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Rocky Shores: From Habitat Threat to Marine Awareness & Well-Being Benefits

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**Rocky Shores:
From Perceived Habitat Threat to
Marine Awareness and Well-Being
Benefits**

By

Kayleigh J. Wyles

A thesis submitted to Plymouth University in partial
fulfilment of the degree of

Doctor of Philosophy

School of Psychology
Plymouth University

January 2014

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Abstract

Rocky Shores: From Habitat Threat to Marine Awareness & Well-Being Benefits

Kayleigh J. Wyles

Previous psychological research has demonstrated the benefits of visiting natural environments, especially coastal areas. However, research within Marine Biology has shown that such visits can harm natural habitats. Consequently, this thesis uses an integrative approach to examine both the risks to the environment and benefits to the human visitors in the context of rocky shores (intertidal areas where solid rock predominates). This was investigated using seven studies that involved a range of methods. Perception-based surveys (Studies 1 & 2) explored the perceived impacts on the visitor, and the potential impacts these visits can have on the rocky shore. Study 3 then examined the impacts on visitors' well-being & marine awareness directly using a before-after survey on current visitors to two rocky shores. The most prominent habitat threat (leaving rubbish) was then examined in greater detail. Studies 4 and 5 examined the effects of marine litter on individuals' well-being using two laboratory experimental designs; comparing individuals' quantitative (Study 4) and qualitative (Study 5) responses to natural and littered shores. The final two studies then focused on an activity that reduces marine litter: Study 6 adopted a pre-post design to examine the benefits of engaging in beach cleans for current volunteers, whilst Study 7 used an experimental design comparing beach cleans with two other coastal activities on a more naïve sample. Overall, these studies provide evidence that experiencing rocky shores are beneficial for well-being and marine awareness. Counteracting such benefits, litter left behind after recreational visits were found to be detrimental to individuals' well-being. As one potential solution to this issue, beach cleans were found to have the same, and additional beneficial effects on the individual as other coastal activities. Thus, activities which have a relatively positive impact on the environment can also have similar if not additional benefits to the visitor. This programme of research shows the importance of taking a holistic, integrative approach that takes into account both the risks to the environment and benefits to the individual resulting from recreational visits to natural environments.

Table of Contents

ABSTRACT.....	3
TABLE OF CONTENTS	5
LIST OF TABLES.....	10
LIST OF FIGURES	12
ACKNOWLEDGEMENTS	15
AUTHOR’S DECLARATION	16
CHAPTER 1 – General Introduction & Context.....	20
1.1 Rocky Shores: An Introduction	21
1.2 Rocky Shores: Societal Importance.....	23
1.3 Rocky Shores: Anthropogenic Stressors	25
1.4 An Integrative Approach to Rocky Shores	29
CHAPTER 2 – Psychological Impacts of Experiencing the Coast	33
2.1 Health and Well-Being Benefits of Nature.....	34
2.1.1. Physiological Benefits.....	35
2.1.2. Psychological Benefits	36
2.1.3. The Research Paradigm.....	37
2.1.4. Theoretical Explanation	38
2.1.5. Types of Nature Exposure.....	39
2.1.6. Visit Characteristics and Individual Differences.....	41
2.1.7. Type of Nature Environment.....	44
2.1.8. Summary & Conclusion.....	48
2.2 Marine Awareness.....	49
2.2.1. The Concept of Marine Awareness	49
2.2.2. The Public’s Level of Marine Awareness	51
2.2.3. Sources of Information.....	53
2.2.4. Summary & Conclusion	56
2.3 Thesis Preview	57

CHAPTER 3 – Perceived Risks and Benefits of Recreational Visits to Rocky Shores: Integrating Impacts on the Environment and Impacts on the Visitor	58
3.1 Introduction	58
3.1.1. Literature Review	59
3.1.2. Present Studies.....	62
3.2 Study 1: Coastal Users’ and Coastal Experts’ Perceptions.....	63
3.2.1. Method.....	63
3.2.2. Results	68
3.2.3. Discussion.....	75
3.3 Study 2: International Academics’ Perceptions.....	77
3.3.1. Method.....	77
3.3.2. Results	79
3.4 General Discussion	82
3.4.1. Conclusion.....	86
CHAPTER 4 – The Rocky Shore Experience: A Field Study Examining the Psychological Benefits of Recreational Visits.....	87
4.1 Introduction	87
4.1.1. Literature Review	88
4.1.2. Present Study	92
4.2 Study 3: An Exploratory Field Study	93
4.2.1. Method.....	93
4.2.2. Results	100
4.3 General Discussion	106
4.3.1. Conclusion.....	111
CHAPTER 5 – Examining the Impacts of Different Types of Litter on Visitors’ Well-Being When Experiencing Rocky Shores.....	112
5.1 Introduction	112
5.1.1. The (Clean) Natural Environment	113
5.1.2. The Littered Natural Environment.....	114
5.1.3. Present Studies.....	117
5.2 Study 4: Does Litter have an Impact?	118
5.2.1. Method.....	118
5.2.2. Results	123
5.2.3. Discussion.....	129

5.3	Study 5: Why Does Litter have an Impact?	129
5.3.1.	Method	130
5.3.2.	Results	132
5.4	General Discussion	140
5.4.1.	Conclusion	146
CHAPTER 6 – What are the Benefits to the Volunteers? Comparing Beach Cleans to Other Coastal Activities		148
6.1	Introduction	148
6.1.1.	Literature Review	149
6.1.2.	Present Studies	154
6.2	Study 6: Current Volunteers’ Experiences	155
6.2.1.	Method	156
6.2.2.	Results	160
6.2.3.	Discussion	162
6.3	Study 7: Comparing Beach Cleans to Other Activities	163
6.3.1.	Method	163
6.3.2.	Results	175
6.4	General Discussion	181
6.4.1.	Conclusion	187
CHAPTER 7 – General Discussion		189
7.1	Theoretical Implications	192
7.1.1.	Stage 1: Well-Being Benefits of Rocky Shore Recreational Visits.....	192
7.1.2.	Stage 2: Marine Awareness Benefits of Rocky Shore Recreational Visits	195
7.1.3.	Stage 3: Habitat Threats Associated with Rocky Shore Visits.....	196
7.1.4.	Stage 4: Impacts of Habitat Threat on Well-Being	197
7.1.5.	Stage 5: Impacts of Activities Addressing Habitat Threats on Well-Being and Marine Awareness	199
7.2	Methodological Limitations and Future Research	202
7.2.1.	Challenges Faced by the Integrative Approach.....	202
7.2.2.	Challenges Faced by the Individual Components of the Model.....	205
7.3	Practical Implications	210
7.4	Conclusion	211
REFERENCES		212

APPENDICES	245
Appendix A – List of Acronyms.....	247
Appendix B – Glossary.....	248
Appendix C – Chapter 3: Materials.....	256
An example of the survey administered for Study 1.....	256
An example of the survey administered for Study 2.....	260
Appendix D – Chapter 3: Additional Analyses.....	264
Appendix E – Additional Analyses: Correlations.....	267
Analysis.....	267
Study 1: Coastal experts and coastal users.....	267
Study 2: International academics.....	268
Study 3: Field study on current visitors.....	268
Study 4: Quantitative-focused laboratory study.....	269
Study 5: Qualitative-focused laboratory study.....	269
Study 6: Current beach cleaning volunteers’ experiences.....	270
Study 7: Comparing beach cleans to other activities.....	272
Appendix F – Chapter 4: Materials.....	275
The before-survey given to participants.....	275
The after-survey.....	277
The first page of the activity diary illustrating how it should be completed.....	279
An example of the accompanying map.....	280
The table the data collectors completed.....	281
Appendix G – Chapter 4: Additional Analyses.....	282
Site specific demographics.....	282
Additional non-reported measures.....	282
Additional activity results.....	283
Full regression analyses.....	284
Exploratory mediation analyses.....	287
Appendix H – Chapter 5: Materials.....	289
Stage 1 of Study 4.....	289
Stage 2 of Study 4.....	290
Stage 3 of Study 4.....	293
Stage 1 of Study 5.....	297
Stage 2 of Study 5.....	298
The pool of experimental stimuli.....	303
Appendix I – Chapter 5: Additional Analyses.....	304
Other variables measured.....	304
Additional repeated contrast analysis.....	305
Additional qualitative analysis.....	306
Marine awareness.....	307

Appendix J – Chapter 6: Materials.....	309
Notes given to the organiser / data collector of Study 6.....	309
Before-survey for Study 6.....	310
After-survey for Study 6.....	312
Study 7’s baseline online measures.....	314
Study 7’s baseline paper measures.....	321
Rock pooling notes.....	322
Shore Thing survey.....	325
Beach cleaning materials.....	327
Beach clean survey.....	331
Coastal walk materials.....	332
Study 7’s measures immediately after.....	334
Study 7’s online measures a week after.....	338
Appendix K – Chapter 6: Additional Analyses.....	343
Objective marine litter awareness.....	343
Behavioural intentions.....	347
What are the most important factors?	349
Exploratory mediation analyses.....	350
Appendix L – Summary of Methods and Findings.....	352
Appendix M – Bound Copies of Publications	353

List of Tables

Chapter 1

Table 1.1. <i>A summary of some of the impacts recreational activities on rocky shores can have on the ecosystem.</i>	28
--	----

Chapter 3

Table 3.1. <i>The means (and standard deviations) for the perceived risk to rocky shores associated with each activity overall (n = 122) and separately for the two samples (n coastal experts = 25; n coastal users = 97) for Study 1.</i>	69
--	----

Table 3.2. <i>The observed (and expected) frequency of comments falling into the themes for the qualitative component on impacts on the environment for Study 1.</i>	70
---	----

Table 3.3. <i>The means (and standard deviations) for the impact on the visitor items associated with each activity for the overall sample (n = 122) and for the coastal experts (n = 25) and coastal users (n = 97) in Study 1.</i>	71
---	----

Table 3.4. <i>The observed (and expected) frequency of comments falling into the themes for Study 1 for the additional qualitative component on impacts on the visitor.</i>	73
--	----

Table 3.5. <i>The means (and standard deviations) for the 11 activities according to impact on the environment (perceived risk) and impact on the visitor (perceived change in happiness) for the international academic sample (n = 44) in Study 2.</i>	80
---	----

Table 3.6. <i>The observed (and expected) frequency of comments falling into the themes for the qualitative component on impacts on the environment for Study 2.</i>	81
---	----

Chapter 4

Table 4.1. <i>The means (and standard deviations) for the six popular activities according to both mood and arousal (n activities = 655) in Study 3.</i>	102
---	-----

Table 4.2. <i>The final regression examining the predictive value of activities along with influential demographic and conceptual variables on overall satisfaction (n participants = 209) in Study 3.</i>	105
---	-----

Chapter 5

Table 5.1. <i>The means (and standard deviations) for each rating measure for the four experimental conditions for participants with high (n = 38) and low (n = 41) connectedness to nature in Study 4.</i>	126
Table 5.2. <i>The means, standard deviations and corresponding rank for each rating measure for all ten conditions (n = 79) in Study 4.</i>	128
Table 5.3. <i>The means (and standard deviations) for each measure for the four experimental conditions overall (in bold, n = 19) and for participants with high (n = 11) and low (n = 8) connectedness to nature in Study 5.</i>	134

Chapter 6

Table 6.1. <i>The abundance of litter found on the UK coast according to source (MCS, 2011).</i>	158
Table 6.2. <i>The means (and standard deviations) for subjective marine awareness (MA) and mood for novice volunteers (n = 54) and regular volunteers (n = 33) in Study 6.</i> ..	161
Table 6.3. <i>Demographic information for each activity in Study 7 (n = 90).</i>	165
Table 6.4. <i>The means (and standard deviations) for mood, satisfaction, meaningfulness and overall perceived restorativeness at different times overall (n = 90) and for each activity (n = 30) in Study 7.</i>	175
Table 6.5. <i>The means (and standard deviations) for subjective and objective marine awareness (MA) for the entire sample (in bold, n = 90) and for each activity (n = 30) in Study 7.</i>	178
Table 6.6. <i>The means (and standard deviations) for overall behavioural intention ratings (n = 90) and intention ratings for the individual activities (n = 30) over the different time points for Study 7 (n = 90).</i>	178
Table 6.7. <i>The final regression examining the predictive value of activities along with influential conceptual variables on overall satisfaction (n = 90) in Study 7.</i>	180

Chapter 7

Table 7.1. <i>A summary of the findings in relation to the key aspects of the research model.</i>	191
--	-----

List of Figures

Chapter 1

- Figure 1.1.** The illustrative distribution of rocky shores in the UK based on records from the extensive Joint Nature Conservation Committee (JNCC) marine database (2013) with a photographic example of one in south west England (Wembury).....21
- Figure 1.2.** A diagram illustrating the zonation of a rocky shore and species that can be found in each zone (species photographs taken by Steve Trehwella, Judith Oakley and Peter Barfield respectively).23
- Figure 1.3.** A summary of the current evidence base for a range of services provided by different coastal habitats. Rocky shores (intertidal rock) are highlighted, with cultural services highlighted in yellow (interpreted as psychological well-being) and blue (interpreted as awareness or knowledge) (reproduced from Fletcher et al., 2012).24
- Figure 1.4.** The research model developed to investigate the risks and benefits associated with recreational visits to rocky shores.31

Chapter 2

- Figure 2.1.** The highlighted elements (well-being and marine awareness) of the research model Chapter 2 reviews.33

Chapter 3

- Figure 3.1.** The elements of the research model that Studies 1 and 2 examine.59
- Figure 3.2.** A schematic diagram of the methodological design, with participants completing one of the two pathways, to counteract any order effects.....66
- Figure 3.3.** Activity plots according to impact on the environment (perceived risk, with positive values referring to greater risk) and on the visitor (mood, with positive values referring to great change in positive mood). Fig. a) is for Study 1 with coastal experts and coastal users rating 15 activities ($n = 122$); Fig. b) is for Study 2 with international experts rating 11 activities ($n = 44$).76

Chapter 4

<i>Figure 4.1.</i> The elements of the research model Study 3 explicitly examines.	88
<i>Figure 4.2.</i> The geographic locations and images of the two sites: A: Wembury, B: South Milton Sands	93
<i>Figure 4.3.</i> A schematic diagram of the methodological design, with participants completing a survey before and after their visit to the shore.	96
<i>Figure 4.4.</i> The nine different activities participants engaged in during their visit.	101

Chapter 5

<i>Figure 5.1.</i> The elements of the research model Studies 4 and 5 examine.	113
<i>Figure 5.2.</i> The format for each individual image for the experimental conditions (i) and an example from each of the four experimental conditions (ii): a) clean; b) seaweed; c) fishing-litter; d) public-litter used in Studies 4 and 5.	119
<i>Figure 5.3.</i> Examples of the other natural environments: a) aquatic-only, b) aquatic-green, c) aquatic-urban, d) green-only, e) green-aquatic, and f) green-urban used in Study 4 (from White et al., 2010).	120
<i>Figure 5.4.</i> A schematic diagram of the methodological design, with participants completing one of the two pathways, to counteract any order effects.	122
<i>Figure 5.5.</i> The means (and 95% confidence intervals) for the four well-being measures centred around the mid-point of 5.5 in Study 4 ($n = 79$).	125
<i>Figure 5.6.</i> A schematic diagram of the methodological design for Study 5.	131
<i>Figure 5.7.</i> The means (and 95% confidence intervals) for the four measures in Study 5 ($n = 19$), centred around the mid-point of 5.5.	133

Chapter 6

<i>Figure 6.1.</i> The elements of the research model Studies 6 and 7 examine.	149
<i>Figure 6.2.</i> A schematic diagram of the methodological design, with participants completing surveys before and after the beach cleaning activity.	156
<i>Figure 6.3.</i> The site used for Study 7, located in the south west of England. All activities began at the entrance of the beach (point 1 in B) as shown in A, with the beach clean and rock pool groups continuing down to the shore. The walking group, in contrast, walked	

along the coastal path, as shown with the dotted line in B (background map sourced from Google Maps, 2013). 164

Figure 6.4. A schematic diagram of the methodological design, with participants completing measures before, immediately after and a week after engaging in one of three activities: Beach cleaning (BC), rock pooling (RP) or coastal walking (CW). 166

Figure 6.5. The materials (including bin bags, a sharps box, gloves and a litter picker), and form used for the beach clean citizen science programme (reproduced and modified from images from MCS, 2012b). 167

Figure 6.6. Identification materials, form and descriptive cards used for rock pooling and Shore Thing citizen science programme (Marine Biological Association, 2012). 169

Figure 6.7. The materials used for the intertidal species identification task for the objective marine awareness task on biodiversity. 172

Figure 6.8. Subjective marine awareness overtime overall ($n = 90$) and for the beach clean (BC), rock pooling session (RP) and coastal walk (CW) activities separately in Study 7. 177

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Author's Declaration

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award without prior agreement of the Graduate Committee. Work submitted for this research degree at the Plymouth University has not formed part of any other degree either at Plymouth University or at another establishment.

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The work reported in this thesis complies with the British Psychological Society's (2009) Code of Ethics and Conduct. Thematic ethics approval was granted in December 2010 by the Faculty of Science and Technology at Plymouth University, which addressed all of the methodological procedures described in this thesis. The author also completed and passed Criminal Record Checks for the opportunity to recruit participants under 18 years of age. Risk assessments were also completed on behalf of Plymouth University (for Studies 3 & 7) and the Marine Conservation Society (Study 7).

Relevant scientific seminars and conferences were regularly attended at which work was often presented; courses were attended to develop specific skills and several papers submitted or prepared for publication. See below:

Published Papers

Wyles, K. J., Pahl, S., & Thompson, R. C. (under revision). The detrimental effects of litter: Examining the impacts of different types of litter on visitors' wellbeing.

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 & Coastal Management*, 88, 53-63

Wyles, K. (2012). "I do like to be beside the seaside" – the psychological benefits of coastal visits. *Views (National Trust Magazine)*, 49, 83-84

Papers in Preparation

Wyles, K. J., Pahl, S., Thompson, R. C., White, M., & Schenke, K. (in prep). The coastal experience: A field study examining why people enjoy visiting the coast

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Oral Presentations

Wyles, K., Pahl, S., & Thompson, R. C. (Sept 2013). The impact of marine litter on people's wellbeing. *Biennial Conference in Environmental Psychology, Magdeburg, Germany*

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Pahl, S., Wyles, K., & Thompson, R.C. (July 2012). The detrimental effects of litter: The impact of coastal litter on well-being. *International Conference of Psychology, Cape Town, South Africa.*

Pahl, S., Wyles, K., & Thompson, R.C. (July 2012). Exploring the risks and benefits of visits to marine environments. *World Congress on Risk 2012, Sydney, Australia*

Wyles, K., Pahl, S., Thompson, R.C., & K. Schenke (June 2012). "I do like to be beside the seaside": A field study on the psychological benefits of visiting rocky shores. *22nd IAPS Conference, Glasgow, UK.*

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Wyles, K., Pahl, S., & Thompson, R.C. (September 2011). Integrating impacts on the environment and visitors: An interdisciplinary analysis of activities on rocky shores. *9th Biennial Conference on Environmental Psychology, Eindhoven, Netherlands.*

Wyles, K., Pahl, S., & Thompson, R.C. (July 2011). Integrating impacts on the environment and visitors: An interdisciplinary analysis of activities on rocky shores. *PsyPAG 2011, Bangor, UK.*

Wyles, K., Pahl, S., & Thompson, R.C. (June 2011). Integrating impacts on the environment and visitors: An interdisciplinary analysis of activities on rocky shores. *School Conference, University of Plymouth 2011, Plymouth, UK.*

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Poster Presentations

Wyles, K., Pahl, S., & Thompson, R. C. (Sept 2013). Beach cleans: Good for the environment, but what about the volunteers? *Biennial Conference in Environmental Psychology, Magdeburg, Germany*

Wyles, K., Pahl, S., & Thompson, R. C. (Sept 2013). Sustainable activities for both the environment and the individual: Investigating the impact of activities on the coast. *Biennial Conference in Environmental Psychology, Magdeburg, Germany*

Wyles, K., Pahl, S., & Thompson, R. C. (Sept 2013). Citizen science programmes: Comparing the psychological impacts of different coastal activities. *European Marine Science Educators Association Conference, Plymouth, UK*

Wyles, K., Pahl, S., & Thompson, R. C. (Sept 2013). Beach cleans: Good for the environment, but what about the volunteers? *European Marine Science Educators Association Conference, Plymouth, UK*

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General Introduction & Context

The marine environment is extremely important, for both the biosphere and human survival. Covering over 70% of the Earth, oceans and seas are an indispensable source of food, minerals and fossil energy: They provide a range of biodiverse habitats and account for almost 50% of the world's carbon fixing potential (Department for Environment, Foods and Rural Affairs, 2009). The bridge between this environment and the land is the coast. As an island nation, the UK has over 20,000 km (12,400 miles) of coastline with the most inland point being less than 113 km (70 miles) from the sea. The coastal environment is a valuable economic asset. Coastal tourism is the largest maritime sector regarding employment, accommodating over 300,000 jobs in the UK; and as an industry, is valued to be worth over £10 billion (€12 billion, EU, 2011; Pugh & Skinner, 2002). Just taking into account visits by English citizens, it was estimated that there were just under 0.3 billion visits to the coast in 2012 (Natural England, 2013).

The coastline is a highly variable environment and encompasses a range of habitats. For instance, the intertidal is exposed to both marine and terrestrial conditions according to the state of the tide and is commonly classified according to its substratum (the sediment or underlying substance of the environment). Thus, at the basic level, intertidal areas can be categorised as predominately rock, coarse sediment, sand, mud or mixed (Connor et al., 2004). Approximately 34% of the UK coastline is made up of rocky shorelines (Figure 1.1; Oakley, 2010). Also referred to as littoral rock, this type of shoreline is the transition between marine and terrestrial environments where solid rock predominates (as illustrated in Figure 1.1; Hawkins & Jones, 1992). This type of habitat is biologically valuable and provides a home to a diverse range of organisms. However, like all environments, this ecosystem provides benefits to humans who visit but simultaneously is threatened as a result of these visits. Both the risks and benefits will be reviewed below, after describing rocky shores in further detail.

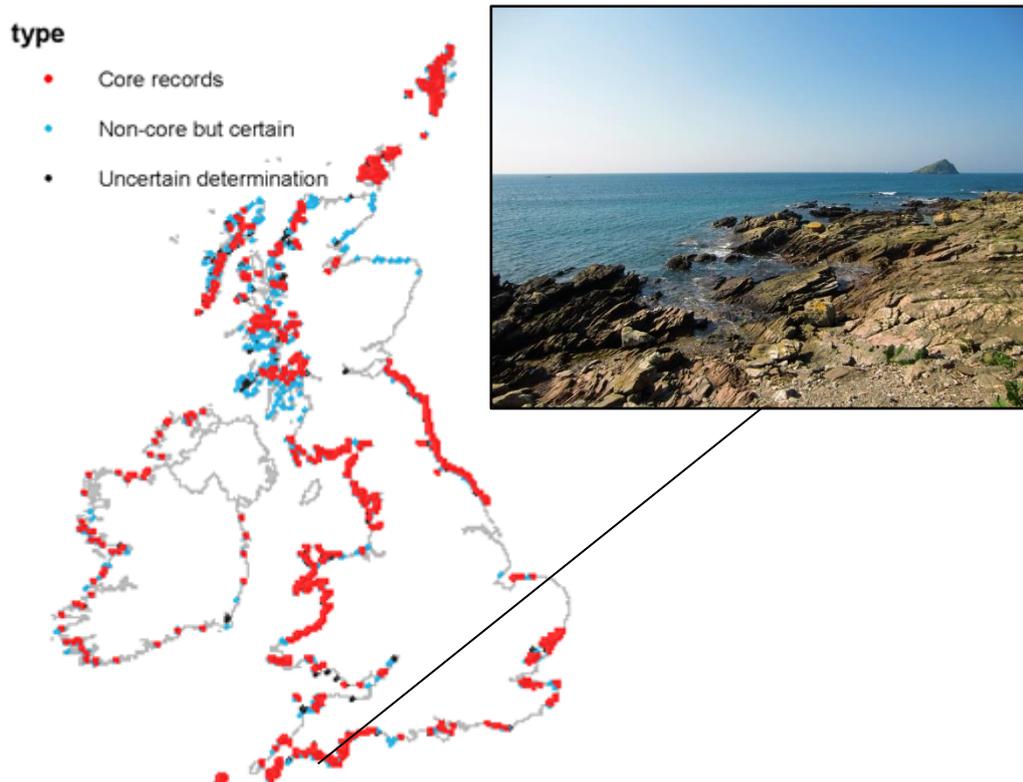


Figure 1.1. The illustrative distribution of rocky shores in the UK based on records from the extensive Joint Nature Conservation Committee (JNCC) marine database (2013) with a photographic example of one in south west England (Wembury; photograph used with permission of the author, all rights reserved).

Note. The colour of the dots refers to the robustness of the evidence regarding the distribution.

1.1 Rocky Shores: An Introduction

Rocky shores can be identified by bedrock (solid rock), boulders, cobbles and pebbles (JNCC, 2013). This prevalent environment is influenced by a number of natural stressors from the land (terrestrial stressors) and the sea (marine stressors), resulting in a complex ecosystem. The composition of individual rocky shores is dependent on a range of physical factors (Barnes & Hughes, 1999), including: Vertical gradient, light availability, degree of wave exposure, changes in temperature, salinity, and biotic features such as biological competition. The vertical gradient refers to the steepness of the shore. In the UK there is a daily tide cycle of two low tides, where the water retreats and returns over roughly a twelve hour period (Hawkins & Jones, 1992). Consequently, species in the intertidal area experience immersion (being in water) and emersion (being out of water) twice a day, with the extent depending on their location on the vertical gradient. In order

to survive, rocky shore organisms selectively reside in an area where they must tolerate this variability and have evolved mechanisms to deal with these intense changes. For example, to reduce water loss whilst being emersed, some species (e.g. barnacles) seal themselves in their shells (Raffaelli & Hawkins, 1996). As well as the tidal cycle, this intertidal area experiences monthly (spring and neap tides), seasonal (for instance with weather), and yearly changes (equinoxes and solstices; Raffaelli & Hawkins, 1996).

Based on the physical characteristics and the habitants, rocky shores can be divided into zones: The sublittoral fringe (lower shore), the eulittoral zone (middle shore) and the littoral fringe (splash zone on the upper shore; see Figure 1.2; Lewis, 1964). For instance, species that can survive greater levels of emersion, such as periwinkles, are commonly found on the littoral fringe; whereas those requiring a more stable immersed environment, such as anemones, are found on the sublittoral fringe (Hawkins & Jones, 1992). Due to the variety of environmental conditions within rocky shores, this environment is typically densely populated by a diverse range of wildlife. This is especially the case for those found in the south west of England, as they attract both Mediterranean and Atlantic species compared to those in the north of the country (Hiscock & Smirthwaite, 2004). For instance, within one rocky shore site in the south west, namely Wembury, 823 different species of plants, animals and fungi were recorded during a 24 hour survey (MarLIN, 2009). Rocky shores are thus an important, highly biodiverse environment with some organisms living close to their levels of tolerance in relation to temperature and desiccation (drying out). As well as its biological relevance, this environment also provides a number of benefits to society.

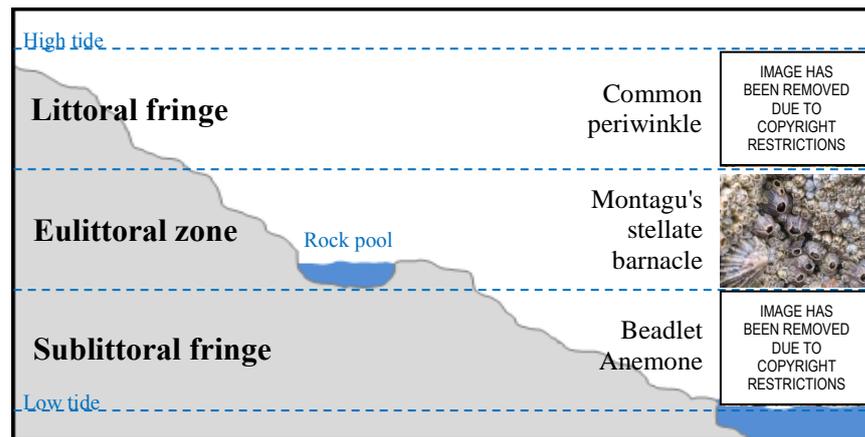


Figure 1.2. A diagram illustrating the zonation of a rocky shore and species that can be found in each zone (species photograph taken by Peter Barfield respectively).

1.2 Rocky Shores: Societal Importance

Rocky shores provide a wealth of ecosystem services, which are outputs of the environment from which people derive benefits (UK National Ecosystem Assessment [NEA], 2011). These benefits in general can be divided into *supporting services*, which are services responsible for the basic infrastructure of life such as primary and secondary production; *regulating services* that refer to the benefits obtained from the regulation of ecosystem processes such as crop pollination and climate regulation; *provisioning services* that focus on the products from the ecosystem such as food and water; and finally, *cultural services* that address the non-material benefits such as recreation, psychological well-being and education (UK NEA, 2011). Rocky shores have been found to provide all of these services. For instance, they contribute to primary and secondary production (supporting services), regulate climate through carbon dioxide sequestration and act as an important sea defence (regulating services), and they are a source of food such as crabs, seaweed and mussels (provisioning services). They also attract visitors to the coast for recreation and are a classic focus for research and education (cultural services; Branch et al., 2008; Fletcher, Saunders, Herbert, Roberts, & Dawson, 2012). There is considerable evidence for these supporting, regulating and provisioning services; however less is known regarding the cultural benefits, as illustrated in Figure 1.3 (Fletcher et al., 2012).

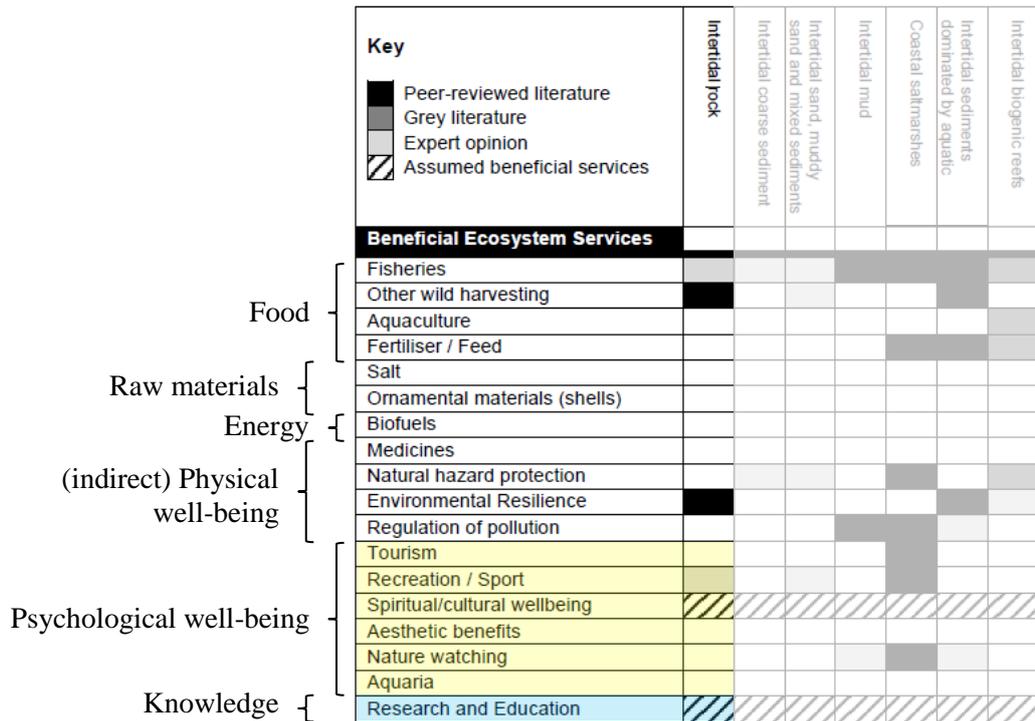


Figure 1.3. A summary of the current evidence base for a range of services provided by different coastal habitats. Rocky shores (intertidal rock) are highlighted, with cultural services highlighted in yellow (interpreted as psychological well-being) and blue (interpreted as awareness or knowledge) (reproduced from Fletcher et al., 2012).

The coast, more generally, provides cultural services such as recreation and tourism through the visits people make, the associated jobs, and the estimated value of this industry; however less is known about rocky shores specifically. With the use of observational studies, it is evident that this coastal environment is used for a range of recreational purposes. Activities can be undertaken in the water such as swimming, snorkelling, surfing and fishing; as well as on the shore, including walking (with or without dogs), rock pooling (exploring the pools of water for creatures), picnicking and sunbathing (Addison, Koss, & O’Hara, 2008; Pinn & Rodgers, 2005; Porter & Wescott, 2004). This recreational use could be seen to result in benefits to the physical and psychological health and well-being of the visitor, as well as for education. As these visits involve fresh air and some form of exercise, this can improve physical health. It could also have other health and well-being impacts, as experiencing coastal environments in general has also been found to have restorative and revitalising effects on mood,

cognitive performance and stress (Ashbullby, Pahl, Webley, & White, 2013; Hipp & Ogunseitan, 2011; White et al., 2010; White, Cracknell, Corcoran, Jenkinson, & Depledge, 2013; White, Pahl, Ashbullby, Herbert, & Depledge, 2013). In addition to these potential and assumed health and well-being impacts, by leisurely exploring this environment, it may also provide educational benefits (such as improving marine awareness about the environment and the threats facing it), especially due to the wealth of observable biodiversity and dynamic changes found in this habitat. However, little research has explicitly examined the associated benefits visiting rocky shores and/or engaging in these specific activities can have on the individuals. As shown in Figure 1.3, the health and well-being and educational benefits of this environment are currently only assumed. The following chapter reviews these benefits in greater detail, but as there is no direct evidence for the benefits of rocky shores, this subsequent chapter relies on the research on natural and coastal environments more broadly. As well as acknowledging the services and impacts this environment has on humans, it is also important to consider the impact our use of the environment has on the environment's health.

1.3 Rocky Shores: Anthropogenic Stressors

Even though there are a range of important benefits to humans, human activity also poses threats to the environment (Thompson, Crowe, & Hawkins, 2002). These anthropogenic stressors are not only from recreation but also pollution, global change and modification of coastal processes (Thompson et al., 2002). For pollution, this can include oil spills from tankers, eutrophication from agricultural run-off, and TBT (Tributyltin) pollution derived from the paints used on boats (Thompson et al., 2002). Global change, such as ultraviolet radiation, sea level rise and extreme weather, has also been seen to influence rocky shores (Thompson et al., 2002). The influence of modifying coastal processes on rocky shores can be through the building of sea defences or offshore renewable energy plants, as these can affect the level of wave exposure reaching the shore, thus modifying the habitat and the organisms that live within it (Moschella et al., 2005). Finally, recreation can also have direct influential impacts on the habitat and organisms (Thompson et al., 2002). After the Second World War when private car use

increased accessibility to nature, a large amount of research was dedicated to the concept of *recreational carrying capacity* in outdoor areas (e.g. Knopf, 1987; Stankey & Manning, 1986; Wager, 1964). This concept looked at the level in which an environment can tolerate or withstand a given type of recreational use (Knopf, 1987; Wager, 1964). The focus of this research was more managerial; helping managers to identify the main habitat threats, understanding them and implementing practices that sustained the visitor rates and maximised the carrying capacity of the recreational lands. This then led to managers adopting frameworks such as the *Limits of Acceptable Change* (Stankey, Cole, Lucas, Peterson & Frissell, 1985). This early research was predominantly conducted in the United States looking at specific case study sites. Within this literature, little is known regarding the recreational carrying capacity of rocky shores. As studied in Marine Biology, species on rocky shores can respond to these anthropogenic stressors by moving, adapting or becoming extinct (Clarke, 1996). As this environment experiences a diverse range of these stressors, it is difficult to identify whether specific impacts are as a result of natural or anthropogenic factors and also to attribute the actions to individuals rather than to an industry (e.g. tourism; Pinn & Rodgers, 2005). Nevertheless, there have been numerous studies within Marine Biology that attempt to explore the more specific impacts that recreational visitors can have on the rocky shore environment and its inhabitants (e.g. Beauchamp & Gowing, 1982; Davenport & Davenport, 2006; Ferreira & Rosso, 2009; Fitzpatrick & Bouchez, 1998; Fletcher & Frid, 1996; Kingsford, Underwood, & Kennelly, 1991; Lindberg, Estes, & Warheit, 1998; Pinn & Rodgers, 2005; Prescott, 2006; Priskin, 2003b).

Visits to rocky shores can be associated with a number of depreciative behaviours. Depreciative behaviours are those that unintentionally damage the environment or organisms, in contrast to vandalism that is more deliberate (Alessa, Bennett, & Kliskey, 2003). An example of a depreciative behaviour can be picking up flora (plant life) and fauna (animal life) and not returning them to where they were found. As noted above, misplacing organisms can have detrimental consequences as their location on the shore affects their chances of survival. Overturning rocks and displacing or poking the flora or fauna can also put organisms at risk, for instance increasing the rate of desiccation and exposing them to other stressors (Alessa et al., 2013). For example, by

picking up a barnacle that has sealed itself to a rock with enough water to survive during emersion would threaten its survival.

Another harmful act related to recreational visits is the act of dropping rubbish (Alessa et al., 2003), which then contributes to the broader environmental issue of marine litter (any persistent, manufactured or processed solid material that enters the marine environment; Galgani et al., 2010). This has a number of potentially harmful impacts on aquatic flora and fauna, which can easily become entangled or mistakenly eat the items (Hall, 2000; Laist, 1997). For instance, one study found that of a specific bird species (the northern fulmar *Fulmarus glacialis*) washed ashore dead, 95% contained plastic such as fragments of bottles and lighters in their stomach (van Franeker et al., 2011). In addition to these depreciative behaviours, individual recreational activities have also been associated with harmful consequences for the environment.

As shown in Table 1.1, research has been dedicated to examine the impacts of specific recreational activities on rocky shore ecosystems. Many of these focus on biological diversity or the impacts on specific organisms. For instance, it has been found, via both observational and experimental studies, that walking (often referred to as ‘trampling’ in the literature) along a rocky shore can have impacts on biodiversity and overall community structure (Beauchamp & Gowing, 1982; Ferreira & Rosso, 2009; Fletcher & Frid, 1996; Pinn & Rodgers, 2005; Prescott, 2006). As illustrated in Fletcher and Frid’s (1996) study, these impacts are complex, increasing the abundance of some species and compromising others. Fletcher and Frid (1996) applied an experimental design where they systematically varied trampling intensity (e.g. with 0, 20, 80 or 160 footsteps per m²) and monitored 28 species of algae. They found, overall, algal cover decreased as trampling increased but, more specifically, that certain species declined as a result of the intensity of trampling, whereas others flourished because of the lack of competition and an increase in available space. In contrast, many studies have concentrated on one species, for instance Fitzpatrick and Bouchez (1998) found that three species of bird (Oystercatcher *Haematopus ostralegus*, Curlew *Numenius arquata* and Redshank *Tringa tetanus*) delayed arrival and quickened departure and had increased vigilance as human disturbance increased. Apart from review papers, there appears to be no research that examines the impacts with a broader perspective, for instance examining

a range of recreational activities and their overall impacts on the environment for rocky shores (Branch et al., 2008; UK CEED, 2000). This research is necessary to help prioritise which activities are the most harmful, and thus in need of management. According to the ecocentric view, this is important as nature has its individual right to survive and be used sustainably, whereas the anthropogenic view argues that nature should be used sustainably to maximise its output for human gain (Newsome, Moore, & Dowling, 2002). Consequently, it is important to take an integrative approach, especially for the anthropogenic view, as by considering the human benefits gained from recreational visits to this environment at the same time as their detrimental effects on the habitat, these cultural ecosystem services can then be managed sustainably.

Table 1.1. *A summary of some of the impacts recreational activities on rocky shores can have on the ecosystem.*

Activity	Environmental Impacts	References
General Presence	<ul style="list-style-type: none"> ◆ Disturbance (noise, visual, physical) ◆ Physical damage to environment / organisms ◆ Reduced flora and fauna ◆ Littering 	Fitzpatrick & Bouchez, 1998; Lindberg et al., 1998; MarLIN, 2011; UK CEED., 2000
Walking	<ul style="list-style-type: none"> ◆ Physical damage to environment / organisms ◆ Change in flora and fauna e.g. community structure ◆ Disturbance (noise, visual) ◆ Reduced nutrients flows ◆ Spread of disease 	Beauchamp & Gowing, 1982; Brosnan & Crumrine, 1994; Ferreira & Rosso, 2009; Fletcher & Frid, 1996; Keough & Quinn, 1998; Pinn & Rodgers, 2005; Priskin, 2003b
Swimming / Snorkelling	<ul style="list-style-type: none"> ◆ Water contamination ◆ Disturbance to wildlife ◆ Loss of biodiversity 	Priskin, 2003b
Harvesting	<ul style="list-style-type: none"> ◆ Decline of fish stocks ◆ Change in flora and fauna e.g. community structure ◆ Littering 	Kingsford et al., 1991; Lindberg et al., 1998; Prescott, 2006; Priskin, 2003b
Rock pooling	<ul style="list-style-type: none"> ◆ Overturning and leaving boulders facing upwards 	Davenport & Davenport, 2006
Wildlife watching	<ul style="list-style-type: none"> ◆ Disturbance 	Bellan & Bellan-Santini, 2001; Priskin, 2003b
Education / interpretation	<ul style="list-style-type: none"> ◆ Disturbance (noise, visual & physical) ◆ Displacement and erosion from trampling or investigating 	MarLIN, 2011
Boating	<ul style="list-style-type: none"> ◆ Disturbance (noise, visual & physical) ◆ Pollution /chemical contamination ◆ Introduction of non-native species 	MarLIN, 2011

1.4 An Integrative Approach to Rocky Shores

Rocky shores are an important coastal environment, with a biologically diverse and complex ecosystem, which offers a range of services. A valuable example is the cultural services this environment provides through recreation. However, rocky shores are vulnerable to a number of anthropogenic threats as a result of visitors making use of these cultural services. Consequently, this thesis aims to explore and understand the risks and benefits associated with recreational visits to this intertidal area. Specifically, the benefits for the visitors and risks to the environment will be investigated. In order to understand and potentially encourage sustainable visits that are good for both the environment *and* the individual, this thesis takes an integrative approach combining two disciplines: Psychology and Marine Biology. Consequently, technical and conceptual terms will be explained throughout this thesis with the aid of a list of acronyms and a glossary in Appendix A & B to clarify discipline-specific terms and approaches. By combining these two disciplines, this thesis aims to explore one key question:

RQ: What are the risks to the environment and benefits to the individual associated with recreational visits to rocky shores?

It is acknowledged that there can be benefits associated with recreation for the environment, for instance the condition of the environment is often managed closely (e.g. regular litter-picking and monitoring and maintaining good water quality) in popular recreational sites. Contrastingly, there are also known risks to the visitors. For example, the World Health Organisation (WHO, 2003) outlined potential risks relating to recreational uses of coastal waters such as risks associated with the sun, heat and cold; pollution and water quality; microbial aspects (e.g. bacteria and fungi); algae and cyanobacteria; chemical agents; dangerous aquatic organisms (e.g. standing on weeverfish or being stung by jelly fish) and drowning. However, as briefly reported above, when reviewing impacts of recreational visits on the environment, greater emphasis is on the harmful risks rather than the benefits. Similarly, the literature examining the impacts of recreational visits on humans tends to focus on the positive

psychological impacts (a richer overview is given in Chapter 2). Thus, this thesis will expand on this previous literature to further explore these risks to the environment and benefits to the visitors.

A number of individual risks to the environment have been thoroughly investigated (as summarised briefly above), but the studies typically focus on one specific activity and/or the impacts on a specific organism. As a result, there is little work that has examined a range of activities and their overall impacts on rocky shores; thus, reduces our ability to identify the most prevalent and damaging impacts and consequently make managerial suggestions that could help tackle them. Similarly, there appears to be a gap in the literature regarding the benefits for the individuals visiting this environment, specifically relating to well-being and marine awareness. Chapter 2 examines the wider literature regarding the psychological well-being and marine awareness benefits; however little is currently known regarding the specific context of rocky shores.

In order to address these gaps and comprehensively examine the main research question, a research model was developed with the sole intention to guide the research. As shown in Figure 1.4, this thesis examines three key constructs: 1) visitors' well-being – how they think and feel about their lives; 2) visitors' marine awareness – their knowledge and understanding about multiple aspects of the sea; and 3) habitat threat, referring particularly to the potential impacts on the environment and its habitants. As illustrated by the respective arrowheads, the impacts of recreational visits to rocky shores on habitat threat and visitors' marine awareness and well-being will be explored. The relationship between habitat threat and both well-being and marine awareness are also under investigation.

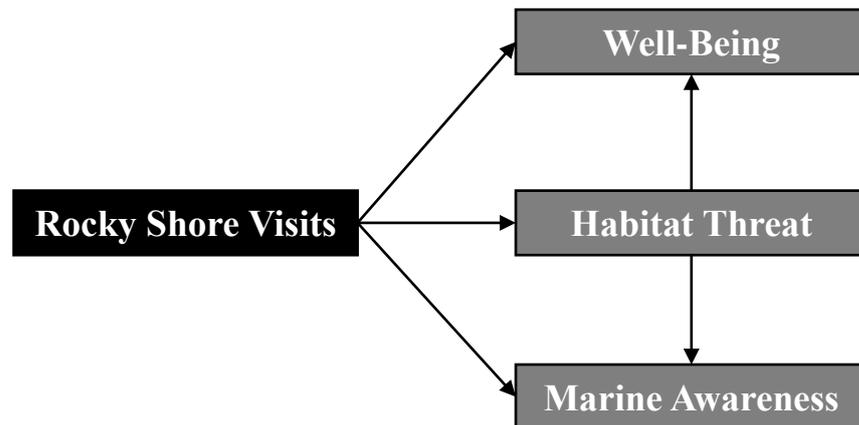


Figure 1.4. The research model developed to investigate the risks and benefits associated with recreational visits to rocky shores.

Translating this illustrative research model to finer research questions, this thesis consequently intends to investigate four supplementary questions:

RQ1: What are the most urgent visitor-related threats this environment faces as a result of recreational visits?

RQ2: What are the psychological well-being benefits of visiting rocky shores?

RQ3: What are the educational or marine awareness benefits of this environment?

RQ4: How do these marine awareness and well-being benefits relate to the habitat threats?

Each of the following chapters addresses one or more of these questions to be able to explore the overarching aim of this thesis. Each chapter will refer to the overall model, highlighting which components it explicitly examines. Perception-based surveys (Studies 1 & 2) will be first reported, exploring the perceived impacts recreational visits can have on the visitor regarding marine awareness and well-being, and the potential impacts these visits can have on the rocky shore (in Chapter 3). Using a before-after survey in the field, Study 3 (Chapter 4) consequently investigates actual well-being and marine awareness impacts directly on current visitors to two rocky shore sites. Based on

the most problematic visitor-related threats found in the perception surveys, the impacts of a habitat threat (marine litter) on visitors will then be explored using controlled laboratory studies (Studies 4 & 5) in Chapter 5. To conclude, one solution to the issue of this habitat threat of marine litter will then be examined in Chapter 6, whereby the effect of beach cleaning on individuals' well-being and marine awareness will be explored using a pre-post design on current volunteers (Study 6) and an experimental design comparing this activity to two other coastal activities (Study 7). To set up the initial studies, it is necessary to examine the current psychological literature in order to refine the complex well-being and marine awareness aspects of this model. I do so in the next chapter.

Psychological Impacts of Experiencing the Coast

“... it is an interesting biological fact that all of us have, in our veins the exact same percentage of salt in our blood that exists in the ocean, and, therefore, we have salt in our blood, in our sweat, in our tears. We are tied to the ocean. And when we go back to the sea, whether it is to sail or to watch it we are going back from whence we came”

An extract from a speech given by John F. Kennedy (1962) during the American Cup Dinner.

As introduced in Chapter 1, a focus of this thesis was the risks to the environment and the benefits to the individual associated with experiencing rocky shores. Specifically, the benefits of visiting this environment relates to two psychological aspects: Well-being and marine awareness (Figure 2.1). No research to date has explicitly investigated these psychological benefits of rocky shores. However, the literature on psychological benefits of natural environments in general (settings where vegetation and other natural elements are dominant, thus includes forests, beaches and urban parks) is extensive and is thus reviewed in this chapter. The wealth of literature dedicated to health and well-being benefits will be examined in greater detail first, followed by an examination of the less extensive literature on marine awareness.

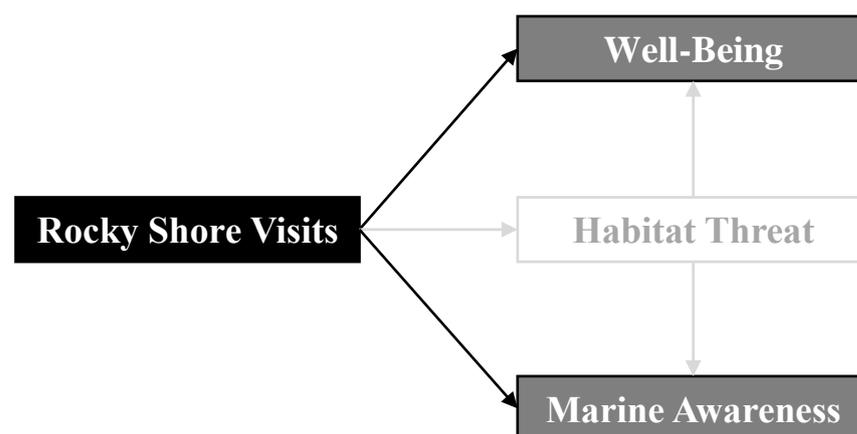


Figure 2.1. The highlighted elements (well-being and marine awareness) of the research model Chapter 2 reviews.

2.1 Health and Well-Being Benefits of Nature

The importance of coastal and natural environments in general in regards to our health and well-being is not a new discovery. The connection between nature and spiritual well-being is evident within religion, as natural elements are seen to be extremely meaningful symbols, for instance the white dove for peace in Christianity and the lotus flower considered as a window to the spirit in some Eastern religions (Mitten, 2009). This powerful connection between nature and man has also been reflected in creative writing (e.g. *Moby Dick*, written by Melville originally published in 1851, famously has references of spirituality attuned to the sea) and is associated with historical figures, as illustrated by President Kennedy's speech above.

In addition to this important spiritual connection with nature, it has also been long believed that nature is vital for our health. Frederick Law Olmsted believed that natural surroundings supported psychological and physical well-being of those living in cities, and therefore designed numerous city parks including Central Park in New York (Olmsted, 1865; as cited in Kaplan, 1995). Recreational users of natural environments also agree with this assumption. Considerable research was undertaken in the middle of the 20th Century that examined people's motives for engaging in recreational activities outdoors (as neatly reviewed by Knopf, 1987). It was often noted that psychological benefits was a reason to visit these settings, such as for escape, affiliation, exploration, exercise and nature appreciation. This is still a key motive half a century later, as the top reasons for visiting natural environments in a UK national sample was to exercise their dog, for health or exercise, and to relax and unwind (Natural England, 2013). A number of cultures have also explicitly utilised the perceived therapeutic powers of nature. For instance, *shinrin-yoku* is a Japanese practice of visiting nature specifically for therapeutic reasons (Park, Tsunetsugu, Kasetani, Kagawa, & Miyazaki, 2010). In Europe in the early 20th Century, patients suffering from severe illnesses were often prescribed to visit the coast to help them recover, and those diagnosed as mentally ill were encouraged to use nature in order to calm insanity (Chalquist, 2009; Edginton, 1997; Fortescue Fox, 1934; van den Berg, Joye, & de Vries, 2013). Thus, historically and spiritually, nature is assumed to be important for our health and well-being.

It is especially relevant to utilise these health benefits now. Along with urbanisation (more people living in towns or cities), those living in Western countries in particular are experiencing more sedentary lifestyles, and increased levels of stress, cardiovascular disease, diabetes and respiratory conditions (van den Berg et al., 2013; U.S. Centers for Disease Control and Prevention, 1996; Department of Health, 2004). As a result, research has begun to empirically examine the health benefits of nature in a more scientific manner. As defined by WHO (1948), the term *health* does not only address the absence of disease, but also the overall ‘state of complete physical, mental and social well-being’. Supporting the historical intuitive ideas above, the psychological literature and work in allied fields using a range of methods have illustrated that experiencing nature offers health benefits. These benefits can be described as health, well-being or emotional benefits; salutogenic (health improving); stress reducing, relaxing, revitalising or restorative effects.

2.1.1. Physiological Benefits

The physiological health benefits of nature have been demonstrated on a range of populations. Using physiological indicators, studies have shown that healthy participants’ blood pressure, heart rate and sweat gland activity reduces after an experience with nature, all of which are typical signs of relaxation (e.g. Hartig, Evans, Jamner, Davis, & Gärling, 2003; Pretty, Peacock, Sellens, & Griffin, 2005; Ulrich et al., 1991). As well as examining the benefits on healthy individuals, research has also been dedicated to hospital patients (Beukeboom, Langeveld, & Tanja-Dijkstra, 2012; Cimprich, 1993; Diette, Lechtzin, Haponik, Devrotes, & Rubin, 2003; Raanaas, Patil, & Hartig, 2012; Schneider, Ellis, Coombs, Shonkwiler, & Folsom, 2003; Ulrich, 1984). For instance, a classic study published in *Science* examined patients’ health and recovery after gall bladder surgery when allocated a room with a window facing a natural scene or a brick wall (Ulrich, 1984). Ulrich (1984) found that patients with the nature view recovered much faster, reported feeling less pain and suffered from fewer complications after surgery. Similar findings have been reported in more recent studies, such as patients reporting less pain when in a room with a natural mural by their bed (Diette et al., 2003; Miller, Hickman, & Lemasters, 1992). Correlational studies using larger more

representative samples of the general public have also found that people who live closer to nature have better self-reported health (Coombes, Jones, & Hillsdon, 2010; De Vries, van Dillen, Groenewegen, & Spreeuwenberg, 2013; Mass et al., 2009; Mitchell & Popham, 2008; White, Alcock, Wheeler, & Depledge, 2013). Thus, nature has been shown to have physiological benefits.

2.1.2. Psychological Benefits

In addition to these physiological findings, health benefits have also been demonstrated using psychological indicators, recording more mental well-being. *Well-being* as a construct is complex and can be viewed differently depending on the discipline. For instance, policy analysts interpret the term based on improvements in objective circumstances and economists view it as more of an ability to fulfil desires. In contrast, psychologists, and this thesis, adopt a mental-state account where the term is used to focus more on how individuals think and feel about their lives (Dolan & White, 2008). Within Psychology, there are two distinct approaches to well-being: *Hedonic well-being* that focuses more on subjective happiness, the presence of positive affect and absence of negative affect; and *eudaimonic well-being*, focusing more on striving for meaningfulness rather than simply attaining desires (Ryan & Deci, 2001). When examining the psychological health benefits of nature, the current literature predominately focuses on the former, measuring emotion. For instance, empirical studies have found that people feel happy when exposed to natural environments (e.g. Ashbullby et al., 2013; Hartig, Mang, & Evans, 1991; Scopelliti et al., 2012; White et al., 2010; White, Pahl et al., 2013). Natural scenes are also commonly rated highly in terms of preference (e.g. Herzog, 1985; Staats, Kieviet, & Hartig, 2003; Tinio & Leder, 2009; White et al., 2010; White, Cracknell et al., 2013). Environmental *preferences* can be said to relate closely with this overall construct, as it gives an indication of the conditions relevant for well-being (Hartig et al., 2010; Ulrich, 1983). Thus, preferences tend to relate positively with emotional responses to environments (e.g. van den Berg, Koole, & van der Wulp, 2003). Numerous studies have also explicitly examined the restorative effects of nature on well-being. *Restoration* typically refers to the process of recovery or renewal of resources that have been diminished (Hartig et al., 2010; Staats, van Gemerden, &

Hartig, 2010). This can concentrate on restoring cognitive attention, recovery from stress or improving hedonic well-being. For instance, studies have found that people's attention and performance on cognitive tasks are improved (e.g. Berman, Jonides, & Kaplan, 2008; Berto, 2005; Hartig et al., 1991), stress levels are reduced (e.g. Hansmann, Hug, & Seeland, 2007; Ulrich et al., 1991) and positive affect is often elevated after experiencing nature (e.g. Hartig et al., 2003; Thompson Coon et al., 2011; Ulrich, 1979; van den Berg et al., 2003).

