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BIRDS AND BEACHES: THE AFFECTIVE GEOGRAPHIES AND SENSE OF
PLACE OF PARTICIPANTS IN THE COASST CITIZEN SCIENCE PROGRAM

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This document, my official dissertation, is only one piece of an extensive journey. It culminates years of coursework, reading, writing, pondering, questioning, and, at times, struggling. Along the way I've enjoyed the company of extraordinary companions. Like birds in a flock, these sojourners have challenged me to new heights, pushed me forward, tended my wounds, soared alongside with enthusiasm, and sheltered me from harm. I therefore acknowledge here, the following members of my chorus ~

With purposeful flight, swallows provide proper perspective. Even more, these masterful architects know just the right blueprint to follow to build a warm, protective home. Providing a constant safe haven, my family of swallows has surrounded me with sustenance, granting an encouraging point of view when the course became muddled. The love of Mom, Gary, Dad, Jackie, Dean, Dorothy, Mary and many others supplied nourishment when it was needed most.

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In both prose and lyric, the canary stands as a symbol of the power of one voice. In the dark recesses of the "mine", one canary can bear substantial force. So too do the

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~ To these members of my dissertation flock, I owe my wings.

ABSTRACT

Participatory science research initiatives within the natural sciences like citizen science or crowd sourcing have enjoyed a recent explosion in popularity due to the efficient and expansive data collection processes they foster and the opportunities for general science outreach and education they provide. Now often the tool of choice among informal science outreach practitioners, Public Participation in Scientific Research (PPSR) programs are purported to expand knowledge and understanding of science and ecology, increase the relevancy of science for society, and cultivate more environmentally sustainable attitudes and behaviors. Despite such claims, the influence and impact of participatory science engagement is still not fully explored or understood. Questions remain regarding the range and extent of program outcomes and impacts on participants, social-cultural systems, and the scientific endeavors supported. In particular, the experiential aspect of volunteer engagement in PPSR programs is not fully theorized.

Being inherently place-based, all in-situ participatory science involves relationships among participatory science participants and the places where they engage. Such people-place relationships provide the fabric through which beliefs, values, and attitudes about the environment form and evolve, with substantial influence on both perceptions of and adherence to environmental stewardship practices. As such, the geographic concept of “sense of place” is utilized in this research as an

empirically underdeveloped, yet theoretically robust, entry point to explore how participatory science volunteers make connections between embodied experiences and behaviors and how such interactions may shape perceptions, values, and attitudes towards science and the environment.

This study examines the relationships between people and places in an expansive participatory science program that extends along the west coast of the United States. The Coastal Observation and Seabird Survey Team (COASST) is a citizen science program now in its fifteenth year dedicated to the regular monitoring of coastal environments and seabird mortality and population health along four U.S. states (AK, WA, OR, CA). Using qualitative methodology to collect data via guided narrative tour interviews and focus groups, this inquiry concentrates on the ways through which place attachment, connection, and meaning influence the cognitive and affective outcomes of participatory science volunteers.

Findings suggest that PPSR experiences can indeed support and facilitate the development and expansion of multi-dimensional place meaning and attachment. Participants noted a complex set of meanings that inform sense of place, including those associated with the symbolism of nature and the ocean, the significance of social and community interactions, and the importance of opportunities to contribute to science and the environment. Numerous aspects of the socio-political contexts, psycho-social processes, and biophysical settings that shape sense of place were also highlighted, underscoring the interactive nature of people-place relationships. Aspects like the species, substrates, and geographic features found at COASST survey sites, the policies and social norms that govern interaction with place, and the unique motivations and interests of

participants were all examined in this analysis. Such material-semiotic interactions help emphasize relationships between place meaning, spatial dependency, and place attachment. Finally, programmatic variables that also mediate participant sense of place were uncovered, bringing attention to the many elements of PPSR program development and management that shape the cognitive and affective experiences of volunteers.

In addition to the practical value of this research, a focus on the significance of people-place relationships in participatory science adds a dynamic layer of knowledge to our understanding of socio-ecological systems, including how individuals connect to and perceive the natural environment, cultivate relationships with other humans and non-humans, and negotiate human-environment interactions. Focusing on the place-based processes and actors involved in participatory science meaning-making helps make sense of complex interactions among people and the natural world. As more citizens engage with science and environmental research and decision-making via participatory efforts, integrated frameworks from which to understand these interactions and how they shape larger aspects of nature-society relationships will become increasingly necessary.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	iii
ABSTRACT	vi
LIST OF TABLES	xii
LIST OF FIGURES.....	xiii
CHAPTER ONE: INTRODUCTION.....	1
Structure of the Dissertation	4
CHAPTER TWO: LITERATURE REVIEW	10
Abstract	10
Introduction	11
Public Participation in Scientific Research: A Heterogeneous Practice	13
Geography and the Concept of Place	18
Advancing "Big Questions" Within PPSR Theory and Practice Via Sense of Place Research	28
Expanding Sense of Place Exploration	34
Conclusions - Far Reaching Contributions	38
CHAPTER THREE: METHDOLOGY AND METHODS.....	40
Methodological Rationale.....	40
Research Population and Study Sites.....	41
Methods of Data Collection.....	43
Respondent Participation & Characteristics.....	49
Data Analysis	49

CHAPTER FOUR: EXPLORING THE LIVED EXPERIENCES OF PARTICIPATORY SCIENCE VOLUNTEERS: THE INFLUENCE OF CONTEXT, SETTING, AND PERSON.... 54

Abstract	54
The Growth of Participatory Science	55
The Changing Nature of Participatory Science	56
The Lived Experiences of Volunteers and a Sense of Place	59
Methodology & Methods.....	68
PPSR Experiences and Outcomes.....	73
Expanding Frameworks to Explore Experiences, Outcomes, and Impacts	93
Conclusions	97

CHAPTER FIVE: PERSONAL MEANING AND VALUE ASSOCIATED WITH PUBLIC PARTICIPATION IN SCIENTIFIC RESEARCH AND THE PROGRAMMATIC VARIABLES THAT SHAPE THEM 101

Abstract	101
Introduction	102
Methodology & Methods.....	109
COASST Participant Outcomes.....	114
Personal Outcomes, Lived Experiences, & Program Aspects that Shape Them	116
Discussion: Implications for Program Design and Management	130
Conclusions	137

CHAPTER SIX: SENSE OF PLACE AMONG CITIZEN SCIENCE VOLUNTEERS AND THE VARIABLE SPATIAL DEPENDENCY OF MEANING..... 140

Abstract	140
Introduction	141
Significance of Place	144
Methodology and Methods	151
Results	157

Connections and Changes Among Place Meaning & Place Attachment.....	168
Conclusions	173
CHAPTER SEVEN: DISCUSSION AND CONCLUSION	177
Final Observations and Reflections	181
Future Research Directions.....	203
Concluding Thoughts	211
BIBLIOGRAPHY	216
APPENDIX A: COPYRIGHT PERMISSION TO REPRINT CHAPTER TWO	232
APPENDIX B: FOCUS GROUP INTERVIEW PROTOCOL.....	238
APPENDIX C: NARRATIVE INQUIRY GUIDED TOUR PROTOCOL.....	247
APPENDIX D: PROJECT LEADER INTERVIEW PROTOCOL	253
APPENDIX E: PERMISSION TO REPRINT FIGURE 4.1.....	257
APPENDIX F: COASST PARTICIPANT PROGRAM OUTCOMES EXPANDED	258
APPENDIX G: DIMENSIONS OF PLACE MEANING AND CATALYSTS OF PLACE ATTACHMENT EXPANDED	272

LIST OF TABLES

Table 2.1: Claims about Citizen Science Participant Benefits	16
Table 3.1: Select Study Participant Characteristics	49
Table 3.2: Categories for Data Analysis Segmentation	50
Table 4.1: Primary Personal Outcomes of COASST Participants	74
Table 4.2: Socio-Political Influences on Experiential Outputs and Outcomes.....	80
Table 4.3: Reported Motivations to Participate in COASST	81
Table 4.4: Biophysical Variables that Shape COASST Sensory Experiences	87
Table 6.1: Select Participant Characteristics	155
Table 6.2: Dimensions of Place Meaning among COASST Participants.....	158
Table 6.3: Place Attachment Catalysts among COASST Participants	164
Table F.1: Prominent Areas of Learning and Knowledge Gain	260

LIST OF FIGURES

Figure 3.1: Study Area Geographic Hubs.....	44
Figure 4.1: Shirk et al. (2012) Framework for Public Participation in Scientific Research.....	57
Figure 4.2: Adapted Framework of PPSR	67
Figure 4.3: Three Aspects of Participant Lived Experience	73
Figure 4.4: Volunteer Motivations and Influence on Experiential Outputs and Outcomes	84
Figure 4.5: Influence of Biophysical Setting on Sense of Place and Social Connections	89
Figure 4.6: Influence of Biophysical Setting on Connection to Wildlife and Coastal Awareness	90
Figure 4.7: Influence of Biophysical Setting on Learning/Knowledge and Satisfaction.....	91
Figure 4.8: Influence of Biophysical Setting on Physical/Mental Health	92
Figure 6.1: Conceptual Relationship Between Place Meaning and Attachment	166
Figure 7.1: Pileated Woodpeckers	212
Figure 7.2: Second Pileated Friend.....	214

CHAPTER ONE

INTRODUCTION

A host of practices exist today to encourage public participation in the scientific research (PPSR) process, ranging from those known as ‘community-based monitoring’ and ‘participatory action research’ to ‘community and citizen science’ (Shirk et al. 2012). PPSR efforts have been noted as efficient strategies to expand the range and complexity of scientific inquiry, "democratize" the research process, enhance knowledge and understanding of science and ecology among citizens, and increase the relevance of science for society (Couvett et al. 2008; Jordan et al. 2011; Trumbull et al. 2000). Even with all of the purported benefits of PPSR research and participation, there has been little in the way of scholarship focused explicitly on the experiences of PPSR volunteers from a multi-dimensional perspective. Many PPSR programs treat data collection as the object of interest, neglecting to recognize the significance of the ‘inner’ dimensions of PPSR programs for participant growth and development (Lawrence 2006). Where participant experiences and outcomes are explored, they are more frequently explored only within the context of demonstrating the effectiveness of such programs for advancing science, environmental decision-making, or natural resource management. Such a focus has privileged questions regarding what participants gain with regards to science knowledge, understanding, skills, and behaviors, and, to a lesser extent, how these aspects may impact greater attitudes and perspectives towards environmental stewardship.

The impressive body of research on the value of PPSR data for science, as well as the benefits of PPSR participation regarding scientific literacy and awareness, has been an essential part of efforts to firmly justify the substantial investments required to develop, implement and sustain PPSR initiatives within the academic research, science education, and public engagement communities. Demonstrating the reliability and validity of the information collected via such programs and the credibility with which they foster science education have been critical components of the success and growth of PPSR in the United States. Yet given the growing numbers of citizens who are now engaging in PPSR efforts, this dissertation research advances a new direction of PPSR scholarship that turns attention inward towards the experiences of volunteers themselves and the role their experiences may play in shaping outcomes and impacts associated with PPSR projects.

This dissertation research is therefore designed to interrogate the personal experiences of volunteers involved in natural science PPSR programs. Such lived experiences are multi-dimensional, including cognitive, affective, and behavioral components that shape human experience and interaction (Eagly and Chaiken 1993). Drawing from theoretical traditions within geography and environmental psychology, central research questions focus on how PPSR experiences both influence and are influenced by the people involved in PPSR (psycho-social processes), the socio-political context that surrounds PPSR programs, and the biophysical settings in which PPSR initiatives occur. In particular, this study foregrounds the significance of ‘sense of place’ among participants, a concept rarely included in conceptual models that attempt to understand PPSR experiences and participant outcomes. Bridging multiple academic

communities via the salient construct of ‘sense of place,’ this study develops conceptual frameworks that draw attention to personal experience in order to enhance understanding of the dynamic relationships between PPSR volunteers, the places in which they work, and the outcomes and impacts of the practice. Such an inventive lens has the potential to inform important changes and improvements in PPSR programs, as well as environmental and experiential education initiatives and participatory governance practices.

Geographic scholars focused on "lived experiences" often utilize significant places as entry points to call forth and wrestle with the multifaceted dimensions of being in and experiencing the world (Whatmore 2002). Such scholarship emphasizes the dynamic nature of the human experience; never static, linear, or segmented. Instead, humans are multi-vocal beings, influenced by a diverse set of characteristics, beliefs, backgrounds, and experiences that are intertwined with places both near and far. As such, utilizing a place-based lens through which to consider the experiential aspect of PPSR participation provides a salient point of entry to study the personal volunteer outcomes of PPSR participation as well as the processes involved in the development of human-environment relationships. Three primary research questions guide this study.

1. How do PPSR participants make meaning of place-based program experiences and what personal significance and value do they find in participation?
2. What socio-political, psycho-social, and biophysical factors influence the lived experiences of PPSR participants and how do these factors interact with program outcomes, and impacts?

3. How does participant sense of place inform PPSR experiences and visa versa and how might this advance knowledge on the relationships between place meaning and attachment?

Structure of the Dissertation

In chapter two, a literature review outlines the growth and evolution of contemporary PPSR programs, the multiple goals and objectives of the practice, and the status and characteristics of existing research on PPSR experiences. A place-based conceptual framework centered on sense of place is identified as a conceptually useful lens through which to explore the often neglected personal outcomes of PPSR experiences. The review continues with an examination of the concept of place within geographic scholarship. Sense of place and the sub-components commonly used to understand it are considered, alongside recommendations regarding how place-based inquiry might advance significant practical and theoretical questions within the PPSR community. This section concludes with a discussion of potential research methods to utilize in place-based research on PPSR experiences, to provide initial background for the methodology and methods section that follows.

Chapter three reviews the research methodology and methods employed in this study. Although geographic theory suggests sense of place as a critical aspect of people-place experiences, a dearth of empirical research on the topic as it relates to PPSR experiences precludes a hypothesis testing methodology and requires an idiographic approach. This chapter outlines the concurrent qualitative research methods utilized in this research, including focus groups, participant observation, and a guided tour narrative research activities. The research methods selected provide a multidimensional perspective

regarding the connections between embodied experiences, thoughts, ideas, interactions, and behaviors among PPSR participants and help establish a foundation for future scholarship on the topic.

The research findings are then presented in three independent manuscripts, prepared to be submitted for peer-reviewed publication. The abstracts for each chapter, as well as information about the journals where they will be submitted are included below.

- Chapter Four: *Exploring the lived experiences of citizen science volunteers: The influence of context, setting, and person*

Participatory science programs, designed to support public engagement in scientific research, often profess significant benefits for volunteer participants, including those connected to environmental attitudes and behaviors. Utilizing sense of place theory and scholarship to explore an expansive citizen science project called COASST, this study fills a literature gap by affording a window into the "lived experiences" of participatory science volunteers. Theoretical tenets from place scholarship provide the foundation for recommendations to modify a major participatory science development and assessment framework (Shirk et al. 2012). This modified framework is then utilized to explore the "environmental embodiment" of COASST participants through three major dimensions of experience. Findings reveal that the *socio-political* aspects of place ownership, access, and use can influence overall feelings of place connection and value, shaping a broader sense of place and program ownership and responsibility. Volunteer motivations around connecting, conserving, and contributing demonstrate how *psycho-social processes* also shape place perception, interactions, and relationships. Finally, the *biophysical* visual, auditory, olfactory, and tactile experiences of place play key roles in

mediating sense and connection to place and place meaning. Highlighting the role of place in these programs provides room to interrogate the meaning-making that occurs among COASST volunteers, meaning which ultimately shapes how such experiences translate into attitudinal or behavioral impacts. Major results from all three embodied experiential dimensions are related to broader participant outcomes around building community, enhancing education and awareness, and increasing satisfaction and personal health to highlight the utility of the modified structure of analysis.

