Tay Estuary Forum
Occasional Report Series

Report No. 1:

'Beach Usage: Understanding the Issues'

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Beach Usage: Understanding the Issues

1. Introduction

There are 60 Scottish beaches designated under the EC Bathing Waters Directive 76/160/EEC. The Directive was introduced in 1976 and is concerned with protecting human health and the environment. Bathing waters are defined as

> 'Those fresh or seawaters in which bathing is either explicitly authorized … or is not prohibited and is traditionally practiced by large numbers of bathers' (EC,1976).

Every year, Scotland's coastal regions receive 50% of the country's population and 400,000 visitors, generating £0.44 billion (StarUK, 2002). More than 70% of Scotland's population lives within 10 kilometres of the coast (SE, 2002).

This paper outlines key issues affecting beach usage and bathing water management and compares four local coastal bathing waters at Broughty Ferry, St Andrews (East and West) and Montrose.

Broughty Ferry beach is a sandy beach on the Firth of Tay (Figure 1), two miles east of Dundee city centre. It was selected for this study because of recent environmental quality improvements that followed investment of some £100M on the Tay Wastewater Project, ending the centuries old practice of direct sewage disposal to the Tay Estuary.

Figure 1. Broughty Ferry beach

Beaches in other Local Authority areas were selected for comparison of beach management, these being St Andrews East & West Sands in Fife, and Montrose Beach in Angus.

St Andrews, Fife is 13 miles south of Dundee and, as the historic home of golf is a popular destination for tourists. St Andrews has two beaches, East and West Sands as shown in Figure 2. West Sands is a Blue Flag award beach and both beaches are designated as bathing waters by the Scottish Executive.

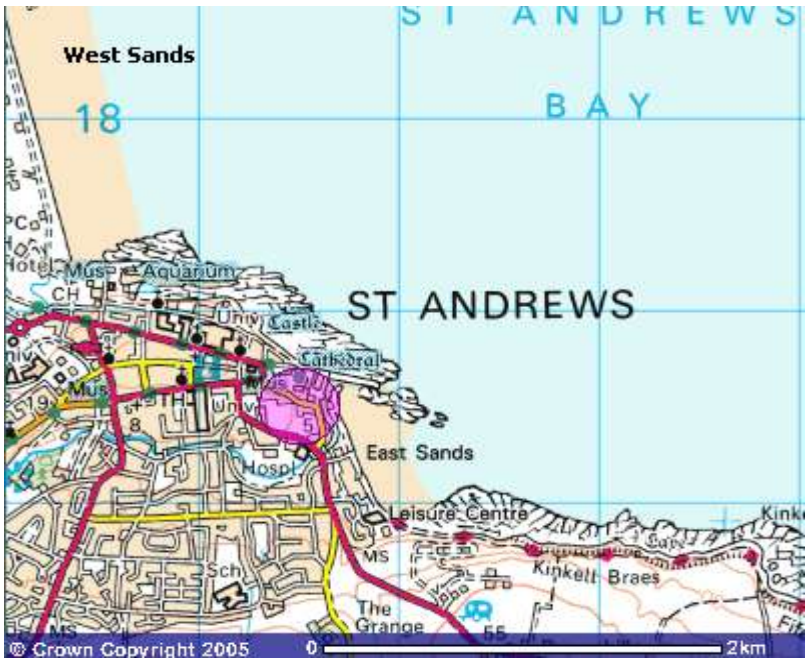


Figure 2. Plan of St Andrews East & West Sands, reproduced from Ordnance Survey map data with permission of Ordnance Survey, © Crown copyright

The final beach was at Montrose in Angus, approximately 25 miles from Dundee at the mouth of the Montrose Basin as shown in Figure 3.

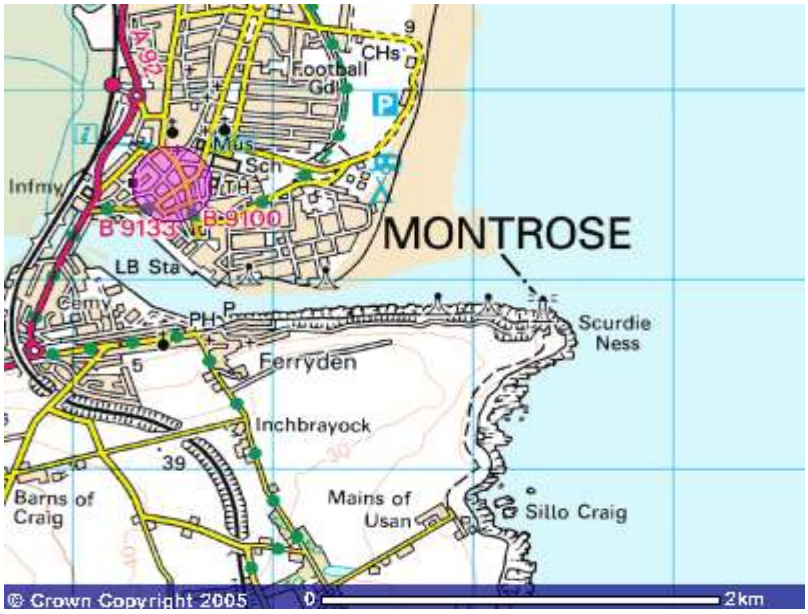


Figure 3. Plan of Montrose, reproduced from Ordnance Survey map data with permission of Ordnance Survey, © Crown copyright

Large scale beach visiting began with the development of the railways as they boosted existing small settlements with cheap and easy access. Over most of the country, the majority of visitors relied on cheap excursions organised by Sunday Schools, employers, temperance societies or commercial promoters. In the 1870s workers from industrialised areas such as Lancashire began mass participation in seaside holidays, funded by saving

through the year. During the 19th century the number and variety of seaside resorts grew rapidly as factory owners realised the value in sending their workers for day-trips or for a whole week to the rapidly developing seaside resorts nearest to them. Scottish beach usage peaked in the early part of the 20th century.

The cheap, all-in 'holiday camp' was introduced first at Skegness in the 1930s by Billy Butlin, was developed by other companies and grew quickly. However, this era of mass usage of bathing waters declined dramatically from the 1960s as increased prosperity and improvements in aviation technology encouraged overseas 'package' holidays.

Today, factors other than socio-economic affect people's choice of going to the seaside. Increased awareness of issues such as sewage effluent, water quality, appearance, technical quality of the beach environment, and even changes in climate may now influence beach usage.

2. Legislation and Bathing Water Quality Awards.

Before 1975 there was no control over waste disposal at sea. However, an international agreement named the "London Convention" was signed (and amended in 1978, 1980, and 1993), and controls sea dumping globally. Article 3 of this convention defined waste disposal at sea as:

"Any deliberate disposal of wastes or other matter from vessels, aircraft, platforms or other man-made structures at sea".

European water legislation gained momentum in the 1970s, with the Dangerous Substances Directive 76/464 a framework directive aimed at reducing or eliminating pollution of all inland coastal and territorial waters. (EC, 1976a).This was translated into Scottish law under the 1974 Control of Pollution Act (CoPA) part II, which is still in force today, and is concerned with controlled waters described in the Water Act 1989. It was amended under the 1995 Environment Act Schedule 22, the same act that led to the formation of the Environment Agencies in the UK: The Environment Agency in England & Wales and the Scottish Environmental Protection Agency (SEPA) in Scotland (HMSO, 1995).

