | 5 | 4 | 2 | 2 | 2 |
| Swansea Bay | 8.67 | 9.24 | 4 | 4 | 3 | 2 | 1 |
| Mumbles | 9.17 | 7.74 | 4 | 4 | 3 | 1 | 1 |
| Bracelet Bay | 9.83 | 9.69 | 3 | 2 | 3 | 2 | 1 |
| Langland Bay | 8.42 | 10.26 | 4 | 3 | 3 | 2 | 2 |
| Caswell Bay | 11.04 | 12.64 | 3 | 2 | 3 | 3 | 3 |
| Three Cliffs Bay | 15.67 | 15.26 | 1 | 1 | 2 | 2 | 1 |
| Oxwich | 9.38 | 10.17 | 3 | 3 | 3 | 1 | 2 |
| Port Eynon | 11.79 | 12.62 | 2 | 3 | 2 | 2 | 2 |
| Rhossili | 14.79 | 15.33 | 2 | 2 | 2 | 2 | 1 |
| Pembray | 11.13 | 13.38 | 1 | 2 | 3 | 1 | 1 |
| Pendine | 10.54 | 10.31 | 3 | 3 | 3 | 1 | 1 |
| Amroth | 10.04 | 9.60 | 4 | 3 | 2 | 2 | 1 |
| WisemanÕs Bridge | 9.50 | 9.40 | 3 | 2 | 2 | 2 | 1 |
| Saundersfoot | 8.42 | 9.55 | 4 | 4 | 2 | 2 | 1 |
| Tenby (North) | 12.04 | 11.69 | 4 | 3 | 2 | 1 | 2 |
| Tenby (South) | 11.37 | 11.60 | 3 | 4 | 2 | 1 | 2 |
| Lydstep Haven | 10.42 | 9.76 | 3 | 3 | 2 | 2 | 1 |
| Manorbier | 12.42 | 12.93 | 2 | 2 | 3 | 2 | 2 |
| Freshwater East | 12.88 | 13.12 | 3 | 2 | 1 | 2 | 2 |
| Barafundle | 15.92 | 16.79 | 1 | 1 | 2 | 1 | 2 |
| Broadhaven (S. Pembs.) | 16.96 | 16.38 | 1 | 1 | 2 | 1 | 1 |
| Marloes Sands | 15.79 | 14.31 | 1 | 1 | 2 | 3 | 1 |
| Broad Haven | 11.58 | 11.98 | 4 | 3 | 1 | 2 | 1 |
| Newgale Sands | 11.42 | 11.02 | 3 | 2 | 1 | 2 | 1 |
| Caerfai Bay | 16.21 | 16.17 | 1 | 2 | 1 | 1 | 1 |
| Whitesands Bay | 13.42 | 14.19 | 2 | 2 | 1 | 2 | 1 |
| Abereiddi Bay | 11.50 | 10.67 | 3 | 2 | 1 | 3 | 1 |
| Newport | 12.42 | 11.71 | 3 | 2 | 3 | 3 | 1 |
| Poppit Sands | 12.29 | 13.76 | 2 | 2 | 2 | 2 | 1 |
| Mwnt | 14.54 | 15.26 | 1 | 1 | 2 | 2 | 1 |
| Llangranog | 14.08 | 13.55 | 3 | 3 | 2 | 3 | 1 |
| New Quay | 12.21 | 12.33 | 2 | 4 | 2 | 2 | 1 |
| Aberaeron | 8.29 | 7.12 | 3 | 3 | 3 | 2 | 1 |
| Aberystwyth (South) | 7.87 | 6.98 | 4 | 4 | 3 | 3 | 1 |
| Aberystwyth (North) | 6.83 | 6.57 | 4 | 4 | 3 | 3 | 1 |
| Borth | 10.67 | 8.48 | 4 | 3 | 2 | 4 | 1 |
| Aberdyfi | 13.58 | 13.26 | 3 | 3 | 2 | 1 | 1 |
| Tywyn | 7.38 | 7.38 | 4 | 3 | 3 | 3 | 1 |
| Fairbourne | 11.29 | 11.90 | 3 | 2 | 2 | 3 | 1 |
| Barmouth | 10.75 | 10.24 | 4 | 4 | 2 | 2 | 1 |
| Llandanwg | 12.04 | 11.95 | 2 | 2 | 3 | 4 | 1 |
| Harlech | 13.42 | 13.40 | 2 | 2 | 2 | 2 | 1 |
| Morfa Bychan | 12.83 | 13.52 | 2 | 1 | 3 | 1 | 1 |
| Criccieth | 6.79 | 6.69 | 5 | 3 | 3 | 3 | 1 |