Chapter four will be submitted to *Social and Cultural Geography*, a publication "concerned with the spatialities of society and culture, particularly the role of space, place and culture in relation to social issues, cultural politics, aspects of daily life, cultural commodities, consumption, identity and community, and historical legacies" (Taylor & Francis 2014a). The place-based lens utilized in this manuscript resonates with the aim of this journal to situate the lived experiences of individuals spatially and relate such experiences to particular dynamics of human-environment interactions.

- Chapter Five: *Personal meaning and value associated with public participation in scientific research and the programmatic variables that shape them*

As public participation in scientific research (PPSR) initiatives have expanded rapidly among private, public, and non-profit science research communities over the past decade, program managers and scholars regularly promote, evaluate, and manage such programs with a focus on the value and impact of PPSR efforts on the practice and relevancy of science. While many of these assessments rely on evaluation of individual participant knowledge and skill, they are driven by a broader interest in how such individual outcomes influence the form and function of science in society. Such a

science-centered emphasis is neither surprising nor inappropriate. Nonetheless, such appraisals are generally not capable of interrogating the full range of program goals and outcomes. This article advocates for greater comprehensive examination of the effects of PPSR participation on program volunteers. A more integrated perspective is therefore assumed to report on research conducted with volunteers in the Coastal Observation and Seabird Survey Team (COASST) citizen science program to interrogate the inter- and intrapersonal outcomes of program engagement through narrative interviews and focus groups. Findings highlight the various PPSR programmatic variables that shape volunteer experiences and how these variables may influence personal outcomes. These include the scope and scale of the project, program governance structure, the duration and frequency of volunteer activity, and processes involved in recruiting, training and motivating volunteers. Based on these findings, the article provides implications for advancing more intentional and meaningful PPSR efforts by focusing on the scale of engagement and interaction, cultivating community and connection, and developing tiered learning practices.

Chapter five will be submitted to *Studies in Science Education*, a journal dedicated to providing "analytical syntheses of research into key topics and issues in science education, consolidating and reflecting upon existing fields of study and promoting new areas for research activity" (Taylor & Francis 2014b). Because this article is applied in nature and geared towards the informal science education practitioner and research communities, the focus of this manuscript aligns well with the aims of this publication to apply interdisciplinary research to questions within science education practice.

- Chapter Six: *Sense of place among citizen science volunteers and the variable spatial dependency of meaning*

Over the past two decades, citizen science has grown in popularity and complexity as a means to expand the scope and scale of scientific inquiry and enhance science and environmental literacy. And yet, the places in which citizen science occur have largely been overlooked in projects aimed at assessing program outcomes and impacts. While most citizen science initiatives are experienced in specific sites, contexts, and relational networks, the influence of these programs on people-place relationships and their material and symbolic encounters is often understudied. This study utilizes the concept of sense of place to explore how participants make meaning of place-based environmental science experiences to address this research gap. Pulling from scholarship within geography and environmental psychology, central research questions ask how PPSR experiences both shape and are shaped by place meaning and place attachment. Using a qualitative methodology to explore the Coastal Observation and Seabird Survey Team (COASST) citizen science program, findings stress the multidimensionality of place attachment and meaning. While these aspects are mutually constituted, they are not consistently predicted by one other. Elements of place meaning connected to symbolic, social, and spiritual connection; sense of stewardship; physical and mental health; and memory and comfort are revealed along with catalysts of place attachment that include personal investment, knowledge, familiarity with place and distinct encounters or properties of a site. Sense of place is discussed as a material-semiotic phenomenon that mediates meaning along a continuum of spatial dependency, positioning place as simultaneously experienced, imagined, located, and relational.

Chapter six will be submitted to *Environment and Planning D: Society and Space*. This publication aims to provide a "forum for the discussion of the mutually constitutive relation between the social and the spatial. It seeks to be philosophically sophisticated, to be practically relevant, and to concretely theorise a range of contemporary, historical, political, and cultural contexts" (Pion Ltd. 2014). As such, the theoretical attention to sense of place, place meaning, and place attachment that underscores this manuscript as well as the concrete fashion in which theory is positioned in research data will align well with the scope of this highly ranked journal.

Finally, chapter seven provides a summary of the major findings of this research project, with attention to how they advance both geographic theory on place and the practical development and management of PPSR initiatives. Final observations and reflections are reviewed to highlight the broader "take-away" messages from this research with regards to the COASST program specifically, the PPSR movement, and the significance of sense of place. Finally, this chapter concludes with remarks regarding several promising potential areas of future research that build on the results of this study.

CHAPTER TWO

LITERATURE REVIEW

A "Sense of Place" in Public Participation in Scientific Research¹

Abstract

Public participation in scientific research (PPSR) within the natural sciences has been demonstrated as an effective strategy to expand cognitive knowledge and understanding of ecology, with implications regarding individual perspectives, attitudes, and behaviors about the environment and feelings about the personal relevance of science. Yet the development of PPSR outcomes, the processes through which they form, and the settings where they are shaped are still not fully understood. Because most PPSR takes place and is grounded in specific sites and socio-ecological contexts, the relationships among PPSR participants and the places in which they explore, collect, and gather information are central to the PPSR experience. Nonetheless, a dearth of empirical research on the interactions between people and places in PPSR highlights a promising area of future scholarship. Drawing from theoretical traditions within geography and environmental psychology, this article contends that PPSR experiences and outcomes both influence and are influenced by a "sense of place." Highlighting the significance of

¹ Haywood, Benjamin. (2014). A "Sense of Place" In Public Participation in Scientific Research. Science Education, 98(1), 64-83. Reprinted here with permission of publisher (see Appendix A).

people–place relationships in PPSR via a place-based window, this article calls for efforts that bridge multiple academic communities to open innovative avenues for understanding natural science PPSR experiences; the cognitive, conative, and affective outcomes of such encounters; and the dynamics of human–environment interactions.

Introduction

Natural science communities have often used information provided by ordinary citizens to inform and expand analysis and research efforts (Dickinson et al. 2012; Dickinson, Zuckerberg, and Bonter 2010). As ecological research has grown in complexity and scale throughout the past century, efforts to include community members in research have multiplied in recognition of the valuable role citizens can play in collecting, submitting, and analyzing ecological data over large spatial and temporal scales (Conrad and Hilchey 2011a; Cooper et al. 2007; Dickinson, Zuckerberg, and Bonter 2010). A host of traditions exist today that have emerged to encourage public participation in the scientific research process. In this context, the basic procedures involved in monitoring and analyzing natural phenomenon are used as platforms to unite scientists, communities, and stakeholders across scales, help frame socially legitimate indicators of environmental problems, and advance locally relevant and practical conservation goals and strategies (Couvet et al. 2008; Danielsen, Burgess, and Balmford 2005).

Acknowledging the convergence and synergies that exist among these varied strategies, scholars have recently advocated the use of an integrated umbrella term called public participation in scientific research (PPSR) to facilitate more collaborative research and practice among this broad collection of participatory traditions (Shirk et al. 2012).

Although each individual PPSR initiative may stress some aspects over others, four overarching goals extend across multiple PPSR projects. These include expanding the scope and scale of scientific research (Couvett et al. 2008; Devictor, Whittaker, and Beltrame 2010; Greenwood 2007; Lee, Quinn, and Duke 2006; Schmeller et al. 2008), enhancing science knowledge and understanding via interactive learning experiences for “nonscientists” (Bell 2009; Bonney, Ballard, et al. 2009; Bonney, Cooper, et al. 2009; Brossard, Lewenstein, and Bonney 2005; Conrad and Hilchey 2011a; Jordan et al. 2011; Trumbull et al. 2000), increasing environmental stewardship (Dickinson et al. 2012; Marshall, Kleine, and Dean 2012; Wolf et al. 2013), and developing more democratic and inclusive science research and policy processes (Mejlgaard and Stares 2010; Powell and Colin 2008; Rowe and Frewer 2005; Wilderman, Barron, and Imgrund 2004; Wooden 2006). Such goals have emerged from a variety of theoretical traditions advancing PPSR efforts. These include those stemming from large-scale ecological research, the public understanding of science and technology tradition, largely focused on science outreach and research expansion (Bauer, Allum, and Miller 2007; Lewenstein 1992), and those from the public engagement in science tradition, focused more on challenging the dominance of the scientific “elite” by opening up the research and policy process to be more responsive to socially negotiated needs and interests (Mejlgaard and Stares 2010).

A large amount of literature on PPSR has focused on evaluating the validity and reliability of data collected by volunteers (Dickinson, Zuckerberg, and Bonter 2010; Lee, Quinn, and Duke 2006; Lepczyk 2005; Schmeller et al. 2008; Wintle, Runge, and Bekessy 2010). Research within this tradition is considered an evaluation of the *external value* of PPSR projects (Lawrence 2006), treating PPSR data as a public good (Dickinson

et al. 2012). Simultaneously, a community of research exists on the *internal value* of PPSR projects in the form of participant outcomes (Lawrence 2006), specifically as it relates to educational effects (Bonney, Ballard, et al. 2009; Bonney, Cooper, et al. 2009). Although most all natural science PPSR takes place and is grounded in specific sites imbued with meaning (Goodchild 2007), neither of these research traditions have extensively interrogated the affective interactions and relationships among volunteer participants and the *places* in which they explore and collect ecological information via such programs. To address this critical contextual dimension, this article argues that the geographic concept of “sense of place” is an empirically underrepresented, yet theoretically well-established entry point to explore how PPSR participants make connections between embodied experiences, thoughts, ideas, interactions, and behaviors and how participant characteristics and positions can influence these experiences. Examining the role of sense of place in the meaning making of PPSR experiences can reveal information about how individuals connect to and perceive the environment, cultivate relationships with other humans and nonhumans, and develop perceptions, values, and attitudes about human–environment interactions. Such information has broad potential to influence not only the educational and stewardship outcomes of PPSR but the quality of research outcomes as well.

Public Participation in Scientific Research: A Heterogeneous Practice

PPSR programs within the natural sciences have changed dramatically over the past several centuries. Whereas some of the earliest PPSR projects (generally referenced as citizen science) in the early 19th century were largely reserved for the privileged or elite, the practice today is much more inclusive and open (Silvertown 2009). At a basic

level, PPSR involves collaborations between professional or “expert” scientists and members of the public (“amateurs”) who are directly involved in a scientific research project. Such projects range from those focused more on environmental justice like “participatory action research” to efforts intended for science outreach or literacy (Shirk et al. 2012). Bonney, Ballard et al. (2009) note that most PPSR projects in the natural sciences involve a “scientific question or environmental issue that is best addressed by analyzing large amounts of data that are collected across a wide area, or over a long period of time” by citizen volunteers. Nonetheless, PPSR programs vary widely with regard to the structure and organization of the program, the topic of interest or question(s) being investigated, and the goals and objectives of program leaders and project participants. While this article is concerned primarily with the experiences of participants engaged in one of the most common forms of PPSR—in situ programs within the areas of natural science—it is important to note that rich opportunities exist for research on sense of place among other forms of PPSR, including those that take place virtually (Nov, Arazy, and Anderson 2011; Rotman et al. 2012).

Public and Personal PPSR Outcomes

A strong cohort of researchers has documented the valuable public, external contributions of PPSR (Bonney, Cooper, et al. 2009; Foster-Smith and Evans 2003; Harvey 2006; Newman, Buesching, and Macdonald 2003; Szabo et al. 2010). Couvet et al. (2008) offer three areas in which PPSR has improved scientific knowledge and public decision-making processes. The first, and most apparent, involves improvements in the massive efforts to monitor and understand biodiversity and other natural phenomenon at multiple scales across the globe. Second, programs help frame socially legitimate

indicators of environmental problems and thus help to “democratize” research and policy processes. Because indicators must be widely accepted and easily understood to gain traction in the broader public arena, the involvement of “amateur” scientists can enhance the transparency and inclusivity of environmental monitoring efforts (Couvet et al. 2008). Finally, projects help decision makers build scenarios and compare the effects of proposed policies or procedures to address environmental concerns. In the context of adaptive learning, PPSR can expand the audience and reach of potential projects and help identify a broader range of human responses to potential threats or policies.

The value of PPSR as an effective tool to advance complex natural science research and expand involvement in research and policy processes is established. Within the past decade, however, a growing body of literature has emerged to study the multidimensional impacts of PPSR on the *participants* involved in the process. Table 2.1 includes an overview of some of the more salient assertions about citizen-science participant benefits. Such research is notoriously difficult as the effects of PPSR project variables on specific outcomes are a challenge to measure or isolate given the range of influences that may mediate these outcomes (e.g., preexisting beliefs, attitudes, and knowledge; motivation to participate; project content and experience; and training) (Phillips, Bonney, and Shirk 2012).

Although claims about the benefits of PPSR participation are highlighted here, it is worth noting that some study results are mixed. For example, some studies on PPSR outcomes have not found statistically significant changes in attitudes toward science and the environment (Brossard, Lewenstein, and Bonney 2005), behaviors (Jordan et al. 2011), or knowledge about science concepts or the scientific process

Table 2.1: Claims about Citizen Science Participant Benefits

Citizen Science Participant Benefit	Citations
<i>Enhanced Science Knowledge & Literacy</i> (e.g. knowledge of science content, science applications, risks and benefits of science, and familiarity with scientific technology)	Braschler et al. 2010; *Brewer 2002; *Danielsen, Burgess, and Balmford 2005; Devictor, Whittaker, and Beltrame 2010; *Evans et al. 2005; *Fernandez-Gimenez, Ballard, and Sturtevant 2008; Jordan et al. 2011; *Krasny and Bonney 2005; Sullivan et al. 2009
<i>Enhanced Understanding of the Scientific Process & Method</i>	Bonney 2004; Bonney and Dhondt 1997; Braschler et al. 2010; Devictor, Whittaker, and Beltrame 2010; Sullivan et al. 2009; *Trumbull, Bonney, and Grudens-Schuck 2005
<i>Improved Access to Science Information</i> (e.g. one-on-one interaction with scientists, access to real-time information about local scientific variables)	*Fernandez-Gimenez, Ballard, and Sturtevant 2008; Sullivan et al. 2009
<i>Increases in Scientific Thinking</i> (e.g. ability to formulate a problem based on observation, develop hypotheses, design a study, and interpret findings)	*Kountoupes and Oberhauser 2008; *Trumbull et al. 2000
<i>Improved Ability to Interpret Scientific Info.</i> (e.g. critical thinking skills, understanding basic analytic measurements)	Bonney 2007; Braschler et al. 2010
<i>Strengthened Connections between People, Nature, and Place</i> (e.g. place attachment and concern, establishment of community monitoring networks or advocacy groups)	*Devictor, Whittaker, and Beltrame 2010; *Evans et al. 2005; *Fernandez-Gimenez, Ballard, and Sturtevant 2008; *Overdevest, Huyck Orr, and Stepenuck 2004
<i>Science Demystified</i> (e.g. reducing the “intimidation factor” of science, correcting perceptions of science as too complex or complicated, enhancing comfort and appreciation for science)	Devictor, Whittaker, and Beltrame 2010; *Kountoupes and Oberhauser 2008
<i>Empowering Participants & Increasing Self-Efficacy</i> (e.g. belief in one’s ability to tackle scientific problems and questions, reach valid conclusions, and devise solutions)	*Danielsen, Burgess, and Balmford 2005; Lawrence 2006; Wilderman, Barron, and Imgrund 2004
<i>Increases in Community-Building, Social Capital, Social Learning, and Trust</i> (e.g. science as a tool to enhance networks,	Bell 2009; *Danielsen, Burgess, and Balmford 2005; *Fernandez-Gimenez, Ballard, and Sturtevant 2008;

strengthen mutual learning, and increase social capital among diverse groups)	*Overdevest, Huyck Orr, and Stepenuck 2004; *Roth and Lee 2002; Wilderman, Barron, and Imgrund 2004
<i>Changes in Attitudes, Norms, and Values</i> (e.g. about the environment, about science, about institutions)	*Danielsen, Burgess, and Balmford 2005; *Ellis and Waterton 2004; *Fernandez-Gimenez, Ballard, and Sturtevant 2008; *Jordan et al. 2011; *Melchior and Bailis 2003
*Studies that have empirically tested outcome hypotheses and reported results are noted with an asterisk.	

