



The value of bathing waters and the influence of bathing water quality: Literature Review



AGRICULTURE, ENVIRONMENT AND MARINE

List of authors:

Liza Papadopoulou^a, Peter Phillips^a, Clare Twigger-Ross^a and Sarah Krisht^b

List of reviewers:

Kayleigh Wyles^c and Ece Ozdemiroglu^b

Affiliations:

^a Collingwood Environmental Planning Limited

^b eftec Limited

^c School of Psychology, University of Surrey

Contents

Contents	2
Executive Summary	4
Introduction	4
Approach to the review	4
Summary of key findings from the review.....	5
The benefits of bathing waters	5
Methods and approaches for measuring the benefits of bathing waters	5
Factors that influence beach visitors' use of bathing waters	6
Awareness, understanding and influence of beach signs	6
Recommendations for bathing water / beach management in Scotland	7
Introduction.....	8
Approach to the review.....	9
Defining the scope	9
Developing the search strategy	10
Identifying and collating relevant literature	11
Review, analysis and synthesis of literature	12
The benefits of bathing waters.....	14
Economic benefits	15
Health and wellbeing benefits.....	16
Social and cultural benefits.....	18
Methods and approaches for measuring the benefits of bathing waters	20
Methods and approaches	20
Revealed preference: Travel Cost Method (TCM).....	20
Stated preference	22
Qualitative assessment: exploring emotional responses.....	23
Measuring the benefits and costs of an improvement or deterioration in BWQ ..	23
Quantitative measures.....	24
Qualitative measures.....	26
Effects on national and local economies: Aggregating benefits and costs.....	26
Local impact.....	27
National impact	28
Estimating local economic impact for Scotland's bathing waters	28
Healthcare savings / reduction in the number of lost working days.....	30

Factors that influence beach visitors' use of bathing waters	31
The importance of information influencing choice of beach	31
Key factors influencing choice of beach	32
Beach choice preferences of different types of user / activity	35
Beach signs: Awareness, understanding and influence	36
Challenges and opportunities for effective BWQ signage	36
How might people respond to information about poor BWQ?	37
Factors influencing poor understanding of BWQ signage / messaging.....	37
Recommendations for bathing water / beach management in Scotland	39
Using information on beach value(s) to inform management.....	39
The role of beach awards and the rBWD as management devices	40
The role of signage and information provision.....	40
Appendix 1: References.....	41
Appendix 2: Summary of literature reviewed	46

Executive Summary

Introduction

Collingwood Environmental Planning Limited (CEP) in association with Economics for the Environment Consultancy (eftec) have been commissioned by the Scottish Government to undertake a research project to improve the empirical knowledge base concerning the value of bathing waters in Scotland and the influence of bathing water quality (BWQ) on this.

As part of the early stages of the research, a literature review has been undertaken to identify existing knowledge, research and practice concerning bathing water values and valuation in Scotland, the wider UK and other similar contexts (e.g. northwest Europe), the influence of BWQ and other issues including the range of benefits (e.g. economic, health and wellbeing) derived from bathing waters, the factors that can influence peoples' choice of bathing water and the influence of BWQ signs and signage on these choices.

Approach to the review

The overall scope of the review was defined by a suite of research questions, based on the Scottish Government's overall research objectives for the project. These are shown in Table E-1 below.

Table E-1: Research questions addressed in the literature review

Research questions
RQ1: What are the range of benefits (economic, health, social and cultural) of bathing waters at the local and national levels and how can these be measured?
RQ2: What value do people put on information about bathing water quality (signs and signage), how do they understand that information (particularly information about changes in classification) and how does it influence beach visit decisions?
RQ3: How can the benefits (or costs) of an improvement (or deterioration) in bathing water quality classification be assessed, taking account of effects on the national as well as local economies and both short- and long-term effects?
RQ4: What learning can be derived from the evidence about the management and assessment of designated bathing water sites and the overall value of bathing water quality in Scotland?

Sources for the review were identified using a dual-track approach. Firstly, experts on the project team listed key sources that would be helpful and relevant to the review. Secondly, structured searches were undertaken across six key electronic databases, using a prescribed search string, to identify additional sources. Inclusion / exclusion criteria were then used to screen out sources (e.g. studies in languages other than English were excluded).

Using this approach, 97 sources were identified as being potentially relevant. These were reviewed and prioritised as either 'key' or 'secondary', depending on their relevance to the research questions and their robustness. This prioritisation exercise drew on expert input from key members of the project team. Following prioritisation, 29 sources were taken forward to the detailed review stage..

Summary of key findings from the review

The benefits of bathing waters

This part of the review identified what is known about the range and type of benefits provided by bathing waters at local and national levels. Key findings include:

- There is no single framework used across the literature reviewed for the classification of benefits from bathing waters. Example frameworks used include ecosystem services and total economic value (TEV);
- The review identified various benefits of bathing waters that can be organised under the following categories: economic; health and wellbeing; and social and cultural;
- Bathing waters sites are important assets for local, regional and national economies. By way of example, a recent (2016) survey in Scotland showed that domestic visits alone to Scottish seaside locations generate an average of 1.5 million trips and £323M in expenditure per annum;
- The literature reviewed identified various physical and psychological benefits derived by visiting or being close to coastal environments (including bathing waters). These include improvements in: mood and cognitive attention; self-reported health and quality of life; physical health (reduced blood pressure); and reduced stress;
- Social and cultural benefits cover a range of aspects including the way in which high quality bathing waters can contribute to a sense of ownership and pride of place for local residents and communities. Beaches also offer an ideal environment for children and adults to learn about coastal environments, giving rise to educational benefits.

Methods and approaches for measuring the benefits of bathing waters

This part of the review brought together evidence relating to methods and approaches for measuring the benefits of bathing waters and the implications of changes in BWQ for local and national economies. Key findings include:

- Studies tend to use a combination of economic methods incorporating questions that identify current and intended use but also capturing the emotional response to beaches and coastal environments;
- There is limited literature on the impacts of a change in bathing water classification on the benefits provided by bathing waters. Quantitative measures that *have* been used include changes in the 'number of visitors' and 'frequency of trips' to bathing water sites due to an improvement or deterioration in BWQ. There is also some evidence suggesting that changes

in BWQ would have a greater economic impact than loss of Blue Flag status (a UK-wide beach award scheme); and

- Three possible approaches for assessing the local economic impact of Scotland's bathing waters have been identified in the review. On balance, it is felt that the Cambridge Model, adapted for use in Scotland, will be the most appropriate approach for use in this project.

Factors that influence beach visitors' use of bathing waters

This part of the review identified what is known concerning the importance people put on information (signs and signage) about BWQ as a factor influencing beach visit decisions. Key findings include:

- From the sources reviewed, there is only a small literature addressing the nature / type of information that influences peoples' beach choice decisions. Further, only two sources in our review dealt explicitly with signage;
- Explicit and implicit information about a beach and its associated bathing water / BWQ influences beach choice decisions. Implicit information relates to beach user perceptions concerning the attributes, characteristics and features of different types of beach (e.g. remote rural vs urban);
- There are a wide variety of factors that can influence beach choice decisions, over and above BWQ. These can be categorised in terms of: (i) facilities; (ii) bathing and swimming safety; (iii) sand and water quality – includes BWQ; and (iv) access and parking;
- Water quality along with wider notions of 'beach cleanliness' is frequently cited as one of the top three factors influencing beach choice decisions. However, it is unclear how members of the public define and understand these factors.

Awareness, understanding and influence of beach signs

This part of the review identified what is known about how / what people understand about the information presented on BWQ signs and signage, particularly in terms of information concerning changes in classification. Key findings include:

- From the sources reviewed, there is very limited evidence against this question, specifically empirical evidence. Only two sources deal specifically with peoples' understanding of BWQ signs and signage and mainly in terms of setting the research agenda
- The effectiveness of different means of communicating BWQ information is poorly understood (e.g. in terms of what types of information is presented and how). Accordingly, further research is needed to better understand this aspect, informing the design of effective signs and signage;
- Empirical evidence from a Scottish study (Ayrshire coast) showed that the majority of survey respondents were not confident in making judgements on water quality. Further, 60% said they know very little about the issue; and

- It has been suggested that the symbols used on existing statutory signage under the revised Bathing Water Directive (rBWD) provides little useful information on what the different classifications might mean in terms of health risks.

Recommendations for bathing water / beach management in Scotland

This part of the review used the available evidence to identify recommendations for bathing water / beach management in Scotland. These initial recommendations will be elaborated following the empirical stages of the wider bathing waters research project that this literature review is part of. Key findings include:

- Information on bathing water / beach values (e.g. economic, socio-cultural) can play a key role informing management decisions (e.g. planning facilities, determining access and transport capacity). It is also important to bear in mind that some more rural / remote sites can be highly valued precisely because they have few amenities and facilities;
- Information on the type and range of recreational user groups that make use of a particular bathing water / beach can be useful for informing management decisions e.g. practical concerns over safety whereby investment to improve BWQ could be targeted towards sites of high use in terms of immersion and on-water recreational activities;
- There may be scope to improve existing beach / BWQ signage by: (i) making signs more interactive, especially for children; (ii) increasing the space on beach signs allocated to BWQ issues; and (iii) better use of social media to communicate information on BWQ issues.

Introduction

Collingwood Environmental Planning Limited (CEP) in association with Economics for the Environment Consultancy (eftec) have been commissioned by the Scottish Government to undertake a research project to improve the empirical knowledge base concerning the value of bathing waters in Scotland and the influence of bathing water quality (BWQ) on this. The study is focussed on several strands of primary research activity including an on-site survey of beach users and focus groups at five case study designated bathing water sites and a wider online survey.

Prior to the primary research, a desk study phase has been undertaken to identify and build on existing knowledge, research and practice concerning bathing water values and valuation in Scotland, the wider UK and other similar contexts (e.g. northwest Europe), the influence of BWQ on this and other issues including the range of benefits (e.g. economic, health and wellbeing) derived from bathing waters, the factors that can influence peoples' choice of bathing water and the influence of BWQ signs and signage on these choices.

This draft literature review report documents the results of the desk study phase. The key purpose of the report is to inform the scope of the primary research phase (e.g. in terms of the number, type, nature and scope of questions posed in the surveys and focus groups). However, the report should also provide a useful resource for the Scottish Government, the Scottish Environment Protection Agency (SEPA) and other bathing water stakeholders in Scotland by setting out the current state of knowledge in terms of the research questions addressed.

Part 2 of this document describes the approach adopted in the literature review including the research questions and sub-research questions addressed (Table 2.1). The remainder of this document (Parts 3 – 7) then presents the results of the desk study, organised by research question.

Approach to the review

The aim of this review was to identify and explore UK and European academic and grey literature to capture existing relevant evidence on: the socio-economic value of bathing water quality (BWQ); attitudes, knowledge and perceptions about BWQ; and approaches to valuing BWQ, along with examples of values generated.

Defining the scope

In order to focus the desk study, a set of key research questions were developed based on the research objectives¹ set out by the Scottish Government in the project specification. Sub-questions were also developed that were later used to facilitate the analysis of the literature review findings. The research questions and sub-questions, as agreed with key members of the Steering Group at the inception meeting, are presented in Table 2.1, mapped against the project objectives.

Table 2.1: Research objectives, questions and sub-questions

Research objective	Research question	Sub-research question
RO1: Assess the benefits of bathing waters and the value of bathing water quality at a local and national scale.	RQ1: What are the range of benefits (economic, health, social and cultural) of bathing waters at the local and national levels and how can these be measured?	SRQ1.1: What are the range/types of benefits (economic, health, social and cultural) of bathing waters at local and national levels?
		SRQ1.2: How are (or can) the range of benefits of bathing waters being (be) measured?
RO2: To assess the impact of the bathing water quality classification signs / symbols.	RQ2: What value do people put on information about bathing water quality (signs and signage), how do they understand that information (particularly information about changes in classification) and how does it influence beach visit decisions?	SRQ2.1: What importance do people put on information (signs and signage) about bathing water quality as a factor influencing beach visit decisions?
		SRQ2.2: What do people understand about the information presented on bathing water quality signs and signage (particularly information about changes in classification)?
RO3: Understand and assess the benefits (or costs) of an improvement (or deterioration) in bathing water quality classification.	RQ3: How can the benefits (or costs) of an improvement (or deterioration) in bathing water quality classification be assessed, taking account of effects on the national as well as local	SRQ3.1: How are (or can) the costs and benefits of an improvement or deterioration in bathing water quality classification being (be) assessed?
		SRQ3.2: How can effects on national and local economies and short and long-term effects be accounted for in assessments?

¹ Note that the first objective refers to carrying out the desk study and has therefore not been translated into a research question.

Research objective	Research question	Sub-research question
	economies and both short- and long-term effects?	
RO4: Make recommendations for policy and practice. Provide recommendations on the management and assessment of designated bathing water sites and the overall value of bathing water quality in Scotland.	RQ4: What learning can be derived from the evidence about the management and assessment of designated bathing water sites and the overall value of bathing water quality in Scotland?	SRQ4.1: What learning or recommendations can be derived from the evidence about the management and assessment of designated bathing water sites in Scotland? <hr/> SRQ4.2: What can be derived from the available evidence about the overall value (potential or otherwise) of bathing water quality in Scotland?