In 1976 the Bathing Waters Directive 76/160 came into effect. This directive is concerned with protecting human health and the environment. In the mid-eighties, a well-developed French bathing water criterion system was adopted *en masse* in the European Union as The Blue Flag Award. In 1985 the first French coastal municipalities were awarded the Blue Flag on the basis of criteria covering sewage treatment and bathing water quality. In 1987, the "European Year of the Environment", the European Commission was presented with a model of the Blue Flag system by the Foundation for Environmental Education in Europe (FEEE). The Commission decided to deliver this to the European Union as a good practice benchmark. The official criteria for achieving Blue Flag status are more comprehensive than those included in water legislation and involve:

Water Quality;

Environmental Education and Information;

Environmental Management; and

Safety and Services.

Although 60 Scottish beaches have been designated as bathing water beaches under the 1976 Bathing Waters Directive, only 6 beaches, including St Andrews West Sands, have achieved the Blue Flag award.

3. Bathing Water Quality

Designated bathing beaches are monitored regularly to see if they are maintaining the guideline or mandatory bacteriological standards set out in the Bathing Waters Directive. These are:

EC mandatory Limits = 2000 FC*/100-ml, 10000 TC/**/100-ml (95% of samples).

There is no mandatory standard for FS***

EC guideline Limits = 100 FC/100-ml, 500 TC/100-ml, (80% of samples), 100 FS/100-ml (90% of samples).

Note: *FC = Faecal Coliforms; **TC = Total Count; *** = Faecal Streptococci.

Faecal Coliforms are a type of coliform bacteria found only in the human enteric system and thus they highlight water polluted by human excreta. Faecal streptococci are also found in the enteric systems of humans and other warm-blooded animals. They survive longer and thus highlight more recent pollution (EC, 1976).

The Scottish Environment Protection Agency (SEPA) monitors bathing water beaches regularly and displays the results on its website. Historical data on water quality for the four beaches are shown in Figure 4. Only three years are shown for Broughty Ferry after the Tay Wastewater project was completed.

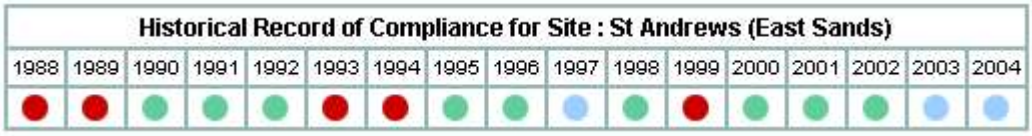
The overall rating for Broughty Ferry has not dropped below the guideline standard during its monitoring. St Andrews East Sands has variable results over 14 years, with only one guideline pass, 8 mandatory and 5 failures. These results, however, were affected by topography and the location of the sewage outlets, which discharged effluent directly onto the East Sands beach until a new sewage plant was commissioned in 2001, 6 miles away on the cliffs to the South of East Sands. West Sands has highly satisfactory results, with 11 guideline passes and 3 mandatory passes, with 8 of the last 9 being guideline passes.

Montrose beach also has good overall quality with 7 years at guideline status, 6 years at mandatory status, and with only 1998 failing.

Broughty Ferry

Historical Record of Compliance for Site: Broughty Ferry		
2002	2003	2004

St Andrews East Sands



St Andrews West Sands

Montrose

Figure 4. Annual bathing water quality data (SEPA, 2004)

4. Climatic Conditions

Each place has a similar climate that may be compared to the South of England so as to assess the impact of climate on local beach usage.

Mean daily sunshine figures reach a maximum in May or June and are at their lowest in December. Scotland's relatively high latitude means that, although winter days are very short, this is amply compensated by long summer days with an extended twilight. At the solstice there is no complete darkness in the North of Scotland. Lerwick for example, in Shetland, has four hours more daylight (including twilight) at midsummer than has London.

Despite a fallacy that the whole of Scotland experiences high rainfall, it varies greatly and is closely related to topography, giving an annual rainfall from 3000 mm in the Western highlands to about 800 mm on the east coast, similar to parts of southern England (Met Office, 2002).

Typically, measurable rainfall equivalent to 0.2 mm occurs on more than 250 days per year over much of the Highlands, reducing to 175 days per year on the eastern seaboard. The driest part of Britain is the Thames Estuary where the average rainfall is 150 days per year.

Data were selected from Southampton, southernmost of the eight Meteorological Office stations, which has been recording monthly maximum and minimum temperatures and rainfall since 1855. The only two recording stations in Scotland are Lerwick in Shetland (439 miles away), with a climate very different to mainland Scotland, and Stornoway in Lewis, off the west coast and without the same rainfall weather patterns as the east coast (Met. Office, 2002a).

The nearest other recording station is Durham, only 200 miles away and from 1880 recording the same three factors as Southampton. Figures 5 to 7 compare average monthly maximum and minimum temperatures at the two locations from 1800 – 2002.