(Brossard, Lewenstein, and Bonney 2005; Jordan et al. 2011; Moss, Abrams, and Kull 1998; Overdevest, Huyck Orr, and Stepenuck 2004). Several study authors have attributed this lack of change to the fact that the projects evaluated in these studies primarily involved participants collecting data, with little or no opportunity to critically reflect on the science content or process. In addition, research on learning in informal settings like museums has demonstrated that participant outcomes are temporal in nature, meaning they are best understood when measured over time and not captured well in static assessments of cognitive knowledge (Falk 2004; Rennie and Johnston 2004). These studies also highlight that the context in which an individual engages in informal science research has substantial implications for the long-term impacts of such engagement (Burns, O'Connor, and Stocklmayer 2003; Rennie and Johnston 2004). Although a participant may be able to recite a set of scientific facts immediately following engagement, other contextual factors (e.g., whether or not the experience was positive, the connections that were made between other actors or concepts) have substantial influence over future cognitive-behavioral outcomes. As such, while rigorous efforts like those reviewed above to measure participant outcomes are critical, so too is a better understanding of the interactions between PPSR participants and the places in which they

engage, and the connections that provide the literal foundation for program outcomes and mediate program experiences. I argue that further research is needed regarding the factors that influence sense of place and the characteristics of place meaning among PPSR participants to inform the development of a more holistic conceptual model of PPSR experiences.

Geography and the Concept of Place

The North American naturalist Leopold (1949) once wrote that places must be experienced via sensory connection to fully understand them. Later, Carson (1965) noted that effective interactions with natural phenomena provide the foundation for our thoughts, attitudes, and behaviors about the physical landscape. The field of geography has a long history of research on human experience, awareness, and meaning as it relates to relationships with space, place, and the environment. As a whole, the discipline has a tradition of scholarship on the “lived experiences” of humans within specific socio-ecological contexts (Allen 2011; Casey 1993; Hubbard et al. 2002). The phenomenological geographers Relph (1976) and Tuan (1975; 1977) first inspired a tradition of “place-based” scholarship that has since expanded into many allied disciplines. In contrast to the notion of space, once seen as an open and fixed plane on which objects and activities were located, Tuan asserts that place is much more particular, linked to life histories, social processes, and individual experiences. Specifically, race, age, gender, sexuality, and spiritual orientation have all been highlighted as factors which influence understanding of place (Brace, Bailey, and Harvey 2006; Hidalgo and Hernandez 2001; Kruger and Jakes 2003; Lane 2002). Agnew and Duncan (1989) have observed that place scholarship within the field of geography

generally assumes one of three conceptualizations of place: place as location, as locale, and as phenomenological event. As location, place is treated as an object that is distributed among other objects on a flat spatial plane, often used alongside spatial-chorological approaches like spatial statistics. Among geographers most interested in the humanistic nature of geographic experience, place is utilized as locale, or the stage on which social interactions take place. While these two conceptualizations utilize place in distinct ways, they both assume a clear separation among the physical characteristics of place and human cultures and social interactions. The third conceptualization of place noted by Agnew and Duncan (1989) regards place as a phenomenological event, an intersubjective interaction among places themselves and the humans that intermingle with them. This third approach to place has a deep history in the field of human geography (Cloke and Johnston 2005; Massey 2005) with roots in the writings of scholars like Martin Heidegger and Maurice Merleau-Ponty (Patterson and Williams 2005). Such a relational lens is highlighted by others in allied fields like architecture, where scholar Pallasmaa (2005) reminds us that experiences of place involve complex sensual interactions. Pallasmaa avers that it is our sense of a place (its smell, touch, color, or sound) that allows us to remember it. Pallasmaa manages to construct the body as a first-order site in which each of us experiences the world—all our ideas about place and space can be traced back to our bodily interactions in physical sites. Whether it is self and the body, home and the family, society and public processes, or structures and buildings, the places where all of these senses collide capture the “multivocal” and “multilocal” aspects of life (Rodman 1992).

Many nature–society geographers have highlighted that relational approaches to place must be firmly grounded in the material networks which hold them together (Anderson and Harrison 2010; Murdoch 1998; 2006). Accordingly, approaches like actor network theory (ANT) are frequently employed to ground relational concepts of place and meaning-making in interconnected systems of nodes and networks (Murdoch 1998; 2006). ANT allows the exploration of place as a multifaceted and multidimensional human–environmental phenomenon and expands place-based analysis to include other nonhuman elements that are part of interactive networks. A number of studies have utilized such theory to guide exploration of human–environment interactions. Mordue (2009, p 549) uses ANT in his research of angling networks to demonstrate how fishing is shaped both by the social construction of the activity as well as “multisensorial interactions with nature.” Campbell (2008), in his study about the geography of avian feeding habits, reveals that intraspecies interactions between humans and birds can have equal, if not greater, bearing on the behavior of birds and humans than interspecies interactions. And according to Bonta (2010), there is no better line of inquiry into the experience of birding than the field of geography. Indeed, he muses “few human endeavors exist in which place is as important, in itself, as it is in birding” (p. 150). Bonta contends that birding is, by nature, geographically charged; that it is a three-way encounter between self, bird, and landscape. Through the lens of “hybrid” geographies like these, geographic scholars utilize spaces and places as entry points to call forth and wrestle with the multifaceted dimensions of being in and experiencing the world. Such perspectives interrogate the ontological dimension of place, an aspect Karrow and Fazio (2010) have called “place-as-being,” a dimension these authors argue has been widely

overlooked within a science education context. A number of more recent theories within the subdiscipline of resource geography attempt to “rematerialize” nature–society scholarship (Bakker and Bridge 2006; Jackson 2000; Stedman 2003a). In particular, practices of “new ecosystem management” (part of the new ecological paradigm in the 1990s) assume a material-semiotic (Haraway 1991) approach to resource management, expanding resource management strategies beyond those squarely concerned with economic or ecological considerations to include the cultural, social, and spiritual meaning attached to resources and landscapes (Williams and Carr 1993).

The political geographer Soja (1999) advanced a salient theoretical schematic of human experience of place that assumes the third conceptualization of place highlighted by Agnew and Duncan (1989), that of a phenomenological event. Soja’s model posits three separate “spaces” of being. “Firstspace,” or “perceived space,” represents our empirical experiences with phenomena that appear to represent objective reality (p. 265). “Secondspace,” or “conceived space,” is our subjective interpretation of the world and items in it (p. 266). Soja also presents a “thirdspace,” or “lived space,” as an integrated area opened up in the margins of the other two where spaces are both “real and imagined” (pp. 267–271). Such thirdspaces are places where connections, networks, and new concepts are formed among the empirical firstspaces and conceptual secondspaces of individual existence. Altogether, Soja contends these spaces constitute “the trialectics of spatiality,” not a combination of all three into one, but a “hybridity” of place, each aspect influenced and interacting with the other.

PPSR experiences might also be viewed in such a fashion, conceived as experiences that bridge firstspaces of empirical investigation and secondspaces of

interpretive understanding to bear hybrid thirdspaces of experiencing the world. The landscapes involved in PPSR investigation and the actors therein play fundamental roles in shaping firstspace experiences. At the same time, the conceived secondspaces of PPSR participants shape the lenses in which the landscape is explored and sensed. Current research on PPSR outcomes and experiences has little to say about these fundamental interactions in place. A focus on the material-semiotic dimension of place succeeds at collapsing binary walls among empirical senses and cognitive processes and helps elucidate the interactions among the two, interactions that lead to what geographers often refer to as a “sense of place” (Jorgensen and Stedman 2001).

Sense of Place

Although the concept of sense of place has been used inconsistently among various academic disciplines (Devine-Wright and Clayton 2010; Manzo 2003), it can be described broadly as “an experiential process created by the setting, combined with what a person brings to it” (Steele 1981, p 9). In this sense, place is understood as a concrete site where the physical environment, the self, and sociopolitical processes overlap, known as the tripartite model of place (Scannell and Gifford 2010). Along these lines, Karrow and Fazio (2010) have suggested that place involves “natural, cultural, and ontological” components. In particular, alongside the physical and socio-cultural dimensions of place, these authors advocate for more attention to the ontological dimension of place that inspires a “psychology of awe” (Karrow and Fazio 2010). As noted above, geographic phenomenologists like Tuan (1975) have studied individual and collective sense of place by examining the “lived experiences” of everyday, even mundane, place-based interactions (Bachelard 1969; Relph 1985; David Seamon 1982; D Seamon 1984). Such

interactions between humans and the physical places in which they engage are informed by individual histories and experiences, leading to an organic and relational sensory landscape (Jorgensen and Stedman 2001). Conceptually speaking, sense of place theory includes two principal aspects, place attachment and place meaning, each with related subcomponents (Stedman 2003b).

Place Attachment

The environmental psychologists Low and Altman (1992) define place attachment as an affective bond between people and places, enveloping different human and nonhuman actors and social relationships. Place attachment broadly encompasses aspects of identity, physical or social dependence, and emotional connection to specific aspects of the physical environment or other creatures that share such space. The amount, intensity, and duration of experiences in a place (often called residence length) has been correlated with changes in sense of place (Semken and Butler-Freeman 2008) and has consistently predicted levels of place attachment (Lewicka 2011). Although various scholars have compartmentalized place attachment into smaller subcomponents, I will utilize the four-dimensional conceptualization of place attachment outlined by Ramkissoon et al. (2012) to provide just one example of how the various components of place attachment might be utilized to expand knowledge and understanding of the numerous purported outcomes of PPSR programs. Ramkissoon et al. (2012) have suggested that place attachment includes the subcomponents of place identity, place dependence, place affect, and place social bonding, all dimensions which these authors contend are linked to what they call “pro-environmental behaviors,” although admittedly to various degrees and via mechanisms not fully understood. I will review each below,

while providing both examples of how such aspects might directly link to or influence the PPSR outcomes highlighted in Table 2.1 and important questions about these relationships.

Place identity, a concept coined by Proshansky (1978), refers to the degree to which place is included in perceptions of individual or collective identity. Feeling that a place is a part of you is just one element that contributes to place attachment. Assuming that the identities and values of people are indeed informed by places they judge significant, then it follows that peoples' bonds with important sites will influence their engagement in those places. Such engagement might take the form of efforts to maintain or protect the sites, respond to threats or changes within them, or interact with them in a specific way (Pretty, Chipuer, and Bramston 2003). In this sense, it is reasonable to assume that the degree to which one identifies with a place may have some bearing on the sense of responsibility felt for that place, an aspect that may influence broader advocacy or further civic engagement behaviors and outcomes (like those demonstrated in Stedman 2002), and may spur community-initiated efforts that enhance feelings of empowerment or self-efficacy among those involved. Indeed, many place-based environmental education pedagogies embrace the objective of increasing local environmental action as a guiding tenet (Semken and Brandt 2010). Furthermore, as a place becomes more intimately entwined with the identities of PPSR participants who have engaged with that place via a particular "scientific" lens, specific habits of mind that foster scientific thinking and interpretation may become a more "natural" part of the way in which volunteers view themselves. The role that place attachment plays in the development of a sense of scientific identity is an area open for study.

Place dependence, on the other hand, refers to functional connections humans have to a setting and the degree to which a place meets day-to-day needs (Schreyer, Jacob, and White 1981). The more a person connects or identifies with a place, the more likely (although not always) that person is to develop a dependence on that place for meeting his/her spiritual, social, or ecological well-being. Although Ramkissoon et al. (2012) discuss this concept largely in regard to a reliance on the physical characteristics of a place to meet a need (e.g., dependency on a local reservoir to provide drinking water), I argue such dependence may also be psychosocial. Because higher levels of place dependence have been associated with increased place loyalty (Yuksel, Yuksel, and Bilim 2010), it is sensible to question the relationship between place dependence among PPSR participants and the nature and level of scientific knowledge and literacy about the specific ecological community to which participants become more dependent. In other words, do PPSR participants who become more dependent on a place also become more scientifically knowledgeable about that place? This is both with respect to knowledge about local natural history and more global scientific concepts. Might higher levels of place dependence influence the degree of scientific literacy participants demonstrate about an area? If so, might the confidence gained from enhanced scientific knowledge of a local ecosystem also reduce the mystical sense of scientific research, demystifying the practice?

A third dimension of place attachment includes place affect, which Ramkissoon et al. (2012) characterize as specific emotional bonds that form between person and place. Although Ramkissoon et al. (2012) conceptualize affect solely as emotional connection in their characterization of place attachment, others like Rose, Degen, and Basdas (2010)

separate the notion of affect, or the “precognitive” inherent nature of a place (Tuan 1975), from emotion (internal personal reaction to a place). As feelings of connection grow between person and place, sentiments associated with that place increase as well. Although research has demonstrated links between affective connection to wilderness places and changes in environmental attitudes and behaviors within environmental education settings (Pooley and O’Conner 2000), little work has been done to consider these relationships within PPSR environments. In particular, because PPSR efforts are generally built around specific scientific protocols and procedures, a reasonable hypothesis might consider whether or not an increase in an emotional bond with place not only influences attitudes about the environment but also attitudes, norms, and values in regard to science and scientific research. Furthermore, how might these sentimental connections with place impact overall sense of trust among participants of both professional scientists and the field of science as a whole, or, as Semken and Brandt (2010) have noted, perhaps even lack of trust in conflict situations?

Finally, place social bonding concerns the degree of attachment to place that results because of interpersonal social bonding in places. As ties develop between individuals that interact within specific places, the sense of belonging or community that ensues may become associated with a particular setting. The setting thus becomes an integral component of that communal relationship and can lead to an increased sense of shared place attachment. One might expect such bonds that form in place to foster enhanced community building and social capacity, along with elevated levels of social learning and confidence in collective action. As with place affect, this subcomponent of place attachment may be significant with regard to the desired PPSR outcomes of

increased trust among participants and professional scientists. As individual bonds over specific places and social networks are developed, those communal relationships reinforced by place attachment may also increase access and sharing of scientific information, another supposed PPSR outcome. The components of place attachment outlined by Ramkissoon et al. (2012) above are provided here as an example of the utility of the concept in regard to research on PPSR outcomes. However, it is worth noting that other conceptualizations of the concept exist (see Trentelman 2009 for a thorough review of scholarship on place), many of which are sure to provide additional relevant insight.

Place Meaning

Often treated as distinct from place attachment, the second major aspect of the sense of place concept is place meaning, which refers to the ascribed symbolic meanings between people and places. Place meaning is negotiated from heterogeneous life positions, while being mediated by culture, politics, and the physical environment (Nassauer 1995). Although place attachment and meaning are commensurate aspects of an overall sense of place, they are not identical concepts. Manzo (2005) has demonstrated that even though multiple individuals may share similar levels of attachment, feelings, or relationships with a place, the meanings associated with that place can be quite diverse and can encompass both positive and negative dimensions. Place attachment therefore reflects the emotional intensity and nature of attraction to places, whereas place meaning exposes the reasons for such an attraction, although the interrelationships between the two concepts should not be overlooked (Wynveen, Kyle, and Sutton 2012). A focus on place meaning has the potential to contribute a nuanced understanding of how people in PPSR programs connect with environmental settings, negotiate environmental values and

attitudes, and conceptualize “natural resources.” As I have argued here, sense of place is a conceptually robust theoretical lens through which to interrogate the connections, interactions, and meaning-making between people and places, a central aspect of all in situ PPSR experiences. While many vigorous efforts have examined the relationships between PPSR experiences and educational or personal outcomes like those reviewed above, few critically feature place as a mediator in or contributor to these relationships. The concept of place provides a holistic entry point to interrogate the sociopolitical, cultural, psychological, *and* physical/environmental actors involved in PPSR experiences and may shed new light on some of the “big questions” within the field.