2.1.3. The Research Paradigm

To be able to deduce the unique well-being benefits of natural landscapes specifically, a popular paradigm in the literature is to compare natural environments with urban environments. Using this approach, it is commonly found that individuals prefer natural environments, and that affective and physiological measures improve more when exposed to natural scenes than urban environments (e.g. Berto, 2005; Hartig et al., 2003; Pretty et al., 2005; van den Berg, Hartig, & Staats, 2007). It has been noted that some of these effects may be biased as urban environments are often not equally represented, for instance urban pictures are often of a poorer photograph quality than natural scenes (Tinio & Leder, 2009). Some studies have shown that urban environments can also be restorative (Lindal & Hartig, 2013), but when comparing with natural scenes and controlling for picture quality, the literature predominately demonstrates greater beneficial effects for nature.

A range of methods have been used to illustrate these findings. Some studies use a more descriptive approach, by measuring the key aspects at one time interval. For instance, participants can be asked to recollect how a particular environment made them feel at the time (Ashbullby et al., 2013; Herzog, 1985; Nanda, Eisen, & Baladandayuthapani, 2008; Natural England, 2010; Ryan et al., 2010; White et al., 2010). The more experimental designs examine this relationship by comparing different conditions (e.g. nature compared to urban) and/or by measuring change in well-being directly (e.g. measuring affect or physiological indicators before and after an experience with nature; Berman et al., 2008; Bodin & Hartig, 2008; Hartig et al., 1991; Pretty et al., 2005; Ulrich et al., 1991; Valtchanov, Barton, & Ellard, 2010). The diverse empirical

literature continually shows that natural environments are beneficial in terms of well-being and health.

2.1.4. Theoretical Explanation

There are numerous theories that try to explain why nature is beneficial. Many involve an evolutionary component, with the premise that we have an innate drive or unlearned disposition to respond positively to nature for our survival (e.g. Biophilia Hypothesis, Wilson, 1984; Prospect-Refuge Theory, Appleton, 1975; Savannah Theory, Orians, 1980; for a review see Hartig et al., 2010 or Ulrich et al., 1991). For instance, the Psychoevolutionary Theory (Ulrich, 1983; 1984; Ulrich et al., 1991) claims that humans have a biologically prepared readiness to respond to natural elements. Compared to urban environments that we are relatively unfamiliar to, this theory claims that humans have developed these adaptive affective responses over thousands of generations, thus experience greater stress recovery when we experience environments resembling an evolutionary safe setting.

In contrast to the evolutionary theories, Attention Restoration Theory (ART; Kaplan, 1995) focuses more on attentional deficits. Primarily used to explain the restoration of attention (a finite cognitive resource), well-being benefits can also be explained using this model as emotions can be seen as symptoms of fatigue in attention (Kaplan, 1995). This theory claims that nature facilitates restoration and recovery by accommodating four key restorative properties: Being away, fascination, extent and compatibility. *Being away* refers to the psychological distance from everyday demands and stressors. *Fascination* is the ability to involuntary capture attention, for instance a bird flying overhead could catch a person's attention. In addition to the ability to capture attention, *extent* refers to the richness of the environment, so the level of scope of exploration, thus a shoreline would be richer in extent compared to a lone goldfish in a barren fish tank. The final factor, *compatibility*, refers to the ability to fulfil a person's intention. For example, a clean quiet smooth path in woodland would be more restorative for a runner than a littered path in a busy urban park where the runner would have to negotiate around other people. Therefore, environmental settings that fulfil these properties are seen to be restorative. A lot of the current literature is dedicated to this

particular theory, consistently finding that natural environments are rated relatively highly on these aspects (Berto, 2005; Hartig, Korpela, Evans, & Gärling, 1997; Herzog, Chen, & Primeau, 2002; Korpela, Klemettilä, & Heitanen, 2002; Laumann, Gärling, & Stormark, 2001; Nordh, Hartig, Hagerhall, & Fry, 2009). In addition to investigating specific theories, the literature has also explored different aspects of the encounters between a person and nature, as relevant to well-being. The following sections briefly addresses the influence of types of exposure, visit characteristics and individual differences and types of natural environment on these well-being benefits, before focusing specifically on the coastal environment.

2.1.5. Types of Nature Exposure

How individuals engage with nature is varied within the literature. Studies using laboratory or clinical contexts often involve a more superficial experience with nature. Many of these experiences are one dimensional, so that a number of variables can be controlled or systematically manipulated. For instance, many require participants to respond to static pictures of natural environments (Berman et al., 2008; Berto, 2005; Diette et al., 2003; Herzog, 1985; Korpela et al., 2002; Nanda et al., 2008; Pretty et al., 2005; Ryan et al., 2010; Staats et al., 2003; Tinio & Leder, 2009; White et al., 2010; White, Cracknell et al., 2013). Rather than using sight, some studies have exposed participants to nature via smell, such as smelling natural aromas like spiced apple (Chalquist, 2009). Other studies have applied more multi-sensory indirect experiences, such as showing videos of nature, engaging both visual and auditory senses (e.g. De Kort, Meijnders, Sponselee, & Ijsselsteijn, 2006; Laumann et al., 2001; Jahncke, Hygge, Halin, Green, & Dimberg, 2011; Ulrich et al., 1991). Along with the development of technology, research has also started to explore virtual reality as a medium of experiencing natural environments (e.g. Schneider et al., 2003; Valtchanov et al., 2010). Virtual reality may be more artificial with its graphics compared to videos; however it does introduce a more interactive experience with nature by facilitating individual exploration of the simulated environment. Studies adopting these indirect experiences of nature, varying the senses activated, have found well-being benefits of natural environments (Berto, 2005; De Kort et al., 2006; Diette et al., 2003; Herzog, 1985; Korpela et al., 2002; Laumann et al., 2001;

Nanda et al., 2008; Pretty et al., 2005; Ryan et al., 2010; Staats et al., 2003; Tinio & Leder, 2009; Ulrich et al., 1991; White et al., 2010; White, Cracknell et al., 2013), thus illustrating the importance of nature. These artificial approaches have significant practical applications, as they can easily be applied to health care settings. Therefore, even when not directly experiencing a natural environment, nature can have significant well-being impacts.

Direct experiences with nature have also been found to be important. Work examining these experiences has involved asking individuals to recollect past experiences with nature, often with relatively large samples (Natural England, 2013; Ryan et al., 2010; Tarrant, 1996; White, Pahl et al., 2013). For instance, using a large national sample of English citizens, a survey examining people's previous engagement with nature found, first, that the well-being benefits were often noted as a motive for visiting these environments and, second, that visitors typically report feeling happier after visiting nature (Natural England, 2010; 2013). Relying on recollections can be ecologically valid as they are based on naturally occurring experiences but can be vulnerable to a number of biases such as relying on memory. Consequently to strengthen these findings, similar conclusions have been made when surveying visitors immediately after a visit (e.g. Hipp & Ogunseitan, 2011; Packer & Bond, 2010). Again, asking current visitors to reflect on a previous experience is valid as it represents a population that uses the environment and examines a naturally occurring engagement, but this approach is also vulnerable to other factors. For instance, individual differences may be responsible for the effects, as individuals that visit may be different to those who chose not to visit (a type of selection bias), or may have different initial preferences (preference effects), or may anticipate beneficial effects therefore may be influenced by expectation effects. To reduce the influence of these potential confounding variables, more experimental designs have been adopted. For instance, some researchers have examined the benefits of a structured activity in nature on a more naïve sample of students (unaware of the experimental conditions), which often involves walking through different environments (e.g. Ekkekakis, Hall, van Landuyt, & Petruzzello, 2000; Hartig et al., 2003; Johansson, Hartig, & Staats, 2011; Ryan et al., 2010). For example, Hartig and colleagues (2003) randomly allocated participants to a walk in a nature reserve or an urban environment.

They found that the former was associated with a greater improvement in positive affect and reduction in negative affect such as anger. There is the occasional study that does not replicate these findings; for instance Berman and colleagues (2008) did not find changes in affect but did find other benefits such as improved performance on cognitive tasks after a walk in nature. However, improvements in affect have been further supported by other similar empirical studies (Ekkekakis et al., 2000; Hartig et al., 1991; 2003; Johansson et al., 2011; Ryan et al., 2010). Thus, by using different samples and complementary designs, visiting natural environments first-hand has been mostly found to provide beneficial impacts on an individual's well-being.

2.1.6. Visit Characteristics and Individual Differences

As well as examining the beneficial impacts of the natural landscape, the literature has progressed to examine these impacts in greater detail, such as considering the influence of individual and situational differences. For instance, the well-being benefits have been found to be greater for those who are more in need of restoration. For example, by imagining or inducing stress, individuals typically experience or expect to experience greater well-being benefits from these environments than those who were not stressed (e.g. De Kort et al., 2006; Felsten, 2009; Staats et al., 2003; Staats et al., 2010; Ulrich et al., 1991; Valtchanov et al., 2010; van den Berg et al., 2003). Well-being benefits have also been found to be greater for those whose work does not relate directly to that environment, such that forest workers do not receive the same level of well-being benefits when visiting forests for leisure than non-forest workers (von Lindern, Bauer, Frick, Hunziker, & Hartig, 2013). As well as being a result of visiting natural environments, connectedness to nature and environmental identity have also been noted to mediate the well-being benefits (Hinds & Sparks, 2009). *Connectedness to nature* is an individual's attachment to the natural environment (Mayer & Frantz, 2004). Correlational findings have implied that as connectedness strengthens so does the well-being benefits of nature (Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009). Consequently, the current literature implies that nature does have health and well-being benefits, but the extent of these may differ depending on the individual and situational circumstances.

The beneficial effects of nature on well-being have also been found to be influenced by visit characteristics. For instance, shorter distances travelled are often preferred, and studies have found that the longer people spend in nature (duration) and the more visits they make (frequency), the more well-being benefits they will receive (Coombes & Jones, 2010; Hansmann et al., 2007; Hinds & Sparks, 2008; Scopelliti et al., 2012). Company, or rather the individuals people experience nature with, has also been noted to have influential effects. It is estimated that 48% of visits to natural environments in England are done on their own (Natural England, 2013). Based on a similar national database consisting of crude information on visit characteristics such as company, activities and restorative experiences of visits to natural environments, White, Pahl and colleagues (2013) were able to compare visits made with children to those conducted alone according to a restorativeness measure. With their analysis, they found that visiting nature was more restorative when alone. Johansson and colleagues (2011) used an experimental design to examine this: By examining the effect of walking in nature or an urban environment with and without a friend on affective measures, Johansson and colleagues also found that well-being benefits were greater when alone than with a friend. Thus, even though the research that has examined the influence of visiting characteristics is limited, current findings imply that the extent of the well-being benefits of nature may be influenced by these finer details.

As well as varying in duration, frequency of visits and company, experiencing nature can also vary according to the activities undertaken. As noted in Chapter 1, rocky shores alone accommodate a vast range of activities. When examining the frequency of activities in natural environments, walking is often noted as the most popular (Addison et al., 2008; Natural England, 2010; Porter & Wescott, 2004; Smallwood, Beckley, & Moore, 2012). Thus, this individual activity is commonly examined in the psychological literature (Berman et al., 2008; Ekkekakis et al., 2000; Hartig et al., 1991; 2003; Johansson et al., 2011; Ryan et al., 2010). Other studies have also explored the impacts of more purposeful stewardship activities (tasks that focus on protecting the natural environment), such as wildlife surveys, landscape management and litter campaigns (e.g. Bowler, Kaiser, & Hartig, 1999; Koss & Kingsley, 2010; Meier & Stutzer, 2008; Ryan, Kaplan, & Grese, 2001). Few studies explicitly compare activities, but for those that do,

the well-being findings are reasonably mixed. For instance, Barton and Pretty (2010) found that light exercise in natural environments (e.g. cycling) had a greater impact on well-being (improving positive affect) compared to moderate and vigorous intensity. Conflicting with this, Hansmann and colleagues (2007) found that levels of stress declined more rapidly for those engaging in more active sports (e.g. playing) compared to less strenuous ones (such as walking and relaxing). When examining more mundane activities, White and Dolan (2009) also found that activities can differ in both hedonic (how enjoyable they are) and eudaimonic well-being (how meaningful they are). Within natural environments specifically, little research has explicitly compared types of activity. Using the national database noted above, White and colleagues (White, Pahl et al., 2013) were able to begin to explore this relationship. Overall, they concluded that individuals received similar well-being benefits from nature regardless of activity. Consequently, the mixed findings imply that well-being benefits may vary in extent depending on activity but, in the context of nature, these differences may be overpowered by the influential effects the environment can have.

The composition of the natural environment can also be seen to have influential impacts. Environments can vary considerably in species density (the abundance of one specific species) and richness (the variability among living organisms, also known as biodiversity); with the impacts on individuals' well-being beginning to be examined. One approach has been to survey people in different natural environments that vary in biodiversity and compare well-being measures (Dallimer et al., 2012; Fuller, Irvine, Devine-Wright, Warren, & Gaston, 2007; Scopelliti et al., 2012). Using this approach, it has been found that well-being ratings increase along with biodiversity (Dallimer et al., 2012; Fuller et al., 2007; Scopelliti et al., 2012). Further research has shown that the perceived, rather than actual, level of biodiversity is especially important (Dallimer et al., 2012; Lindemann-Matthies, Junge, & Matthies, 2010). Thus, the more biologically rich an environment is (or perceived to be), the more beneficial the environment has been found to be for well-being.

In addition to varying in biological diversity and abundance, natural environments can also vary in state. These varying states, such as differing levels of degradation and weather conditions, can also be seen to influence the well-being value of

an environment. For instance, a littered and graffitied natural environment during heavy rain and strong winds may elicit different reactions compared to the same environment during a calm, sunny, pristine day. The generic literature typically overlooks these impacts and primarily focuses on pleasant, generic natural environments during clement weather conditions (e.g. Berto, 2005; Laumann et al., 2001; White et al., 2010); however, the occasional study has explicitly explored these factors. Correlational work has found that people prefer to visit natural environments during warm and dry weather conditions, and when the environment is clean (Ballance, Ryan, & Turpie, 2000; Coombes & Jones, 2010; Coombes et al., 2009; Tudor & Williams, 2006). When manipulating these elements in photographic stimuli in the laboratory, it has been found that the well-being benefits are, in fact, not as pronounced when the environment is degraded or during poor weather (Pretty et al., 2005; White, Cracknell et al., 2013). Thus, the extent to which a natural environment is found to be beneficial is also dependent on the situational state of the environment, in terms of pristineness and weather.

2.1.7. Type of Nature Environment

As well as varying in overall state (e.g. weather and pristineness), natural environments can also vary in habitat type. The current literature is based on a very broad concept, addressing all settings that predominately contain vegetation and other natural elements (Hartig et al., 2010; Steg, van den Berg, & de Groot, 2013). Consequently, this broad category can encompass a diverse range of habitats, including beaches, parks, deserts, mountains, farmland, lakes, and forests. Many of the studies collapse these different types under the umbrella term of ‘nature’. However, it is commonly found that these well-being benefits noted above are often associated with natural environments that contain water elements (Barton & Pretty, 2010; Berto, 2005; Diette et al., 2003; Felsten, 2009; Han, 2010; Hartig et al., 1991; Herzog, 1985; Hinds & Sparks, 2008; Laumann et al., 2001; Laumann, Gärling, & Stormack, 2003; Mayer et al, 2009; Nordh et al., 2009; Pretty et al., 2005; Ulrich, 1983; Ulrich et al., 1991). Numerous studies have highlighted, either directly or indirectly, that natural scenes with water (also referred to as waterscapes, blue-space and aquatic landscapes) are distinctively beneficial for well-

being. This has been shown via preference measures, perceived restorativeness, and reported benefits.

As an indication of well-being (Hartig et al., 2010; Ulrich, 1983), blue-space is often rated highly on preference. Numerous studies have found that waterscapes are often noted as a favourite and preferred place compared to alternative natural environments (Herzog, 1985; Hubbard & Kimball, 1967; Nanda et al., 2008; Schafer & Brush, 1977; Zube, 1974). White and colleagues (2010) conducted a series of studies that systematically examined this. Using controlled laboratory designs, they asked participants to rate photographic stimuli according to a range of measures including preference. The proportion of aquatic, green or urban features in each photograph was manipulated in order to form nine environmental conditions: Aquatic-green, aquatic-urban, aquatic-only, green-aquatic, green-urban, green-only, urban-aquatic, urban-green, and urban-only. For example, a predominately green scene with a river in the background would be classed as green-aquatic. Using this manipulation, they found that the aquatic-green and aquatic-only conditions were rated the highest for preference. These patterns have also been noted outside of the laboratory using, for example, subtle revealed preference techniques that are based on observable data rather than asking people directly. For instance, residential properties located near water are often valued much higher (Luttik, 2000; Kildow, 2007). Similarly, when looking at hotel room rates, those rooms with a water view are considerably more expensive, implying that people are willing to pay more for this more attractive, potentially more restorative, view (Lange & Schaeffer, 2001).

Complementing the preference findings, numerous studies have also found that other well-being effects are stronger for waterscapes compared to other natural environments. Originally designed to test a rating scale examining the restorative properties of environments, Laumann and colleagues (2001) found that when comparing five different videos of walks (through a forest, park, sea area, city, and a snowy mountain), the forest and sea area were consistently rated as more restorative. When examining this specifically, White and colleagues (2010) further supported the additional benefits associated with blue-space. Along with the preference items in their laboratory studies described above, White and colleagues (2010) also assessed mood and the perceived restorativeness of each scene based on ART's (Kaplan, 1995) properties.

Reflecting the same pattern as before, they found that aquatic-green and aquatic-only conditions were consistently rated higher than the other environment categories. The occasional study has produced contradictory findings where they do not find a difference (Ulrich et al., 1991; van den Berg et al., 2003); however many do find a blue-space effect (blue environments providing more positive outcomes). For instance, illustrating that natural scenes with water have greater well-being benefits, numerous studies have found that people are happier when viewing waterscapes, and experience a reduction in negative affect, an increase in positive mood and greater expectations of restoration from stress compared to other natural scenes (Barton & Pretty, 2010; Felsten, 2008; Gelso & Peterson, 2005; Han, 2010; Herzog & Barnes, 1999; Korpela, Ylén, Tyrväinen, & Silvennoinen, 2010; Roe, 2008; Ulrich et al., 1991; White et al., 2010; White, Cracknell et al., 2013; White, Pahl et al., 2013).

2.1.7.1. The coastal environment.

Like the term ‘natural environments’, waterscapes are still a reasonably broad environmental category, comprising a range of aquatic environments including the coast. Even though few studies have examined natural environments to this more detailed level, many perceive the coast to be especially beneficial. For instance, back in 1934, Fortescue Fox wrote a narrative article describing ‘convalescence’ or the restoring powers the coast provides. He believed that the coast could act as a sedative, especially for those with ill-health. This belief is still present in the general population. In a survey of 1,500 Americans, 68% of respondents believed that oceans are important for emotional well-being and 90% find them relaxing (Ocean Project, 1999b). To complement these beliefs, a few studies have examined this relationship.

When examining geographical proximity to the coast, correlational studies have implied a positive relationship between well-being and the coast. Important for physical health, levels of physical activity have been found to be higher for people who live closer to the coast (Bauman, Smith, Stoker, Bellew, & Booth, 1999; Humpel, Owen, Iverson, Leslie, & Bauman, 2004). Self-reported positive health is also greater for those closer to the shore (Wheeler, White, Stahl-Timmins, & Depledge, 2012). Using data from the British Household Panel Survey containing over 10,000 adults, White and colleagues

(White, Alcock et al., 2013) also found that when controlling for socioeconomic status, those living close to the coast had better physical and mental health. However, they did not find an influence of proximity for the well-being measure of life satisfaction. Therefore, these correlational studies imply that people may physically benefit simply by living near the coast.

Rather than examining the more abstract relationship between health and proximity to this environment, other studies have investigated and found that direct experiences can have health and well-being benefits. As noted in Chapter 1, the coast is an economically valuable recreational resource, welcoming around 0.3 billion visits each year, and valued at £10 billion (£12 billion, Natural England, 2013; Pugh & Skinner, 2002). A couple of studies have explored the well-being impacts of these visits on the individuals. Interviewing 15 families in coastal regions in England, Ashbullby and colleagues (2013) found that health and well-being benefits of recreational visits to the coast were voluntarily noted without prompt. When imagining a trip to the coast, family members often noted physical health benefits such as getting fresh air, sunshine, increasing physical activity, and improving physical skills such as swimming. In addition, they also noted psychological well-being benefits such as facilitating activities that were seen as fun, energising and relaxing, and described elements such as the space, sound of the waves, beauty of the scene, and dynamic features that promoted stress relief, relaxation and restoration. Similar findings were found using qualitative focus groups in a broader sample, showing that coastal features such as the sound of the water were seen to be therapeutic (Natural England, 2010). These findings based on exploratory, comparatively small studies examining imagined visits have been further supported using a more structured field survey recruiting a larger sample. By asking over 1,000 coastal visitors to complete a survey during their visit to a sandy beach, Hipp and Ogunseitan (2011) found that this environment was rated highly in terms of restorativeness based on ART (Kaplan, 1995).

The coast has also been found to be especially beneficial when compared to other more specific environments. Using a national database of the English population's experiences with natural environments, White and colleagues (White, Pahl et al., 2013) examined 4,255 people's recollections of visits to different natural environments

including coastal landscapes. They found that, when controlling for socio-demographics and visit characteristics, the coast was consistently found to be the most restorative environment. Therefore, these diverse studies indicate that the coast has distinctive well-being benefits.

2.1.8. Summary & Conclusion

Nature, in general, is an important resource for human health and well-being. The vast literature examining nature in this broader sense has found that experiencing natural environments, either directly (by visiting the environment) or indirectly (e.g. by viewing photographs), can have beneficial impacts on our physical health, as well as mental well-being (elevating our mood, reducing stress and generally restoring people). These beneficial effects are generally found when comparing natural with urban environments. The majority of the literature relates and explicitly examines these beneficial impacts to specific theories, whereas other studies are also exploring other influential factors. It has been shown that the extent that natural landscapes are therapeutic can depend on a range of factors, such as what people do when in these natural environments, other visit characteristics such as who they go with, an individual's need for restoration and their existing level of connection to nature, and the state and composition of the environment (how biologically rich, the weather conditions and pristineness of the environment). Consequently, when exploring the well-being impacts of nature, it is necessary to put in relevant precautions to control for these aspects; for instance, by collecting base-levels (of connection to nature and well-being), using the same weather and overall state conditions and recording potentially confounding variables such as visit characteristics.

As well as concluding that well-being benefits may vary in extent according to these aspects, numerous studies have distinguished different types of nature, often observing that blue-environments are especially beneficial. More specifically, coastal environments have been found to facilitate these benefits. However, little research has been dedicated to specific types of coastal environments, with none, to the author's knowledge, examining rocky shores in particular. Rocky shores are a distinct coastal environment, with unique topography, biologically diverse habitants and habitat threats. As well as being distinctively different to other coastal environments, rocky shores can

also vary considerably according to temporal and spatial aspects (e.g. with high and low tides; reviewed in Chapter 1). As noted in the preceding chapter, this specific habitat is assumed to provide well-being services, but, as highlighted above, has yet to be empirically tested. Therefore, this thesis examines this directly by exploring both perceived and reported well-being benefits of rocky shores specifically. Another cultural service this environment is assumed to provide is educational; increasing people's awareness about marine topics. Similarly, this has not been explicitly examined within the rocky shore context; thus the following section reviewing the literature, again, relies on the broader concept of nature.

2.2 Marine Awareness

As noted above for well-being, little is known regarding people's marine awareness and how this is influenced by experiences with rocky shores. Thus, this section will review the public's current awareness about the marine environment in general, the sources of this awareness and the impacts that experiencing the marine environment, including visiting the coast, can have on this construct. The literature examining marine awareness is diverse in its disciplines, theoretical and methodological approaches. Thus, before reviewing this broad multidisciplinary literature, the definition and measures of this construct first need to be addressed.

2.2.1. The Concept of Marine Awareness

As defined by the Oxford English Dictionary (Soanes & Stevenson, 2006), awareness refers to a person's knowledge or understanding of a situation or subject. Consequently, marine awareness refers to this knowledge or understanding relating specifically to the sea, for instance regarding the biology of the organisms, physical forces of the waves and the uses and impacts humans have on this environment. Due to the multidisciplinary interest, a number of terms exist that fall within this area. For instance, the term 'environmental literacy' was initially defined as showing extensive knowledge or learning about the natural environment in general; whereas other definitions refer more specifically to nature's influence on humans and the influence

humans have on nature (e.g. environmentalism; Monroe, Lau, Schubel, & Cassano, 2006; Roth, 1992; Steel, Smith, Opsommer, Curiel, & Warner-Steel, 2005). As well as varying in focus, definitions can also vary in their breadth, with some having a rather specific cognitive focus; whilst others are much broader, encompassing other aspects such as emotion and behaviour (e.g. ocean literacy, Fletcher & Potts, 2007; environmental conscience, Roth, 1992; marine mindset, Wyles et al., 2013). These latter definitions can also be closely related to goals of increased pro-environmental behaviour. For example, while overlooking other behavioural predictors (such as attitudes, perceived control and social norms; Ajzen, 1985), it is explicitly hoped, and often assumed, that greater marine awareness would lead to maintaining, restoring and improving the health of the environment (addressing terms such as ‘environmental’ or ‘ocean citizenship’; Fletcher & Potts, 2007; Hawthorne & Alabaster, 1999; McKinley & Fletcher, 2010; Roth, 1992). In order to be focused, this thesis will use the more cognitive meaning. Specifically, *marine awareness* is defined as a person’s knowledge or understanding about multiple aspects of the sea, including biological aspects (e.g. marine life), natural stressors (e.g. tidal and weather systems) and associated global (e.g. pollution) and local (e.g. a person standing and dislodging a barnacle) anthropogenic threats.

Because of the range of terms and definitions for this construct, it is not surprising that a standardised universal measure of marine awareness does not currently exist (Roth, 1992). To construct a reliable and valid measure is an extremely difficult task. A vast number of topics surround this environment; for instance, the processes and functions, the biology of marine organisms, and the human uses and impacts on this environment (Levinton, 2009; Steel, Lovich, Lach, & Fomenko, 2005; Steel, Smith et al., 2005). Consequently, the current measures of marine awareness vary in specificity, depending on the individual studies’ research questions. For instance, some measures touch on a number of topics (Steel, Lovich et al., 2005; Steel, Smith et al., 2005) whereas others focus on specific subjects such as biodiversity, renewable energy and conservation (Adelman, Falk, & James, 2000; Dallimer et al., 2012; Fletcher, Potts, Heeps, & Pike, 2009; Ocean Project, 2012).

As well as varying in specificity, the level of measurement also differs within the literature. One approach is for individuals to judge their own marine awareness. In this

more subjective, self-report approach, individuals may rate their overall marine awareness on a Likert scale from *not informed* to *very well informed*; they may rate their agreement to marine-related statements; or state whether they know or have heard of specific terms before (Ocean Project, 2011; Steel, Lovich et al., 2005; Steel, Smith et al., 2005). These measures are easy and quick to administer, not very demanding on the participant and can address a range of marine topics; however they are vulnerable to social desirability, as participants may rate their awareness higher in order to look more knowledgeable. By asking participants to judge their own awareness, these measures also do not offer information regarding the accuracy of participants' marine awareness. Consequently, other measures involve more objective techniques such as answering multiple choice questions, identifying species and responding to open-ended questions, which can then be compared to the scientific literature (Cummins & Snively, 2000; Dallimer et al., 2012; Falk & Adelman, 2003; Falk et al., 2007; Fletcher et al., 2009; Settar & Turner, 2010; Steel, Lovich et al., 2005; Steel, Smith et al., 2005). These measures can therefore be argued to be harder to falsify, tapping more directly into individuals' marine awareness. However, these objective measures require a more tailored, narrow focus; thus are more appropriate for assessing specific marine topics, such as participants' awareness about marine species. These measures are also more time consuming and demanding, therefore may be more vulnerable to higher refusal rates and selection biases. It is also important to note that both scientific and public knowledge is dynamic, continually evolving over time. Consequently, these individual objective measures may be weak in regards to test-retest reliability, as an answer that was correct 10 years ago may have since been unearthed as being incorrect. As a result, there is no standard measure of marine awareness. Depending on type of awareness to be measured (subjective or objective) and the specific topics of interest, it is necessary to tailor measures specifically to individual research questions.

2.2.2. The Public's Level of Marine Awareness

The current literature, adopting a range of these subjective and objective measures noted above, has consequently examined people's marine awareness. Unlike the ever-growing well-being literature mentioned above, research dedicated to the public's

understanding of the marine environment is limited (Fletcher et al., 2009). One of the leading studies within this field used a national sample of 1,500 Americans and found that American's awareness regarding the marine environment is low (Ocean Project, 1999a; 1999b). Specifically, 75% of Americans strongly agreed that the health of the oceans is essential for human survival. However, when assessed on their objective marine awareness regarding oceans' functions, the majority of respondents could not answer more than two out of five questions correctly (Ocean Project, 1999b). A follow-up survey ten years later, on a further 1,206 US citizens, found that this knowledge about the ocean still remains low (Ocean Project, 2011). This has been further supported in other US and European samples using a mixture of subjective and objective measures (Fletcher et al., 2009; Potts, O'Higgins, Mee, & Pita, 2011; Steel, Lovich et al., 2005; Steel, Smith et al., 2005). For instance, the majority of the 1,233 respondents in Steel and colleague's study (Steel, Smith et al., 2005) reported being somewhat informed about ocean and coastal policy issues, and on average correctly answered 40% of multiple choice questions correctly. Even though people's knowledge and understanding may not be in line with science, this does not mean that people are not interested in this environment. People do report finding marine topics, marine life and issues affecting this environment interesting (such as pollution, climate change and overfishing) (Fletcher et al., 2009).

Studies have also illustrated that people are aware, to some extent, of the threats that face this environment from humans. Most people seem to be aware that oceans are vulnerable and can be damaged by humans generally, but not necessarily directly by their own individual actions (Adelman et al., 2000; Ocean Project, 1999). Pollution, climate change and overfishing are often freely noted as the most pressing issues facing the marine environment; however awareness about these and other environmental issues seems limited (Clamer, 2011; Fletcher et al., 2009). For instance, with a primary focus on climate change and the marine environment, a multinational study recorded individuals' self-assessed awareness about different marine issues (Clamer, 2011). Interviews with 7,000 people from seven European countries found that people are most informed about melting sea ice, pollution and overfishing, with 45-50% of respondents self-assessing their awareness as being informed. These respondents claimed to be considerably less informed about other issues such as ocean acidification, effects of marine native species

and destruction of habitats at the coast (Clamer, 2011). Thus, the limited research implies that people have a rather superficial level of marine awareness about the environment in general and the threats it encounters.

From the literature that has examined current levels of marine awareness, it is evident that this differs between people. Cross-cultural studies have shown that awareness can differ according to country of residence (Clamer, 2011; Potts et al., 2011). For instance, Germans and Italians gave higher subjective awareness scores, stating that they felt more informed about marine-related issues, whereas the Dutch and Estonians reported being less informed (Clamer, 2011). People's proximity to the coast has also been correlated with marine awareness, with those living closer to the sea as having higher awareness than those further away (Clamer, 2011; Fletcher & Potts, 2007; Steel, Lovich et al., 2005; Steel, Smith et al., 2005). For instance, individuals living in coastal states in the USA were found to rate their subjective awareness as being more informed, knew more ocean-related terms, and scored marginally higher on an ocean quiz than non-coastal residents (Steel, Smith et al., 2005). There have also been correlations with demographics, for instance males, those from richer socioeconomic contexts, and people who have higher education qualifications are generally more informed (Fletcher & Potts, 2007; Steel, Lovich et al., 2005; Steel, Smith et al., 2005). Unsurprisingly, people who also work in a marine-related industry also have greater marine awareness (Settar & Turner, 2010). As well as individual differences, marine awareness can vary depending on people's learning experience.

2.2.3. Sources of Information

An individual's level of marine awareness develops over time in different contexts. The technicalities and mechanics behind learning in general are heavily discussed in the educational literature, where a number of theories are proposed (e.g. Behaviourism focusing on the notion that learning involves associating a stimuli with a response, Cognitivism focusing on the mental and internal processing of information, and Constructivism focusing on the notion that learning involves continuous building and amending previous structures and schemas. Please see Fry, Ketteridge, & Marshall, 2003 for a more detailed overview). However, instead of focusing on the internal components

and processes of how marine awareness is developed, the focus of this section is the contexts that facilitate this cognitive development.

People's marine awareness can evolve by experiencing nature. Originally used to describe development in children, Kellert (2002) distinguished between three types of nature experiences. First, *direct experience* is seen to involve physical contact with natural settings and wildlife free from human development. Second, *indirect experience* still involves physical contact but in a much more restricted and managed contexts, for instance in zoos and aquariums. Finally, *vicarious* or *symbolic experience* does not involve physical contact with the nature world, but rather involves more abstract encounters with nature, such as through media, computers and books. Marine awareness can be seen to be positively related to these three different types of experiences, both in formal education, for instance within the classroom (vicarious experience) and field trips (indirect experience); as well as in informal settings such as visiting institutions like aquariums (indirect experience) and the coast (direct experience; Clamer, 2011; Steel, Lovich et al., 2005; Steel, Smith et al., 2005). Each of these will be reviewed.

Within formal education, students can learn about the marine environment in a number of ways, for instance within more abstract classroom settings and during field trips. Field trips are popular with students; they typically look forward to the trip, enjoy the experience at the time and often remember the trip many years later (Ballantyne & Packer, 2002; Falk & Dierking, 1997). For example, when interviewed about school field trips taken during the early years of their school education, 94% of adults surveyed were able to recall a field trip, with trips to natural sites and centres most frequently remembered (Falk & Dierking, 1997). They are also influential on students' learning (Ballantyne & Packer, 2002; Bogner, 1998; Cummins & Snively, 2000; Dillon et al., 2006; Duerden & Witt, 2010). For instance, grade 4 (aged 9-10) pupils' marine awareness about physical oceanography, ocean ecology and human effects on the ocean were found to increase after a field trip to sandy and rocky shores, as measured by multiple choice questions before and after the field trip (Cummins & Snively, 2000). However, the evidence on whether these trips are better than vicarious experiences within the classroom is rather limited. Many studies within the educational literature are more descriptive, reporting individual field trips, rather than experimentally examining the effectiveness of

field trips in comparison to classroom learning (Ballantyne & Packer, 2002; Bogner, 1998; Cummins & Snively, 2000; Dillon et al., 2006; Duerden & Witt, 2010). However, the overall conclusions do suggest that experiencing marine and natural environments through field trips are beneficial to awareness.

Marine awareness does not only develop within formal education. It is estimated that the average person spends only 3% of their lifetime in school (Falk & Dierking, 2002). Consequently, the single, most dominant form of learning is free-choice learning. Falk and Dierking (2002) describes this as self-directed, voluntary learning that is guided by individual interests and needs. Via indirect experiences with nature, aquariums and zoos are one type informal setting that can facilitate learning about the marine environment. As highlighted in numerous mission statements, aquariums, for example, see their institutions as being a valuable educational resource, and have the goal to educate and promote conservation in their visitors (Patrick, Matthews, Ayers, & Tunnicliffe, 2007; Ramberg, Rand, & Tomulonis, 2002). However, most people's key reasons for these visits are more commonly linked to entertainment, with a small proportion of visitors stating more educational motives (Ballantyne, Packer, Hughes, & Dierking, 2007; Shackley, 1997; Sickler & Fraser, 2009). Yet, as well as being enjoyable, visits to aquariums have also been found to have an impact on marine awareness (Adelman et al., 2000; Falk et al., 2007). Adelman and colleagues (2000) found that when interviewing visitors at the entrance and exit of an aquarium, respondents used more technical vocabulary and demonstrated a greater breadth of discussion after their visit compared to before. As well as illustrating a change in marine awareness; studies have also found that visitors are often more knowledgeable compared to others who have not visited an aquarium recently (Adelman et al., 2000; Falk et al., 2007).

Free-choice learning can also occur during direct experiences with nature, and is often noted to be especially effective (Kellert, 2002). This can include outdoor ocean experiences such as visiting coastlines like rocky shores (Monroe et al., 2006). Public surveys have shown that the marine environment is seen to be an important educational resource (Potts et al., 2011). However, similar to aquariums, learning is not a main reason for visiting this environment. Using a large national survey of English residents ($n = 46,749$), only 5% of visits to the coast were associated with wanting to learn (Natural

England, 2013). Even though learning may not be a central motive for initiating the visit to the coast, this same national survey found that people strongly agreed that they had learned something new during 12% of their visits to the coast (Natural England, 2013). Looking at correlational data, Steel and colleagues (Steel, Lovich et al., 2005; Steel, Smith et al., 2005) also found that subjective and objective marine awareness is higher for individuals who visit the coast more often. However, causal relationships cannot be inferred from correlational work, as there may be underlying factors currently not visible.

There is also indicative research that certain activities, whilst on the coast, may facilitate free-choice learning. Settar and Turner (2010) found that people who engaged in more activities when in the coastal or marine environment were better at identifying marine species. Observing animals has also been noted to be beneficial, as it is both fun and educational (Ballantyne et al., 2007). For instance, marine wildlife tours have been reported to facilitate learning (Zeppel, 2008; Zeppel & Muloin, 2007). Marine wildlife tourism incorporates any recreational activity that has the primary purpose of watching, studying or enjoying marine wildlife (Zeppel, 2008). This can include reading signs, interacting with marine wardens, or doing free-style exploratory rock pooling. However, apart from these few studies that primarily rely on retrospective and correlational surveys, the actual impact (for instance measuring change in marine awareness) of general leisure visits to the coast has not been explicitly explored. Nor have effects of more purposive volunteering activities, such as beach cleans and monitoring marine biota, been investigated in terms of marine awareness.

2.2.4. Summary & Conclusion

In spite of not having a common term or standardised measures, the current literature suggests that, in general, people have reasonably poor marine awareness. This can be enhanced by experiencing nature, including direct experiences such as visiting the coast. However, in order to understand these marine awareness benefits, more research is necessary. As English citizens alone make around 0.3 billion visits to the English coastline each year, the impacts of these visits on marine awareness seems to be a promising yet under researched area (Natural England, 2013). In contrast, research examining the impact of visiting specific types of coastline, such as rocky shores, seems

to be lacking. Consequently, this thesis will explore the impacts of recreational visits to rocky shores on individuals' marine awareness.

2.3 Thesis Preview

The above reviews of the well-being and marine awareness literatures show that experiencing natural (and coastal) environments can facilitate positive impacts for well-being and marine awareness, yet little is known relating specifically to rocky shores, a biologically important environment. Consequently, this thesis aims to empirically investigate these impacts directly. In order to promote sustainable use of this habitat, an integrative approach is adopted. As summarised in the earlier chapter (and illustrated in the schematic research model in Figure 1.4), these benefits will be examined alongside the potential negative impacts these visits can have on the environment. To examine all three aspects together and to justify studying this relationship further, exploratory surveys were first used to explore people's perceptions (Chapter 3).

Perceived Risks and Benefits of Recreational Visits to Rocky Shores: Integrating Impacts on the Environment and Impacts on the Visitor

This chapter is a version of a published peer-reviewed paper:

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

3.1 Introduction

Coastal marine environments provide important industrial, recreational, and biological services. The rocky shore environment alone is a valuable asset with high biodiversity. As noted in Chapter 1, it also offers a number of important services, including food, natural sea defences, and recreation (Branch et al., 2008). However, rocky shores experience numerous threats, and to preserve the benefits of this environment, sustainable use and management needs to be encouraged. Considering the activities that take place is crucial for a consensual approach and for developing policies that regulate these activities effectively. In particular, perceptions of both risks and benefits associated with using the environment need to be considered together, and impacts on both the environment and the user need to be taken into account. This chapter first briefly reviews the literature regarding the negative impacts visits can have on the environment and the literature regarding typically positive impacts on the visitors themselves. Two studies are then reported that examine perceptions of both the risks for the environment (in terms of habitat threat) and benefits for the user simultaneously (in terms of well-being and marine awareness, as illustrated in Figure 3.1). Samples of marine experts and recreational users of rocky shores were surveyed, focusing on recreational visits to rocky shores in the UK (Study 1) and more globally (Study 2).

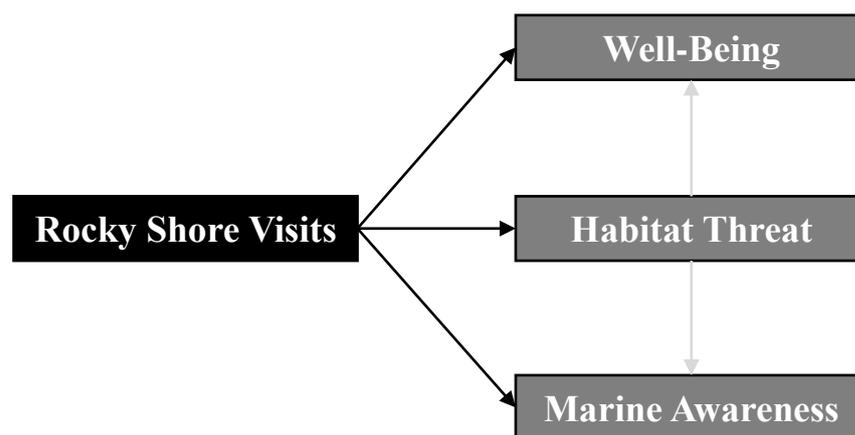


Figure 3.1. The elements of the research model that Studies 1 and 2 examine.

3.1.1. Literature Review

Marine scientists have examined the effects recreational visitors have on rocky shores by examining activities (e.g. Addison et al., 2008; Natural England, 2010; Porter & Wescott, 2004; Smallwood et al., 2012) and relating them to potential impacts on the habitat (e.g. Beauchamp & Gowing, 1982; Fitzpatrick & Bouchez, 1998; Fletcher & Frid, 1996). For example, Pinn and Rodgers (2005) compared areas frequented by visitors with areas less commonly visited and found that the former had lower levels of biodiversity. Fletcher and Frid (1996) systematically manipulated the amount of walking on different communities and found that the abundance of some species increased whilst others declined as a consequence. As noted in Chapter 1, there is a vast amount of literature examining recreational ecology, the study of the ecological relationships in recreational contexts between human and nature, however many of the empirical studies focus on one particular activity (e.g. trampling; Beauchamp & Gowing, 1982; Brosnan & Crumrine, 1994; or four-wheel driving; Priskin, 2003a) and/or on one particular species (e.g. mussels; Smith, Fong, & Amrose, 2008). Consequently, apart from descriptive review articles (e.g. Branch et al., 2008; UK CEED, 2000), there appears to be little research that simultaneously considers the impacts caused by a range of activities on this particular environment (rocky shores).

Priskin's paper (2003b) is one exception that examined the detrimental effects of different activities. Using a survey completed by visitors as they left the shore, Priskin

examined tourists' perceptions of twelve activities according to their impact on sandy shores and compared this with her personal knowledge guided by the literature. Some activities were seen as more damaging than others, for instance fishing was seen as *very harmful* whilst swimming was rated as *slightly harmful*. Visitors were generally aware of some of the impacts activities had on the environment but rated these consistently as less harmful than the expert did. Priskin's contribution is important as it compared visitor and expert perceptions, which helps work towards consensual solutions, and it compared a range of activities, which improves the understanding of the relative harm of individual activities. However, several questions remain. First, Priskin found preliminary differences between the public and her own ratings, but conclusions would be more powerful if perceptions from coastal users were compared with a larger sample of experts within the coastal field. Second, the ratings in Priskin's study assumed that all activities were similar in frequency; hence it would be useful to see if conclusions differ when commonness is taken into account. Third, it is unknown whether these findings would be similar in other habitats, such as rocky shores. Finally, and perhaps most importantly, Priskin examined the negative impacts associated with a visit to the coast, but what are the benefits associated with the different activities, for instance on the visitor's well-being? Only considering both together will allow us to properly understand the impacts, which could then potentially help inform management techniques.

Current psychological research examining impacts on the individual uses a much more general environmental context than the ecological research examining the impacts on the intertidal assemblages. Numerous studies have shown that natural environments in general have a number of psychological benefits compared to urban settings. They have been shown to improve emotion (Barton & Pretty, 2010; Hartig et al., 2003; van den Berg et al., 2003; Ulrich, 1984), increase the ability to perform cognitive tasks (Berman et al., 2008; Berto, 2005; Hartig et al., 2003; Laumann et al., 2003; van den Berg et al., 2003) and speed up recovery after surgery (e.g. Ulrich, 1984). More specifically, aquatic environments were preferred over green environments such as forests (Felsten, 2009; Laumann et al., 2001) and were associated with more positive mood and relaxation (White et al., 2010; White, Pahl et al., 2013). Recent qualitative research has also explored how families use beach visits in general for improving psychological and

physical health (Ashbullby et al., 2013). However, there is little research on the benefits of specific environments, such as rocky shores, rather than of aquatic or natural environments in general.

As well as looking at nature in a very general manner, the psychological approach has tended to overlook the effect of different activities. Many studies in this line of research simply show natural scenes passively on a computer (e.g. Berto, 2005; Felsten, 2009; Laumann et al., 2001; 2003; Staats et al., 2003; van den Berg et al., 2003) or focus on walking (e.g. Berman et al., 2008; Hartig et al., 2003). The coastal environment has numerous recreational uses, which can include activities from rock pooling to playing or sunbathing. Within the recreational and resource management literature, considerable amount of research has been dedicated to activities, such as recording the activities undertaken, their typical characteristics and the participants' motives for engaging in each of these (e.g. Knopf, Peterson, & Leatherberry, 1983; Natural England, 2010, 2013; Outdoor Recreation Resources Review Commission, 1982). This literature has demonstrated how environments are used and shown that motives vary between activities (e.g. Knopf, 1987; Pierce, 1980). However, this detailed investigation of activities in the environmental psychological literature examining the psychological outcomes seems to be missing. Some research has considered the intensity of a particular activity on a person's well-being, such as cycling when viewing a video of a natural scene (Barton & Pretty, 2010); yet there appears to be little research on the psychological effects of different activities in natural settings. Consequently, more research is necessary to examine the psychological well-being benefits of different activities in natural environments.

In addition to the well-being benefits of visiting the environment (such as improving mood), there may also be benefits for visitors' marine awareness. Studies have examined the impact of direct and indirect natural experiences using school groups and excursions (Zeppel & Muloin, 2007). For example, Cummins and Snively (2000) examined an educational programme on grade 4 pupils (age 9-10), which involved a classroom session and a field trip to sandy and rocky shores. Children's knowledge and attitudes towards the ocean significantly increased as a consequence of this field trip. Changes in awareness have also been shown in adults, for example after visiting an

aquarium, marine awareness was found to increase (Adelman et al., 2000; Falk & Adelman, 2003). Similarly, Americans who lived close to the coast and often visit this environment had higher levels of marine awareness (Steel, Smith et al., 2005). However, little is known about the direct impacts of a general recreational visit to a natural environment in the absence of any educational input or interpretation.

3.1.2. Present Studies

As reviewed above, previous research suggests that exposure to aquatic environments is beneficial for well-being and marine awareness; but at the same time, certain activities can have specific detrimental effects on the marine habitat. However, it appears that no previous work has examined these effects on the habitat *and* on people together. As a first step, the present studies investigate perceptions of risks for the environment and benefits for the visitor, in an integrated fashion. Such a broad approach allows those activities that are most beneficial to humans but of low negative impact to the environment to be identified (and encourage people to engage in them). Conversely, it would also highlight which activities have little benefit to human well-being yet considerable costs to the environment, which would then be able to guide management strategies that can protect the environment and maximise visitors' well-being. Participants were asked to estimate the impact of a range of recreational activities on the environment in terms of commonness and harmfulness (combined to calculate a perceived risk score, following traditional approaches to risk assessment; Slovic, Fischhoff, & Lichtenstein, 1977; Vlek, 1996). They were also asked to estimate the impact the activities had on the individuals engaging in them, in terms of well-being. Finally, regardless of specific activities, they were asked to estimate the impact of a visit on marine awareness. The pros and cons of such a broad, perception-based approach will be discussed in more detail later but it is important to note that this approach gave the ability to compare and integrate the impact of a substantial number of activities. Study 1 used two separate British samples (extending Priskin's (2003b) approach): Coastal experts, who were defined as professionals linked to the management of coastlines and/or engaged with the public in these coastal environments, and coastal users who visit but have no specialist knowledge regarding rocky shores. This study focused on British rocky shores, whereas Study 2's

sample consisted of international academics with expertise specifically relating to rocky shores in order to gain an understanding of the generalisability of the issues beyond the British context.

These two studies aimed to answer one key question: What are the perceived risks to the environment and benefits to the individual associated with recreational visits to rocky shores? More specifically, four sub-questions were addressed: First, which activities are seen as most harmful to the environment, thus potentially in need of management strategies? Second, are visits to rocky shores seen to be beneficial for the visitor (in terms of well-being and marine awareness)? Third, is there a difference between experts and coastal users in their perceptions and between different countries? And finally, which activities maximise visitor benefits and minimise environmental risks?

3.2 Study 1: Coastal Users' and Coastal Experts' Perceptions

The first study investigated and compared perceptions of risks and benefits associated with visits to British rocky shores between coastal experts and non-experts. Specifically, 15 recreational activities were rated according to 1) their perceived commonness and harmfulness to the coastal environment, and 2) their perceived influence on visitors' well-being in terms of mood and arousal. Perceived changes in marine awareness after a visit were also included. The differences between coastal users' and coastal experts' perceptions were also explored.

3.2.1. Method

3.2.1.1. Participants.

The sample consisted of 122 participants: 25 coastal experts (7 men, 18 women) and 97 coastal users (24 males, 72 females, 1 not stated). The majority (40%) of the coastal experts fell into the 25-30 age category, whilst the majority (30%) of the coastal users fell into the 51-60 age category. Coastal experts were professionals predominantly employed by conservation charities such as the National Trust. Their roles linked directly to the management of coastlines and/or involved engaging with the public in these coastal environments, specifically rocky shores, for instance arranging events such as rock pool rambles (warden led explorations of rock pools). This specialised sample was recruited

using the snowball sampling technique. They were recruited via professional networking (e.g. at conferences) and were sent an email with the study information and survey link to an online questionnaire that they were asked to forward onto others within the same profession. Of those who were directly contacted by the researcher, 34% responded. This resulted in a sample of coastal experts who, on average, had spent eight years working in the coastal field ($SD = 6.57$; range = 1-26 years). Their coastal sites varied from the Isles of Scilly to Teesside in the UK, with the majority based in Devon (44%).

For this study, coastal users were defined as individuals that often visit the coast but do not have expertise or work in a profession that involves working on the coast. A convenience sample was recruited using a staff announcement that was placed on Plymouth University's internal website that all employees see when accessing any online services. The university is located near rocky shores in the south west of England. The advert included a short description of the study, the inclusion criteria (that participants often visit the coast and are not coastal experts) and the link to the survey. This sample did comply with the coastal user definition above; with the majority visiting once or twice a month (38%) or once every couple of months (26%), with no coastal-based occupations reported.

3.2.1.2. Materials.

To encourage participation and reduce demand, a short survey with three sections was used: Impacts on the environment, impacts on the visitor and demographics (see Appendix C for materials).

3.2.1.2.1. Impacts on the environment.

Based on previous literature that observed and/or examined activities, 15 activities that are typically performed in this particular intertidal area were chosen: Walking, dog walking, jogging, swimming, snorkelling, crabbing, fishing, playing with the family, paddling, sunbathing / relaxing, rock pooling, wildlife watching (e.g. bird watching), picnicking, fossil hunting, and cycling (e.g. Coombes & Jones, 2010; Pinn & Rodgers, 2005; Priskin, 2003b). Other activities such as power boating and sailing were not included as they were not directly relevant for this intertidal environment, as they

were more offshore than shore-based activities and the list needed to be reasonably concise to reduce demand on participants. Participants were required to rate how common they thought each activity was within rocky shore environments in general on a 5-point scale from *not common at all* (1) to *extremely common* (5), and to what degree they perceived them to be harmful to the environment from *harmless* (1) to *extremely harmful* (5) (similar to Priskin, 2003b). In order to examine the perceived overall impact on the environment, later relate it to the impact on the visitor, and to be in line with traditional risk and utility assessment; commonness and harmfulness were then multiplied to obtain a perceived total risk score (Slovic et al., 1977). There are many different approaches to conceptualising and calculating risk scores (see Vlek, 1996 for critical discussion). A fairly common method has been adopted here, but it is recommended that there should be further testing and development of this approach for use in further integrated analyses (see Appendix D for alternative analyses). Using an open-response format, participants were also asked *if there was one visitor-related behaviour you would change in regard to damage caused to rocky shore species or habitats, what would it be and why* to get a deeper understanding.

3.2.1.2.2. Impacts on the visitor.

Participants also rated the same activities according to their perceived impacts on general visitors. Based on the Circumplex Model of Affect (Russell, 1980) which emphasises that emotion is represented by two-dimensions: Activation and valence participants were asked to rate how each activity would change visitor mood (1 = *much worse mood*, 3 = *no change*, 5 = *much better mood*) and visitor arousal using a 5-point scale (1 = *much calmer*, 3 = *no change*, 5 = *much more excited*). Participants were also asked to rate whether they thought visitors' marine awareness increases after a visit on a five-item scale. Specifically, items referred to a) *the overall biology (the science of life) of this rocky shore environment*, b) *the overall ecology (the interactions between organisms and their environment) of this rocky shore environment*, c) *the natural threats faced by organisms (including via habitat destruction) on rocky shores (e.g. wave action)*, d) *the general human-induced challenges facing rocky shore organisms (e.g. oil spills)*, and e) *the specific visitor-induced threats to rocky shore organisms (e.g. from trampling)* (based

on Steel, Lovrich et al., 2005; Steel, Smith et al., 2005 approach). Responses varied from a *large decrease* (1) to a *large increase in awareness* (5) on a 5-point Likert-type scale with a midpoint of *no change* (Cronbach's $\alpha = .84$). An open-ended section also gave participants the opportunity to provide *additional comments regarding this section*.

3.2.1.3. Design and procedure.

As shown in the schematic diagram (Figure 3.2), participants were first presented with a brief description of the study. A short definition of a rocky shore and a photograph was provided to give an indication of the environment being examined. Respondents then completed the survey. To reduce order effects of the survey section, the first two sections were counterbalanced. After completing the survey, the aim of the study was reiterated and contact details were provided.