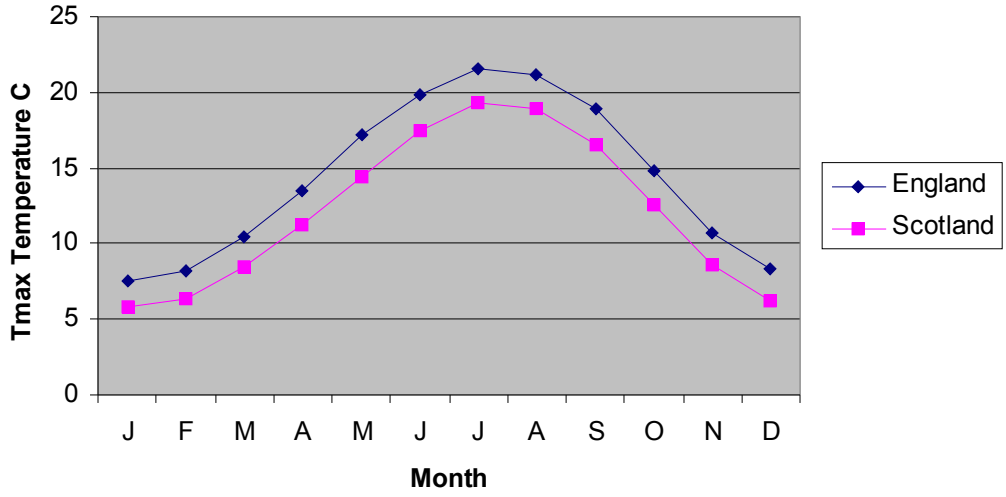


Figure 5. Average maximum temperature: Scotland & England 1880- 2001

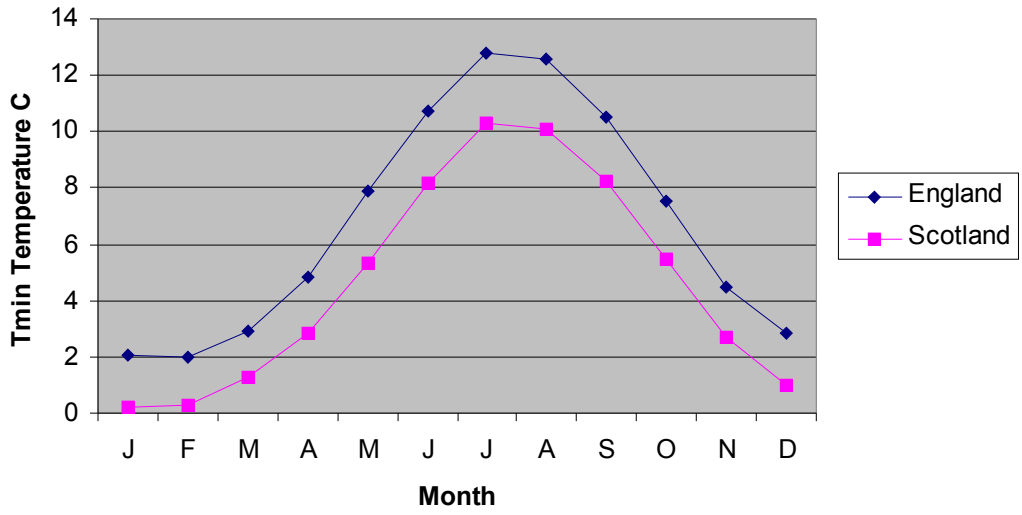


Figure 6. Average minimum temperature for Scotland & England: 1880- 2001

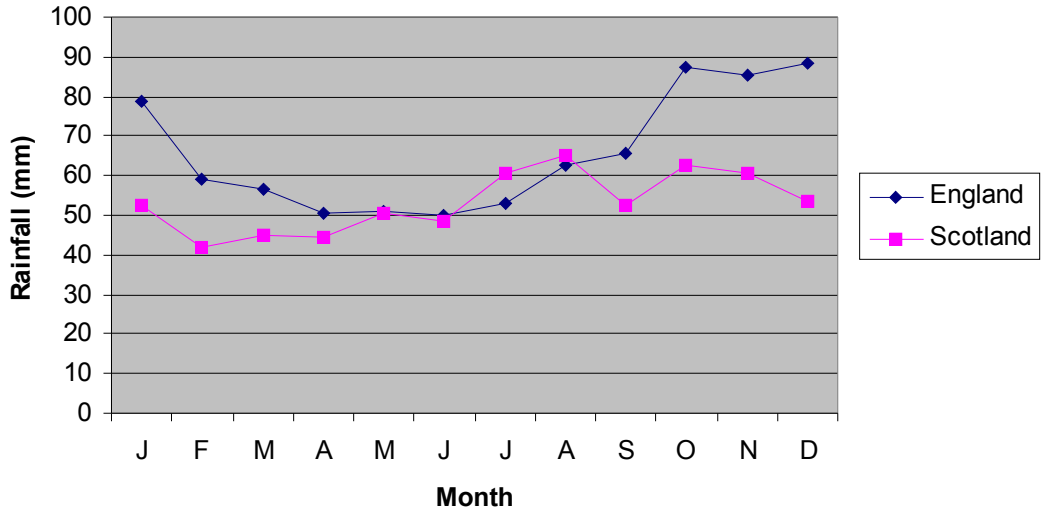


Figure 7. Average rainfall (mm) for Scotland and England: 1880-2001

The figures show that the average maximum temperatures for each month differ by a maximum of 2 degrees and the average minimum temperatures differ by up to 3 degrees. The annual pattern is virtually identical.

Air temperature affects mean sea temperatures, which are generally 2 degrees lower in east central Scotland than in the South of England, as shown in Figure 8.

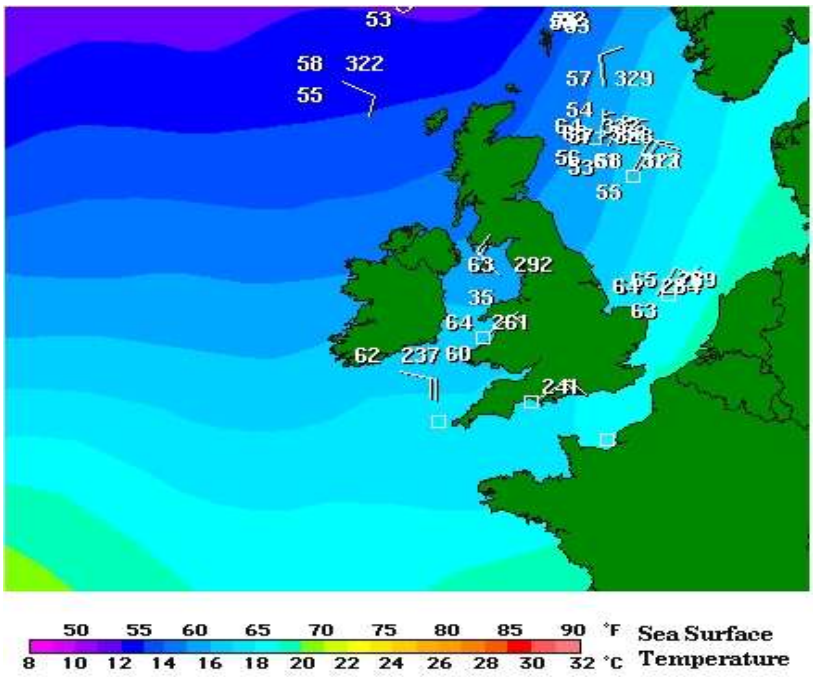


Figure 8. Sea surface temperatures for September 13th 2002 (A1Surf, 2002)

The above figures show that rainfall and temperature during the bathing season are similar at both Meteorological Office locations. Wind may have a more significant impact on beach usage than rainfall and temperature. Unfortunately, daily wind speed data are not available for the four selected beaches, but a comparison of the relative frequencies of wind may be made for gales. Many major Atlantic depressions travel over or close to Scotland, and the frequency of strong winds and gales is higher than in other parts of the United Kingdom. A day of gale is defined as a day on which the mean wind speed at the standard measuring height of 10 m above ground reaches 34 knots (39 miles per hour, 17.2 metres per second) or more over any period of 10 minutes.

Over low ground, the windiest areas are the Western Isles, the northwest coast, Orkney and Shetland, consistently with over 30 days of gales per year (Figure 9). In contrast, England has only 5-15 days of gales (Figure 10).