Advancing "Big Questions" Within PPSR Theory and Practice Via Sense of Place Research

Focusing on the processes and actors involved in the meaning making associated with PPSR sites has the potential to contribute to the development of new conceptual frameworks that help make sense of complex PPSR experiences and outcomes for volunteers. As demonstrated in the preceding section, sense of place inquiry provides promise for expanding understanding of PPSR outcomes by including an often neglected dimension of participation, the material-semiotic relationships between people and place. Research findings, key themes, and lessons learned within this vein will be of interest to those who are involved in participatory research and policy processes as well as those who manage and develop specific PPSR programs. In addition, scholars who focus on geographic or environmental education, informal learning, or place-based therapies may benefit from this type of analysis (Kudryavtsev, Stedman, and Krasny 2012). Four broad areas in which major questions have been raised in PPSR scholarship are outlined below

to highlight future research directions that present particular promise for sense of place exploration.

Participant Motivation and Retention

Bonney et al. (2009) have noted that there is a need for “significant research into motivations for members of the public to understand and participate in [scientific] research”. Although Measham and Barnett (2008) have suggested that place attachment is one of several central motivating factors for environmental volunteers, we still do not know to what extent this factor may motivate participants across a variety of PPSR programs or settings which are not always connected to environmental concerns directly. How does place attachment inform motivation to engage in PPSR? Does the level of motivation inspired by place attachment vary by geographic location, participant characteristics, or program format (e.g., in situ or online)? Recent evidence reveals that volunteer motivation is rarely static, demonstrating a temporal dimension that can change throughout participation (Clary and Snyder 1999; Rotman et al. 2012). Accordingly, it is important to know whether attachment to place also changes as participants engage in PPSR over time. Although sense of place and place attachment is certainly not the only factor that influences volunteer motivation, the research reviewed in this article suggests it may be a significant one. Researchers will need to explore more fully how time engaged in the project, level of engagement in the project, and life position (i.e., age, gender, race, sexual, and spiritual orientation) influences the sense of place among participants. Of particular relevance to practitioners will be the identification of “best practices” in regard to the cultivation of a rich sense of place within PPSR as well as those place-based aspects that contribute to participant satisfaction and commitment to

the program. Are there programmatic elements, for example, that might help facilitate a deeper connection to place among participants, or strategies that appear to be more effective under particular program parameters like duration of project or participant audience? Perhaps it is even possible to create innovative partnerships between groups that demonstrate a preexisting attachment to place and PPSR efforts designed to expand knowledge of that place. Such inquiry might make significant contributions to efforts to increase PPSR participation and science literacy, specifically among individuals from minority and traditionally underrepresented groups (Georgia et al. 2001; Hobbs and White 2012).

Expanding Inquiry on Concepts of Nature, Environmental Attitudes, & Behaviors

Pitkanen, Puhakka, and Sawatzky (2011) have documented the bidirectional relationship between sense of place and concepts of nature, noting that place meanings and attachment are both informed by and inform individual and collective definitions of “nature” and the norms that influence nature–society interactions. Several studies have concluded that sense of place can influence broader feelings of “connectedness to nature,” affective bonds which develop between individuals and their own conceptualization of “nature” in ways that are quite personal (Brugger, Kaiser, and Roczen 2011; Mayer and Frantz 2004; Schultz and Tabanico 2007). These affective connections influence not only the attachment and meaning of specific places but also broader ideas about environmental responsibility and concern (Schultz 2001). As noted earlier, several studies have demonstrated a correlation between place attachment and “environmentally responsible behaviors” (Kyle et al. 2004; Uzzell, Pol, and Badenas 2002; Vaske and Kobrin 2001) as well as increased learning (Semken and Butler-

Freeman 2008). The absence of connections among people and place can lead to a relationship “deficit” with the natural world, with purported broad behavioral consequences (Louv 2008). Podeschi and Howington (2011) have argued that people need to know about the places in which they live, feel a connection to those places, and be engaged in managing those places. Similar sentiments have been expressed for decades within the “place-based education” movement, centered on a pedagogy designed to facilitate “essential links between a person and her place” among a “rootless” society (Sobel 2005, p ii). PPSR presents a unique opportunity for those kinds of connections to occur, but the practice would benefit from thinking more critically about how and when these relationships form and what dimensions are most influential. Traditional measures of scientific knowledge (literacy) and skills of PPSR participants, while of critical importance, are not likely to fully explain or predict PPSR outcomes with regard to environmental attitudes and behaviors because cognitive, behavioral, and affective dimensions collectively inform these aspects (Aiken 2002). Research on sense of place in PPSR may again shed much light on the interactional relationships between PPSR experiences in particular places and attitudinal or behavioral outcomes.

Such inquiry would build on an already rich body of scholarship around the cognitive-behavioral consequences of differences in human socio-cultural perspectives of nature and nature–society interactions (Anderson 2010; Bakker and Bridge 2006; Bang, Medin, and Atran 2007; Kellert 2005; Williams and Patterson 1996). This research suggests that such differences have implications for science education and literacy as well. Bang et al. (2007) have argued that traditional science education often misses the boat when it comes to effectively engaging non-majority cultural groups because many of

these approaches fail to consider the diversity of ecological frameworks various communities use to understand and interact with the environment. Research on the interactions between concepts of place, place attachment and meaning, nature, and science among PPSR participants will have much to contribute to scholarship around nature–society interactions and science education. How do diverse ecological frameworks conceptualize place and place attachment? Can PPSR programs change perceptions and beliefs about human–environment relationships? From a science or environmental education vantage point, are specific PPSR practices or programs more effective at engaging one type of ecological framework over the other? An expansive research opportunity exists within PPRS scholarship when it comes to socio-cultural influences on place perception, methods and pathways to connect with place, and place meaning-making processes.

Enhancing Local Empowerment, Advocacy, and Community Action

As noted in Table 2.1, some PPSR initiatives have been linked with increased feelings of community empowerment and personal self-efficacy in regard to the ability to investigate and mitigate environmental concerns on a local level (Danielsen, Burgess, and Balmford 2005; Lawrence 2006; Wilderman, Barron, and Imgrund 2004). Although multiple factors are likely at play, how does sense of place and place connection influence such outcomes? Does place attachment, for example, increase the willingness of participants to utilize data collected via PPSR programs to autonomously advocate for environmental policy or management changes? From an environmental psychology context, evidence suggests that people can be more protective of and concerned about spaces imbued with meaning (Podeschi and Howington 2011; Williams and Vaske 2003).

As such, affective ties to places may motivate people to be better informed about the relationships between environmental health and community wellbeing and may lead to the advancement of ecojustice concerns regarding the fair distribution of environmental benefits and burdens (Adams, Ibrahim, and Lim 2010). But questions still remain regarding what aspects of place elicit personal response and connection and how those elements shape the type or degree of community action that develops. Do participants feel more confident in their ability to protect sea turtle nests than they do at mitigating the water quality of a local stream, for example? If so, what biogeographic or sociopolitical elements serve as facilitating or constraining factors? Furthermore, uncertainties remain regarding what components of significant places (e.g., natural, cultural, or ontological) most often elicit concerted action among those most closely attached. Could further inquiry identify differences among these responses based on the level or type of connection felt by participants? From a science in society perspective, how do such actions make use of scientific research or “data?”

PPSR Research Process, Efficacy, and Impacts

Sense of place research within PPSR demonstrates promise to go beyond contributions to practical program management or the education and stewardship objectives of science and environmental education. Asking place-based research questions might also contribute to enhancements of the scientific procedures that underpin all PPSR research. As Goodchild (2007) has noted, despite the massive growth in technology that can aid in the survey and analysis of biogeographic information, the “human sensory system” is still one of the best tools available for the study and investigation of the natural world. Even with the sophisticated technology available

today, most data on species-level occurrence still must be gathered by humans (Kelling 2008). Investigations into sense of place among PPSR participants may reveal strategies in which to enhance the accuracy and precision of volunteer-collected data as researchers explore how participants “tune-in,” sense, perceive, and process the intricacies of the environment around them. Of even greater interest to those involved in research on the history of science and technology studies may be how the unique sense of place of PPSR participants is molding, shaping, and influencing the scientific knowledge that is produced in participatory science programs. Research might also contribute to efforts to integrate traditional ecological knowledge (TEK) into conventional science knowledge paradigms. Elbroch et al. (2011) have already begun the work of integrating TEK into PPSR research protocols and infrastructure, but further research will need to explore how ecological knowledge of place is formed and interpreted among groups indigenous to an area to better inform integration efforts. Given the magnitude and complexity of current day environmental challenges, the need for wide-scale, efficient, and collaborative programs to evaluate environmental phenomena, test hypotheses, and develop applied policies and management practices is evident. Investigating the ways in which PPSR participants connect to, interact with, monitor, and alter places can provide helpful insight into the types of research questions best suited for PPSR programs, biases that can emerge among participants and how they might be overcome, and methods to enhance the ecological assessments that take place.

Expanding Sense of Place Exploration

With new PPSR programs emerging en masse across diverse fields of scientific inquiry, the growth of the practice is outpacing understanding and systematic evaluation

of the impacts of PPSR participation on volunteers (Bonney, Ballard, et al. 2009; Dickinson, Zuckerberg, and Bonter 2010; Phillips, Bonney, and Shirk 2012). To help close this knowledge gap, I have argued that a focus on place-based interactions and sense of place provides a foundation for a deeper understanding of the affective bonds which develop between individuals and places in PPSR programs to shed light on critical questions about PPSR impacts and outcomes. Not only will this enhanced understanding provide opportunities to improve PPSR practice and impact, but it also has enormous potential to inform key concerns and questions about scientific literacy, as well as the theories and tenets of science and environmental education.

Fortunately, methodological traditions within sense of place scholarship afford a host of robust tools with which PPSR practitioners or researchers might expand research on people–place relationships in PPSR and subsequent outcomes. Evaluating outcomes and testing specific programmatic impacts is an established habit within most PPSR projects given the accountability required of many of these programs by external funding sources. Utilizing existing sense of place research tools alongside established PPSR assessment practices may initiate novel metrics with which to understanding the relationships between people, place, and program outcomes.

Historically, place meaning and place attachment have been measured using opposing methodological approaches (Kudryavtsev, Stedman, and Krasny 2012). Place meaning more frequently is gauged using qualitative investigatory strategies, underscoring the highly variable and context-specific nature of psycho–social–ecological meaning (Davenport and Anderson 2005). In contrast, place attachment is often measured quantitatively for nomothetic purposes, by using scales in which individuals indicate

degree of attachment using common numerical intervals (Halpenny 2010). Such an approach can provide useful information regarding intensity of attachment, but is typically not able to explore, in depth, the details of such attachment, such as why, how, and via what processes attachment forms. Quantitative scales of place attachment, while valuable for establishing broad-scale trends and changes (Semken and Butler Freeman 2008), often overlook the specific objective and subjective attributes and social systems in which attachment is cultivated and are generally not able to consider what aspects of the setting people attach to and the active role of those items in that relationship. As Lewicka (2011, p 209) has noted, places are “qualitative totalities of a complex nature” and thus involve contingent and unique experiences and interpretations that resist broad and analytically derived generalizations. Furthermore, generalizations about PPSR experiences can be problematic as the task of accounting for multiple - often overlapping - participant and programmatic variables confounds investigation.

Lewicka (2011) and Kudryavtsev, Stedman, and Krasny (2012) have provided a thorough and detailed review of both quantitative and qualitative methods in sense of place scholarship, an effort I will not duplicate here. These include quantitative approaches that rely on unidimensional or multidimensional scales of place attachment, as well as qualitative approaches that include both verbal and pictographic measures of place connection and meaning (Lewicka 2011, pp 219-222). Others are devising new techniques, like Everett and Barrett’s (2012) “guided tour” strategy to deepen the way we study the pathways through which intimate relationships between people and place form and develop. Mixed methods approaches that draw from both quantitative and qualitative traditions have also been utilized to explore sense of place relationships (Devine-Wright

and Clayton 2010; Morrell and Tan 2009), although disagreement exists regarding the philosophical validity of mixing methodological paradigms to study place (Beckley et al. 2007; Williams and Patterson 2007). Haywood and Besley (2013) have recently outlined a set of “integrated indicators” of successful program outcomes in participatory science that, while not specifically designed to interrogate sense of place, integrate existing indicators that draw from Karrow and Fazio’s (2010) natural, cultural, and ontological dimensions of place.

Given the range of existing techniques available to study the concept of sense of place and the comfort many PPSR administrators have with program assessment and research, I argue that the benefits of exploring sense of place components among PPSR participants far outweigh any potential initial costs associated with updating or expanding research questions, protocols, or evaluation procedures. Even expanding assessment of PPSR outcomes to include one dimension of sense of place might provide a useful start to consider this essential component of participatory science experiences. For program managers, this might be accomplished initially by allowing PPSR participants to document their “favorite” aspects of their study site(s) using photo elicitation or free-write strategies during annual program evaluation procedures. For researchers, exploration of the role of place in PPSR experiences might begin by adding basic measures of place attachment to research metrics, to track changes over time or document the nature of such attachment. These cursory suggestions are not provided to imply that the complexity of people–place interactions and their impact on cognitive or behavioral outcomes can be identified and categorized with the addition of a few basic survey questions. Instead, they are included to encourage program managers and scholars to

consider those dimensions of sense of place that may be more relevant to program or research objectives and contexts and to begin exploring with program participants the role such aspects play in dynamic PPSR systems.

Conclusions - Far Reaching Contributions

Bridging scholarship within the fields of environmental and geographic education, environmental psychology, and human and environmental geography, expanding the PPSR research agenda to include inquiry on sense of place is particularly pertinent and timely given the extensive socio-ecological challenges of the twenty-first century. These challenges necessitate relevant, responsive, and sound scientific research and policy that accounts for the heterogeneous social contexts in which science is developed and enacted. As such, research within this vein has the potential to contribute to each of the major overarching goals of PPSR projects (increasing the scope of research, scientific literacy, environmental stewardship, and the transparency and responsiveness of science).

In addition to the value of this research for those engaged in communities of science education and participatory engagement, this research will provide wide-ranging insight regarding the highly social and negotiated processes of human–environment interactions by opening up new discoveries regarding phenomenological sense of place. As such, it follows a strong emphasis within cultural and political ecology on the social and contested nature of human–environment relationships (Peet, Robbins, and Watts 2010; Robbins 2004; Zimmerer 2007). Questions regarding how and why physical space is valued, who and what it is used for, and how it should be managed will likely reveal important clues about the sociopolitical influences that shape sense of place. Similarly, attention to “positionality” (McCleery 2004) within PPSR place-based research obliges

questions regarding who participates in PPSR, how they identify with place, what narratives inform such identities, and, just as importantly, who is not participating in those experiences. Information obtained from this analysis will further understanding of why certain groups or individuals choose to participate in PPSR.

Probing questions about sense of place, the processes involved in place connection and attachment, the values associated with place meaning, and the hybrid human and nonhuman networks that glue such aspects together has great promise for enhancing understanding of the novel forms of scientific inquiry and policy taking shape in the twenty-first century. Accordingly, this article has positioned sense of place scholarship as an appropriate entrée into the complex and dynamic world of PPSR program impacts and outcomes, while highlighting how such inquiry might inform questions within science and environmental education theory and practice. Four broad-spectrum research directions have been provided to suggest salient research questions and avenues for future inquiry to enrich and enliven areas of synthesis and connection among strands of complementary research grounded in both socio-cultural and physical dimensions of human–environment interactions. It is the belief of the present author that capitalizing on such synergies will advance scholarship around place and science education while also elevating the impact and effectiveness of the growing practice of participatory science.

CHAPTER THREE

METHODOLOGY AND METHODS

Methodological Rationale

Geographic scholars frequently contend that the complexity of place warrants a contextualized methodology, one that accounts for variation and diversity in experiences and perceptions (Brandenburg and Carroll 1995; Fishwick and Vining 1992; Lewicka 2011). While arguments exist regarding the most appropriate research methods to utilize in order to capture such complexity, both quantitative and qualitative approaches have been employed to explore sense of place, depending on the type of research question asked and the goals of the study (Kudryavtsev, Krasny, and Stedman 2012; Lewicka 2011). On the one hand, quantitative methods are often utilized for studies aimed at the investigation of systematic relationships between people and place to test for prediction and causality among various place-based constructs. On the other, qualitative methods are often the norm among those studies interested in the phenomenology of place, in particular as it regards the unique and heterogeneous "lived experiences" of place. While both approaches add valuable perspective, given the lack of research in this area, this study was designed to explore the variety, contextual influences, and unique attributes of sense of place among PPSR participants, necessitating an idiographic approach to explore such phenomena 'on their own terms' (Husserl 1970; Seamon 1982; 2000).