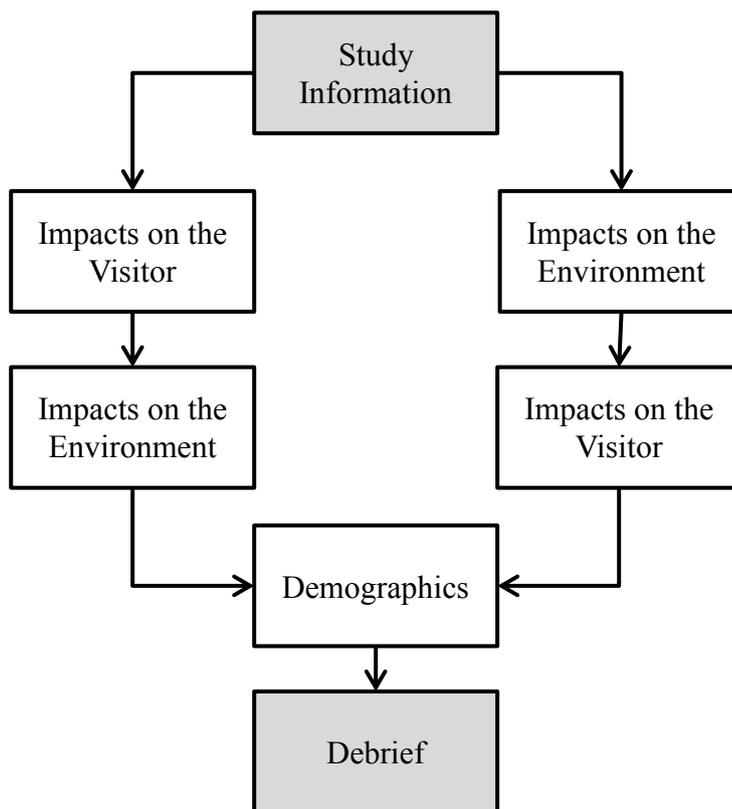


Figure 3.2. A schematic diagram of the methodological design, with participants completing one of the two pathways, to counteract any order effects.

3.2.1.4. *Analysis.*

Analysis (for this and the subsequent studies) first involved screening the data by examining boxplots for statistical outliers, checking for skew and kurtosis to indicate normality and running inferential statistics (such as mixed analysis of variances) to explore whether theoretically less important factors such as demographics (e.g. gender and age) and methodological factors (e.g. order effects) influenced the overall findings. Where variables deviated from normal distribution, both parametric and non-parametric tests were used, with the former being reported unless results differ. When exploring the main effects of gender, age and questionnaire section order on the main variables in this study, only one main effect emerged, females perceived the environmental risks to be greater than males, $F(1, 92) = 4.78, p = .03, \text{partial } \eta^2 = .05$ (small effect). All of the other analyses resulted in non-significant effects, thus will not be addressed further (all $ps > .05$).

For the main analyses, a range of inferential statistics were reported. Throughout this thesis, null hypothesis significance testing according to the $p < .05$ criterion was adopted, with test-specific effect sizes reported to describe the magnitude of each of the observed effects. Analyses of variances (ANOVAs) were used to compare activities on each of the ratings and to analyse differences between the two samples. For all of these repeated-measures analyses where sphericity is not given, Greenhouse-Geisser correction is applied when the sphericity estimates are below 0.75, and Huynh-Feldt correction when above, as recommended by Girden (1992; as cited in Field, 2005). Where main effects or interactions were significant, follow-up analyses were carried out (e.g. planned contrast and simple effects analysis). Familywise error was adjusted in specific statistical tests or manually using Bonferroni correction (Field, 2005). One-sample t -tests were also used for the data on impacts on the visitor section, to see if responses were significantly different to the mid-point of the scale representing *no change*. The relationships between the main variables (e.g. marine awareness and well-being) were not central to this specific chapter's and the overall thesis' research questions, but correlational results for this and the subsequent chapters can be found in Appendix E.

For the additional open-response sections, quantitative content analysis (Millward, 1995) was used. Following thematic analysis procedures, the entire qualitative

responses for the sections were initially examined to identify prominent recurring themes (Braun & Clarke, 2006). The themes and sub-themes were then developed further by re-reviewing the data. Once the themes were condensed into suitable categories, the frequency of each theme was recorded in order to be able to compare responses from the coastal experts and coastal users using chi-square tests. All analyses and coding was completed by the author. A second independent coder coded twenty percent of the qualitative data. Agreement between coders was moderate to high for the two qualitative analyses, Cohen's $\kappa > .46$ (Landis & Koch, 1977).

3.2.2. Results

First, the two samples were examined together, examining the perceived impacts of visits on the environment and on the visitor. Any differences between coastal experts' and coastal users' ratings were then explored.

3.2.2.1. *Impacts on the environment.*

To calculate the total perceived risk to the environment, perceived commonness of each activity was multiplied by perceived harmfulness (see Appendix D for the means of the respective variables alone). As shown in Table 3.1, it was found that activities did significantly differ in terms of their perceived risk to the environment, $F(7.28, 807.96) = 45.27, p < .001$, partial $\eta^2 = .29$ (medium effect)¹; descriptively, with rock pooling, fishing and crabbing seen to have the highest risk to the shore, and cycling, swimming and sunbathing / relaxing having the least.

¹ According to Cohen's (1992) benchmark criteria, small effects are those of a partial η^2 value of 0.10, medium is 0.25 and large effects have a value of 0.40 or higher.

Table 3.1. *The means (and standard deviations) for the perceived risk to rocky shores associated with each activity overall (n = 122) and separately for the two samples (n coastal experts = 25; n coastal users = 97) for Study 1.*

	Overall	Coastal Experts	Coastal Users	Difference between samples
Walking	10.37 (4.37)	9.32 (3.68)	10.64 (4.59)	n.s.
Dog walking	11.43 (5.14)	8.82 (5.25)	12.01 (4.99)	n.s.
Jogging	6.23 (3.70)	4.55 (3.54)	6.64 (3.71)	n.s.
Swimming	5.60 (2.89)	5.09 (2.51)	5.69 (3.05)	n.s.
Snorkelling	6.01 (3.80)	6.18 (3.51)	5.70 (3.74)	n.s.
Crabbing	11.52 (5.45)	12.00 (5.86)	11.27 (5.52)	n.s.
Fishing	12.58 (5.06)	12.64 (5.03)	12.55 (5.20)	n.s.
Playing with Family	10.78 (4.72)	10.09 (5.04)	10.91 (4.83)	n.s.
Paddling	8.02 (4.19)	8.05 (3.71)	7.87 (4.31)	n.s.
Sunbathing / Relaxing	5.77 (3.70)	4.36 (2.52)	6.22 (3.93)	n.s.
Rock pooling	14.48 (5.73)	15.50 (5.73)	13.90 (5.75)	n.s.
Wildlife Watching	6.70 (4.10)	8.05 (4.94)	6.25 (3.87)	n.s.
Picnicking	9.93 (5.36)	8.14 (5.50)	10.35 (5.30)	n.s.
Fossil Hunting	9.37 (6.04)	8.73 (6.06)	9.31 (6.16)	n.s.
Cycling	4.61 (3.73)	2.77 (2.33)	5.05 (3.91)	$p < .01$

Note. Risk was calculated by multiplying commonness (*not common at all* [1] – *extremely common* [5]) with harmfulness (*harmless* [1] – *extremely harmful* [5]), thus ranged from 1 to 25, where higher scores indicate worse impact.

3.2.2.1.1. Content analysis.

Qualitative data in response to *if there was one visitor-related behaviour you would change in regard to damage caused to rocky shore species or habitats, what would it be and why* emphasised problematic activities and behaviours further. A total of 106 responses (25 from coastal experts, 81 from the non-expert sample) were collected, addressing 148 individual points. From their responses, three prominent themes were found: Littering, lack of rock pooling ethics and general disturbance. *Littering* represented comments directly referring to the leaving of rubbish (e.g., generally, food-related, fishing, or dog fouling). For instance, “...The rubbish left behind is an eye sore and potentially dangerous to other visitors or the wildlife”. *Lack of rock pooling ethics* generally referred to acting in an inconsiderate manner in the rock pools (e.g. displaying general lack of knowledge, not returning boulders or organisms back) that can lead to “...exposing animals and plants to the drying air is not good and will change the ecology of a location in time”. The final theme, *general disturbance*, covers comments that

addressed more generally the disturbance by visitors to the habitat and the wildlife, such as from walking over the rocks or from rock pooling or crabbing; e.g., “...in terms of disturbing the habitat of shore creatures.” Littering behaviours were mentioned the most (Table 3.2).

Table 3.2. *The observed (and expected) frequency of comments falling into the themes for the qualitative component on impacts on the environment for Study 1.*

Theme	Coastal Experts (n = 25)	Coastal Users (n = 97)	Total
General Disturbance	9 (8.38)	22 (22.62)	31
Littering	11 (19.73)	62 (53.27)	73
Lack of rock pooling ethics	20 (11.89)	24 (32.11)	44
Total	40	108	148

Note. Some comments addressed more than one theme; hence the number of comments exceeds the sample size.

3.2.2.2. *Impacts on the visitor.*

All activities were perceived to have a positive impact on visitors’ mood, as all values were above the *no change* value of 3 (all $ps < .001$; Table 3.3). Activities were found to differ from one another in terms of change in mood, $F(5.83, 624.16) = 12.56, p < .001$, partial $\eta^2 = .11$ (small effect). Descriptively, walking, wildlife watching, and snorkelling were seen to have the most positive impact, whereas cycling, fossil hunting, and jogging had the least (Table 3.3).

For the arousal scale, any values below 3 represented calming feelings, whilst values above 3 represented increased feelings of excitement. One-sample *t*-tests found that playing with the family, crabbing, snorkelling, rock pooling, fossil hunting, and cycling were seen to make visitors feel more excited (all $ps < .02$). Sunbathing / relaxing, walking, dog walking, picnicking, and paddling were seen to make visitors feel significantly more calm (all $ps < .005$). These differences between activities were found to be statistically significant, $F(9.05, 967.80) = 33.43, p < .001$, partial $\eta^2 = .24$ (medium effect, see Table 3.3).

Table 3.3. The means (and standard deviations) for the impact on the visitor items associated with each activity for the overall sample ($n = 122$) and for the coastal experts ($n = 25$) and coastal users ($n = 97$) in Study 1.

	Overall	Coastal Experts	Coastal Users	Difference
Perceived Change in Mood				
Walking	4.22 (0.86)	4.21 (0.72)	4.22 (0.89)	n.s.
Dog walking	3.92 (1.06)	4.00 (0.78)	3.90 (1.13)	n.s.
Jogging	3.79 (1.12)	3.92 (0.83)	3.76 (1.19)	n.s.
Swimming	4.08 (0.82)	4.17 (0.70)	4.05 (0.85)	n.s.
Snorkelling	4.17 (0.85)	4.33 (0.76)	4.13 (0.87)	n.s.
Crabbing	3.97 (0.99)	3.83 (0.96)	4.01 (1.00)	n.s.
Fishing	3.86 (1.08)	3.63 (1.06)	3.92 (1.08)	n.s.
Playing with Family	4.16 (0.97)	4.21 (0.98)	4.15 (0.97)	n.s.
Paddling	4.11 (0.86)	4.13 (0.85)	4.11 (0.86)	n.s.
Sunbathing / Relaxing	4.04 (0.87)	4.17 (0.70)	4.01 (0.92)	n.s.
Rock pooling	4.12 (1.04)	4.13 (1.08)	4.12 (1.04)	n.s.
Wildlife Watching	4.20 (0.81)	4.25 (0.85)	4.19 (0.81)	n.s.
Picnicking	3.80 (1.12)	3.79 (0.66)	3.80 (1.21)	n.s.
Fossil Hunting	3.75 (1.08)	3.75 (0.79)	3.75 (1.15)	n.s.
Cycling	3.45 (1.19)	3.38 (1.01)	3.45 (1.24)	n.s.
Perceived Change in Arousal				
Walking	2.01 (0.88)	2.25 (0.90)	1.95 (0.87)	n.s.
Dog walking	2.31 (0.90)	2.25 (0.74)	2.33 (0.94)	n.s.
Jogging	2.86 (0.98)	2.92 (0.88)	2.85 (1.01)	n.s.
Swimming	2.86 (1.01)	3.21 (1.06)	2.77 (0.98)	n.s.
Snorkelling	3.32 (1.08)	4.25 (0.53)	3.08 (1.05)	$p < .001$
Crabbing	3.42 (1.02)	4.00 (0.66)	3.26 (1.04)	$p < .001$
Fishing	2.97 (1.02)	3.46 (1.06)	2.85 (0.97)	n.s.
Playing with Family	3.42 (1.02)	3.79 (0.83)	3.32 (1.04)	n.s.
Paddling	2.73 (1.02)	3.13 (0.97)	2.63 (1.01)	n.s.
Sunbathing / Relaxing	1.90 (0.82)	1.83 (0.76)	1.91 (0.84)	n.s.
Rock pooling	3.32 (1.12)	4.00 (0.93)	3.14 (1.11)	$p < .001$
Wildlife Watching	2.86 (1.11)	3.38 (1.10)	2.73 (1.08)	n.s.
Picnicking	2.58 (0.82)	2.71 (0.75)	2.55 (0.84)	n.s.
Fossil Hunting	3.23 (0.94)	3.46 (0.78)	3.18 (0.97)	n.s.
Cycling	3.21 (0.96)	3.17 (0.92)	3.22 (0.98)	n.s.

Note. Perceived change in mood ranged from 1 (*much worse mood*) to 5 (*much better mood*); perceived change in arousal ranged from 1 (*much calmer*) to 5 (*much more excited*); both with 3 as *no change*.

General visits to rocky shores were also seen to have positive effects on marine awareness. The average rating of marine awareness change was 3.70 ($SD = 0.51$), which was statistically higher than *no change* ($p < .001$).

3.2.2.2.1. Content analysis.

Fifty participants (16 coastal experts, 34 coastal users) took the opportunity to provide further information for the *additional comments* question within the impacts on the visitor section, resulting in 60 separate points. There were four key themes in these responses: Other factors, personal experience, measurement issues, and the visitor-environment relation. The theme *other factors* represented comments that noted other aspects that could influence how a visitor experiences a trip to a rocky shore, for instance “these questions are difficult to answer as it would depend on many things e.g. Tide state, whether you catch anything when fishing, whether accompanied by an expert etc.”. Some comments also reflected on *personal experience*, for instance one participant wrote “I find that being at the beach / shore line is the most relaxing place to be and also takes all your troubles away after, either, a nice long walk, surf or rock pool exploring”. The *measurement issues* theme represented a number of comments that related to the measures in the survey specifically. Two key issues raised within this theme were that the arousal dimension of affect was difficult to rate, as some noted that “some activities here can leave you elated (more excited) but fulfilled and calmer at the same time” and that it depends on the individual activity episode “e.g. if a crabber or fisherman caught a big fish or crab or a nature spotter saw a rare animal, then they may become very excited. If not, then just the experience of being by the sea and the natural world is likely to make them feel calmer”; and that it is difficult to respond from a third person perspective (visitors in general). The *visitor-environment relation* theme consisted of comments that reflected on the overall relationship between visitors and the environment, for example “on balance I cannot help but think that, weighed against the amount of benefit a visit to the coastline is to people, the limited amount of negative impact in a small area is almost acceptable”. Other factors followed by measurement issues were noted the most (see Table 3.4).

Table 3.4. *The observed (and expected) frequency of comments falling into the themes for Study 1 for the additional qualitative component on impacts on the visitor.*

Theme	Coastal Experts (n = 25)	Coastal Users (n = 97)	Total
Other factors	19 (11.55)	14 (21.45)	33
Personal experience	0 (3.50)	10 (6.50)	10
Measurement issues	2 (4.55)	11 (8.45)	13
Environment-Visitor relation	0 (1.40)	4 (2.60)	4
Total	21	39	60

Note. Some comments addressed more than one theme; hence the number of comments exceeds the sample size.

3.2.2.3. *Differences between expert and coastal user samples.*

As shown in Table 3.1, the coastal experts and coastal users responded similarly for 14 activities regarding the environmental risk of each activity. Statistically, sample did not have a main effect ($p = .31$) but a small interaction between sample and activities was statistically significant, $F(7.28, 807.96) = 2.63$, $p = .001$, partial $\eta^2 = .02$ (a negligible effect). The only discrepancy between the two samples found during the post-hoc analysis was that coastal users perceived cycling as having a greater risk on the environment than coastal experts (Table 3.1). Despite this difference, both groups agreed that this activity was associated with the smallest risk compared to the other activities. Consequently, generally both coastal experts and coastal users perceived the impact on the environment of different activities similarly.

As shown in Table 3.2, the open-ended comments did differ in their focus on littering and lack of rock pooling ethics. Forty-eight percent of coastal experts' comments related to the lack of rock pooling ethics, whilst only 21% of the users' comments related to this theme. In contrast, 54% of coastal users' comments related to the litter theme, whilst only 26% of coastal experts' comments related to this. A chi-square analysis found that the two samples significantly differed in the focus of their comments, $\chi^2 = 12.93$, $df = 2$, $p = .002$.

Regarding perceived impacts on the visitor, both samples had similar ratings for the mood effects overall and for each activity ($p > .15$, Table 3.3). For the arousal ratings, there was a small effect that coastal experts generally saw activities as more exciting than

the coastal users, $F(1, 107) = 8.69, p = .004$, partial $\eta^2 = .08$ (small effect). For the majority of activities, both samples were similar in their perceptions; however, a small interaction was statistically significant, $F(9.05, 967.80) = 3.81, p < .001$, partial $\eta^2 = .03$ (small effect). As shown in Table 3.3, both coastal experts and coastal users perceived that visitors would feel excited after snorkelling, crabbing or rock pooling, but the coastal experts perceived that visitors would experience a slightly greater level of excitement.

For marine awareness, both samples believed visitors' marine awareness would increase after a visit (all $ps < .001$). However, coastal users were slightly more optimistic in the marine awareness benefits, as they believed visitors would leave with greater marine awareness ($M = 3.75, SD = 0.52$) than the coastal experts did ($M = 3.50, SD = 0.44$), $t(118) = 2.15, p = .03, d = .47$ (medium effect)².

Similar to the other qualitative findings, the additional qualitative comments regarding the impacts on the visitor also differed between the two samples in their focus. The other factors theme was the main focus of the coastal experts' comments, whereas coastal users did address this theme but also addressed measurement issues and personal experience. A chi-square analysis found that the two samples significantly differed in the focus of their comments, $\chi^2 = 17.51, df = 3, p < .001$.

3.2.2.4. Integrating impacts on visitor and environment.

To integrate perceived impact on the environment and impact on the visitor, the z-scores³ for perceived risk to the environment and effect on mood were plotted on a risk perception map (Figure 3.3, similar to Slovic, 1987). Mood was chosen over arousal because it was most relevant and commonly used measure of well-being. The top right quadrant highlights the activities that had high mood benefits to the visitor but also high risk to the environment (e.g. rock pooling and playing with the family), the lower right quadrant highlights activities with greater benefits to the visitor that were less detrimental to the environment (e.g. swimming and sunbathing / relaxing), and activities in the quadrants on the left were seen to be less beneficial to the visitor and either potentially

² Small effects for Cohen's d are those of a value of 0.20, medium is 0.50 and large effects have a value of 0.80 (Cohen, 1992).

³ Z-scores (values converted to standard deviation units) were used to standardise the two measures that were originally on different scales so that they could be compared.

detrimental to the environment (top left; e.g. fishing and picnicking) or not as detrimental (bottom left; e.g. cycling and jogging).

3.2.3. Discussion

This study examined the perceived risks and benefits associated with visits to British rocky shores. Participants felt impacts on the environment and on the visitor were dependent on the activities. Apart from some small differences between the two samples, the experts and coastal users agreed. They both perceived a number of psychological benefits to the visitors on rocky shores but that certain activities can have more detrimental effects on the shore; specifically harvesting and foraging activities like rock pooling and fishing, but also littering. However, the expert sample was small, and many of these were wardens who dealt directly with visitor management on rocky shores.

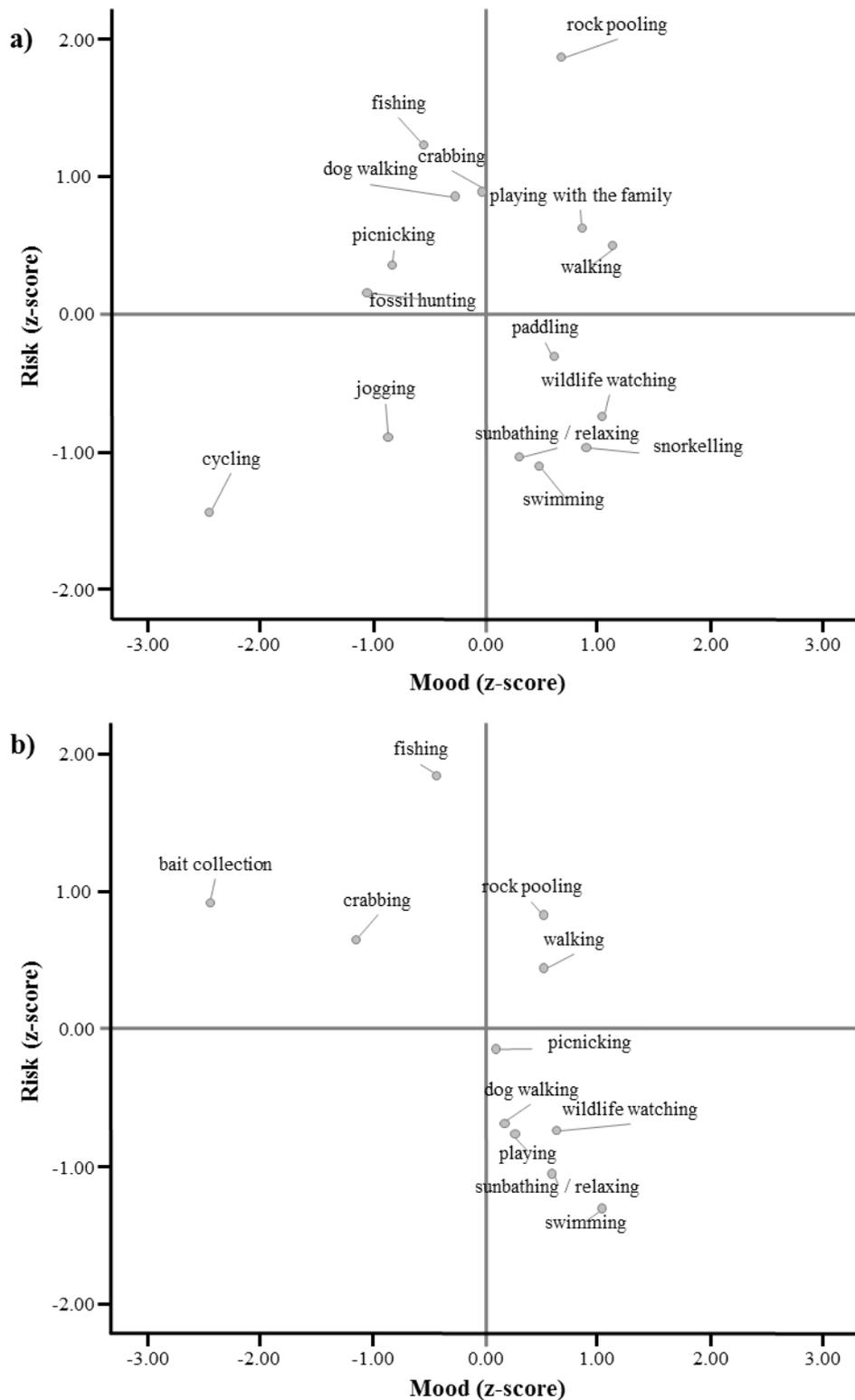


Figure 3.3. Activity plots according to impact on the environment (perceived risk, with positive values referring to greater risk) and on the visitor (mood, with positive values referring to great change in positive mood). Fig. a) is for Study 1 with coastal experts and coastal users rating 15 activities ($n = 122$); Fig. b) is for Study 2 with international experts rating 11 activities ($n = 44$; reproduced from Wyles, Pahl & Thompson, 2014). Note. Even though coastal experts and users significantly differed according to their perceived risk of cycling on the coast, the pattern was the same, thus the overall mean is presented here.

3.3 Study 2: International Academics' Perceptions

Study 2 develops the coastal expert sample further by using a more geographically global but specialised sample of international marine ecologists, who scientifically study rocky shore environments. Measures were also refined based on the findings of Study 1, for instance removing the activities rated to be less common on rocky shores (see Appendix D) and using a simpler well-being measure. Consequently, Study 2 examines the perceived impacts of recreational visits to rocky shores more globally, regarding both the environment and the visitor.

3.3.1. Method

3.3.1.1. *Participants.*

Participants were conference delegates attending the 9th International Temperate Reefs Symposium that comprised marine ecologists who engage in research and/or teach university students about rocky shores. Twenty five percent of all delegates completed the survey, resulting in a sample of 44 (26 male, 18 female). The majority of participants worked for a university (89%), had worked in the coastal field on average for 14 years ($SD = 10$; range = 1-43 years) and were aged between 31 and 40 (34%). The nationality most largely represented in this sample was British (29%); however the sample also consisted of experts from the USA, Australia, Italy, Portugal, Chile, France, Hong Kong, Canada, Spain, and New Zealand.

3.3.1.2. *Materials.*

As in Study 1, the sections covered the impacts on the environment, impacts on the visitor and demographics (see Appendix C). However, there were some modifications to the individual items, which are addressed below.

The list of activities were reduced to eleven for ease and conciseness. The four least common activities from Study 1 were removed (cycling, fossil hunting, snorkelling, and jogging) and any seen to be ambiguous for a multi-national sample were also omitted (paddling). Bait collection (harvesting organisms to be later used as bait) was added, as this can be a more common activity in other countries (Thompson et al., 2002).

To examine the impacts on the visitor, a more concise, less debatable yet sensitive approach was also adopted, where the Overall Happiness Scale (Campbell, Converse, & Rodgers, 1976) was used. Participants marked on a line where they perceived visitors' happiness to be after performing each activity on a rocky shore. Ratings were then converted into scores, ranging from zero where visitors were perceived to leave *much less happy* to 100 where visitors were perceived to leave *much more happy*. The score of 50 implied there was *no change in happiness*.

For the perceived change in marine awareness items, the scale was also modified. Originally, Study 1 had a bidirectional scale from *a large decrease in awareness* to a *large increase*; however, less than 1% of answers were below *no change* (3). Consequently, a unidirectional scale was adopted, ranging from *no change in awareness* (1), *moderate change* (3) to *a large increase in awareness* (5), thus being more sensitive to record differences in perceived change in awareness. This scale was still found to be reliable (Cronbach's $\alpha = .77$). The two qualitative components for the impacts on the visitor and impacts on the environment were also included; however only the latter is reported below, as the few ($n = 18$) comments provided for the impacts on the visitor section did not extend Study 1's findings.

3.3.1.3. Design and procedure.

Participants were recruited during the 9th International Temperate Reefs Symposium. The conference delegates were given the survey with their conference pack and explicitly introduced to the study by the conference organiser on the first day. The survey included a brief description of the study before proceeding onto the questions. Similar to Study 1, the two sections (impacts on the environment and impacts on the visitor) were counter-balanced (see Figure 3.2). Participants then had three days to complete and return the survey. At this point, the purpose of the study was explained and the researcher's contact details were provided.

3.3.1.4. *Analysis.*

The analysis procedure was identical to Study 1. Participants who received one order (impacts on the visitor then impacts on the environment) perceived marine awareness improvements to be greater than participants with the other order, $F(1, 21) = 6.49, p = .02$, partial $\eta^2 = .24$ (medium effect), but this one section-order finding was seen to be a lone arbitrary result thus the two groups were combined. There were no statistically significant effects of gender, age, or nationality on the quantitative responses (UK vs. non-UK; $ps > .06$). Consequently, these variables will not be discussed further. An independent second coder checked twenty percent of the qualitative data for inter-rater reliability. Agreement between coders was found (Cohen's $\kappa > .60$, Landis & Koch, 1977).

3.3.2. **Results**

3.3.2.1. *Impacts on the environment.*

After calculating perceived risk, activities were found to significantly differ from one another in terms of perceived total risk to the environment, $F(5.91, 224.70) = 12.60, p < .001$, partial $\eta^2 = .25$ (medium effect). Descriptively, fishing, bait collecting and rock pooling were perceived as having the most risk to the environment, and swimming, sunbathing / relaxing and playing were seen as having the least (Table 3.5 and Appendix D for individual means).

Table 3.5. The means (and standard deviations) for the 11 activities according to impact on the environment (perceived risk) and impact on the visitor (perceived change in happiness) for the international academic sample ($n = 44$) in Study 2.

	Environmental Risk		Visitors' Change in Happiness	
Walking	8.84	(5.09)	79.10	(11.56)
Dog Walking	6.07	(4.30)	76.38	(15.68)
Swimming	4.59	(2.95)	82.54	(11.66)
Crabbing	9.32	(5.49)	67.24	(17.23)
Fishing	12.21	(5.91)	72.33	(18.50)
Playing with family	5.93	(4.48)	77.31	(13.29)
Sunbathing / relaxing	5.23	(3.57)	79.07	(15.42)
Rock pooling	9.75	(5.95)	79.42	(15.66)
Wildlife Watching	5.95	(4.12)	79.40	(16.01)
Picnicking	7.42	(5.35)	75.91	(13.11)
Bait collecting	9.98	(6.26)	57.93	(17.75)

Note. Perceived risk was calculated by multiplying commonness that ranged from 1 (*not common at all*) to 5 (*extremely common*) with perceived harmfulness that ranged from 1 (*harmless*) to 5 (*extremely harmful*), thus ranged from 1 to 25. Happiness responses ranged from 0 (*much less happy*) to 100 (*much more happy*), with a mid-point of 50 (*no change*).

3.3.2.1.1. Content analysis.

There were 34 comments (addressing 42 individual points) that responded to the open-response item examining the one visitor-related behaviour they would like to have seen changed. Four themes arose (Table 3.6): 1) *Disturbance*, direct manipulation and disruption to the environment such as “People looking under boulders either for observation or fishing and bait collection WITHOUT turning them back in place [resulting in] organisms used to shade will die”. 2) *Removal of organisms*, damage to the habitat and wildlife by removing individual items; for example “Harvesting of species - Removing biomass, genetic variability and reproductive potential cannot enhance the dynamics of the system”. 3) *Littering*, the act of leaving rubbish on the shore; for example being left “...by visitors using beach for picnics etc.” 4) *Trampling*, detrimental effects of people walking on the shore on the environment and species including “... crushable algae & sessile animals like mussels”. To verify that country of residence did not influence these themes, a chi-square analysis compared responses from the UK residents ($n = 12$) to the remaining residents ($n = 29$) (comparing all nationalities was not feasible due to group sizes). Overall they highlighted similar themes, $\chi^2 = 0.75$, $df = 3$, $p = .86$.

Table 3.6. *The observed (and expected) frequency of comments falling into the themes for the qualitative component on impacts on the environment for Study 2.*

Theme	UK Frequency (<i>n</i> = 12)	Non-UK Frequency (<i>n</i> = 32)	Overall Frequency
Disturbance	6 (4.86)	11 (12.14)	17
Removal of Organisms	3 (4.00)	11 (10.00)	14
Litter	2 (2.00)	5 (5.00)	7
Trampling	1 (1.14)	3 (2.86)	4
Total	12	30	42

3.3.2.2. *Impacts on the visitor.*

All of the activities were seen to improve visitors' happiness, as all scores were above the midpoint of *no change* (all p s < .006, Table 3.5). It was found that the activities did differ in regards to perceived happiness, $F(4.23, 156.40) = 9.68, p < .001$, partial $\eta^2 = .21$ (medium effect); with swimming, rock pooling and wildlife watching seen to have the greatest positive influence.

As well as believing that happiness increases with a visit to a rocky shore, participants also felt that marine awareness increased with a visit. On average, participants believed that visitors will experience a slight change in marine awareness ($M = 2.18, SD = 0.77$), statistically more so than *no change* ($p < .001$).

3.3.2.3. *Integrating impacts on visitor and environment.*

The risk perception map in Figure 3.3 shows the relationship between impact on the environment and impact on the visitor by plotting the activities' standardised z-scores for risk to the environment and effect on happiness. It shows that bait collecting, fishing and crabbing were perceived to have a high negative impact on the environment but a low positive effect on the visitor (top left quadrant), suggesting they may not be that important to the visitor's well-being. In contrast, swimming, sunbathing / relaxing and wildlife watching were perceived to have a small amount of negative impact on the environment but a positive effect on the visitor (bottom right quadrant), suggesting an overall positive effect. Rock pooling and walking were seen to have both positive effects on visitors and potentially detrimental impacts on the environment (top right quadrant).

3.4 General Discussion

These two studies used a novel integrative approach to examine recreational visits to rocky shores. Unlike the previous literature, the two studies reported examined the perceived impacts that visits have on the visitor as well as on the environment. Thus the present findings are novel because they begin to provide an integrative approach to inform management and policy strategies. Overall, both studies agree that visits to rocky shores are perceived to be beneficial to visitors in terms of well-being and marine awareness. However, depending on the activity performed, these visits are perceived to vary in their harmful impact on the environment. There were few differences between coastal experts and non-experts in Study 1; overall, their perceptions were very similar. These findings were further supported in Study 2 that used a sample of international marine ecologists, which incorporated a more global viewpoint and thus further generalised these findings.

When combining the perceived commonness and harmfulness for each activity to calculate the perceived risk to the environment, foraging or rock pooling activities were seen to be the worst. The qualitative responses in both studies also reflected this, with comments often relating to unsustainable foraging behaviours such as removing organisms, turning rocks over and showing little respect or awareness towards the environment. This finding corresponds well with previous research (e.g. Davenport & Davenport, 2006; Fitzpatrick & Bouchez 1998; Prescott, 2006). Overall, the current study clearly emphasises that different activities were seen to have different effects on the environment, with these foraging type activities agreed to be the most harmful.

Priskin (2003b) started to examine perceived differences in activities and compared the general public's perceptions to a marine expert's. The current studies expanded on this approach. The current findings support Priskin's (2003b) original conclusion that the public do distinguish between different activities; however Priskin also found that they generally underestimate the negative impacts on the environment compared to that of the marine expert. However, within the current samples, there were only few differences, with the coastal user sample generally in agreement with the coastal experts. This may be due to methodological differences such as country (Australia versus

UK), type of shoreline (sandy versus rocky) and the time of data collection (data collected in 1999 for Priskin, and 11 years later for this current work). It could also be because of the reliability of the expert ratings. For this current study, 25 coastal experts from around the UK and a further 44 international academics were used, whilst Priskin relied purely on her own expertise. Overall, the views between experts and coastal users were remarkably similar which can increase the confidence in these perception-based findings. As the method was further developed for Study 2, direct statistical comparisons between the two data sets cannot be made. However, the overall patterns were very similar between the two studies and no differences were found between coastal experts from the UK as opposed to elsewhere. This seems to indicate that the findings can be seen as more global issues than only relevant to the United Kingdom. However, the exact level of detrimental impact on the environment may be different in other countries and would be interesting to explore further with a more cross-cultural study.

In addition to the perceived impacts different activities have on rocky shores, the open-ended questions offered in-depth insights. As mentioned above, participants used this opportunity to explain the depreciative behaviours linked with foraging activities, including turning rocks over and lack of knowledge or awareness. Another frequently mentioned theme, especially for the coastal user sample, was littering. Crucially, littering was mentioned spontaneously without a researcher prompt (as this study focused on purposive recreational activities), yet it turned out to be a consistent key theme. Littering is known to be an important environmental issue, with roughly 2,000 litter items found per kilometre on the UK coastline alone (Marine Conservation Society [MCS], 2012a). Litter can have numerous effects, including entanglement, ingestion and damage to the environment and its residents (Hall, 2000; Laist, 1997). Interestingly, however, many of the responses did not only emphasise those detrimental effects of litter on the environment and organisms, but also highlighted the effect it has on visitors' experiences. This is in line with the finding that marine litter can be a key deterrent for visiting specific beaches (Tudor & Williams, 2006), and is further examined in Studies 4 and 5 (Chapter 5). Consequently, the current findings highlight that there are some key depreciative behaviours that need to be focused on further, including littering, not just because of the impact on the environment but also the impact on the visitors' experience.

In contrast to the perceived negative impacts the activities were seen to have on the environment, all activities were seen to be beneficial to visitors, such as leaving the shore happier than when they arrived. All activities were seen to improve visitor mood, with wildlife watching consistently seen a more beneficial one. Some activities were also seen to be calming and others more exciting. These findings agree with White and colleagues (2010) that the aquatic environment is perceived to be beneficial, as, regardless of the activity performed, visitors are believed to leave the shore in a happier mood. However, this research supplements past work as it has started to explore the differences between activities. As participants perceived that activities would have different beneficial intensities on the individual, it shows that this is an important aspect in need of further investigation. To extend this perceptual work and the previous research that studied the effects of visits in general according to estimated effects (e.g. White et al., 2010) or one particular activity on an experimental measure of well-being (e.g. walking, Hartig et al., 2003), comparative analysis of different activities taking place on rocky shores are further examined in Studies 3 and 7.

As well as the perceived psychological benefits on visitors' well-being, these two studies also found that marine awareness is seen to increase with a visit to the shore. Previous literature highlights that experiencing nature is beneficial to people's awareness in combination with educational sessions (Cummins & Snively, 2000; Duerden & Witt, 2010; Zeppel & Muloin, 2007). In the current studies, the extent of this was noted to be dependent on the level of information and interpretation available, for instance information boards or marine biologists assisting rock pooling sessions were seen to have a greater impact (which is later controlled in Study 7), but a visit in general was still noted to improve visitors' awareness about marine topics. This is consistent with Steel and colleagues' (Steel, Lovrich et al., 2005; Steel, Smith et al., 2005) correlational finding that people who visit the coast had higher levels of marine awareness. Therefore, regardless of whether visitors seek additional information, a general visit to the shore is seen to be beneficial to the visitors by increasing their marine awareness.

As well as examining the impacts on the environment and on the visitor independently, a key contribution of these studies was to examine the two components together. Some activities were perceived to be better, having positive impacts on the

visitor and little negative impact on the environment. For example, sunbathing / relaxing was seen as a calming activity and, as it typically involves little movement, there would be less trampling, fewer depreciative rock pooling behaviours and less overall disturbance to the wildlife. Regarding management implications, these activities would ideally be encouraged, whereas the activities in the top quadrants in Figure 3.3 would require greater managerial attention. For instance, some activities (including walking and rock pooling) were beneficial to the visitor but had the potential to be rather harmful to the environment. In psychological terms, these activities allow exploration of this environment, show fascination towards the landscape and wildlife, and may involve learning by finding certain species, or include exercise along a scenic environment. Environmentally, as these activities are exploratory they may involve walking over vulnerable areas and can involve depreciative behaviours such as turning rocks over and removing organisms. Consequently, these activities should not be prohibited or discouraged, but rather regulated so that the benefits are maximised and the risks minimised.

The main limitation associated with these two studies reported is that they relied on participants' perceptions. As this research is the first to examine a range of activities in terms of impacts on both the environment and on the individual in an integrated fashion, a perceptual approach was seen to be the most cost-effective and appropriate method. However, this was noted to be especially difficult regarding the impacts on the visitor section. This broad approach examining activities and visitors generally overlooked influential other factors such as differences between individuals and individual episodes. For instance, within the qualitative measure it was mentioned that one rock pooling session may be rather relaxing, whereas another session where a rare species is discovered may be more exciting (which could explain why the arousal measure was rather troublesome in Study 1). Nonetheless, these two studies still found promising effects that a visit is seen to improve people's well-being and marine awareness. The following chapter explicitly measures this *in situ* by surveying visitors to rocky shores before and after their visit.

3.4.1. Conclusion

The two studies presented here on coastal experts, coastal users and international coastal academics have extended the existing literature by examining recreational visits in more detail. Using an integrative approach examining both perceived risks to the environment and benefits for the visitor, rocky shores were perceived to have great benefits for the visitor, including improving well-being and increasing marine awareness. Additionally, these visits were associated with a number of risks regarding the habitat, stressing that certain activities can have more harmful impacts on the environment. There was extensive agreement between coastal experts and coastal users in all aspects and findings were comparable beyond the British context. By examining a range of activities, it was possible to deduce which activities were seen to be especially beneficial for the visitors but have the greatest risk on the environment. By exploring the two effects together for the first time, this research offers a new approach to understanding and managing the risks and benefits associated with activities in the coastal environment. Additionally, it has emphasised the importance of considering activities in psychological research in general, which will be further addressed in Studies 3, 6 and 7; as well as highlighting the visitor-related behaviours and activities that have the higher potential risks to the environment, which will be examined and controlled in Studies 4, 5, 6 and 7.

The Rocky Shore Experience: A Field Study Examining the Psychological Benefits of Recreational Visits

This chapter is largely taken from a journal article in preparation:
Wyles, K. J., Pahl, S., Thompson, R. C., White, M., & Schenke, K. (in prep). The coastal experience: A field study examining why people enjoy visiting the coast.

4.1 Introduction

Experiencing the natural environment has been found to have a range of psychological benefits, including increasing marine awareness and well-being. Strengthening other studies' conclusions, White and colleagues (White, Pahl et al., 2013) found that the marine environment is especially effective in improving well-being compared to other natural environments. By exploring past visits to natural environments in greater detail, White and colleagues (White, Pahl et al., 2013) were also able to deduce what factors play an important role in these well-being effects. However, for their study and the more generic literature, little is known regarding specific environments, such as rocky shores. As shown in the previous chapter, rocky shores were perceived to improve people's well-being, the extent of which was seen to depend on the activities people engage in during the visit. Marine awareness was also seen to increase as a result of a leisure visit to the coast. Yet, it is unknown what people actually directly experience when engaging in recreational visits to this particular coastal environment. Consequently, this chapter extends the previous two studies and White, Pahl and colleagues' (2013) study and examines these potential well-being and marine awareness benefits of rocky shores further (as illustrated in Figure 4.1), by using a pre-post field study that explores these visits in detail.

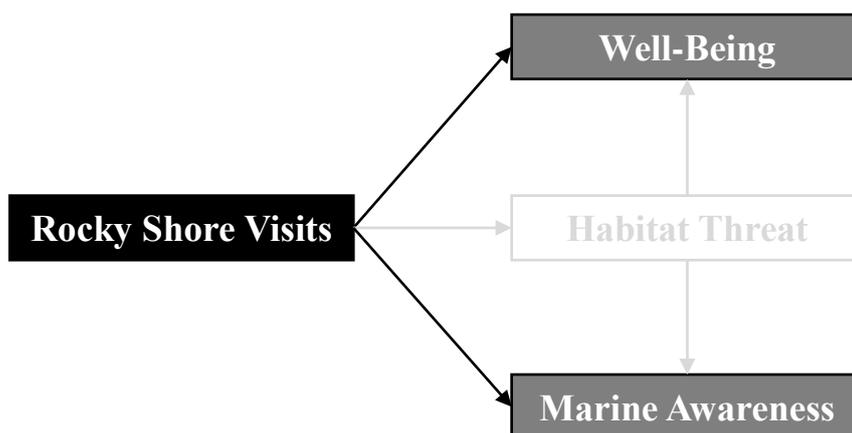


Figure 4.1. The elements of the research model Study 3 explicitly examines.

4.1.1. Literature Review

Numerous studies have found that blue-space (including the coast) provides well-being benefits. Using secondary data collected as part of a national survey of the English adult population titled *Monitoring Engagement with the Natural Environment (MENE)* survey, White and colleagues (White, Pahl et al., 2013) were able to compare different natural environments according to a self-reported well-being measure (specifically a retrospective measure of emotional restoration). This survey consisted of recollections of visits to different natural environments, gathering information on socio-demographics and visit characteristics. They found that the coast was consistently found to be the most restorative environment, even when controlling these socio-demographics and visit characteristics. These more pronounced well-being findings for coastal environments have also been found when comparing environments in the laboratory (e.g. Felsten, 2008; Laumann et al., 2001; White et al., 2010) as well as other studies evaluating past experiences to the coast (Ashbullby et al., 2013; Hipp & Ogunseitan, 2011).

In addition to comparing different types of natural environments, White and colleagues (White, Pahl et al., 2013) were also able to take a rather novel approach, examining these past experiences with nature in greater detail. For instance, respondents were asked to state which activities they undertook during their visit from a list of 20. When investigating just the visits that involved a single activity, walking was found to be the most common and a more restorative activity compared to visiting an attraction and playing with children. However, overall, White and colleagues concluded that activity

was not highly influential regarding the overall experience. Within the limited literature examining the influence of activity on well-being, broader studies have found contradictory findings. For instance, when using the Day Reconstruction Method (DRM, Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004), one study was able to compare everyday more mundane activities according to well-being (White & Dolan, 2009). By asking participants to divide their day into different episodes and then to describe and evaluate how they felt during each one, it was found that activities did vary in well-being. Regarding more recreational activities, studies have also found that well-being benefits can depend on intensity (Barton & Pretty, 2010; Hansmann et al., 2007). Recreational activities on rocky shores specifically were also seen to vary in both mood and arousal outcomes in the preceding chapter. These mixed findings suggest two contradictory conclusions: Either that activities may differ in their well-benefits; or that people may receive the same beneficial outcomes after visiting the coast, regardless of the activities undertaken.

Within the analysis of the national dataset, it was also possible to examine the influence of other visit characteristics, such as visit duration and presence of others alongside socio-demographic aspects (e.g. age and gender) on the overall restorativeness of the visit. White, Pahl and colleagues (2013) found that longer visits were associated with greater recalled restoration, supporting other studies' findings (Hansmann et al., 2007; Hinds & Sparks, 2008; Scopelliti et al, 2012); however this finding disappeared in the more developed analysis when more defined environmental categories were included in the analysis. Who the participants visited the environment with was found to be influential, with unaccompanied visits resulting in greater recalled restoration than visiting with children or with another adult. This has also been found using more controlled field studies (e.g. Johansson et al., 2011). Age was also noted to have an influence, with the youngest participants (16-24) recalling lower restoration than those who were 35-44 years old. Consequently, different factors may influence the extent to which coastal environments facilitate restorative effects.

White and colleagues' (White, Pahl et al., 2013) analysis is a valuable contribution to the restoration literature; however by using secondary data, the study itself was considerably constrained. As a result, a number of aspects of the study were not

ideal, thus to strengthen their conclusions, these findings need to be replicated after addressing and resolving these obstacles. First, the environment categories were relatively broad. The MENE survey had a reasonably comprehensive list compared to previous studies that often compare aquatic with rural green environments for example, which allowed White and colleagues to statistically explore the differences between environments at a much finer level compared to the previous literature. However, the categories were still relatively large, for instance the coast involved collapsing seaside resorts and other seaside coastlines into the same category. For their research questions, this level of detail was sufficient and they were able to conclude that coastal environments were consistently recalled to be the most restorative environment. However, to develop this further, a greater understanding of more specific coastal environments would be worthwhile. Studies 1 and 2 started to examine rocky shores more specifically and found that this specific habitat was perceived to have well-being benefits, but relied on people's general perceptions rather than individuals' experiences. Thus, Study 3 extends both the preceding perception studies (1 & 2) and White, Pahl and colleagues' (2013) study by examining a specific environment, rocky shores, in greater detail.

A second issue is that the measures were not ideal. As the MENE survey was commissioned and designed on behalf of governmental departments and advisory bodies rather than being scientifically led, the original analysis relied on less standardised measures. For instance, the main variable collapsed two items to construct a 'recalled restoration' concept. One or two item scales are popular in reducing the demand on participants; however, within the scientific literature, larger more reliable scales are more widely used (e.g. the Perceived Restorativeness Scale, Hartig et al., 1997). By adopting a concise approach, the survey was consequently vulnerable to overlooking different aspects of well-being benefits. As noted in Chapter 2, there are two approaches to well-being: Hedonic (relating to pleasure) and eudaimonic (the level of meaningfulness), both of which can be measured in numerous ways. For instance, depending on the field, hedonic well-being is often examined using mood measures (e.g. in the restoration literature; i.e. van den Berg et al., 2003) or overall satisfaction measures (e.g. in the broader well-being literature; i.e. Dolan, Peasgood, & White, 2008). As with the majority

of the restoration literature, the ‘recalled restoration’ concept focused on the former, yet studies have shown that eudaimonic well-being is also an important element (Ryan & Deci, 2001). These two approaches can be found to correlate with one another but also exist in their own right. Ryan and Deci (2001) have argued that to be able to enhance our understanding of well-being, it is important to measure both approaches. For instance, when comparing mundane activities, White and Dolan (2009) found that playing with children was not as pleasurable as watching television, but was found to be a much more meaningful activity. As well as potentially overlooking different types of well-being, the survey also did not examine the restorative properties of the environments as proposed by ART (Kaplan, 1995), such as being away, compatibility, fascination and extent (outlined in Chapter 2). Thus, it would be valuable to explore environments according to their perceived restorativeness as well as impacts on both hedonic and eudaimonic well-being and how these factors contribute to the overall benefits.

Third, in addition to the restricted restorative measure, the analysis of the activity data was also rather limited. For the statistical analyses, White, Pahl and colleagues (2013) excluded visits that involved more than one activity. Even though most participants only mentioned one activity in the MENE survey, this is not ecologically valid. Visits to the coast can involve a number of activities, such as relaxing in the sun, then having a wander along the waters’ edge, before having lunch. The categories offered to the participants were also restricted and rather broad, for instance *visits to a beach, sunbathing or paddling in the sea* were classed as one activity. As illustrated in the previous chapter, sunbathing and paddling alone can be seen to elicit different responses, especially for arousal. Consequently, it would be valuable to examine activities more specifically, by focusing on individual activities and further exploring their influence on well-being.

A fourth potential weakness of this analysis is the design of the study. An advantage of asking individuals to recollect a nature experience was that White, Pahl and colleagues (2013) were able to compare a range of natural environments in a more ecologically valid approach by looking at past experiences, rather than the more abstract laboratory studies using hypothetical or photographic stimuli (e.g. Berman et al., 2008; Korpela et al., 2002; White et al., 2010). It is also a practical method that is not too

demanding for the participants and can consequently recruit large national samples. However, reflections of previous experiences are vulnerable to a number of biases such as poor memory. It is also not possible to control for base levels and conclude change in well-being. In order to complement these findings further, well-being should be studied *in situ* before and after a visit to the coast to investigate these directly.

Finally, this analysis only examined the well-being benefits of natural environments, overlooking other benefits such as increasing environmental awareness. As noted in Chapter 2, natural landscapes can also facilitate learning. By experiencing nature directly, studies have shown that people's awareness about the environment and conservation issues can increase (Monroe et al., 2006; Settar & Turner, 2010; Steel, Lovrich et al., 2005; Steel, Smith et al., 2005). These studies typically demonstrate this increase alongside an education programme (Cummins & Snively, 2000; Zeppel & Muloin, 2007). It is believed that leisure visits to rocky shores can elicit this enhancement in awareness in marine topics, as shown in the Studies 1 and 2. Yet, no research has directly examined whether marine awareness changes as a result of a recreational visit to this environment, outside of a specific educational programme.

4.1.2. Present Study

In order to extend White and colleague's analysis and the more generic literature, a field survey was adopted to examine recreational visits to the coast in greater detail, specifically applying to rocky shore environments. By surveying the same visitors as they arrive and leave, this study explored the well-being and marine awareness impacts of visiting this environment (as illustrated in Figure 4.1). Using standardised measures, both hedonic and eudaimonic well-being were recorded along with the perceived restorative properties of the sites. Greater detail was also collected regarding the overall visit as well as the individual activities undertaken. Consequently, this study aimed to answer two main research questions: First, is a visit to a rocky shore beneficial for well-being? Second, is a visit beneficial for marine awareness? By extending the detailed analyses from White, Pahl and colleagues (2013), the first question was subdivided into three smaller questions: 1) At an activity level, do activities differ in their benefits when undertaken in this environment? 2) For the visit overall, are visits to this environment

found to be beneficial supporting White, Pahl and colleagues' (2013) and Chapter 3's perception-based findings? And using a similar regression approach as White, Pahl and colleagues (2013), 3) what are the key influential factors for these overall benefits?

4.2 Study 3: An Exploratory Field Study

4.2.1. Method

4.2.1.1. Sites

Two coastlines in the south west of England were used in this research: Wembury and South Milton Sands, as shown in Figure 4.2. Both are similar in that during low tide, both sites have a sandy beach with rocky shores on either side.

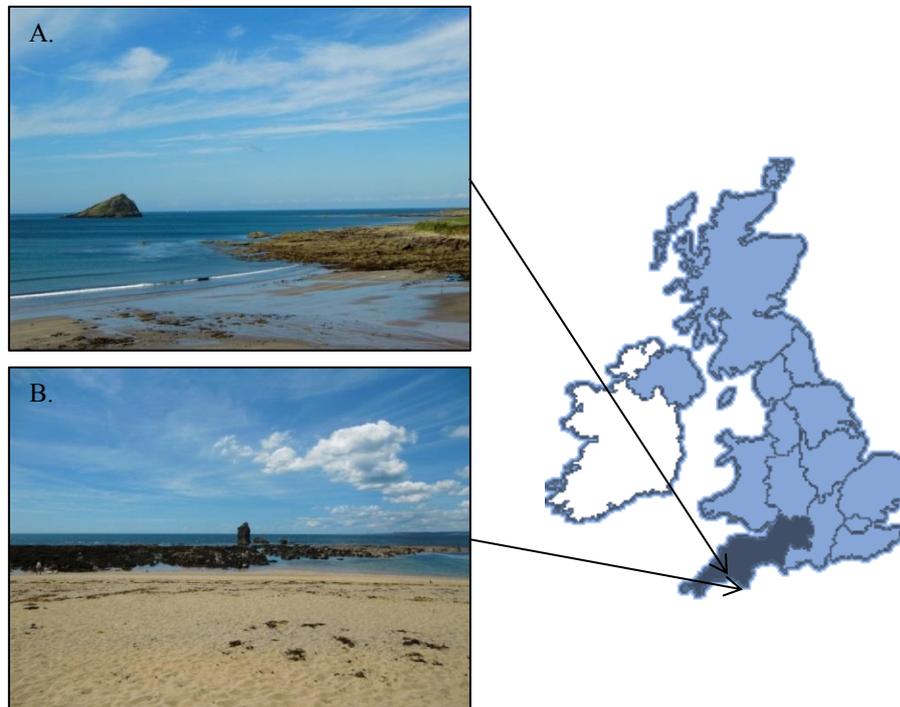


Figure 4.2. The geographic locations and images of the two sites: A: Wembury, B: South Milton Sands (photographs used with permission of the author, all rights reserved)

Wembury is just east of Plymouth in Devon. During low tide, its sand and shingle beach is approximately 110 metres wide and is surrounded by 1350 metres worth of accessible rocky shoreline. It is a popular destination for visitors, with over 150,000 visitors a year (L. Sherriff, personal communication, October 11, 2011). As well as

having the beach and rocky shores to explore, the coastal path runs parallel to the shoreline; and there are facilities by the beach, including a car park, shop, toilets, café, and a marine centre.

South Milton Sands is further east of Wembury, near Kingsbridge in Devon. The coastal path also runs parallel to the approximate 700 metre sand which joins with the 640 metre rocky shoreline. This site also has a café, toilets and a car park, as well as life guards during the summer months. South Milton Sands receives roughly 60,000 visitors annually (S. Hill, personal communication, October 25, 2011). Dogs are also allowed on this beach all year round, unlike Wembury where they are restricted during the summer season.