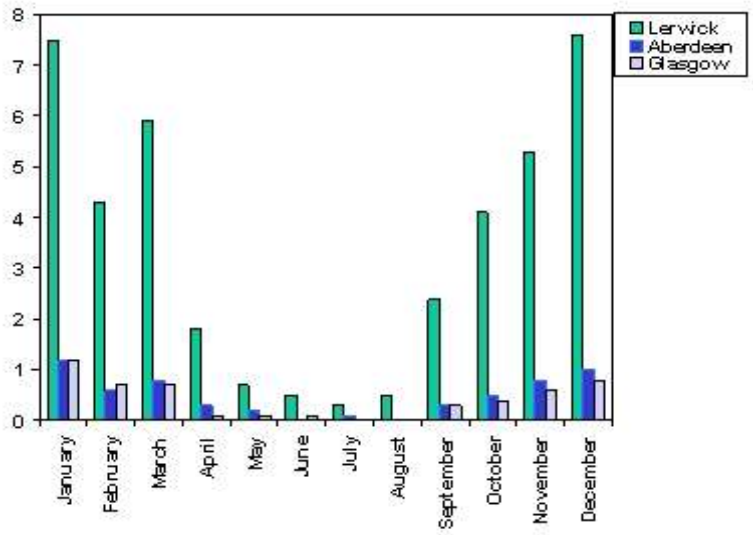


Figure 9. Days of gales for selected Scottish meteorological stations: average 1961-1990 (Met. Office, 2002b)

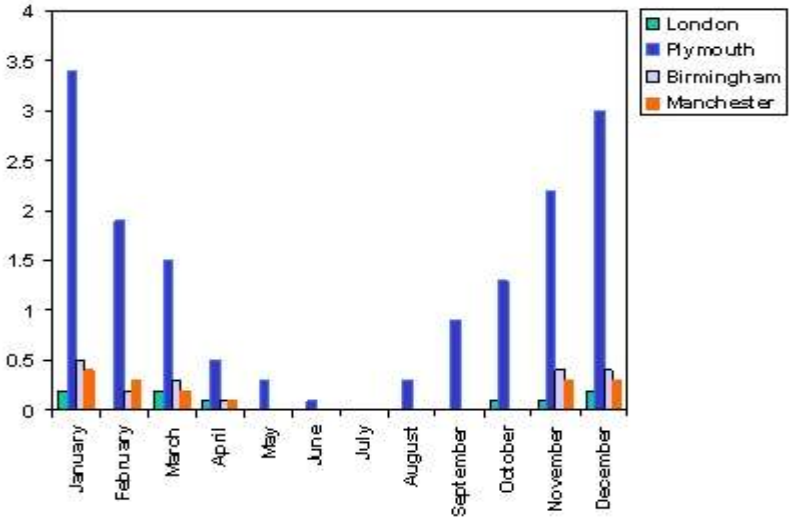


Figure 10. Days of gales for selected English meteorological stations: average 1961-1990 (Met Office, 2002c)

Although gale data are not the most useful measure of wind effects on bathing waters, they suggest it likely that winds have greater impact in Scotland than in the South of England. Figure 11 shows how wind chill can change the perceptions and effects of temperature.

Little Danger | Increasing Danger | Greater Danger that Exposed Flesh Will Freeze

WIND VELOCITY (mph)

TEMPERATURE (°F)	0	5	10	15	20	25	30	35	40	45	50
-10	-10	-15	-31	-45	-52	-58	-63	-67	-69	-70	-70
-5	-5	-11	-27	-40	-46	-52	-56	-60	-62	-63	-63
0	0	-6	-22	-33	-40	-45	-49	-52	-54	-54	-56
5	5	1	-15	-25	-32	-37	-41	-43	-45	-46	-47
10	10	7	-9	-18	-24	-29	-33	-35	-36	-38	-38
15	15	12	-2	-11	-17	-22	-26	-27	-29	-31	-31
20	20	16	2	-6	-9	-15	-18	-20	-22	-24	-24
25	25	21	9	1	-4	-7	-11	-13	-15	-17	-17
30	30	27	16	11	3	0	-2	-4	-4	-6	-7
35	35	33	21	16	12	7	5	3	1	1	0
40	40	37	28	22	18	16	13	11	10	9	8

WIND CHILL TABLE

Figure 11. Chart showing the impact of wind chill (UCAR, 2002)

5. Beach Management Systems

Beach management may be described as a process of maintaining or improving a beach as a recreational resource and as coastal protection. This has been known as the "hazards and playgrounds" view (Bird, 1996; James, 2000). Alternatively it may be viewed as the maintenance, as far as is practical, of the natural habitat of a beach. The former approach is seen in Figure 12, where dunes have been removed to give a larger recreational area, which is raked and cleaned. In contrast, Figure 13 shows a natural beach with a protective dune system to prevent erosion and aid the progression of natural plants.

Figure 12. "Hazards and Playgrounds" approach in Wildwood, New Jersey, USA (Nordstrom, & Mitteager, 2001)

Figure 13. A natural dune system with sand trapping fences: Ship Bottom, New Jersey, USA (Nordstrom, & Mitteager, 2001)

Many beaches, before bathing legislation, were degraded by sewage disposal, over-engineering of defences or increasing urbanisation of beachfronts (James, 2000). Public awareness of environmental issues is increasing and public consultation is now required in environmental legislation such as the Water Framework Directive 2000/60 (EC, 2000) and the Environmental Impact Assessment, Scotland Statutory Act 1999 (HMSO, 2002).

Therefore, coastal management and its ramifications must be more widely interpreted. The beach is multidimensional with physical, biological and social interactions. Beach ecosystems are complex and support a huge variety of organisms. A view is developing that beach management should be approached from an ecological perspective and that maintenance of species habitats and heterogeneity is more important than coastal protection and enhanced human use (Mann, 2000). From a human viewpoint, people use beaches for many different purposes such as recreation, which includes walking, angling, swimming and surfing, and commercial activities such as tourism, housing and fishing. The beach management approaches of two of the three local authorities in the study area were reviewed by interviewing key staff for their professional and personal viewpoints.

Semi-structured interviews were based around the questions in table 1, which also shows the results. In Table 1 is qualitative and interviewees were asked for a personal viewpoint. It therefore indicates beach management approaches but does not necessarily represent the Councils' strategies. The table shows two clear and very different outlooks. Council A's representative uses the playgrounds and hazards approach: safety and cleanliness are key; child facilities are important; the blue flag 'ensures standards'; and coastal protection predominates. Council B's representative however is clearly more interested in the ecological aspects of beaches as in their responses to questions 3 and 8.

	Question	Council A representative's response	Council B representative's response
1	Are you a regular beach user?	No	Yes
2	What qualities do you look for in a beach if you wish to use it, and do these qualities change with use?	Cleanliness, sand not shale, Safe for children, Easy Access Toilets, parking and some play equipment for children	Fauna and Flora and quiet recreation
3	How would you as an individual define a good beach?	Good walking distance Nice views, Access and free of debris	Rich fauna and flora a sustainable use and quiet recreation
4	How would you, as a council representative, define a good beach?	Cleanliness, free of material that could cause injury to users	As Above
5	Are you a member of any non-governmental organisation that deals with environmental issues?	No	Yes numerous including RSPB
6	Do you think that beach awards such as the Blue Flag are important?	Yes it ensures standards	Yes but not personally
7	What do you believe is the primary use of the beach (es) in [Beach Location]?	Family leisure	Quiet recreation , Dog Walking
8	Do you believe that this affects the effort your council places on promoting it?	No	Yes Clean and safe beaches result but at the detriment to fauna and flora
9	How do you believe the public perceives [Beach location]?	Excellent amenity personally described as "Breathtaking"	Good but most complaints about facilities (Car Parking) and other users, but lots of repeat usage
10	What part do you believe the media plays in beach usage?	Negative impact	Make of break a beach
11	In your experience has the media helped or hindered [Beach Location]?	Neutral	Mixed
12	What are the future plans for the coastal regions in [Council Name]?	Committed to coastal erosion, also committed to seaside, but can only work within budget, an example of this commitment is in XXXXX where £700,000 has been spent by the end of the year	Evolving topic, legislation issues, handling not up to speed

Table 1. Answers given to 12 questions by council representatives

6. Relative Merits of the Beaches From a Human Use Perspective.

A system for evaluating beaches from a perspective of human use was developed by Morgan (1999) and applied to over 70 beaches in Wales. It was developed from a survey of 859 people, seeking key opinions, which resulted in a 49-point checklist that could be used on any beach. This system provides data on social, biological and physical aspects, such as washing facilities, fresh water supply to the width of beach and the quality of water.