As Lewicka (2011) notes, places are “qualitative totalities of a complex nature” and thus involve contingent and unique experiences and interpretations that resist broad and analytically derived generalizations. Given the qualitative nature of the research questions and topic of this study and the lack of empirical observations on ‘sense of place’ among PPSR participants that might allow hypothesis generation and testing, the goal of this study is not to develop extensive generalizations about PPSR outcomes but instead to investigate a broad spectrum of meanings assigned to places, how these meanings develop, as well as the aspects of PPSR participation that contribute to meaning-making processes. Nonetheless, as Seamon (2000) highlights, although many of the early place-focused phenomenologists like Tuan (1975) were not interested in purely nomothetic inquiry, they were still eager to identify “commonalities,” or general qualities and characteristics that are shared across places. In this spirit, although a predominantly idiographic lens is employed for this study, areas of common experience and connection among distinct places are also granted full attention via systematic analysis of data. Such an approach is useful in efforts to understand the *processes* involved in the development and evolution of PPSR participant experiences alongside a deeper exploration of the contexts in which participatory science is enacted and thus, provides a rich foundation for further systematic evaluation of the topic.

Research Population and Study Sites

A sample was recruited in the spring of 2013 among participants in a large multi-state, multi-site citizen science program called COASST, the Coastal Observation And Seabird Survey Team. The COASST project was established in 1998 by Dr. Julia Parrish of the University of Washington. COASST is an expansive citizen science program

focused on marine ecosystem health and conservation via ecological monitoring and research as well as efforts to encourage local participation in coastal management and governance. With a decentralized, team-based management approach, the program involves nearly eight hundred participants in monitoring and data collection at over five hundred beaches in four states (WA, CA, OR, AK). Program participants select a specific beach to canvass (unique to each individual or team) at least once a month, identify and tag beached seabirds, record observations about the beach, and submit reports to a program database. By tracking the deposition of beach bird carcasses along the coast of the Pacific Northwest, the program is designed to create a "normal" baseline against which potential impacts can be assessed and overall patterns and trends identified.

The COASST program is well-established with strong records of consistent program management and success for over fifteen years. COASST provides ample opportunity to consider sense of place among PPSR participants as the program is designed so that individuals repeatedly visit the same place over time and are asked to focus attention on the place itself. In addition, participants engage a wide range of beach sites, across a diverse geographical area, yet undergo consistent training and instruction while completing identical tasks at each site. Now in their sixteenth year, the program has participants that have engaged from a range of nearly fifteen years to less than one. This allows for the comparison of sense of place across a diverse sample of places and individuals who engage in a similar type of place interaction. In consultation with COASST program leaders, six geographic hubs across three states (WA, OR, CA) were selected after considering which places would offer geographic and participant diversity and contain a high density of COASST volunteers (Figure 3.1). Alaska was excluded

because of the logistical difficulty in reaching widely distributed participants. In the spring of 2013, an invitation letter describing the purpose of the research and opportunities to participate was sent to all participants with study beaches within a forty-five mile radius of each hub. Invitations were sent directly from COASST program leaders, with links to online documents explaining the project in more detail (research focus, participation options, confidentiality procedures) and an online form that allowed invitees to opt out or in to the study. For those that opted-in, information was collected regarding participant length of residence in proximity to the beach, length of service in the program, frequency of participation, and the average rate at which birds are found. As noted earlier, residence length has been suggested as a major predictor of place attachment and both the frequency and quality of participant engagement in the project has been noted as a factor influencing PPSR participant outcomes (Shirk et al. 2012). While this is a purposive, non-random sample, the assorted geographic distribution of study sites, heterogeneity of COASST participants, as well as the independent nature of project participation enhances the rigor of the study by allowing analytic comparisons among varied participants and physical settings that are part of a common program.

Methods of Data Collection

Research methods comprised two primary means of data collection, focus groups and guided tour narrative interviews. PPSR interactions in places are often experienced in specific social contexts, underscoring the collective meaning-making of sense of place in such programs. Focus groups are noted for their ability to allow social interaction and discussion among participants, encourage conversation and questioning, and provide an avenue for participants themselves to compare and contrast experiences

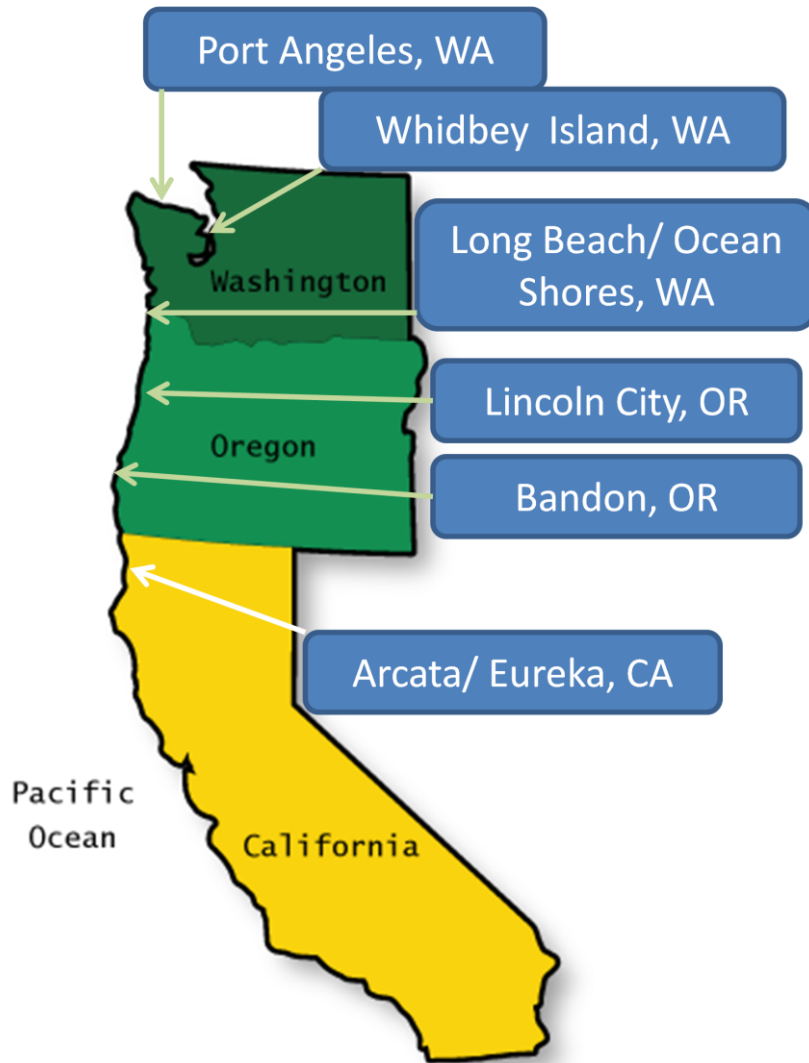


Figure 3.1: Study Area Geographic Hubs

(Goss and Leinbach 1996; Krueger 1994; Montell 1999; Morgan 1997; Seale et al. 2004). A semi-structured open-ended question protocol was developed for these meetings to elicit more detail and depth from interview participants during shared conversation (Appendix B). The protocol focused on prompting responses to the three primary research questions of the study:

- Question one (meaning-making) - Focused on the meaning, value, and personal significance of participation, the meaning participants assign to program sites, and the degree of attachment felt for those places. Examples include:
 - *Why is participation in COASST important to you and what do you gain from the experience?*
 - *What do you enjoy the most about your citizen science work? Least? Are there specific parts of the program that you feel like you get more out of than others?*
 - *After you complete a COASST survey, do you usually feel satisfied? Why or why not?*
 - *How easy would it be for you to go without visiting your beach? What would be missing? Do you think you could find what you would miss somewhere else?*

- Question two (factors that inform lived experience) - Focused on specific aspects of the study site or context that inform sense of place and participant experiences and overall sense of connection to nature. Examples include:
 - *Let's think more deeply about the meaning you associate with your beach. I'm specifically interested in whether or not particular aspects of your beach contribute to the meaning you feel. Let's consider:*
 - *Biological/Ecological Dimensions (e.g. ecosystem services, animals, ecological value)*
 - *Aesthetic (e.g. scenery, colors, textures, beauty)*

- *Cultural/Historical (e.g. cultural history of the place, historical significance)*
 - *Community/Social (e.g. role the place plays as a setting for social or community interaction or events)*
 - *Personal (e.g. spiritual or philosophical value, recreational or leisure benefits of place)*
 - *Other aspects?*
- Question three (sense of place) - Focused on the feelings, emotions, and interactions that inform participant sense of place. Examples include:
 - *When you think of your site, what are some of the first words or feelings that come to mind? They can be positive or negative.*
 - *Can anyone tell me when you get that feeling at your beach? What are the circumstances? Have you always felt that way at your beach? Do you have to be in a certain mood to feel that way?*

Guided narrative tours have been used in other leisure and recreation settings as a strategy to strengthen researcher/participant relationships and as a context-based form of research (Everett and Barrett 2012). Emerging in the field of management science and utilized frequently in cognitive science, education, and sociology, narrative inquiry is designed to expose knowledge, concepts, ideas, and attitudes, but also the “emotion of the moment” (Clandinin and Connelly 2000; Czarniawska 2004). Again, semi-structured questions were developed for these interviews to prompt conversation and give instruction (e.g., please show me around the area where you do research, describe what you do here), although a primarily open-ended format was utilized (Appendix C). Guided

tour interviews also allowed the principal researcher to immerse in the research context, serving as a method to observe and engage with research participants in an effort to build rapport, but also exposing the place-based dynamics and constructs of participation. Tour questions aligned with the three primary study research questions.

- Question one (meaning-making) - Focused on personal connection to and significance of study site and general value found via program engagement.

Examples include:

- *What is the value of what you are doing as a COASST volunteer? Why is participation in COASST important to you and what do you gain from the experience?*
 - *Is the opportunity to learn new skills or knowledge important? How about the social aspects of volunteering (interacting with other people)? Or the feelings you get when you are here?*
- Question two (factors that inform lived experience) - Focused on the psychosocial and socio-political elements of lived experience. Examples include:
 - *What interested you most about the program initially? What would you say was your primary motivation to volunteer to begin with? Did you have an interest in birds before you started the COASST project?*
 - *Has your motivation to participate (i.e. the reason you are willing to volunteer) changed since you have been a part of the program? Have your interests changed since then?*
 - *Why is it important that this beach be a part of the project? What is unique about this place or the way it is managed?*

- Question three (sense of place) - Focused on history with place, the development of a place relationship and the evolution of that relationship. Examples include:
 - *Could you share a little bit about yourself and your history with this place or area? How long have you lived here? For how long have you visited this beach?*
 - *If I were to ask you to try to describe the kind of connection you feel to your beach using a metaphor of another place, what might you say? Does it feel more like the connection you feel to your home, to your office space, to a classroom, vacation spot, recreational venue, or something else?*

In the summer of 2013, the principal investigator traveled to all six hubs to conduct research interviews. Before engaging in interviews with program participants, interviews were conducted with two members of the professional project management team at the University of Washington. These interviews were included as an essential aspect of data collection for they provided more context for the analysis of participant responses and helped position COASST participant experiences within the appropriate social, political, and historical context. A semi-structured interview format was utilized to elicit information regarding perceptions of the development of ‘sense of place’ among program participants and observations about the characteristics, behaviors, motivations and interests of program participants (Appendix D). All interviews were audio recorded for analysis with the permission of study participants and a researcher observation log was maintained during and after each interview while digital photographs of the guided tour sites were collected.

Respondent Participation & Characteristics

In total, one-hundred-eighty participants were invited to participate in this study, with seventy-eight opting in to the study for a forty-three percent participation rate. Thirty-five percent of participants were male and sixty-five percent were female. Ninety-six percent of participants were Caucasian. A total of seventy-one participants engaged in a one-on-one interview. A portion of these (n=twenty-one) occurred either over the phone or in places other than the COASST survey site in cases where availability or environmental factors (rain) prevented meeting at the participant's specific COASST beach. Additionally, fourteen participants engaged in one of three focus groups. As Table 3.1 indicates, residence length and the duration and nature of program engagement ranged substantially among participants.

Table 3.1: Select Study Participant Characteristics

Participant Characteristic	Study Participant Average	Study Participant Median	Minimum Study Participant Value	Maximum Study Participant Value
Residence Duration <i>Years residing at location</i>	12.6 Years	10 Years	< 1 Year	49 Years
Program Participation <i>Years participating</i>	5.6 Years	5 Years	< 1 Year	12 Years
Survey Frequency	1.19/month	.92/month	.41/month	5.58/month
Average Find Per Survey <i># of beached birds</i>	3.9 birds/survey	3.1 birds/survey	0 birds/survey	11.9 birds/survey

Data Analysis

All narrative interviews and focus groups were transcribed verbatim for analysis. Additional raw data included the personal notes and observations of the principal

investigator. A general inductive approach (Thomas 2006) was utilized to process interview data, including the following steps:

1. Data Immersion: Following an initial transcription of each audio recording by the principal investigator, all transcripts were reread in detail and notes were taken to highlight key themes, major areas of interest, important contextual factors, and major areas of convergence or disjuncture.
2. Developing Data Segmentation Categories: Based on major themes that emerged among participant responses, categories were developed to guide the first phase of textual analysis (Table 3.2 below). Each category was defined as to ensure that consistent definitions and interpretations were utilized for data segmentation.

Table 3.2: Categories for Data Analysis Segmentation

Coding Category
<i>Description</i>
Recruitment to Program & Beach Selection
<i>How the participant found out about the program, got involved and how and why their specific beach was selected or assigned for survey.</i>
Motivation to Engage
<i>Why the participant wanted to participate in COASST, what specific factors influenced motivation, and what elements of participation were particularly attractive.</i>
Program Rationale & Value
<i>Descriptions provided by participants of the value of the COASST program, the rationale for program procedures and processes as well as the use of program data for broader aims.</i>
Interest in Birds/Wildlife
<i>The overall interest participants have in birds and other forms of wildlife, including details about when and how such interests emerged and how they have evolved over time. Broader themes around connectedness to nature and natural resources were included as well.</i>
Thoughts about Science & Research
<i>How participants perceive science as a whole and the value of scientific research. Is science important and why? This includes discussions about participant background and knowledge of science and perceptions about whether or not they consider themselves a scientist.</i>
Participant Outcomes

<i>Descriptions of the various outcomes participants attribute to program participation. This includes outcomes at a personal, programmatic, or community/societal level.</i>
Place Attachment & Meaning <i>The participants relationship with his/her COASST site, how connected he/she feels to the site, what the site means, and whether or not attachment exists between person and place.</i>
Program Management & Recommendations <i>The positive and negative aspects of participation in the program. What do participants enjoy and what do they think could be improved? This includes specific recommendations with regards to program management.</i>

3. Coding Text: QSR N'Vivo software (version 2.10), a qualitative analysis tool that allows the review, segmentation, and comparison of large sets of textual data, was used for this step in the process. Each transcript was read and all text was first assigned into the coding categories noted above. Subsequently, each category was considered independently, all text within that category was re-read and sub-nodes were developed to identify central themes within that area of interest. For example, text coded under *participant outcomes* was then assigned to an additional node like "social connections", "increased environmental awareness", and "greater knowledge about birds." These themes were developed iteratively with a grounded theory approach, based on constant comparison of other text within the category and previous scholarship and literature on place. As thematic nodes were developed, a coding dictionary was recorded to capture how each theme was defined and interpreted. Although narrative interviews and focus groups were coded similarly, text from focus group conversation was coded more often as a string of text, to ensure that the full conversation and context was assigned to the appropriate category.
4. Reviewing Category Themes and Cleaning Data: Text assigned to each node within N'Vivo (representing a unique themed finding like outcomes associated with "social

connection") was examined to ensure consistency in coding by identifying the central themes and "take-away" messages indicated by the data in that node and reassigning text that did not align with the majority of the node text. At this point, major findings within each category were compared against the writing and audio clip notes of the principal investigator to enhance reliability.