4.2.1.2. Participants

Every visitor that left the respective car parks and walked towards the beach was approached, unless it was visible that they did not fulfil the inclusion criteria. The inclusion criteria were that they were over 16 years of age, had not completed the survey a previous day, and were planning to go onto the shore at some point and return to the car park that day. The refusal rate was low with 12% declining and an additional 21% not participating as they did not fulfil these criteria (e.g. due to low age or having completed the survey before). As members of groups were likely to engage in similar activities and report the same visit characteristics, only one individual was used from each group⁴. Due to logistics and constraints on the visitors (such as children), the member of the group that fulfilled the inclusion criteria and was most willing to participate was used.

In total, 275 individuals completed the before-survey (148 at Wembury, 127 at South Milton Sands). Eighty percent of participants returned to complete the final measures (112 from Wembury; 108 from South Milton Sands), and were not found to statistically differ on the initial measures from those who had dropped out (all $ps > .06$). Participants who completed the survey but were later discovered to not fall within the inclusion criteria were removed ($n = 6$). The final sample consisted of 214; 108

⁴ This enabled the observations to remain independent, an assumption necessary for the future inferential statistical tests.

participants from Wembury (33 male; 75 female) and 106 from South Milton Sands (48 male; 58 female)⁵.

The age categories most largely represented were 31 to 40 (29%) and 41 to 50 (29%). Many participants had either a university level qualification (33%) or a professional qualification (26%). When exploring past visits to rocky shores, 24% claimed to visit this type of environment once or twice a year, whereas 27% had never visited that particular site before. Participants were categorised as being local if they travelled from home ($n = 107$), with those staying elsewhere the night before seen as tourists ($n = 107$). By retrospectively calculating distances from the site to where participants lived and travelled from using Google Earth, it was calculated that local participants took approximately 25 minutes ($SD = 28$ minutes) to get to the respective site from their home. For participants classed as tourists, it took roughly 23 minutes ($SD = 31$ minutes) from their start destination that day to the site, and, on average, lived two hours and 54 minutes from the respective sites ($SD =$ one hour & 13 minutes).

4.2.1.3. Design

As illustrated in Figure 4.3, a pre-post design was used, where visitors completed a self-report survey immediately before and after visiting the shore. Surveys were undertaken at both sites from June to August 2011, under predominately clement weather conditions. To control the state of the environment (such as tidal times as noted in Chapter 1) and to examine the full use and experience of the shoreline, surveys were completed on days when low tide occurred between 10:00 and 15:00, so that access to the intertidal area was optimum for day-time visitors. The before-surveys were conducted at the main entrance/exit point one to three hours prior to low tide for a minimum of one hour; with after-surveys completed as participants left on their own accord.

⁵ As noted below in Section 4.2.6, results were similar for both sites, therefore will be reported collectively. The demographics for each site, however, can be found in Appendix G.

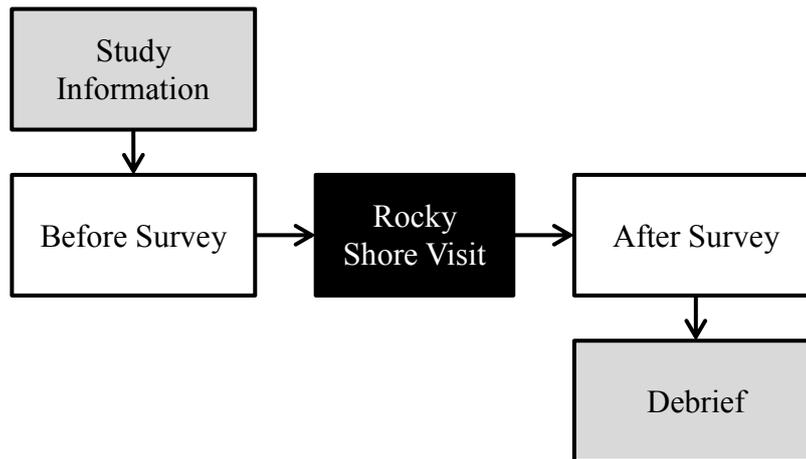


Figure 4.3. A schematic diagram of the methodological design, with participants completing a survey before and after their visit to the shore.

4.2.1.4. Measures

Two surveys were used (see Appendix F). The before-survey was much shorter, addressing mood, marine awareness and demographic details; whilst the after-survey included the mood and marine awareness items along with overall satisfaction, meaningfulness, perceived restorative qualities of that site, a map to show where they walked (this will not be discussed but an example of this can be found in Appendix F) and a diary component to record the activities they engaged in. Time, group size, weather, and busyness of the car park were also recorded separately by the data collector (Appendix F). The key individual measures are addressed in more detail below.

4.2.1.4.1. Activity specific measures.

To examine how participants spent their time during their visit, a diary method based on the DRM (Kahneman et al., 2004; White & Dolan, 2009) was used. This method involved breaking up the visit into the different activities undertaken. Participants labelled each activity, gave a brief description, an estimation of duration and number of times they had engaged in that activity, along with where they did it (e.g. in the sea, on the rocks, on sand) and who with. Each activity was also evaluated in terms of mood and arousal, similar to that of Study 1. This involved participants rating their mood on a scale from 0 = *very unhappy* to 50 = *neutral* to 100 = *very happy*; then similarly, rating how

excited they felt during the activity from 0 = *very calm*; 50 = *neutral*; to 100 = *very excited*. This scale received methodological-related comments in Study 1 (e.g. that it depended on the individual episode whether it was calming or exciting, see Section 3.2.2.2.1); however it was deemed to be more appropriate in the current context as it was applied to more specific activity episodes in comparison to the Study 1's more generic approach.

4.2.1.4.2. Overall well-being measures.

To examine well-being effects for the overall visit, four measures were used. First, to examine change in hedonic well-being, participants were required to state how strongly they felt certain emotions at that moment in time on a five-point scale from *not at all* (1) to *very strongly* (5), similar to other state-emotional measures (e.g. White & Dolan, 2009). Compared to the single item scales in Studies 1 and 2, a more reliable multi-item scale that was still relatively short, quick and unambiguous was desired. Subsequently, three items were used that examined positive affect (*happy, content/relaxed, calm*; Cronbach's $\alpha > .76$), and three for negative affect (*nervous/anxious, sad/depressed, frustrated*; Cronbach's $\alpha > .44$)⁶. An overall mood variable was then calculated based on the affect-balance tradition (Bradburn, 1969), where the average positive affect score was subtracted by the average negative score. Consequently, the overall mood measure ranged from very negative (-4) to very positive (+4).

Second, to evaluate the overall experience, overall satisfaction with the visit was rated on a scale from *very unsatisfied* (1) to *very satisfied* (10). This is more in line with the hedonic well-being interpretation in the broader well-being literature rather than the restorative environments literature to examine overall events (e.g. Dolan et al., 2008; Roehl & Ditton, 1993; White & Dolan, 2009).

Third, to assess the rocky shore experience according to eudaimonic well-being, three items asked how worthwhile and meaningful the visit was 1) to them as an individual, 2) to their family and friends and 3) whether they were in line with their

⁶ The complete set of items used in White and Dolan's (2009) study were originally piloted, but due to confusion in this general public sample, some were omitted resulting in these six items.

values (e.g. White & Dolan, 2009). Items were rated on a scale from *not at all* (1) to *very strongly* (5) and averaged to produce a relatively reliable meaningfulness scale (Cronbach's $\alpha = .66$).

Finally, the perceived restorativeness of the environment was rated using a short modified version of the Perceived Restorativeness Scale (Hartig et al., 1997) based on ART (Kaplan, 1995)⁷. As used in White and colleagues (2010), participants rated their level of agreement to four statements on a 7-point Likert scale for a) *This site is a place which is away from everyday demands and where I would be able to relax and think about what interests me* (being away); b) *This place is fascinating; it is large enough for me to discover and be curious about things* (fascination); c) *This site is a place which is very large, with no restrictions to movements; it is a world of its own* (extent); d) *Here, it is easy to orient and move around so that I could do what I like* (compatibility). An average restorativeness score was calculated (Cronbach's $\alpha = .65$). Items related to attention were also measured but are only reported in the Appendix G due to the emotional well-being focus of this chapter and thesis.

4.2.1.4.3. Overall marine awareness measures.

To measure subjective marine awareness, the same topics addressed in the previous two studies in Chapter 3 were used but on a 5-point scale from *lower than average awareness* (1) to *higher than average level of awareness* (5). This five-item scale was found to be extremely reliable (Cronbach's $\alpha > .91$)

4.2.1.5. Procedure

Potential participants were approached by one of two data collectors as they left their vehicles and walked towards the beach. After providing verbal consent, participants completed the before-survey. Participants were then given a card with a participant ID number, to enable the before and after surveys to be matched. When the participants returned to the car-park to leave, they were approached to see if they were still happy to continue with the study. They then completed the after-survey along with the diary

⁷ The 16-item Perceived Restorativeness Scale (Hartig et al., 1997) was initially piloted; however, due to time and confusion regarding some items (e.g. *it is a confusing place*, and *being here suits my personality*), a shorter, less ambiguous scale was adopted.

component, followed by the debrief. During the surveys, the data collector took note of additional factors (e.g. the time and group size).

4.2.1.6. Analysis

For the qualitative descriptive components in the diary DRM, data were coded using thematic analysis. Similar to Section 3.2.1.4, themes were developed by reviewing each individual activity numerous times, along with discussions with the supervisory team. Based on the final themes, each activity was then coded, with an independent second coder coding a random subsample of the data (five percent of the data) to check for inter-rater reliability. Excellent agreement between coders were found, Cohen's $\kappa = .97$ (Landis & Koch, 1977). These activities were then condensed into more suitable categories.

For the main quantitative analysis, data were first screened and checked according to the standard procedures outlined in Section 3.2.1.4. Apart from the very occasional effect (e.g. males reported a greater increase in subjective marine awareness than females, $F(1, 133) = 4.61, p = .03$, partial $\eta^2 = .03$ (small effect), and participants within the 31-40 year age category rated the environments to be less restorative on the restorativeness measure than the older (61+) age group, $p = .01$), there were no effects of site, demographics (e.g. age, gender and education) and days of data collection on the main variables including on the change variables from before and after the visit (all $ps > .08$), thus it was not necessary to control for these in the following analyses.

In order to answer the research questions, a range of analyses were conducted. To explore the well-being benefits, three analytical procedures were used. First, activities within the DRM were compared according to the activity-level well-being measures (mood and arousal), replicating the analyses from Study 1. Only activity episodes that were exclusively described as a single activity were used in this analyses, with activity episodes as the unit of analysis ($n_{activities} = 690$). Second, with participants as the unit of analysis ($n_{participant} = 214$), overall well-being benefits were analysed by reporting average responses for overall satisfaction, meaningfulness and perceived restorativeness; and measuring change in mood using a within-subject t -test. Finally, similar to White, Pahl and colleagues (2013) and to be able to uncover the key factors for making the experience

beneficial, multiple regressions were conducted. As the overall evaluation of the visit, overall satisfaction was used as the predicted dependent variable. Due to the number of individual variables and statistical assumptions, two separate regressions were used. The first examined whether demographic and visit characteristic variables predicted satisfaction. Those that were seen to significantly predict satisfaction were then included in the second regression, which explored the predictive value of theoretical concepts and activity type on satisfaction. Only participants that did at least one of the top six activities were included in these analyses ($n_{\text{participant}} = 209$). Even though the structure of the data was suitable for multilevel modelling to examine different levels (such as the activity-specific and overall-visit levels) on an overall variable, this technique was not ideal due to the appropriate assumptions not being fully met (e.g. residuals were not normally distributed, the dependent variable was too skewed for such a sensitive test and residuals needed to be uncorrelated). Consequently, a more cautionary approach using regressions was adopted to initially examine any possible effects.

To examine change in subjective marine awareness, similar to that of change in hedonic well-being, a within-subject *t*-test was used.

4.2.2. Results

4.2.2.1. Well-Being Benefits

4.2.2.1.1. Does well-being differ between activities?

On average, participants engaged in four activities during their visit ($SD = 1.56$), ranging from one to eight. Nine key activities were reported, as shown in Figure 4.4. The descriptive properties for each activity type can be found in Appendix G; however the analyses of interest are how these activities differ in the well-being measures.

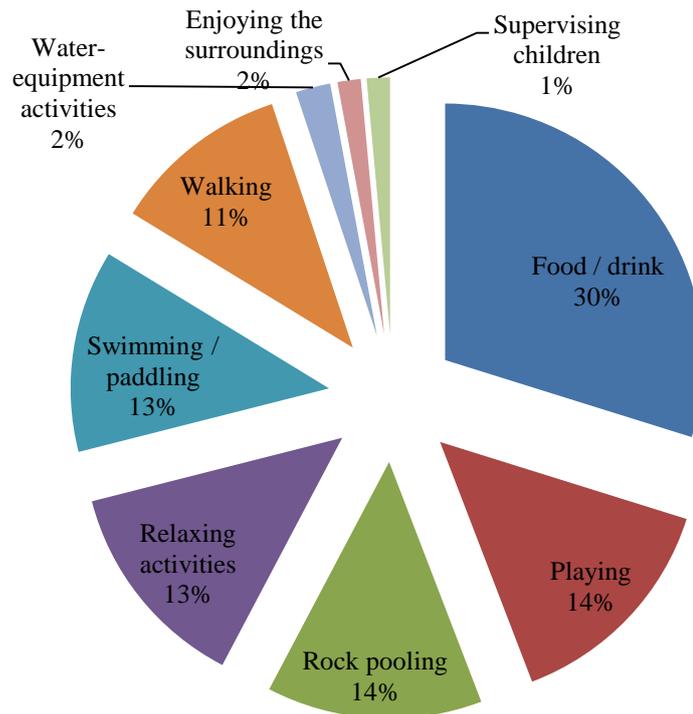


Figure 4.4. The nine different activities participants engaged in during their visit.

Activities varied considerably in popularity, for instance the ‘enjoying the surroundings’ category had 10 cases whereas food-related activities had 206 (representing 30% of all of the activities). Consequently, to improve statistical power when comparing activities, only those that had more than 30 cases were examined (as suggested in Field, 2005). For the mood measure, it was found that regardless of the activity, participants were happy ($M = 88.90$, $SD = 15.99$), and that activities did not statistically differ in these ratings, $H(5) = 6.06$, $p = .30$, as shown in Table 4.1. For the arousal item, responses were more varied. As shown in Table 4.1, activities generally were more on the calm side of the bidirectional spectrum (0-50), with relaxing activities and walking seen as the most calming and rock pooling as the least. Statistically, activities were found to differ according to arousal, $F(5,635) = 12.62$, $p < .001$, partial $\eta^2 = .09$ (small effect).

Table 4.1. *The means (and standard deviations) for the six popular activities according to both mood and arousal ($n_{activities} = 655$) in Study 3.*

Activity	Mood		Arousal	
Relaxing Activities	89.12	(16.55)	20.10	(26.56)
Playing	89.19	(14.91)	44.97	(35.51)
Rock Pooling	91.01	(14.69)	52.40	(35.43)
Food-related Activities	85.78	(18.47)	33.93	(29.56)
Swimming	90.77	(13.54)	45.82	(35.17)
Walking	91.98	(12.51)	31.09	(31.18)

Note. Self-reported mood ranged from 0 (*very unhappy*) to 100 (*very happy*); arousal ranged from 0 (*very calm*) to 100 (*very excited*); both with a mid-point of 50.

4.2.2.1.2. *Is the overall visit beneficial for well-being?*

Participants arrived high in positive mood ($M = 3.13$, $SD = 0.97$). This positive mood significantly increased to an average of 3.46 ($SD = 0.90$), $t(213) = 4.93$, $p < .001$, $d = .34$ (small effect), at the end of the visit. In terms of meaningfulness, participants also felt that their visit to the shore was highly meaningful to them ($M = 4.73$, $SD = 0.49$). The visits were also evaluated very positively overall. On a scale from one to ten, participants gave on average 9.00 for overall satisfaction with the visit ($SD = 1.36$). In addition to these positive ratings, this coastal environment was also seen to be highly restorative on the Perceived Restorativeness Scale ($M = 6.44$, $SD = 0.69$). Overall, participants were very satisfied with their visit.

4.2.2.1.3. *What makes the visit beneficial?*

In order to begin to understand what makes the visit satisfactory, two multiple regressions were used. First, demographic and visit characteristics were examined to predict visit satisfaction. Due to the categorical nature of many of the variables, the hierarchical method was selected. This involved three steps: Step 1) demographic variables (including dummy coded variables of gender, age and education); Step 2) past experience with rocky shores (both generally and to that particular site, also dummy coded); and Step 3) visit characteristics (distance travelled that day and distance from home, duration of overall visit, group profile, day of week, time of year, site, and whether they were a local or tourist to the site). While the model significantly improved once the visitor characteristics were added to the model (Step 3), $F_{change}(10, 168) = 2.47$, $p = .01$;

it remained statistically not significant, $F(33, 168) = 1.39, p = .09$. However, when examining the coefficients, three significant predictors of satisfaction emerged (see Appendix G for the full regression table). Those who had never visited a rocky shore before were less satisfied than those who visit once or twice a year ($\beta = -0.18; p = .03$). However, due to the lack of statistical significance for the other frequency categories ($p > .16$) and that this lone finding was based on a comparison of seven participants, this was not considered reliable thus will not be examined further. Distance travelled was also found to predict overall satisfaction ($\beta = -0.27; p < .001$), with shorter distances related to higher levels of satisfaction. Duration was also a significant predictor, with satisfaction increasing as duration increased ($\beta = 0.21; p < .001$). Consequently, these latter two variables remained in the following regressions.

The second, and final, hierarchical multiple regression focused on the predictive value of the conceptual variables and activity type. The significant predictors from the previous regression were included (time spent travelling and duration of visit) as Step 1. Step 2 involved the before-measure of mood in order to take into account the baseline of mood. As psychological theories (e.g. ART, Kaplan, 1995) imply that the restorative qualities of an environment are important for the overall well-being benefits, Step 3 involved the overall restorativeness rating. Step 4 consisted of the remaining conceptual measures of meaningfulness and the after-measure of mood. Finally, Step 5 involved the addition of the six most common activities (relaxing, playing, rock pooling, food-related activities, swimming, and walking; all dummy coded. Walking was used as the reference category, as the recreation and psychological literature implies it is the normative activity e.g. Addison et al., 2008; Berman et al., 2008; Hartig et al., 1991; Johansson et al., 2011; Natural England, 2010; Porter & Wescott, 2004; Smallwood et al., 2012; White, Pahl et al., 2011). The final model was found to explain 43% of variance; adjusted $R^2 = .43, F(11, 195) = 15.10, p < .001$. For each step, the model continued to improve (all $ps < .001$), apart from when activity type was included⁸, $F_{change}(5, 195) = 0.47, p = .80$ (see Table 4.2). For the conceptual variables, restorativeness was found to be a significant predictor for Step 3 ($\beta = .23, p < .001$), however this lessened to a marginal effect when

⁸ Using more exploratory analysis, the influence of activity-level variables (e.g. activity duration and company) on overall satisfaction were found not to be statistically significant but were not appropriate to report as the data did not meet the assumptions of the relevant statistical tests.

the other conceptual measures were included ($\beta = .11, p = .07$; see Table 4.2). For the final model, it was found that the only significant predictors were time spent travelling ($\beta = -.24, p < .001$) and time spent at the coast ($\beta = .18, p = .005$); mood afterwards in that the higher mood was, the higher satisfaction was ($\beta = .41, p < .001$); and meaningfulness, independently showing the same pattern as mood ($\beta = .24, p < .001$).

4.2.2.2. Marine Awareness Benefits

At the start of the visit, participants rated their subjective level of marine awareness to be slightly above average ($M = 3.61, SD = 0.77$). This was rated slightly higher when concluding their visit ($M = 3.71, SD = 0.81$). Even though this change was small, statistically, it was a significant increase, $t(213) = 3.27, p = .001, d = .12$ (small effect).

Table 4.2. *The final regression examining the predictive value of activities along with influential demographic and conceptual variables on overall satisfaction ($n_{participants} = 209$) in Study 3.*

	<i>B</i>	<i>SE B</i>	β	<i>p-value</i>
Step 1 – Sig. Demographics				
$R^2 = .11$ Adjusted $R^2 = .10$ $F_{change}(2, 204) = 12.97, p < .001$				
Constant	8.84	0.20		
Distance Travelled (time)	-0.01	< 0.01	-0.28	< .001
Overall duration	< 0.01	< 0.01	0.19	.004
Step 2 – Sig. Demographics & Baseline				
$R^2 = .17$ Adjusted $R^2 = .16$ $F_{change}(1, 203) = 14.78, p < .001$				
Constant	7.76	0.34		
Distance Travelled (time)	-0.01	< 0.01	-0.25	< .001
Overall duration	< 0.01	< 0.01	0.18	.006
Affect-balance (baseline)	0.35	0.09	0.25	< .001
Step 3 – Sig. Demographics & Baseline & Restorativeness				
$R^2 = .22$ Adjusted $R^2 = .21$ $F_{change}(1, 202) = 12.78, p < .001$				
Constant	5.04	0.83		
Distance Travelled (time)	-0.01	< 0.01	-0.25	< .001
Overall duration	< 0.01	< 0.01	0.20	.002
Affect-balance (baseline)	0.26	0.09	0.19	.004
Restorativeness	0.46	0.13	0.23	< .001
Step 4 – Sig. Demographics & Baseline & Restorativeness & Well-Being				
$R^2 = .45$ Adjusted $R^2 = .44$ $F_{change}(2, 200) = 42.32, p < .001$				
Constant	2.26	0.85		
Distance Travelled (time)	-0.01	< 0.01	-0.23	< .001
Overall duration	< 0.01	< 0.01	0.16	.003
Affect-balance (baseline)	-0.09	0.09	-0.06	.31
Restorativeness	0.21	0.11	0.11	.07
Meaningfulness	0.69	0.17	0.25	< .001
Affect-balance (after)	0.65	0.09	0.43	< .001
Step 5 – Sig. Demographics & Baseline & Restorativeness & Well-Being & Activities				
$R^2 = .46$ Adjusted $R^2 = .43$ $F_{change}(5, 195) = 0.47, p = .80$				
Constant	2.33	0.90		
Distance Travelled (time)	-0.01	<0.01	-0.24	<.001
Overall duration	<0.01	<0.01	0.17	.01
Affect-balance (baseline)	-0.07	0.09	-0.05	.42
Restorativeness	0.22	0.11	0.11	.06
Meaningfulness	0.66	0.18	0.23	<.001
Affect-balance (after)	0.64	0.10	0.42	<.001
Activity (relaxing)	-0.20	0.17	-0.07	.23
Activity (playing)	-0.11	0.16	-0.04	.51
Activity (rock pooling)	0.05	0.16	0.02	.77
Activity (food-related)	0.09	0.21	0.03	.66
Activity (swimming)	0.08	0.16	0.03	.62
Activity (walking - ref)	-	-	-	-

4.3 General Discussion

Within the broad literature, natural environments have been found to be beneficial in terms of environmental awareness and well-being, which has been found to be more pronounced for marine environments (e.g. Felsten, 2008; Hipp & Ogunseitan, 2011; Laumann et al., 2001; White et al., 2010). For instance, when exploring the predictive factors of the well-being benefits of nature, White, Pahl and colleagues (2013) found the effects are more pronounced for marine landscapes. However, little is known about specific marine environments, such as rocky shores. When examining individuals' perceptions, the previous chapter concluded that recreational visits to rocky shores were believed to improve people's well-being and marine awareness. Thus, to extend these perception-based findings and the generic literature, a field study was used to examine the benefits directly in this specific environment. Using a pre-post design, visitors were surveyed at the beginning and end of their recreational visit to a rocky shore. Recording information about their visit, demographics, and overall experiences; this field study showed that visitors left this environment with greater marine awareness and well-being. Influential factors of the well-being effects were also uncovered.

Following from White, Pahl and colleagues' (2013) in-depth analysis of previous visits to natural environments and using the current detailed survey design, it was possible to explore *why* these rocky shores elicited well-being benefits. The more comprehensive activity measures using the DRM approach provided insightful information. According to the mood and arousal ratings gathered for each activity episode, participants were similarly happy, regardless of the activity they were engaging in. This supports Studies 1 and 2's findings that all activities would have positive impacts on people's mood, but does not support that some activities have a greater benefit. In contrast, the arousal ratings were more in line with these earlier findings, implying that the extent to which people felt calm or excited depended on the activity. However, when considering the overall visit satisfaction, activity type was not found to have a significant influence; thus, supporting White, Pahl and colleagues' (2013) conclusions but also contradicting the more generic literature that has found differences between activities (Barton & Pretty, 2010; Hansmann et al., 2007). It may be that activities do have an

influence on well-being in other settings, but is overpowered by the beneficial effects this coastal environment offers. It could also be argued that it would be expected that visitors would choose to do recreational activities that they believe would be enjoyable. Therefore, these findings could simply imply that people are generally good at selecting and spending time on doing activities that make them happy in these coastal environments.

In addition to the finding that activities do not influence the overall well-being benefits of natural environments, some other findings from the MENE analysis (White, Pahl et al., 2013) were also replicated in this field study. For instance, the duration of the visit was seen to influence the overall experience, with longer visits having greater restorative impacts. This echoes both White and colleagues findings as well as other studies such as Hansmann and colleagues' (2007) field study. However, the current study was unable to replicate White and colleagues' (White, Pahl et al., 2013) findings that company influenced the overall experience. Perceived restorative properties were found to differ with age, but unlike White, Pahl and colleagues (2013), this was not found to be a significant predictor of the overall experience in the final model. Novel findings also emerged that did not arise in their initial analysis. For instance, people who travelled shorter distances to the site experienced greater benefits than those who travelled further. It could be inferred that this novel finding could be related to the anticipated journey ahead and its associated stressors (such as traffic, tired moaning children and the desire to be at their final destination); however more exploratory research would be necessary to understand this relationship more fully.

Another unique aspect that extends White, Pahl and colleagues' (2013) analysis is the conceptual component of this study. By using secondary data, they were constrained to use a non-standardised, less reliable two-item measure examining only one aspect of well-being. Extending both this and the more generic literature, this study used four different measures of well-being (namely change in mood, overall satisfaction, meaningfulness and perceived restorative quality of the environment) and examined their predictive value on the overall evaluative measure of satisfaction. Mood and meaningfulness were both significant predictors of overall satisfaction, in that the happier people found the experience and the more meaningful it was, the more satisfied they were

with the overall visit. As these two constructs (hedonic and eudaimonic well-being) had independent influences on satisfaction, this also implies that they are two distinct, yet equally important constructs; thus should be continued to be explored simultaneously when examining future well-being benefits.

Interestingly, perceived restorativeness was only found to have a marginal influence. As noted above, these two rocky shores were seen to be restorative according to ART's four components, however their relation to the overall experience was less pronounced. Initially found to significantly predict satisfaction (the higher ratings of restorativeness related to more positive experiences overall), this effect was lessened once mood and meaningfulness were incorporated in the model. This could imply that these two aspects of well-being mediate people's perceptions of the restorative qualities of the environment (such that the more meaningful someone finds an experience, the restorative properties of an environment become less important for overall satisfaction). It is believed that this is the first to explore the relationship between these constructs, thus it was inappropriate to apply more theoretically-led mediation analyses. Yet, these findings emphasise that future research should explore this relationship further. It is possible that when exploring this relationship in more varied environments (such as comparing urban landscapes, farmland and the coast); the influence of restorativeness may be more pronounced. Thus, by strengthening some original findings and uncovering new results such as this more conceptual level, this study complements White, Pahl and colleagues' (2013) more wide scale approach.

In addition to sustaining the belief that rocky shores are valuable for well-being, this field study also further supports the potential marine awareness benefits of this coastal environment. Surveys have indicated that the general public has an overall concern for the marine environment, but they often lack the relevant marine knowledge and awareness (Ocean Project, 1999; Steel, Lovrich et al., 2005; Steel, Smith et al., 2005). Experiencing the environment directly is believed and, to some extent, has been found to have influential impacts on people's awareness as well as attitudes and behavioural intentions (Adelman et al., 2000; Monroe et al., 2006; Settar & Turner, 2010; Steel, Lovrich et al., 2005; Steel, Smith et al., 2005; Wyles et al., 2013). However, little is understood about the influence of recreational visits to the coast. In Studies 1 and 2, it

was highlighted that people perceived rocky shores to be a valuable educational resource, believing that people would leave the shore with a heightened awareness about the marine environment. By measuring self-reported marine awareness before and after a visit, this current study has found that subjective awareness does increase after a leisure visit to the shore, reinforcing these earlier perceptions and the more generic literature.

By using a field survey that was completed immediately before and after a naturally occurring visit to the shore, this study addressed the MENE survey's weakness of relying on recollections. Relying on individuals' memories of past events is vulnerable to a number of confounding variables and biases such as poor memory. Consequently, a pre-post design was adopted in this current study to eliminate these potential influences, to be able to examine change in well-being (and marine awareness) more directly and be able to strengthen our confidence in these conclusions. However, a number of methodological limitations can be associated with this field survey approach.

First, unlike the measures of well-being, only one aspect of marine awareness was measured; subjective marine awareness. As highlighted in Chapter 2, due to the diversity of marine topics, a standard measure does not currently exist thus a new measure needed to be constructed for this study. Despite the fact that the scale was found to be statistically reliable and was based on that used in the previous two studies, the rating anchor points could be criticised for being too subjective, asking participants to rate their awareness relative to the average. Consequently, less subjective rating points that have been used in other studies could be adopted (e.g. from *not informed* to *very well informed* as used in Steel, Lovrich et al., 2005; Steel, Smith et al., 2005). Ideally, these measures should be complemented with objective measures, assessing individuals' actual marine awareness, though this would require a more specific topic rather than the broad categories currently being measured (see Studies 6 & 7).

Second, the DRM provided detailed information about a range of activities people undertook during their visit, with a smaller interval between completing the activity and responding to the survey compared to other retrospective studies (e.g. Ashbullby et al., 2013; Ryan et al., 2010; White, Pahl et al., 2013). Yet, responses may still have been less accurate compared to if responses were collected immediately after each activity. Recency effects, for example, may have occurred so that the most recent

activities were more vivid thus were more accurately reported (Matlin, 2005). However, as there has been little investigation regarding specific activities in this context, a retrospective measure was deemed to be appropriate at this stage. To develop this further, Studies 6 and 7 obtain more reliable data by surveying people immediately after individual activities.

Third and finally, this field design was an ecologically valid approach, but, as a result, it lacked experimental control. For instance, by recruiting visitors already at the site, this study could be prone to selection biases. The before measures of mood could have also been influenced by previous stressors such as the journey to the site, which would then reduce mood and increase the need for restoration. Alternatively, people's expectations of the day ahead could heighten their mood before arriving. Consequently, the reported change in well-being could be due to overcoming the experiences prior to arriving at the site rather than their visit overall. However, as a significant increase in well-being was found and the diary measure consistently found high reportings of happiness, it would suggest that the actual visit was rather influential. To improve this, a more structured longitudinal approach could have been used: Regulating the initial stressors such as the journey (e.g. having participants spend the same amount of time and use the same mode of transport to get to the site), using a more naïve sample that is randomly allocated to an activity thus reducing expectation effects, and measuring well-being and marine awareness over a range of time intervals (as later implemented in Study 7). A number of other confounding variables may have influenced people's experiences. The environmental context was relatively controlled, in that data collection only occurred during low tide and clement weather conditions, but other factors such as crowdedness and cleanliness of the shore could have influenced participants' ratings. The latter point, cleanliness, is especially relevant as the previous perception surveys highlighted that litter was the most detrimental visitor-related behaviour for the environment, but can also influence visitors' experiences of the shore. The current study was unable to examine whether this influenced people's well-being outcomes, thus the following chapter explores this further.

4.3.1. Conclusion

Using a detailed pre-post design within the field, this study was able to both complement and extend previous findings. As well as being perceived to offer well-being and marine awareness benefits as found in the preceding chapter, the current findings imply that rocky shores are psychologically beneficial for individuals, as these measures of these two constructs increased after a visit. Exploring the factors behind the well-being benefits specifically, this study resulted in some conclusions that echoed prior findings in the literature (e.g. that duration of the visit does and variation in the chosen activities do not influence the overall well-being benefits) and unearthed some new discoveries (e.g. the importance of perceived restorativeness, hedonic and eudaimonic well-being). Consequently, in the forthcoming chapters, more controlled studies further explore the impacts rocky shores can have on both well-being and marine awareness.

Examining the Impacts of Different Types of Litter on Visitors’ Well-Being When Experiencing Rocky Shores

This chapter is a version of a paper currently under revision:
Wyles, K. J., Pahl, S., & Thompson, R. C. (under revision). The detrimental effects of litter: Examining the impacts of different types of litter on visitors’ well-being.

5.1 Introduction

As reported in the previous two chapters, rocky shores are perceived and found to provide benefits to its visitors. This is in line with the more generic literature that has also found that aquatic environments improve mood and health (Felsten, 2009; Hipp & Ogunseitan, 2011; Laumann et al., 2001; White et al., 2010; White, Pahl et al., 2013). However, rocky shores face a number of anthropogenic threats. In Studies 1 and 2, littering was most commonly noted in the content analysis as being the most troublesome visitor-related behaviour, but not only for this habitat but also for people who choose to visit this environment. Yet, the impacts of degraded or littered environments on people’s psychological well-being are less well known. Coastlines, like rocky shores, can vary considerably in state, with different types of marine debris found on the shore, including natural products such as drift seaweed (dislodged seaweed that has drifted to the shore) as well as marine litter from fishing and public sources. This chapter first reviews the comprehensive literature regarding the psychological benefits of clean natural environments followed by a more detailed focus of less pristine marine environments and the limited research examining the associated impacts on individuals. Two experimental studies are then reported that test whether these different types of debris reduce the initial benefits rocky shores provide, and secondly, explore in greater detail *why* the presence of different types of debris influences people’s experiences (addressing the well-being and habitat threat components of the thesis research model, Figure 5.1).

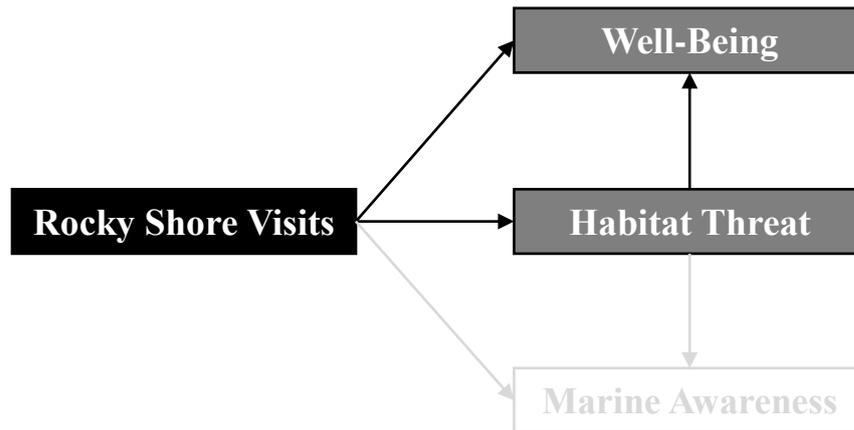


Figure 5.1. The elements of the research model Studies 4 and 5 examine.

5.1.1. The (Clean) Natural Environment

As noted previously, natural environments, in particular aquatic or coastal environments, have been found to produce a number of psychological benefits (Felsten, 2009; Laumann et al., 2001; White et al., 2010; White, Cracknell et al., 2013). When examining preferences (noted as an indication of well-being; Hartig et al., 2010; Ulrich, 1983), a number of studies have shown that the marine environment is often preferred, is aesthetically pleasing and that people are willing to spend considerable more money to have a water view (Herzog, 1985; Luttik, 2000; Nanda et al., 2008; White, Pahl et al., 2013). Studies examining people’s perceptions and actual experiences *in situ* have also shown that people typically feel happier after visiting the coast (Hipp & Ogunseitan, 2011; White et al., 2010; White, Pahl et al., 2013), and also when visiting rocky shores specifically (Studies 1, 2 & 3). In addition to being a preferred environment and improving mood, the coast has also been seen to have great restorative potential (Felsten, 2009; Hipp & Ogunseitan, 2011). After experiencing this environment people typically report feeling revitalised, calm and refreshed (Ashbullby et al., 2013; White et al., 2010, White, Pahl et al., 2013; Study 3). Thus, visiting this popular destination, when clean, has been found to be psychologically beneficial.

The extent of the psychological benefits has been found to vary according to a number of factors. Connectedness to nature, an individual’s attachment to the natural environment, is believed to be one factor that can influence an experience in nature

(Mayer et al., 2009). Within the Biophilia Hypothesis, Wilson (1984) believed that people's psychological health is associated with their connection to nature. Studies have since found that people with greater connectedness to nature typically have greater levels of life satisfaction and well-being (Howell, Dopko, Passmore, & Buro, 2011; Mayer & Frantz, 2004). When exposed to natural environments, connectedness is also seen to partially moderate these effects on well-being (Mayer et al., 2009). These correlational studies further support the psychological benefits natural environments such as the coast provide, but imply that the extent of these benefits can depend on an individual's level of connectedness. However, this research examining the psychological impacts of visiting natural environments, such as the coast, primarily focuses on clean environments. In contrast, little is known regarding the impacts of degraded environments and whether initial connectedness to nature influences this.

5.1.2. The Littered Natural Environment

Marine litter, manufactured solid waste material that enters the ocean environment, is a worldwide environmental problem (Galgani et al., 2010). Its vast global distribution contaminates habitats from the poles to the equator and from the shoreline to the deep sea, and is commonly found on the coast (Thompson, Moore, Vom Saal, & Swan, 2009). For example, in one weekend, a national beach survey in the UK found on average 2,007 litter items per kilometre of coastline (MCS, 2012a). Many of the materials are extremely slow to degrade thus will remain in the ocean for hundreds of years (Kershaw, Katsuhiko, Lee, Leemseth, & Woodring, 2011). Consequently, this man-made waste continues to have a prolonged negative impact on the environment. Marine litter can have both lethal and sub-lethal effects on biodiversity; through entanglement in fishing nets and other debris, physical damage by ingestion and possible chemical contamination from those materials, and changing entire ecosystems by transporting species to non-native environments (Hall, 2000; Kershaw et al., 2011). As well as harming the natural environment, research has started to explore the impacts marine litter has on people.

Socio-economic studies have found this environmental problem to be extremely expensive for a large range of industries. For instance, it has been calculated that marine

litter costs the Scottish fishing industry over €11.7 million (\$15.9 million) each year because of time lost clearing nets of rubbish, repairing equipment and getting caught in litter (Mouat, Lopez-Lozano, & Bateson, 2010). It is also problematic for the tourism industry. Governing bodies for the UK coastline have stated that ensuring beaches are clean, attractive and safe for tourists are a key priority (Mouat et al., 2010). Getting entangled in floating debris, standing on sharp items and reduced water quality are only some of the physical risks associated with marine litter for humans. As a result, it has been calculated that it costs around €18 million (\$24.5 million) each year to remove beach litter in the UK (Mouat et al., 2010). Thus marine litter is an expensive problem and has potential health risks associated with it, but the specific psychological impacts are currently less well known.

The impacts of marine litter on visitors' psychological well-being have received little scientific attention. Survey studies on tourism organisations and members of the public have shown that rubbish is typically disliked (Mouat et al., 2010; Tudor & Williams, 2006; WHO, 2003). Survey studies have also found that the absence or presence of rubbish on a coastline influences individuals' decisions to visit or not visit a particular site (Ballance et al., 2000; Tudor & Williams, 2006; Williams, Sellers, & Phillips, 2007; Wilson, Robertson, Daly, & Walton, 1995). This has also been found in a more controlled laboratory study looking at environmental degradation more generally. Wilson and colleagues (1995) digitally manipulated eight waterscape pictures to either be clean or have visual cues of degradation (including litter items but also surface foam and algal bloom). By showing participants a selection of these images, they found that scenes indicating environmental degradation were less liked and were less likely to be picked for hypothetical future visits.

As well as a negative preference towards litter, degraded environments may reduce the mood and restorative benefits pristine environments provide. When surveying visitors to a coastline in Texas, Roehl and Ditton (1993) found that the presence of marine litter influenced visitors' grading of the beach. This perceived grading was then found to correlate with overall satisfaction, so those who perceived the beach to have a lower grading were less satisfied with their visit than those who graded the beach much higher. This has also been investigated using a controlled laboratory design. Within a

more terrestrial context, Pretty and colleagues (2005) compared pleasant and unpleasant scenes. The pleasant scenes were similar to those within the more generic psychological literature examining clean environments, whereas the novel unpleasant scenes typically focused on salient degraded features, such as damaged trees, burnt out cars and litter. Overall, Pretty and colleagues (2005) found that the unpleasant scenes were less beneficial to well-being, regarding both physiological and psychological measures such as blood pressure and mood. Thus, the limited research to date implies that litter is disliked, it will influence individuals' decisions to visit an environment and it may reduce the psychological benefits a pristine environment usually offers. However, more research is necessary to understand these findings more fully and whether these effects vary by type of litter.

Marine litter can be categorised in a number of ways, including by its identified source. The three most common categories found on the UK coastline are public-litter, non-sourced litter and fishing-litter (MCS, 2012a). Over forty percent of marine litter found on the UK coast are thought to consist of items that are accidentally or deliberately left on the beach or carried there by winds and rivers, including drinks bottles, sweet and crisp wrappers, and barbeque remains (termed as *public-litter*; MCS, 2012a). The second most common source is classed as *non-sourced*, as these are items that are too small and/or damaged to be able to identify what they were and where they came from (MCS, 2012a). The third most common category is *fishing-litter* (14% of the marine litter found), which typically includes pieces of fishing crates, fishing rope and lines, and heavy duty gloves (MCS, 2012a). To strengthen ecological validity, studies manipulating litter should represent these more commonly found categories accordingly, unlike Wilson and Pretty and colleagues (1995; 2005) who used highly salient but, in reality, rarely observed items such as burnt out cars or floating tires. As well as grounding psychological research to litter data, it would be insightful to know whether different litter sources have different impacts on people. For instance, there is research that shows that fishing-litter can have specific physical impacts, such as entangling animals and boat propellers (Kershaw et al., 2011); however little is known regarding the psychological impacts of different types of this litter when encountered in coastal environments. As highlighted by Pretty and colleagues' (2005) focus on the pristine and less pristine natural environment, it is also

important to consider natural debris that does not contribute to marine litter as an environmental issue, but may still reduce the pristineness of a natural environment. For instance, drift seaweed is naturally found on the shore, but can be associated with negative impacts on individuals due to its unattractive smell and aesthetics (WHO, 2003). Thus further research is needed to examine in greater detail the impacts debris (lose materials, both man-made and natural) has on its visitors; specifically, whether there are differences between types of debris and why.

5.1.3. Present Studies

Two laboratory studies used rocky shore photographs that were systematically manipulated to produce four conditions differing in debris: A clean condition that involved a pristine coastal scene; a seaweed condition that had additional drift seaweed; a public-litter condition addressing the habitat threat outlined in Chapter 3 with items representing the most common source of marine litter in the UK; and a fishing-litter condition representing another common and easily identifiable source. To be able to conclude that effects are due to these manipulations and relate specifically to rocky shores, only this type of marine environment was used for the experimental stimuli. In order to reduce the saliency of these manipulations and also further embed the research into the current literature, additional clean natural environments were used.

Two separate studies were conducted for this chapter. The first (Study 4) took a more quantitative approach, where participants rated all images according to three types of well-being measures: Preference (combining aesthetic and behavioural), affect (mood and arousal) and perceived restorativeness; whereas the second (Study 5) recorded the same ratings for a small subset of the images along with qualitative responses justifying those ratings. Connectedness to nature was also included to explore whether this influenced participants' responses. Consequently, these two studies aimed to explore five specific research questions: 1) Controlling for background characteristics of the scenes, are scenes with debris seen to have negative impacts on well-being compared to a clean shore as predicted by the literature? 2) Do ratings differ according to the type of debris (seaweed, public-litter, and fishing-litter)? 3) If so, what reasons do people report for the different ratings? 4) Does initial connectedness to nature influence peoples' experiences

of these environments? And finally, 5) how do these findings fit in comparison to other environments?

5.2 Study 4: Does Litter have an Impact?

By using quantitative measures, this study aimed to answer four of the research questions: Is a rocky shore with debris worse for well-being than a clean shoreline; are there differences in ratings between the different types of debris; does initial connectedness to nature influence peoples' experiences of these environments; and how do these findings fit in comparison to other natural environments?

5.2.1. Method

5.2.1.1. Development of experimental stimuli.

The experimental stimuli were developed so that the presence of different types of debris was the only difference between them. As mentioned in Chapter 1, rocky shores can vary considerably with physical conditions such as weather and tide cycles. Consequently, all of the photographic stimuli consisted of the same format and backdrop (see Figure 5.2) and were taken on dry days under clement weather conditions and during low tide, so that the intertidal area was equally exposed. Three different rocky shore sites in the south west of England were used (Portwrinkle, Cornwall; South Milton Sands, Devon; Wembury, Devon); where photographs were taken at different locations. By positioning the camera accordingly, the images were taken from a perspective as though the viewer was sitting on the shore looking out to sea. Lighting, weather conditions and overall picture quality was further matched using suitable computer software.

The conditions were constructed by physically manipulating the environment, by adding and removing relevant items accordingly (Figure 5.2). For the seaweed condition, drift seaweed from the upper shore was placed in a natural manner in the appropriate zone as shown in Figure 5.2. To be representative of marine litter, the items for both litter conditions were collected from the sites and consisted of the more commonly found items on British shores (MCS, 2012a). For public-litter; this included drink cans, plastic bottles, sweet and crisp wrappers and beach toys such as deflated footballs. For fishing-litter; typical fishing debris such as rope, fishing nets, broken crates and packaging, and

industrial rubber gloves were used. Only items that were of suitable size to be seen in photographs were used (10cm to 60cm in length), with the number of items, depending on size, ranging from four to twelve. A variety of items were used throughout the images in order to reduce recognisability of individual pieces of litter.

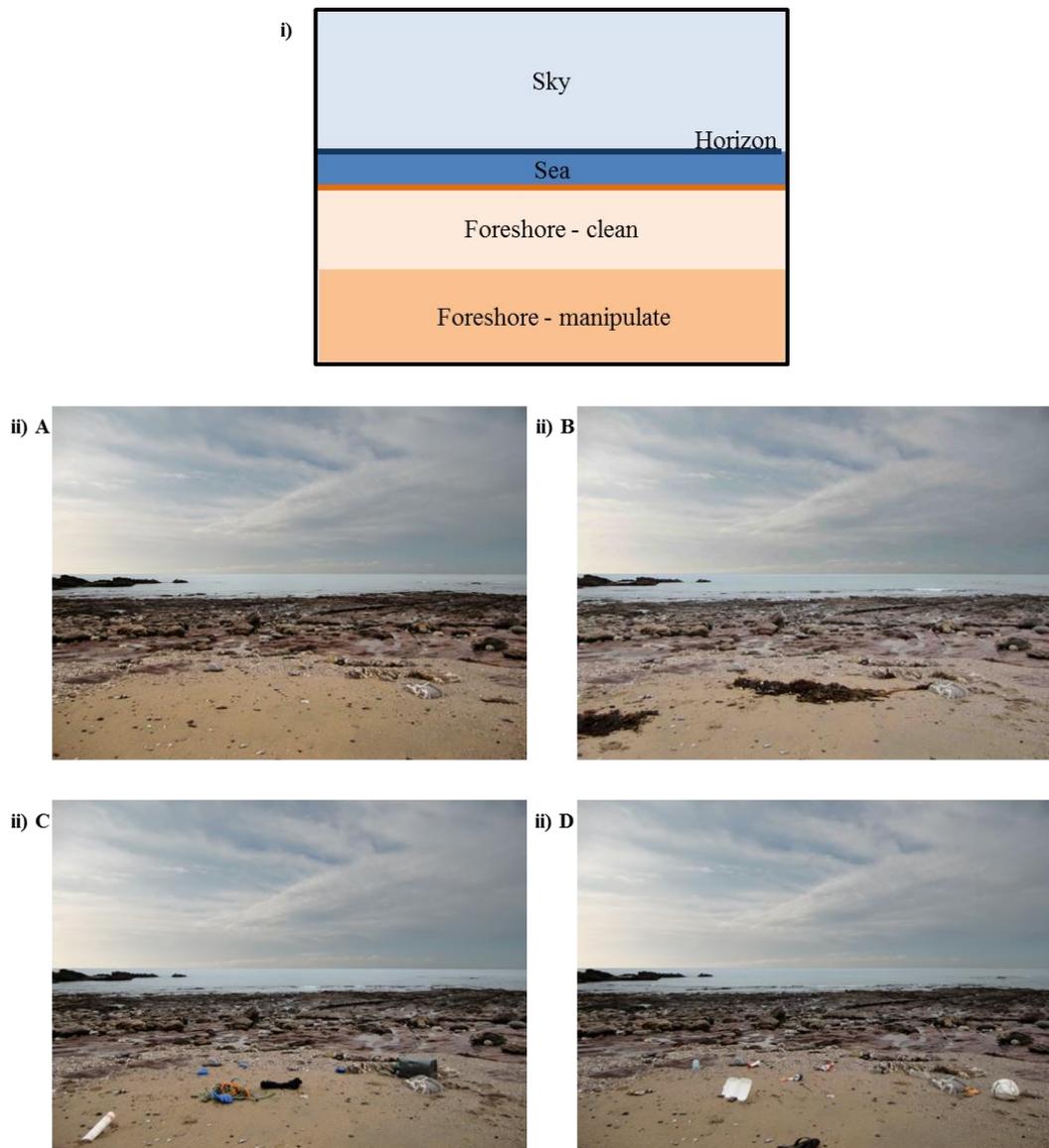


Figure 5.2. The format for each individual image for the experimental conditions (i) and an example from each of the four experimental conditions (ii): a) clean; b) seaweed; c) fishing-litter; d) public-litter used in Studies 4 and 5 (photographs used with permission of the author, all rights reserved).

A total number of 24 experimental stimuli were collated, consisting of six rocky shore backdrops for each condition. To embed this study in previous research and to

decrease the saliency of the four conditions, 24 other environmental images were used. The majority were sourced from White and colleagues' (2010) study, representing their six predominately natural scenes (as shown in Figure 5.3). Piloting of the stimuli was undertaken on a total of 13 participants and showed that the litter and seaweed was reasonably salient in the relevant images.

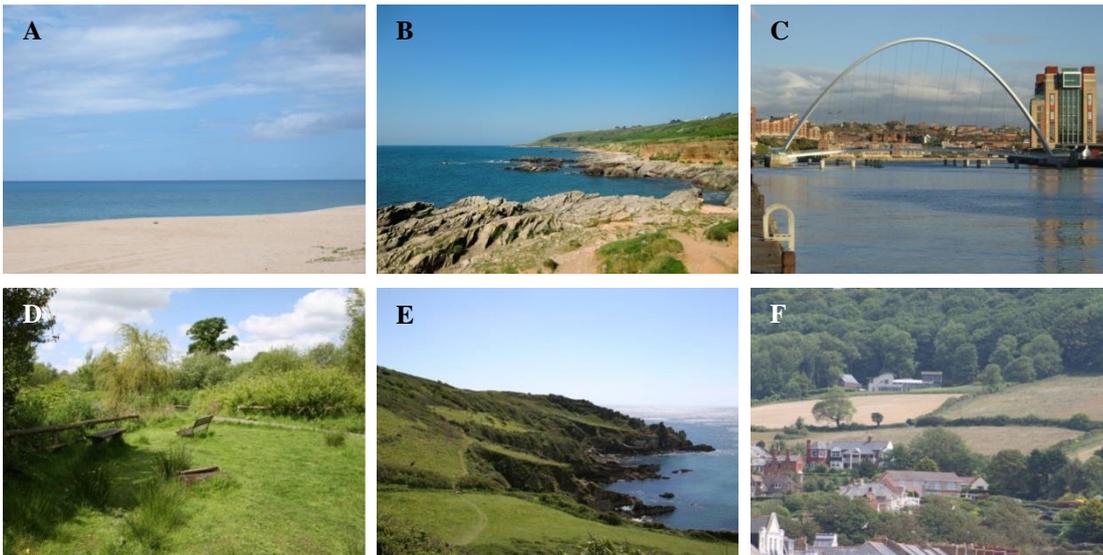


Figure 5.3. Examples of the other natural environments: a) aquatic-only, b) aquatic-green, c) aquatic-urban, d) green-only, e) green-aquatic, and f) green-urban used in Study 4 (from White et al., 2010).

5.2.1.2. Participants.

The sample consisted of 79 undergraduates from Plymouth University's Psychology participation pool, who were accredited a course credit for their participation. The majority were females (75%) and the average age was 20 years ($SD = 3.00$). The majority of participants visited rocky shores once or twice a year (50%) and had an average connected to nature score of 3.24 ($SD = 0.47$, scale 1-5).

5.2.1.3. Measures.

Images were rated according to three types of well-being measures preference, affect and perceived restorativeness. To measure preferences, participants were asked how attractive they found the view and how willing they would be to stay in a hotel with that view (as used in White et al., 2010). Responses were on a 10-point scale from *not at*

all (1) to *extremely* (10). Similar to White and colleagues (2010), these two items were combined to produce a reliable overall preference scale (Cronbach's $\alpha = .83$).

To measure affect, the concise measure described in Section 3.2.1.2.2 was adopted where participants rated how each scene made them feel on a scale from *very sad* (1) to *very happy* (10) and from *very calm* (1) to *very excited* (10). The longer, more reliable measure from Study 3 was not appropriate with the current design, as it would have been too time-consuming and demanding for participants for each of the 48 images, thus this previously used measure that has been applied in similar designs was adopted (White et al., 2010).

Similarly to the affect measure, a more convenient measure was adopted for restoration likelihood compared to the four-item scale described in Study 3. Based on similar studies (Lindal & Hartig, 2013; Nordh et al., 2009), participants were asked to rate *to what level [they] would agree with the statement: I would be able to rest and recover my ability and focus in this environment* on another 10-point scale from *not at all* (1) to *completely* (10).

The 14-item Connectedness to Nature Scale (Mayer & Frantz, 2004) was also included to explore the role of participants' initial attachment to the natural environment (Cronbach's $\alpha = .77$), including items such as *I often feel a sense of oneness with the natural world around me* and *my personal welfare is independent of the welfare of the natural world* (reversed). Each statement was rated on a five-point scale from *completely disagree* (1) to *completely agree* (5). Standard demographic items were also included (e.g. age and gender). Other items such as environmental experiences, ranking different environments according to preference, postcode and upbringing were included but are not central to the current research question, therefore will not be discussed (See Appendix H for the materials and Appendix I for descriptives).

5.2.1.4. Design and procedure.

This study used a one-way within-subject design, whereby each participant rated each image for all ten conditions: The four experimental scenes (clean, seaweed, public-litter, and fishing-litter) plus the six other types of natural environments from the previous literature. Image order was pre-set and partially randomised. Complete randomisation

was inappropriate as a level of control was necessary so that similar images (regarding condition and backdrop) did not follow from one another. Consequently, participants were randomly allocated to one of two different pre-set orders of images (see Figure 5.4).

