Estimation of water carrying capacity for surf schools, Cornwall - UK

1. Policy Objective & Theme

- SUSTAINABLE USE OF RESOURCES: Sound use of resources and promotion of less resource intensive processes/products

2. Key Approaches

- Knowledge-based

3. Experiences that can be exchanged

The development of software that can incorporate a number of different parameters and be used as a decision-support tool to decide the safety levels of surf user numbers on multi-use beaches.

4. Overview of the case

A methodology to determine the number of surfers that can use a beach safely under dynamic conditions.

5. Context and Objectives

a) Context

Surfing has become an increasingly popular activity over the last ten years in the UK, particularly on the north coast of Cornwall in the southwest of England. With larger numbers of people now having more leisure time, more able to travel, and being more conscious of their health, they are increasingly being attracted to outdoor sports and leisure activities. Beaches in the southwest of England are now dealing with more people than ever before, particularly during the holiday season and especially when there is good weather and there are good surfing conditions. The sport has also provided increasing opportunities for surf school operators to profit from this growing enthusiasm for outdoor recreation.

The physical space available at any beach for water-based recreational activities is limited; by the physical geographical location, the state of the tide, and by other recreational activities. Space is often at a premium when the weather is good during the holiday season or on public holidays when there are even more people at the beach. This has greatly increased the potential for overcrowding of the beach and water areas and ultimately the potential to compromise individual and public safety.

The concept of Carrying Capacity (CC) is not new and many different tools and techniques have been used as the basis for its calculation. These include measurements of distance and area, shape, buffer zones, field counts of the number of individuals, interviews and questionnaires, surveys, ground and aerial photography, as well as the use of Geographical Information Systems (GIS), and spatial analysis such as identifying clusters as an index of overcrowding. However, these models provide only a fixed Water Carrying Capacity (WCC) number and are seen as restrictive, inflexible and, in the longer term, detrimental to the survival of surf schools, many of whom have considerable sums of money invested in their businesses.

b) Objectives

North Cornwall District Council (NCDC) (now Cornwall Council) commissioned research into beach and water use at its

beaches on the north coast, particularly focusing on the development of a simple and practical way to calculate the WCC for surfers and surf schools as a basis for future management of on-site numbers at peak times.

6. Implementation of the ICZM Approach (i.e. management, tools, resources)

a) Management

Cornwall Council is responsible for management of the beaches in this area and commissioned the software decision tool.

b) ICZM tools

In practice, the total usable beach and water area available for surf schools and pupils to operate in will be determined by the shape (straight coastline or cove) and size (length and width) of the beach/water area, and the state of the tide (low or high). Many other constraints prevent safe use of the area e.g. rocks, cables, currents, river and sewage outlets, the number of other people on the beach & water. and the prevailing weather conditions. Together these factors control where and when surf schools can find the space to operate both on the beach (theory lessons) and in the water (practical lessons). Therefore, the beach or water area available to surfers at any one time, at any one beach, is significantly less than the entire physical beach/water area (BWA). Furthermore, these factors are all very dynamic making a practical, usable and repeatable calculation for the carrying capacity very difficult.

Therefore, in order to calculate a Beach or Water Carrying Capacity (BCC, WCC) it is first necessary to estimate the number of individuals who can fit into a unit area such as an hectare. This provides the basis for calculating user density. To estimate how many people will fit into the unit area one must also establish how much space is required by an individual and/or an activity. This can be done by defining what will be termed here as a ‘physical footprint’. The ‘physical footprint’ can be defined by providing a physical characterisation using measurable elements or descriptors of the individual and activity. Knowing the area needed by each individual then allows for the calculation of the carrying capacity of an area e.g. beach or water area. For an individual this can be determined simply by calculating the required space for that individual. The individual may be standing, lying down, or a combination of both. To simplify the calculation the area can be defined as a square, rectangle or circle.

For any recreational activity, particularly where equipment is likely to be used, the calculation of the area occupied by an individual participating in a leisure or recreational activity or sport, also needs to include the dimensions of the specialised equipment and whether the person is in an upright or horizontal position; thereby defining the maximum operational space required by the activity. Naturally this will reduce the number of people in the unit area simply because each individual requires more space for the activity than just their own physical space.