**Table 1.** (*continued*)

| Beach | Judges' Raw Scores (means) Group A | Group B | Semi-quantitative assessment of beach parameters (see key below) Prominence of structures | Beach comm. level | Weather (cloud cover) | Visible wave size | No. of people present |
|---|---|---|---|---|---|---|---|
| Pwllheli | 6.54 | 7.21 | 4 | 2 | 3 | 2 | 1 |
| Abersoch | 6.50 | 8.60 | 4 | 3 | 2 | 3 | 3 |
| Dinas Dinlli | 8.21 | 6.83 | 3 | 3 | 3 | 4 | 1 |
| Rhosneigr (Traeth Llydan) | 10.96 | 11.86 | 2 | 1 | 3 | 2 | 1 |
| Rhosneigr (North) | 8.42 | 8.79 | 4 | 2 | 3 | 2 | 2 |
| Trearddur Bay | 8.63 | 8.83 | 3 | 2 | 3 | 2 | 2 |
| Benllech | 8.92 | 9.38 | 3 | 3 | 2 | 2 | 2 |
| Llandudno (West) | 11.46 | 1.14 | 3 | 3 | 2 | 1 | 1 |
| Llandudno (North) | 9.04 | 7.38 | 5 | 4 | 3 | 1 | 2 |
| Colwyn Bay | 9.75 | 9.21 | 3 | 3 | 3 | 1 | 1 |
| Kinmel Bay | 9.25 | 10.64 | 3 | 2 | 3 | 2 | 2 |
| Rhyl | 6.50 | 7.02 | 5 | 4 | 3 | 1 | 1 |
| Prestatyn | 4.96 | 7.90 | 5 | 3 | 1 | 2 | 2 |

**Key to Table 1**

**Prominence of vehicles/anthropogenic structures**
1 None visible
2 Few visible (distant)
3 Moderate prominence in scene
4 Considerable prominence
5 Domination of landward view

**Beach commercialization level**
1 Beach with no visitor facilities
2 Beach with few, basic facilities
3 Beach at small resort with moderate facility provision in immediate vicinity of beach
4 Beach at medium/large resort with many and varied facilities in immediate vicinity of beach

**Cloud cover at time of filming**
1 Sunny, more or less cloudless
2 Broken cloud
3 Overcast

**Size of breaking waves at time of filming**
1 <10cm
2 10 - 30cm
3 30cm - 1m
4 >1m

**No. of people visible in filmed panorama**
1 <10
2 10 - 50
3 >50

For group A judges, five of the six highest scoring beaches were those classified as having no visitor facilities (Table 3), while beaches at medium/large resorts received three of the four lowest scores.Similarly, the top three beaches according to judging group B had no visitor facilities for tourists and three of the four lowest scores were given to beaches at medium/large resorts.

Multiple regression analysis was carried out on corrected mean beach scores for both judging groups, using the independent variables of wave size, prominence of anthropogenic structures, beach commercialization level and number of people present on the beach at time of filming.A stepwise method was used for entry of independent variables into the regression equations, with significance limits set at $p < 0.05$.For judging group A, the only independent variable included in the regression equation was prominence of anthropogenic structures ($p = 0.00$).Beach com mercialization level did not feature in the equation ($p = 0.12$).The apparent correlation of beach commercialization level with mean beach scores shown by the Spearman rank correlation test was due to the strong relationship (Spearman rank correlation coefficient = 0.00) between commercialization level and prominence of structures.In multiple regression analysis, prominence of anthropogenic structures was also shown to be a significant factor ($p = 0.00$) for judging group B.However, the analysis showed that beach commercialization level was also a significant factor ($p = 0.02$) in mean beach scores, independent of

**Table 2**. Corrections applied to raw mean scores on basis of weather conditions at time of filming.

| Weather | Judging Group A | Judging Group B |
|---|---|---|
| 1 (Sunny) | Ð 1.16 | Ð1.44 |
| 2 (Broken cloud) | Ð0.90 | Ð0.98 |
| 3 (Overcast) | 1.27 | 1.36 |

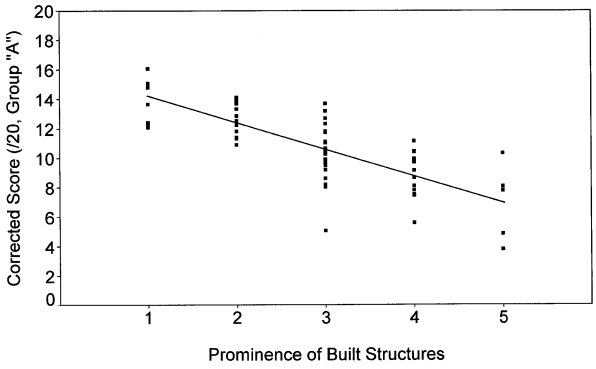



**Fig. 6.** Relationship of corrected scores of group A judges to prominence of anthropogenic structures (showing least-squares linear regression line).

prominence of structures.

Regression equations obtained were:

Judging group A:
Mean corrected score = 15.9 Ð 1.8 (prominence of structures)
Judging group B:
Mean corrected score = 16.3 Ð 1.3 (prominence of structures)
Ð0.6 (commercialization level)

where prominence of structures was on a scale of 1 to 5 and commercialization level was on a scale of 1 to 4 (see Table 1).The findings with respect to preference for absence of structures, support those of Kaplan et al. (1972).