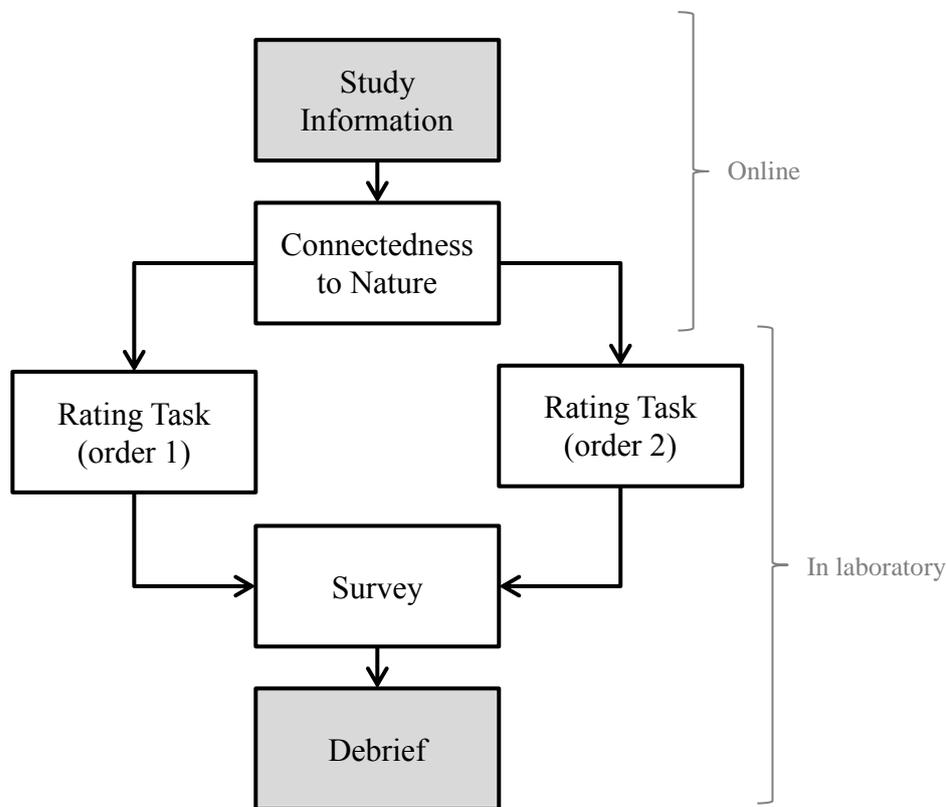


Figure 5.4. A schematic diagram of the methodological design, with participants completing one of the two pathways, to counteract any order effects.

The connectedness to nature measure was completed online the day before the main study to reduce the influence of the measure itself on the well-being outcomes. On arrival at the laboratory the following day, participants were seated in front of a computer monitor and were fully briefed. If happy to continue, they were then shown an introductory passage that explained that they were going to rate a series of images according to five questions and were instructed to imagine that *it is a sunny day and you have decided to go for a leisurely walk. After a while you decide to sit down and take in the view. This is what you see....* The images were displayed in the middle of a white screen taking approximately 75% of the screen. The questions appeared individually below the image, and were replaced by the next question once the participant had clicked their response (as illustrated in Appendix H). Participants first performed a trial rating on

four additional images, which were not included in the analysis, before proceeding onto the main task at their own pace. After completing the rating task, participants answered the remaining survey questions before being debriefed and thanked.

5.2.1.5. Analysis.

In line with the screening procedure described in Section 3.2.1.4, preliminary checks were first conducted. For each condition, average responses were calculated for each well-being measure (preference, mood, arousal & restoration likelihood). The two stimulus orders given to participants were not found to have any significant effects (all p s > .05); therefore these two groups were combined. The main analyses were also not statistically influenced by potential demographic effects (e.g. gender and age; all p s > .07), thus it was not necessary to analyse these variables further. Consequently, as there was no need to control for any covariates, the main analysis consisted of one-way repeated ANOVAs followed by repeated contrasts to compare the four experimental conditions. To explore the significance of connectedness, 4 (condition: clean, seaweed, fishing-, public-litter) x 2 (connectedness: high, low⁹) mixed-ANOVAs were used, and further one-way repeated ANOVAs examined the four rocky shore conditions in relation to the other six environments.

5.2.2. Results

5.2.2.1. Differences between clean and environments with debris.

As shown in Figure 5.5 (see Table 5.2 for exact means), when comparing the four rocky shore conditions, the same pattern for all four measures emerged: The clean condition was consistently rated the most positive, followed by seaweed, whilst the two littered conditions were rated more negatively, with the public-litter condition rated the worst. In terms of the individual measures, participants gave positive preference ratings, felt happy and calm when viewing the clean and seaweed conditions and found them to be restorative environments. In contrast, the two littered conditions were less preferred, made participants feel unhappy and less calm and were seen less likely to support

⁹ For ease of interpretation, connectedness was converted to a dichotomous variable by a median split into low (values < 3.2) and high (values > 3.3) connectedness.

restoration. Statistically, these ratings were found to differ between the four conditions on each measure: Preference = $F(1.39, 108.25) = 190.82, p < .001$, partial $\eta^2 = .71$ (large effect), mood = $F(1.42, 110.89) = 167.21, p < .001$, partial $\eta^2 = .68$ (large effect), arousal = $F(1.74, 135.45) = 13.79, p < .001$, partial $\eta^2 = .15$ (small-medium effect) and restoration likelihood = $F(1.59, 124.19) = 161.79, p < .001$, partial $\eta^2 = .68$ (large effect). Repeated contrasts consistently found that ratings were significantly more negative for the fishing-litter compared to the seaweed condition (all $ps < .001$), and that public-litter was given significantly lower ratings compared to fishing-litter (all $ps < .001$; see Figure 5.5 for all significant repeated contrasts).

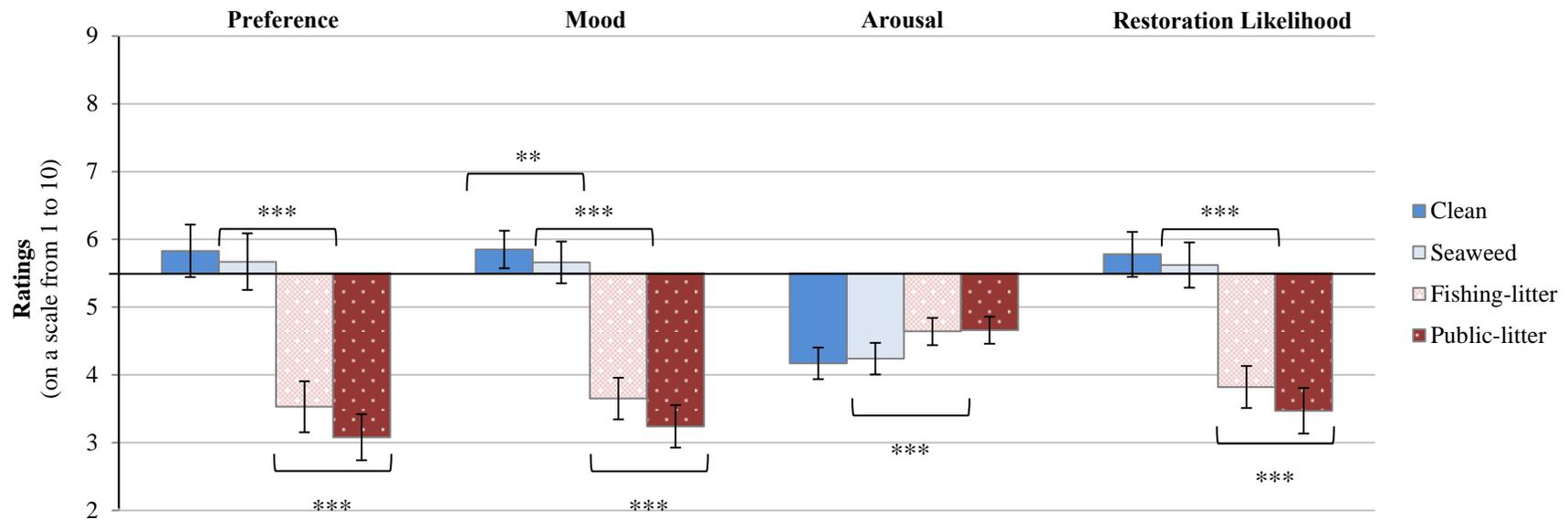


Figure 5.5. The means (and 95% confidence intervals) for the four well-being measures centred around the mid-point of 5.5 in Study 4 ($n = 79$). Note. The scale for preference ranged from *not at all* (1) to *extremely* (10); mood ranged from *very sad* (1) to *very happy* (10); arousal ranged from *very calm* (1) to *very excited* (10); and restoration likelihood ranged from *not at all* (1) to *completely* (10). * $p < .05$; *** $p < .001$

5.2.2.2. The influence of connectedness.

When including connectedness within the analysis to examine its influence on participants' ratings of the experimental stimuli, the main effects of condition remained (all $ps < .001$). However, interactions between condition and connectedness were found for preference ratings, $F(1.41, 108.86) = 5.15, p = .02$, partial $\eta^2 = .06$ (small effect), whereby participants with higher connectedness rated the clean and seaweed conditions more positively than those with lower connectedness. In contrast, connectedness did not affect ratings of the littered environments (see Table 5.1). This interaction also occurred for the mood measure, $F(1.45, 111.52) = 4.27, p = .03$, partial $\eta^2 = .05$ (small effect); and for restoration likelihood measure, $F(1.65, 127.05) = 6.45, p = .004$, partial $\eta^2 = .08$ (small effect); with the same pattern occurring.

Table 5.1. The means (and standard deviations) for each rating measure for the four experimental conditions for participants with high ($n = 38$) and low ($n = 41$) connectedness to nature in Study 4.

		Overall Preference	Affect – Mood	Affect – Arousal	Restoration Likelihood
Clean					
	Low	5.39 (1.80)	5.59 (1.01)	4.17 (0.79)	5.34 (1.21)
	High	6.30 (1.53)	6.14 (1.39)	4.18 (1.28)	6.24 (1.60)
Seaweed					
	Low	5.26 (1.96)	5.43 (1.28)	4.31 (0.84)	5.15 (1.37)
	High	6.12 (1.65)	5.91 (1.43)	4.17 (1.23)	6.14 (1.44)
Fishing-litter					
	Low	3.50 (1.85)	3.72 (1.45)	4.72 (0.73)	3.76 (1.50)
	High	3.56 (1.49)	3.57 (1.36)	4.56 (1.02)	3.89 (1.50)
Public-litter					
	Low	3.02 (1.70)	3.37 (1.41)	4.76 (0.80)	3.39 (1.36)
	High	3.14 (1.31)	3.10 (1.32)	4.55 (0.98)	3.55 (1.41)

Note. Responses ranged from: 1 = *not at all* to 10 = *extremely* for preference; 1 = *very sad* to 10 = *very happy* for mood; 1 = *very calm* to 10 = *very excited* for arousal; and 1 = *not at all* to 10 = *completely* for restoration likelihood.

5.2.2.3. *Differences between conditions and other clean natural environments.*

To embed the litter-focused findings into the current restoration literature, six contrasting natural environments were used as a comparison. For the preference, mood and restoration likelihood, the two littered conditions were still rated the lowest, being the only conditions lower than the mid-point (Table 5.2). The aquatic-only and aquatic-green environments were rated the most positively regarding preference, mood and restoration likelihood. Whilst all environments were found to be rather calming, participants felt calmer for the green-only and clean rocky shore environments. Similar to before, these ratings were found to statistically differ between the different environments for each measure: Preference = $F(3.94, 306.96) = 285.11, p < .001, \text{partial } \eta^2 = .79$ (large effect), mood = $F(3.94, 307.60) = 280.23, p < .001, \text{partial } \eta^2 = .78$ (large effect), arousal = $F(3.92, 305.87) = 5.95, p < .001, \text{partial } \eta^2 = .07$ (small effect), and restoration likelihood = $F(4.48, 349.29) = 184.23, p < .001, \text{partial } \eta^2 = .70$ (large effect; see Appendix I for additional contrast analysis).

Table 5.2. The means, standard deviations and corresponding rank for each rating measure for all ten conditions (n = 79) in Study 4.

	Preference			Affect – Mood			Affect – Arousal			Restoration Likelihood		
	M	SD	Rank	M	SD	Rank	M	SD	Rank	M	SD	Rank
Rocky Shores												
Clean	5.83	1.73	6	5.85	1.23	6	4.17	1.05	9	5.78	1.47	5
Seaweed	5.67	1.86	8	5.66	1.37	8	4.24	1.04	7	5.62	1.48	6
Fishing-litter	3.53	1.67	9	3.65	1.40	9	4.64	0.88	4	3.82	1.50	9
Public-litter	3.08	1.52	10	3.24	1.37	10	4.66	0.89	2	3.47	1.38	10
Predominantly Aquatic												
Aquatic-only	8.50	1.07	2	8.25	1.07	2	4.52	2.03	5	7.82	1.33	1
Aquatic-green	8.72	0.88	1	8.27	1.03	1	4.22	2.05	8	7.70	1.44	2
Aquatic-urban	6.20	1.22	5	6.10	0.99	5	4.92	1.04	1	5.60	1.26	7
Predominantly Green												
Green-only	7.60	1.12	4	7.43	1.06	4	3.95	1.43	10	7.41	1.22	3
Green-aquatic	8.22	1.01	3	7.71	1.03	3	4.26	1.63	6	7.18	1.25	4
Green-urban	5.70	1.46	7	5.70	1.15	7	4.66	0.97	3	5.52	1.54	8

Note. Responses ranged from: 1 = *not at all* to 10 = *extremely* for preference; 1 = *very sad* to 10 = *very happy* for mood; 1 = *very calm* to 10 = *very excited* for arousal; and 1 = *not at all* to 10 = *completely* for restoration likelihood.

5.2.3. Discussion

Using a controlled experimental design with clean, seaweed, public-litter and fishing-litter conditions; this study was able to compare the well-being impacts differing types of debris has on individuals. Participants consistently gave the clean and seaweed condition similarly positive ratings, whereas the two littered conditions were consistently given lower ratings in comparison to both the other experimental conditions and other environments, with the public-litter receiving the lowest ratings. Additionally, connectedness was found to influence participants' ratings of the clean and seaweed conditions, but regardless of initial connectedness, everybody rated the littered environments similarly detrimental. These findings therefore suggest that the more natural state of a rocky shore (the clean and seaweed conditions) is better for psychological well-being, but the presence of litter in general does have a detrimental impact on people's enjoyment (in terms of preference, mood, and restoration likelihood). In addition, the extent of this detrimental impact depended on the type of litter. However, this study was unable to explain the reasons for these effects.

In order to explore why the presence of litter influenced people's ratings, a second study was conducted to provide richer, more explanatory data. Participants in Study 5 were exposed to only one image for each of the four experimental conditions. Similar to Study 4, participants first rated the images, but were then asked to provide a justification for their rating. This approach was chosen because it would provide a greater understanding as to why litter can be detrimental compared to the more natural conditions (clean and seaweed) and why public-litter was rated worse than fishing-litter. The majority of the measures were consequently the same for Study 5, with the addition of the qualitative component. In order to also generalise Study 4's findings beyond a sample of Psychology students, a general public sample was recruited in Study 5.

5.3 Study 5: Why Does Litter have an Impact?

This study continued to explore whether people experience environments with different types of debris differently but also explored what factors influenced these responses using self-report open-ended responses.

5.3.1. Method

5.3.1.1. Participants.

The sample consisted of 20 members of the public. Participants were recruited from the Plymouth University's paid participation pool, where members received £4 (€4.80) for participating in the study. One participant was omitted after they disclosed they had not followed the instructions fully. Of the 19 participants, just over half were females (58%) and the average age was 35.79 years ($SD = 17.13$). The majority of participants claimed to visit rocky shores once every 2-3 months (44%) and scored just above the mid-point for connectedness to nature ($M = 3.70$, $SD = 0.78$).

5.3.1.2. Stimuli and measures.

The majority of the stimuli and measures were kept consistent with Study 4, thus only modifications are addressed here. To reduce the saliency of the main litter manipulation in the stimuli, four backdrops were selected from Study 4. The rating scales for each picture remained the same, examining preference (aesthetic and behavioural; Cronbach's $\alpha = .79$), affect (mood and arousal) and restoration likelihood. Additional qualitative items were included, where participants were asked to provide five words that they associated with the scene and were then reminded of their mood rating and asked *what is it about this scene that made you respond this way and why?* The reported qualitative analysis focused on the richer data resulting from the latter question, but results from the association question can be found in Appendix I.

To reduce demand on the participants, a short more concise and convenient version of the Connectedness to Nature Scale (Mayer & Frantz, 2004) was adapted by using the four most highly correlated items from Study 4: *I think of the natural world as a community to which I belong; I often feel part of the web of life; I feel that all inhabitants of Earth, human, and nonhuman, share a common 'life force'; and like a tree can be part of a forest, I feel embedded within the broader natural world.* Responses ranged from *completely disagree* (1) to *completely agree* (5) and was found to be a reliable scale (Cronbach's $\alpha = .80$).

Marine awareness measures were also included but were not central to this chapter's research questions (see Appendix I for further details and results).

5.3.1.3. Design and procedure.

The design and procedure were similar to Study 4, where participants completed the connectedness to nature measure online, then completed the rating component and survey measures the day after in the laboratory (see Figure 5.6). For the rating component, a one-way within-subject design was used; but for this study participants only responded to one image for each of the four conditions (see Appendix H for the entire stimuli set). First, participants rated each image according to the five measures. Then they were shown the images again along with their mood rating in order to complete the qualitative measures. The order of presentation for both the condition (clean, seaweed, fishing- and public-litter) and backdrop (from a selection of 4 from Study 4) were fully randomised.

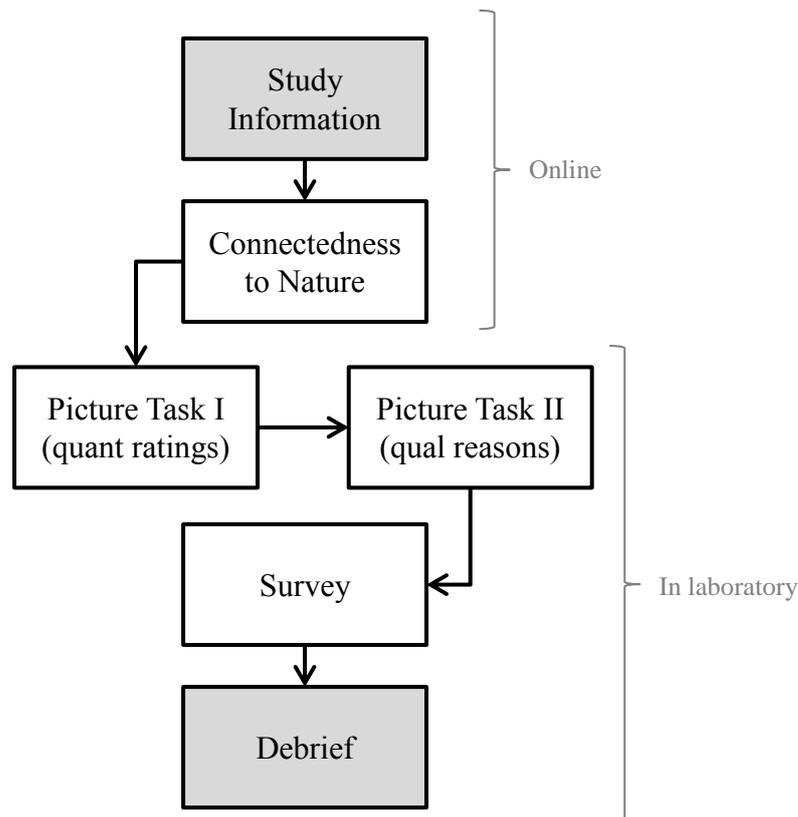


Figure 5.6. A schematic diagram of the methodological design for Study 5.

5.3.1.4. Analysis.

The analyses of the quantitative data were identical to Study 4. Stimuli order, age and gender were all not found to influence the overall conclusions (all $ps > .06$), thus

these variables will not be analysed further. For the qualitative data, thematic analysis was used (Braun & Clarke, 2006). As the earlier quantitative findings consistently found that a) the two natural conditions were different to the littered ones, and that b) ratings also differentiated between public- and fishing-litter, the qualitative analysis focused on two specific aspects: 1) Why did people respond differently to the natural (clean and seaweed) and littered (fishing and public) environments? 2) Why did people respond differently to the fishing- and public-litter? Using a semantic realist approach¹⁰ exploring these specific aspects (Braun & Clarke, 2006), the data were initially examined to work out prominent unique themes for the natural and littered environments, and again for the fishing- and public-litter environments specifically. Themes were then developed and refined over a number of iterations. Analysis was predominately completed by the author, along with active discussions with the supervisory team.

5.3.2. Results

5.3.2.1. Quantitative analysis.

Statistically, apart from the arousal measure of affect ($p = .85$), ratings were found to differ significantly between the four conditions: Preferences, $F(3, 54) = 25.73$, $p < .001$, partial $\eta^2 = .59$ (large effect); mood, $F(1.90, 34.15) = 39.71$, $p < .001$, partial $\eta^2 = .69$ (large effect), and restoration likelihood, $F(1.58, 28.52) = 19.20$, $p < .001$, partial $\eta^2 = .52$ (large effect). For these measures, the two natural conditions (clean and seaweed) were rated positively (consistently above the mid-point), whereas the littered ones were rated negatively, with the public-litter consistently given the lowest ratings. The seaweed condition was given the highest ratings for preference and mood, but the clean condition was seen as the most restorative; however these differences were not statistically significant in the contrast analysis (all $ps > .35$; see Figure 5.7). On the other hand, the fishing-litter was consistently rated different to the clean or seaweed condition (all $ps < .001$), with public-litter often rated significantly worse than fishing-litter (all $ps < .03$; Figure 5.7).

¹⁰ An explicit analytical approach that assumes a unidirectional relationship between meaning and language

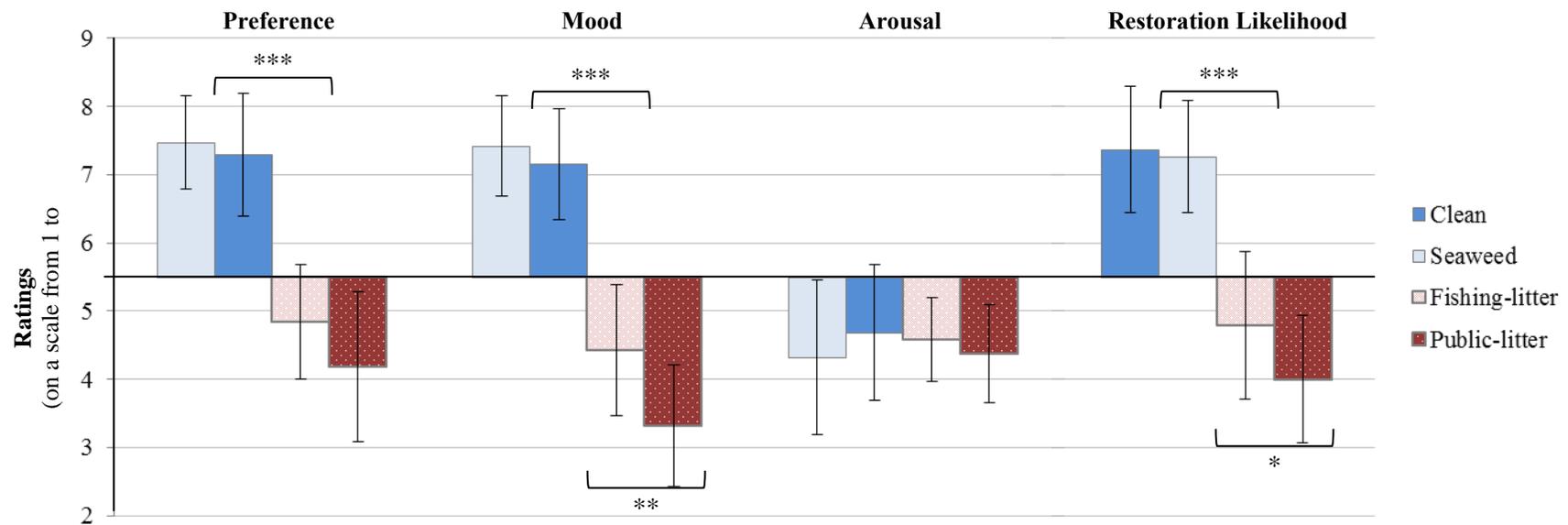


Figure 5.7. The means (and 95% confidence intervals) for the four measures in Study 5 ($n = 19$), centred around the mid-point of 5.5.
 Note. The scale for preference ranged from *not at all* (1) to *extremely* (10); mood ranged from *very sad* (1) to *very happy* (10); arousal ranged from *very calm* (1) to *very excited* (10); and restoration likelihood ranged from *not at all* (1) to *completely* (10). * $p < .05$; ** $p < .01$; *** $p < .001$

In sum, for the preference, affect (mood only) and restoration likelihood items, the two littered conditions were consistently rated more negatively than the natural conditions (seaweed and clean). The seaweed condition was rated the best for preference and mood, but the clean condition seen as the most restorative, with public-litter rated the worst on all measures. The qualitative data were then used to further understand the reasons for these ratings.

5.3.2.2. *The influence of connectedness.*

Similar to Study 4, the impact of connectedness on participants' ratings were examined. However, due to sample size ($n_{\text{low connectedness}} = 11$; $n_{\text{high connectedness}} = 8$), it was not appropriate to run the same statistical analyses. There was one statistically significant correlation, whereby as levels of connectedness increased, the restorative potential for the fishing-litter condition also increased, $r = .53, p = .02$. However, as the remaining correlations were not statistically significant ($p > .06$; see Appendix E) and there were no visible differences between people with high and low connectedness in the descriptive data (see Table 5.3); it seems that connectedness had little influence for this sample.

Table 5.3. *The means (and standard deviations) for each measure for the four experimental conditions overall (in bold, $n = 19$) and for participants with high ($n = 11$) and low ($n = 8$) connectedness to nature in Study 5.*

	Overall Preference	Affect – Mood	Affect – Arousal	Restoration Likelihood
Clean	7.29 (1.97)	7.16 (1.77)	4.68 (2.16)	7.37 (2.03)
Low	7.41 (2.00)	6.82 (1.72)	4.64 (2.54)	7.18 (2.18)
High	7.13 (2.05)	7.63 (1.85)	4.75 (1.67)	7.63 (1.92)
Seaweed	7.47 (1.50)	7.42 (1.61)	4.32 (2.47)	7.26 (1.79)
Low	7.59 (1.22)	7.18 (1.60)	3.55 (2.34)	7.27 (1.74)
High	7.31 (1.89)	7.75 (1.67)	5.38 (2.39)	7.25 (1.98)
Fishing-litter	4.84 (1.84)	4.42 (2.09)	4.58 (1.35)	4.79 (2.04)
Low	4.68 (1.37)	4.09 (1.76)	4.73 (0.90)	4.27 (1.79)
High	5.06 (2.44)	4.88 (2.53)	4.38 (1.85)	5.50 (2.27)
Visitor-litter	4.18 (2.38)	3.32 (1.95)	4.37 (1.57)	4.00 (2.36)
Low	4.18 (2.17)	2.91 (1.14)	4.27 (1.62)	3.27 (1.85)
High	4.19 (2.80)	3.88 (2.70)	4.50 (1.60)	5.00 (2.73)

Note. Responses ranged from: 1 = *not at all* to 10 = *extremely* for preference; 1 = *very sad* to 10 = *very happy* for mood; 1 = *very calm* to 10 = *very excited* for arousal; and 1 = *not at all* to 10 = *completely* for restoration likelihood.

5.3.2.3. *Qualitative analysis.*

5.3.2.3.1. *Why do people respond differently to the natural and littered environments?*

For the question *what is it about this scene that made you respond this way and why* a number of themes highlighted why the natural and littered environments were perceived and responded to differently. For the two natural conditions (clean and seaweed), comments centred around four themes: Psychological benefits, evaluative descriptions of the scene, familiarity, and imagining use. In contrast, four themes elaborated on why the two littered conditions were rated negatively: Negative emotions, experience disrupting effects of litter, environmental consequences of litter, and behavioural response. These themes will now be described briefly.

The *psychological benefits* theme consisted of comments that explicitly noted positive effects of the natural scenes on the participant's state of mind. Many of these focused on experiencing restorative effects and/or an improved mood from viewing these environments. For instance, one participant wrote

The jagged rocks indicate erosion and the natural power of the sea is visible from the waves, which gives me a sense of insignificance when compared to the power of the ocean. This releases tension/stress and improves happiness. Participant ID: PP120
(condition: clean)

This and other comments commonly expressed a feeling of being 'happy', 'content' and 'enjoying' the scene, which further validates the mood and restorative rating measures. There were also comments that related specifically to the psychological benefit of feeling connected to nature and how the natural environments were seen to facilitate or inhibit this need. The majority of comments addressed by this theme were positive, however one participant stated a preference to be close to the sea, therefore the intertidal area during low-tide was seen to act as a barrier for this participant to fully experience this connected to nature psychological benefit:

I like to be close to the sea, when you can almost feel the waves breaking / sea spray etc., so this scene is a bit distant for me. PP111 (seaweed)

As well as expressing the positive psychological benefits of the clean and seaweed scenes, another theme (*evaluative descriptions of the scene*) addressed the natural scenes in terms of aesthetics and naturalness (including cleanliness) using either positive or negative valenced descriptions. Some comments were general, often describing the scene as ‘nature as it should be’, whilst others focused on specific elements. Most comments were positive, with the occasional comment expressing a preference for sandy over rocky foreshores. However, many comments positively emphasised the lack of rubbish in the scene, for instance:

It has a lovely view which is uncluttered and the open sea relates to having an open mind.

It is a natural view with no manmade objects in it. PP114 (clean)

The theme *familiarity* was defined as references to familiarity, feeling at home and/or reminiscing over happy memories. The sense of familiarity triggered by these natural images also overlapped with the psychological benefits. For instance, a couple of responses explained the main reason to visit this type of environment is to receive those psychological benefits:

...this bit of coast looks very familiar to me, I go to places like this to calm and centre myself. The rugged natural beauty is inspiring and I love it. PP113 (seaweed)

The final theme, *imagining use*, also overlapped the psychological benefit theme. Within this theme, comments spontaneously referred to how people imagine using that environment. Most of these comments expressed the more behavioural aspect, picturing themselves engaging in specific activities such as exploring areas of the intertidal area; whilst other comments related their imagined use of the environment with the anticipated psychological benefits. For instance:

... I could imagine sitting on one of the larger rocks and being really content. PP111 (clean)

Overall, the comments referring to the natural environments were mainly very positive and focused on the psychological benefits the environment facilitates, the positive and familiar elements of the scene (such as being clean) and how they could imagine using and experiencing that natural environment. In contrast, the themes for the two littered environments were much more negative.

Some comments simply noted the presence of litter, whilst a prominent theme in the two littered conditions was the *experience disrupting effects of litter*. This theme addressed comments that emphasised the presence of litter and how it subtracts from the positive aspects of the scene. These comments often included positive descriptions about the environment surrounding the litter, but would also emphasise that the presence of the litter reduced ‘the warmth’ of the environment or that the rubbish ‘ruins’ or ‘spoils’ the scene. The extent of this disrupting effect varied between participants. For some, the rubbish was seen to completely ruin the environment:

The rocky shore towards the sea has a nice view. However, the evidence of rubbish on the sandy beach destroys the image of the picture. PP116 (fishing)

In contrast, other participants agreed that the presence of litter did disrupt the aesthetics and psychological benefits of the natural environment, but were able to overlook this:

Note the flotsam (cans and bottles) and whilst it would be better without it ... only marginally detracts from the overall beauty. PP121 (public)

Another theme that explained participants’ responses to the two littered conditions was the *environmental consequences of the litter*. This included the anticipated impacts of the litter on the environment spatially (ending up in the sea) and temporally (e.g. long-term effects). Some comments referred to the risk that rubbish on the shore would likely end up in the sea, whilst others noted the material of the rubbish, stating that as it was non-biodegradable, the presence and impacts of the rubbish would be continuous. For example:

... the plastic doesn’t break down for decades or even hundreds of years. PP119 (fishing)

Another prominent theme in these two littered conditions was *negative emotions*, specifically comments referring to negative emotions such as feeling sad and angry as a result of the litter. These negative emotions were often associated with the presence of litter generally, but were also associated with the previous themes. For instance, some comments noted feeling sad because of the *environmental consequences*:

Although the day is still pleasant & the sea is blue & calm, the debris left behind makes me feel sad for the environment and what the human race does to it. PP102 (public)

Other comments elaborated that the negative emotions were elicited because of the *experience disrupting effects of the litter*:

It's sad that a nice beach can be ruined by the waste from humans. PP110 (public)

The final theme, *behavioural response*, found in the littered data was relatively positive. This referred to the action tendency how to deal with the litter. To reduce the detrimental effect that litter was seen to have on people's experiences, some participants noted that they would remove the litter:

...However, rather than dwell on it, I would simply pick up the rubbish, put it in a bin, enjoy the scene and hope that others might enjoy it too. PP111 (fishing)

Overall, these qualitative data highlighted that the two natural conditions were rated positively because of the psychological benefits they promote, the positive aspects of the scene, that the environment reminded participants of pleasantly familiar environments and because they could imagine how they would use and experience that environment. On the other hand, the two littered environments were mainly rated negatively because they elicited negative emotions because of the presence of rubbish, which was seen to have disrupting effects on the benefits the coastal environment typically provides, and the environmental consequences of the litter. However, the impact of litter on the individual seemed to vary between participants, with some overcoming these impacts by picking up the rubbish in order to enjoy a clean coastline. These litter related themes were found for both types of litter (fishing and public); however, it was also apparent within the qualitative data that there were subtle differences between the fishing and public-litter.

5.3.2.3.2. Why do people respond differently to the fishing- and public-litter?

Even though there were similarities between the two littered conditions within the qualitative data (as reported above), there were themes that subtly distinguished the two. A unique theme for the fishing-litter was the lack of intention; whereas the public-litter had three unique themes: Disrespect for nature, physical risks, and reminiscent of the city. These themes further explained why public-litter was consistently rated more negatively than the fishing-litter, as described below.

The unique theme for the fishing-littered environments was the *lack of intention*. This referred to the reason for the litter items found on the beach being the result of an accident rather than the carelessness of someone leaving rubbish on the coastline. For instance, one participant wrote:

... nets from fishing boats that could have been brought in by the sea, but not deliberately dropped by people visiting. PP115 (fishing)

Unlike the fishing-litter that was often noted to wash up on the shore accidentally, the public-litter was seen to be deliberately left. The theme *disrespect for nature* addressed this, with comments emphasising the individuals responsible for leaving litter, especially their disrespect regarding the natural environment. Many comments described the individuals as acting in a 'careless' or 'selfish' manner and 'disrespecting' nature. For instance:

The rubbish seems much more intrusive this time, people being careless and disrespectful; whereas in the [fishing-litter] scene it could have been brought there more by accident. It gets in the way much more of the enjoyment of the scene... PP109 (public)

This theme was also commonly associated with the earlier *negative emotions* theme, as people expressed anger towards those who were believed to have deliberately littered the environment. For instance:

... [The rubbish] it would make me feel sad and a little angry at the carelessness of some people... PP111 (public)

Public-litter was also associated with the theme of *physical risks*. This theme addressed the potential consequences of litter for others, including both other people and wildlife. Some comments referred to dangers to wildlife such as mistaking rubbish for food, whilst others highlighted the potential injury from standing on items, such as:

Presence of non-biodegradable objects (plastics) is really harmful to ocean life. Furthermore, I would not like to step on the "what looks like muddy area" places and which are full of rubbish. PP116 (public)

The final theme for the public-litter was titled *reminiscent of the city*, which stressed that this type of litter does not belong in the coastal environment and is recognised to be more of an urban issue. Only one participant addressed this point:

It makes me feel sad as this kind of pollutant should only be seen in the city. PP105
(public)

Within the public-litter condition, this was not a prominent theme; however it does nicely contrast with the *evaluative descriptions of the scene* theme for the natural conditions, which often noted aspects belonging in nature and how things should be.

In sum, both the fishing- and public-littered environments were seen negatively because people reported that the litter disrupted their experience of the natural environment, the environmental consequences of the rubbish and the negative emotions it elicited but also elicited adaptive behavioural responses such as picking the items up. However, the reason why public-litter was consistently rated more negatively was found to be centred on the implied deliberateness and disrespect for nature by the litter culprits, the physical risks associated with that specific type of rubbish, and that these items should only be seen in the city.

5.4 General Discussion

Unlike the current psychological literature that predominately focuses on pristine natural environments, these two studies explored the worldwide pressing issue of marine litter. Known for its harmful impacts on the environment and wildlife, the consequences of debris on people were explored. Representing commonly found debris on the British coast, four conditions were examined: A clean pristine coastal environment similar to previous studies, a seaweed condition representing a natural but less pristine environment, a public-litter condition representing the most commonly found source of marine litter and addressing the habitat threat noted in Chapter 3, and a fishing-litter condition representing another salient, common source of litter. By asking student and general public samples to rate pictures from a visitor perspective, these studies aimed to explore whether rocky shores with varying debris are rated differently, and, using more exploratory qualitative analyses, what the reasons are for the different ratings.

When comparing the four conditions, two broader groupings emerged in both the quantitative and qualitative measures. The clean and seaweed conditions were consistently rated similarly positive and rarely rated differently from one another, thus collectively can be termed *natural conditions*. In contrast, the public- and fishing-litter conditions both received negative responses, thus can be grouped as *littered conditions*. Using a more representative and data-led debris manipulation, these findings both support and extend Wilson and Pretty and colleagues' (1985; 2005) findings. It was similarly found that environments with litter (or cues of degradation) were less liked, were less likely to be restorative and made people unhappy. The positive findings for the natural conditions (rated positively in terms of preference, mood and restoration likelihood) were also in line with the majority of the literature, that the marine environment is beneficial for well-being (Ashbullby et al., 2013; Felsten, 2009; Hipp & Ogunseitan, 2011; Laumann et al., 2001; White et al., 2010; White, Cracknell et al., 2013; White, Pahl et al., 2013). These findings also complement the previous chapters', as by adopting a different method (a hypothetical scenario using a controlled laboratory design) compared to the previous perception-based (Studies 1 & 2) and field surveys (Study 3), the present studies further support that rocky shores (when in a natural state) are beneficial to people.

By including other environments within Study 4, this chapter also embeds itself in the wider restoration literature. The ratings for the other environments replicate those found in White and colleagues' (2010) original study, with the aquatic-only and aquatic-green scenes found to be the most preferred and perceived to be the most beneficial environments. The focus of Study 4 was not to compare environment types, but it was evident that the clean rocky shore scenes were often not rated as highly as the other much broader environments. This could imply environment differences to research further. Alternatively, it could simply illustrate the stimuli differences, as images from White and colleagues' (2010) study were often brighter, some were evidently not British and they were also less standardised regarding visual perspective. Regarding the litter manipulation, these current findings show that the littered scenes were not only rated worse in comparison to identical clean environments but also to other more generic scenes, further emphasising the detrimental impact of litter. It should be noted that this

litter manipulation was still subtle (see Figure 5.2). Nevertheless this was enough to produce strong and consistent effects.

As well as having noticeable differences between the natural and littered conditions, some differences also emerged regarding the more specific debris type. The clean and seaweed conditions rarely differed in their ratings, with similar psychological benefits reported. In contrast, the two littered environments did differ, with the public-litter always rated more negatively. Thus these findings suggest that litter has negative impacts on visitors, but the unique strength of this work is that the detrimental effects are not simply due to the presence of marine litter but also the type of litter. Some studies have found when showing people images of specific items, medical waste such as syringes are perceived as more offensive (e.g. Tudor & Williams, 2003), but to the author's knowledge, these two studies are the first that examine and find that different sources of litter in natural environments have different impacts on people's well-being (as measured by preference, mood and restoration likelihood).

A number of potential reasons for the differences emerged from the two studies. Previous studies have implied that connectedness to nature is a potentially important factor, where people with greater levels of connectedness experience greater improvements in well-being from natural, predominately clean, environments (Howell et al., 2011; Mayer & Frantz, 2004; Mayer et al., 2009). This was partially supported in Study 4, where participants with higher connectedness rated the clean and seaweed conditions much more positively than those with lower connectedness for preference, mood and restoration likelihood. In contrast, the two littered conditions were rated similarly negative, regardless of connectedness; thus implying connectedness only has an influence on environments when in a natural state. However, this was not strongly found in Study 5. Some comments within the qualitative data were seen to vaguely reflect this, as the natural conditions were said to be rated positively because of the sense of closeness to nature, but the lack of correlations within the quantitative data implied connectedness to nature was not a pronounced factor for this sample. The wealth of data from the qualitative analysis also highlighted other key reasons for the differences between natural and littered conditions, as well as why the two littered conditions consistently differed.

The justifications for the ratings for the natural and littered conditions differed considerably. For the natural conditions, participants further elaborated on the beneficial impacts such as feeling restored and happy and touched on a number of concepts that explained these impacts. The unique key factors focused on specific components of the scene such as being clean, a level of familiarity with the environment, and imagining using and experiencing the environment. Whilst the comments for the natural conditions were predominately very positive, the reasons for the littered ratings were much more negative. Comments for these environments focused on the negative emotions associated with the scene, the disrupting effects on the benefits the coastal environment typically provides, and the environmental consequences of the litter. The public-litter condition was also seen to be worse because of the inferred disrespect others had for the natural environment by not disposing rubbish appropriately, the physical risks associated with the items, and that the items do not belong in the coastal environment.

These ratings and justifications could be indirectly related to ART (Kaplan, 1995). ART claims environments are restorative if they have four properties: Being away, fascination, extent and compatibility, and has originally only been tested on clean environments. Consequently, for the natural conditions, the comments that described how they could use the environment could imply that the environment is compatible with their behavioural goals. The evaluative descriptions of specific elements of the scene could be associated with fascination, as these elements have captured the participants' attention. The diversity of elements participants focused on and that some could imagine exploring the environment could relate to extent, as it implies a richness and depth of the scene. Finally, the joyous reminiscences of past recreational visits and the absence of comments relating to work, stress and everyday more mundane things could imply participants received a sense of being away. In a novel way, the factors linked to the littered conditions could also illustrate how this coastal environment no longer meets these four properties. For instance, the emphasis on the presence of litter alone could be seen to distract the viewer from the extent and richness that the environment has to offer. These two conditions could also be seen to not have the same sense of being away as the natural conditions, as the litter was seen to act as a degradation or stressor cue, especially for the public-litter, as one participant explicitly stated it should only be found in the city. The

more detailed responses referring to the physical risks within the public-litter condition, such as standing on the items, implies that the littered scenes were not as compatible with individuals' behavioural goals. The fascination property could theoretically be seen to have been met as elements of the scene still grabbed the participants' attention; however this was not as positive as for the natural conditions, as the focus was on the litter, typically distracting the viewer from the scenic beauty surrounding it. The relationship between ART and littered environments has yet to be explicitly explored, but these innovative interpretations suggest that this theory could explain why littered environments were not as restorative.

Both studies in this chapter were mainly in agreement; however some differences in the findings were observed. For instance, the ratings for the conditions varied somewhat in extent, where participants in Study 5 typically gave more generous ratings. The order of preference for the clean and seaweed conditions also varied, where the clean condition was typically most popular for Study 4, whilst the seaweed condition was for Study 5. Connectedness to nature also only influenced participants' ratings in Study 4. A number of factors could be responsible for these differences. First, it is noted that the sample size for Study 5 was considerably smaller due to the focus on the qualitative component. This resulted in reduced power for the statistical analyses. Second, the two samples also varied in demographics. Study 4 consisted of a more homogeneous sample, whereas Study 5 recruited a more heterogeneous sample from the general public. As a result, the two samples were reasonably different, for instance in age and gender. The connectedness to nature measure also differed between studies, with the general public sample completing a subset of the original items. This smaller pool of items was still found to be statistically reliable, but may further explain why connectedness to nature did not consistently correlate with the quantitative ratings. The larger stimuli set in Study 4 may have also influenced the differences in ratings, as these findings were based on a much bigger, more balanced sample of stimuli thus should be more robust. The presence of other environmental contexts may have also influenced the students' ratings in Study 4, as their responses would have naturally been influenced by comparing other scenes. However, overall the main conclusions remained the same for both studies: The two natural environments were found to offer beneficial impacts for viewers, whereas the two

littered conditions had detrimental effects; and public-litter was evidently the most problematic type of debris examined regarding impacts on well-being.

Even though both studies resulted in the same conclusions and support the limited literature currently available, methodological limitations still remain regarding the design, measures and stimuli. The laboratory design enabled different variations of rocky shores to be systematically compared, but, even though laboratory and field studies have shown great consistency (Berman et al., 2008; Ryan et al., 2010), the findings cannot be generalised to individuals when they ordinarily experience these environments. For instance, important senses were not activated in the current studies (such as auditory and olfactory senses) which could play an important role in people's experience when *in situ*. Future research may wish to explore this further. For instance, using a between-subject approach, participants could complete similar ratings when visiting a particular site that is clean, has seaweed or different types of litter present.

The chosen design also meant that the measures were reasonably constrained. Ideally, reliable multiple-item scales for each measure would have been used, but due to the number of ratings required, previously used one-item measures (mood, arousal and restorativeness) were chosen. Yet, for the mood and restoration likelihood measures, both studies still found consistent and strong effects. The arousal measure was less distinct, with ratings centring around the neutral values and resulting in fewer substantial effects. This may imply that this type of measure is much more state dependent (for instance is more sensitive when measured *in situ* and focused on a specific episode like the diary technique in Study 3), and not appropriate for more abstract hypothetical scenarios as used in these studies, or in perception-based surveys as used in Studies 1 and 2. Consequently, future research may wish to omit this aspect and possibly include more multi-scale items (as well as examining ART's properties more explicitly to relate this theory to littered environments).

A potential methodological issue regarding the stimuli could be the variation, number of litter items and litter categories represented. An attempt was made to control variation, number and size of litter items, but there were some differences between the two littered conditions. For instance, the fishing-litter included types of large tangled up rope that can appear bigger and less varied than different types of rather small food

packaging, in comparison, in the public-litter. This research was novel in that it examined different types of litter; however by only examining two categories of litter, roughly 54% of the litter commonly found on the UK coast was represented (MCS, 2012a). Other litter categories would not have been appropriate within this design, for instance small items would not have been visible. But as these current studies discovered a difference between these two sources in people's ratings, it may be worth exploring different sources of litter further with a range of designs. Consequently, future work could attempt to further control the debris items and could potentially examine whether people tolerate a certain level of marine litter, are influenced by the variation and size of individual items and gain a more specific understanding of different types of litter in regards to their impacts on the environment and on people. This current and future work could therefore highlight the importance of this environmental issue, and help guide and promote management approaches. For instance, if public-litter is especially problematic to individuals and the environment, management implications could focus on this particular source.

5.4.1. Conclusion

While most research on restoration in nature arguably focuses on pristine, clean environments, the reality is increasingly looking different. Many environments are littered or in other ways damaged or degraded. Thus it is important to understand the effects this may have on experiencing these environments. Using an experimental laboratory approach that systematically manipulated photographic stimuli, the present research showed that marine litter undermines the well-being benefits that a rocky shore ordinarily provides. Environments with litter were rated negatively in terms of preferences, affective responses and restoration likelihood, compared to both clean alternatives and other environments. The intensity of these detrimental effects was found to be dependent on the type of litter, with public-litter perceived to be the worst. Thus, the present studies add evidence that in addition to economic and environmental costs of marine litter, there are also costs on people who may visit and experience the coast.

On a positive note, there are number of potential solutions to this environmental issue, such as removing litter from the coastline. However, with any potential solution, there is a risk of unintended side effects. For instance, mechanised techniques for

cleaning sandy beaches can be invasive, as this involves a machine sifting and/or raking the sand, removing not only rubbish but also dead and stranded biota. These techniques consequently improves the initial environmental issue of marine litter but simultaneously harms the environment, as the repeated turnover and removal of seaweed deprives the ecosystem of valuable nutritional input and modifies the overall structure of the habitat (Davenport & Davenport, 2006). In contrast, beach cleans where individuals selectively pick up the rubbish is much more desirable and seen to be non-damaging to the environment (Davenport & Davenport, 2006). Nonetheless, the ideal solutions would be those that tackle the problem without generating new risks, including to society. For instance, little is known regarding the impact beach cleans can have on the volunteers themselves. Consequently, the following chapter reviews the existing literature and further explores the consequences of beach cleans on current volunteers, as well as experimentally comparing with other coastal activities on a student sample.

What are the Benefits to the Volunteers?

Comparing Beach Cleans to Other Coastal Activities

This chapter is largely taken from a journal article in preparation:
Wyles, K. J., Pahl, S., & Thompson, R. C. (in prep). What are the benefits to the volunteers? Comparing beach cleans to other coastal activities.

6.1 Introduction

Coastal environments, including rocky shores specifically, have been found to provide a range of psychological benefits, including for well-being and marine awareness. Unfortunately, at the same time as providing these valuable benefits, visiting these environments can have harmful consequences on the habitat. As noted in Studies 1 and 2, leaving rubbish was seen to be the most harmful behaviour for the habitat in terms of recreational visits to rocky shores. This behaviour was also seen to have negative impacts on other visitors, as it was noted as being unattractive and disliked (Studies 1, 4 & 5), as well as making people feel sad and sacrificing the restorative qualities of the environment (Studies 4 & 5). A solution to this environmental (and psychological) issue is the stewardship activity of beach cleans. With the assistance from members of the public, removing the rubbish that has accumulated on the shore helps tackle this environmental issue. However, little is known regarding the impacts on those who engage in this pro-environmental act. Consequently, this chapter explores the benefits associated with beach cleaning for the individuals themselves, specifically looking at well-being and marine awareness (see Figure 6.1), as well as intentions to perform other pro-environmental behaviours. Two studies are reported that examine current volunteers' experiences of taking part in beach cleans (Study 6) and how they compare with other coastal activities in a controlled experimental design (Study 7).

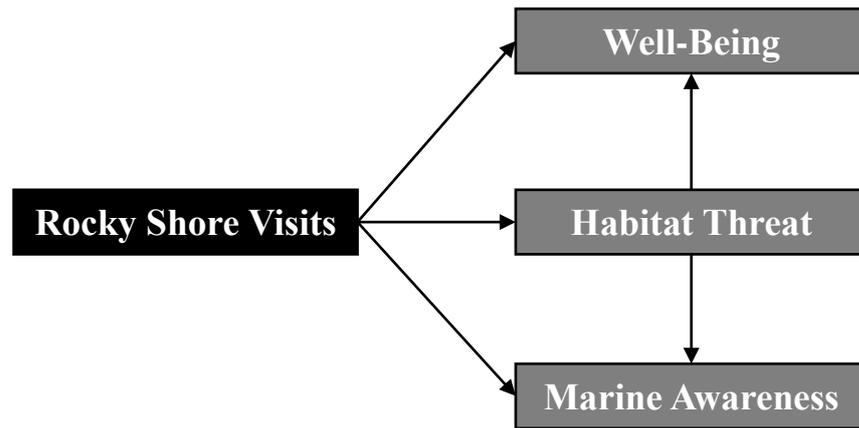


Figure 6.1. The elements of the research model Studies 6 and 7 examine.

6.1.1. Literature Review

As an environment, the coast has been found to provide its visitors a range of psychological benefits, such as well-being and marine awareness effects (as outlined in Chapter 2). For well-being, these environments often fulfil ART's (Kaplan, 1995) restorative properties, namely that environments are perceived to be beneficial if they give a sense of being away, facilitate fascination, are rich in extent and are compatible with a person's intention. Consequently, several studies have found that coastal environments are often rated highly according to these restorative properties (Hipp & Ogunseitan, 2011; White et al., 2010; White, Cracknell et al., 2013). In addition to these perceived restorative properties, experiencing the coast (and rocky shores specifically) have been found to improve hedonic well-being as well as seen to be beneficial for eudaimonic well-being (e.g. Ashbullby et al., 2013; White, Pahl et al., 2013; Study 3). Furthermore, experiencing this natural environment can also provide other benefits. Illustrated in Studies 1 and 2, it is believed that a recreational visit to the shore can increase people's awareness about the environment and the stressors facing it, which was then demonstrated when current visitors in Study 3 reported greater subjective marine awareness after visiting a shoreline.

Unfortunately, whilst receiving these benefits, visitors can simultaneously harm the environment. Studies 1 and 2 examined this specifically. For example, it was shown that rock pooling was seen to have positive impacts on the visitors' well-being but, if conducted in an unsustainable manner such as not returning organisms and boulders to

where they were found, could have detrimental impacts on the environment. The most detrimental behaviour noted was leaving rubbish. The largest proportion of litter found on the coast is sourced from the public, rubbish that has been left on the beach or carried there by winds and rivers (MCS, 2012a). This litter can have serious effects on the environment and its habitants, such as being mistaken as food, entangling marine animals and causing physical damage to the environment (Hall, 2000; Kershaw et al., 2011). Recent findings have also shown that it is not only harmful to the environment: Seen as a common form of visual pollution, it produces both a scenic and sanitary problem, potentially harming visitors' physical and psychological well-being (Santos, Friedrich, Wallner-Kersanach, & Fillmann, 2005; Tudor & Williams, 2008). Using a laboratory design that asked participants to imagine visiting a range of scenes, the preceding chapter explicitly examined the psychological consequences of litter, finding that the presence of litter (especially public-litter) diminished the well-being benefits clean rocky shores typically provide (as measured by negative ratings of preference, mood and restoration likelihood). One approach that has been taken to address this pressing environmental issue comes in the form of organised beach cleans.

Beach cleaning campaigns are arranged around the world, involving individuals volunteering their time and effort to help collect and dispose of the rubbish found. As an activity protecting the marine environment through careful management, beach cleans can be classed as a marine stewardship activity (Steg et al., 2013). Beach cleans are sometimes undertaken with the sole aim of improving the condition of the beach (reducing and disposing of the litter found). Some programmes are furthermore part of a wider initiative where data on litter is systematically recorded and passed on. These can be defined as *citizen science* approaches (Measham & Barnett, 2008). Within the UK, two leading organisations, Marine Conservation Society (MCS) and Keep Britain Tidy (KBT), run beach cleaning initiatives (Beachwatch & BeachCare, respectively) where they support individuals, groups and communities to do both: Collect and monitor marine litter found on the UK coastline. For instance, during a national survey involving 3,366 volunteers, over 180,000 items of rubbish were found on the UK coastline within one weekend (MCS, 2012a). The data collected from these beach cleaning events can be used to develop further scientific understanding about marine litter, for instance the material

and source of the items and the trends over time. Using citizens to gather this information has also been found to be a reliable and cost-effective approach (Hidalgo-Ruz & Thiel, 2013). Consequently, individuals engaging in these activities are benefiting the environment and scientific research; however, the consequences for the participating individuals are less well understood.

The impacts of beach cleaning on individuals are considerably under-researched. Consequently, it is necessary to infer impacts from related literature, such as literature examining other environmental stewardship activities and volunteering in general. Within these broader fields, findings indicate that volunteers in general experience greater well-being benefits, such as heightened life satisfaction and greater levels of positive emotion compared to those who do not volunteer (Borgonovi, 2008; Meier & Stutzer, 2008; Piliavin & Siegl, 2007; Thoits & Hewitt, 2001). When examining volunteers of a marine monitoring programme, which involved gathering data about marine biota in Australia, volunteers reported experiencing both hedonic and eudaimonic well-being benefits. For instance, volunteers typically noted that they enjoyed the work, felt emotionally good, calm and peaceful, and found that it gave them meaning (Koss & Kingsley, 2010). In addition, studies examining volunteering in general have also found that these activities correlate more strongly with eudaimonic well-being (Sons & Wilson, 2012). In relation to a broader range of activities, volunteering has also been seen to be the most meaningful and rewarding activity (e.g. compared to sex, socialising and time with children; White & Dolan, 2009). When exploring people's motivations to volunteer, the wish to do something meaningful is a popular reason (Grese, Kaplan, Ryan, & Buxton, 2000; Ryan et al., 2001). Thus, the literature examining the relationship between well-being and environmental stewardship activities and volunteering in general indicates a positive correlation, especially for eudaimonic well-being.