Developing the search strategy

The project team has extensive knowledge on many of the aspects identified as relevant in the research questions (Table 2.1). Our approach to the literature review aimed to take advantage of the existing knowledge and complement it with emerging literature and recent research undertaken in this area. A dual-track approach was therefore adopted combining the following elements:

- **Expert input:** Team members have contributed to literature and / or have undertaken studies that are directly relevant to social impact assessment and economic valuation in the area of marine environments. Our combined knowledge across social research, psychology, economic valuation, and environmental expertise provided the basis for this high-level study, avoiding the need to revisit standard texts.
- **Database searches:** We undertook structured searches across a range of electronic databases, namely Scopus, Web of Science, ECONBIZ, ECONSTOR, EconPapers and Google Scholar, to ensure that both peer reviewed and grey literature was captured. The focus was on identifying:
 - New perspectives on the assessment of the economic and social value of bathing waters;
 - Current approaches to the valuation of BWQ; and
 - Identifying the less tangible benefits provided by bathing waters (e.g. direct and indirect outcomes for wellbeing, place attachment / connection to the site, etc.) and current approaches to their assessment and valuation.

A detailed search strategy was developed for the purposes of filtering, collating and prioritising the results of these searches. Box 2.1 presents the search string²

² The search string was adjusted depending on the capabilities and functions of each database's search tool.

developed for this purpose and Table 2.2 below lists the exclusion and inclusion criteria applied to narrow down the search.

Box 2.1: Search string and additional limitations

(Bathing water* OR recreational water*) AND (quality OR valu* OR evaluat* OR assess* OR classif* OR designat* OR Directive OR monetary OR *econom* OR travel cost OR stated preference OR revealed preference OR beach* OR social OR community OR attitud* OR perception OR touris* OR recreation OR cost OR benefit OR health* OR disease OR infect*) AND NOT (simulat* OR forecast*)

In developing the search string and filtering the results the inclusion and exclusion criteria specified in Table 2.2 have been considered.

Table 2.2: Exclusion / inclusion criteria for the literature review search

Exclusion / inclusion criteria	Comments
Exclude studies reported in languages other than English.	<ul style="list-style-type: none"> • Use databases in English. • Filter results by language.
Include studies published after 2010.	<ul style="list-style-type: none"> • CEP and effec have good knowledge of key socio-economic valuation literature, so any relevant literature prior to 2010 has already been identified and included as part of the expert input. • Grey literature dates quite quickly: the past six years is adequate.
Exclude studies that are not in Northern Europe.	<ul style="list-style-type: none"> • Filter results by country. • Prioritise UK studies.

Identifying and collating relevant literature

Using the dual-track approach described above, a total of 97 documents were identified by the team as potentially relevant. Key information about the documents identified (title, author(s), date of publication and source) was entered in an Excel spreadsheet. The collated documents were reviewed and prioritised to key and secondary documents according to their relevance to the research questions and the robustness of the evidence presented. The prioritisation was an expert-led approach whereby key experts on the project team (e.g. Prof. Nick Hanley, Dr Kayleigh Wyles) suggested the sources that would be most beneficial to review on the basis of e.g. relevance, robustness of methodology etc. By this approach, some key studies pre-2010 and from locations other than Northern Europe were included in the review as priority sources.

Table 2.3 summarises the results of the literature search in numbers, specifying the source of the information. Upon a closer review of the documents' abstracts, or full text where necessary, a list of 29 publications was agreed across the team to be taken forward for a full review³.

³ The research questions were used to guide the review of the 97 documents. The focus was on relevance to those questions which often was not clear from just the title, hence closer review of the abstract or paper.

Table 2.3: Number of documents identified and reviewed

	Source of potentially relevant documents identified		Source of final list of documents reviewed	
	Expert input / team knowledge	Database searches ⁴	Expert input / team knowledge	Database searches
Number of documents	58	40	22	7
	97		29	

Review, analysis and synthesis of literature

The following steps provided a structured approach to the review, analysis and synthesis of the prioritised evidence, drawing out key findings that will inform both the fieldwork and the recommendations from the project as a whole. Each document has been reviewed in depth by a team member from a relevant discipline, in order to identify, tag and record evidence of relevance to the project research questions and sub-questions.

Step 1: The selected publications were added to Mendeley⁵, an online reference management programme, which facilitated the review and allowed the team to share results internally.

Step 2: The documents were ‘tagged’⁶ to indicate their relevance to the headline research question(s) using the following codes:

- RQ1_Benefits;
- RQ2_Signage;
- RQ3_Assessment; and
- RQ4_Learning.

Step 3: Text excerpts were annotated and linked to specific research sub-questions using the comments function in Mendeley.

Step 4: For the collation and analysis of the findings a literature review database was populated in Excel where key information, approaches and findings emerging from each document were recorded against the common set of sub-questions presented in Table 2.1 above. Entries for sub-research questions also included brief commentary, where necessary, clarifying how the source relates to / can help answer the sub-research question. A summary table (see Appendix 2) has been produced listing all the documents reviewed, indicating their relevance to their research questions and including information on whether or not they have been peer reviewed as an indicator of their reliability and robustness.

⁴ The results have been combined across databases and duplicates have been removed.

⁵ <https://www.mendeley.com>

⁶ Tagging function available on Mendeley.

Step 5: The findings of the desk study were written up and are presented in this literature review report. The headings of this report largely correspond to the research sub-questions, which were used as the basis of structuring the findings⁷.

⁷ In some cases, sub-questions, that cross-cut research questions, have been clustered under an overarching heading.

The benefits of bathing waters

This part of the literature review corresponds to *SRQ1.1: What are the range / types of benefits (economic, health, social and cultural) of bathing waters at local and national levels?* (see Table 2.1). It aims to identify and cluster the benefits derived from bathing waters for visitors, local communities and the national economy. As categorisations tend to vary across disciplines, and the documents reviewed, the typology provided in the research question was used as the basis for clustering the benefits identified in the literature.

The benefits that marine and coastal environments offer to society are well recognised and documented (eftec *et al.*, 2014; GESAMP, 2015; Ghermandi *et al.*, 2010; Brown *et al.*, 2006; MEA, 2005; Watson *et al.*, 2001; GESAMP, 2001). Some of these emerge from products and services that are traded in markets, and can be easily expressed in monetary terms. These include the provision of food and tourism which generate increasingly significant revenues in coastal and marine areas (UNEP, 2008). Beyond these market benefits, the Scottish Government highlights the benefits that people gain from the environment recognising that “*by managing the environment well we can provide many more benefits and greatly improve our quality of life*”⁸. Such improvements include benefits for physical and mental health, well-being and other social and cultural benefits for local communities and visitors alike.

There is no single framework across literature used for the classification of benefits emerging from bathing waters. Common categorisations in natural and social science literature include the ecosystems based approach (MEA, 2005; Ghermandi *et al.*, 2010) or the more recent ecosystem services framework (UK NEA, 2011), while in economic literature total economic value is the main framework (Johnston *et al.*, 2017; Oliver *et al.*, 2016; Hynes *et al.*, 2013). Total economic value is the sum of use and non-use values. Use values refer to the benefits emerging from the activities undertaken in the bathing water site. These would include, for example, benefits from angling or commercial recreational sports as well as informal recreation like going for a stroll or paddling. Non-use values refer to the social, aesthetic, spiritual, religious and well-being benefits derived from bathing waters related to reasons other than individuals' own use – knowledge that others use the bathing waters (altruism), they will be available for future generations (bequest value) and simply that good quality bathing waters exist (existence value). In empirical work, it is often more practical to think about users' values (which include both use and non-use values) and non-users' values (only non-use value). This is because it is easier (and more useful) to identify these two separate populations than it is to disaggregate the total economic value. For example, the on-site survey that will be undertaken for this project will estimate the total economic (use + non-use) value of users of bathing waters. The online survey is likely to capture both users' and non-users' values.

⁸ SEWeb benefits from the environment pages: <http://www.environment.scotland.gov.uk/get-informed/people-and-the-environment/benefits-from-the-environment/>.

The range of activities linked to the recreational value of beaches is quite extensive and includes, but is not limited to, the following activities:

- Angling;
- Surfing / kayaking / paddling;
- Boating / sailing;
- Swimming / snorkelling / diving;
- Sunbathing / relaxing;
- Walking or sitting on the beach;
- Dog walking;
- Bird, whale and other wildlife watching / rock pooling;
- Getting fresh air, relaxing, and
- Playing / beach sports.

Depending on the particular bathing site characteristics, the climatic conditions and the user group, some activities may be more widespread than others (Coombes and Jones, 2010). Different user groups can therefore derive different benefits from the same bathing site or otherwise the same bathing site can offer a range of different benefits to different users. Understanding what gives rise to these benefits is key to understanding beach visitors' preferences and the factors influencing decision making about beaches (Phillips and House, 2009). This is something we revisit in Part 5 of this review below.

For the purposes of this study and focussing on the benefits of bathing waters in particular, the range of benefits identified in the literature review were clustered under the following categories: Economic, Health and Well-being, Social and Cultural.

Economic benefits

Across the literature reviewed, bathing water sites are identified as an important asset for the local, regional and national economy (Tudor and Williams, 2006; Vaz *et al.*, 2009; Gillespie *et al.*, 2016; Reed and Buckmaster, 2015; Phillips and House, 2009; Morrissey and Moran, 2011; Hynes *et al.*, 2013; Ballance *et al.*, 2000).

The economic benefits of tourism are wide-ranging and include direct benefits to economy in the form of revenue emerging from tourist expenditure on travelling, local amenities, leisure activities and recreation in and around the visiting area, as well as, benefits in job creation in the wider economy. Gillespie *et al.* (2016 p.2) note that the economic benefits generated through these activities represent “*a component of the value inherent in the local environment*”. These benefits are particularly important for local and regional economies that are frequently dependent on such seasonal income. Spending, as a result of increased available income of those employed in the sector, further spreads these benefits to the local and regional economies.

Economic benefits to the national economy are equally significant. According to a recent survey in Scotland (Visit Scotland, 2016), domestic visits alone to seaside locations in Scotland were estimated to generate an average of 1.5 million trips and £323 million in expenditure per annum. Similarly, the latest Great Britain Day Visits Survey (GBDVS, 2015) identified a total of 4 million tourism day visits to the beaches in Scotland, corresponding to an estimated £82 million in expenditure.

Studies undertaken in Ireland and Wales, show that in 2007 marine leisure generated €453.3 million in gross value added (GVA) to the Irish economy and employed 5,800 individuals (Morrissey *et al.*, 2010), while Welsh annual spending on seaside holidays in 2003 amounts to £0.7 billion (Wales Tourist Board, 2001). In England, *eftec et al.* (2014) also used GVA to estimate the economic impact of visits more than 70 'at risk' bathing waters. This approach and some of the challenges in aggregating impact from a local to national level are discussed in Part 4.

The challenge for this research is to estimate how a change in BWQ (as defined by the Bathing Water Directive) would affect individuals' decisions to visit a beach. A decline in visitor numbers is assumed to result in a proportional decline in spending and hence local economic benefits.

Benefits emerging from leisure activities in bathing water sites go beyond economic benefits and are further discussed in the next sections.

It is worth noting there is considerable research in the valuation of green and blue spaces, which has demonstrated significant economic benefits emerging from natural sites. Fewer studies exist that quantify the benefits of improvements in the condition of such sites. However, those that do exist also point to long-term benefits in the range of billions. By way of example, Austin *et al.* (2007), estimated the economic benefits of ecological improvements in America's Great Lakes to be between \$30 and \$50 billion in short term benefits to the regional economy and over \$50 billion in long-term benefits to the national economy. Also, in a valuation of the recreational and non-use value of the Scottish lochs, Glenk *et al.* (2011) found a mean value of £1,500 per hectare of loch improved in terms of its ecological status⁹. This study estimated that if 72% of Scottish lochs reached 'good' ecological status they would produce a benefit of £5.7m per year.

Health and wellbeing benefits

The physical and psychological benefits derived by visiting or being close to coastal environments, have been recognised in improvements in people's mood and cognitive attention¹⁰, self-reported health (White *et al.*, 2013a), reduced stress¹¹ and restored emotional and cognitive resources (Wyles *et al.*, 2017; Wyles *et al.*, 2014; White *et al.*, 2013b), quality of life¹², affect – feeling positive emotions (Brajsa *et al.*,

⁹ Reaching 'good' ecological status under the Water Framework Directive.

¹⁰ van den Berg, Koole, & van der Wulp (2003) and Karmanov & Hamel (2008): in Hipp and Ogunseitan (2011).

¹¹ Velarde, Fry, & Tveit (2007): in Hipp and Ogunseitan (2011).

¹² Ogunseitan (2005), de Vries, Verheij, Groenewegen, & Spreeuwenberg (2003): in Hipp and Ogunseitan (2011).

2010), ,as well as, improvements in physical health manifested in reduced blood pressure¹³ (Hipp and Ogunseitan, 2011; Wyles *et al.*, 2016; GESAMP, 2015). Walking, which has been identified as “*the most cost-effective means of improving physical health*”¹⁴, was the second most popular activity (22% of respondents) undertaken by visitors to UK beaches following dog walking (57% of respondents) (Coombes and Jones, 2010).