5. Identifying Patterns & Interactions: Major themes and findings from each category were examined against other categories to identify relationships, similarities, or differences among the results. For example, if results from analysis of participant outcomes revealed that a large majority of participants highlighted place meaning associated with the birds and wildlife of that place, this result would be compared against information regarding the motivation of those participants to engage in the program. On the one hand, if results from motivation analysis suggest a high percentage of participants motivated to participate because of a desire to see birds, the place meaning centered on this aspect of place would be situated within that context. However, if interest in birds was not a significant motivator for participants who expressed place meaning around interactions with wildlife, further review would interrogate how the major motivating factors among these participants might play a role in facilitating place meaning centered on birds. At this point, N'Vivo matrix coding was utilized to compare the results in each category against participant demographic information, including age, gender, and race as well as select program participation characteristics (see above) to determine whether or not patterns existed between these variables and significant research findings.

6. Summarizing, Situating, and Evaluating Against Theory and Practice: Major findings were summarized and situated within relevant knowledge communities and applied participatory science practices. Specifically, results were evaluated against literature highlighted in chapter two about PPSR and the theoretical frameworks that guide participatory science program development and assessment as well as research on affective geographies, sense of place, and the significance of place meaning and attachment as a mediator of human-environment interactions. The methods employed in this study allow for data and environmental triangulation, while a detailed coding dictionary provides both transparent and defensible coding strategies.

CHAPTER FOUR

EXPLORING THE LIVED EXPERIENCES OF PARTICIPATORY SCIENCE VOLUNTEERS: THE INFLUENCE OF CONTEXT, SETTING, AND PERSON²

Abstract

Participatory science programs, designed to support public engagement in scientific research, often profess significant benefits for volunteer participants, including those connected to environmental attitudes and behaviors. Utilizing sense of place theory and scholarship to explore an expansive citizen science project called COASST, this study fills a literature gap by affording a window into the "lived experiences" of participatory science volunteers. Theoretical tenets from place scholarship provide the foundation for recommendations to modify a major participatory science development and assessment framework (Shirk et al. 2012). This modified framework is then utilized to explore the "environmental embodiment" of COASST participants through three major dimensions of experience. Findings reveal that the *socio-political* aspects of place ownership, access, and use can influence overall feelings of place connection and value, shaping a broader sense of place and program ownership and responsibility. Volunteer motivations around connecting, conserving, and contributing demonstrate how *psycho-social processes* also shape place perception, interactions, and relationships. Finally, the

² Haywood, Benjamin. To be submitted to *Social and Cultural Geography*

biophysical visual, auditory, olfactory, and tactile experiences of place play key roles in mediating sense and connection to place and place meaning. Highlighting the role of place in these programs provides room to interrogate the meaning-making that occurs among COASST volunteers, meaning which ultimately shapes how such experiences translate into attitudinal or behavioral impacts. Major results from all three embodied experiential dimensions are related to broader participant outcomes around building community, enhancing education and awareness, and increasing satisfaction and personal health to highlight the utility of the modified structure of analysis.

The Growth of Participatory Science

Over the past two decades, participatory science practices like citizen and community science have become increasingly popular as tools to communicate and enhance science and to enact participatory public engagement processes that cultivate more "democratic" science research and policy initiatives (Dickinson, Zuckerberg, and Bonter 2010; Miller-Rushing, Primack, and Bonney 2012). More members of the public are now engaging in scientific research projects and exploring various natural science topics through participatory science programs (Bonney, Ballard, et al. 2009). Furthermore, the data produced from these efforts has become a highly desirable commodity among professional scientists and research institutions (Devictor, Whittaker, and Beltrame 2010; Dickinson et al. 2012). As participatory science becomes an increasingly common avenue through which citizens engage in informal science exploration, research on the impact of these practices on program participants has expanded rapidly (Ballard and Belsky 2010; Braschler et al. 2010; Brossard, Lewenstein, and Bonney 2005; Evans et al. 2005; Jordan et al. 2011; Trumbull et al. 2000). Even still,

questions remain regarding the phenomenology of the participatory science experience itself, how it is felt, lived, and interpreted, and how that may shape the effects of these programs.

This article reports on results from a study designed to explore the phenomenological experiences of participatory science volunteers and to consider in depth the role of lived experiences in mediating project outcomes. Examining the relationships between the people and places involved in participatory science programs provides a significant point of entry to study the multi-dimensional processes involved in the overall meaning-making that contributes to those experiences. Drawing from literature within geography and environmental psychology, the focus of this research is on how participatory science both impacts and is impacted by volunteer ‘sense of place’, a topic seldom included in conceptual models designed to understand such experiences and volunteer outcomes.

The Changing Nature of Participatory Science

As Silvertown (2009) has noted, some of our most revered early scientists like Benjamin Franklin and Charles Darwin were only “informal” scientists, making a living in areas outside of what today has become a professionalized science research community. Yet Franklin and Darwin were not anomalies in their day. Just two centuries ago, almost all natural scientists were what we might now call “citizen scientists,” making a living in other fields but meticulously observing and collecting information about natural phenomena because of sheer interest or pleasure. While the idea of citizen science itself may not be new, the practice has changed since Darwin’s voyage on the *H.M.S. Beagle*. Today, participatory science practices like citizen science have grown in

size, scale, and scope, generally organized as a more formal partnership between citizen volunteers and portions of the professional science research community, falling under an umbrella of practices dedicated to public participation in scientific research (PPSR) (Shirk et al. 2012).

Shirk et al. (2012) has outlined a framework for PPSR initiatives (Figure 4.1) that conceptualizes the life cycle of a PPSR project. Beginning with the interests, questions, and resources that intersect to initiate a project (inputs), the framework highlights significant segments of the PPSR experience, all the way to the long-term results of the program (impacts). In between are the activities initiated by program leaders to structure and manage it (activities), the immediate results of program participation (outputs) like the information collected, and the results of such experiences (outcomes), for science, social-ecological systems, and individuals. Based on this framework, outputs are defined as the immediate products of PPSR programs, outcomes are the direct results of those aspects, and impacts are the long-term, sustained effects that may emerge.

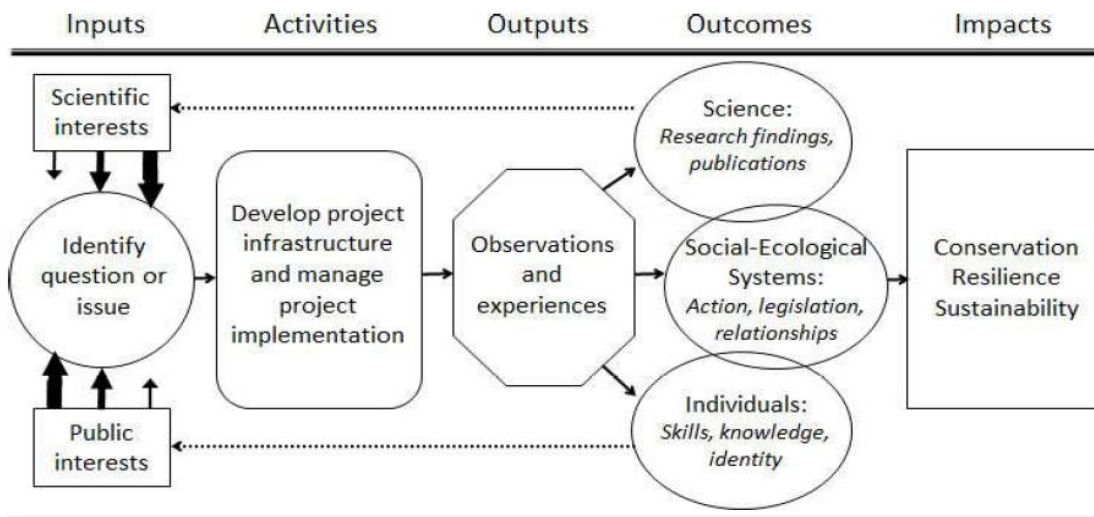


Figure 4.1: Shirk et al. (2012) Framework for Public Participation in Scientific Research (reprinted with permission, see Appendix E)

The framework presented above represents a shift in PPSR program development and assessment away from a traditional narrow emphasis on the outcomes of such programs for research alone. As Lawrence (2006) has noted, early scholarship on the growth and value of PPSR within the twenty-first century largely focused on the "external" value of these programs for the advancement of scientific knowledge and data collection techniques. Yet, as PPSR programs continue to grow in number, more scholarship is now being devoted to the impact these programs have on social-ecological processes like resource management (Cooper et al. 2007; Danielsen, Burgess, and Balmford 2005) and environmental policy (Overdeest, Orr, and Stepenuck 2004; Wilderman, Barron, and Imgrund 2004), as well as the personal outcomes of participation for volunteers (Ballard and Belsky 2010; Bell 2009; Evans et al. 2005; Jordan et al. 2011). A focus on PPSR volunteer outcomes in particular aligns with broader strategies by science professionals to enhance informal science education via participatory science regimes (Bonney, Ballard, et al. 2009).

This body of growing research has attributed a number of impressive outcomes to PPSR programs. From a social-ecological perspective, PPSR has been linked with increases in public engagement in science policy and decision-making and enhanced social connections and capacity (Bell 2009), growth in the overall resiliency of local communities (Berkes 2009; Walker and Salt 2006), and improvements in the accessibility and availability of scientific information for environmental conservation (Overdeest, Orr, and Stepenuck 2004). Improved relationships and collaboration among community members and natural resource managers including strengthened trust has also been noted (Ballard and Belsky 2010; Roth and Lee 2002).

The list of outcomes for participants is much longer (for a thorough review see Haywood 2014), but generally includes enhancements to science literacy, knowledge, and understanding (Brewer 2002; Danielsen, Burgess, and Balmford 2005; Jordan et al. 2011; Sullivan et al. 2009), increases in "scientific thinking" and the ability to interpret science information (Braschler et al. 2010; Kountoupes and Oberhauser 2008), and growth in science skills like observing, measuring, and recording data (Bonney et al. 2009). A large portion of the research on individual PPSR outcomes is situated within a science literacy lens and often privileges questions regarding cognitive knowledge and inquiry, while passing over the many other behavioral and affective aspects of participation that both influence cognitive gain and inform overall experiences.

As Figure 4.1 demonstrates, Shirk et al. (2012) incorporate not just science outcomes in their framework, but those for social-ecological systems and individuals as well, suggesting these outcomes are shaped by a string of inputs, program activities, and specific outputs of participation. The relationships depicted in this diagram raise a number of questions regarding how PPSR outcomes form, the variables that shape them, and how they inform broader impacts.

The Lived Experiences of Volunteers and a Sense of Place

Although a network of actors are involved in initiating, managing, and implementing PPSR projects, the volunteers that are the life-blood of PPSR efforts provide the core of such programs. Accordingly, their engagement and experience plays a fundamental role in the outcomes and impacts of participatory science. Within the framework provided by Shirk et al. (2012), participant experiences are included in the outputs portion of the diagram. Describing this portion, Shirk et al. (2012, p 29) suggest

outputs include "the active experiences of making, facilitating, and/or analyzing observations and measurements." Participant experiences are presented as a minimal component of the framework, with little emphasis on the dynamic and multi-faceted actors, systems, and processes that mediate this component of the participatory science model. Though participant experiences are acknowledged within this definition, program outputs are more often assessed as quantified results of activities (e.g. amount of observations made, volunteer hours committed). Given this emphasis on measurable output variables, experiential components of participation are often overlooked. Considering the prominent role of volunteers in participatory science and the relative lack of attention their experiences have received in scholarship, an opportunity exists to further recent research trends focused on the multi-dimensional outcomes and impacts of PPSR by examining the experiential aspects of these programs.

Research on "lived experiences", sometimes called "everyday geographies" is a robust area of inquiry within the field of human geography that affords a unique perspective into PPSR programs. With roots in humanistic, existential, and phenomenological traditions, inquiry within this tradition foregrounds human experience, awareness, and meaning in analysis of relationships between people and the world around them (Low and Altman 1992; Proshansky, Fabian, and Kaminoff 1983; Tuan 1975). Central to lived experience scholarship is the concept of environmental embodiment - "the various lived ways, sensorily and mobility-wise, that the body in its pre-reflective perceptual presence encounters and works with the world at hand" (Seamon 2013, p 148). Such embodiment is original and subjective, stemming from immediate cognitive, affective, and behavioral interactions with what phenomenologists call the "life-world"

(Seamon 1979). The way in which individuals experience place and the activities that occur there, how meaning is developed via such experiences, and the networks of variables that influence them are of principal concern. Because the majority of PPSR initiatives involve in situ interactions between people and a particular place, examining the relationships between program volunteers and the places they explore provides a unique window into the everyday lived experiences of these participants.

Sensing Place

Emphasizing the lived experiences of people in place is particularly effective at highlighting the many modes through which individuals experience the world. The architect Juhani Pallasmaa (2005) has critiqued Western thought as relying too heavily on the sense of sight as the most essential of all senses, neglecting the other valuable means through which individuals engage the environment around them. Pallasmaa advocates what he calls "sensory engagement" as an architectural tenet, focusing not just on what is seen, but also on what is felt, smelled, and heard. Beyond just built structures, all spaces are sensed with the human body. It is a sense of the environments around us that allows us to remember them; their smell, touch, color, or sound.

As these sensual experiences intersect and form meaning at a spatially concentrated site, a *place* takes form (Tuan 1975, 1977). Place, in this context, is more personal, particular, and intimate than space. Space surrounds us always, yet place is where we find meaning and comfort among the vast expanse of possibility. Home, for example, is a powerful and intimate place in which to find meaning, positioned within the greater possibilities of space.

Even still, although place in this context implies a spatially grounded phenomenon, Pallasmaa (2005) avers that multi-sensory engagement with place is a vehicle to move “past” the physical surface of things, to interact with other dimensions of the world that inform inter and intrapersonal meaning. These interactions collectively allow individuals to form a sense of place, an overall collection of impressions, feelings, and beliefs. This involves a recognition that place is more than just a material site, but is also a relational network. Such networks are comprised of structures of power and control, ideas and imaginations, and individual and communal relationships. Scholars like Massey (1991) have advocated for a fully relational conceptualization of place, one which foregrounds the global interconnectedness of all things and thus positions place as only a temporary intersection of relationships that form at a given site. Jones (2009, p 489), on the other hand, proposes a hybrid concept in his notion of phase space, a concept that “acknowledges the relational making of space but insists on the confined, connected, inertial, and always context-specific nature of existence and emergence”.

Place as a Multilateral Phenomenon

The field of cultural and social geography has a long tradition of scholarship on place, sense of place, place making, and place meaning (Brace, Bailey, and Harvey 2006; Hidalgo and Hernandez 2001; Kruger and Jakes 2003; Relph 1976; Tuan 1975; Tuan 1977). Relational perspectives within this body of literature conceive of place as a product of co-constructed meanings among multiple actors that involve cognitive, affective, and behavioral dimensions. To the extent that studies on sense of place have considered human-environment interactions, these studies highlight place as a spatially concentrated site at which networked socio-political contexts, psycho-social processes,

and biophysical settings overlap (Ardoin, Schuh, and Gould 2012; Scannell and Gifford 2010; Stedman 2003a). Seamon (2013, p 150) has defined place as "any environmental locus that draws human experiences, actions, and meanings together spatially". Among a rich and diverse literature on place, these elements together constitute three central components of place as a multifaceted phenomenon (Cheng, Kruger, and Daniels 2003).