As well as potentially having well-being benefits, beach cleans may also increase individuals' awareness about the environmental issue (Bravo et al., 2009; Grese et al., 2000; Kordella, Geraga, Papatheodorou, Fakiris, & Mitropoulou, 2013; Ryan et al., 2001). The surveys that explore individuals' motives for engaging in stewardship programmes, or volunteering in general, commonly find that people wish to learn more, for instance regarding skills, the environment or about themselves (Evans et al., 2005;

Grese et al., 2000; Ryan et al., 2001). Many of the beach cleaning organisations have the goal or assume that volunteers will leave such events with greater public awareness about this marine issue (Bravo et al., 2009; Kordella et al., 2013). Theoretically, this is a plausible assumption as learning about a topic in the appropriate context has been found to be more effective than learning in a more abstract environment such as a classroom, however few explicitly measure this (Duerden & Witt, 2010). Evans and colleagues (2005) did briefly examine this in volunteers of a bird recording programme. They found that volunteers reported an increased knowledge regarding bird biology and overall environmental awareness after engaging in the programme. In this and other studies examining environmental awareness, measures are primarily subjective, involving individuals judging their own levels of knowledge (Ocean Project, 2011; Steel, Lovrich et al., 2005; Steel, Smith et al., 2005; Studies 1, 2, & 3). To the author's knowledge, there has been no research that examines the impact environmental stewardship activities can have on objective marine awareness (actual knowledge and understanding of the marine environment), thus this still needs to be studied.

The activity in itself is a pro-environmental behaviour; however, as well as aiming to increase volunteers' awareness, it is also hoped that engaging in beach cleans and similar environmental stewardship activities would encourage more pro-environmental behaviours (Cunningham & Snowden, 2006; Hidalgo-Ruz & Thiel, 2013; Ryan et al., 2001; Unepetty, Evans, & Suyoso, 1998). This can involve generalising the activity into people's everyday routines. For instance, individuals involved in ecological stewardship programmes that restored terrestrial environments, were found to protect and encourage native wildlife in their own gardens outside of the programme (Ryan et al., 2001). Relating to beach cleans specifically, one study monitored volunteers' behaviour after a beach cleaning event in Indonesia, and found that volunteers continued to pick up rubbish and not litter themselves a couple of months later (Unepetty et al., 1998). Self-report surveys have also found that current volunteers often intend to volunteer again in the future (Cunningham & Snowden, 2006; Hidalgo-Ruz & Thiel, 2013). As well as encouraging pro-environmental behaviours directly related to the environmental stewardship activity, other more generic pro-environmental acts can also be encouraged, such as more sustainable energy use or food consumption (e.g. Thøgersen & Ölander,

2003). This, therefore, illustrates a potential positive spillover effect, which is an indirect side effect of an intervention, behaviour or process (Thøgersen & Ölander, 2003). Thus, participating in beach cleans may result in other similar and transferable pro-environmental behaviours.

As briefly reviewed, beach cleans may be seen to offer psychological benefits to the individuals in terms of well-being, marine awareness and pro-environmental behaviour. However, the methods adopted to examine these relationships heavily depend on correlational approaches and rarely examine beach cleaning specifically. For instance, these studies commonly collect their measures outside of the activity context and correlate with a dichotomous variable (whether they have volunteered in the past year or not) or the number of hours volunteered (Borgonovi, 2008; Grese et al., 2000; Koss & Kingsley, 2010; Meier & Stutzer, 2008; Piliavin & Siegl, 2007; Ryan et al., 2001; Son & Wilson, 2012; Thoits & Hewitt, 2001). Consequently, the direct impacts of engaging in these stewardship activities are not explicitly examined. For instance, a technique used in the restoration literature where variables are measured immediately before and after engaging in a specific activity (typically walking, e.g. Berman et al., 2008; Johansson et al., 2011; Hartig et al., 1991) could be adopted to be able to deduce a more causal relationship.

There are additional methodological weaknesses. For instance, as partially found in Studies 3, 4 and 5, connectedness to nature and visit characteristics could influence the well-being effects. Consequently, it is necessary to control for these aspects to be able to examine the relationship between beach cleans and the impacts more directly. To be able to infer unique benefits to beach cleans, it is also necessary to compare beach cleans with other activities. Different activities can elicit different results, for instance wildlife watching was seen to be more strongly associated with pro-environmental acts compared to other activities such as hiking, camping and fishing in a study using self-report data (Teisl & O'Brien, 2003). Within coastal environments specifically, Studies 1 and 2 did find that activities were seen to differ in their well-being effects, however Study 3 and White, Pahl and colleagues (2013) indicated that the coastal environment elicits the same positive impacts, regardless of the activities undertaken. Consequently, beach cleans may be found to be beneficial simply because it involves spending time in an environment

known to be restorative rather than because of the activity itself (Ashbullby et al., 2013; Hipp & Ogunseitan, 2011; White et al., 2010; White, Pahl et al., 2013). For instance, simply viewing or experiencing a restorative natural environment in general has been related to higher pro-environmental behaviours independent from engaging in a specific activity (Hartig, Kaiser, & Bowler, 2001; Hartig, Kaiser, & Strumse, 2007). To further explore this relationship, it would be appropriate to compare beach cleans with other coastal activities.

As well as understanding its unique benefits, it would also be useful to examine the longitudinal impacts of beach cleans on the volunteers. When examining the behavioural impacts of beach cleans, Unepetty and colleagues (1998) did examine the benefits over 6 months. They found that within the first three months, volunteers continued to act sustainably by not littering and by picking up rubbish; however, six months later their behaviours returned to a similar level to before the beach cleaning events. Unlike Unepetty and colleagues (1998); however, the majority of the literature examining beach cleans, volunteering in general and the broader restoration literature often overlooks whether the impacts have longer lasting effects (e.g. Borgonovi, 2008; Grese et al., 2000; Koss & Kingsley, 2010; Meier & Stutzer, 2008; Piliavin & Siegl, 2007; Ryan et al., 2001; Son & Wilson, 2012; Thoits & Hewitt, 2001). Consequently, more longitudinal research is required.

6.1.2. Present Studies

In light of this literature, two studies are reported that examine the benefits of beach cleaning more directly and in comparison to other activities in this environment. The first study (Study 6) examined current beach cleaning volunteers' experiences by having them complete surveys immediately before and after a pre-organised beach clean. By using individuals who had already committed to this marine stewardship activity, this sample was ecologically valid but also more vulnerable to selection bias, preference and expectation effects, as they had freely chosen to visit that environment and engage in that activity. Using a naïve sample of students who were only informed that they would be participating in an unspecified coastal activity and were randomly assigned to one of three activities, Study 7 attempted to reduce these initial biases and effects, and monitored

well-being, marine awareness and behavioural intention immediately before and after an activity, and again a week later. To compare beach cleans in relation to other activities, participants in Study 7 were randomly allocated to one of three carefully selected activities: Beach cleaning, rock pooling or coastal walking. Rock pooling, as highlighted in Study 3, is a popular activity on rocky shores. Within Study 7, this particular activity was designed to be reasonably sustainable (following rock pooling ethics addressing an issue highlighted in Studies 1 & 2) and involved both an exploration and a citizen science element to it, which have been shown to have psychological benefits in both the recreational and stewardship literature (Ashbullby et al., 2013; Koss & Kingsley, 2010; Studies 1, 2 & 3). As a comparison activity, walking was selected as it is the most popular activity to be undertaken in natural environments in England (Natural England, 2010) and in recreation more generally (Addison et al., 2008; Porter & Wescott, 2004; Smallwood et al., 2012; Study 3), as well as being found to be associated with well-being benefits within the psychological literature (Berman et al., 2008; Hartig et al., 1991; Johansson et al., 2011; White, Pahl et al., 2013). Using these two different approaches, this chapter focuses on addressing three main research questions: First, is participating in beach cleans beneficial to the individuals as suggested by the volunteering literature; specifically in terms of a) well-being (both hedonic and eudaimonic); b) marine awareness (both subjective and objective) and c) pro-environmental intentions? Second, how do beach cleans compare to other coastal activities in terms of these impacts? And third, do any effects remain one week after the event? Finally, to complement and extend the earlier analyses from Study 3 where the key factors were explored, the regression analysis is replicated to answer the question: What factors have the greatest predictive value for overall satisfaction?

6.2 Study 6: Current Volunteers' Experiences

Using a pre-post design, volunteers participating in a pre-arranged beach cleaning event were surveyed. This study aimed to examine the impacts this specific activity had on well-being, marine awareness and behavioural intentions.

6.2.1. Method

6.2.1.1. Participants.

Current beach cleaning volunteers from KBT's BeachCare project and the MCS' Beachwatch programme were recruited. The inclusion criteria were for participants to be members of public over 18 years of age who have volunteered their time to complete a beach clean. Over the course of twelve different beach cleans, approximately 60% of volunteers ($n = 87$; 36 males; 49 females; 2 non-reported) completed the surveys. Some volunteers did not participate in the survey due to being too young, arriving late, or unwilling to take part. Thirty percent of the sample fell within the 18 to 24 age category and 31% had a university qualification. Many of the participants had never visited that particular site (43%) and had also never done a beach clean before (62%).

6.2.1.2. Design.

A pre-post design was used, where a survey was completed before and after a beach cleaning event (see Figure 6.2).

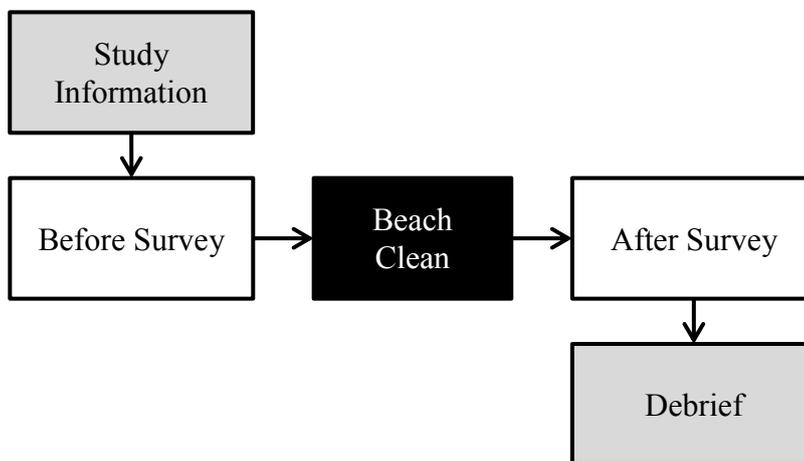


Figure 6.2. A schematic diagram of the methodological design, with participants completing surveys before and after the beach cleaning activity.

6.2.1.3. The activity.

The beach cleaning events were run by independent organisations. This involved the organiser (independent to this research) explaining the procedure, followed by distributing the equipment to the volunteers (e.g. bin bags, gloves and pickers) then a

session recording and collecting the litter found at the site. On average, these events lasted just under two and a half hours (ranging from 1 to 5 hours), with an average group size of 11 ($SD = 5.65$, range = 5-23).

6.2.1.4. *Materials.*

A concise survey pack was used consisting of a freepost pre-addressed envelope with the relevant materials inside. This included a brief explaining the procedures of the questionnaire, which was attached to a before-survey. The before-survey examined well-being, marine awareness, beach cleaning history (e.g. frequency of beach cleans), and demographics (e.g. gender and age). Within the pack, the after-survey repeated the well-being and marine awareness items along with additional behavioural intentions (see Appendix J); as well as a detailed debrief for participants to keep. The specific items are discussed below:

6.2.1.4.1. *Well-being.*

To monitor change in hedonic well-being, the statistically more reliable six-item positive and negative affect scale from Study 3 was used on a scale from *not at all* (1) to *extremely* (7). Both positive and negative affect scales were seen to be reliable (Cronbach's $\alpha = .65$ & $.66$ respectively). As before, affect-balance was then calculated by subtracting negative affect from positive affect, resulting in scores ranging from -6 to 6. Similar to Study 3, to examine participants' overall evaluation of the activity, a single-item satisfaction measure was included in the after-survey asking *all things considered, how satisfied are you with today's beach clean* ranging from *very unsatisfied* (1) to *very satisfied* (10). To monitor meaningfulness (eudaimonic well-being), participants rated their level of agreement to whether the beach clean was *worthwhile and meaningful to me* and *in line with my values* (similar to that in Study 3) on a 7 point rating scale from *not at all* (1) to *extremely* (7; Cronbach's $\alpha = .84$).

6.2.1.4.2. *Marine awareness.*

Awareness about marine litter specifically was measured by two forms of questions in both surveys: 1) self-perceived level of marine litter awareness (subjective

awareness), and 2) objective marine litter awareness. Similar to the previous studies (Studies 1, 2 & 3), subjective awareness involved participants rating *how informed* [they] *feel about beach litter?* on a scale from *not at all informed* (1) to *high expertise* (5; similar to that used in Steel, Lovrich et al., 2005; Steel, Smith et al., 2005).

For objective marine awareness, two novel measures were used in this study. Similar to other open-response marine awareness measures (e.g. Falk & Adelman, 2003; Settar & Turner, 2010), participants were first required to list the *three most common litter items found on the general UK coast*, which were later compared to the three correct answers of *plastic pieces, plastic caps or lids, and polystyrene pieces* (MCS, 2011, see Appendix I for the pilot findings). Consequently, correct scores ranged from zero to three. Second, participants were asked to rate seven different sources of marine litter according to *how much litter found annually on the UK coastline is from each source?* Responses ranged from *very little* (1) to *lots* (7) and were later converted to ranks. These converted ranks were then compared to scientifically correct ranks¹¹ (see Table 6.1 for the correct answers). Thus scores ranged from zero to seven, for instance, a score of one could be accomplished if a participant gave public-litter the highest value (thus converted to the top rank) but then confused the order of the remaining six sources. The two scores were totalled to produce an overall objective marine awareness score out of ten (see Appendix K for the scores for each individual item).

Table 6.1. *The abundance of litter found on the UK coast according to source (MCS, 2011).*

	Percentage	Rank
Public	39.9	1
Non-sourced	38.3	2
Fishing	11.4	3
Sewage Related Debris	5.4	4
Shipping	3.6	5
Fly-tipped	1.2	6
Medical	0.2	7

¹¹ When originally designing this measure, respondents were asked to assign a percentage or rank for each source; however these two formats were found to be too complicated for respondents, thus a simpler rating scale which was then converted to ranks was adopted.

6.2.1.4.3. *Behavioural intention.*

Behavioural intentions regarding litter were examined using five items, such as to *volunteer to do another organised beach clean within the next year* and *use more biodegradable products*. Responses ranged from *not at all* (1) to *definitely* (5). This five-item scale resulted in a moderately reliable measure (Cronbach's $\alpha = .72$).

6.2.1.5. *Procedure.*

At the beginning of the beach clean, volunteers were invited to complete the survey before and after the event. A survey pack was then given to those who were interested, whereby the brief explaining the nature of the study was first read. Participants were then instructed to complete the first survey before the start of the beach clean. Once completed, participants returned the survey into the unsealed envelope and continued with the event. When concluding the beach clean, participants were reminded to complete the after-survey. Participants were then instructed to keep and read the debrief, place the two surveys in the envelope, seal and send in the post.

6.2.1.6. *Analysis.*

In order to calculate objective marine awareness, the open response aspect of the common item question first needed to be coded. Responses were coded according to content analysis (Millward, 1995). As the aim of this question was to assess the accuracy of specific responses, the coding criteria were centred around scientific marine litter reports, specifically the MCS's Beachwatch report (MCS, 2011). All analysis and coding was completed by the author, with a second independent coder to check inter-rater reliability. Agreement between coders was very high, Cohen's $\kappa = .84$ (Landis & Koch, 1977). The number of correct responses was then calculated for this and the source question for each participant.

Following the screening and preliminary checks as outlined in Section 3.2.1.4, there appeared to be no statistical differences between the beach cleans that involved the KBT ($n = 78$) and MCS ($n = 9$) procedures (all $ps > .27$), therefore these can be analysed jointly. There was the occasional demographic effect: A main effect for education on the objective marine awareness measure was found, $\chi^2(4, n = 81) = 21.66, p < .001$, where

participants educated to a postgraduate level reported more correct items than other participants; and age was found to influence meaning and intentions, $\chi^2(5, n = 83) = 11.24, p = .05$; $\chi^2(5, n = 84) = 17.99, p = .003$ respectively, with the youngest group (18-25 year olds) giving lower ratings for meaning and intention. However, education, gender and age, overall, were seen not to influence the overall conclusions, thus these will not be reported further. For the main analysis, descriptives are reported, with changes over time examined using within-subject *t*-tests.

6.2.2. Results

6.2.2.1. Well-being.

Overall, participants left the event feeling satisfied ($M = 8.28, SD = 1.62$) and found it to be a moderately meaningful experience ($M = 5.01, SD = 1.17$). Participants reported feeling happy before the beach cleaning event had begun ($M = 3.73, SD = 1.49$), and were found to leave similarly happy ($M = 3.75, SD = 1.61$). Consequently, there was no statistical change in mood over time, $t(68) = .02, p = .98$.

6.2.2.2. Marine awareness.

Regarding subjective marine awareness, participants felt that they were moderately informed ($M = 2.70, SD = 0.95$) before they took part in the beach clean. This self-perception was found to significantly increase after the beach clean ($M = 3.41, SD = 0.70$), $t(76) = 7.65, p < .001, d = .78$ (large effect). In contrast, participants were poor at the objective marine awareness tasks. Out of a possible score of 10, the average score before the beach clean was 1.53 ($SD = 1.08$). This increased slightly to 1.61 ($SD = 1.05$) but was not statistically significant, $t(63) = 0.41, p = .68$. For instance, 16% of participants were able to correctly name at least one item in the top 3 of the most common litter items found on the coast before the beach clean, which increased to 40% after the beach clean.

6.2.2.3. Behavioural intention.

Unlike the mood and marine awareness measures, behavioural intentions were only recorded in the after-survey. At this later point, participants reported having high

behavioural intentions regarding pro-environmental waste-related behaviours ($M = 4.20$, $SD = 0.60$).

6.2.2.4. Additional findings.

In addition to these overall effects, previous experience of beach cleaning was found to influence some of the main variables. When comparing participants who had not volunteered before that event ($n = 54$) with those who had ($n = 33$), previous experience was not found to influence satisfaction, meaningfulness, objective marine awareness or behavioural intention (all $ps > .13$), but did influence subjective marine awareness and mood. A mixed 2 (time: before; after) x 2 (frequency: regular, novice) ANOVA found that regular volunteers saw themselves as more aware than those who were novices, $F(1, 75) = 12.87$, $p = .001$, partial $\eta^2 = .15$ (small effect). An interaction also arose, $F(1, 75) = 21.25$, $p < .001$, partial $\eta^2 = .22$ (small-medium effect), whereby novices had poorer subjective marine awareness before the beach clean compared to the regular volunteers ($p < .001$, see Table 6.2), but increased considerably to match the regular volunteers' levels by the end of the event ($p = .39$). There was also an interaction over time between novices and regular volunteers on mood, $F(1, 67) = 4.46$, $p = .04$, partial $\eta^2 = .06$ (small effect), whereby novices arrived marginally happier than the regular beach cleaners ($p = .06$), but both groups left the beach clean similarly happy ($p = .85$; Table 6.2).

Table 6.2. *The means (and standard deviations) for subjective marine awareness (MA) and mood for novice volunteers ($n = 54$) and regular volunteers ($n = 33$) in Study 6.*

	Subjective MA		Mood	
	Before	After	Before	After
Novices	2.35 (0.83)	3.36 (0.66)	3.97 (1.38)	3.72 (1.70)
Regulars	3.31 (0.84)	3.50 (0.76)	3.27 (1.62)	3.80 (1.46)

Note. Subjective MA was rated from *not at all informed* (1) to *high expertise* (5); and the affect-balance measure of mood ranged from -6 (very negative) to +6 (very positive).

6.2.3. Discussion

Surveying current volunteers before and after a pre-organised beach clean, this study found that volunteers, overall, found the experience to be meaningful and were satisfied with the use of their time. Participants were happy when they started the event, and remained happy. In contrast, subjective marine awareness was shown to increase after a beach clean, which was especially evident for the novice volunteers. However, the objective marine awareness measure did not reflect this. In addition to positive ratings of well-being and increased subjective marine awareness, intention to do similar pro-environmental acts was also high within the sample. Thus, these findings imply that this particular pro-environmental activity is advantageous to the volunteer as well.

The use of current volunteers during existing beach cleaning events meant that this study was broadly representative of current beach cleaning opportunities in the UK, thus ecologically valid. However, as a result, this field design was vulnerable to some methodological limitations, which Study 7 addresses. First, both specific environment and beach cleaning protocol were not controlled, as two different procedures and twelve events on different coastlines were included, which may have had subtle underlying influences on the results. Second, participants were individuals who had already committed to a pre-organised beach clean. As a result, this study had little control over the sample sizes for each event, where they came from and their motivations for volunteering (for instance, some participants were introduced to the event through work or college initiatives thus had potentially different motivations to traditional volunteers). Similar to other studies, including Study 3 and others from the broader literature (e.g. Hipp & Ogunseitan, 2011; Packer & Bond, 2010; Scopelliti et al., 2012; Tarrant, 1996; White, Pahl et al., 2013), biases such as selection biases, expectation effects, and preference effects may have influenced the results as individuals had voluntarily engaged in this activity. Third, by only collecting data before and after beach cleans, it was not possible to conclude how these findings relate to alternative coastal activities and whether these effects are long lasting. Finally, the newly constructed objective marine awareness measure seemed problematic. This measure was very specific, requiring specialised knowledge about marine litter, which appeared too difficult for participants as indicated by the low scores. Consequently, Study 7 standardised the site and used a more

homogenous sample that were experimentally blind to the activity they would engage in. Participants engaged in one of three activities (beach cleaning, rock pooling or coastal walking) and completed additional follow-up measures one week later. The objective marine awareness was also further developed to examine a slightly broader level of awareness. Therefore, by adopting an experimental design, Study 7 examined the impacts of beach cleaning in further detail.

6.3 Study 7: Comparing Beach Cleans to Other Activities

6.3.1. Method

6.3.1.1. Site.

This experimental field study took place at Mount Batten Bay, a rocky shore in the south of Devon, UK, less than 4.83 km (3 miles) away from Plymouth city centre (Figure 6.3). The upper shore is predominantly sand and shingle, with the intertidal area consisting of solid rock. During low tide, the beach is approximately 170 metres wide. It is accessible to visitors, with easy access from roads and public transport, has a coastal path run parallel to the shoreline and has facilities such as free parking, toilets and food facilities nearby.

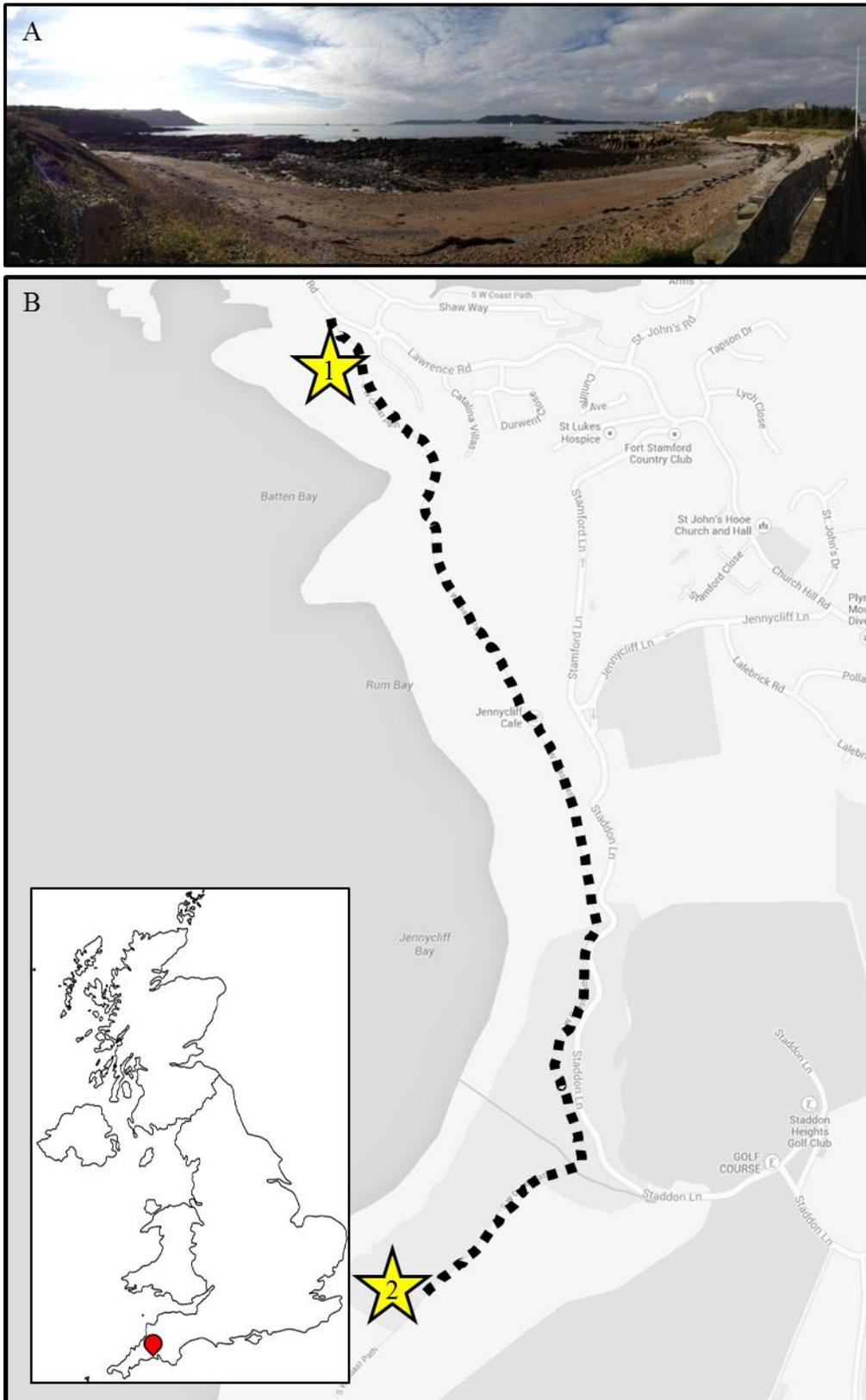


Figure 6.3. The site used for Study 7, located in the south west of England. All activities began at the entrance of the beach (point 1 in B) as shown in A, with the beach clean and rock pool groups continuing down to the shore. The walking group, in contrast, walked along the coastal path, as shown with the dotted line in B (background map sourced from Google Maps, 2013; photograph used with permission of the author, all rights reserved).

6.3.1.2. Participants.

Participants were recruited using the Plymouth University Psychology undergraduate points system, similar to Study 4. The recruitment criteria were that participants needed to be physically fit and mobile, have normal or corrected vision and suitable walking and weather appropriate clothing. Ninety two participants were recruited (22 male; 69 female, 1 non-reported), but due to withdrawals (one participant for ill-health and another because of disliking the beach clean activity), the final sample consisted of 90 participants (21 male; 68 female, 1 non-reported) with an average age of 22 years ($SD = 6.18$). The majority of participants reported spending their leisure time typically with friends; usually inside (e.g. relaxing, watching TV or doing exercise), outside in nature (e.g. walking or relaxing) or shopping in town. Many (46 %) participants reported visiting this particular type of coastline (rocky shores) once or twice a year, with the majority of participants walking (82%), relaxing (64%) and socialising (63%) during those visits. The sample was evenly split between the three activity groups (see Table 6.3 for more information).

Table 6.3. Demographic information for each activity in Study 7 ($n = 90$).

	Beach Clean ($n = 30$)	Rock Pool ($n = 30$)	Coastal Walking ($n = 30$)
Gender	8 male, 22 female	5 male, 24 female, 1 non-reported	8 male, 22 female
Age	21.30 ($SD = 3.54$)	20.38 ($SD = 3.36$)	23.23 ($SD = 9.38$)
Frequency of rocky shore visits	47% = once or twice a year	40% = once or twice a year	50% = once or twice a year
Most common activities performed when on shore	Walking Relaxing Socialising	Walking Socialising Relaxing	Walking Relaxing Socialising / Eating
Experience in these activities*	0% Beach cleaning 57% Rock pooling 87% Coastal walking	3% Beach cleaning 40% Rock pooling 87% Coastal walking	0% Beach cleaning 23% Rock pooling 73% Coastal walking
Baseline connectedness	3.32 ($SD = 0.78$)	3.43 ($SD = 0.80$)	3.10 ($SD = 0.75$)

Note. * percentage of participants who claimed to do those activities; baseline connectedness varied from 1 = *completely disagree* to 5 = *completely agree*.

6.3.1.3. Design.

This study used a longitudinal approach, whereby measures were collected before the activity, again immediately afterwards and once again one week later (see the

schematic diagram in Figure 6.4). Activities were performed as small groups (ranging from 2 to 12); with the surveys completed individually. To reduce the selection and expectation effects highlighted in Studies 3 and 6, activities were pre-assigned to specific days, which the participants selected unaware of the condition until after the baseline measures were collected.

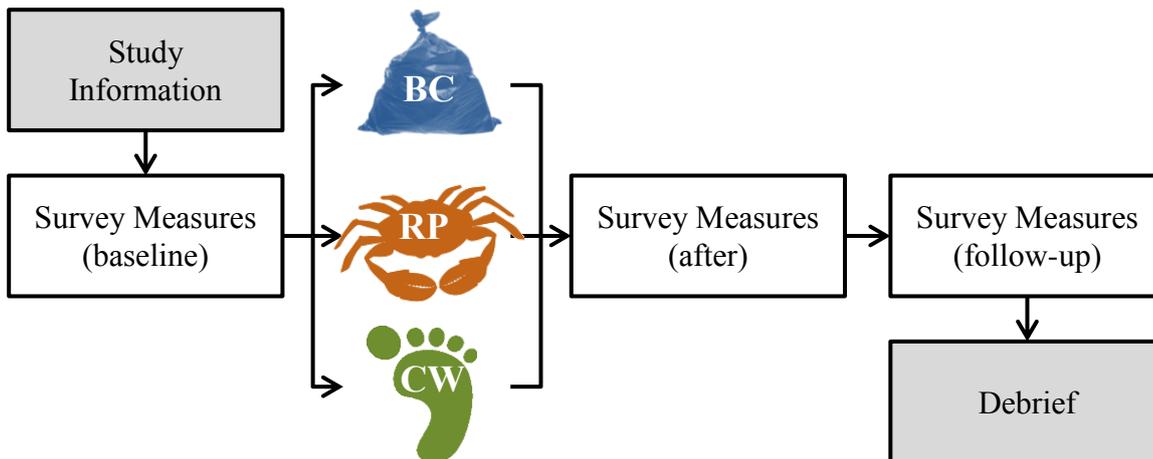


Figure 6.4. A schematic diagram of the methodological design, with participants completing measures before, immediately after and a week after engaging in one of three activities: Beach cleaning (BC), rock pooling (RP) or coastal walking (CW).

As mentioned previously in Chapter 1, rocky shores vary considerably in state, which some qualitative responses in Study 1 noted it may influence visitors' experiences. So that the visible intertidal area and daylight levels were standardised, data collection occurred between 10:00 and 13:00 on days when low tide fell within these times (similar to that in Study 3). In total, there were 10 days of data collection between September and November 2012, which were primarily dry days under clement weather conditions.

6.3.1.4. The activities.

There were three planned activities: Beach cleaning, rock pooling and coastal walking. These activities all lasted approximately 90 minutes in total. The individual activities are described below.

6.3.1.4.1. Beach cleaning.

This activity replicated a pre-existing beach cleaning programme organised by the MCS, similar to that of previous study. Permission and resources were given by the MCS (L. Davis, personal communication, September 11, 2012). An independent marine biologist ran these sessions in an attempt to keep the psychological surveys independent from the activity. Each session began with a standardised briefing, where the marine biologist introduced the citizen science programme by describing the programme, its relevance, where the data goes and how it is used to tackle marine litter. Participants were then briefed on how to complete the recording survey by the marine biologist (see Figure 6.5). The equipment was distributed amongst the participants, who were encouraged to work in pairs or threes. Following this briefing session that lasted roughly 15 minutes, participants were then free to identify, record and dispose of each piece of marine litter they found, with the help from the marine biologist. After an hour, the participants were gathered to tally up the results and discuss what they found as a group. Data collected were sent to the MCS to contribute to their national dataset.

[Figure has been removed due to Copyright restrictions]

Figure 6.5. The materials (including bin bags, a sharps box, gloves and a litter picker), and form used for the beach clean citizen science programme.

6.3.1.4.2. Rock pooling.

Rock pooling was led by the marine biologist and involved a briefing and debriefing session either side of the activity involving a free-style rock pooling session and a citizen science session. As with the activity above, the citizen science component of this activity followed the protocol of a current marine monitoring programme, namely the Shore Thing survey. Shore Thing is an established nationwide survey and involves a timed species search where abundance levels for 32 specific intertidal species are recorded within a 20 minute period. These data are used to monitor the nationwide impact of rising sea temperature on coastal species (Marine Biological Association, 2012).

For the overall rock pooling activity, the marine biologist first explained the importance of rocky shores and offered some facts regarding the organisms that live in that habitat. The citizen science aspect was then explained to the participants, where the Shore Thing programme was described, participants were talked through the procedures and explained the importance of the data. After explaining how to rock pool sustainably (e.g. returning boulders and organisms how and where they were found), they were free to explore the rocky shore in small groups (pairs or threes) for 30 minutes, with the use of materials such as species identification indices (see Figure 6.6). During this time, the marine biologist helped to identify species, offered information regarding different species and made sure that everyone was rock pooling in a sustainable manner. Afterwards, participants completed the Shore Thing survey. Over the 20 minute period, each participant was allocated a small number of species to search for in a particular environment (such as rock pools or open rock), with the aid of the marine biologist and descriptive cards stating identifiable characteristics of each species (Figure 6.6). At the end of this timed search, participants were required to report back to the marine biologist the overall level of abundance for each of their allocated species. To conclude the activity, the marine biologist debriefed everyone, summarising the most common species found that day. The data collected were then sent to the national database for further scientific analysis.

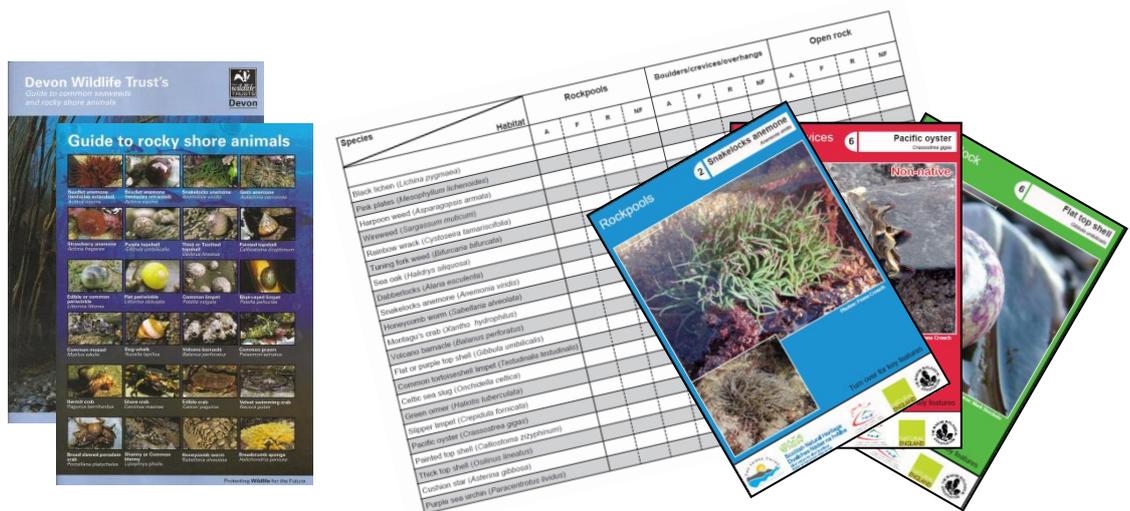


Figure 6.6. Identification materials, form and descriptive cards used for rock pooling and Shore Thing citizen science programme (permission to reproduce these figures has been granted by Devon Wildlife Trust and the Marine Biological Association).

6.3.1.4.3. Coastal walking.

This activity was different to the former two, as it did not have a citizen science aspect and did not require such a standardised briefing, debriefing or the expertise of a qualified marine biologist. Consequently, this activity was led by one of the two data collectors, who explained to the group that they would be walking along the coastal path. Participants were fore-warned that the path had reasonably steep gradients, potentially slippery mud terrain, some steps and were consequently advised to walk at a comfortable pace, taking breaks where needed. Walking in small groups, participants walked 35 minutes along the coastal path (see Figure 6.3), having occasional short breaks, before walking back; taking in total, just over one hour. Typically, walks involved four short breaks and covered just over 3.5 km (2.17 miles).

6.3.1.5. Materials.

Standard materials for the activities involved first aid equipment, a mobile phone, participant information and antibacterial wipes (especially for the beach clean and rock pooling activities). For the beach cleaning activity, bin bags, gloves, pickers, a secure container for any sharp or medical waste, clipboards, pencils, and recording forms were provided (Figure 6.5; Appendix J). For the rock pooling sessions, the only additional

materials were identification indexes provided by the Devon Wildlife Trust, buckets for participants to use to examine animals in more detail, a stop watch for the timed survey and the 32 species cards and form for the Shore Thing survey (Figure 6.6; Appendix J).

Baseline measures were collected using online and paper surveys examining well-being, marine awareness, behavioural intention, and demographics (including connectedness to nature). The immediately-after paper surveys and the online follow-up survey recorded well-being, marine awareness and behavioural intention again as well as perceived restorativeness. The specific items are described in further detail below and questionnaires can be found in Appendix J.

6.3.1.5.1. Well-being.

The same mood measure as Study 6 was used at baseline and immediately after the activity, and was found to be similarly reliable (Cronbach's $\alpha > .81$ and $> .51$ for the positive and negative scales respectively). The same overall satisfaction and meaningfulness measures were also included immediately after and during the follow-up, with the latter two-item measure found to be reliable (Cronbach's $\alpha > .79$).

In addition to measuring well-being directly, the perceived restorativeness of the environment was also noted. Rather than using the single-item, less reliable measure as used in Studies 4 and 5 in the preceding chapter, the more statistically reliable yet still concise scale from Study 3 was used. Each of the four statements were rated on the same scale from Study 3: From *completely disagree* (1) to *completely agree* (7), and formed a reliable scale (Cronbach's $\alpha = .83$).

6.3.1.5.2. Marine awareness.

Adapting the measures used in Study 6, three forms of marine awareness were used to examine 1) general subjective marine awareness, 2) objective marine awareness regarding marine litter, and 3) objective marine awareness regarding intertidal biodiversity. Subjective awareness involved participants rating their level of awareness according to the same four topics as first described in Study 1 on the same scale as Study 6 (*not at all informed* [1] to *high expertise* [5]). When combined to form an overall scale of subjective marine awareness, this was highly reliable (Cronbach's $\alpha > .82$).

Unlike the measures used in Study 6 that only examined two aspects, to record objective marine awareness regarding marine litter, five multiple choice questions were constructed to assess different aspects of this topic (based on the publically accessible literature on marine litter; MCS, 2011; a similar approach to Falk & Adelman, 2003; Falk et al., 2007; Steel, Lovrich et al., 2005; Steel, Smith et al., 2005). For instance, questions looked at the most common type and source of litter found, the amount found annually and the time it takes for items to biodegrade. These questions were piloted ($n = 19$) and were found to not be too easy or difficult (between 50 and 70% of people answered the questions correctly, see Appendix I). Percentage of correct responses was then calculated to produce an overall correct percentage score for each person at each time point (see Appendix K for individual item responses).

A similar approach was used for objective marine awareness in relation to biodiversity. From a pool of items originally piloted on 14 individuals, this included a multiple choice item regarding the definition of ecology and correctly identifying species as being native to the UK. For this latter aspect, participants were shown nine pictures of intertidal species (Figure 6.7) and had to identify whether those species can be found in the UK waters. All were native to the UK. Species were systematically chosen so that species varied in difficulty (from the pilot sample's responses), colourfulness, and rarity. Similar to above, percentages of correct responses were then calculated for each participant at each time point (see Appendix K for individual item responses).

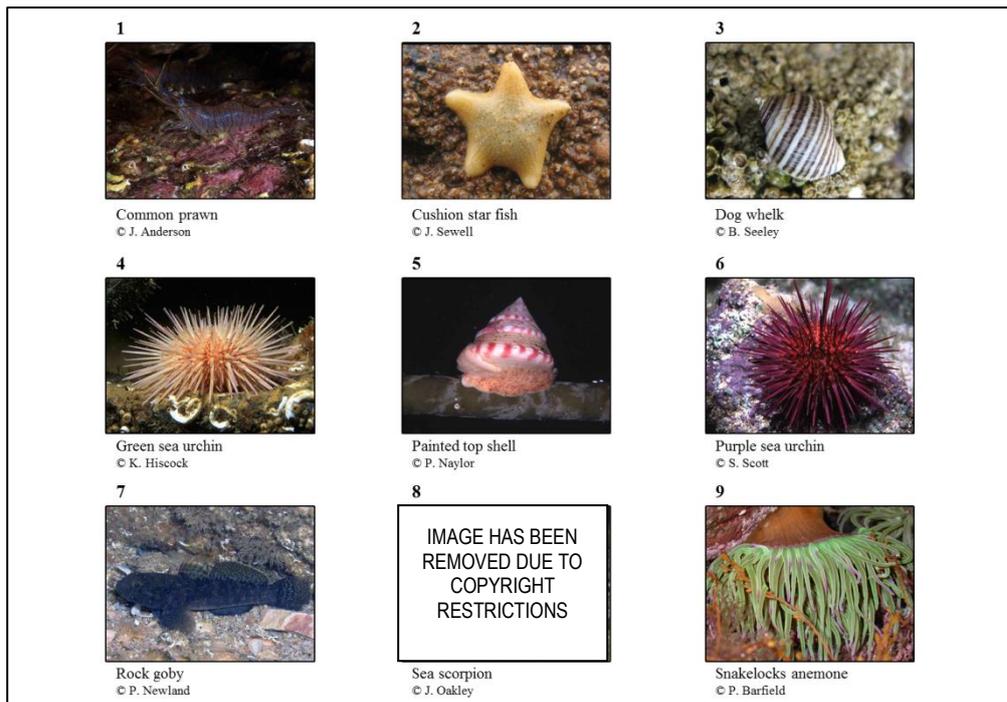


Figure 6.7. The materials used for the intertidal species identification task for the objective marine awareness task on biodiversity (permission to use these images has been granted by the respective owners).

6.3.1.5.3. Behavioural intention.

General pro-environmental behavioural intentions were measured on a scale from *never* (1) to *all of the time* (5). This scale consisted of the same five behavioural items from Study 6 relating to marine litter; three items on respecting biodiversity, such as *when walking in nature, I will take care where I tread*; five items on general pro-environmental behaviours, including *buy high energy-efficient appliances* and *support sustainable policies with petitions and political vote* (based on the more difficult behaviours used in Boomsma, 2013); and a single item on behavioural intent to *walk along my local coastal path*. This scale resulted in a reasonably reliable environmental intention measure (Cronbach's $\alpha > .79$). For more detailed analyses for the activity-specific intentions (e.g. to go rock pooling, volunteer to participate in a beach clean and undergo a coastal walk), see Appendix K.

6.3.1.5.4. *Additional measures.*

As found in the preceding chapter, connectedness to nature may influence the extent a natural experience impacts well-being, consequently, the same items as used in Study 5 were measured on a five-point scale from *completely disagree* to *completely agree*, and together formed an internally consistent scale (Cronbach's $\alpha = .80$).

6.3.1.6. *Procedure.*

Participants were first emailed the online baseline survey two days before the visit to the coast. This included the detailed brief explaining that they will complete surveys either side of a structured trip to the coast lasting around two hours, where they will do a selected coastal activity¹². They then provided a unique identification code so that the different surveys could be appropriately matched. Once completed, they were reminded of the clothing requirements for the field aspect of the study. On the day of the activity, participants met the two data collectors at a central point on the university campus, where additional written consent and health and safety information was collected. As a group, they were then led by one of the data collectors to a water taxi that took them near to the site, where they then walked to the starting point highlighted in Figure 6.3. Once at the site, they completed the well-being baseline measures and were informed which activity they would complete. Participants then completed that day's activity, followed by the immediately-after survey. They were then led back to the water taxi, completing the field stage of the study. Participants were emailed the follow-up survey seven days later.

6.3.1.7. *Analysis.*

After screening the data, preliminary checks were performed. Participant demographics and baseline measures were not different between the three activities (all $ps > .13$). There were no main effects of day of activity, age and gender (all $ps > .06$). In line with Studies 4 and 5's analyses, connectedness to nature was also checked (as a dichotomous variable) and found not to influence the main conclusions. However,

¹² Originally the activity was not specified, but half way through data collection, it arose that there was some confusion regarding the study details, so a line was added to the brief giving examples of the type of activities participants could be asked to perform: (*e.g. walking, beach cleaning and rock pooling*).

participants with higher connectedness did express greater satisfaction, found it more meaningful, were happier, reported having greater subjective marine awareness and had greater intention to perform environmental acts in the future than those with lower connectedness to nature (all $ps < .05$). There was also a marginal interaction between activity and connectedness for subjective marine awareness, $F(2, 83) = 3.17, p = .05$, partial $\eta^2 = .07$ (small effect), where subjective marine awareness varied with connectedness (participants with higher connectedness reported greater awareness than those with low connectedness) for the beach clean and coastal walk groups; whereas subjective marine awareness did not differ between people with high and low connectedness for the rock pooling group. When controlling for connectedness, the conclusions remained the same, thus the following analyses did not control for any of these variables.

To examine both changes over time and differences between activities, mixed ANOVAs were applied, with time (baseline, immediately after, follow-up) as a within-subject variable, and activity (beach clean, rock pooling, coastal walk) as the between-subject variable (following the statistical procedures outlined in Section 3.2.1.4). To explore statistically significant main effects further, Sidak post-hoc tests were used for to explore main effects of time (when sphericity was not violated, and Bonferroni within-subjects post-hoc tests when it was), and, as a conservative test for smaller number of comparisons, Bonferroni post-hoc tests were used to examine main effects of activity. Simple effect analyses were conducted when significant interactions were examined further, involving breaking the interaction down and running tests on each component whilst controlling for familywise error (e.g. three sets of one-way ANOVAs looking at the variable over the three time points for each of the activities).

As well as examining the benefits of these experiences on well-being, marine awareness and pro-environmental behaviour, an additional analysis was conducted. In order to further examine the well-being impacts of visiting the coast, the key predictors of overall satisfaction were explored. The analytical procedure replicates that used in Study 3, where two separate regressions were adopted to explore what best predicts satisfaction immediately after a visit to the coast: First looking at demographic variables, then looking at the conceptual levels along with activity type.

6.3.2. Results

6.3.2.1. Well-being.

As shown in Table 6.4, the visit to the rocky shore, regardless of activity, was rated highly for all measures of well-being. The mood measure was rated positively both before and after the visit, however it did not change over time ($p = .94$). Activities were also similar in their mood ratings ($p = .44$), and there was no interaction between activity and time ($p = .07$).

Table 6.4. *The means (and standard deviations) for mood, satisfaction, meaningfulness and overall perceived restorativeness at different times overall (n = 90) and for each activity (n = 30) in Study 7.*

		Overall (n = 90)	Beach Clean (n = 30)	Rock Pooling (n = 30)	Coastal Walk (n = 30)
Mood	Before	3.28 (1.81)	3.26 (1.77)	3.40 (1.85)	3.18 (1.86)
	After	3.24 (1.90)	2.67 (1.95)	3.24 (1.97)	3.82 (1.64)
Satisfaction	After	7.40 (1.87)	7.20 (1.71)	7.70 (1.86)	7.30 (2.04)
	Follow-up	6.93 (2.08)	6.48 (2.49)	7.30 (1.84)	7.00 (1.84)
Meaningfulness	After	4.79 (1.22)	5.33 (1.14)	4.68 (1.28)	4.37 (1.07)
	Follow-up	4.73 (1.19)	5.09 (1.21)	4.77 (1.13)	4.35 (1.15)
Restorativeness	After	4.63 (1.22)	4.19 (1.35)	4.66 (1.27)	5.03 (0.89)

Note. Mood was calculated via affect-balance, thus ranging from -6 (very negative) to +6 (very positive); Satisfaction was rated from *very unsatisfied* (1) to *very satisfied* (10); Meaningfulness ranged from *not at all* (1) to *extremely* (7); Restorativeness ranged from *completely disagree* (1) to *completely agree* (7).

The overall satisfaction measure was also rated positively after the event; however, participants ratings of satisfaction statistically declined a week later compared to immediately after the visit, $F(1, 86) = 11.30, p = .001$, partial $\eta^2 = .12$ (small effect). Satisfaction ratings were also found not to differ between activities ($p = .45$) or for the interaction between time and activity ($p = .33$).

In contrast, the eudaimonic well-being measure, meaningfulness, did not change a week later ($p = .33$) and there were statistical differences between the three activities, $F(2, 86) = 5.11, p = .008$, partial $\eta^2 = .11$ (small effect). The only statistically significant difference was that beach cleaning was perceived as more meaningful than walking ($p = .006$). The interaction of time and activity for this eudaimonic well-being measure was not statistically significant ($p = .15$).

As well as reporting positive experiences as a result of this visit to the coast (remaining high in positive mood, feeling satisfied with the visit and rating it highly on meaningfulness), participants perceived this environment to have a high restorative value ($M = 4.63$, $SD = 1.22$). Technically, all three activities occurred within the same coastal environment, however each activity explored different areas. For instance, coastal walking covered a broader coastal area, whereas rock pooling and beach cleaning were more focused on specific areas of the intertidal area (lower and upper shore, respectively). Consequently, the environment was rated differently for its restorative qualities between activities, $F(2, 87) = 3.79$, $p = .03$, partial $\eta^2 = .08$ (small effect), with participants engaging in the coastal walk rating the environment the most restorative ($M = 5.03$, $SD = 0.89$) followed by those rock pooling ($M = 4.66$, $SD = 1.27$) then the beach cleaning group ($M = 4.19$, $SD = 1.35$). Post-hoc tests showed that the only statistical difference was between the beach clean and coastal walking groups ($p = .02$).

6.3.2.2. Marine awareness.

At baseline, participants felt they knew the basics regarding marine topics (see Figure 6.8 & Table 6.5). This subjective marine awareness increased after a visit to the coast and remained high one week later, $F(2, 174) = 16.80$, $p < .001$, partial $\eta^2 = .16$ (small effect). Post-hoc analysis found that the only significant differences were that both the immediately after and the follow-up measure were rated more highly than the baseline (all $ps < .001$). There was no significant main effect of activity ($p = .12$); however a statistically significant interaction arose, $F(4, 174) = 2.51$, $p = .04$, partial $\eta^2 = .05$ (small effect). Simple effect analysis found that there was only a main effect of time for beach cleaning, $F(2, 58) = 10.04$, $p < .001$, partial $\eta^2 = .26$ (medium effect), and rock pooling, $F(1.35, 39.26) = 9.31$, $p = .006$, partial $\eta^2 = .24$ (medium effect). Thus, for both beach cleaning and rock pooling, subjective marine awareness significantly increased from baseline to immediately after the activity (all $ps < .04$), and remained at this higher level (all $ps > .58$, see Figure 6.8).

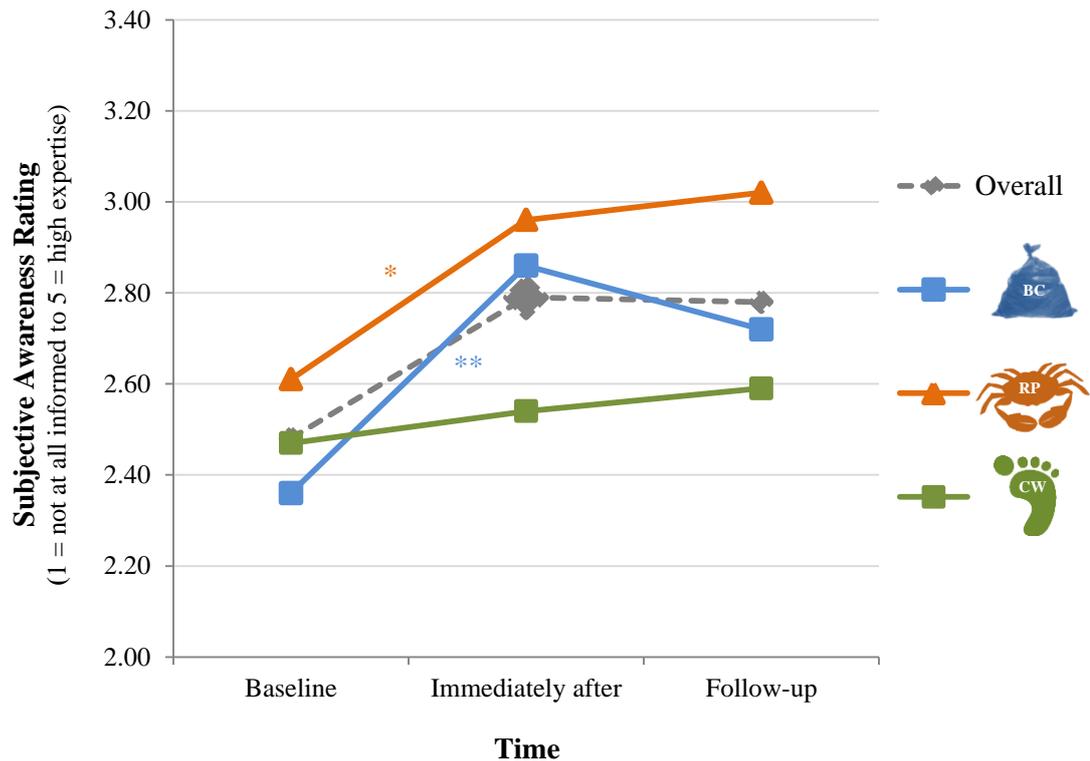


Figure 6.8. Subjective marine awareness overtime overall ($n = 90$) and for the beach clean (BC), rock pooling session (RP) and coastal walk (CW) activities separately in Study 7.

Note. * $p < .05$; ** $p < .01$.

To see whether these findings were also reflected in the more objective measures of marine awareness, participants' accuracy on the multiple choice questions were examined. As shown in Table 6.5, there were no obvious patterns emerging from the data for the litter-based questions. The main effect of time, activity and the interaction between the two were all not statistically significant (all $ps > .19$).

In contrast to the litter-related multiple choice questions, significant differences did arise for the biodiversity questions. First, the main effect for time was found to be significant, $F(2, 174) = 5.85, p = .003$, partial $\eta^2 = .06$ (small effect). It was discovered that correct responses increased over time, but statistically, only the follow-up responses had significantly improved from the baseline ($p = .001$). There was also a main effect for activity, $F(2, 87) = 5.97, p = .004$, partial $\eta^2 = .12$ (small effect), whereby participants rock pooling were more accurate in their responses overall than both the beach cleaning ($p = .02$) and the walking groups ($p = .007$). However, the interaction between time and activity was not found to be statistically significant ($p = .12$).