Blue spaces and coastal environments have also been known to have a beneficial impact on well-being (Fleming *et al.*, 2014) and to support psychological restoration. The attention restoration theory (ART) (Kaplan & Kaplan, 1989) recognises four restorative qualities of coastal environments:

- **A sense of being away:** Psychological distance from everyday stressors and distractions;
- **Fascination:** The ability to effortlessly redirect attention and capture one’s surrounding environment;
- **Extent:** The ability to appreciate the connectedness to and richness of the environment; and
- **Compatibility:** The ability to associate and fulfil a person’s needs and desires with what the environment offers.

These restorative qualities have been extensively referred to in subsequent studies (Bodin and Hartig, 2003; Hug *et al.*, 2009; White *et al.*, 2010;) and have been more recently used as a framework to describe and measure the restorative effect that bathing water sites have on making visitors feel revitalized, calm, and refreshed (Hipp and Ogunseitan, 2011; Wyles *et al.*, 2014; 2016; 2017). Empirical evidence from a study with beach visitors in California, has shown that participants perceive the bathing water sites to be psychologically restorative (Hipp and Ogunseitan, 2011). The researchers used a variation of the four restorative qualities identified in ART to ask participants to rate the various elements. Results showed a mean score on the Perceived Restorativeness Scale (PRS) of 4.8 out of 6.0.

In other studies these ‘restorative qualities’ are identified in the therapeutic, inspirational and spiritual benefits of being close to blue spaces and are found to emerge from the overall aesthetic experience of enjoyment of the beach and views, relaxation and spiritual enrichment. These benefits can be enhanced by the beauty of seascapes which adds to the aesthetic experience and scenic values derived (Phillips and House, 2009; Tudor and Williams, 2006) and which, as discussed in Part 5, is also one of the factors that influences decisions around the choice of beach.

Other benefits associated with visiting the beach include the sense of familiarity, described as “feeling at home”, and feeling content (Wyles *et al.*, 2016).

¹³ Chang, Hammitt, Chen, Machnik, & Su (2008): in Hipp and Ogunseitan (2011).

¹⁴ SEWeb recreation pages: <http://www.environment.scotland.gov.uk/get-informed/people-and-the-environment/recreation/>.

Besides the direct benefits to human health, bathing waters provide a living space for numerous plant and vertebrate populations (birds, fish and marine mammal species). Hence, in a healthy bathing site, visitors can further benefit from contact with wildlife. In a survey by Hynes *et al.* (2013), improvements in benthic health, explained as the chance of seeing fish, birds and mammals, were positively valued and linked with an increase in beach visitors' utility derived from the site visit (statistically significant results). Wildlife and the conservational value of coastal environments were also mentioned as one of the "attractions" to bathing water sites for locals and visitors on Welsh bathing sites (Tudor and Williams, 2006).

The challenge for this research is to identify the impact of BWQ (as defined by the Bathing Water Directive) on these benefits, and show how a change in the BWQ would change these benefits. It may affect some significantly, and it may not affect others.

Social and cultural benefits

The social and cultural benefits of bathing water sites relate to the historical heritage, culture, learning and social cohesion opportunities they provide for local communities and the wider society.

While people frequently attribute value to the mere existence of habitats and landscapes as links to their heritage and identity (Heritage Lottery Fund, 2016; Kyle *et al.*, 2004), further cultural benefits can arise from bathing sites with rich maritime heritage and historical importance (Tudor and Williams 2006). These may well be designated sites (Ballinger *et al.*, 2005) which also add to the attraction of visitors and the economic benefits discussed earlier (*ibid*). High quality bathing waters and popular destinations can further contribute to a sense of ownership and pride of place for local residents and communities (Barnes, 2008).

A key issue to be aware of, however, is that local identity is linked to perceptions of beach quality. In social science literature the 'social identity' theory posits that people are likely to consider beaches they are attached to as better quality (or less polluted) which is a result of denial of a potential threat to their place identity (Bonaiuto *et al.*, 1996). In recent literature (see review by Wyles *et al.* 2016) there are conflicting opinions as to the direction of that impact with some arguing that attachment to a particular site suggests a greater ability to overlook deterioration in that environment (or be negatively impacted by it), while others suggest it implies greater sensitivity in response to such a deterioration. Wyles *et al.* (*ibid*) in surveying participants on the impacts of litter on marine environments found that a person's bond with nature did not affect people's ratings of environments in a deteriorated state (i.e. littered) with locals and visitors rating those sites similarly negatively. However, there was a difference in participant's ratings for clean environments when they were emotionally attached to a site. Surveys of beach visitors have shown (Bonaiuto *et al.*, 1996) that direct experience of a beach shapes perceptions of quality rather than knowledge of the official rating (in this case Blue flag award).

At a local level, bathing sites can contribute to community cohesion by offering places for the local community to meet, interact (Reed and Buckmaster, 2015) and engage in activities, which may include local festivals and competitions, such as, sand sculpturing . For families, the beach offers an opportunity to strengthen family bonds by engaging in recreational activities and experiencing fun and stress relief (Ashbullby *et al.*, 2013).

Further, the beach offers an ideal environment for children and adults alike to learn more about coastal environments and develop an appreciation of what these environments have to offer. Activities such as rock pooling, the fourth most common activity in a survey of visitors' use of the beaches in England and Wales (King *et al.*, 2015), give rise to educational benefits (Wyles *et al.*, 2017).

Regardless of the specific activity undertaken during a visit, bathing sites have an effect on individuals' welfare. This is linked not only to the recreational activities but is derived from building and strengthening social and familial structures and combating social exclusion (Morrissey and Moran, 2011; Ashbullby *et al.*, 2013).

The challenge for this research is to identify these social and cultural benefits as part of motivations for visiting bathing waters, and as factors influencing the economic and wellbeing values. It is also part of the challenge to have a deeper understanding of these benefits through focus groups.

Methods and approaches for measuring the benefits of bathing waters

This part of the literature review brings together elements of the evidence relating to methods and approaches for measuring the benefits of bathing waters and the implications of variations of a change (improvement and deterioration) in BWQ in terms of the benefits identified on local and national economies. As we have seen above, these impacts can be wide-ranging and go beyond the purely economic impacts on tourism and employment, to include impacts on people's health and well-being, as well as, social and cultural benefits for visitors and local communities alike. Under this theme, this part presents findings on the following research sub-questions (see Table 2.1) in the order they are presented below:

- *SRQ1.2_How are (or can) the range of benefits of bathing waters being (be) measured?*
- *SRQ3.1_How are (or can) the costs and benefits of an improvement or deterioration in bathing water quality classification being (be) assessed?*
- *SRQ3.2_How can effects on national and local economies and short and long-term effects be accounted for in assessments?*

Within the literature reviewed (see Appendix 2) there is a mix of qualitative and quantitative approaches, which are presented and discussed in terms of their appropriateness and practicality of use in a bathing water context. We find that the combination of revealed and stated preference methods, incorporating questions that identify current and intended use but also capture the emotional responses to these environments, to be a commonly used approach. While there is some evidence in the literature on how BWQ (among other beach characteristics) influences benefits derived from bathing waters there is little to no evidence relating to how changes in bathing water classifications may impact on these benefits. A study undertaken for the Environment Agency (eftec, 2002) and ongoing (as yet unpublished) work by eftec for United Utilities and Southern Water have, however, considered these aspects by estimating whether there would be a change in visit behaviour given changes in BWQ.

Methods and approaches

Revealed preference: Travel Cost Method (TCM)

Revealed preference methods estimate the preference for a non-market (non-traded) good by observing consumer choice for market goods and services that are affected by the non-market good. Amongst these methods, the travel cost method and hedonic pricing have commonly been used to capture the value of coastal environments. Hedonic pricing, can measure the impact of the presence of different environmental attributes (e.g. green or blue space, view of the sea etc.) on the housing market (i.e. house prices). An example would be the impact of beach proximity beach as one the attributes of the total price of a property, when that is disaggregated and expressed as a set of attributes (Ghermandi *et al.*, 2010).

In the travel cost method, what people spend on travel (a market service) to a beach is used as a proxy for how much they value the recreational experience of being at that beach. The travel cost method is particularly appropriate for the valuation of bathing waters at sites where: (1) There is no entrance fee; (2) services from the natural resource are consumed in situ; (3) there is a recreational appeal (Gillespie *et al.*, 2016; Ballance *et al.*, 2000). This method assumes that the travel cost represents the 'fee' that visitors are willing to pay to access, what is otherwise, a 'public' and free access good. Travel cost would be applicable even if there was an entrance fee.

Travel cost method collects data on what visitors spend on items like travel, accommodation, food etc. on a beach visit day, where they travel from and how, how long they stay in / near the beach and other factors that will help researchers analyse the visitor demand for the visits. The data can be collected from routine visitor surveys or specifically designed questionnaires applied to randomly selected sample of visitors – as will be in this research. The result is a travel cost across different types of visitors for different activities, as much as data allow. If the overall visitor population is known, the survey results can be extrapolated to the bathing site to calculate the recreational value of the particular site.

Most studies reviewed use some primary data collected on beaches for their calculations (Ballance *et al.*, 2000; Coombes and Jones, 2010; Morrissey and Moran, 2011). Data collected includes:

- Number of visitors;
- Frequency of visits (over the last 12 months);
- Activities undertaken on the beach;
- Duration of stay;
- Distance travelled / time required / starting location for the trip; and
- Spending (local and other).

These studies almost always include qualitative elements aiming to capture visitors' preferences on beach characteristics and factors that influence their decision about which beach to visit. These are presented to respondents in the form of Likert scale questions that asks visitors to rate various characteristics in terms of their influence or significance on their decision, on a scale of 'Strong' to 'Weak' or 'Significant' to 'Insignificant'. Sociodemographic characteristics of respondents are also recorded.

Some examples of the travel cost method from the sources reviewed include:

- Morrissey and Moran (2011) used the travel cost method to capture both the economic and welfare value¹⁵) of commercial recreational activities in the West coast of Ireland. They found that the welfare impact on consumers,

¹⁵ The welfare value captures the positive effect on people's welfare emerging as a result of the recreational activities they engaged in. It can include a range of effects these activities might have had, such as, strengthening social and family structures or making people feel positive emotions.

frequently referred to in economics as consumer surplus, emerges from the utility individuals derived from: (1) engaging in a niche recreational market; (2) the sense of identity; (3) the ability to engage in recreational activities in an environmentally sustainable manner; and (4) the ability to engage with companies with local knowledge. This study calculated the mean consumer surplus at €2,500 per trip, while the average travel cost was estimated at €1,283 per trip, meaning that individuals received almost double the benefit from engaging in these activities in excess of their travel cost; and

- Gillespie *et al.* (2016) employed this method to assess the use value a fishery provides to anglers (in-situ benefits) in Ireland. The study estimated consumer surplus (i.e. the welfare derived by anglers over and above what was paid for the trip) (per trip) resulting from the services provided from recreational fishing and used that to construct estimates of users' WTP.

Stated preference

Stated preference methods are used to estimate the value of benefits and outcomes for which there are no prices in the marketplace and for which there are no revealed preference data that would enable their estimate. They "*represent the only known approach to estimate values for changes in many public goods, including environmental services, human health effects [...]*"(Johnston *et al.*, 2017 p.320-321).

Stated preference methods involve questionnaires for eliciting individuals' preferences for a given change in environmental quality. The two main approaches are:

- **Discrete choice / contingent valuation:** Respondents are asked their willingness to pay (WTP) to ensure an improvement or avoid a loss, or their willingness to accept (monetary) compensation (WTA) to forgo an improvement or tolerate a loss. The questions can be asked in a variety of formats including open ended, yes / no questions for a given amount and 'bidding games' (e.g. if respondent says yes to £x, they are asked a second question with a higher amount); and
- **Choice experiment:** Respondents are asked to indicate their preference among two or more options, each of which consists of a combination of attributes. The status quo is commonly included as one of the options. One of the attribute is a cost element which enables respondents' WTP or WTA to be inferred from the choices they make.

Some examples of stated preference valuation of improvements in BWQ from the sources reviewed include:

- Hynes *et al.* (2013) used a combination of choice experiment and contingent valuation to estimate the economic benefits attached to an improvement in BWQ. Expressed in mean visitors' willingness to pay the value of these improvements was estimated as €6.78 per beach visit; and
- Hanley *et al.* (2003) used a combination of revealed behaviour (e.g. current number of trips to the beach) and contingent behaviour (e.g. stated number

of intended trips under a scenario of increased environmental quality) to estimate an average individual value for the improvement in BWQ of £5.81 per person per year.

What is important to document and be aware of is the generalisability of value estimates from stated preference methods especially when these are used to support decision or policy-making (Johnston *et al.*, 2017). Similar warnings exist in Ghermandi *et al.* (2010) with reference to the use of economic values from a particular study site to another geographical setting, at a national or sub-regional scale, as bathing water sites as well as the beneficiaries may vary across locations. While these considerations are crucial when looking for examples across Europe, this should not impact the aggregation of benefits across Scotland for this study, especially since the methodology incorporates bathing sites that account for the diversity of bathing sites in Scotland.