Morgan's method was modified to reflect the available resources. The methods are compared in table 2 and table 3 presents the results.

Morgan 1999 Method	Staines 2002 Modified Method
49 Factors Applied	43 Factors Applied
Factors Omitted: None	Factors Omitted:
	Question 14:Beach Safety (public questioned, not part of this section) Question 15: Aesthetic Landscape Quality(Panel of coastal experts not available) Question 16: Temperature Sensation (Lack of original research paper, test based on) Question 17: Rainfall (No data on individual sites, too close for distinction in national data) Question 18: Sunshine (As Above Question 19: Wind Speed (As Above)
Grading System: Linear and re-calculated by Experts, into a percentage	Grading System: Linear without percentages calculated

Table 2. Modifications of Morgan's method

Beach	Score
Broughty Ferry	110
Montrose	107
St Andrews East Sands	108
St Andrews West Sands	118

Table 3. Scores using modified Morgan method

Table 3 suggests that St Andrews West Sands is best in terms of human use, perhaps reflecting that this is the only Blue Flag award. However, the difference in ratings between the four beaches was small.

St Andrews West Sands drew highest points for areas such as the width of the beach, giving a larger recreational area, its consistent quality of water and the type of predominant beach material, sand. Montrose lost points in its beach width, the predominant beach material above high tide because there was a large rock sea wall, and access to the beach, which wasn't fully highlighted. However, Montrose gained points with regard to facilities such as cafes selling hot meals and other products. St Andrews East Sands gained points for beach material, beach slope and shoreline fauna, and lost points with regard to water quality, beach width and submerged obstacles. Broughty Ferry gained points in access and good overall beach cleanliness, but lost points in such areas as facilities and provision of lifeguards (now provided, 2005). Broughty Ferry was resurveyed in 2004 with a revised score of 119, reflecting the council's investment in achieving a seaside award in 2004.

The scores compare favourably with those of Morgan (1999) for the Welsh beaches. The scores for the four beaches in this study, as a percentage of the available maximum, ranged between 78 and 86% compared to scores of up to 70% for the Welsh beaches. This suggests that these beaches as valuable for human use as those in Wales but, as the scores derived from a modification to Morgan's method, any comparison must be treated with caution. The results from the modified method do, however, offer a benchmark to value the future human use of the beaches.

7. Beach users: Viewpoints and Attitudes

A survey of 700 people at 23 Welsh beaches demonstrated that, when asked to select 3 most important attributes for beach usage, only 10% chose a beach award as an important criterion, whereas 76% thought distance and 33% thought cost of travel to be important. However, to a separate question asking if beach awards should be sought, 72% of respondents said yes (Nelson et al. 2000).

These results were later corroborated (Nelson & Botterill, 2002): only 32% of respondents thought awards important to their beach choice. In another survey in Wales, up to 14.8% of 859 respondents said their main priority in beach choice was landscape and aesthetics (Morgan, 1999).

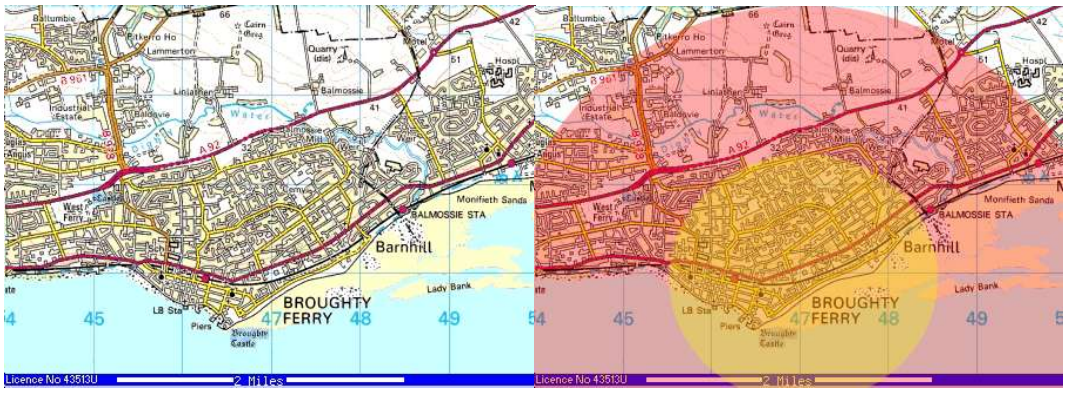
In a recent study of 400 randomly picked Los Angeles households (Pendelton et al 2001), 73% could remember hearing or seeing a pollution incident at a beach in the last year compared with only 16% respondents who had actually suffered from any form of pollution.

Half those who went to the beach but not in the water cited pollution as their main reason for not entering the water. Despite documented success in LA water quality, people still see it as polluted, a stigma massively detrimental to the economy. This illustrates how, in bathing water usage, perception may be more important than reality.

Survey to assess attitudes and viewpoints of beach usage

We undertook a survey to discover people's viewpoints and attitudes towards local beach use. Questions were included from SEPA, dealing with the impact of boards at beaches displaying SEPA data, and from Angus Council, asking about use of bathing water other than paddling and swimming.