The *socio-political context* in which a place is situated forms the boundaries that govern that place and the communal aspects that contribute to it. The network of family, friends, and acquaintances connected to a place can have prominent influence over the meaning and significance created there and the human-environment interactions that occur (Lewicka 2011). Furthermore, Ardoin (2006) has highlighted that the symbolic and cultural significance of place, along with specific components, artifacts, or place-based processes, contribute to the overall feeling one has in any given place and the manner in which that becomes a part of social or personal identity. At the same time, the political and economic systems which shape places have significant power over sense of belonging or exclusion (Dominy 2000; Price 2004; Smith 1984), aspects rooted in historical and contemporary political-economic systems or power (Cheng, Kruger, and Daniels 2003; Davis 2005; Pred 1984).

What a person brings to a place and how that person interacts with it is a second major element of the place-making and meaning-making experience connected with *psycho-social processes*. The individual backgrounds, beliefs, values, memories, and experiences of individuals that inform a sense of self (Droseltis and Vignoles 2010), as well as how those aspects are integrated and molded via group dynamics, all influence experiences of place. Finger (1994) has suggested that the life experiences, worldviews,

and behavioral interactions of individuals contribute to his/her "life-world", an element he has demonstrated has significant impact on overall attitudinal and behavioral outcomes of human-environment interactions. Specifically, the motivations one has to engage with a place and what he/she hopes to gain from it will inevitably color experiences of place. Within a PPSR context, research on the outcomes of environmental volunteering and PPSR has indicated that participant motivation to engage may help predict volunteer outcomes (Jordan et al. 2011; Measham and Barnett 2008; Rotman et al. 2012).

Research on motivation has revealed several broad motives for engaging in volunteer activities, including those around egoism, altruism, collectivism, and principlism (Batson, Ahmad, and Tsang 2002). Focusing more directly on environmental volunteerism, Schultz (2001) has proposed three primary motives - egoistic, altruistic, and biospheric - as the primary psychological drivers for participation in such projects. In a pilot study with environmental volunteers in two separate areas in Australia, Measham & Barnett (2008) identified six general factors that motivate environmental volunteering. These include contributing to community, social interaction, personal development, learning about the environment, a general ethic of care for the environment, and attachment to a particular place. Motivation, therefore, often serves as a useful proxy to consider the role of the self in shaping PPSR volunteer experiences and may help explain how those experiences are shaped by people-place relationships.

Finally, *biophysical* features are integrated into theories about place in multiple ways. In some cases, the material aspects are considered of little importance in contrast to the socially constructed meanings developed in that place (Greider and Garkovich 1994).

Others theorize the setting as a backdrop, inscribed as a platform on which larger social-cultural processes occur (Abbott-Chapman and Robertson 2009). On the other hand, scholars like Stedman (2003) argue that the biophysical characteristics of a place are the foundation of the meanings constructed in places. Further still, several researchers argue that biophysical components play a more active role in the formation of place, as central elements of dynamic place-making processes (Manzo 2003; Shumaker and Taylor 1983; Trentelman 2009).

One approach to place scholarship that emphasizes the biophysical aspects of place is Actor Network Theory (ANT), which expands the notion of actors involved in lived experiences to include more than just humans. As such, inanimate objects and non-human actors are acknowledged as part of the complex networks that come to ground in particular places (Hitchings 2003; Wolch and Emel 1998). Within this framework, PPSR experiences are constructed within networks of material-symbolic experiences, not just human representational processes.

ANT treats place as an assemblage of networks that come to ground in particular sites (nodes). These networks include both human and non-human (biophysical) actors. Expanding the plane of analysis to include non-human actors has encouraged new investigation of the agency of plants (Hitchings 2003) and animals (Emel, Wilbert, and Wolch 2002; Wolch and Emel 1998; Wolch 2002), even though "agency" in this case is relative and not always based on an assumption of equal power. Even the climate of a place has been linked to the meaning found there (Knez 2005). For scholars that maintain an actor-network perspective, the biophysical setting does not pre-ordain the meaning that forms in place, yet does play a substantial part in the meaning-making process.

Relational geographic theories like ANT provide helpful approaches to consider the multi-dimensional actors, systems, and processes that constitute place.

Such a threefold model allows the investigation of place as both a globally interconnected process and situated experience. The socio-political context of place is shaped by historical and contemporary structures or power and institutional systems, but also explicitly mediates behavior in particular settings. Psycho-social processes emerge from extensive collections of personally and socially constructed meaning forged at the intersection of mind, body, and spirit, yet are always imbued with the fabric of specific sites. And although any one geographic location will demonstrate unique biophysical properties and character, such aspects are inherently connected and dependent on larger interrelated ecological systems.

Inserting Lived Experience and Place in the PPSR Framework

Such a place-based window helps expand analysis of the many people, places, and processes that influence the development and management of PPSR programs and the impacts these programs have on science, social-ecological systems and the individuals that participate. This place-based approach to participatory science therefore expands the framework presented by Shirk et al. (2012) by inserting participant lived experience as a sixth major element of such programs and by modifying ideas around program outputs to include an experiential component. Additionally, the multilateral model of place discussed above is incorporated into the framework to recognize the substantial influence that socio-political context, psycho-social processes, and biophysical settings play throughout the PPRS process, from shaping initial interests and research questions, to mediating long-term impacts. The tailored framework (Figure 4.2) structures the

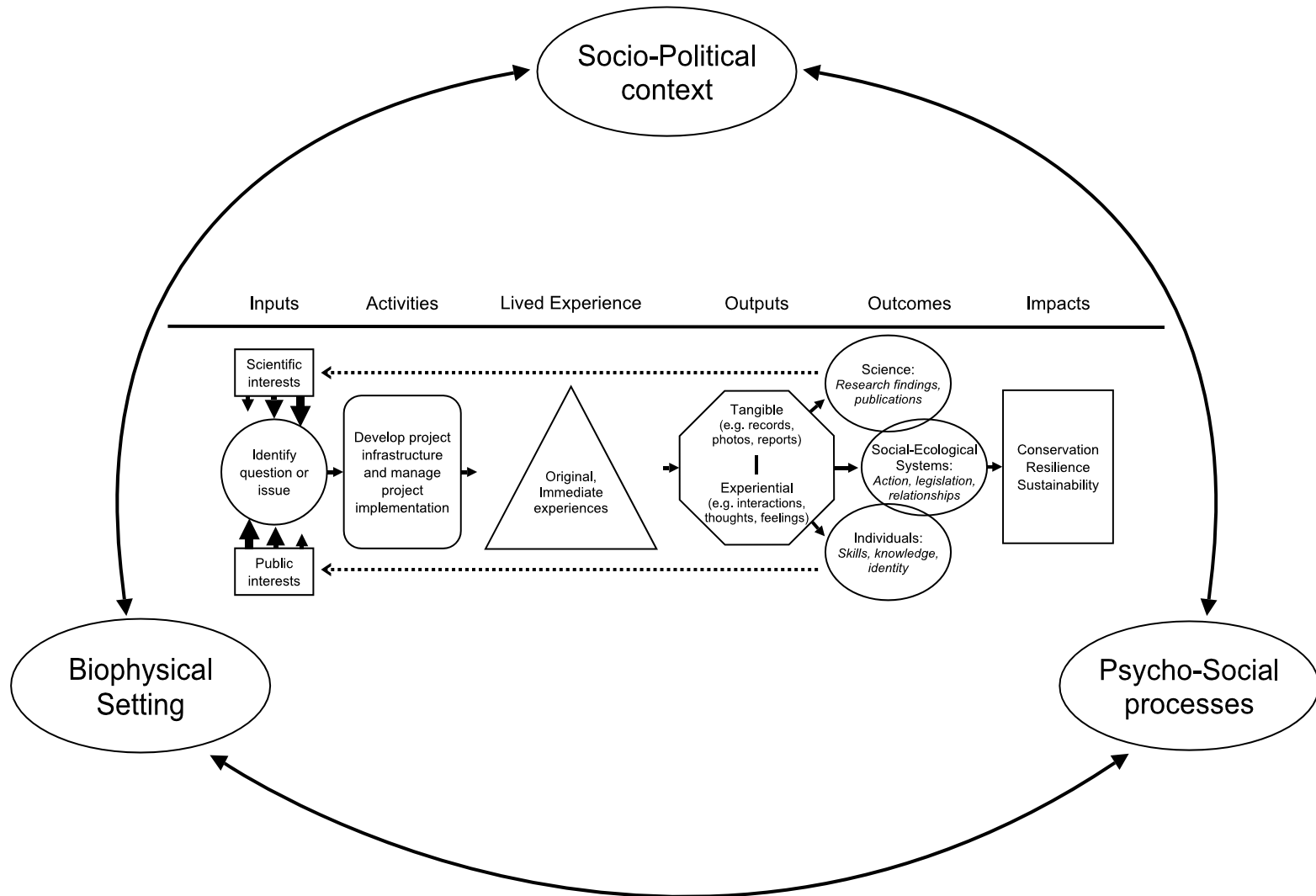


Figure 4.2: Adapted Framework of PPSR

approach used in this article to analyze the lived experiences of volunteers in participatory science, with specific attention to how these experience mediate program outputs and outcomes.

Methodology & Methods³

This study uses an idiographic methodology that approaches places as “qualitative totalities of a complex nature” that involve contingent and unique experiences and interpretations that resist broad and analytically derived generalizations (Lewicka 2011, chapter six). Nonetheless, as Seamon (2000) has highlighted, although phenomenologists like Tuan (1975) do not seek nomothetic inquiry, they are still invested in identifying “commonalities,” or general qualities and characteristics that are shared across places. In this vein, although a predominantly idiographic lens was employed for this study, areas of common experience and connection among distinct places are also granted full attention.

The Coastal Observation and Seabird Survey Team (COASST) program was selected as the focus of this study as the program objectives and structure have several characteristics which make it a strong project in which to thoroughly interrogate sense of place. Organized in 1998, the program was established to determine a baseline rate of seabird mortality and health along the Pacific Northwest U.S. by documenting the distribution of beached sea birds. Since then, the study has grown to now span four states (AK, CA, OR, WA) and include nearly eight hundred participants. Program volunteers

³ To include the note: Portions of the methodology and methods section were first published in Haywood, B. Birds and Beaches: The Affective Geographies and Sense of Place of Participants in the COASST Citizen Science Program. The University of South Carolina

select a beach to "adopt" in their community and commit to survey the beach at least once a month for beached bird carcasses and other marine debris. Over five hundred beaches are a part of the program, each with highly diverse features and characteristics. Situated on the boundary of several major mountain ranges (Cascade, Olympic, and Columbia ranges) and the Pacific Ocean, the COASST study area is constantly shaped by geologic, weather, and tidal forces, forming rocky cliffs, bays, and river deltas that abut the vast nutrient rich waters of the Pacific.

Not only does COASST have a long record of successful volunteer recruitment and retention, but it also has contributed substantial scientific data for agencies and organizations across the Pacific Northwest region. COASST provides ample opportunity to consider sense of place among PPSR participants as the program is designed so that individuals repeatedly visit the same place over time and are asked to focus attention on the place itself. In addition, participants engage a wide range of beach sites, across a diverse geographical area, yet undergo consistent training and instruction while completing identical tasks at each site. This allows for the comparison of sense of place across a diverse sample of places and individuals who engage in a similar type of place interaction.

In the summer of 2013, COASSTers were contacted who lived within a forty-five mile radius of six unique geographic "hubs" across the program territory (with the exception of Alaska). These hubs were selected in consultation with program administrators after considering which places would offer geographic and participant diversity and contain a high density of COASST volunteers. All recruitment was coordinated through the COASST program office, with initial emails serving as a first

line of contact and follow-up phone calls used to target individuals who had not yet responded to invitations. COASSTers invited to participate were provided with an online link to additional project material (e.g., participation options, confidentiality procedures) and were asked to either opt-in or opt-out of the project. Those that elected to opt-in were contacted to confirm participation and review scheduling and logistics. A total of one-hundred-eighty individuals were invited to participate in the study. Seventy-eight volunteers elected to join the study, for a forty-three percent participation rate.

Two primary research methods were used, focus groups and guided tour narrative interviews. Focus groups are noted for their ability to allow social interaction and discussion among participants, encourage conversation and questioning, and provide an avenue for individuals themselves to compare and contrast experiences (Morgan 1997; Krueger 1994; Seale et al. 2004). A semi-structured open-ended question protocol was developed for these meetings to elicit more detail and depth from COASSTers during shared conversation (see chapter three for more detail). These included questions regarding what participants value most about volunteering; words, feelings, and meaning associated with survey sites; details regarding volunteer responsibilities and experiences; and the various actors that help shape experiences.

Second, guided narrative tours have been used in other leisure and recreation settings as a strategy to strengthen researcher/participant relationships and as a context-based form of narrative research (Everett and Barrett 2012). Emerging in the field of management science and utilized frequently in cognitive science, education, and sociology, narrative inquiry is designed to expose knowledge, concepts, ideas, and attitudes, but also the “emotion of the moment” (Clandinin and Connelly 2000;

Czarniawska 2004). General semi-structured questions (available in chapter three) were developed for these interviews to prompt conversation and give instruction (e.g. please show me around your beach). So that COASSTers were free to consider and define personal outcomes on their own terms, they were asked open-ended questions that encouraged them to reflect on what they have gained from and value about volunteering and what benefits they most appreciate on a personal level. This strategy was employed as an alternative to a more narrow inquiry into specific outcomes (i.e. what have you learned from participating, have you developed new friendships) to ensure that participants were not influenced to consider only certain types of outcomes more commonly measured in formal assessments. Additionally, follow-up questions regarding outcomes associated with relationships with place were posed to explore further how sense of place may be influenced by PPSR experiences.

In the summer of 2013, the author traveled to all six hubs to conduct research interviews. Fourteen COASSTers participated in one of three focus group events, while seventy-one engaged in guided tour narrative interviews (seven did both). Twenty-one of the seventy-one personal interviewees had to be conducted over the phone because of environmental (rain) or scheduling constraints. In record keeping, all participant names were replaced with pseudonyms to protect confidentiality and are thus utilized to attribute quotes in this manuscript.

Analysis

All study interviews were audio recorded and transcribed verbatim for analysis. Additional raw data included the authors' own personal notes and observations. A general inductive approach (Thomas 2003, p 2) was utilized to process interview data. This

included an initial step of immersion and transcription of all the audio data, followed by the development of a textual codebook. The data codebook was developed with a focus on two central topics of this research, participant outcomes and lived experiences.

An initial set of coding categories for participant outcomes was developed using existing literature (see Haywood 2014 for a review of outcomes types), paying special attention to the potential affective aspects of engagement like building trust (Overdevest, Orr, and Stepenuck 2004; Roth and Lee 2002), cultivating self-efficacy (Lawrence 2006; Wilderman, Barron, and Imgrund 2004), and enhancing connection to place (Evans et al. 2005). Additional categories were added that emerged in the data once all text was reviewed (e.g. physical/mental health). Outcome responses were then coded using QSR N'Vivo software (version 2.10) and separated into the categories presented below in the results section (for more detail on these outcomes see chapters five and six).

Concurrently, responses about participant outcomes as well as those regarding the thoughts, feelings, and opinions of COASSTers about survey procedures, program interaction, and the elements that shape them (i.e. lived experiences) were separated into three categories based on the theoretical approach outlined above (see Figure 4.3).