For surfing, calculation of the operational space includes a physical characterisation of the activity as a composite of: the height of the person, the length of the surf board, and the length of the safety leash, and additionally making the assumption that although the individual may normally be within the physical dimensions of the surf board when riding it standing up, or lying down, this will not always be the case e.g. when the person falls off the board and is potentially lying in the water and holding on to the board with the leash. The calculation of the area required by a surfer also needs to take into account the dynamic nature of the recreational activity arising from movement. Like many other leisure activities, surfers and surfboards are highly mobile as well as being static at certain times; often in random directions within an area, at different times, and with changes in direction, and speed. It also involves experience and skill. The boards will also be manoeuvred with different levels of skill and expertise, determining the ability to turn and stop. Furthermore, not everyone will be located in the same place and there will be different distributions and clusters of people in the water area. Therefore, when calculating the numbers of surfers it is also necessary to try to take these factors into account. Environmental conditions at the time will also have a bearing on this calculation as well.

Using a circle as the footprint provides a logical definition of space for individual movement and therefore the dynamic nature of the activity. However, as with any such activity, movement in one or more directions can potentially lead to collisions. As such the operational space defined by the footprint therefore needs to be extended to minimise the risk of collisions. To do this requires the addition of a ‘safety buffer’, referred to here as a ‘comfort zone’, to the ‘physical footprint’ to increase the operational area needed for an individual. In so doing this will reduce the numbers physically able to use an area of water. In practice, this can therefore also be used as a practical and logical means to help reduce the likelihood of collision in the calculation of a WCC for safety.

This safety buffer can easily be adjusted to take into account certain weather and surf conditions where, for example, it is assumed that a larger operational area equates to greater safety e.g. less likelihood of collisions and therefore smaller numbers, as well as being used as the means to control numbers on the basis of skill level i.e. a larger overall footprint for a beginner, with a larger comfort zone for safety, and therefore fewer numbers in the water, and less likelihood of a collision, and reducing the risk. The comfort zones could also be equated with skill and expertise ranging from the beginner, intermediate to the advanced (i.e. larger comfort zones to smaller comfort zones) and could also accommodate mixes of skills. Similarly the numbers in the water at any one time could range from the upper limit, down to zero (no people in the water) based upon environmental conditions that pose a potential risk to safety e.g. based on wind speed, wind direction, wave height, and wave direction, again leading to a reduction in the numbers of people in the water at any one time. It has been practically applied to set surfer numbers and is also being tested through the use of monitoring forms.

7. Cost and resources

£10,000 Consultancy grant.

8. Effectiveness (i.e. were the foreseen goals/objectives of the work reached?)

The software can easily be run by a non-technical person in a council office and is spreadsheet based or similar with the rest in a GIS format e.g. ESRI's ArcView. One concern for the beach manager and surf school operators is one of the practicality of such a method. This was important as the overall aim was to try to find an objective way to assist NCDC and the surf school operators to help manage the total number of surfers and surf schools at peak times. Additionally the model developed here also sought to overcome the problems associated with other current approaches to managing surf school numbers such as the arbitrary capping of numbers (not an objective or transparent solution to the problem). The approach taken provides transparent way of generating surfer numbers on the beach and in the water. It is also flexible enough to cater for the dynamic nature of surf school operations, helping those who are resident at the beach to continue to provide surf schools and support businesses, whilst also allowing for others to participate. This is done in a way that helps to manage numbers to minimise user conflict and safety issues at times when overcrowding may be an issue and may compromise safe operation and a pleasant experience.

9. Success and Fail factors

The method can easily be translated from site to site and can be used to provide an upper threshold per unit area whilst also providing a flexible capacity value determined by an assessment of the skill and expertise of individuals, as well as environmental conditions.

10. Unforeseen outcomes

The method can help to reduce problems arising from inexperienced surfers who do not participate in surf schools from jeopardising the safety and experience of others. For NCDC, stakeholder participation and cooperation are therefore needed to encourage this aspect of beach management.

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13. Sources

- Developing a Practical Method to Estimate Water Carrying Capacity for Surf Schools in North Cornwall, SW England. 2009. D.Green, M. Carlisle & J. Ortiz. Chapter in Green, D.R., 2009 (Ed.)
- Coastal Zone Management. Thomas Telford Publishing Ltd. UK. 392p [not available electronically].