Qualitative assessment: exploring emotional responses

One of the scales used to measure the social and cultural benefits of bathing waters is the Perceived Restorativeness Scale (PRS) developed by Hartig *et al.* (1997) using the four restorative qualities identified in the attention restoration theory (ART) and referred to in Part 3 above. The PRS presents beach visitors with a series of 26 statements to which they answer using a Likert scale of 0 to 6 to record their responses. The final restorativeness score is the result of the mean aggregated scores across these statements. Hipp and Ogunseitan (2011) used this method, in a study with more than 1,000 visitors in Californian beaches, which calculated the mean score on the Perceived Restorativeness Scale to be 4.8 out of 6.0. A simplified version of the PRS was used more recently by Wyles *et al.* (2016), who presented beach visitors with a ten point Likert scale from not at all (1) to very much (10), to rate the original four factors associated with the attention restoration theory (ART). The same study also used the Circumplex Model of Affect (Russell, 1980) to measure the impact of bathing waters on their mood and levels of excitement as a result of visiting the beach. Visitors were asked how the beach makes them feel on a scale of 1 to 10 from sad to very happy and from very calm to very excited (Wyles *et al.*, 2016).

Measuring the benefits and costs of an improvement or deterioration in BWQ

There is limited literature on the impacts of a change in bathing water classification on the benefits of bathing waters (Cascade Consulting and eftec, 2009; eftec *et al.*, 2014; Accent, 2010; Mourato *et al.*, 2003; eftec, 2002). However, there have been studies exploring the benefits and costs of an improvement in BWQ (Coombes and Jones, 2010; Gillespie *et al.*, 2016; Hanley *et al.*, 2003; Hynes *et al.*, 2013; McKenna *et al.*, 2011; Nahman and Rigby, 2008; Czajkowski *et al.*, 2015). This section looks across this literature to identify approaches in measuring the impacts of such a change. There is also a relatively large grey literature on the impacts of implementing the Bathing Water Directive in England and Wales for the Environment Agency and water companies. While this literature is confidential and cannot be reviewed here, as eftec and South West Research Company were

involved in most of these their experience is reflected in the research design for the on-site and on-line surveys to be used in this current study.

Quantitative measures

Across the literature, there is a common set of indicators that have traditionally been used to measure the benefits and costs of a change in BWQ.

A change in the **number of visitors** attracted to a bathing site or a change in the **frequency of trips** undertaken by visitors to the beach has been used in a number of studies as a measure of the impact of an improvement or deterioration in BWQ (Hanley *et al.*, 2003; McKenna *et al.*, 2011; Gillespie *et al.*, 2016). The assumption is that visitors treat travel costs as a kind of price so, similar to any goods traded in the marketplace, a deterioration in the BWQ will reduce the benefit¹⁶ that visitors gain from the bathing site (good), leading to a reduced number of trips to the bathing site, representing a decrease in demand (Gillespie *et al.*, 2016). Hanley *et al.* (2003) measured the change in the **welfare per trip**¹⁷ visitors gained by recording respondents' stated intended changes in behaviour. The results of their survey revealed that 63% of respondents stated they would visit the beach more frequently if water quality improved. A similar method was used by Coombes and Jones (2010) in exploring the impact of beach litter on visitors' behaviour; 85% of both tourists and residents stated they would not visit the beach if it had more than 2 items of debris per square metre, while for more than 10 items per square metre that rose to 97%.

ettec *et al.* (2014) estimate a trip-generating function which predicts the frequency of visits to 'at risk' bathing waters in England as a function of visitor and beach characteristics. The study relies on a survey of 7,000 visitors at over 40 'at risk' bathing waters in England. The trip-generating function investigates the impacts of the following factors on the number of visits by an individual to a single bathing water: distance travelled, visitor type, bathing water quality (poor versus otherwise), visitor expenditure, group size, visitor age, visitor income, and the availability of substitutes (other beaches) within three different distance bands.

Nahman and Rigby (2008) attempted to establish the difference between the impact of a change in BWQ, as opposed to, a change in the Blue Flag status of beaches in South Africa. For that purpose, respondents were presented with two hypothetical scenarios: a 10% decline in BWQ; or the withdrawal of the Blue Flag status. In a deterioration of water quality, visitors responded with a reduction in their visits by 39%, whereas under the loss of Blue Flag scenario visitors suggested only a 6% reduction in visits. Despite these results not being transferable to the context of the bathing water classifications in Scotland, they do show: (1) the importance visitors attribute to BWQ; and (2) the importance / extent of the influence of beach awards on visitors' behaviour. Therefore, the potential

¹⁶ Depending on the study a different terminology or measure might be used so instead of benefits some studies refer to welfare or consumer surplus.

¹⁷ A change in welfare per trip is used in this study to measure the impact of an improvement in water quality on the positive effects a visit at the beach has on people (Also see earlier footnote on welfare value). It is a common measure when trying to assess the benefits of visits to natural sites (Harris and Roach, 2013).

reductions or increases in bathing water trips “*depends not only on genuine water quality improvements but on the satisfaction and public perception of the quality of the bathing waters, influenced by the media and beach awards*” (Cascade Consulting and ettec, 2009: p.6). This presents an interesting line of inquiry and highlights important aspects for similar studies to consider.

Using the stated preference and revealed methodologies (reviewed in the previous section) these intended changes in behaviour can be translated into **losses for the tourism economy** emerging from reductions in **annual recreational value** and the **total expenditure** of visitors for travelling to bathing sites (the methodology for aggregating across local and national impacts is discussed in the next section). Estimates of an increase or decrease in **visitor spend** to a particular beach has also been explored as a measure of impact (McKenna *et al.*, 2011). Nahman and Rigby (2008) estimated that economic loss in the range of £1.5 to £2 million per annum under the loss of a Blue flag status, and between £6 to £7 million per annum in relation to a deterioration in BWQ¹⁸.

Another common option in measuring the impact of an improvement in BWQ is the use of a choice experiment to estimate visitors' **willingness to pay** for improvements in water quality (Hynes *et al.*, 2013; Czajkowski *et al.*, 2015). This approach allows the researchers to explore, at the same time, other attributes that can offer a better understanding of factors that influence visitors' behaviour. Czajkowski *et al.* (ibid) use this method to estimate the economic value to a specific category of beach users (“active recreationalist”) of potential improvements to coastal water quality.

Finally, there is a link between improvements in BWQ and the “*potential for **healthcare savings** and a reduction in the number of **lost working days***” Oliver *et al.* (2016: p.58). Health benefits associated with better BWQ link to the reduced risks to human health from bathing, and mainly refer to respiratory illness, urinary infections, ear infections and gastrointestinal illness (World Health Organisation, 2003). Out of these illnesses, previous bathing water valuation studies have focused mostly on gastrointestinal illness, and, to a lesser extent, on ear ache. Mourato *et al.* (2003) estimated the marginal WTP for a 1% reduction¹⁹ in the risk of gastrointestinal illness across all bathing waters in England & Wales to be £1.10 per household per year. These value estimates have been used by Cascade and ettec (2009) to estimate the benefits of a reduction in gastrointestinal illness, as a result of achieving compliance with microbial standards in Scotland, at £5.8 million (over 25 years). Alternatively, instead of asking for WTP, studies can estimate the exposure to health risks and incidence of illness and value these at **cost of illness** including medical costs and work days lost. In assessing the merits of a potential improvement in BWQ, the cost of achieving this improvement would need to be considered and may indeed exceed any health benefit estimates. Cascade and ettec, estimated the costs of achieving compliance with microbial standards at

¹⁸ These costs were estimated from the average decrease in the number of visits indicated by 247 visitors across beaches in South Africa and correspond to a reduction in visits by 6% under the loss of a Blue Flag scenario and a reduction by 39% under the quality deterioration scenario.

¹⁹ Absolute reduction in risk.

£81.3 million (over 15 years) compared to the £5.8 million benefit seen above. Still, the health benefits from a reduction in the incidence of gastrointestinal illnesses are only part of a wider range of benefits that would emerge from an improvement in BWQ.

Qualitative measures

Changes in BWQ can have an impact on the benefits provided by these environments and the enjoyment visitors derive. Studies have shown that changes in the environmental quality of bathing sites negatively impact on the perceived restorative qualities offered (Hipp and Ogunseitan, 2011; Wyles *et al.*, 2016). These changes can be measured using the PRS scale (see Part 3) and by presenting respondents in beach surveys with hypothetical scenarios of reduced or improved bathing water quality. This method, used by Wyles *et al.* (2016) to understand the impact of litter on perceived restorative quality, revealed that this was much lower²⁰ for beaches with litter. This negative impact extended to affect, with participants stating that they were unhappy and less calm in littered environments.

Effects on national and local economies: Aggregating benefits and costs

There are many approaches to addressing economic valuation of the benefits and costs of bathing waters. In the literature, the main criterion in choosing the most appropriate approach is the availability of data. The approach to measuring the benefits of an improvement in bathing water classification in particular, has been explored in a combined revealed and stated preference survey study for the Environment Agency which collected and analysed data on the benefits and costs of improving at risk bathing waters in England (eftec *et al.*, 2014). The study focused on the recreational benefits of bathing waters but could include non-use motivations of users too. The study did not attempt to estimate the health benefits (avoided health risks from low BWQ) and did not perform a qualitative assessment of social and cultural values. The approach is nevertheless interesting in the way the benefits are estimated and aggregated from a bathing site level to the national level. The initial assumption, similar to the one we have seen in studies exploring the impact of changes in BWQ, is that deterioration in bathing water quality classification implies a reduction in visits per year. The approach to moving from that initial impact to the impact on the national population is summarised in the steps below (eftec *et al.*, 2014):

1. **Estimate the change in the number of visits:** Visitors' stated intentions when presented with a scenario of changed bathing water quality;
2. **Estimate the value per visit:** Visitors' willingness to pay per visit calculated using travel cost method;
3. **Aggregate benefit (or cost):** Multiplying the avoided reduction or increase (reduction) in visits by the value per visit;

²⁰ Statistically significant result.

4. **Estimate the value of a potential improvement in bathing water quality:** Calculated as increased willingness to pay per household per year;
5. **Extrapolate to calculate the national level value of improvements;** and
6. **Compare benefits (avoided loss of value) and costs (measures taken to attain an improved status):** Calculate Net Present Value and the Benefit Cost Ratio to inform decision making.

Having calculated the value per visit (step 2 above) using the methods reviewed in previous parts (e.g. TCM or stated preference), the extrapolation and aggregation of impacts is dependent on the availability of local and national data on the total visitor population and frequency of visits to bathing sites.

Alternative methods for aggregating impacts exist in relevant literature in similar areas, such as the valuation of improvements in freshwater quality. Austin *et al* (2007) adopted two approaches in benefit aggregation by:

1. Identifying specific effects of the improvement (e.g. more visitors swimming or lower water treatment costs for managing authorities) and adding up the individual estimates to calculate the total benefit; and
2. Estimating the effect of the improvement on property values in the adjacent areas and aggregating that to calculate the total benefit (see earlier references to hedonic pricing).

Revisiting the previous point regarding data availability, the latter approach is a useful example of a single measure (property value) that is aggregate in that it *“reflects how individuals value all of the various disaggregated benefits associated with restoration of any given area”* (Austin *et al.*, 2007 p.6)

Local impact

Various surveys have tried to estimate the economic value of Scotland's bathing sites including:

- Hanley *et al.* (2003) combined information on the average number of trips to the beach per person across the local population to estimate the aggregate benefits of the total number of trips undertaken in a year. This figure added up to £1.25 million per annum, although calculations were caveated on assumptions on the population's trips to the beach due lack of actual data; and
- Fife Council (2000) estimated that from 250,000 visits to Fife's award beaches there is a £232,800 spend and that for every £1 spent around Fife's award beaches £20 goes back into the local economy²¹. In a later study in 2006 on the value of the Fife Coastal Path an annual net expenditure was estimated at between £24-29 million, with beaches mentioned as one of the key strengths for visiting the area by a quarter (26%) of the 480,000 to

²¹ These results need to be caveated on the basis of the date this study was undertaken and the specificity of the location.

580,000 estimated visitors (Fife Coast and Countryside Trust, 2007). Amongst visitors staying overnight, visiting the beach was mentioned by 46% of respondents²². Keep Scotland Beautiful (2004) estimated the average spend per person per visit to be £2.80 for non-award beaches, while it averaged at £3.00 for Seaside Award beaches and £7.80 for Blue Flag beaches.

National impact

An issue in the calculation of the impact of improvements at a wider level is the displacement effect (Cascade Consulting and ettec, 2009; McKenna *et al.*, 2011; Oliver *et al.*, 2016;). Provided with the choice of a bathing site with improved BWQ, visitors of a bathing site may decide to simply change their destination instead of increasing the overall number of visits to the beach. Thus, at the local level improved beach gains visitors, which is a benefit to the local economic; but at the national (or even regional) level, other beach(es) lose visitors and hence gain in one could be offset by the loss in others: *“overall, these effects contribute to a transfer of Scotland’s tourism wealth from one location to another”* (Cascade Consulting and ettec, 2009: p.8).