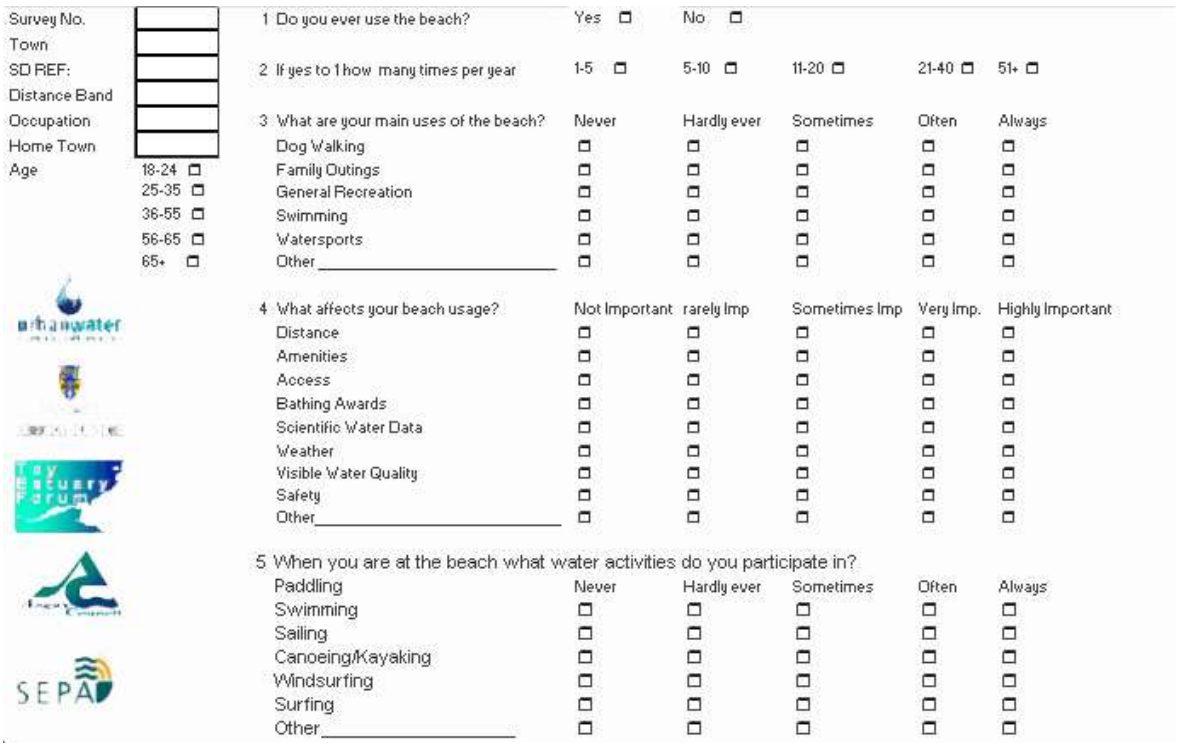
Face to face interviews ensured a better response rate (Fink, 1995). A sample size of 540 people ensured that data were representative, but also achievable in the available project time. The sample comprised 180 people in Broughty Ferry, Montrose and St Andrews. These samples were further categorised by their distance from the beach (Figure 14). Three bands were identified: on the beach; 0-1 mile; 1-2 miles.



OS Drawing with Distance Bands

Figure 14. Broughty Ferry survey bands, Reproduced from Ordnance Survey map data by permission of Ordnance Survey, © Crown copyright

Fourteen questions were used with a variety of yes/no and multiple-choice answers. The survey forms are presented in Figures 15 and 16. The survey was carried out over three weeks in August 2002, the first week in Broughty Ferry, the second in St Andrews and the final week in Montrose.



Survey No.
Town
SD REF:
Distance Band
Occupation
Home Town
Age 18-24 ☐ 25-35 ☐ 36-55 ☐ 56-65 ☐ 65+ ☐

1 Do you ever use the beach? Yes ☐ No ☐

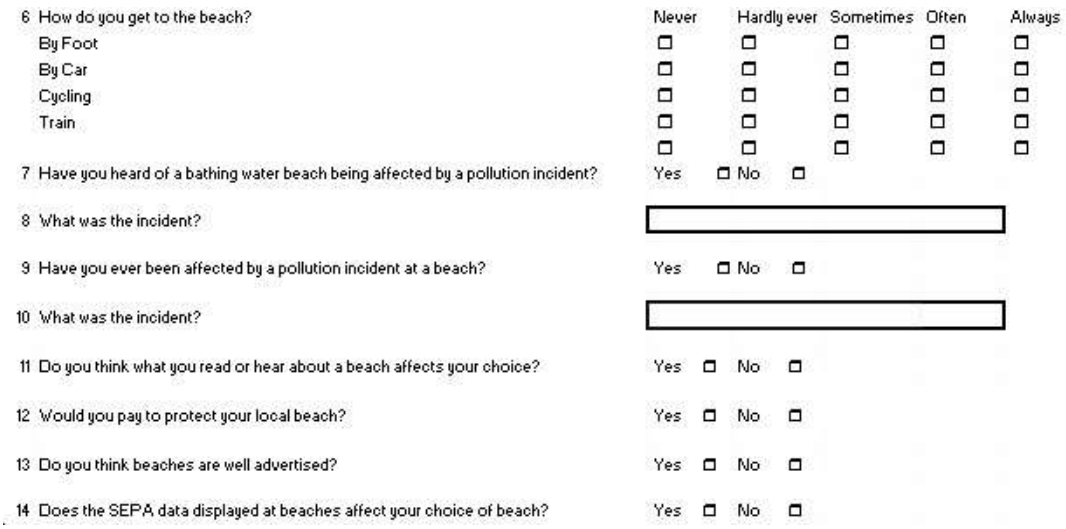
2 If yes to 1 how many times per year 1-5 ☐ 5-10 ☐ 11-20 ☐ 21-40 ☐ 51+ ☐

3 What are your main uses of the beach?	Never	Hardly ever	Sometimes	Often	Always
Dog Walking	☐	☐	☐	☐	☐
Family Outings	☐	☐	☐	☐	☐
General Recreation	☐	☐	☐	☐	☐
Swimming	☐	☐	☐	☐	☐
Watersports	☐	☐	☐	☐	☐
Other _____	☐	☐	☐	☐	☐

4 What affects your beach usage?	Not Important	rarely Imp	Sometimes Imp	Very Imp.	Highly Important
Distance	☐	☐	☐	☐	☐
Amenities	☐	☐	☐	☐	☐
Access	☐	☐	☐	☐	☐
Bathing Awards	☐	☐	☐	☐	☐
Scientific Water Data	☐	☐	☐	☐	☐
Weather	☐	☐	☐	☐	☐
Visible Water Quality	☐	☐	☐	☐	☐
Safety	☐	☐	☐	☐	☐
Other _____	☐	☐	☐	☐	☐

5 When you are at the beach what water activities do you participate in?	Never	Hardly ever	Sometimes	Often	Always
Paddling	☐	☐	☐	☐	☐
Swimming	☐	☐	☐	☐	☐
Sailing	☐	☐	☐	☐	☐
Canoeing/Kayaking	☐	☐	☐	☐	☐
Windsurfing	☐	☐	☐	☐	☐
Surfing	☐	☐	☐	☐	☐
Other _____	☐	☐	☐	☐	☐

Figure 15. Page one of survey form



6 How do you get to the beach?	Never	Hardly ever	Sometimes	Often	Always
By Foot	☐	☐	☐	☐	☐
By Car	☐	☐	☐	☐	☐
Cycling	☐	☐	☐	☐	☐
Train	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

7 Have you heard of a bathing water beach being affected by a pollution incident? Yes ☐ No ☐

8 What was the incident? _____

9 Have you ever been affected by a pollution incident at a beach? Yes ☐ No ☐

10 What was the incident? _____

11 Do you think what you read or hear about a beach affects your choice? Yes ☐ No ☐

12 Would you pay to protect your local beach? Yes ☐ No ☐

13 Do you think beaches are well advertised? Yes ☐ No ☐

14 Does the SEPA data displayed at beaches affect your choice of beach? Yes ☐ No ☐

Figure 16. Page two of survey form.

A numerical scale (1-5) was applied to the questions: 5 corresponded to “most frequent” or “most important” answers; 1 corresponded to “never” or “not important”. Yes/No answers were interpreted using a 1/0 format.

Results are analysed statistically below.