No overall drift in scores was observed during the videotape sequence, although it must be admitted that the possibility exists of a variation in discrimination between high and low scoring beaches during the course of the videotape viewing.

## Discussion

In the opinion of many members of the judging panels, the number of beaches investigated in this study (70) probably represented a maximum for a single stage viewing assessment.Several judges suggested that it would be useful to see a few ÔgoodÕ and ÔbadÕ beaches (from the aesthetic quality point of view), at the start of the judging session so that they could calibrate the marking scale in their own minds.Also, for future assessments of this kind, it is recommended that ÔcontrolsÕ (repeats of beaches expected to receive extreme scores, both high and low), are inserted at intervals during the sequence.Bearing these two considerations in mind, it would seem that a maximum of about 50 beaches (including an opening sequence of calibration beaches plus repeats to act as controls), could be assessed using this technique in a single judging session.Possibly, larger numbers of beaches could be assessed by dividing them between several separate videotapes, which could be viewed on separate occasions by a judging panel.Inter-tape calibration of scores could be achieved by including a number of ÔreferenceÕ beaches on each videotape and correcting beach scores by looking at tape-to-tape changes in scoring of these reference beaches.

The observed tendency for beaches with prominent anthropogenic structures to attract low scores suggests that minimising the visibility by beach users of such structures should be a priority for coastal planners.In this regard, it may be noted that the sample used in this study (coastal managers and environmental science students), may not be representative of the views of the general beach-using public with respect to preferences for beach scenery.Investigations are currently proceeding in order to establish whether similar preferences exist in members of the general public.It may be that the beach-using public will evaluate a particular coastal scene, what they perceive it contains and the implications for enjoyment of what is visible, very differently from managers, academics and students who have been trained in environmental management.

The methodology described in this paper is currently being used as part of a beach-rating scheme which endeavours to encompass all beach aspects of importance to users (Morgan et al. 1995; Morgan 1997).Data from Turkey (Morgan et al. 1995) and preliminary results from Wales (Morgan 1997), suggest that 8.9% to 14.8% of total beach rating scores can be attributed to scenic quality, depending on beach type. This alone implies that beach scenic quality should be one of the most important aspects of Integrated Coastal Zone Management (ICZM) for touristically important areas of coastline.

It is axiomatic that environmental problems can occur on coastlines if relevant planning authorities do not have, Óclear policies for tourism development, are not familiar with requirements for coastal ecosystems protection, sediment dynamics and the importance of *landscape* and habitat protectionÓ (our italics, Anon. 1993, p. 108). In the realm of ICZM, it is a truism that coastal resources of especially high natural and visual value can suffer environmental degradation (Anon. 1995). In an era of expected climate change and sea-level rise, some of the most important aspects in this regard in the near future are likely to be concerned with coastal defence works. This applies in terms of their final appearance and also during actual construction, which often overruns its expected timescale (Balas and Ergin, 1997; Balas, 1998). Clark (1992), has argued that one of the guiding principles for ICZM should be to regard the coastal area as a unique resource, with the sea edge a focal point for management programmes. The

value of this resource to humanity in terms of economics, recreation, culture and aesthetic pleasure continues to grow. More than 20 yr ago, Laurie (1975) pointed the way forward by indicating that protective landscape policies should include landscape evaluations, yet the number of large-scale practical investigations into coastal scenery appreciation has been almost desultory. Hopefully, this research will make a contribution to the future expansion of this important field of study.

## Conclusion

The study demonstrated the feasibility of assessing the scenic quality of a relatively large number of beaches ($n$ =70), using a video panorama technique based on that of Clamp (1976) and Banerjee (1977).Judging was carried out by coastal zone managers ($n$ =24) and final year Degree/Master of Science, environmental science students ($n$ =42). Cloud cover had a significant effect ( $p$ = 0.00) on scoring of the beach panoramas by both groups of judges.A correction was applied for this factor for final score calculation and ranking of assessed beaches.Corrected mean scores of coastal managers ranged from 80% for Broadhaven in South Pembrokeshire to 19% for Prestatyn in North Wales.Mean scores given by University students specializing in environmental sciences, ranged from 80% for Barafundle to 31% for Trecco Bay, Porthcawl.Overall level of scoring did not differ significantly between the two judging groups. A clear preference was observed in both judging groups for beaches without prominent man-made structures.Multiple regression analysis showed that beach type in terms of level of commercialization independently affected scores from the student group only.

70 beaches appeared to represent a limit in terms of the number which can be reasonably assessed at a single viewing using this methodology.It is recommended that future studies of this type should feature a preliminary sequence of beaches expected to achieve high and low scores, so giving judges reference points for their scoring.The findings could contribute to management of coastal aesthetic resources.It is also proposed to use these scores for beach scenery/aesthetic quality in a novel, comprehensive beach rating system.For such a system to become widespread would require assessment of a large number of beaches, in which case inter-tape calibration of judgesÕ scores would be essential.

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