Similarly, given a restricted budget for the management of a number of beaches across a region, the beach managing authority may decide to allocate resources on improving the quality of bathing waters on a particular bathing site, hence retracting resources that may be necessary for maintaining the BWQ in another site (McKenna *et al.*, 2011) (these issues are explored further in Part 7 below).

Estimating local economic impact for Scotland’s bathing waters

In Scotland, local economic impact analysis utilises the Scottish Input-Output (I-O) tables (Scottish Government, 2016). The tables use the 2007 UK Standard Industrial Classification (SIC) of economic activities. Tourism, and coastal tourism are not neatly covered by the SIC codes used in the I-O tables. This explains why tourism has been assessed separately to other industries in Scotland in studies such as the Tourism Multiplier Study (Surrey Research Group, 1993) and the subsequent development of tourism satellite accounts (TSAs) (Scottish Government, 2005). The Tourism Multiplier Study is now considered out of date and is no longer used in estimating local economic impacts related to tourism. Further, TSAs are no longer produced, even though elements of TSAs are used to estimate non-resident expenditure in the Scottish I-O tables.

As part of this research, the team contacted economists in the Scottish Government with experience of developing and or using the Scottish I-O tables as part of local economic impact analysis. This was based on helpful suggestions provided by the steering group. These contacts confirmed the findings above. They also suggested that the approach used in Scotland to assess the Commonwealth Games (CWG) spending (Scottish Government, 2015) could be a possible approach to consider. However, further investigation showed that the method – which was developed over a number of years in the planning, delivery and legacy

²² 55% of respondents referred to the towns and villages along the path as one of the main attractions and 47% mentioned the coastal path (Fife Coast and Countryside Trust, 2007).

of the CWGs – would require complex modelling which is beyond the scope of this study. Further, the model relies on data regarding regional Local Authority employment by industry which is not publicly available and internally held by the Scottish Government due to disclosure issues.

The information above suggests that:

- Previous work to assess the local economic impact of tourism is now dated and no longer being used;
- The published Scottish I-O tables do not provide the level of specificity required to assess the local economic impact of tourism and in particular coastal tourism; and
- A possible method following the approach used for the CWG could be applied to estimate the local economic impact of beach visits. This method would require complex modelling which is beyond the scope of the current study.

Based on this, the suggestion is to use the Cambridge Model as outlined in the study's proposal and briefly described in Box 4.1 below.

Box 4.1: The Cambridge Model

The Cambridge Model is a computer-based model originally developed to calculate estimates of the volume, value and economic impact of tourism on a County or District basis. It draws on the combined experience of PA Cambridge Economic Consultants Ltd, Geoff Broom Associates and utilises a standard methodology capable of application throughout the UK. It therefore offers the potential for direct comparisons with similar destinations throughout the country. The approach was the subject of independent validation (R.Vaughan, Bournemouth University) in December 1994. The Model was judged robust and the margins of error acceptable and in line with other modelling techniques. Whilst the main part of the model was developed for tourism use the expenditure, employment and GVA approaches can be adapted to suit any situation with the use of updated specific data being applied to the model as it will be in this study.

The model was developed specifically to estimate the local economic impacts of tourism. It is applied by being populated with local data as much as possible. In this case, local data will be used to ensure that the model provides an accurate reflection of the economic and social parameters that are characteristic of Scotland (e.g. wage costs, employment data, population data, other socio-economic data, etc.). The Cambridge Model has been successfully used in previous studies in England which have focused on bathing waters, notably by the Environment Agency in the Bathing Water Valuation Study (eftec *et al.*, 2014). Using the same model, adapted to Scotland, would make the results from this study comparable to previous studies²³.

²³ Note also that the model has also been applied in Wales. See for example Geoff Broom Associates, 2000.

In the longer term, there is the option for the Scottish Government to utilise the CWG approach using internally held data within the Scottish Government. This would require data about visitor spend at beaches which the on-site survey at the five survey locations will collect. Having this data (visitor spend per site) gives some flexibility regarding which approach(es) to use in the future²⁴.

Healthcare savings / reduction in the number of lost working days

Benefits of improving BWQ in terms of avoided illnesses (and related medical costs and work days lost) can be estimated using two approaches: willingness to pay (WTP) to avoid the risk (or certain case of illness) or cost of illness methods. The former is done via stated preference where respondents are presented with the symptoms of the illness, and the risk of them contracting it. However, as most UK studies, including the one by *eftec et al.* (2014) show, most beach visitors do not come into contact with the water during their visit. This would make it difficult to ask a meaningful WTP questions (to those who are not exposed to the risk), and difficult to find those who are exposed to the risk. This also shows that, while unit health costs (per person or per incidence of illness) could be high, the total cost could be low.

Therefore, cost of illness method is preferred as being more practical. On-site survey of visitors can collect data on the proportion of visitors immersing themselves (head in particular) in water – which is the main risk factor, and their past experience of (self-reported) illness due to BWQ (including how long they lasted for and how long ago they occurred). This provides the number of likely cases of relevant diseases which can then be valued using medical costs and lost work days using average wage rates in Scotland.

²⁴ Collecting data about visitor spend is the main input required for local economic impact analysis and is consistent with data collected in other visitor surveys. This is confirmed by LUC (2015) which reviews questions included in various visitor surveys.

Factors that influence beach visitors' use of bathing waters

This part of the literature review responds to *SRQ2.1: what importance do people put on information (signs and signage) about bathing water quality as a factor influencing beach visit decisions?* (see Table 2.1). Within the scope of our review (see Part 2 above), we can conclude that there is only a small literature dealing explicitly with the nature / type of information influencing peoples' beach choice decisions (Tudor and Williams, 2006; Phillips and House, 2009; McKenna et al., 2011; Shepherd, 2014). Further, only two of the sources reviewed deal explicitly with signage (eftec, 2002; Oliver et al., 2016); this has been addressed in Part 6 of the review. Accordingly, the question addressed in this part of the review has been broadened to consider the relative importance of BWQ in the context of various other factors that can influence beach visit decisions. We also consider how the importance of these factors can vary between different beach users and the undertaking of different activities on the beach or in designated bathing waters.

The importance of information influencing choice of beach

Explicit or implicit information about a beach and its associated bathing water quality can influence the decision to visit a beach. Explicit information can include rBWD electronic or manual signage on BWQ, forecasts and abnormal events (Oliver *et al.*, 2016). These aspects are dealt with in Part 6 of the review. Other types of explicit information include beach awards as proxies of various specific indicators of beach quality (McKenna *et al.*, 2011). Implicit information relates to beach user perceptions of the attributes / characteristics / factors of different types of beach (Morgan, 1999; Vaz *et al.*, 2009). For example, there is a perception that urban beaches have more facilities and amenities, such as car parking, cafes, lifeguards etc (Vaz *et al.*, 2009), which can be attractive features for some user groups (e.g. families).

Relatively recent empirical studies (survey and case study research) from the UK (Wales) and northwest Europe (Ireland) suggest that beach awards, such as the Blue Flag Award²⁵ and the Good Beach Guide²⁶, are not strong motivating factors behind beach visit choices (Tudor and Williams, 2006; Phillips and House, 2009; McKenna *et al.*, 2011). In effect, beach awards *per se* are not valued as a source of information determining beach choice. There appear to be several reasons for this. Firstly, in relation to BWQ and the wider cleanliness of the beach as an important factor influencing beach choice (see below), Tudor and Williams (2006) note that there is no strong link between beach awards and beach cleanliness (no beach investigated in their study was free of sewage-related debris). Secondly, specific indicators / factors assessed as part of the beach award process, including the cleanliness of water and sand, are very important to beach users rather than the award *per se* (McKenna *et al.*, 2011). Finally, practical factors such as

²⁵ https://www.thebeachguide.co.uk/best-beaches/blue_flag.htm

²⁶ <http://www.goodbeachguide.co.uk/>

proximity / access and less tangible influences such as family tradition and individual experience of a beach are considered more important than information of official ratings or awards (ibid). Conversely, it has been suggested that foreign visitors may be more influenced by beach awards though this is identified as an area for future research (ibid).

Beach typology provides implicit information on the type of characteristics, attributes, features etc that might be expected at a given beach (Morgan, 1999; Vaz *et al.*, 2009). For example, beaches within a category of 'rural and remote' are likely to offer few facilities (Vaz *et al.*, 2009) and appeal more to those who "enjoy what might be termed the 'natural attributes' of a beach" (Morgan, 1999 p.62). The opposite is likely to be true of resort / urban beaches which may hold greater appeal to users who prefer the facilities and amenities provided by more traditional beach resort qualities (ibid). As such, beach typology can provide an initial albeit broad-brush source of information influencing beach choice for different user groups.

eftec *et al.* (2014) developed a database of beach characteristics and tested whether some of these influence the frequency of visits to the beach, via the estimation of a 'trip-generating function'. Different specifications of the trip-generating function included variables for beach type (i.e. sand, shingle, pebbles) to test whether they were statistically significant in explaining the variation in visits to beaches. For example, the 'best fit' model, which presents the highest explanatory power (i.e. explains the most variation in frequency of visits) shows that beaches with sand are less visited than beaches with shingle, rocks and pebbles.

A recent survey based study undertaken in Poole (southern England) considered the sources of BWQ information used by beach users at four locations across Poole beaches (Shepherd, 2014). The survey asked questions relating to: (1) the information sources that were used most frequently to inform bathing; and (2) ranking questions to assess the quality of the information, based on criteria relating to relevance, accuracy / reliability and how up-to-date the information is. The findings provide a valuable insight into the importance / quality beach users attach to different sources of BWQ information, albeit for a limited sample (n=125) from one study site only (Poole beaches). Although the Environment Agency was the most commonly used source of information (80%) of respondents, it was ranked fourth in terms of the quality criteria assessed. Surfers Against Sewage, the RNLI and the Blue Flag Scheme were considered to provide higher quality information overall. Interestingly, this conflicts with other sources reviewed (Tudor and Williams, 2006; Phillips and House, 2009; McKenna *et al.*, 2011) which suggest that beach awards are less valued / important influencing beach choice relative to other factors (see above).

Key factors influencing choice of beach

As mentioned above, there is little literature that specifically considers how BWQ information (signs and signage) influences beach choice (e.g. Oliver *et al.*, 2016). However, several studies have used survey based methodologies to identify and

rank the multiplicity of factors that can influence beach choices. These are addressed in this sub-section.

Morgan (1999) identified 50 individual factors for 'beach user prioritisation'. These were clustered into four major 'beach facets' that were used in a survey of beach users at 23 study sites in Wales:

- Facilities – e.g. washing / drinking water, toilet provision;
- Bathing and swimming safety – e.g. strong currents, lifeguard provision, dangerous animals in water;
- Sand and water quality – e.g. sewage debris, water quality, litter; and
- Access and parking – road access, car park location and access onto beach by path.

Morgan's survey results provide a useful historic reference point of the relative importance of different factors influencing overall beach user priority levels (i.e. the factors that determine choice of beach). Interestingly, water quality was identified as the third most important (3.12%) though there are a cluster of five other factors with similar (2.97-3.04%) priority scores, three of which are also from the 'sand and water quality' category (sewage debris, litter, oil on beach). Landscape quality (11.3%) and beach safety (8.28%) were the first and second most important factors respectively and, importantly, both had much higher priority scores (by at least a factor of 2.6) than the next nearest factor (water quality at 3.12%). Around the same period, Wilson *et al.* (1995) explored the impact of visual cues of deterioration on people's preferences. Preference ratings (of liking a site and finding it appealing for recreational activities) showed that people downrated waterscapes with rubbish, algal bloom, surface foam, a health warning sign, or an industrial backdrop (Wilson *et al.*, 1995). While these results may be expected, the authors note that in the absence of visual cues of deterioration, other considerations may in fact become more important.

More recent studies identify similar priorities though in many cases water quality (along with wider notions of 'beach cleanliness') have moved up in priority. Beach cleanliness provides a broad proxy of BWQ and other 'sand and water quality' aspects, as per Morgan (*ibid*). This highlights how members of the public may have different definitions and interpretations of BWQ as well as information and signage on BWQ. For example, although the rBWD defines BWQ in terms of E coli concentrations (cfu/100ml), 'wider notions of beach cleanliness' (Morgan, 1999) are likely to include a range of additional factors such as litter in the water, odor and aesthetic appearance (all of which have no bearing on BWQ in terms of the rBWD). Although a rather different context to Scotland / UK, an empirical study (survey design) from Ballance *et al.* (2000) in South Africa identified 'cleanliness' as the most important 'attribute' for beach visitors. Results from the large survey (n=2,306) undertaken by Tudor and Williams (2006) across 19 beach sites in Wales identified clean, litter-free sand followed by clean water as the most important aspects of a beach. Vaz *et al.* (2009) is closely aligned to this; surveys in Wales and Portugal identified beach litter and water quality as the first and second most important issues respectively. In McKenna *et al.* (2011), survey results showed that

beach cleanliness was the most important factor in the Welsh cases followed by beach safety. However, for Ireland, beach cleanliness was identified as less critical (fifth out of 18 factors overall / identified by 16% of respondents) behind the general attraction of the beach (41%) and scenery (40%) (ibid). Cited in McKenna *et al.* (ibid), an extensive study of 37 UK beaches in Duck *et al.* (2009) found that beach users place a high value on litter free sediment and clean seawater. In his survey of beach users in Poole (n=125), Shepherd (2014) found water quality as the second most important factor. In their assessment of seven beaches in Wales, Phillips and House (2009) structured their criteria under three separate categories (physical, biological, human use). The biological category, which includes factors relating to water quality aspects (e.g. floating / suspended material, presence of sewage), was consistently identified as the most important factor across all study sites. Hanley *et al.* (2003) showed how in areas where beaches had failed to meet water quality standards, improvements in BWQ would lead to increased visits. More recent work by eftec *et al.* (2014) also investigates the influence of visitor and site characteristics on the frequency of visits to beaches (see Part 4 above).