In response to question 1, 73% of respondents in Broughty Ferry, 66% in Montrose and 67% in St Andrews indicated that they were beach users. Their frequency of use (Question 2) is shown in Figure 17. At Broughty Ferry and Montrose most beach users tend to visit more than 10 times per year with a reasonable proportion visiting at least

once per week. At St Andrews the pattern is different with a higher proportion of users making five or less visits. This may owe to a higher proportion of tourists or visitors.

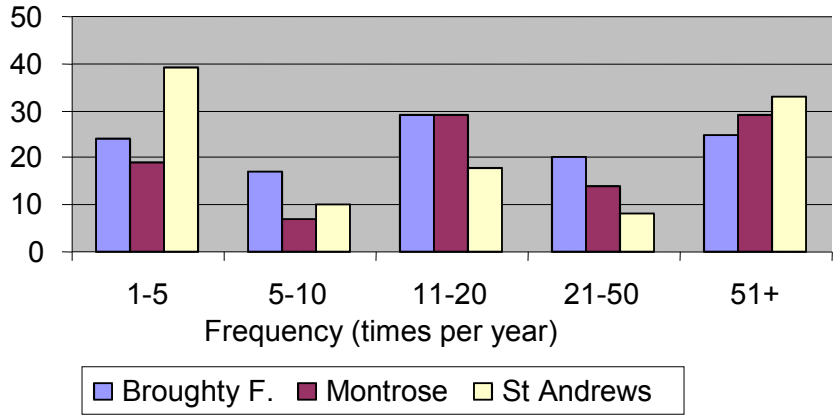


Figure 17. Frequency of beach usage

In question 3, respondents were asked their main usage of the beach and the results are shown in Tables 4 to 6. The main use was general recreation, with the main specific use being family outings, with activities involving immersion being infrequent.

Activity	Mean	Standard Deviation
Dog Walking	2.28	1.66
Family Outings	2.70	1.48
General Recreation	2.95	1.54
Swimming	1.59	0.99
Watersports	1.44	0.93
Other	1.44	1.00

Table 4. Main uses of Broughty Ferry beach

Activity	Mean	Standard Deviation
Dog Walking	2.23	1.67
Family Outings	2.45	1.56
General Recreation	2.86	1.60
Swimming	1.56	1.06
Watersports	1.25	0.77
Other	1.56	1.34

Table 5. Main uses of Montrose beach

Activity	Mean	Standard Deviation
Dog Walking	2.30	1.63
Family Outings	2.86	1.79
General Recreation	3.52	1.62
Swimming	2.04	1.47
Watersports	1.39	0.86
Other	1.02	0.29

Table 6. Main uses of St Andrews beaches.

In question 4, respondents rated the factors affecting their beach usage, and the results are shown in Tables 7 to 9. Weather was the most important factor, followed at Broughty Ferry and Montrose by visible quality and safety. However, at St Andrews a beach award seems to have had elevated importance. Scientific water quality and distance were consistently the least important.

Factor	Mean	Standard Deviation
Distance	2.98	1.55
Amenities	2.73	1.28
Access	3.21	2.07
Bathing Awards	2.58	1.50
Scientific Water Data	2.18	1.40
Weather	3.60	1.34
Visible Water Quality	3.34	1.43
Safety	3.45	1.39
Other	1.09	0.53

Table 7. Factors affecting beach usage – Broughty Ferry

Factor	Mean	Standard Deviation
Distance	2.01	1.45
Amenities	2.05	1.42
Access	2.62	1.44
Bathing Awards	2.59	1.42
Scientific Water Data	2.39	1.37
Weather	3.52	1.44
Visible Water Quality	2.91	1.44
Safety	2.73	1.51
Other	1.00	1.00

Table 8. Factors affecting beach usage – Montrose

Factor	Mean	Standard Deviation
Distance	1.68	1.29
Amenities	1.72	1.09
Access	2.22	1.26
Bathing Awards	2.87	1.38
Scientific Water Data	2.13	1.33
Weather	3.84	1.15
Visible Water Quality	3.10	1.50
Safety	2.55	1.44
Other	1.06	0.23

Table 9. Factors affecting your beach usage – St Andrews

Question 5 explored in more detail the frequency of use of bathing waters. Tables 10 to 12 show mean scores lower than Tables 5 to 7, confirming earlier indications that many beach users do not use the waters. Paddling and swimming are the most common activities.

Activity	Mean	Standard Deviation
Paddling	2.15	1.23
Swimming	1.91	1.18
Sailing	1.36	0.87
Canoeing	1.17	0.59
Windsurfing	1.19	0.64
Surfing	1.08	0.53
Other	1.17	0.68

Table 10. Participation in Water Activities – Broughty Ferry

Activity	Mean	Standard Deviation
Paddling	2.37	1.35
Swimming	1.77	1.23
Sailing	1.38	0.91
Canoeing	1.11	0.49
Windsurfing	1.09	0.46
Surfing	1.16	0.65
Other	1.03	0.3

Table 11. Participation in Water Activities – Montrose

Activity	Mean	Standard Deviation
Paddling	2.75	1.35
Swimming	2.33	1.55
Sailing	1.61	1.19
Canoeing	1.17	0.58
Windsurfing	1.19	0.67
Surfing	1.37	0.92
Other	1	0

Table 12. Participation in Water Activities – St Andrews

Questions 7 to 9 investigated perceptions and impacts of beach pollution. Tables 13 and 14 seem to confirm the conclusions of Pendelton et al (2001) who noted that, although only 17% of respondents had been affected by pollution, 76% had heard of a pollution incident. Although the "yes" percentages in our survey are lower, the ratio of those who have heard of pollution to those who have experienced it is similar. It is interesting to note the higher "yes" percentages for Broughty Ferry where pollution had been visible before the Tay Wastewater project**.**

	Beach Location		
Heard Of Incident	Broughty Ferry	Montrose	St Andrews
YES	95	56	71
NO	63	102	84
PERCENTAGE YES	60	38	49

Table 13. Heard of a pollution incident

	Beach Location		
Affected by incident	Broughty Ferry	Montrose	St Andrews
YES	38	8	11
NO	120	140	144
PERCENTAGE YES	24	5	7

Table 14. Been affected by a pollution incident

Questions 11, 13 and 14 explored the influence of publicity on beach usage. Table 15 shows the high influence of the media on beach choice and it is interesting to note that this was higher at Montrose and St Andrews where personal experience of beach pollution was lower. Only 25% of the 461 respondents thought that beaches are were well-advertised and only 42% thought that SEPA data displayed at beaches were important to their choice of beach.

	Location		
Read or Hear Affect you Choice?	Broughty Ferry	Montrose	St Andrews
YES	88	95	100
NO	70	53	55
PERCENTAGE YES	56	64	64

Table 15. Influence of media on beach choice

33% of the respondents were interviewed on the beach, allowing a comparison of the use of the beaches by locals and visitors. A "visitor" was defined as someone living outwith the 0-2 miles band. Table 16 shows numbers and percentages of locals and visitors on the beaches during the surveys.