Table 6.5. *The means (and standard deviations) for subjective and objective marine awareness (MA) for the entire sample (in bold, n = 90) and for each activity (n = 30) in Study 7.*

	Baseline	Immediately After	Follow-up
Subjective MA	2.48 (0.66)	2.79 (0.77)	2.78 (0.70)
<i>Beach Clean</i>	2.36 (0.71)	2.86 (0.88)	2.72 (0.77)
<i>Rock Pooling</i>	2.61 (0.52)	2.96 (0.68)	3.02 (0.66)
<i>Coastal Walk</i>	2.47 (0.74)	2.54 (0.70)	2.59 (0.61)
Objective MA – litter	48.44 (22.43)	46.67 (23.80)	51.33 (22.04)
<i>Beach Clean</i>	52.67 (20.67)	50.00 (21.50)	51.33 (21.45)
<i>Rock Pooling</i>	48.00 (20.07)	44.67 (23.89)	48.00 (18.64)
<i>Coastal Walk</i>	44.67 (26.09)	45.33 (26.23)	54.67 (25.69)
Objective MA – biodiversity	56.36 (13.98)	58.44 (17.09)	61.82 (15.00)
<i>Beach Clean</i>	54.24 (10.26)	54.33 (13.57)	60.61 (12.25)
<i>Rock Pooling</i>	60.61 (16.94)	65.00 (20.47)	69.39 (16.62)
<i>Coastal Walk</i>	54.24 (13.40)	56.00 (14.99)	55.45 (12.71)

Note. Subjective MA was rated from *not at all informed* (1) to *high expertise* (5); both objective measures are scored according to percentage of correct answers.

6.3.2.3. Behavioural intention.

To examine whether general pro-environmental behavioural intention changed over time and between activities, another mixed ANOVA was used. Intention was found to significantly change over time, $F(1.81, 155.61) = 65.92, p < .001$, partial $\eta^2 = .43$ (large effect). As shown in Table 6.6, overall intention increased from baseline to immediately after the activity ($p < .001$) but one-week later decreased slightly ($p < .001$) but was still higher than the original baseline measure ($p < .001$). All three activity groups responded in a similar way, thus there was not a statistically significant main effect or interaction (all $ps > .20$).

Table 6.6. *The means (and standard deviations) for overall behavioural intention ratings (n = 90) and intention ratings for the individual activities (n = 30) over the different time points for Study 7 (n = 90).*

	Baseline	Immediately After	Follow-up
Overall Intention	2.81 (0.49)	3.21 (0.55)	3.09 (0.58)
<i>Beach Clean</i>	2.85 (0.47)	3.35 (0.45)	3.18 (0.51)
<i>Rock Pooling</i>	2.81 (0.53)	3.24 (0.61)	3.11 (0.68)
<i>Coastal Walk</i>	2.76 (0.47)	3.06 (0.57)	2.99 (0.55)

Note. Scale ranged from *never* (1) to *all of the time* (5).

6.3.2.4. *What are the most important factors?*

In order to explore the key predictors of overall satisfaction (immediately after the visit), two regressions were run. Using the same statistical procedures used in Study 3, demographic and visitor characteristic variables including age, gender, connectedness to nature, frequency of visits to rocky shores, and activity group size were first examined¹³. The final model was found to not be significantly better than no model and was found to explain 3% of satisfaction, adjusted $R^2 = .03$, $F(10, 78) = 1.30$, $p = .25$. Within this model, there were no statistically significant predictors (all $ps > .06$; see Appendix K for the full regression table) thus none were required to be entered into the next regression. To examine the predictive value of the conceptual and activity variables in the second and final regression, the hierarchical method was used to include the variables at controlled steps. Similar to Study 3, Step 1 involved the baseline measure of mood, Step 2 consisted of the perceived restorativeness of the environment, Step 3 involved the addition of mood (after) and meaningfulness, and finally, Step 4 incorporated activity type (to be in line with both the regression in Study 3 and the recreation and psychological literature that implies it is the most common activity undertaken in nature and on the coast, the coastal walk was selected as the reference category). The final model was statistically significant, $F(6, 82) = 17.80$, $p < .001$, explaining 53% of the variance. The model significantly improved with each step (all $ps < .03$), apart from for the final step. When activities were included, the model did not significantly improve ($p = .12$, see Table 6.7), thus were not seen as important predictors of overall satisfaction. Perceived restorativeness was initially found to significantly predict satisfaction ($\beta = .42$, $p < .001$) then disappeared after meaningfulness and mood were included ($p = .15$; see Table 6.7). Overall, the only significant predictors were mood ($\beta = .38$, $p < .001$) and meaningfulness ($\beta = .49$, $p < .001$).

¹³ Fewer variables were included compared to the analyses in Study 3, as many of those variables were controlled using the experimental design (e.g. duration, distance travelled).

Table 6.7. The final regression examining the predictive value of activities along with influential conceptual variables on overall satisfaction ($n = 90$) in Study 7.

	<i>B</i>	<i>SE B</i>	β	<i>p-value</i>
Step 1 – Baseline				
$R^2 = .05$ Adjusted $R^2 = .04$ $F_{change}(1, 87) = 4.91, p = .03$				
Constant	6.62	0.40		
Mood (before)	0.24	0.11	0.23	.03
Step 2 – Baseline & Restorativeness				
$R^2 = .23$ Adjusted $R^2 = .21$ $F_{change}(1, 86) = 19.79, p < .001$				
Constant	3.75	0.74		
Mood (before)	0.21	0.10	0.20	.04
Restorativeness	0.64	0.14	0.42	< .001
Step 3 – Baseline & Restorativeness & Hedonic and Eudaimonic Well-Being				
$R^2 = .54$ Adjusted $R^2 = .52$ $F_{change}(2, 84) = 28.66, p < .001$				
Constant	2.14	0.70		
Mood (before)	-0.05	0.09	-0.05	.53
Restorativeness	0.19	0.13	0.12	.15
Mood (after)	0.39	0.09	0.40	< .001
Meaning (after)	0.69	0.12	0.45	< .001
Step 4 – Baseline & Restorativeness & Hedonic and Eudaimonic Well-Being & Activities				
$R^2 = .57$ Adjusted $R^2 = .53$ $F_{change}(2, 82) = 2.18, p = .12$				
Constant	2.02	0.71		
Mood (before)	-0.06	0.08	-0.06	.45
Restorativeness	0.15	0.14	0.10	.27
Mood (after)	0.38	0.09	0.38	< .001
Meaning (after)	0.75	0.14	0.49	< .001
Activity (beach clean)	-0.26	0.40	-0.07	.52
Activity (rock pool)	0.45	0.34	0.11	.19
Activity (coastal walk - ref)	-	-	-	-

In sum, using an experimental design to explore the impact of beach cleans further; this study compared beach cleans with two other coastal activities, where participants did not know beforehand which activity they were going to engage in. With numerous factors controlled by using a rather homogenous sample (reducing individual differences), the same site under the same environmental conditions (e.g. tide and weather) and structured activities, numerous findings arose. For well-being, all measures were given ratings to the upper end of each respective scale. Mood was rated highly for all activities demonstrating positive affect, but did not change over time. The visits were also rated highly for overall satisfaction, again regardless of activity, but were found to decline slightly a week later. In contrast, meaningfulness was also rated highly but remained high a week later and was found to be more pronounced for the beach cleaning activity. The environment was also rated positively in terms of restorative qualities, with

ratings found to be lower for the beach cleaning activity compared to the coastal walk. For marine awareness, subjective awareness increased after the visit to the coast, more so for the beach cleaning and rock pooling groups; however this was not consistently reflected in the objective measures. No main effects (of time or activity) or interactions were found for the measures related to marine litter, but for the biodiversity measures, objective marine awareness was found to be higher for the rock pooling group and was greater during the follow-up measures than at baseline. Positively, intention to engage in pro-environmental acts were found to increase but implied the effects may be relatively short-term, as intentions started to drop a week later and, also, did not differ between activities. Finally, replicating the analysis from Study 3, it was found that the main predictors of whether people felt overall satisfied with a visit to the coast were mood (afterwards) and meaningfulness, with the effect of restorativeness seen to diminish once these factors were included.

6.4 General Discussion

The previous empirical chapters and the more generic literature work has illustrated that the coast accommodates a range of activities and can have beneficial impacts on its visitors. However, a result of such visits can be the accumulation of marine litter on the shore. Using two complementary methods, this chapter examined the benefits associated with beach cleans, the pro-environmental activity to reduce this environmental issue, on the volunteers themselves. Specifically, well-being, marine awareness and behavioural intentions were examined over time, with Study 7 comparing beach cleans to two other activities. Current volunteers were found to leave beach cleaning events satisfied and found the experience meaningful, as well as increasing their subjective marine awareness and intentions to complete pro-environmental behaviours. When comparing to rock pooling and coastal walking, beach cleaning was found to be a more meaningful activity, and rock pooling and beach cleaning were associated with a greater improvement in subjective marine awareness than walking. All three activities were rated highly for satisfaction and found to have similar positive impacts on pro-environmental behavioural intentions. Some of these effects were also noted to be long lasting, as

subjective marine awareness, behavioural intentions and meaningfulness remained high a week later. However, following from Study 3's exploratory analysis, it was evident that other factors can have an influence. Exploratory analysis found that mood and meaningfulness of a visit influenced the overall satisfaction of the day more than the activity itself.

Both studies found that individuals arrived happy, and left similarly happy irrespective of the activity. In line with the earlier chapters, where mood was perceived (Studies 1 & 2) and found to increase (Study 3) after a visit to a rocky shore, and the more generic literature that coastal environments improves mood (e.g. Ashbullby et al., 2013; White, Pahl et al., 2013), it was expected that positive mood would also increase in these two studies. Yet, in both studies, even though participants were happy when they arrived, mood did not statistically change. It is unlikely these results are due to a ceiling effect, as the scores were not to the highest point of the scale (+6), and especially as Study 3's scores were closer to the end of the scale and was still able to find a statistically significant effect. Alternatively, Study 6 and 7's findings could be as a result of not spending long enough at the respective sites to produce a measurable change in mood. Some research has found a *dose-response effect*, indicating that there may be an optimum amount of time (or intensity or number of visits) for an individual to receive the most benefit from an environment (Barton & Pretty, 2010; Hansmann et al., 2007; Hinds & Sparks, 2008; Nordh et al., 2009; Scopelliti et al., 2012; Tennessen & Cimprich, 1995; White et al., 2010; White, Pahl et al., 2013). Consequently, the lack of change in mood could imply that this optimum amount of time had not been reached. As activities did not vary in mood in Study 7, this also supports the literature that activities have similar hedonic well-being impacts when in this particular environment (White, Pahl et al., 2013; Study 3).

The impact on meaningfulness (eudaimonic well-being) was somewhat different to the (lack of) change in hedonic well-being. First, unlike the overall satisfaction that declined a week later, the meaningfulness of a visit to the coast in general was more long lasting. Second, beach cleaning volunteers found the activity meaningful in both studies, and more so than the other two activities in Study 7. This supports the more generic volunteering and activity-based literature, especially those that have found that

volunteering is more influential for eudaimonic well-being compared to hedonic well-being (Sons & Wilson, 2012; White & Dolan, 2009); and extends specifically to beach cleans. Thus, while all activities were found to have similar impacts on hedonic well-being, volunteers of beach cleaning activities experience greater eudaimonic well-being.

The perceived restorativeness of the environment was only measured in Study 7, and found to be rated highly according to ART's restorative properties (Kaplan, 1995). This is in line with previous chapters that rocky shores are perceived to be restorative (Studies 3, 4 & 5), as well as further supporting the broader literature that coastal environments have these restorative qualities (Hipp & Ogunseitan, 2011; White et al., 2010; White, Cracknell et al., 2013). Interestingly, even though the same geographical location was used, the environment was rated differently depending on the activity undertaken there. Specifically, those who conducted a beach clean rated the environment less restorative than those who underwent a coastal walk. This could be because activities could focus attention differently; for instance a coastal walk may highlight the depth and extent of this environment whereas a beach clean would increase the salience of marine litter, which had already been noted to be psychologically harmful in Studies 4 and 5. This is a novel finding, as, to date, no other study has examined how this perceived value varies depending on activity; thus more research is needed to uncover this relationship further.

Overall, participants were satisfied with their experiences. Similar to mood, satisfaction was rated highly regardless of activity. Within Study 7, by replicating the exploratory analysis from Study 3, it was possible to uncover the key factors for this high rating, with more variables controlled by adopting an experimental design. Similar as before, mood and meaningfulness were seen as the only significant predictors of overall satisfaction; whereby satisfaction ratings were greater when people were happy and found the experience personally meaningful. As before, this highlights that these two aspects of well-being (hedonic and eudaimonic) are two important yet distinct components (Ryan & Deci, 2001; White & Dolan, 2009). The influence of perceived restorativeness also disappeared once these constructs were included in the analysis (comparable to the findings in Study 3), further suggesting that the perceived restorative qualities of an environment were not as influential as mood and meaningfulness.

Within these two studies, self-reported subjective marine awareness was seen to improve after a beach clean. In Study 6, this was especially evident in volunteers where the event was their first experience of an organised beach clean, increasing more extremely to result in similar levels as the regular volunteers' awareness by the end of the beach clean. In comparison to other activities in Study 7, it produced similar results as rock pooling. This both supports and extends the previous chapters (Studies 1, 2, & 3) and literature that visiting the coast increases marine awareness (Monroe et al., 2006; Settler & Turner, 2010; Steel, Lovrich et al., 2005; Steel, Smith et al., 2005), but that the extent of the increase depends on the activity engaged in (Study 1). This is specifically important for citizen science programmes, as they typically have the goal to gather scientific data as well as engage and educate volunteers in scientific methodologies and the topic specifically (Bravo et al., 2009; Kordella et al., 2013). As both the activities with a citizen science element found an increase, this supports that general goal and the occasional study that has explicitly measured this in other programmes (e.g. Evans et al., 2005). Even better, this improvement was also found to remain a week later. Further research could examine the more longitudinal effects, but as Study 6 found that novices were less aware than the volunteers who had previous experience in such events, it may indicate that awareness may drop over time thus still benefiting from future beach cleaning events, but do not fall to the original baseline level.

Unfortunately, the findings for the subjective measure of marine awareness were not mirrored by the objective measures for marine litter. These measures were not found to change over time or vary between activities. The only evident effect was for the biodiversity related questions for participants rock pooling. This finding can extend previous ones that completing this type of citizen science programme (identifying marine biota) does not just improve people's subjective awareness but also their more objective awareness (Evans et al., 2005; Koss & Kingsley, 2010). The explanation behind the lack of significant effects for the marine litter related questions were less well understood. It could be inferred that the procedures linked with this particular structured event was simply not as effective in informing the volunteers about the associated issue compared to the rock pooling event for biodiversity. The measures were also uniquely constructed; therefore the findings could be as a result of the measures and construct validity. For

instance, the biodiversity measure predominately focused on identification (identifying species natively found in the UK), whereas the marine litter measures took a broader approach examining people's objective awareness about different elements of the issue (biodegradability, source and type of litter commonly found). Thus, it could be suggested that the differences in the results could be as a result of the different measures assessing different types of marine awareness.

As well as increasing subjective awareness, pro-environmental behavioural intentions were also seen to increase, declining slightly over time but still remaining higher than baseline one week after a visit to the coast (Study 7). Similar to Koss and Kingsley (2010) that examined a marine biota citizen science programme, participants of the two citizen science activities left with greater intention to change their behaviour in order to protect the marine and coastal environment; however this was also the case for the coastal walking group. As all three activity groups responded similarly in Study 7, this impact appears not to be activity dependent. This could indicate that it is the environment that is influential in these outcomes rather than the activity, as when viewing waterscape images can have similar outcomes (Hartig et al., 2001). Overall, this is an encouraging finding that engaging with the environment, at any level, can potentially empower people's intention and desire to act more environmentally responsibly. It would be hoped that these intentions would be translated into actual behaviours, but even though intentions are often correlated with behaviours (e.g. Ajzen, 1985; Bamberg & Schmidt, 2003); actual behaviour was not directly examined in these two studies.

Despite the informative findings, future research may wish to develop the methods (such as items, sample, activities and time intervals) further. As mentioned earlier, the marine awareness items demonstrated some unusual patterns. The subjective items were in line with the previous literature; however few of the objective measures echoed these findings. Construct validity could be one possible reason as stated above; other methodological-based explanations could also be responsible. As previous awareness measures involve self-reported subjective methods or specific objective measures on different topics (e.g. renewable energy and conservation), it was necessary to construct a new measure. It could be argued that these new measures were too difficult; yet Study 7 adapted the items from Study 6, and as shown by the lack of floor and ceiling

effects, successfully reduced the level of difficulty. It may have been that these particular multiple choice items were too specific making them more arbitrary instead of testing relevant knowledge. As a result, these studies highlight the need to understand this relationship more, either by checking measure reliability and/or verifying these findings.

Both the sample and activities were carefully selected for the purpose of these two studies; however different populations and activities could be investigated to generalise these findings further. For instance, Study 6 surveyed current beach cleaning volunteers. Completing surveys during pre-organised beach cleans was ecologically valid and representative of current beach cleaning opportunities but did limit experimental control for the research. Consequently, Study 7 adopted a more experimental design using a more naïve sample of students and comparing three activities using a between-subject design. Ideally, a general public sample who engaged in each activity would result in a more representative sample and eliminate any individual differences effects. However, this hypothetical design would have been time consuming, demanding, and likely to reduce response rates of participants. Therefore, by using a more practical between-subject design with a young, educated homogenous sample means that the generalisability of the results to the wider population was less strong, but the influences of individual differences were reduced. This was evident with the similar baseline measures across all groups in Study 7.

In terms of activities, the coast accommodates a diverse range of activities, of which Study 7 only examined three types. Consequently, future research may wish to adopt a similar experimental design to examine differences and effects of more coastal activities; however, for the purpose of this particular chapter, these three activities were deliberately chosen. Rock pooling was chosen as it was similar to the beach cleaning activity as it involved a citizen science aspect, was a relatively less harmful to the environment as rock pooling ethics were followed, and also resembled a popular activity undertaken in this environment (e.g. in Study 3). Coastal walking was a more passive less structured activity but represented the most common activity conducted in the natural environment, both for leisure and for psychological research (Addison et al., 2008; Berman et al., 2008; Hartig et al., 1991; Johansson et al., 2011; Natural England, 2010; Porter & Wescott, 2004; Smallwood et al., 2012; White, Pahl et al., 2011). Thus, by just

using these two samples and comparing these three activities, these two studies have produced some insightful conclusions, which it is hoped will be expanded on in future research.

As well as exploring the awareness, sample and activity effects in more detail, future studies may wish to explore the longitudinal effects further. Prior studies often only examine the short-term benefits of visits to nature or report self-reported frequency of visits (e.g. Felsten, 2009; Hartig et al., 2003; Hipp & Ogunseitan, 2011; Ryan et al., 2001; White et al., 2010). Even though Study 7 found some effects to last seven days later, it would be useful to understand how long these effects last. Previous literature has also touched upon the concept of a dose-response effect, that in addition to an optimum amount of time, there may be an optimum frequency or intensity for an individual to receive the most benefit (Barton & Pretty, 2010; Hansmann et al., 2007; Nordh et al., 2009; Tennessen & Cimprich, 1995; White et al., 2010). By examining multiple time points and regularity of beach cleans and other activities, it may be possible to deduce the optimum number of beach cleans for the volunteer to benefit individual psychological health (e.g. well-being and awareness) but also help sustain the environments' health (e.g. via behaviour change).

6.4.1. Conclusion

Previous chapters highlighted that visiting rocky shores can elicit a range of benefits, including improving well-being and subjective marine awareness, but simultaneously can harm the environment by contributing to marine litter. This chapter examined a specific pro-environment activity that focuses on this environmental issue, beach cleaning; exploring the impacts for those participating in this act. Overall, it was found that volunteers were satisfied with their experience, found it meaningful, felt they had learned more about the marine environment and intended to engage in more pro-environmental behaviours. However, when investigating the unique impacts by comparing with other coastal activities, the only distinctive findings for beach cleaning were that it portrayed the environment to be less restorative, was more meaningful and increased subjective marine awareness more than engaging in a coastal walk (but similar to the other activity with a citizen science element). Thus, rather than being associated

with a specific activity, rocky shores (as a context) can be seen to be beneficial for hedonic well-being and behavioural intention. Therefore, this activity that is designed to tackle a prominent environmental issue was not only beneficial to the environment, but was also a valuable experience for the volunteers (by experiencing a restorative environment and also engaging in a worthwhile activity).

General Discussion

Rocky shores, intertidal areas where solid rock predominates, are a highly variable, biologically rich coastal environment. As summarised in Chapter 1, this environment offers a range of valuable ecosystem services; categorised as supporting, regulating, provisioning and cultural services. However, as a result of utilising these services, humans can have harmful impacts on this complex ecosystem. Thus, to sustainably use and maintain this environment and its services, both the benefits to humans and any associated impacts on the environment need to be considered simultaneously. Prior to this thesis, research had not examined this overall relationship. Consequently, using an integrative approach combining Psychology with Marine Biology, this thesis explored the overarching research question: What are the risks to the environment and benefits to the individual associated with recreational visits to rocky shores? Specifically, impacts of rocky shore visits in terms of well-being, marine awareness and any associated habitat threat were explored along with the relationships between these components (see Figure 1.4 for a schematic representation of the approach).

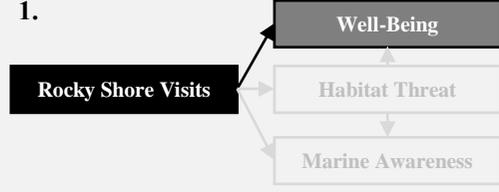
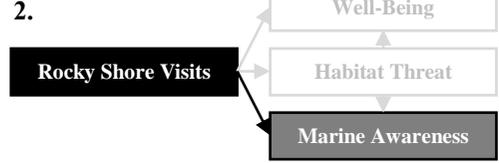
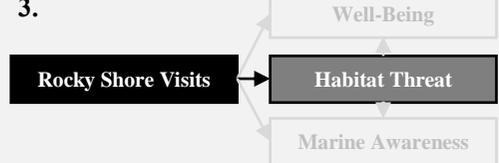
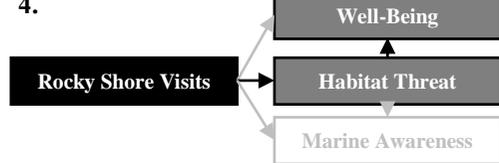
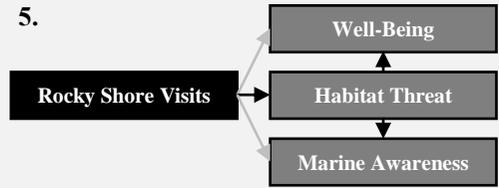
A range of methods were adopted to explore these different components, resulting in seven studies. First, perception-based surveys (Studies 1 & 2), collecting both quantitative and qualitative data, explored whether coastal users and coastal experts felt that rocky shores facilitate well-being and marine awareness benefits to its visitors, and highlighted the most troublesome recreational behaviours in terms of habitat threat. Study 3 then examined the well-being and marine awareness benefits more directly using a pre-post design, where current visitors completed a descriptive survey before and after a recreational trip to a rocky shore. After examining the well-being and marine awareness benefits more directly, the habitat threats associated with these visits were explored in greater detail. Studies 4 and 5 directly examined depreciative behaviours associated with rocky shore visits (specifically marine litter) in terms of individuals' well-being. Using a systematically controlled laboratory design, these studies had participants quantitatively

rate images (Studies 4 & 5) and qualitatively expand on these ratings (Study 5).

Concluding with two field studies, the final empirical chapter then focused on activities that have less negative impacts in terms of habitat threat, with the well-being and marine awareness impacts examined. Specifically, Study 6 adopted a pre-post design to explore the benefits of engaging in beach cleans for current volunteers, whereas Study 7 used a more experimental approach by comparing beach cleans with two other coastal activities on a more naïve sample. See Appendix L for a more detailed summary of the methods used.

Table 7.1 integrates the key findings of the seven studies. Overall, it was shown that rocky shores are beneficial for well-being and marine awareness, with the extent of which depending on the measures used (e.g. subjective or objective marine awareness). In contrast to these positive cultural services, recreational visits were also noted to have potentially harmful consequences on the environment. The main habitat threat associated with these visits were related to leaving rubbish that then accumulates in the marine environment (contributing to marine litter) and engaging in foraging activities, such as rock pooling, in an unsustainable manner (e.g. not returning organisms or boulders where or how they were originally found). As well as being noted to being harmful to the environment and its habitants, it was also found that litter can have detrimental impacts on people's well-being. Consequently, an activity that reduces the negative impacts of marine litter on both the environment and fellow visitors was investigated, namely beach cleans. Volunteers engaging in beach cleans were found to experience beneficial impacts in terms of both well-being and marine awareness, such as being rated positively for satisfaction and meaningfulness and increasing subjective marine awareness. When compared to other coastal activities (coastal walking and rock pooling), beach cleans were perceived to be less restorative, more meaningful, and they increased subjective marine awareness to a greater extent. Thus, this integrative and more holistic approach found that recreational visits to rocky shores are associated with both risks to the environment and benefits to the individual; but, on a positive note, when engaging in activities that minimises those risks (such as engaging in beach cleans), both the visitor and the environment can benefit.

Table 7.1. A summary of the findings in relation to the key aspects of the research model.

The Stages of the Research Model	Summary Findings (with reference to the supporting studies)
<p>1.</p> 	<p>Rocky shores were found to have beneficial impacts on individuals' well-being: Using a range of measures, it was found that rocky shores were perceived as being a restorative environment when measured in situ (Studies 3 & 7) and in the laboratory when viewing photographic stimuli (Studies 4 & 5); were rated positively for preference and mood (Studies 4 & 5); individuals reported feeling happy and satisfied when visiting this environment (Studies 3, 6 & 7), with mood being enhanced after a visit to the coast (Study 3 only); as well as individuals finding the experience meaningful (Studies 3, 6 & 7).</p>
<p>2.</p> 	<p>Rocky shores were found to have a positive impact on individuals' marine awareness: Visitors were believed to leave this environment with greater marine awareness (Studies 1 & 2) and, in the field studies, were found to leave with a greater sense of subjective marine awareness (Studies 3, 6 & 7). The impact on objective marine awareness was less clear (Studies 6 & 7).</p>
<p>3.</p> 	<p>Recreational visits to rocky shores were seen to have harmful impacts on the environment: Littering and unsustainable rock pooling were believed to be the most detrimental (Studies 1 & 2)</p>
<p>4.</p> 	<p>The impact of littering was found to have harmful impacts to people's well-being: Individuals expressed disliking littered coastlines and felt it ruined the environment for other visitors (Studies 1 & 5), and relative to clean alternative environments and ratings scales, littered rocky shores were rated negatively in terms of preference, mood and restorativeness (Studies 4 & 5) with public-litter rated most negatively (Studies 4 & 5).</p>
<p>5.</p> 	<p>Engaging in activities that minimises the recreational threats (e.g. a beach clean or following rock pooling ethics) can have the same, if not additional benefits, for well-being and marine awareness on the individuals. Specifically, individuals engaging in a beach clean remained happy after engaging in this activity (Studies 6 & 7), reported feeling satisfied and found the experience to be especially meaningful (Studies 6 & 7), and left the environment with a much greater level of subjective marine awareness compared to individuals undertaking a coastal walk (Studies 6 & 7).</p>

By addressing each of the stages highlighted in Table 7.1, the following section elaborates on these findings, relating it to the broader literature. The potential methodological limitations of this research will then be discussed along with suggestions on how future research may wish to proceed. The thesis will then be concluded with some practical implications on how this research can be applied to the management and use of rocky shores in order to maintain and protect this evidently valuable resource.

7.1 Theoretical Implications

7.1.1 Stage 1: Well-Being Benefits of Rocky Shore Recreational Visits

Prior to this thesis, a vast amount of research had examined well-being impacts of natural environments in general, commonly finding that experiencing nature (and aquatic environments) can have well-being benefits (Ashbullby et al., 2013; Hipp & Ogunseitan, 2011; Laumann et al., 2001; White et al., 2010; White, Pahl et al., 2013), but the impacts of rocky shores specifically were unknown. According to a key theory commonly cited in the psychological literature, ART (Kaplan, 1995), it would make theoretical sense for rocky shores to be restorative. As introduced in Chapter 2, ART claims that encounters with environments are restorative if they fulfil four key properties: Being away, extent, fascination, and compatibility. Rocky shores could be seen to have each of these properties: They are often psychologically distant from most people's work and other stressors (being away); are renowned for being biologically rich (extent); they have numerous dynamic features, such as waves and wildlife, that can grasp visitors' attention (fascination); and they can accommodate a range of recreational activities (compatibility). Even though this thesis took an integrative approach thus was not theory-driven, a short scale was included to address these properties, and as hypothesised, this environment was perceived to be restorative (Studies 3 & 7).

As well as grounding the results in an established popular theory, the findings from these studies were also in line with empirical studies that have examined restorative properties of other environments. Other coastal environments have been found to be similarly restorative, for instance Hipp and Ogunseitan (2011) found that a sandy beach was rated highly for perceived restorativeness. When comparing to other environments, waterscapes like the coast are often found to be perceived to have more restorative

elements than other environments (e.g. Felsten, 2009; Laumann et al., 2001; White et al., 2010). Consequently, this thesis both supports and extends the literature, illustrating that another type of natural environment of great biological importance is perceived to have these restorative qualities.

As well as being perceived to have restorative qualities, throughout the thesis, rocky shores were also found to have direct beneficial impacts on well-being. As reviewed in Chapters 2 and 4, well-being is a complex construct and can be measured in a number of ways. Within the psychological literature, the most popular approach is to examine how pleasurable an experience is, namely hedonic well-being (e.g. Ashbullby et al., 2013; Scopelliti et al., 2012; White et al., 2010). Often examined using measures of emotions, previous research has shown that people are happy when experiencing natural environments, or coastal environments more specifically (e.g. Ashbullby et al., 2013; Scopelliti et al., 2012; White et al., 2010). The positive ratings recorded in the perception surveys (Studies 1 & 2) and laboratory rating studies (Studies 4 & 5) are in line with these earlier findings, again, extending the conclusions to this specific habitat.

Some studies in the more generic literature have also demonstrated that experiencing natural environments can result in a change in hedonic well-being, with positive mood increasing after seeing or spending time in certain environments (e.g. Hartig et al., 2003; Thompson Coon et al., 2011; Ulrich, 1979; van den Berg et al., 2003). The field studies reported in the current thesis (Studies 3, 6 & 7) partially support this. When surveying individuals who were visiting one of two rocky shore sites for recreational purposes (Study 3), it was found that even though the average baseline mood was very positive, participants left the shore with an even more elevated positive mood, suggesting that rocky shores facilitate well-being benefits even when individuals are already happy. However, when examining more specific coastal visits (to engage in beach cleans, rock pooling or coastal walking) in Studies 6 and 7, participants still arrived very happy but, unlike the other study, this did not change. These mixed findings are not uncommon in the wider literature as some studies have also failed to find an effect on mood (e.g. Berman et al., 2008), but many published articles do (e.g. Ekkekakis et al., 2000; Hartig et al., 1991; 2003; Johansson et al., 2011; Ryan et al., 2010). There could be numerous reasons for these mixed findings. For instance, Studies 3, 6, and 7 used

different samples (current visitors compared to beach cleaning volunteers and students), designs (a more exploratory survey approach for an overall recreational visit compared to explicitly examining an individual activity) and sites; all of which may have contributed to the mixed findings. Another factor could be duration. Studies 6 and 7, that did not find any changes in mood, involved shorter visits (under two hours) compared to that of Study 3 (on average lasting three hours); thus participants may not have experienced this particular environment long enough to receive the full benefits. This explanation would be in line with the dose-response effect and the finding from Study 3 that well-being benefits increase as duration increases (Barton & Pretty, 2010; Hansmann et al., 2007; Hinds & Sparks, 2008; Nordh et al., 2009; Scopelliti et al., 2012; Tennessen & Cimprich, 1995; White et al., 2010). However, when reviewing all of the findings from the entire set of studies together, it is still apparent that people felt happy when experiencing this particular natural environment and that mood can sometimes improve even more.

As well as demonstrating hedonic well-being effects, these studies have also found that rocky shores are beneficial for eudaimonic well-being. This approach to well-being concentrates on how meaningful an experience is rather than how pleasurable it is (Ryan & Deci, 2001), but is typically overlooked when examining the well-being benefits of nature. Researchers, such as Ryan and Deci (2001), have highlighted the importance of this approach; claiming that hedonic and eudaimonic well-being are two distinct, independently important constructs. The findings from the field studies (Studies 3, 6, & 7) support these claims by: First, demonstrating eudaimonic well-being benefits as the visits were rated positively; second, as hedonic and eudaimonic well-being were found to be independent predictors of overall satisfaction in Studies 3 and 7; and finally, indicating long-lasting benefits as meaningfulness values remained high a week after a visit to a rocky shore in Study 7. Thus, overall, these seven studies have supported and extended the previous literature to address a specific habitat, demonstrating that rocky shores do offer well-being benefits in terms of the perceived restorative properties linked to ART, hedonic well-being measures and also, more uniquely, eudaimonic well-being.

7.1.2. Stage 2: Marine Awareness Benefits of Rocky Shore Recreational Visits

As well as providing well-being benefits, rocky shores were also found to be beneficial for marine awareness, increasing people's predominantly subjective awareness about the marine environment and the natural and anthropogenic stressors facing it. Prior to this thesis, it had been shown that people generally have poor awareness about the marine environment (Ocean Project, 1999a; 1999b; Steel, Lovrich et al., 2005; Steel, Smith et al., 2005). Descriptive studies had indicated that experiencing natural environments directly can increase this awareness, but these earlier studies typically involved school children as part of formal education programmes (Ballantyne & Packer, 2002; Bogner, 1998; Cummins & Snively, 2000; Dillon et al., 2006; Duerden & Witt, 2010). Apart from the occasional correlational study that found that people who visit coastal environments more tend to have greater marine awareness (Steel, Lovrich et al., 2005; Steel, Smith et al., 2005), little was known about the impacts recreational visits to marine environments can have on the general public. Consequently, these studies within this thesis were able to shed some light on this aspect.

It was perceived (Studies 1 & 2) and found that visitors would leave a rocky shore with a greater sense of marine awareness (subjective marine awareness; Studies 3, 6, & 7). However, later objective measures used in Studies 6 and 7 did not fully replicate this improvement in marine awareness. Specifically, objective marine awareness about marine litter was not found to improve, but awareness about overall biodiversity was shown to increase from baseline to a week after a visit to the coast. A reason for these mixed findings could be the measures used. The subjective and objective marine awareness involved different measures, with the former asking participants to judge their overall awareness, compared to the latter that explicitly asked questions about specific topics. The specificity of the measures could have had an influence. As discussed in Chapter 2, objective measures require a much more detailed focus; thus for these studies, subjective marine awareness addressed a broad level of awareness (comprising of overall biology, natural and anthropogenic stressors) whilst the objective measures focused on specific aspects of marine litter and marine biodiversity. It is conceivable that if these measures had been matched in terms of specificity, the earlier findings may have been replicated.

Finally, these measures could have also been measuring different constructs. Whereas the objective measures focused on assessing individuals' factual knowledge about specific concepts, the subjective measures focused on overall perceived awareness. Thus, with the latter consistently finding the improvements, it could be inferred that visiting rocky shores increases the salience and awareness of this environment rather than actual factual knowledge. Therefore, these studies have begun to show that direct experiences with an environment, such as a rocky shore, has the potential to be beneficial for broad and more perceived marine awareness, but more research is needed to examine awareness benefits further, especially for objective marine awareness (or factual knowledge).

7.1.3. Stage 3: Habitat Threats Associated with Rocky Shore Visits

Unfortunately, rocky shores can experience harmful impacts resulting from recreational visits, which provide these well-being and marine awareness benefits noted above. As outlined in Chapter 1, previous studies have focused on specific behaviours (typically examining individual species), such as leaving litter, trampling over algae and general disturbance to bird colonies (Fitzpatrick & Bouchez, 1998; Fletcher & Frid, 1996; Hall, 2000; Laist, 1997); but the overall impacts of visits had been relatively under-researched. Priskin (2003b) had explored the perceived harmful impacts different recreational activities can have on sandy beaches. Priskin's work was influential as it highlighted which activities were seen to be the most harmful and therefore in need of appropriate management. Thus, based on her study, Studies 1 and 2 applied this approach to rocky shores; however the methodology was developed to consider the popularity of activities, producing a perceived risk variable. The frequency of activities was seen to play an important role, as the environment may experience more detrimental effects from an activity that is seen to be moderately harmful but frequently engaged in compared to an activity that is extremely harmful but rare. Examining experts and coastal users' perceived level of risk (combining harmfulness with frequency), these studies revealed the activities that were believed to have the greatest potential to harm the environment. This highlighted that foraging activities, such as rock pooling and fishing, has the highest potential to harm the environment. Responses to an open-response item further emphasised this, highlighting that rock pooling without following any appropriate

guidelines can have harmful impacts. For instance, if boulders are not turned back, or species are dislodged and/or not placed back where they were found, organisms can be put at risk. This is in line with other studies that have noted similar impacts when examining a specific activity on its own (Davenport & Davenport, 2006; Lindberg et al., 1998; MarLIN, 2011; UK CEED, 2000).

In addition to specific recreational activities, leaving litter was also noted to be one of the main visitor-related behaviours people would most want to see changed because of the damage it causes the environment. This supports the vast and growing amount of literature that has been dedicated to examining the impacts of marine litter on the environment and its inhabitants. Studies have shown that litter can cause physical damage to the environment, entangle wildlife and be mistakenly eaten as food (Hall, 2000; Laist, 1997). And with marine litter found in seas from the poles to the equator and from the shoreline to the deep sea, it has been proven to be a prevalent, global issue (Thompson et al., 2009). Public opinion surveys have also emphasised the importance of this environmental issue. These surveys have found that litter and pollution are commonly mentioned by the public as one of the most troublesome threats facing natural environments more generally (Clamer, 2011; Fletcher et al., 2009). These findings demonstrate that the participants in Studies 1 and 2 agree with other survey data and the environmental literature that marine litter is a severe issue, as well as highlighting and prioritising a key habitat threat in need of further investigation.

7.1.4. Stage 4: Impacts of Habitat Threat on Well-Being

This thesis also showed that the presence of rubbish on rocky shores can have detrimental impacts on people's well-being (Studies 1, 4, 5, & 7). Rubbish left by visitors contributes (along with other sources such as fishing, sewage-related-debris and shipping) to the wider environmental issue of marine litter. Litter is disliked by visitors and is often noted as a key deterrent against visiting a particular coastal site (Ballance et al., 2000; Mouat et al., 2010; Tudor & Williams, 2006; Williams et al., 2007; Wilson et al., 1995), but other well-being impacts of rubbish on individuals were somewhat unknown. Pretty and colleagues' (2005) laboratory rating study touched on this, by comparing environments that were pristine to more unpleasant scenes. Their unpleasant scenes did

include littered environments, along with other degraded features such as damaged trees and burnt out cars. In their study, they demonstrated that less pristine and degraded natural environments were less restorative than scenes without these degraded features. Developing this limited literature further, this thesis highlights that marine litter in particular can have harmful impacts on people's well-being: not only diminishing the positive impacts a clean shoreline can have but can actually make people feel worse. Specifically, it was spontaneously noted as being an eye sore and spoiling people's experiences in the perception surveys in Study 1. Also, when manipulating the type of debris in photographs in Studies 4 and 5, whereas the natural scenes were rated positively on all well-being measures, littered scenes were rated much more negatively in terms of preference, mood and restorativeness (Studies 4 & 5) and were found to elicit negative emotions, disrupt the ordinary effects a clean rocky shore offers and remind people of the harmful consequences on the environment (Study 5). Thus, overall Studies 1, 4 and 5 supports the limited literature that litter is disadvantageous to well-being, but was also unique in that it examined *types* of marine litter.

As public-litter was originally noted as a key habitat threat facing rocky shores as a result of recreational visits and is the most common source of marine litter (MCS, 2012a; Study 1 & 2), this aspect was particularly examined. Apart from Tudor and Williams (2003) who compared different litter items in terms of 'offensiveness', no studies to-date had compared the impacts of types of litter on well-being. Consequently, by comparing public-litter with the next most common identifiable source of litter, fishing-litter, Studies 4 and 5 were the first to find that different types of litter can vary in the impact on people's well-being. Specifically, public-litter was rated worse on all measures and was associated with a disrespect for nature, physical risks related to the individual items, and reminded people of the city. This could be indirectly related to ART (Kaplan, 1995). As noted above, when clean, rocky shores were perceived to be restorative as they fulfil each of the four key properties of ART. However, the properties could be seen to be reduced when litter, and specifically public-litter, is present. For instance, the presence of rubbish could distract the viewer from the extent and richness that the environment has to offer; it provides additional physical risks that a visitor needs to negotiate around, reducing compatibility; it involves a more negative feature that can

grasp individuals' fascination, and finally, as noted by participants as being a reminiscent of the city, it implies it can act as a cue for everyday stressors thus reducing the sense of being away. The relation between ART and litter was not explicitly examined, but future research may wish to examine this new relationship further. In terms of the relationship between recreational visits to rocky shores and habitat threat and well-being, these studies show a potential negative feedback loop: When visiting rocky shores, people collectively experience well-being benefits whilst simultaneously littering the environment, this littered environment then diminishes the initial well-being benefits for future visits.

7.1.5. Stage 5: Impacts of Activities Addressing Habitat Threats on Well-Being and Marine Awareness

In light of the earlier findings that marine litter is troublesome for both the environment and the visitors, beach cleans were examined as one potential solution to this issue. With the help from members of the public, beach cleans involve removing rubbish from the marine environment in a non-intrusive manner (compared to more mechanised techniques for example, Davenport & Davenport, 2006). This stewardship activity can also involve a citizen science element, where the items collected are recorded then contributed to a national dataset that can then inform science about litter trends (e.g. the MCS Beachwatch programme). Using members of the public to collect and record the rubbish is known to be beneficial for the environment and can produce reliable litter results (Hidalgo-Ruz & Thiel, 2013), but the well-being and marine awareness impacts on the volunteer themselves was considerably under-researched. Consequently, the last two empirical studies examined this by measuring well-being and marine awareness before and after a beach cleaning event in current volunteers (Study 6) as well as experimentally comparing it to a rock pooling session or a coastal walk in a student sample (Study 7).

Engaging in a beach clean was found to have some marine awareness benefits. Subjective marine awareness was found to improve after engaging in a beach cleaning event, both in current volunteers and in a more naïve sample of students. Developing the previous literature, the impact of a beach clean on marine awareness was also compared to two other activities: Another coastal activity consisting of a citizen science element (rock pooling; undertaken in a sustainable manner to minimise the impacts on the

environment) and the most popular activity undertaken in natural environments (a coastal walk). When comparing these activities, it was shown that participants engaging in a beach clean or going rock pooling demonstrated a greater improvement in subjective marine awareness than the participants walking along the coastal path. This improvement in subjective marine awareness was also found to remain high a week later. This was partially replicated for the objective measures, as the rock pooling groups were able to correctly identify more UK native species than the other activity groups. As both volunteers in general and the beaching cleaning organisations often have the goal for the activity to facilitate learning, these findings suggest that this goal is somewhat met (Bravo et al., 2009; Kordella et al., 2013). They also support the generic studies that have previously found similar effects on subjective awareness after engaging in other stewardship and/or citizen science projects (Evans et al., 2005). These findings also strengthen a point noted in Study 1, where participants often noted in the additional comments open-response item that marine awareness benefits were dependent on a number of factors, including the level of interpretation. Both the beach cleans and rock pooling sessions had a clear interpretive element, with a marine biologist informing them of a specific topic (marine litter or biodiversity) and assisting them with identification (of litter or organisms). Therefore, these collective findings show that marine awareness can increase as a result of a recreational visit to a rocky shore, but will be more enhanced when engaging in more structured, interpretational events.

Looking at the more generic volunteering and stewardship literature, it was also suggested that these activities can afford well-being benefits. For instance, when reflecting on previous volunteering events, volunteers typically report feeling good, calm and peaceful and found that it gave them meaning (Koss & Kingsley, 2010). The last two studies (6 & 7) support this, as participants (both current volunteers and students) engaging in beach cleans were satisfied, were happy (however mood did not change compared to before the event) and found the experience to be meaningful. Unlike the more descriptive studies that had previously examined volunteering and stewardship activities (e.g. Borgonovi, 2008; Koss & Kingsley, 2010; Meier & Stutzer, 2008; Thoits & Hewitt, 2001), beach cleans were also compared with two other coastal activities to help reveal the unique effects of this volunteering, environmental stewardship activity.

When compared to coastal walking and rock pooling, beach cleaning was only found to be different for the eudaimonic well-being measure and perceived restorativeness (Study 7). It is not surprising that the activities did not differ for the hedonic well-being measures, as Study 3 and the broader literature (White, Pahl et al., 2013) have found that well-being measures are not necessarily influenced by the activities undertaken; implying that the environment has more influential impacts on hedonic well-being rather than the individual activity. In contrast to the finding that hedonic well-being was not distinctively beneficial for beach cleaning, eudaimonic well-being was more pronounced for this activity. As well as providing further support that eudaimonic well-being is an important approach to consider, it extends the broader well-being literature that has shown that volunteering is a meaningful activity (Son & Wilson, 2012; White & Dolan, 2009) by demonstrating that beach cleans were *more* meaningful than alternative coastal activities.

Beach cleans were also found to be different from the other activities in terms of perceived restorativeness, but in a more negative way. Compared to participants engaging in a coastal walk who rated the environment positively in terms of ART's (Kaplan, 1995) properties, individuals participating in the beach clean rated the environment as more neutral. Even though these activities were both undertaken in a similar overall context (the coast), the environments experienced were different, thus could be an explanation for these different ratings (e.g. the coastal walk covered more ground and types of habitats whereas the beach clean focused on the littoral fringe of a rocky shore). Another reason for this lower perceived restorativeness rating could be related to the earlier findings that litter can have detrimental impacts on people's well-being. By engaging in the act of recording and collecting rubbish, the degraded feature, marine litter, is made more salient. Thus, this lower rating could then be seen to partially support these earlier findings, as the environment is no longer seen as restorative. However, if a (salient) littered environment was to have such powerful impacts on people's well-being as suggested by the earlier laboratory findings in Chapter 4, it would be expected that participants engaging in this activity would have considerably poorer well-being as a result of the activity. Yet, hedonic well-being was found to be the same as for the other activities, and eudaimonic well-being was found to be better. This could suggest that litter does detract from the restorative properties of a rocky shore but is not as detrimental to well-being *in situ* as

first believed. Alternatively, as perceived restorativeness that focuses on the environmental quality is rated lower, whereas hedonic and eudaimonic well-being that focuses on people's experiences are the same if not better, it could suggest that the environment itself is less restorative but the activity is beneficial to well-being, thus counteracting the potential harmful environmental impacts. However, these explanations are purely speculative; therefore, after addressing the generic methodological limitations of this overall work, future research is suggested to look at how this could be explored further. Overall, when engaging in activities that minimise the risks to the environment (such as engaging in beach cleans); individuals can still receive the same, if not additional, psychological benefits.

7.2 Methodological Limitations and Future Research

This thesis took a novel approach, examining both the impacts recreational visits to rocky shores have on the environment in terms of habitat threat and on individuals in terms of well-being and marine awareness. By being the first to examine these impacts together, it was expected that new challenges would arise. These challenges focus from the broader approach (the research model and combining disciplines) as well as on the individual components of the model (e.g. measures relating to well-being, marine awareness and habitat threat).

7.2.1. Challenges Faced by the Integrative Approach

To help develop and organise this integrative research, a systematic research model (see Figure 1.4) was adopted to highlight the key concepts and relationships under investigation. It is acknowledged that this model is not comprehensive, with a number of factors and relationships not being represented. Within the wider context of the model, numerous factors have been overlooked that could potentially influence the impacts measured. Studies have identified factors that can predict whether individuals visit particular coastal sites (e.g. Morgan, 1999; Vaz, Williams, Silva & Phillips, 2009), which would then potentially affect the overall recreational use of the environment, which in turn would then consequently influence the impacts measured in the model (habitat threat,

well-being and marine awareness). A popular example could be water quality, as it is often noted as an important predictor (Morgan, 1999; Vaz et al., 2009) and is a key criterion for publically read beach guides (e.g. the MCS, 2014). Policy and management changes would also influence the accessibility to rocky shores and how they are used. This was experienced and documented in the United States after the Second World War, when recreational use of federal lands was growing in popularity (Knopf, 1987). By responding to these demands through changes in management and services, it was found that both the environment and user characteristics changed. For instance, the newly managed areas attracted more social-focused groups, whereas before veterans seeking solidarity would visit these environments (Clarke, Hendee, & Campbell, 1971; Knopf, 1987). As well as overlooking potential influential factors, this model does not encompass all potential outcomes. For instance, recreational visits can have other impacts not acknowledged within this model, such as benefits to the environment and society through economic investment from the recreational revenue and improving water quality to encourage visitation, as well as negative impacts on its visitors such as through sun-burn and standing on sharp weeverfish (see Chapter 1 for more potential risks and benefits). Thus, other factors and outcomes could be found to be important in regards to recreational visits to rocky shores, which this current model is unable to address. However, the purpose of this model was to outline and guide this research in understanding the specific components: Habitat threat, well-being and marine awareness. Future research may wish to develop the model to be more theoretical and comprehensive, but for the purpose of this thesis, it has fulfilled its objective.

In addition to including more influential factors and outcomes, another possibility to develop the model further would be to examine the strength and intensity of the impacts studied. The current work primarily focused on the presence or absence of impacts visits to rocky shores had on the environment in terms of habitat threat and to the individuals in terms of well-being and marine awareness. This model guided this research and resulted in seven studies that demonstrated that visits can have well-being and marine awareness benefits to its visitors and identified the habitat threats that were perceived to be the most troublesome. It may have been valuable to quantify these impacts more fully in terms of intensity and likelihood, by developing further the risk perception approach

used in Studies 1 and 2 where probability was combined with intensity. However, as demonstrated in the current studies, the individual aspects of the model were found to be complex (e.g. visits were found to have differing well-being and marine awareness impacts according to measures used and activities considered) thus it would have been inappropriate to apply such a broad analysis at this stage and could have potentially oversimplified these complicated relationships. Based on these findings though, future research may wish to take this forward and explicitly examine the strength of these relationships.

In addition to developing and extending the current research model in this specific context, it is also recommended that future work could apply a similar model to other contexts. By considering both negative impacts on the environment and positive impacts on humans, integrative research can aid our understanding of different issues and encourage sustainable practices. For instance, examining both types of impact could help address environmental issues, such as microplastics. Microplastics are plastic particles less than 5 mm in diameter (Andrady, 2011) and have a number of cultural uses, such as in cleaning and cosmetic products (beneficial to humans). However, as a result of being washed down people's drains and entering the marine environment, these small pieces of plastic can have harmful impacts on the environment and organisms (Andrady, 2011). Compared to public-litter examined in Studies 1, 4, 5, 6, and 7, this would be an interesting issue to examine further as these items are less visible. This integrative approach can also be applied to broader areas of research, such as studying the multi-disciplinary risks and benefits of using other environments and resources (e.g. residential energy usage in terms of impacts on the home owner and on the environment, and speeding behaviours on roads in terms of risks and benefits for the driver, other road users and the environment). Thus, based on the findings and lessons learned within this thesis, it is encouraged that similar integrative research models should be applied to more research, promoting more partnerships between disciplines.

Combining different disciplines offers valuable insights into important issues; however it also raises a number of unique challenges. One challenge of adopting an integrative approach experienced in this research was the different interpretations of terms, statistical analyses and results. To reduce ambiguity, key concepts, analytical

procedures, and statistical findings were written in a transparent manner (e.g. the glossary in Appendix B, the detailed description of the analyses used, and the interpretive explanation of effect sizes for each test). As decision makers (such as those considering ecosystem services) are continually relying on evidence from a range of disciplines (e.g. Biology, Psychology, and Geography), defining a standardised approach across disciplines would be helpful. The lack of which was found to be an obstacle when combining Psychology and Marine Biology in the current thesis. The psychological literature exploring well-being and marine awareness benefits typically adopts a wider stance, examining the benefits of natural environments in general, often collating a range of habitats and examining overall visits (as outlined in Chapter 2). In contrast, when examining habitat threats of recreational visits, marine biological research takes a much more focused approach, examining specific sites, activities and individual species (as outlined in Chapter 1). Consequently, to be able to examine both aspects of the research questions (the risks and the benefits), it was necessary to find a middle ground for these two approaches. This involved broadening the marine biological approach to examine recreational visits in general on the overall ecosystem, and specifying the psychological approach to a definite coastal environment. Consequently, in order to examine different components simultaneously, along with compromising on specificity, methodological rigour and theoretical analysis for each component may have been jeopardised as a result.

7.2.2. Challenges Faced by the Individual Components of the Model

Due to the range of concepts addressed in each study, concise scales and measures were favoured to reduce the demand on participants and sustain response rates. In terms of well-being, relatively short scales were adopted to measure the different finer constructs (perceived restorativeness, hedonic and eudaimonic well-being) instead of the more commonly used longer, more time consuming but often statistically reliable scales (e.g. the 16-item the Perceived Restorativeness Scale, Hartig et al., 1997; PANAS [Positive and Negative Affect Schedule], Watson, Clark, & Tellegen, 1988; Ryff, 1989). Consequently, the use of these shortened measures could be seen to reduce the strength of the current construct-specific conclusions. This is especially noteworthy for the shortened Perceived Restorativeness Scale used in Studies 3 and 7. Because of the integrative

approach of the thesis, the studies were not explicitly theory-driven; however, to relate and embed the well-being results to the broader literature, perceived restorativeness was examined. Consequently, a four-item scale was adopted, with one item examining each of the four properties. As a result, the robustness and the reliability of this could be questioned. However, throughout the studies, reliability remained high for these shorter modified scales. Thus, for the purpose of this thesis, these scales were sufficient and produced insightful results, but it could be suggested that future research should select more detailed, reliable scales. It should also be noted that the measurement of restorativeness is still being developed and debated in the literature (e.g. Hartig et al., 1997; Pals, Steg, Siero, & van der Zee, 2009; White et al., 2010).

In addition to the potential concern of reliability for the well-being measures, another potential critique for these measures could be the individual items used. As this collection of research progressed, the well-being measures evolved. Initially well-being was examined according to hedonic well-being (affect), then eudaimonic well-being (meaningfulness) and perceived restorativeness was later included. The measures of hedonic well-being were not always ideal. As mentioned above, scales were restricted due to length. The first two surveys used one and two item measures: Happiness in Study 2 and mood and arousal based on the Circumplex Model of Affect (Russell, 1980) in Study 1. Within this model, stress reduction is typically expressed by a move from individuals experiencing an activated-unpleasant affect toward an unactivated-pleasant affect. However, these dimensions were treated more independently in this research, recording mood and arousal separately. Thus this analysis was not applied in the same manner as other studies (Russell, 1980). The arousal dimension was also not always found to be ideal as it was difficult to rate due to its dependency on situational factors. The example provided in Chapter 3 was that rock pooling could be rather relaxing observing animals but could be made more exciting if a rare species was identified. Fortunately this was identified early on in this thesis, thus the subsequent studies in this thesis applied different hedonic measures (e.g. focusing more solely on positive and negative affect). However, it would be advised for future work to review the use of the Circumplex Model of Affect within this well-being literature. In addition to reviewing

these measures, other complementary techniques could also be adopted, such as using physical health indicators, such as measuring heart rate and blood pressure.