With the exception of the Irish results in McKenna *et al.* (2011), the sources reviewed here show clearly how water quality / beach cleanliness is consistently one of the top three factors influencing choice of beach from studies in the UK, other parts of northwest Europe and one example from South Africa. This includes results from a recent (2014) study in southern England.

Clearly there are a number of other factors that influence beach choice. Morgan (1999) provides an exhaustive list of the full range of possible factors. Wind direction / force and water temperature can be important factors (e.g. top five) determining levels of comfort on the beach for certain activities such as relaxing or sunbathing (Ballance *et al.*, 2000; Coombes and Jones, 2010; Shepherd, 2014). Coombes and Jones (ibid) showed how climate change will affect these factors for two case study beaches in Norfolk (England), with both positive and negative implications; e.g. sea level rise causing narrowing of beaches / less capacity, hotter summer temperatures increasing demand for bathing waters. McKenna *et al.* (2011) also undertook surveys at beaches in the US and Turkey. In both of these cases, beach proximity / travel distance was seen as the most important factor followed by clean water and sand. Scenery / scenic setting and general ambience are also important factors (ibid), especially for rural beaches where Tudor and Williams (2006) showed this to be the most important factor followed by beach tranquillity. More generally, access to facilities and lifeguard services are identified as much less important for rural beaches (Morgan, 1999; Tudor and Williams, 2006).

Hipp and Ogunseitan (2011) assessed the psychological restorativeness of coastal parks in California (US). They used attention restoration theory (ART) to define the aspects / characteristics of coastal parks that can contribute to this benefit (the section above on *the benefits of bathing waters* introduces the various 'factors' within ART which are: being away; fascination; compatibility; and extent). The study findings suggests that the ART factors may influence peoples' beach choices, particularly where psychological restorativeness is a purpose of the visit, either implicitly or explicitly.

Beach choice preferences of different types of user / activity

In addition to the consideration of factors influencing beach choice in a general sense (i.e. where each factor is 'weighted' equally), there are situations where factors may be more / less important. This section considers evidence of how the importance of different factors can change for different categories of beach user (e.g. families, surfers). This issue is also relevant for people undertaking different activities at the beach (Ballance *et al.*, 2000; Coombes and Jones, 2010) though this crosses over extensively with different user categories (e.g. active recreationalists are likely to participate in surfing and therefore have similar beach preferences). Also, the characteristics of individuals and groups (e.g. socio-economic background) can influence the relative importance of different factors (GESAMP, 2015). For example, Shepherd, (2014) reviewing the BWQ and the impact it had on people's perceptions revealed that the influence of BWQ decreases with increasing age.

In terms of different categories of beach user, Ballance *et al.* (2000) in their empirical study from South Africa showed how tourists (domestic and foreign) spent more time on beaches that were considered clean or acceptable. This echoes evidence above where water quality / beach cleanliness is identified as one of the most critical factors determining beach choice. Hynes *et al.* (2013) in their empirical Irish study (survey and choice experiment) showed how the user category 'active recreationalists' place more emphasis on weather and surf conditions (physical factors) and are less sensitive to water quality and associated health risks. This is interesting given that this group is likely to undertake immersive activities (e.g. surfing), thereby increasing the health risks associated with poor BWQ. However, Ravenscroft and Church (2011) suggest that recreationalists involved in immersion and on water non-immersion activities make continuous assessments of water quality, which could be a mitigating factor. Similarly, Phillips and House's (2009) theoretical assessment of seven case study beaches in Wales from the perspective of different user groups identified physical factors (e.g. beach width, size of breaking waves, number of waves / width of breaker zone) as the most important aspect for surfer 'interests'. Unsurprisingly, biological factors (e.g. wildlife, floating / suspended human material) were assessed as the most critical factors for conservation interests and human use factors (e.g. trash and litter, safety record, access) for families (ibid).

Beach signs: Awareness, understanding and influence

This part of the literature review responds to *SRQ2.2: what do people understand about the information presented on bathing water quality signs and signage (particularly information about changes in classification)?* (see Table 2.1). Within the scope of our review (see Part 2 above), we can conclude that the exact scope of this research question is a key evidence gap; from the sources reviewed, only two papers deal explicitly with peoples' understanding of BWQ signs and signage and mainly in an exploratory / setting the research agenda sense (eftec, 2002; Oliver *et al.*, 2016). Accordingly, the question addressed in this part of the review has been broadened to consider some key related issues including how members of the public might respond to information about poor BWQ and the factors that might influence peoples' poor understanding of signage and messaging on BWQ issues.

Challenges and opportunities for effective BWQ signage

Oliver *et al.* (2016) explored a range of issues around emerging technological changes in BWQ assessment and the potential implications of this for the provision of public information on BWQ (e.g. via on-beach signage). The use of new, much quicker molecular tools for BWQ testing present the opportunity of quicker more 'real time' statements of the health risks posed by BWQ. There is a suggestion that beach users are likely to welcome such 'real time' information as this would allow them to make more informed decisions concerning: (1) which beaches to visit; and (2) what activities to undertake (e.g. not undertaking immersion based activities in the instance of poor BWQ). There is discussion around the use of probabilistic risk forecasting for BWQ – e.g. explicitly informing publics of the percent chance of illness of bathing at a particular beach. Related to this point, the paper also cites eftec (2002), highlighting how socio-economic evidence indicates that simple advisory messages about whether swimming (i.e. a specific immersion based activity) is safe or not are given higher value than detailed information about health risks. There is also discussion about the ambiguous nature of risk communication and interpretation.

While Oliver *et al.* (2016) make several suggestions for how BWQ information and messaging (e.g. signage) could potentially be improved, they also point to critical areas of uncertainty concerning how members of the public will interpret and act on the information: *"little is known about how the public perceives the risk of illness associated with different microbial water-quality standards (e.g. risk of illness associated with 'excellent' versus 'good' versus 'sufficient' regulatory classifications of the rBWD) or how this relates to a beach user's acceptability threshold for FIO [faecal indicator organism] exposure during bathing"* (Oliver *et al.*, 2016 p.55). They also cite several other sources (Dufour *et al.*, 2006; Wade *et al.*, 2008; Pratap *et al.*, 2013²⁷) concerning variation in BWQ health risk perception between different

²⁷ In Oliver *et al.* (2016)

types of beach user (e.g. family groups comprising children or immunosuppressed persons who may be more vulnerable to infection). In short, the effectiveness of different means of communicating BWQ information is poorly understood, so it is hard to know how best to respond to new BWQ assessment technologies that could facilitate 'real time' information provision. The paper calls for various areas of socio-economic research to be progressed to answer these questions. This includes consideration of local economic impacts if, for example, there is use of rapid assessment methods and 'real time' information provision in one location but not in others.

How might people respond to information about poor BWQ?

Although not explicitly related to BWQ signs and signage, two of the sources reviewed provide some insight as to how members of the public might respond to information about poor BWQ. In part, this may help to address (in simple non-specific terms) some of the gaps highlighted in Oliver *et al.* (2016) in terms of how people might respond to BWQ information and what types of information might be most effective.

In a survey of beach users (n=125) in Poole (southern England), Shepherd (2014) asked participants how they would respond to a scenario of poor BWQ. Participants who rate water quality issues as a 'medium' or 'high' importance factor (see Part 5 above) are split in terms of whether they would visit the bathing water site or not. Unsurprisingly, those who rate water quality as 'unimportant' would still visit. Importantly, the types of activity that people undertake at the beach would influence their decision-making in a poor BWQ scenario. Perhaps unsurprisingly, those who are there just for the view would still visit. Interestingly, Shepherd (*ibid*) identified only a weak relationship between water quality and watersports users, suggesting that this group may still visit and undertake their activities in a poor BWQ scenario.

Crucially, results from the Scottish (Ayrshire coast) survey in Hanley *et al.* (2003) showed that the majority of respondents were not confident in making judgements on water quality, with 60% agreeing that they know very little about the issue. The discussion in Oliver *et al.* (2016) echoes this sentiment where the question of how members of the public would interpret and respond to BWQ information was raised.

The study by *eftec et al.* (2014) for the Environment Agency included questions as part of a beach visitor survey about visitors' response to seeing signs showing that a beach has poor bathing water quality. Visitors' stated response fed into estimating the avoided loss of benefit from improving bathing water quality. The trip-generating function estimated as part of the study confirmed that the presence of an advisory sign negatively affects respondents' frequency of visits.

Factors influencing poor understanding of BWQ signage / messaging

Building on the sub-sections above, three of the sources reviewed provide some evidence on the factors that might influence poor understanding of BWQ signage /

messaging amongst members of the public. McKenna *et al.* (2011) specifically considered the role of beach awards influencing beach visits. As beach awards often include indicators on BWQ (e.g. the Blue Flag Award²⁸), the results provide a useful indication of how members of the public interpret and act upon on-beach signage (in this case signage on beach awards). Survey results indicated poor levels of understanding of beach awards though this was considered unsurprising given poor provision of public information boards at designated beaches.

This issue is perhaps less relevant in the case of BWQ / the rBWD given statutory requirements for on-beach signage, though the question of interpretation and understandability remains (Oliver *et al.*, 2016). Shepherd (2014 p.53) echoes this, highlighting how information displayed on beach award signage (not rBWD) is presented in a scientific / data based format which is only understandable by individuals who are “*either scientifically minded or particularly interested in bathing quality*”.

Oliver *et al.* (2016) identify specific interpretation issues with rBWD BWQ signage; the symbols / classifications are considered to provide little information in terms of what the classification might mean for health risk and the inherent uncertainties associated with health risk assessments (e.g. different levels of vulnerability between different groups). Interestingly, this contrasts with the review of effec (2002) in Oliver *et al.* (ibid) which suggests that simple advisory messages about swimming can be highly effective (see above).

²⁸ https://www.thebeachguide.co.uk/best-beaches/blue_flag.htm

Recommendations for bathing water / beach management in Scotland

This part of the literature review responds to *SRQ4.1: what learning or recommendations can be derived from the evidence about the management and assessment of designated bathing water sites in Scotland?* (see Table 2.1).

The literature suggests that characteristics of the beach, types of recreational activities and socio-economic characteristics of the visitors are important factors in determining individuals choices to (i) whether to visit any beach, (ii) if so what type of a beach and (iii) how to react to changes in BWQ. Therefore the empirical research needs to collect information on these.

For health benefits (in terms of avoided health impacts), surveys need to collect information on past health incidence that can be linked (even if self-reported) to BWQ and risk factors such as whether individuals undertake immersive activities.

For the importance of signs about BWQ – preferences seem to be for simpler signs. The detail of such preferences can be discussed in a focus group. For the economic valuation survey, the topic is of importance if seeing a sign makes a visitor change their mind about visiting that site again. This will need to be tested.

In terms of the social and cultural benefits, qualitative approaches could be more appropriate as there will be more time, for example in a focus group than in an on-site survey, to delve deeper into issues.

It is important to note that this review and wider study adopts an anthropocentric approach in the identification of bathing water benefits. However, there may be unintended negative impacts on the environment emerging as a result of an increase in visitor numbers which could be the result of, an improvement in BWQ.

Using information on beach value(s) to inform management

Reliable estimates of the value of bathing waters and the range of benefits provided are important for planning facilities, determining access and transport capacity, estimating the potential for new business development and for pollution / litter control and management (Ballance *et al.*, 2000). The logic behind this approach is clear; understanding the value of a given bathing water site can help to inform the nature and scope of the necessary facilities. However, as Morgan (1999) and Vaz *et al.* (2009) point out, some more rural / remote sites can be highly valued precisely because they have few amenities and facilities (see Part 5) so the type of values used to inform management need to be considered carefully (e.g. monetary alone vs, wider socio-cultural values). Hynes *et al.* (2013) illustrate the importance of value informing management at the local level (similarly to Ballance *et al.*, 2000) and a more aggregate national level. National level assessments of costs and benefits of bathing water management are important for identifying cost-effective ways of implementing the revised BWD (i.e. if the costs outweigh the benefits then bathing water designation may not be viable). This type of cost-benefit oriented

approach is also suggested by McKenna *et al.* (2011). In a related point, Nordstrom and Mitteager (2001), cited in Tudor and Williams (2006), suggest that maintenance of beach quality (i.e. a cost) should be seen as an investment in the local economy.