Beach Users	Location		
	Broughty Ferry	Montrose	St Andrews
LOCAL	28(76%)	16 (47%)	23 (38%)
VISITOR	9 (24%)	18 (53%)	37 (62%
TOTAL	37 (100%)	34 (100%)	60 (100%)

Table 16. Numbers of Locals and Visitors in Beach samples

Table 16 shows overall use of beaches in the area during the bathing season. Data were collected over five weekdays, between 0900 and 1700. In Broughty Ferry and Montrose, every beach user was interviewed but a sample of only about 40% was interviewed at St Andrews. The data suggest an average weekday usage of 8, 7, and 30 for Broughty Ferry, Montrose & St Andrews respectively. Approximately 45% of these are visitors and 56% are locals. The numbers of beach users may be compared to a Scottish Executive aerial weekends survey in the summer of 2003 (Scottish Executive, 2003). Average daily numbers were 28 at Montrose, 30 at Broughty Ferry, 65 at St Andrews East Sands, and 131 and St Andrews West Sands. Table 16 shows that approximately 44% of those surveyed are visitors and 55% are locals. This suggests a low attraction of the local population to beaches that declines significantly outwith a two mile radius of the beach.

The survey results were further analysed for differences in opinion on the factors affecting beach usage between locals and visitors. The results are presented in Figure 18.

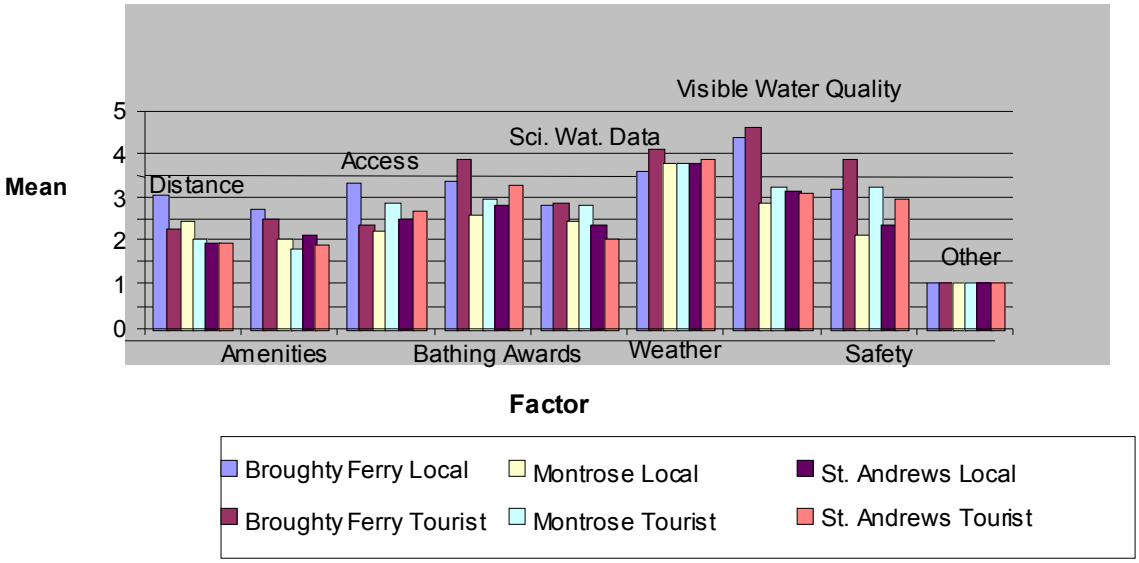


Figure 18. Comparison of factors affecting locals' and visitors' beach usage, based on respondents surveyed on the beach.

In Broughty Ferry, the three factors most important to tourists and locals are similar: visible water quality, followed by weather and then bathing awards. This differs from the overall results for Broughty Ferry and shows that weather is not as important to the group on the beach, suggesting that group to be a sub-set of the general population that is more

tolerant of local weather. Alternatively, the higher importance of visible pollution may be a legacy of the previously high degree of pollution on this beach.

At Montrose, tourists and locals both rated weather followed by visible water quality as the most important, with tourists rating safety third whereas locals rated bathing awards third. The tourist views matched the views of the full surveyed population.

St Andrews tourists' most important factors were weather, bathing awards and visible water quality - in that order; whereas the locals' choices were visible water quality, weather, followed by bathing awards.

In general the weather, visible pollution and bathing water awards were consistently the most important factors. It is interesting to note no evidence that bathing water awards were more highly rated by tourists than locals at Montrose and Broughty Ferry, but they were more highly rated at St Andrews, which has Blue Flag Status.

8. Conclusions

This paper has provided an overview of key issues affecting beach usage, an assessment of bathing water management practice in the Tay Estuary area and a comparison of local beaches.

Key factors that affect choice of a beach have been identified. Weather was the most important, followed - at Broughty Ferry and Montrose - by visible quality and safety. At St Andrews, a beach award seems to have elevated the importance of this factor. Scientific water quality and distance were consistently the least important factors. A comparison of weather between this area and the South of England suggests that bathing season rainfall and temperature are similar, but that wind may exert more significant influence on beach use in this area.

The technical quality of the beaches from a human-use perspective was assessed using a method developed for and applied to beaches in Wales. The results suggest that the beaches studied here are no less valuable for human use than those in Wales. The results from this study offer a benchmark against which to monitor human use value in future. The water quality of all these beaches is now very good and the positive impact of Scottish Water's recent investment in wastewater treatment plants may be seen clearly.

The results suggest that there is no significant difference between beaches in this area and those in other parts of the United Kingdom but our survey, supported by the results of the Scottish Executive study in 2003, indicates that beach use is very low and that most activities on our beaches do not involve immersion.

It may be concluded that the beaches in the area offer a significant resource that is not well utilised by the local communities nor by visitors. This presents a challenge to all those involved in the promotion and management of beaches.

Two alternative beach usage approaches have been identified in this paper, namely, managing the beach for recreation and coastal protection or maintaining, as far as practical, the natural habitat of the beach. There is evidence of both approaches to beach management in the area. In order to reconcile these sometimes conflicting

viewpoints a new, not exclusively human-centred, approach to beach management may be needed to incorporate physical, biological and social factors. Figure 19 shows how a holistic approach to coastal management might work and how each individual system might integrate.

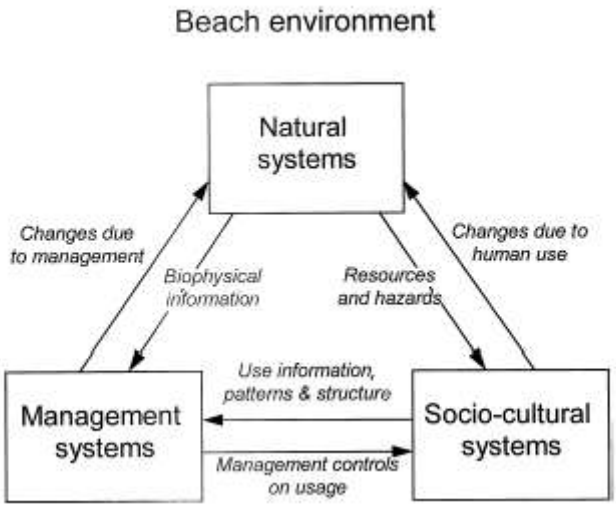


Figure 19. Simple conceptual model of system integration

This paper makes no recommendations on the best way forward but it provides information to assist decision makers in the development of systems of sustainable beach management that reflect the balance of human use and the natural habitat and is proportionate to the degree of use of the beaches.

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