The measures used to examine marine awareness could also be critiqued; however, unlike well-being, there are currently no standard measures that could be used. As discussed in Chapter 2, in order to assess marine awareness, measures need to be constructed and tailored specifically to a research question. Consequently, these measures were continually being developed throughout this thesis. Initially, different topics (biology, ecology, natural stressors, and general and visitor-related habitat threats) were evaluated on perceived change in awareness (Studies 1 & 2), then, when directly examining change in subjective marine awareness onsite (Study 3), participants were required to rate their awareness for these topics in relation to the average person. By relating it to an average person, this was seen to be extremely subjective and dependent on what people think is average. Consequently, the later measures used more independent categories (*not informed to high expertise*) similar to other studies (Steel, Lovrich et al., 2005; Steel, Smith et al., 2005). Even though these newly made scales produced reliable scores, they were vulnerable to factors such as social desirability (as were the self-reported well-being measures). It seems doubtful that the findings reported are purely as result of social desirability due to the consistency of the findings and it seems unlikely participants would remember exactly how they had responded hours earlier to each item. Nevertheless, more objective measures were developed in an attempt to reduce this influence. As noted above, the lack of replication in the subjective and objective measures could suggest that different constructs were being examined, but could also be as a result of the measures themselves (see Section 6.4 for a more detailed description). Therefore, more careful designing and testing of marine awareness measures is needed, with an urge to verify these current findings further. If these findings are later validated (that subjective awareness increases as a result of a visit but objective marine awareness does not), the consequences also need to be considered. It would not be surprising if visitors express an overconfidence in their knowledge, as other studies have found that people tend to overestimate their subjective awareness compared to their objective awareness (e.g. Alba & Hutchinson, 2000; Carlson, Vincent, Hardesty & Beaden, 2009). However, this overconfidence could inhibit further learning; as by essentially facilitating false

confidence in their subjective awareness about the marine environment, visitors may feel less motivated to actively learn more about the environment. Thus, it would be advisable to further research these measures and also examine the potential consequences of targeting one or both of these types of marine awareness.

In contrast to well-being and marine awareness that was measured continually throughout the thesis, habitat threat was only investigated in the first two studies then used as the manipulation or context rather than a main outcome. Relying on individuals' perceptions initially helped guide the overall research, but this technique is not as robust and objective as measuring impacts directly. This was seen to be beyond the scope of the thesis, due to time and methodological constraints. Indicators of habitat threat (both evidence of damage and recovery) can take considerable time to show and depends highly on the type of habitat (Castilla & Durán, 1985; Southward & Southward, 1978). A good example of the variation in time it takes to show change in rocky shore communities is that of an oil spill: Southward and Southward (1978) showed that some rocky shores recovered within two to three years, whereas others took between ten and 15 years. Also, to be able to deduce with a certain level of confidence that an effect has been as a result of a particular activity or behaviour (e.g. unsustainable rock pooling), experimental designs using thorough techniques with a focused specificity would be needed (as explained in Chapter 1). As numerous studies currently exist looking at individual activities (see Table 1.1) and due to the breadth and time constraints of the thesis, it was seen to be appropriate to rely on the perception-based findings and use habitat threat as a more contextual variable. Despite the critiques associated with the perceived risk approach in Studies 1 and 2, the findings have also demonstrated a methodological technique that can be easily applied to other environments or contexts for a quick overview of a range of risks, which can then help prioritise future investment in research and management.

As highlighted in Studies 1 and 2, the perceived risks to the environment and benefits to the visitors were seen to be relatively universal, however the sample used in these studies must be noted. Different samples were used throughout the thesis including current visitors (Study 3), more general public samples (Studies 1 & 5), expert samples (Studies 1 & 2) and current volunteers (Study 6), as well as more homogenous samples of

students (Studies 4 & 7). Thus different populations were recruited and can therefore broaden the applicability of the findings; however the majority of the sampling occurred in the south west of England. According to the geographical distribution of rocky shores, this is appropriate as the south west has numerous rocky shores to visit (Figure 1.1) but future research may wish to apply this to a wider context, such as examining the impacts of rocky shores elsewhere in the UK as well as cross-culturally.

Overall, these findings suggest that rocky shores provide well-being and marine awareness benefits. However, future research could use other environments as a comparison. Study 4 did include other natural environments in order to embed the research in the broader literature and found that rocky shores were not perceived as positive as other classic beautiful natural environments. However, as the associated stimuli were not standardised in the same manner as the rocky shore scenes, some ambiguities remain. For example, rocky shores were compared to broader environmental categories taken from different visual perspectives. As the focus of this thesis was purely rocky shores, this comparative aspect was not of high interest but it is suggested that future research could compare rocky shores with other similarly precise habitats to be able to decipher the benefits that are unique to this coastal environment. This would also be able to help explain the well-being effects of litter. Noted above, it was suggested that engaging in a beach clean can increase the salience of rubbish in the environment thus reduces the restorativeness of the setting, but that the activity of collecting rubbish may be beneficial to well-being thus neutralises this effect. By conducting a similar design as Study 7 where activities are compared (e.g. a clean-up activity compared to a walk) but in multiple environments (e.g. a coastline, a park or city streets), it may be possible to distinguish the activity and environment effects further.

Even though this thesis set out to examine the impacts of recreational visits on habitat threat, well-being and marine awareness, environmental behaviours were also an important outcome. This was included in the final studies (Studies 6 & 7), finding that people's intention to engage in pro-environmental acts increased after visiting a rocky shore (regardless of the activity they undertook), supporting other studies that have shown similar impacts as a result of direct experiences with nature (e.g. Finger, 1994; Teisl & O'Brien, 2003). Studies have also started to examine the links between behaviour and

well-being and marine awareness (Fletcher & Potts, 2007; Hartig et al., 2007; Roth, 1992; Settar & Turner, 2010). For instance, it is typically assumed and often found that environmental awareness is positively linked with pro-environmental behaviours (Fletcher & Potts, 2007; Roth, 1992; Settar & Turner, 2010). Individuals who gain well-being benefits from natural environments have also been found to engage in more pro-environmental acts (Hartig et al., 2007). Consequently, to continue to develop this research, it is recommended that these relations are examined more explicitly. This would consequently complement the current thesis and overall approach, as recreational visits that can be beneficial to the visitor in terms of well-being and marine awareness may also have indirect beneficial impacts on the environment by encouraging more pro-environmental acts.

7.3 Practical Implications

Despite these methodological limitations, these findings can help inform relevant environmental management techniques, national policies, and be used to encourage stewardship programmes. As recreational visits were found to be beneficial for visitors, it could be advantageous for these visits to be encouraged further. Even though visiting the coast is already a popular excursion (Natural England, 2013), encouraging more people to visit could extend these findings further, improving individuals' well-being and marine awareness, and as found in the last studies, can promote more pro-environmental behaviours. However, as this thesis highlights, these visits can result in potential health threats to the environment. Consequently, recreational visits need to be managed and regulated accordingly to minimise those negative impacts but to sustain the positive impacts on the visitors. As the earlier studies (1 & 2) highlighted the most troublesome activities, this can help prioritise management (e.g. focusing on rock pooling, fishing and crabbing). Optimistically, as beach cleaning and sustainable rock pooling were both found to have similar (if not additional) benefits on the visitor but reduced the impacts on the environment, these particular activities should be encouraged. For instance, by stressing that beach cleans are good for *both* the environment and the volunteer, this

could encourage more people to participate, attracting both people with a more ecocentric view (for the good of nature) and also the anthropogenic view (for human gain).

7.4 Conclusion

The overarching research question in this thesis was: What are the risks to the environment and benefits to the individual associated with recreational visits to rocky shores? Seven studies investigated this question, using a range of methods and samples. Empirically, it was found that recreational visits to this environment can provide well-being and marine awareness benefits to its visitor, but that these visits are associated with potentially harmful impacts to the environment. Marine litter, especially, was found to have the potential to interrupt the psychological benefits of visiting rocky shores. Positively though, as demonstrated in the last two studies, when the most prominent recreational-related threats are minimised (e.g. via a beach clean), both the environment and the individuals can experience positive outcomes. In addition to these empirical discoveries, this thesis also highlights the valuable contribution integrative research can provide. This relatively novel approach of combining Psychology with Marine Biology provided a unique perspective applied to a particular environment. By examining the two together simultaneously, this broader more applied approach can help to prioritise both the risks and benefits associated with this environment, which can then potentially assist the management of this biologically rich coastal environment.

References

- Addison, P. F. E., Koss, R. S., & O'Hara, T. D. (2008). Recreational use of a rocky intertidal reef in Victoria: Implications for ecological research and management. *Australasian Journal of Environmental Management*, 15 (3), 169-179.
- Adelman, L. M., Falk, J. H., & James, S. (2000). Impact of National Aquarium in Baltimore on visitors' conservation attitudes, behavior, and knowledge. *Curator: The Museum Journal*, 43, 33–60.
- Ajzen, I. (1985). From intentions to actions: A theory of planned behaviour. In J. Kuhl & J. Beckmann (Eds.) *Action Control: From Cognition to Behavior* (pp. 11–39). Heidelberg, Germany: Springer.
- Alessa, L., Bennett, S. M., & Kliskey, A. D. (2003). Effects of knowledge, personal attribution and perception of ecosystem health on depreciative behaviors in the intertidal zone of Pacific Rim National Park and Reserve. *Journal of Environmental Management*, 68 (2), 207-218.
- Andrady, A. L. (2011). Microplastics in the marine environment. *Marine Pollution Bulletin*, 62, 1596-1605.
- Appleton, J. (1975). *The Experience of Landscape*. London, UK: Wiley.
- 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.

- 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.
- Ballantyne, R., & Packer, J. (2002). Nature-based excursions: School students' perceptions of learning in natural environments. *International Research in Geographical and Environmental Education*, 11 (3), 218-236.
- Ballantyne, R., Packer, J., Hughes, K., & Dierking, L. (2007). Conservation learning in wildlife tourism settings: Lessons from research in zoos and aquariums. *Environmental Education Research*, 13 (3), 367-383.
- Bamberg, S. & Schmidt, P. (2003). Incentives, mortality, or habit? Predicting students' car use for university routes with the models of Ajzen, Schwartz and Triandis. *Environment and Behavior*, 35 (2), 264-285.
- Barnes, R. S. K., & Hughes, R. N. (1999). *An Introduction to Marine Ecology*. Oxford, UK: Blackwell Science.
- Barton, J., & Pretty, J. (2010). What is the best dose of nature and green exercise for improving mental health? A multi-study analysis. *Environmental Science & Technology*, 44 (10), 3947-3955.
- Bauman, A., Smith, B., Stoker, L., Bellew, B., & Booth, M. (1999). Geographical influences upon physical activity participation: evidence of a 'coastal effect'. *Australian and New Zealand Journal of Public Health*, 23 (3), 322-324.
- Beauchamp, K. A., & Gowing, M. M. (1982). A quantitative assessment of human trampling effects on a rocky intertidal community. *Marine Environmental Research*, 7 (4), 279-293.

- Bellan, G. L., & Bellan-Santini, D. R. (2001). A review of littoral tourism, sport and leisure activities: Consequences on marine flora and fauna. *Aquatic Conservation: Marine and Freshwater Ecosystems*, *11*, 325-333.
- Berman, M. G., Jonides, J., & Kaplan, S. (2008). The cognitive benefits of interacting with nature. *Psychological Science*, *19* (12), 1207-1212.
- Berto, R. (2005). Exposure to restorative environments helps restore attentional capacity. *Journal of Environmental Psychology*, *25*, 249-259.
- Beukeboom, C. J., Langeveld, D., & Tanja-Dijkstra, K. (2012). Stress-reducing effects of real and artificial nature in a hospital waiting room. *The Journal of Alternative and Complementary Medicine*, *18* (4), 329-333.
- 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.
- Bogner, F. (1998). The influence of short-term outdoor ecology education on long-term variables of environmental perspective. *Journal of Environmental Education*, *29* (4), 17-29
- Boomsma, C. (2013). *Visual Images as a Motivational Bridge to Pro-Environmental Behaviour: A Cognitive Approach* (Doctoral thesis). Plymouth, UK: Plymouth University. Retrieved from <http://pearl.plymouth.ac.uk/handle/10026.1/1546?show=full>
- Borgonovi, F. (2008). Doing well by doing good. The relationship between formal volunteering and self-reported health and happiness. *Social Science & Medicine*, *66*, 2321-2334.

- Bowler, P. A., Kaiser, F. G., & Hartig, T. (1999). A role for ecological restoration work in university environmental education. *The Journal of Environmental Education*, 30 (4), 19-26.
- Bradburn, N.M. (1969). *The structure of psychological well-being*. Chicago: Aldine.
- Branch, G. M., Thompson, R. C., Crowe, T. P., Castilla, J. C., Langmead, O., & Hawkins, S. J. (2008). Rocky intertidal shores: Prognosis for the future. In N. V. C. Polunin (Ed.) *Aquatic Ecosystems: Trends and Global Prospects*. (pp. 209-225). Cambridge, UK: Cambridge University Press.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3, 77-101
- Bravo, M., Gallardo, M. A., Luna-Jorquera, G., Núñez, P., Vásquez, N., & Thiel, M. (2009). Anthropogenic debris on beaches in the SE Pacific (Chile): Results from a national survey supported by volunteers. *Marine Pollution Bulletin*, 58 (11), 1718-1726.
- Brosnan, D. M., & Crumrine, L. L. (1994). Effects of human trampling on marine rocky shore communities. *Journal of Experimental Marine Biology and Ecology*, 177 (1), 79-97.
- Campbell, A., Converse, P. E., & Rodgers, W. L. (1976). *The quality of American life*. New York, USA: Russell Sage Foundation.
- Castilla, J. C. & Duran, L. R. (1985). Human exclusion from the rocky intertidal zone of Central Chile - the effects on *Concholepas concholepas* (Gastropoda). *Oikos*, 45, 391-399.

- Centers for Disease Control and Prevention (1996). *Physical Activity and Health. A Report of the Surgeon General*. Washington, DC: CDC.
- Chalquist, C. (2009). A look at the ecotherapy research evidence. *Ecopsychology, 1* (2), 1-11.
- Cimprich, B. (1993). Development of an intervention to restore attention in cancer patients. *Cancer Nursing, 16* (2), 83-92.
- Clamer (2011). Report on European public awareness and perception of marine climate change risks and impacts. Retrieved July 23, 2013 from <http://clamer.eu/awareness>.
- Clarke, A. (1996). The influence of climate change on the distribution and evolution of organisms. In I. A. Johnston & A. F. Bennett (Eds.) *Animals and Temperature: Phenotypic and Evolutionary Adaptation, Society for Experimental Biology Seminar Series 59* (pp. 377–407). Cambridge, UK: Cambridge University Press.
- Clarke, R. N., Hendee, J. C., & Campbell, F. L. (1971). Values, behavior, and conflict in modern camping culture. *Journal of Leisure Research, 3*, 143-159.
- Cohen, J. (1992). A power primer. *Psychological Bulletin, 112* (1), 155-159.
- Connor, D. W., Allen, J. H., Golding, N., Howell, K. L., Lieberknecht, L. M., Northen, K. O., & Reker, J. B. (2004). The Marine Habitat Classification for Britain and Ireland Version 04.05. Peterborough, UK: JNCC. Retrieved from: http://jncc.defra.gov.uk/pdf/04_05_introduction.pdf
- 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*, 303-313.

- Coombes, E. G., Jones, A. P., & Hillsdon, M. (2010). The relationship of physical activity and overweight to objectively measured green space accessibility and use. *Social Science & Medicine*, 70, 816-822.
- Coombes, E. G., Jones, A. P., Bateman, I. J., Tratalos, J. A., Gill, J. A., Showler, D. A., ... Sutherland, W. J. (2009). Spatial and temporal modelling of beach use: A case study of East Anglia, UK. *Coastal Management*, 37, 94-115.
- Cummins, S., & Snively, G. (2000). The Effect of instruction on children's knowledge of marine ecology, attitudes toward the ocean, and stances toward marine resource issues. *Canadian Journal of Environmental Education*, 5 (1), 305-324.
- Cunningham, D., & Snowden, E. (2006). *MCS Beachwatch 2007 Questionnaire Analysis* [unpublished data, available from E. Snowden]
- Dallimer, M., Irvine, K. N., Skinner, A. M. J., Davies, Z. G., Rouquette, J. R., Maltby, L., ... Gaston, K. J. (2012). Biodiversity and the feel-good factor: Understanding associations between self-reported human well-being and species richness. *Bioscience*, 62 (1), 47-55.
- Davenport, J. & Davenport, J. L. (2006). The impact of tourism and personal leisure transport on coastal environments: A review. *Estuarine, Coastal and Shelf Science*, 67 (1-2), 280-292.
- De Kort, Y. A. W., Meijnders, A. L., Sponselee, A. M., & Ijsselsteijn, W. A. (2006). What's wrong with virtual trees? Restoring from stress in a mediated environment. *Journal of Environmental Psychology*, 26 (4), 309-320.
- Department for Environment, Foods and Rural Affairs (2009). The marine environment and fisheries. Retrieved August 15, 2009 from <http://www.defra.gov.uk/marine/index.htm>

- Department of Health (2004). *At least five a week: Evidence on the impact of physical activity and its relationship to health. A report from the Chief Medical Officer.* London, UK: Department of Health
- De Vries, S., van Dillen, S. M. E., Groenewegen, P. P., & Spreeuwenberg, P. (2013). Streetscape greenery and health: Stress, social cohesion and physical activity as mediators. *Social Science & Medicine, 94*, 26-33.
- Diette, G. B., Lechtzin, N., Haponik, E., Devrotes, A., & Rubin, H. R. (2003). Distraction therapy with nature sights and sounds reduces pain during flexible bronchoscopy. *Chest Journal, 123* (3), 941-948.
- Dillon, J., Rickinson, M., Teamey, K., Morris, M., Choi, M., Sanders, D., & Benefield, P. (2006). The value of outdoor learning: Evidence from research in the UK and elsewhere. *School Science Review, 87* (320), 106-110.
- Dolan, P., & White, M. P. (2008). How can measures of subjective well-being be used to inform public policy? *Perspectives on Psychological Science, 2* (1), 71-85.
- Dolan, P., Peasgood, T., & White, M. (2008). Do we really know what makes us happy? A review of the economic literature on the factors associated with subjective well-being. *Journal of Economic Psychology, 29*, 94-122.
- Duerden, M. D., & Witt, P. A. (2010). The impact of direct and indirect experiences on the development of environmental knowledge, attitudes, and behavior. *Journal of Environmental Psychology, 30*, 379-392.
- Edginton, B. (1997) Moral architecture: The influence of the York retreat on asylum design. *Health Place, 3*, 91-99.

- Ekkekakis, P., Hall, E. E., Van Landuyt, L. M., Petruzzello, S. J. (2000). Walking in (affective) circles: Can short walks enhance affect? *Journal of Behavioral Medicine*, 23 (3), 245-275.
- EU (2011). EU maritime policy: facts and figures – United Kingdom. Retrieved May 20, 2011 from http://ec.europa.eu/maritimeaffairs/pdf/country_factsheets/uk_en.pdf
- Evans, C., Abrams, E., Reitsma, R., Roux, K., Salmonsens, L., & Marra, P. P. (2005). The Neighborhood Nestwatch Program: Participant outcomes of a citizen-science ecological research project. *Conservation Biology*, 19 (3), 589-594.
- Falk, J. H., & Adelman, L. M. (2003). Investigating the impact of prior knowledge and interest on aquarium visitor learning. *Journal of Research in Science Teaching*, 40, 163–176.
- Falk, J. H., & Dierking, L. D. (1997). School field trips: Assessing their long-term impact. *Curator: The Museum Journal*, 40 (3), 211-218.
- Falk, J. H., & Dierking, L. D. (2002). *Lessons Without Limit: How Free-Choice Learning is Transforming Education*. Walnut Creek, USA: AltaMira Press.
- Falk, J. H., Reinhard, E. M., Vernon, C. L., Bronnenkant, K., Heimlich, J. E., & Deans, N. L. (2007). *Why zoos and aquariums matter: Assessing the impact of a visit to a zoo or aquarium*. Silver Spring, USA: Association of Zoos and Aquariums.
- Felsten, G. (2009). Where to take a study break on the college campus: an attention restoration theory perspective. *Journal of Environmental Psychology*, 29, 160-167.

- Ferreira, M. N., & Rosso, S. (2009). Effects of human trampling on a rocky shore fauna on the Sao Paulo coast, Southeastern Brazil. *Brazil Journal of Biology*, 69 (4), 993-999.
- Field, A. (2005). *Discovering Statistics Using SPSS*. London, UK: Sage Publications Ltd.
- Finger, M. (1994). From knowledge to action? Exploring the relationship between environmental experiences, learning and behavior. *Journal of Social Issues*, 50, 141–160.
- Fitzpatrick, S., and Bouchez, B. (1998). Effects of recreational disturbance on the foraging behaviour of waders on a rocky beach. *Bird Study*, 45, 157-171.
- Fletcher, H. & Frid, C. L. J. (1996). Impact and management of visitor pressure on rocky intertidal algal communities. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 6, 287-297.
- Fletcher, S., & Potts, J. (2007). Ocean citizenship: An emergent geographical concept. *Coastal Management*, 35, 511–524.
- Fletcher, S., Potts, J. S., Heeps, C., & Pike, K. (2009). Public awareness of marine environmental issues in the UK. *Marine Policy*, 33, 370-375.
- Fletcher, S., Saunders, J., Herbert, R., Roberts, C. & Dawson, K. (2012). *Marine Ecosystem Services: Description of the ecosystem services provided by broad-scale habitats and features of conservation importance that are likely to be protected by Marine Protected Areas in the Marine Conservation Zone Project area*. Sheffield, UK: Natural England Commissioned Reports
- Fortescue Fox., R. (1934). Convalescence on the coast. *The Lancet*, 224 (5785), 115-116.

- Fry, H., Ketteridge, S., & Marshall, S. (2003) Understanding student learning. In H. Fry, S. Ketteridge & S. Marshall (Eds.) *A handbook for teaching and learning in higher education*, 2nd edition. (pp. 9-25). London, UK: Kogan Page.
- Fuller, R. A., Irvine, K. N., Devine-Wright, P., Warren, P. H., & Gaston, K. J. (2007). Psychological benefits of greenspace increase with biodiversity. *Biology Letters*, 3, 390-394.
- Galgani, F., Fleet, D., Van Franeker, J., Katsanevakis, S., Maes, T., Mouat, J., ... Janssen, C. (2010). *Marine Strategy Framework Directive: Task Group 10 Report Marine Litter*. Luxembourg: Office for Official Publications of the European Communities.
- Gelso, B. R., & Peterson, J. M. (2005). The influence of ethical attitudes on the demand for environmental recreation: incorporating lexicographic preferences. *Ecological Economics*. 53, 35–45.
- Google Maps. (2013). [Mount Batten, Plymouth] [Street map]. Retrieved from <https://maps.google.co.uk/>
- Grese, R. E., Kaplan, R., Ryan, R. L., & Buxton, J. (2000). Psychological benefits of volunteering in stewardship programs. In P. H. Gobster & R. B. Hull (Eds.) *Restoring Nature: Perspectives from the Social Sciences and Humanities* (pp. 265-280). Washington, DC: Island Press.
- Hall, K. (2000). *Impacts of marine debris and oil: economic & social costs to coastal communities*. Shetland: Kommunenes Internasjonale Miljøorganisasjon.
- Han, K. T. (2010). An exploration of relationships among the responses to natural scenes: scenic beauty, preference and restoration. *Environment and Behavior*, 42 (25), 243-270.

- Hansmann, R., Hug, S-M., & Seeland, K. (2007). Restoration and stress relief through physical activities in forests and parks. *Urban Forestry & Urban Planning*, 6, 213-225.
- Hartig, T., Evans, G. W., Jamner, L. D., Davis, D. S., & Gärling, T. (2003). Tracking restoration in natural and urban field settings. *Journal of Environmental Psychology*, 23 (2), 109-123.
- Hartig, T., Kaiser, F. G., & Bowler, P. A. (2001). Psychological restoration in nature as a positive motivation for ecological behavior. *Environment and Behavior*, 33 (4), 590-607.
- Hartig, T., Kaiser, F. G., & Strumse, E. (2007). Psychological restoration in nature as a source of motivation for ecological behaviour. *Environmental Conservation*, 34 (4), 291-299.
- Hartig, T., Korpela, K., Evans, G. W., & Gärling, T. (1997). A measure of restorative quality in environments. *Scandinavian Housing and Planning Research*, 14, 175-194.
- Hartig, T., Mang, M., & Evans, G. W. (1991). Restorative effects of natural environment experiences. *Environment and Behavior*, 23 (1), 3-26.
- Hartig, T., Van den Berg, A. E., Hagerhall, C. M., Tomalak, M., Bauer, N., Hansmann, ... Waaseth, G. (2010). Health benefits of nature experience: Psychological, social and cultural processes. In K. Nilsson, M. Sangster, C. Gallis, T. Hartig, S. De Vries, K. Seeland, and J. Schipperijn (Eds.) *Forest, trees and human health*. (pp. 127-167). Dordrecht, Netherlands: Springer Science Business and Media.
- Hawkins, S. J., & Jones, H. D. (1992). *Rocky Shores*. California, USA: IMMEL Publishing.

- Hawthorne, M., & Alabaster, T. (1999). Citizen 2000: development of a model of environmental citizenship. *Global Environmental Change, 9*, 25-43.
- Herzog, T. R. (1985). A cognitive analysis of preference for waterscapes. *Journal of Environmental Psychology, 5* (3), 225-241.
- Herzog, T. R., & Barnes, G. J. (1999). Tranquility and preference revisited. *Journal of Environmental Psychology, 19*, 171–181.
- Herzog, T. R., Chen, H. C., & Primeau, J. S. (2002). Perception of the restorative potential of natural and other settings. *Journal of Environmental Psychology, 22* (3), 295-306.
- Hidalgo-Ruz, V., & Thiel, M. (2013). Distribution and abundance of small plastic debris on beaches in the SE Pacific (Chile): A study supported by a citizen science project. *Marine Environmental Research, 87-88*, 12-18.
- Hinds, J., & Sparks, P. (2008). Engaging with the natural environment: The role of affective connection and identity. *Journal of Environmental Psychology, 28*, 109-120.
- 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.
- Hiscock, K., & Smirthwaite, J. (2004). Marine Life Topic Note: Marine Biodiversity. Plymouth, UK: Marine Biological Association of the United Kingdom. Retrieved from: http://www.marlin.ac.uk/PDF/MLTN_biodiversity.pdf

- Howell, A. J., Dopko, R. L., Passmore, H. & Buro, K. (2011). Nature connectedness: Associations with well-being and mindfulness. *Personality and Individual Differences, 51*, 166-171.
- Hubbard, H. V., & Kimball, T. (1967) *An Introduction to the Study of Landscape Design*. Boston, USA: Hubbard Educational Trust.
- Humpel, N., Owen, N., Iversen, D., Leslie, E., & Bauman, A. (2004). Perceived environment attributes, residential location, and walking for particular purposes. *American Journal of Preventative Medicine, 26* (2), 119-125.
- Jahncke, H., Hygge, S., Halin, N., Green, A. M., & Dimberg, K (2011). Open-plan office noise: Cognitive performance and restoration. *Journal of Environmental Psychology, 31* (4), 373-382.
- Johansson, M., Hartig, T., & Staats, H. (2011). Psychological benefits of walking: Moderation by company and outdoor environment. *Applied Psychology: Health and Well-being, 3* (3), 261-280.
- Joint Nature Conservation Committee [JNCC] (2013). Littoral rock (and other hard substrata). Retrieved November 6, 2010 from <http://jncc.defra.gov.uk/marine/biotopes/biotope.aspx?biotope=JNCCMNCR00000003>
- Kahneman, D., Krueger, A. B., Schkade, D. A., Schwarz, N., & Stone, A. A. (2004). A survey method for characterizing daily life experience: The Day Reconstruction Method (DRM). *Science, 306*, 1776–1780.
- Kaplan, S. (1995). The restorative benefits of nature: toward an integrative framework. *Journal of Environmental Psychology, 15*, 169-182.

- Kellert, S. R. (2002). Experiencing nature: Affective, cognitive, and evaluative development in children. In P. H. Kahn & S. R. Kellert (Eds.) *Children and Nature: Psychological, Sociocultural, and Evolutionary Investigations* (pp. 117-151). London, UK: The MIT Press
- Kennedy, J. F. (1962, September). *America's Cup Speech*. Speech presented at the American Cup Dinner, Newport, Rhode Island, USA. Retrieved October 10, 2013 from <http://home.comcast.net/~ceoverfield/sea.html>
- Keough, M. J., & Quinn, G. P. (1998). Effects of periodic disturbances from trampling on rocky intertidal algal beds. *Ecological Applications*, 8, 141–161.
- Kershaw, P., Katsuhiko, S., Lee, S., Leemseth, J. & Woodring, D. (2011). *Plastic debris in the ocean*. In UNEP year book: emerging issues in our environment. Nairobi, Kenya: UNEP.
- Kildow, J. T. (2007). The influence of coastal preservation and restoration on coastal real estate values. In L. H. Pendleton (Ed.) *The Economic and Market Value of Coasts and Estuaries: What's At Stake?* (pp. 116-139). Arlington, USA: Restore America's Estuaries.
- Kingsford, M. J., Underwood, A. J., & Kennelly, S. J. (1991). Humans as predators on rocky reefs in New South Wales, Australia. *Marine Ecology Progress Series*, 72, 1-14.
- Knopf, R. C., Peterson, G. L., & Leatherberry, E. C. (1983). Motives fo recreational river floating: Relative consistency across settings. *Leisure Sciences*, 5, 231-255.
- Knopf, R. C. (1987). Human behavior, cognition, and affect in the natural environment. In D. Stokols, & I. Altman (Eds.) *Handbook of Environmental Psychology* (pp. 783-825). New York, USA: Wiley.

- Kordella, S., Geraga, M., Papatheodorou, G., Fakiris, E., & Mitropoulou, M. (2013). Litter composition and source contribution for 80 beaches in Greece, Eastern Mediterranean: A nationwide voluntary clean-up campaign. *Aquatic Ecosystem Health & Management*, *16* (1), 111-118.
- Korpela, K. M., Klemettilä, T., & Heitanen, J. K. (2002). Evidence for rapid affective evaluation of environmental scenes. *Environment and Behavior*, *34* (5), 634-650.
- Korpela, K. M., Ylén, M., Tyrväinen, L., & Silvennoinen, H. (2010). Favorite green, waterside and urban environments, restorative experiences and perceived health in Finland. *Health Promotion International*, *25* (2), 200-209.
- Koss, R. S., & Kingsley, J. Y. (2010). Volunteer health and emotional wellbeing in marine protected areas. *Ocean & Coastal Management*, *53*, 447-453.
- Laist, D. (1997). Impacts of marine debris: Entanglement of marine life in marine debris, including a comprehensive list of species with entanglement and ingestion records (pp.99-139). In J. Coe & D. B. Rodgers (Eds.) *Marine Debris: Sources, Impacts and Solutions*. Miami, USA: Springer Series for Environmental Management 1997.
- Landis, J. R. & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics*, *35*, 159-174.
- Lange, E. & Schaeffer, P. V. (2001) A comment on the market value of a room with a view. *Landscape and Urban Planning*, *55*, 113–120.
- Laumann, K., Gärling, T., & Stormark, K. M. (2001). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology*, *21* (1), 31-44.

- Laumann, K., Gärling, T., & Stormark, K. M. (2003). Selective attention and heart rate responses to natural and urban environments. *Journal of Environmental Psychology, 23*, 125-134.
- Levinton, J. S. (2009). *Marine biology: function, biodiversity, ecology*. New York, USA: Oxford University Press.
- Lewis, J. R. (1964) *The Ecology of Rocky Shores*. London, UK: English Universities Press.
- Lindberg, D. R., Estes, J. A., & Warheit, K. I. (1998). Human influences on trophic cascades along rocky shores. *Ecological Applications, 8* (3), 880-890.
- Lindemann-Matthies, P., Junge, X., & Matthies, D. (2010). The influence of plant diversity on people's perception and aesthetic appreciation of grassland vegetation. *Biological Conservation, 143* (1), 195-202.
- Luttik, J. (2000). The value of trees, water and open space as reflected by house prices in the Netherlands. *Landscape and Urban Planning, 48*, 161-167.
- Marine Biological Association (2012). The Shore Thing. Retrieved July 20, 2012 from http://www.mba.ac.uk/shore_thing/index.htm
- Marine Conservation Society [MCS] (2011). Beachwatch big weekend: 2011 summary report results. Retrieved August 20, 2012 from http://www.mcsuk.org/downloads/pollution/beachwatch/latest2012/Beachwatch_Summary_Report%2012.pdf
- Marine Conservation Society [MCS] (2012a). Beachwatch big weekend: 2012 summary report results. Retrieved July 6, 2013 from

http://www.mcsuk.org/downloads/pollution/beachwatch/2012/Beachwatch_summary_2012_lowres.pdf

Marine Conservation Society [MCS] (2012b). Beachwatch Organiser Guide. Retrieved August 14, 2012 from <http://www.mcsuk.org/beachwatch/>

Marine Conservation Society [MCS] (2014). Good Beach Guide: because clean seas mean great beaches. Retrieved May 8, 2014 from www.goodbeachguide.co.uk/

MarLIN (2009). Wembury Bioblitz 2009. Retrieved February 14, 2010 from <http://www.marlin.ac.uk/bioblitz-wembury/>

MarLIN (2011). Effects of Marine Activities and Natural Events. Retrieved January 29, 2011 from <http://www.marlin.ac.uk/marinenaturaleffects.php>

Mass, J., Verheij, R. A., De Vries, S., Spreeuwenberg, P., Schellevis, F. G., & Groenewegen, P. P. (2009). Morbidity is related to a green living environment. *Journal of Epidemiology & Community Health, 63*, 967-973.

Matlin, M. W (2005). *Cognition*. Pennsylvania, USA: John Wiley & Sons, Inc.

Mayer, F. S. & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology, 24*, 503-515.

Mayer, F. S., Frantz, C. P., Bruehlman-Senecal, E., & Dolliver, K. (2009). Why is nature beneficial? The role of connectedness to nature. *Environment and Behaviour, 41* (5), 607-643.

- McKinley, E., & Fletcher, S. (2010). Individual responsibility for the oceans? An evaluation of marine citizenship by UK marine practitioners. *Ocean & Coastal Management, 53*, 379-384.
- Measham, T. G., & Barnett, G. B. (2008). Environmental volunteering: motivations, modes and outcomes. *Australian Geographer, 39* (4), 537-552.
- Meier, S., & Stutzer, A. (2008). Is volunteering rewarding in itself? *Economica, 75*, 39-59.
- Melville, H. (2001). *Moby Dick*. London, UK: Norton.
- Miller, A. C., Hickman, L. C., & Lemasters, G. K. (1992). A distraction technique for control of burn pain. *Journal of Burn Care and Rehabilitation, 13*, 576-580.
- Millward, L. J. (1995). Focus Groups. In G. M. Breakwell, S. Hammond & C. Fife-Shaw (Eds.). *Research Methods in Psychology* (pp. 274-292). London, UK: Sage Publications
- Mitchell, R., & Popham, F. (2008). Effect of exposure to natural environment on health inequalities: an observational population study. *The Lancet, 372*, 1655-1660.
- Mitten, D. (2009). *The healing power of nature: the need for nature for human health, development, and wellbeing*. Retrieved June 14, 2012 from <http://norwegianjournaloffriluftsliv.com/doc/122010.pdf>
- Monroe, C., Lau, A., Schubel, J., & Cassano, E. (2006). *Public ocean literacy: Making ocean science understandable*. Long Beach, USA: MCRI Aquatic Forum Report Reference.

- Morgan, R. (1999). Preferences and priorities of recreational beach users in Wales, UK. *Journal of Coastal Research*, 15 (3), 653-667.
- Moschella, P. S., Abbiati, M., Åberg, P., Airoidi, L., Anderson, J. M., Bacchiocchi, F., ... Hawkins, S. J. (2005). Low-crested coastal defence structures as artificial habitats for marine life: Using ecological criteria for design. *Coastal Engineering*, 52 (10-11), 1053-1071.
- Mouat, T., Lopez-Lozano, R. & Bateson, H. (2010). *Economic impacts of Marine litter*. Shetland: Kommunenes Internasjonale Miljøorganisasjon.
- Nanda, U., Eisen, S. L., & Baladandayuthapani, V. (2008). Undertaking an art survey to compare patient versus student art preferences. *Environment and Behavior*, 40 (2), 269-301.
- Natural England. (2010). Monitor of engagement with the natural environment: the national survey on people and the natural environment. Annual report from the 2009-10 survey. Retrieved January 15, 2011 from <http://publications.naturalengland.org.uk/publication/40014>
- Natural England. (2013). Monitor of engagement with the natural environment: the national survey on people and the natural environment. Annual report from the 2012-13 survey. Retrieved October 7, 2013 from <http://publications.naturalengland.org.uk/publication/5331309618528256?category=47018>
- Newsome, D., Moore, S. A., & Dowling, R. K. (2002). *Natural Area Tourism: Ecology, Impacts and Management*. Buffalo, USA: Channel View Publications.
- Nordh, H., Hartig, T., Hagerhall, C. M., & Fry, G. (2009). Components of small urban parks that predict the possibility for restoration. *Urban Forestry & Urban Greening*, 8 (4), 225-235.

- Oakley, J. (2010). *Seashore Safaris: Exploring rocky and sandy seashores with Judith Oakley*. Wales, UK: Graffeg.
- Ocean Project. (1999a). Communicating about Oceans: Results of a National Survey. Retrieved October 16, 2013 from http://www.cepatoolkit.org/html/resources/2A/2A176E57-D06A-4375-AC7A-3ED717392EA5/Communication%20oceans_final_report.pdf
- Ocean Project. (1999b). Questionnaire and topline results from a national poll regarding oceans. Retrieved October 16, 2013 from http://theoceanproject.org/wp-content/uploads/2012/1999/Poll_Questionnaire_1999.pdf
- Ocean Project. (2011). America and the Ocean Annual Update. Retrieved September 25, 2013 from <http://theoceanproject.org/reports>
- Ocean Project. (2012). America and the Ocean: Ocean acidification. Retrieved October 10, 2013 from http://theoceanproject.org/wp-content/uploads/2012/09/Special_Report_Summer_2012_Public_Awareness_of_Ocean_Acidification.pdf
- Outdoor Recreation Resources Review Commission (1982). *Participation in outdoor recreation: Factors affecting demand among American adults*. Washington, DC, USA: Government Printing Office
- Orians, G. H. (1980). Habitat selection: general theory and applications to human behavior. In J. S. Lockard (Ed) *The evolution of human social behavior* (pp 49–66). New York, USA: Elsevier.
- Packer, J., & Bond, N. (2010). Museums as restorative environments. *Curator: The Museum Journal*, 53 (4), 421-436.

- Pals, R., Steg, L., Siero, F. W., & van der Zee, K. I. (2009). Development of the PRCQ: A measure of perceived restorative characteristics of zoo attractions. *Journal of Environmental Psychology, 29*, 441-449.
- Park, B., Tsunetsugu, Y., Kasetani, T., Kagawa, T., & Miyazaki, Y. (2010). The physiological effects of Shinrin-yoku (taking in the forest atmosphere or forest bathing): Evidence from field experiments in 24 forests across Japan. *Environmental Health and Preventive Medicine, 15* (1), 18-26.
- Patrick, P. G., Matthews, C. E., Ayers, D. F., & Tunnicliffe, S. D. (2007). Conservation and education: Prominent themes in zoo mission statements. *The Journal of Environmental Education, 38* (3), 53-60.
- Pierce, R. C. (1980). Dimensions of leisure III: Characteristics. *Journal of Leisure Research, 12*, 273-284.
- Piliavin, J. A., & Siegl, E. (2007). Health benefits of volunteering in the Wisconsin longitudinal study. *Journal of Health and Social Behavior, 48*, 450-464.
- Pinn, E. H., & Rodgers, M. (2005). The influence of visitors on intertidal biodiversity. *Journal of the Marine Biology Association, 85*, 263-268.
- Porter, C., & Wescott, G. (2004). Recreational use of a marine protected area: Point Lonsdale, Victoria. *Australasian Journal of Environmental Management, 11* (3), 201-211
- Potts, T., O'Higgins, T., Mee, L., & Pita, C. (2011). Public perceptions of Europe's seas: A policy brief. (Publication no. EU FP7 KNOWSEAS Project). ISBN 0-9529089-3-X. Retrieved from: <http://www.lwec.org.uk/publications/public-perceptions-europes-seas-policy-brief>

- Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers*, 36 (4), 717-731.
- Prescott, R. C. (2006). An investigation into the impacts of recreational activities on intertidal assemblages at Westward Ho, Devon. *Earth and Environment*, 2, 211-252.
- Pretty, J., Peacock, J., Sellens, M., & Griffin, M. (2005). The mental and physical health outcomes of green exercise. *International Journal of Environmental Health Research*, 15 (5), 319-337.
- Priskin, J. (2003a). Physical impacts of four-wheel drive related tourism and recreation in a semi-arid, natural coastal environment. *Ocean & Coastal Management*, 46 (1-2), 127-155.
- Priskin, J. (2003b). Tourist perceptions of degradation caused by coastal nature-based recreation. *Environmental Management*, 32 (2), 189-204.
- Pugh, D., & Skinner, L. (2002). A new analysis of marine-related activities in the UK economy with supporting science and technology. IACMST Information Document No. 10. Retrieved from: http://www.oceannet.org/library/publications/documents/marine_related_activities.pdf
- Raanaas, R. K., Patil, G. G., & Hartig, T. (2012). Health benefits of a view of nature through the window: A quasi-experimental study of patients in a residential rehabilitation center. *Clinical Rehabilitation*, 26 (1), 21-32
- Raffaelli, D., & Hawkins, S. (1996). *Intertidal Ecology*. London, UK: Chapman & Hall.

- Ramberg, J. S., Rand, J., & Tomulonis, J. (2002). Mission, message, and visitors: How exhibit philosophy has evolved at the Monterey Bay Aquarium. *Curator: The Museum Journal*, 45, 302–320.
- Roe, J. (2008). *The Restorative Power of Natural and Built Environments* (Doctoral thesis). Edinburgh, UK: Heriot-Watt University. Retrieved from http://www.openspace.eca.ac.uk/pdf/JennyRoePhD_Final_March09-1.pdf
- Roehl, W. S., & Ditton, R. B. (1993). Impacts of the offshore marine industry on coastal tourism: The case of Padre Island National Seashore. *Coastal Management*, 21, 75-89.
- Roth, C. E. (1992). *Environment Literacy: Its Roots, Evolution and Directions in the 1990s*. Columbus, USA: ERIC Clearinghouse for Science, Mathematics, and Environmental Education.
- Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology*, 39 (6), 1161-1178.
- Ryan, R. L., Kaplan, R., & Grese, R. E. (2001). Predicting volunteer commitment in environmental stewardship programmes. *Journal of Environmental Planning and Management*, 44 (5), 629-648.
- Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: a review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology*, 52, 141-166.
- Ryan, R. M., Weinstein, N., Bernstein, J., Brown, K. W., Mistretta, L., & Gagné, M. (2010). Vitalising effects of being outdoors and in nature. *Journal of Environmental Psychology*, 30, 159-168.

- Ryff, C. D. (1989). Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *Journal of Personality and Social Psychology*, *57*, 1069–1081.
- Santos, I. R., Friedrich, A. C., Wallner-Kersanach, M., & Fillmann, G. (2005). Influence of socio-economic characteristics of beach users on litter generation. *Ocean and Coastal Management*, *48*, 742-752.
- Schafer, E. L. & Brush, R. O. (1977) How to measure preferences for photographs of natural scenes. *Landscape Planning*, *4*, 237–256.
- Schneider, S. M., Ellis, M., Coombs, W. T., Shonkwiler, E. L., & Folsom, L. C. (2003). Virtual reality intervention for older women with breast cancer. *CyberPsychology & behaviour*, *6* (3), 301-307
- Scopelliti, M., Carrus, G., Cini, F., Mastandrea, S., Ferrini, F., Laforteza, R., ... Semenzato, P. (2012). Biodiversity, perceived restorativeness, and benefits of nature: A study on the psychological processes and outcomes of on-site experiences in urban and peri-urban green areas in Italy. In S. Kabisch, A. Kunath, P. Schweizer-Ries, & A. Steinführer (Eds.) *Vulnerability, Risks, and Complexity: Impacts of Global Change on Human Habitats* (pp. 255-270). Göttingen, Germany: Hogrefe Publishing .
- Settar, C., & Turner, T. (2010). Coral reefs and residents of the U.S. Virgin Islands: A relationship of knowledge, outdoor activities and stewardship. *Revista de Biologia Tropical*, *58* (3), 197-212.
- Shackley, M. L. (1997). *Wildlife tourism*. Boston, USA: International Thomson Business Press.
- Sickler, J., & Fraser, J. (2009). Enjoyment in zoos. *Leisure Studies*, *28*, 313–331.

- Slovic, P. (1987). Perception of Risk. *Science*, 236 (4799), 280-285.
- Slovic, P., Fischhoff, B. & Lichtenstein, S. (1977). Behavioral Decision Theory. *Annual Review of Psychology*, 28, 1-39.
- Smallwood, C. B., Beckley, L. E., Moore, S. A. (2012). Influence of zoning and habitats on the spatial distribution of recreational activities in a multiple-use marine park. *Coastal Management*, 40, 381-400.
- Smith, J. R., Fong, P., & Amrose, R. F. (2008). The impacts of human visitation on mussel bed communities along the California coast: Are regulatory marine reserves effective in protecting these communities? *Environmental Management*, 41 (4), 599-612.
- Soanes, C., & Stevenson, A. (2006). *Concise Oxford English Dictionary*. Oxford, UK: Oxford University Press.
- Sons, J., & Wilson, J. (2012). Volunteer work and hedonic, eudemonic, and social well-being. *Sociological Forum*, 27 (3). 658-681.
- Southward, A. J., & Southward, E. C. (1978). Recolonization of rocky shores in Cornwall after use of toxic dispersants to clean up the *Torrey Canyon* spill. *Journal of the Fisheries Research Board of Canada*, 35 (5), 682-706.
- Staats, H., Kieviet, A., & Hartig, T. (2003). Where to recover from attentional fatigue: An expectancy-value analysis of environmental preference. *Journal of Environmental Psychology*, 23 (2), 147-157.
- Staats, H., Van Gemerden, E., & Hartig, T. (2010). Preference for restorative situations: interactive effects of attentional state, activity-in-environment and social context. *Leisure Sciences: An Interdisciplinary Journal*, 32 (5), 401-417.

- Stankey, G. H., & Manning, R. E. (1986). Carrying capacity of recreation settings. A *Literature Review: The President's Commission on Americans Outdoors*.
- Stankey, G. H., Cole, D. N., Lucas, R. C., Petersen, M. E., & Frissell, S. S. (1985). The limits of acceptable change (LAC) system for wilderness planning. *General Technical Report, Intermountain Forest and Range Experiment Station, USDA Forest Service*, (INT-176).
- Steel, B. S., Lovrich, N., Lach, D., & Fomenko, V. (2005). Correlates and consequences of public knowledge concerning ocean fisheries management. *Coastal Management*, 33, 37-51.
- Steel, B. S., Smith, C., Opsommer, L., Curiel, S., & Warner-Steel, R. (2005). Public ocean literacy in the United States. *Ocean & Coastal Management*, 48 (2), 97-114.
- Steg, L., Van den Berg, A. E., & De Groot, J. I. M. (2013) *Environmental Psychology: An Introduction*. Chichester, UK: John Wiley & Sons Ltd
- Tarrant, M. A. (1996). Attending to past outdoor recreation experiences: Symptom reporting and changes in affect. *Journal of Leisure Research*, 28 (1), 1-17.
- Teisl, M. F., & O'Brien, K. (2003). Who cares and who acts? Outdoor recreationists exhibit different levels of environmental concern and behavior. *Environment and Behavior*, 35, 506-522.
- Tennessen, C., & Cimprich, G. (1995). Views to nature: Effects on attention. *Journal of Environmental Psychology*, 15, 77-85.
- Thøgersen, J. & Ölander, F. (2003). Spillover of environment-friendly consumer behaviour. *Journal of Environmental Psychology*, 23, 225-236.

- Thoits, P. A., & Hewitt, L. N. (2001). Volunteer work and well-being. *Journal of Health and Social Behavior*, 42 (2), 115-131.
- Thompson, R. C., Crowe, T. P., & Hawkins, S. J. (2002). Rocky intertidal communities: Past environmental changes, present status and predictions for the next 25 years. *Environmental Conservation*, 29 (2), 168-191.
- Thompson, R. C., Moore, C., vom Saal, F. S. & Swan, S. H. (2009) Plastics, the environment and human health: current consensus and future trends. *Philosophical Transactions of the Royal Society B* 364, 2153-2166
- Thompson Coon, J., Boddy, K., Stein, K., Whear, R., Barton, J., & Depledge, M. H. (2011). Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors? A systematic review. *Environmental Science & Technology*, 45 (5), 1761-1772.
- Tinio, P. P. L., & Leder, H. (2009). Natural scenes are indeed preferred, but image quality might have the last word. *Psychology of Aesthetics, Creativity, and the Arts*, 3 (1), 52-56.
- Tudor, D. T. & Williams, A. T. (2003). Public perception and opinion of visible beach aesthetic pollution: The utilisation of photography. *Journal of Coastal Research*, 19 (4), 1104-1115.
- Tudor, D. T., & Williams, A. T. (2006). A rationale for beach selection by the public on the coast of Wales, UK. *Area*, 38 (2), 153-164.
- Tudor, D. T., & Williams, A. T. (2008). Important aspects of beach pollution to managers: Wales and the Bristol Channel, UK. *Journal of Coastal Research*, 24 (3), 735-745.

- UK CEED (2000). A Review of the Effects of Recreational Interactions within UK European Marine sites. Wales, UK: Countryside Council for Wales. Retrieved from: http://www.ukmarinesac.org.uk/pdfs/recreation_report.pdf
- UK National Ecosystem Assessment [NEA] (2011). The UK National Ecosystem Assessment Technical Report. Cambridge, UK: UNEP-WCMC. Retrieved from: <http://uknea.unep-wcmc.org/Resources/tabid/82/Default.aspx>
- Ulrich, R. S. (1979). Visual landscapes and psychological well-being. *Landscape Research*, 4 (1), 17-23.
- Ulrich, R. S. (1983). Aesthetic and affective response to natural environment. In I. Altman & J. F. Wohlwill (Eds.) *Behavior and the Natural Environment* (pp. 85-125). New York, USA: Plenum Press.
- Ulrich, R. S. (1984). View through a window may influence recovery from surgery. *Science*, 224, 420-421.
- Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology*, 11, 201-230.
- Uneputty, P., Evans, S. M., & Suyoso, E. (1998). The effectiveness of a community education programme in reducing litter pollution on shores of Ambon Bay (eastern Indonesia). *Journal of Biological Education*, 32 (2), 143-147.
- Valtchanov, D., Barton, K. R., & Ellard, C. (2010). Restorative effects of virtual nature settings. *CyberPsychology, Behavior and Social Networking*, 13 (5), 503-512.

- Van den Berg, A. E., Hartig, T., & Staats, H. (2007). Preference for nature in urbanized societies: Stress, restoration, and the pursuit of sustainability. *Journal of Social Issues, 63* (1), 79-96.
- Van den Berg, A. E., Joye, Y., & De Vries, S. (2013). Health benefits of nature. In L. Steg, A. E. Van den Berg & J. I. M. De Groot (Eds) *Environmental Psychology: An Introduction*. (pp. 47-56). Chichester, UK: John Wiley & Sons Ltd.
- Van den Berg, A. E., Koole, S. L., van der Wulp, N. Y. (2003). Environmental preference and restoration: (How) are they related? *Journal of Environmental Psychology, 23*, 135-146.
- Van Franeker, J. A., Blaize, C., Danielsen, J., Fairclough, K., Gollan, J., Guse, N., ... Turner, D. M. (2011). Monitoring plastic ingestion by the northern fulmar *Fulmarus glacialis* in the North Sea. *Environmental Pollution, 159*, 2609-2615.
- Vaz, B., Williams, A. T., Silva, C. P. D., & Phillips, M. (2009). The importance of user's perception for beach management. *Journal of Coastal Research, 56*, 1164-1168.
- Vlek, C. A. J. (1996). A multi-level, multi-stage and multi-attribute perspective on risk assessment, decision-making and risk control. *Risk Decision and Policy, 1*, 9-31.
- Von Lindern, E., Bauer, N., Frick, J., Hunziker, M., & Hartig, T. (2013). Occupational engagement as a constraint on restoration during leisure time in forest settings. *Landscape and Urban Planning, 118*, 90-97.
- Wager, J. A. (1964). *The Carrying Capacity of Wild Lands for Recreation*. Washington, USA: Society of American Foresters.

- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54* (6), 1063-1070.
- Wheeler, B. W., White, M., Stahl-Timmins, W., & Depledge, M. H. (2012). Does living by the coast improve health and wellbeing? *Health & Place*, *18* (5), 1198-1201.
- White, M. P. & Dolan, P. (2009). Accounting for the richness of daily activities. *Psychological Science*, *20* (8), 1000-1008.
- White, M. P., Alcock, I., Wheeler, B. W., & Depledge, M. H. (2013). Would you be happier living in a greener urban area? A fixed-effects analysis of panel data. *Psychological Science*, *24* (6), 920-928.
- White, M., Cracknell, D., Corcoran, A., Jenkinson, G., & Depledge, M. H. (2013). Do preferences for waterscapes persist in inclement weather and extend to sub-aquatic scenes? *Landscape Research*, DOI: 10.1080/01426397.2012.759919
- White, M., P., Pahl, S., Ashbullby, K., Herbert, S., & Depledge, M. H. (2013). Feelings of restoration from recent nature visits. *Journal of Environmental Psychology*, *35*, 40-51.
- White, M., Smith, A., Humphries, K., Pahl, S., Cracknell, D., & Depledge, M. (2010). Blue space: The importance of water for preference, affect, and restorativeness ratings of natural and built scenes. *Journal of Environmental Psychology*, *30* (4), 482-493.
- Williams, A. T., Seller, V., & Phillips, M. R. (2007). An assessment of UK heritage coasts in South Wales JA Steers revisited. *Journal of Coastal Research*, *50*, 453-458.

- Wilson, E. O. (1984). *Biophilia*. Cambridge, UK: Harvard University Press.
- 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*, 53-63.
- Wordle (2013). [Wordle word cloud, create]. Retrieved from <http://www.wordle.net>
- World Health Organization [WHO]. (1948). Preamble to the Constitution of the World Health Organization as Adopted by the International Health Conference, New York, 19–22 June, 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, No. 2, p. 100) and entered into force on 7 April 1948.
- World Health Organization [WHO]. (2003). *Guidelines for safe recreational water environments. Volume 1: Coastal and fresh waters*. Geneva, Switzerland: WHO.
- 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 & Coastal Management, 88*, 53-63.
- Wyles, K. J., Pahl, S., White, M., Morris, S., Cracknell, D., & Thompson, R. C. (2013). Enhancing the “marine mindset”: The effects of an aquarium visit and information booklet on attitudes and intentions about fish sustainability and marine pollution. *Visitor Studies, 16* (1), 95-110.
- Zeppel, H. (2008). Education and conservation benefits of marine wildlife tours: Developing free-choice learning experiences. *The Journal of Environmental Education, 39* (3), 3-17.

Zeppel, H., & Muloin, S. (2007). Marine wildlife tourism: Education and conservation benefits. In M. Lück (Ed.), *Proceedings of the 5th Coastal & Marine Tourism Congress: Balancing marine tourism, development and sustainability* (pp. 430–446). Auckland, New Zealand: AUT University

Zube, E. H. (1974) Cross-disciplinary and intermode agreement on the description of evaluation of landscape resources. *Environmental Behaviour*, 6, 69–89.