As well as value, information on the type / range of recreational user groups that make use of a particular beach / bathing water can be useful informing management of the beach (Morgan, 1999; Phillips and House, 2009; McKenna *et al.*, 2011; Hynes *et al.*, 2013). This is driven by practical concerns over safety; e.g. targeting BWQ improvement investment at sites of high use in terms of immersion and on-water recreational activities (Hynes *et al.*, 2013). However, it is also driven by concerns over the need to consider carefully the needs and values of specific user-groups and the attributes and facilities they look for in a site (*ibid*); e.g. the points raised by Morgan (1999) and Vaz *et al.* (2009) concerning the preferences and values of people who frequent more remote / rural beaches. With a more general approach, Phillips and House (2009) suggest that beach management strategies should be based on local characteristics and the associated tourism offer / markets, including an understanding of the motivating factors behind beach visits (see Part 5).

The role of beach awards and the rBWD as management devices

Whilst McKenna *et al.* (2011) suggest that the value of beach awards is questionable (including on the basis of testimony from beach management authorities in Scotland), they suggest that the award procedure can provide a useful template for management and the status that comes with having an award can provide leverage when competing for funding / resources. Further, evidence from France suggests that BWQ is the only real 'pull factor' determining beach choice, the inference being that the rBWD can be used as a key driver of management aimed towards BWQ improvements (*ibid*).

The role of signage and information provision

Signage and information provision can play a key role in the day-to-day management of bathing water sites in terms of peoples' interaction with water and associated risks (Oliver *et al.*, 2016). Shepherd (2014) drew a number of conclusions concerning the effective use of signage in this regard: (1) beach signs and information on BWQ should be more interactive, especially in terms of helping to engage children; (2) increasing the space on beach signs allocated to BWQ issues could increase awareness; and (3) there is a need for better use of social media to communicate information on BWQ issues.

Appendix 1: References

- Accent (2010). Review of Stated Preference and Willingness to Pay Methods. Report prepared in association with RAND Europe. Final report submitted to Scottish Water, Accent Ltd, Scotland.
- Ashbullby, K. J., Pahl, S., Webley, P., & White, M. P. (2013). The beach as a setting for families' health promotion: A qualitative study with parents and children living in coastal regions in Southwest England. *Health & Place*, 23, 138-147.
- Austin, J. C., Anderson, S., Courant, P. N., & Litan, R. E. (2007). America's North Coast: a benefit-cost analysis of a program to protect and restore the Great Lakes. *Ann Arbor, MI: Healing our Waters—Great Lakes Coalition*.
- Ballance, A., Ryan, P. G., & Turpie, J. K. (2000). How much is a clean beach worth? The impact of litter on beach users in the Cape Peninsula, South Africa. *South African Journal of Science*, 96(5), 210–213.
- Bodin, M., & Hartig, T. (2003). Does the outdoor environment matter for psychological restoration gained through running?. *Psychology of sport and exercise*, 4(2), 141-153.
- Bonaiuto, M., Breakwell, G. M., & Cano, I. (1996). Identity processes and environmental threat: The effects of nationalism and local identity upon perception of beach pollution.
- Brajša-Žganec, A., Merkaš, M., & Šverko, I. (2011). Quality of life and leisure activities: How do leisure activities contribute to subjective well-being?. *Social Indicators Research*, 102(1), 81-91.
- Brown, C., Corcoran, E., Herkenrath, P., & Thonell, J. (2006). Marine and coastal ecosystems and human well-being: synthesis.
- Cascade Consulting and eftec (2009). Revised Bathing Water Directive Impact Assessment RERAD/007/08: Achieving Compliance with Microbial Standards. For the Scottish Government.
- Coombes, E. G., & Jones, A. P. (2010). Assessing the impact of climate change on visitor behaviour and habitat use at the coast: A UK case study. *Global Environmental Change*, 20(2), 303–313.
<https://doi.org/10.1016/j.gloenvcha.2009.12.004>
- Climate Change & European Marine Ecosystem Research [CLAMER] (2011). Report on European public awareness and perception of marine climate change risks and impacts. *FP7 PROJECT: CLAMER (www.clamer.eu) DELIVERABLE 2.2*.
- Czajkowski, M., Hanley, N., & Lariviere, J. (2015). The effects of experience on preferences: Theory and empirics for environmental public goods. *American Journal of Agricultural Economics*, 97(1), 333–351.
<https://doi.org/10.1093/ajae/aau087>
- Duck, R. W., Phillips, M. R., Williams, A. T., & Wadham, T. (2009). Is beach scenic quality a function of habitat diversity?. *Journal of coastal research*, 415-418.
- eftec (2002). Valuation of Benefits to England and Wales of a Revised Bathing Water Quality Directive and Other Beach Characteristics Using the Choice Experiment Methodology, (June), 97.
- eftec, Ipsos MORI & The South West Research Company (2014). Bathing Water Valuation Study. Technical report to the Environment Agency. December 2014.

(unpublished).

- European Environment Agency [EEA] (2015). *European bathing water quality in 2014. European Environment Agency Reports*. <https://doi.org/10.2800/1804>
- Fife Coast and Countryside Trust (2007). Fife Coast and Countryside Trust Usage and Impact Study – Fife Coastal Path Final Report JN: 145629. Report produced by TNS. Retrieved from <http://fifecoastandcounsidetrust.co.uk/userfiles/Fife%20Coastal%20Path%20Study%20-%20Final%20Report%20-%20FV%2018%2005%2009.pdf>
- Fife Council (2000). Economic Impact of visits to the Fife Countryside. Report prepared by System Three
- Fleming, L.E., McDonough, N., Austen, M., Mee, L., Moore, M., Hess, P., Depledge, M.H., White, M., Philippart, K., Bradbrook, P. & Smalley, A. (2014). Oceans and Human Health: A rising tide of challenges and opportunities for Europe. *Marine Environmental Research*, 99, 16–19. <https://doi.org/10.1016/j.marenvres.2014.05.010>
- Geoff Broom Associates (2000). Ceredigion Tourism Local Area Tourism Model - Final report 2000
- GESAMP [IMO/FAO/UNESCO-IOC/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection] (2015). Sources, fate and effects of microplastics in the marine environment: a global assessment. Reports and Studies GESAMP No. 90, 96.
- GESAMP [IMO/FAO/UNESCO-IOC/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection] (2001). A sea of troubles. Reports and Studies GESAMP No. 70, 35.
- Ghermandi, A., Nunes, P. A., Portela, R., Nalini, R., & Teelucksingh, S. S. (2010). Recreational, Cultural and Aesthetic Services from Estuarine and Coastal Ecosystems. FEEM Working Paper No. 121.2009.
- Gillespie, P. R., Hynes, S., & Reilly, P. O. (2016). Valuing the Waterville Fishery : A travel cost analysis of anglers ' recreational use -values, 1–17.
- Glenk, K., Lago, M., & Moran, D. (2011). Public preferences for water quality improvements: implications for the implementation of the EC Water Framework Directive in Scotland. *Water Policy*, 13(5), 645-662.
- Great Britain Day Visits Survey [GBDVS] (2015). The GB Day Visitor Statistics 2015. Retrieved from https://www.visitbritain.org/sites/default/files/vb-corporate/Documents-Library/documents/England-documents/gbdvs_annual_report_2015_13.06.16.pdf
- Hanley, N., Bell, D., & Alvarez-Farizo, B. (2003). Valuing the benefits of coastal water quality improvements using contingent and real behaviour. *Environmental and resource economics*, 24(3), 273-285.
- Harris, J. M., & Roach, B. (2013). *Environmental and natural resource economics: A contemporary approach*. ME Sharpe.
- Hipp, J. A., & Ogunseitan, O. A. (2011). Effect of environmental conditions on perceived psychological restorativeness of coastal parks. *Journal of Environmental Psychology*, 31(4), 421–429. <https://doi.org/10.1016/j.jenvp.2011.08.008>
- Howell, A. J., Dopko, R. L., Passmore, H. A., & Buro, K. (2011). Nature connectedness: Associations with well-being and mindfulness. *Personality and Individual Differences*, 51(2), 166–171.

- <https://doi.org/10.1016/j.paid.2011.03.037>
- Hug, S.-M., Hartig, T., Hansmann, R., Seeland, K., & Hornung, R. (2009). Restorative qualities of indoor and outdoor exercise settings as predictors of exercise frequency. *Health & Place*, 15
- Hynes, S., Tinch, D., & Hanley, N. (2013). Valuing improvements to coastal waters using choice experiments: An application to revisions of the EU Bathing Waters Directive. *Marine Policy*, 40(1), 137–144.
<https://doi.org/10.1016/j.marpol.2012.12.035>
- Johnston, R.J., Boyle, K.J., Adamowicz, W., Bennett, J., Brouwer, R., Cameron, T.A., Hanemann, W.M., Hanley, N., Ryan, M., Scarpa, R. & Tourangeau, R. (2017). Contemporary Guidance for Stated Preference Studies. *Journal of the Association of Environmental and Resource Economists*, 4(2), 319–405.
<https://doi.org/10.1086/691697>
- Kaplan, R., & Kaplan, S. (1989). *The experience of nature: A psychological perspective*. New York, NY: Cambridge University Press.
- Keep Scotland Beautiful (2004). Our beaches & seas - keeping them clean. Firth of Clyde Forum Seminar 21 March 2005. Retrieved from <http://www.clydemarineplan.scot/wp-content/uploads/2016/06/Our-beaches-seas.pdf>
- King, S., Exley, J., Winpenny, E., Alves, L., Henham, M. L., & Larkin, J. (2015). The Health Risks of Bathing in Recreational Waters: A Rapid Evidence Assessment of Water Quality and Gastrointestinal Illness. *Rand Health Quarterly*, 4(August), 5. Retrieved from <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&D=prem&AN=28083352>
- Kyle, G., Graefe, A., Manning, R., & Bacon, J. (2004). Effects of place attachment on users' perceptions of social and environmental conditions in a natural setting. *Journal of environmental psychology*, 24(2), 213-225.
- Land Use Consultants [LUC] (2016). Scottish Marine Recreation and Tourism Survey 2015, (March). Retrieved from <http://www.gov.scot/Topics/marine/seamanagement/national/RecandTourism>
- Land Use Consultants [LUC] (2015). Valuing marine tourism and recreation. Literature review, data review and recommendations for survey. For Marine Scotland.
- McKenna, J., Williams, A. T., & Cooper, J. A. G. (2011). Blue Flag or Red Herring: Do beach awards encourage the public to visit beaches? *Tourism Management*, 32(3), 576–588. <https://doi.org/10.1016/j.tourman.2010.05.005>
- Millennium Ecosystem Assessment [MEA] (2005). Ecosystems and Human Well-being. Millennium Ecosystem Assessment, 2005. Ecosystems and Human Well-being: Synthesis.
- Morgan, R. (1999). Preferences and Priorities of Recreational Beach Users in Wales. *Journal of Coastal Research* 15(3), 653–667.
- Morrissey, K., & Moran, C. (2011). The Non-Market Value of Water Based Activities in the West of Ireland.
- Nahman, A., & Rigby, D. (2008). Valuing blue flag status and estuarine water quality in Margate, South Africa. *South African journal of economics*, 76(4), 721-737.

- Nordstrom, K. F. & Mitteager, W. A. (2001). Perceptions of the value of natural and restored beach and dune characteristics by high school students in New Jersey, USA. *Ocean and Coastal Management* 44(7), 545-559.
- Oliver, D.M., Hanley, N.D., van Niekerk, M., Kay, D., Heathwaite, A.L., Rabinovici, S.J., Kinzelman, J.L., Fleming, L.E., Porter, J., Shaikh, S. & Fish, R. (2016). Molecular tools for bathing water assessment in Europe: Balancing social science research with a rapidly developing environmental science evidence-base. *Ambio*, 45(1), 52–62. <https://doi.org/10.1007/s13280-015-0698-9>
- Oxfam. (2012). Humankind Index. *Oxfam UK Website - Policy & Practice*. Retrieved from <http://policy-practice.oxfam.org.uk/our-work/poverty-in-the-uk/humankind-index>
- Potts, T., O'Higgins, T., Mee, L. & Pita, C. (2011). Public perceptions of Europe's Seas - A Policy Brief. EU FP7 KNOWSEAS Project. ISBN 0-9529089-3-X
- Phillips, M. R., & House, C. (2009). An evaluation of priorities for beach tourism: Case studies from South Wales, UK. *Tourism Management*, 30(2), 176–183. <https://doi.org/10.1016/j.tourman.2008.05.012>
- Ravenscroft, N. & Church, A. (2011). The attitudes of recreational user representatives to pollution reduction and the implementation of the WFD. <https://doi.org/10.1017/CBO9781107415324.004>
- Reed, M. & Buckmaster, S. (2015). Public perceptions and behaviours towards the water environment Lessons for theory, communication and action. Prepared for WWF-UK.
- Rögnvaldsdóttir, L. B. (2016). Economic effects of tourism: Analysis at the subnational level in Iceland.
- Russell, J.A. (1980). A circumplex model of affect. *Journal of personality and social psychology* 39 (6).
- Scotland's Environment (2015). Health and Wellbeing.
- Scottish Environment Protection Agency [SEPA] (2013). Scottish bathing waters 2012-2013, 9–17. Retrieved from <http://www.sepa.org.uk/media/39112/scottish-bathing-waters-report-2012-2013.pdf>
- Scottish Government (2005). Introduction to TSA. Retrieved from <http://www.gov.scot/Topics/Statistics/18300/12608> [Accessed June 2017].
- Scottish Government (2008). The Bathing Waters (Scotland) Regulations 2008 No. 170.
- Scottish Government. (2012). Mental Health Strategy for Scotland : 2012-2015, 60. Retrieved from <http://www.scotland.gov.uk/Resource/0039/00398762.pdf>
- Scottish Government (2015). Economic Impact Assessment of the Commonwealth Games 2014: Summary of Methods Used. Retrieved from <http://www.gov.scot/Resource/0049/00495122.docx> [Accessed June 2017].
- Scottish Government (2016). Input-Output Tables and Multipliers for Scotland. Retrieved from <http://www.gov.scot/Topics/Statistics/Browse/Economy/Input-Output> [Accessed June 2017]
- Surrey Research Group (1993). Scottish Tourism Multiplier Study 1992. Edinburgh: HMSO.
- Shepherd, J. (2014). Bathing water quality : public perception and awareness, (2), 38–58.
- Tudor, D. T. & Williams, A. T. (2006). A rationale for beach selection by the public on the coast of Wales , UK, 38(2), 153–164.

- Turbow, D., Lin, T. H., & Jiang, S. (2004). Impacts of beach closures on perceptions of swimming-related health risk in Orange County, California. *Marine Pollution Bulletin*, 48(1–2), 132–136. [https://doi.org/10.1016/S0025-326X\(03\)00371-0](https://doi.org/10.1016/S0025-326X(03)00371-0)
- Vanclay, F. (2002). Conceptualising social impacts. *Environmental Impact Assessment Review*, 22(3), 183–211. [https://doi.org/10.1016/S0195-9255\(01\)00105-6](https://doi.org/10.1016/S0195-9255(01)00105-6)
- Vaz, B., Williams, A. T., Pereira, C., Silva, D., & Phillips, M. (2009). The importance of user's perception for beach management. *Journal of Coastal Research (Journal of Coastal Research SI Proceedings) Journal of Coastal Research SI*, 56(56), 1164–1168.
- VisitScotland (2016). Coastal Tourism in Scotland. Insights Department Topic Paper. Retrieved from <http://www.moraychamber.co.uk/wp-content/uploads/2016/10/CoastalTourisminScotlandTopicPaper2016.pdf>
- Watson, R., Albon, S., Aspinall, R., Austen, M., Bardgett, B., Bateman, I., Berry, P., Bird, W., Bradbury, R., Brown, C. & Bulloch, J. (2011). *UK National Ecosystem Assessment: Technical Report*. United Nations Environment Programme World Conservation Monitoring Centre.
- Wales Tourist Board (2001). UK Annual Tourism Survey WTB, Cardiff.
- White, M. P., Alcock, I., Wheeler, B. W., & Depledge, M. H. (2013a). Coastal proximity, health and well-being: results from a longitudinal panel survey. *Health & place*, 23, 97-103.
- White, M. P., Pahl, S., Ashbullby, K., Herbert, S., & Depledge, M. H. (2013b). Feelings of restoration from recent nature visits. *Journal of Environmental Psychology*, 35, 40-51.
- Wilson, M. I., Robertson, L. D., Daly, M., & Walton, S. A. (1995). Effects of visual cues on assessment of water quality. *Journal of Environmental Psychology*, 15(1), 53-63.
- World Health Organisation [WHO] (2003). Guidelines for safe recreational water. Volume 1, coastal and fresh waters. *Risk Management*, 1, 253.
- Wyles, K. J., Pahl, S., Holland, M., & Thompson, R. C. (2017). Can Beach Cleans Do More Than Clean-Up Litter? Comparing Beach Cleans to Other Coastal Activities. *Environment and Behavior*, 1391651664941. <https://doi.org/10.1177/0013916516649412>
- Wyles, K. J., Pahl, S., Thomas, K., & Thompson, R. C. (2016). Factors That Can Undermine the Psychological Benefits of Coastal Environments. *Environment and Behavior*, 48(9), 1095–1126. <https://doi.org/10.1177/0013916515592177>
- Wyles, K. J., Pahl, S., & Thompson, R. C. (2014). Perceived risks and benefits of recreational visits to the marine environment: Integrating impacts on the environment and impacts on the visitor. *Ocean and Coastal Management*, 88, 53–63. <https://doi.org/10.1016/j.ocecoaman.2013.10.005>
- Zhang, J. W., Howell, R. T., & Stolarski, M. (2013). Comparing Three Methods to Measure a Balanced Time Perspective: The Relationship Between a Balanced Time Perspective and Subjective Well-Being. *Journal of Happiness Studies*, 14(1), 169–184. <https://doi.org/10.1007/s10902-012-9322-x>

Appendix 2: Summary of literature reviewed

Source details				Relevant headline research questions				Peer reviewed? 29
Author(s)	Title	Published in / by	Year	RQ1	RQ2	RQ3	RQ4	
Ballance, A., Ryan, P. G., and Turpie, J. K.	How much is a clean beach worth? The impact of litter on beach users in the Cape Peninsula, South Africa	<i>South African Journal of Science</i>	2000	✓	✓	✓	✓	✓
Bonaiuto, M., Breakwell, G. M., and Cano, I.	Identity processes and environmental threat: The effects of nationalism and local identity upon perception of beach pollution	<i>Journal of Community & Applied Social Psychology</i>	1996	✗	✓	✗	✗	✓
Cascade Consulting and eftec	Revised Bathing Water Directive Impact Assessment RERAD/007/08: Achieving Compliance with Microbial Standards	Scottish Government	2009	✗	✓	✓	✗	✗
Coombes, E. G., and Jones, A. P.	Assessing the impact of climate change on visitor behaviour and habitat use at the coast: A UK case study	<i>Global Environmental Change</i>	2010	✓	✓	✗	✗	✓
Czajkowski, M., Hanley, N. and LaRiviere, J.	The effects of experience on preference uncertainty: Theory and empirics for public and quasi-public environmental goods	<i>American Journal of Agricultural Economics</i>	2015	✗	✗	✓	✗	✓
eftec	Valuation of Benefits to England and Wales of a Revised Bathing Water Quality Directive and Other Beach Characteristics Using the Choice Experiment Methodology	Department for Environment, Food and Rural Affairs (Defra)	2002	✗	✓	✓	✗	✗

²⁹ Sources have been categorised as 'peer reviewed' only where there is clear evidence that this is the case (i.e. publications in peer-reviewed journals). We acknowledge that grey literature sources may have gone through a substantial peer review process, however, it was not possible to evidence this as part of the literature review undertaken.

Source details				Relevant headline research questions				Peer reviewed? 29
Author(s)	Title	Published in / by	Year	RQ1	RQ2	RQ3	RQ4	
eftec, Ipsos MORI and The South West Research Company	Bathing water valuation study for the Environment Agency	Environment Agency	2014	x	x	✓	✓	x
GESAMP	Sources, fate and effects of microplastics in the marine environment: A global assessment	Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP)	2015	✓	✓	x	x	x
Ghermandi, A., Nunes, P. A., Portela, R., Nalini, R., and Teelucksingh, S. S.	Recreational, cultural and aesthetic services from estuarine and coastal ecosystems	Fondazione Eni Enrico Mattei (FEEM)	2010	✓	x	✓	x	x
Gillespie, P. R., Hynes, S., and O'Reilly, P.	Valuing the Waterville fishery: A travel cost analysis of anglers' recreational use-values	Conference proceedings: 90 th Annual Conference of the Agricultural Economics Society	2016	✓	x	✓	x	x
Hanley, N., Bell, D., and Alvarez-Farizo, B.	Valuing the benefits of coastal water quality improvements using contingent and real behaviour	<i>Environmental and Resource Economics</i>	2003	x	x	✓	x	✓
Hipp, J. A., and Ogunseitan, O. A.	Effect of environmental conditions on perceived psychological restorativeness of coastal parks	<i>Journal of Environmental Psychology</i>	2011	✓	✓	x	x	✓
Hynes, S., Tinch, D., and Hanley, N.	Valuing improvements to coastal waters using choice experiments: An application to revisions of the EU Bathing Waters Directive	<i>Marine Policy</i>	2013	✓	x	✓	✓	✓

Source details				Relevant headline research questions				Peer reviewed? 29
Author(s)	Title	Published in / by	Year	RQ1	RQ2	RQ3	RQ4	
Johnston, R.J., Boyle, K.J., Adamowicz, W., Bennett, J., Brouwer, R., Cameron, T.A., Hanemann, W.M., Hanley, N., Ryan, M., Scarpa, R. and Tourangeau, R.	Contemporary Guidance for Stated Preference Studies	<i>Journal of the Association of Environmental and Resource Economists</i>	2017	x	x	✓	x	✓
McKenna, J., Williams, A. T., and Cooper, J. A. G.	Blue flag or red herring: Do beach awards encourage the public to visit beaches?	<i>Tourism Management</i>	2011	x	✓	✓	✓	✓
Morgan, R.	Preferences and priorities of recreational beach users in Wales, UK	<i>Journal of Coastal Research</i>	1999	✓	✓	x	✓	✓
Morrissey, K., and Moran, C.	The Non-Market Value of Water Based Activities in the West of Ireland	National University of Ireland SEMRU Working Paper	2011	✓	x	x	x	x
Oliver, D. M., Hanley, N. D., van Niekerk, M., Kay, D., Heathwaite, A. L., Rabinovici, S. J., Kinzelman, J. L., Fleming, L. E., Porter, J., Shaikh, S. and Fish, R.,	Molecular tools for bathing water assessment in Europe: Balancing social science research with a rapidly developing environmental science evidence-base	<i>Ambio</i>	2016	✓	✓	✓	x	✓
Phillips, M. R., and House, C.	An evaluation of priorities for beach tourism: Case studies from South Wales, UK	<i>Tourism Management</i>	2009	✓	✓	x	✓	✓

Source details				Relevant headline research questions				Peer reviewed? 29
Author(s)	Title	Published in / by	Year	RQ1	RQ2	RQ3	RQ4	
Ravenscroft, N., and Church, A.	The attitudes of recreational user representatives to pollution reduction and the implementation of the European Water Framework Directive	<i>Land Use Policy</i>	2011	✗	✓	✗	✗	✓
Reed, M., and Buckmaster, S.	Public perceptions and behaviours towards the water environment: Lessons for theory, communication and action	WWF	2015	✓	✓	✗	✗	✗
Rögnvaldsdóttir, L. B.	Economic effects of tourism: Analysis at the subnational level in Iceland	MSc Thesis, University of Iceland	2016	✗	✗	✓	✗	✗
Shepherd, J.	Bathing water quality: public perception and awareness	<i>The Plymouth Student Scientist</i>	2014	✗	✓	✗	✓	✓
Tudor, D. T., and Williams, A. T.	A rationale for beach selection by the public on the coast of Wales, UK	<i>Area</i>	2006	✓	✓	✗	✗	✓
Vaz, B., Williams, A. T., Silva, C. P. D., and Phillips, M.	The importance of user's perception for beach management	<i>Journal of Coastal Research</i>	2009	✗	✓	✗	✗	✓
Wilson, M. I., Robertson, L. D., Daly, M., and Walton, S. A.	Effects of visual cues on assessment of water quality	<i>Journal of Environmental Psychology</i>	1995	✗	✓	✗	✗	✓
Wyles, K. J., Pahl, S., and Thompson, R. C.	Perceived risks and benefits of recreational visits to the marine environment: Integrating impacts on the environment and impacts on the visitor	<i>Ocean and Coastal Management</i>	2014	✓	✗	✗	✓	✓
Wyles, K. J., Pahl, S., Thomas, K., and Thompson, R. C.	Factors that can undermine the psychological benefits of coastal environments: Exploring the effect of tidal state, presence, and type of litter	<i>Environment and Behavior</i>	2016	✓	✗	✓	✗	✓

Source details				Relevant headline research questions				Peer reviewed? 29
Author(s)	Title	Published in / by	Year	RQ1	RQ2	RQ3	RQ4	
Wyles, K.J., Pahl, S., Holland, M., and Thompson, R. C.	Can Beach Cleans Do More Than Clean-Up Litter? Comparing Beach Cleans to Other Coastal Activities	<i>Environment and Behavior</i>	2016	✓	✗	✗	✗	✓



© Crown copyright 2018

You may re-use this information (excluding logos and images) free of charge in any format or medium, under the terms of the Open Government Licence. To view this licence, visit <http://www.nationalarchives.gov.uk/doc/open-government-licence/> or e-mail: psi@nationalarchives.gsi.gov.uk. Where we have identified any third party copyright information you will need to obtain permission from the copyright holders concerned.

The views expressed in this report are those of the researcher and do not necessarily represent those of the Scottish Government or Scottish Ministers.

This document is also available from our website at www.gov.scot.
ISBN: 978-1-78781-130-0

The Scottish Government
St Andrew's House
Edinburgh
EH1 3DG

Produced for
the Scottish Government
by APS Group Scotland
PPDAS451287 (08/18)
Published by
the Scottish Government,
August 2018



Social Research series
ISSN 2045-6964
ISBN 978-1-78781-130-0

Web and Print Publication
www.gov.scot/socialresearch

PPDAS451287 (08/18)