Responses relating to the political or social dimensions of COASST participation (e.g. policies that govern survey spaces) were grouped in the *socio-political context* category. Those relating to the motivations of participants to engage or remain involved in COASST were assigned to the *psycho-social* processes category as this one dimension of participant experience was used to explore the psycho-social influence on the COASST experience. Finally, any responses focused on the value of various elements of the natural setting in which COASST surveys take place (e.g. wildlife, colors, sounds) were assigned

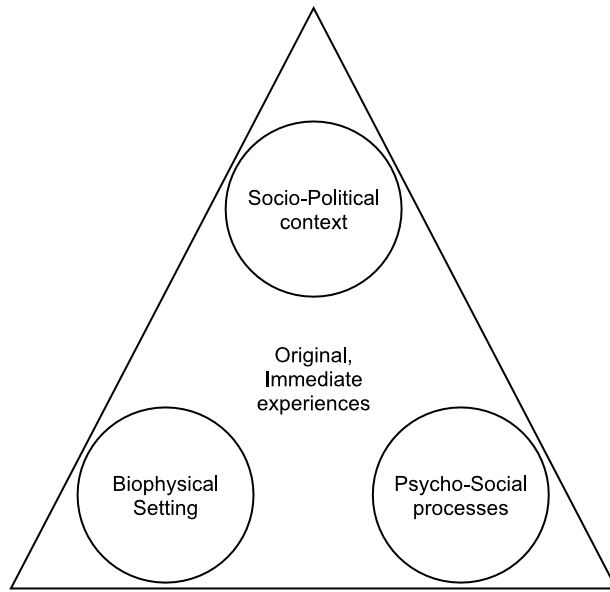


Figure 4.3: Three Aspects of Participant Lived Experience

to the *biophysical setting* category. From that point, data were reviewed inductively for the purpose of identifying the major themes in each category. These topics were recorded in a codebook and all data were subsequently assigned exclusively to the appropriate category (using N'Vivo). Once coding was completed, a final review was conducted of all established categories for consistency and to cross-check with research observation notes. These findings form the basis of the results reported below. For more information about this process, chapter three provides a thorough review of the methodology and methods used in this study.

PPSR Experiences and Outcomes

What do COASST Participants Gain from Participation?

Before considering the role that the socio-political context, psycho-social processes, and the biophysical setting play in influencing PPSR volunteer experiences, it is useful to first consider the personal outcomes reported by COASSTers. A subsequent review of lived experience will help account for these outcomes and contribute to an

understanding of their development. Although not an exhaustive list, Table 4.1 provides a brief overview of the outcome themes indicated by COASSTers most frequently. These fall within three major categories, including building connection, education & awareness, and satisfaction & health. For a more detailed explanation of these outcomes see chapters five and seven.

Table 4.1: Primary Personal Outcomes of COASST Participants

<p>Building Connection</p> <p><i>Altered Sense of Place and Connection</i> Altered or enhanced meaning associated with the survey site, or a stronger sense of connection or attachment to that particular place.</p> <p><i>Social/Community Connections</i> Social interaction facilitated by the program (with team partners, other local volunteers, COASST network participants) supports increased social bonds with other people or communities.</p> <p><i>Connection to Wildlife & Nature</i> Heightened or more intense feelings of connection to wildlife or concepts of "nature". For some, this was an overall sense of connection to "natural" places like coastal environments, others found increased ties with specific aspects of wildlife like birds or marine mammals.</p>
<p>Education & Awareness</p> <p><i>Greater Awareness and Appreciation for the Coast</i> Increased sense of awareness of coastal environments and their role in larger ecosystems, fostering a stronger sense of appreciation for such systems. Elevated consciousness of the dynamics of coastal places.</p> <p><i>Learning & Gaining Knowledge</i> Increased knowledge of coastal ecosystems, the natural history and anatomy of birds, and scientific research and processes were among the top areas of learning noted by participants. Participants noted increased learning about a broad range of topics, facilitated by program training, program resources, and experiential processes.</p>
<p>Health & Satisfaction</p> <p><i>Sense of Satisfaction & Contribution</i> Personal satisfaction associated with a sense of making contributions to science, society, and the environment. Recognizing specific contributions to a much larger project elicits feelings of pride and accomplishment.</p> <p><i>Physical/Mental Health</i></p>

Due to the physical nature of volunteer engagement (walking beaches) and the mental stimulation encouraged by focused attention and challenging cognitive tasks, overall improvements to health were noted.

The Role of Lived Experiences in Shaping Participant Outputs and Outcomes

The various volunteer outcomes reviewed above reflect the lived experiences of COASSTers. Such experiences are shaped by heterogeneous actors and phenomena and produce the direct tangible and experiential outputs (reports, connections, interactions, observations) that ultimately shape program outcomes. Highlighting the three aspects of place that I argue encompass all participatory science initiatives, the lived experiences of COASST participants are considered below.

Socio-Political Context

COASSTers revealed three broad socio-political-economic forces which shape and govern the beach spaces in which volunteers engage. Issues of beach ownership, access, and use heavily influence participant experiences on beaches in Washington, Oregon, and California.

Ownership: The question of who owns beaches in these three states is a matter of historical and contemporary conflict. In Washington State, for example, a bill was passed in 1889 approving the sale of state tidelands to private citizens. Approximately sixty to seventy percent of the state's beach areas were privately owned by 1971, when the practice of selling beach property rights ended. The legacy of this history still exists today, with a patchwork of public and private beaches across the state, where access issues are often contested and complex. On the other hand, a 1967 "Beach Bill" ("Oregon Beach Bill" 2013) in Oregon established public ownership of land from the water inland up to sixteen feet throughout the Oregon coast. Although private citizens can own land

abutting this boundary, all wet and dry beach areas within the boundaries of the law are owned by state residents. California law rests somewhere in the middle, recognizing the right of private citizens to own property to the "mean high tide line" as well as the right of the public to access the "wet," tidally influenced portion of the beach.

In each case, study participants frequently expressed how issues of ownership shape the connection, sense of pride, and responsibility felt for specific beach areas. Ownership laws govern the rights or lack thereof to interact or alter the beach landscape. The degree to which a particular beach is privately or publically owned, for example, influences the level of connection or attachment felt for that specific beach, the sense of satisfaction felt with participation, or the nature of connections felt between participants and the wildlife at that site. Explaining why he felt a responsibility for his beach site, William, who surveys a beach in Oregon, added:

Well the other thing is it is all public property. There is no private beach in the state, up and down the coast. And they have state parks and beach access I think about every half mile. So you can get to the beach and enjoy it. Up to the vegetation line is owned by the public. This used to be a public highway, yeah, in the old days, for wagons and stagecoach and stuff. Well, the interior was all very dense forest and you couldn't get through it and so they came up along the beaches. And that was the basis for public ownership. (William)

Jeannie, on the other hand, noted the selection of her beach as a way to assert her right to a piece of a large privately owned beach area in Washington. Her feelings of ownership and need to express that right has influenced her feelings of connection to that place.

And most of these beaches are private beaches anyway. For COASST, we said we would do our beach because we live out on this road here. It is like a home owners association but everyone is supposed to own 1/60 of the beach. Once we claimed our area through COASST, it has become 'our beach'. (Jeannie)

Access: Struggles over beach ownership raise questions of beach access as well. In some cases, like in Washington State, the experience is quite different when private beach owners have the right to restrict access to specific beach sites, limiting who, what, and when individuals utilize the site. As a result, many beaches are completely closed or restricted with barriers preventing public access. In other areas, like California, property owners often erect fences and gates to restrict coastal access along the mean high tide line, but are challenged by members of the public who have a legal right to access the property along the wet shoreline. In Oregon, where all coastal areas within a specific extent are publicly owned, private property owners and members of the public often disagree about where access boundaries begin and end. These diverse laws and regulations are interpreted differently at both state and local levels, influencing the ability of specific individuals to access beach sites. Even on publicly owned beaches, however, a variety of regulations exist to govern specific access points as well as the use of coastal resources. Speaking of the peace-of-mind expressed as an outcome of program participation, Marian and Jackie credit some of this to the beach access afforded due to program participation on an otherwise private beach.

I hardly ever see anyone. They don't let public people on this beach so I have a special permission form COASST that I have to stick in my window. Once I saw a couple of guys surfing and that was it. It is kind of nice, it is very relaxing. (Marian)

When I selected my beach, I knew that it was private - it is all owned by the homeowners association. Honestly, that was attractive because that meant there would be fewer people and I would be able to relax. (Jackie)

Use: Beyond issues of ownership and access are questions about beach use. In particular, conflict around vehicle (passenger and ATV) use on beaches exists in all three states and was a major concern for many COASST participants. In Washington, some

public beach areas are actually designated state highways, allowing all forms of vehicle traffic on the beach. California generally limits certain types of vehicular use or denies access at particular times of the year, although local laws produce a landscape of highly variable regulation. The presence or absence of vehicles on the beach directly influences the atmosphere and culture of each specific beach site, often leading to specific beaches being associated with unique activities or communities. The presence of vehicles themselves is cause for alarm for many COASSTers, given negative experiences associated with wildlife and vehicle collisions.

Vehicles are allowed on our beach. There have been dogs hit and people sometimes get hurt. Things can get out of hand. We will get some yahoo in his pickup and he will decide to mow down birds. It is just terrible to have vehicles on the beach. I forget how many gulls just a couple of years ago were killed by a driver. And we got outraged about it. Thankfully he was caught. (Lisa)

Further still, beach use issues extend to conflicts around laws regulating development and land management in beach areas (e.g., height limit of structures, beach re-nourishment or hardening practices). Such locally-based zones and ordinances directly shape the extent and nature of built systems and structures, again influencing the atmosphere and character with regards to who belongs in that space. Finally, a wide range of official designations regulate the ways in which visitors use beach sites, including federal or state areas of special protection (e.g., national seashore, cultural heritage sites), areas identified as native tribal lands, and local ordinances concerning pets on the beach or the permissibility of particular items like alcohol or fireworks. Sharing about how her relationship with her beach has changed, Ina noted the influence that a particular use conflict involving horses has had on her overall feeling of responsibility for the beach:

The beach is more like a living organism every time I go on it to do a walk, and the ocean is important to me. But horseback riding on the beach is fine except when those horses are allowed to pollute the beach. So that is another way that my relationship with the beach has changed. I'm more militant. I've gotten involved, and have even gone to the county commissioners. So yeah, because I am there on that beach, I feel possessive of it. But I think the overriding feeling I have with this horse business is private profit from public resources, that is a big no-no. The more I'm on the beach, the more I know the dynamics and the ecology, because I see all the users. (Ina)

Participants provided numerous examples of how the factors of beach ownership, access, and use influence their lived experiences. Table 4.2 highlights many of these examples, demonstrating how specific outcomes are influenced by the experiential outputs that result from program participation, outputs mediated by the three socio-political factors discussed above. Starting at the bottom of the table, questions are provided to illustrate the effect the socio-political factors of beach ownership, access, and use have on participant experiences, followed by the specific experiential outputs that emerge from those experiences.

Psycho-Social Processes

Participants in this study were asked several questions regarding their motivation to engage in the COASST program to provide information regarding one of the potential psycho-social influences participants bring to PPSR experiences. Although motivation is only one element of psycho-social influences of place, research suggests it plays an important role in influencing personal outcomes in participatory science (Jordan et al. 2011; Measham and Barnett 2008; Rotman et al. 2012). Participants in this study shared information regarding how they found out about the COASST program and what motivated them to participate, the degree to which their motivation to engage in the

Table 4.2: Socio-Political Influences on Experiential Outputs and Outcomes

Outcome	Altered Sense of Place and Connection	Social/ Community Connections	Connection to Wildlife & Nature	Greater Coastal Awareness & Appreciation	Learning and Gaining Knowledge	Sense of Satisfaction & Contribution	Physical/Mental Health
Outputs	<ul style="list-style-type: none"> -Strength of connection -Feelings of belongingness or exclusion -Sense of duty or responsibility -Symbolism connected to place 	<ul style="list-style-type: none"> -Formation of friendships/ relationships -Interactions with visitors -Support of local management practices 	<ul style="list-style-type: none"> -Level of advocacy for natural resources -Investment in sustainable behavior -Strength of connection to nature 	<ul style="list-style-type: none"> -Value attributed to coastal ecosystems -Opinions about who should "own" the site and how it should be used 	<ul style="list-style-type: none"> -Degree and type of information exposure -Frequency of engagement topics of interest 	<ul style="list-style-type: none"> -Feelings of pride and efficacy -Frequency of use of existing skills/abilities 	<ul style="list-style-type: none"> -Duration and nature of physical activity -Level of mental stimulation -Feelings of comfort and relaxation
Socio-Political Forces	<p><i>Ownership</i></p> <ul style="list-style-type: none"> -Do I belong? -Should I have a voice here? -Am I responsible for this place? <p><i>Access</i></p> <ul style="list-style-type: none"> -Would I be excluded or included without COASST? <p><i>Use</i></p> <ul style="list-style-type: none"> -What do people do here and does that shape the nature of place? 	<p><i>Ownership</i></p> <ul style="list-style-type: none"> -Is this ours, mine, or theirs? -Are the people or entities that own this place 'like-minded'? <p><i>Access</i></p> <ul style="list-style-type: none"> -Will I see the same people regularly? -Can my friends or family visit ? <p><i>Use</i></p> <ul style="list-style-type: none"> -What role does this place play in the community? 	<p><i>Ownership</i></p> <ul style="list-style-type: none"> -Who owns "nature" here? -Who manages the natural resources? <p><i>Access</i></p> <ul style="list-style-type: none"> -Who is able to enjoy wildlife here and are their perceptions of nature like mine? <p><i>Use</i></p> <ul style="list-style-type: none"> -How do the visitors interact with wildlife? -How is wildlife treated? 	<p><i>Ownership</i></p> <ul style="list-style-type: none"> -Is this a place I would see without COASST? -Who makes decisions about this place? <p><i>Access</i></p> <ul style="list-style-type: none"> -What does this place mean to others? -Who benefits from this place? <p><i>Use</i></p> <ul style="list-style-type: none"> -What services does this place provide and how is it used? 	<p><i>Ownership</i></p> <ul style="list-style-type: none"> -What resource management practices govern this place? <p><i>Access</i></p> <ul style="list-style-type: none"> -Do distractions or hazards prevent me from focusing on learning? <p><i>Use</i></p> <ul style="list-style-type: none"> -Is this place popular for birding, or finding agates? 	<p><i>Ownership</i></p> <ul style="list-style-type: none"> -Am I serving a public or private good? -Do I have an obligation to care for this place? <p><i>Access</i></p> <ul style="list-style-type: none"> -Who else would monitor and report here? <p><i>Use</i></p> <ul style="list-style-type: none"> -Do I contribute something unique to the users here through my service? 	<p><i>Ownership</i></p> <ul style="list-style-type: none"> -Can I relax and escape here legally? <p><i>Access</i></p> <ul style="list-style-type: none"> -Can I visit without too many people around , so I can enjoy the place? <p><i>Use</i></p> <ul style="list-style-type: none"> -Am I safe here? -Will I run into families with children or people with dogs?

program changed over time, and how such motivation influences what they value most about program participation. Table 4.3 reviews the primary motives of participants, grouped into five general categories around conserving and protecting, learning & awareness, connection to wildlife/outdoors, personal health, and contributing to society.

Table 4.3: Reported Motivations to Participate in COASST

Conserving and Protecting
<p><i>Concern about the Environment and/or Coasts</i> Specific concern or passion for the environment or coastal ecosystems of the Pacific Northwest. Desire to contribute to work that helps protect and preserve those valued resources. Many noted the "power" of engaging in science for conservation.</p> <p><i>Investment in a Specific Beach</i> Pre-existing attachment to a specific beach and a desire to monitor, protect, and invest in that site via the program.</p>
Understanding and Learning
<p><i>Learn more about Coasts</i> Desire to learn more about the Pacific Northwest coast in a structured manner. May be an interest in learning about beaches in general or a specific place of interest (e.g. favorite beach). COASST provides a platform for regular, guided interaction.</p> <p><i>Learn more about Birds</i> Desire to learn more about coastal birds, avian ecology, or local bird populations. COASST provides a unique way to learn from an up-close perspective.</p> <p><i>Learn more about Science</i> An interest in science and science research and a desire to explore via hands-on processes.</p>
Connection to Wildlife/Outdoors
<p><i>Interact with Nature</i> Desire to spend more time outdoors and connect with natural environments. Drawn to the beauty or stimulation "nature" provides.</p> <p><i>Interact with Beaches</i> A specific draw to the ocean or water compels an interest in connecting with coastal environments.</p> <p><i>Interact with Birds</i> A pre-existing interest or fascination with birds motivates participation for the opportunity to witness unique species of birds in person, including hard-to-find pelagic varieties.</p>
Personal Health

<p><i>Mental/Physical Health</i> Desire to stay in good mental or physical health. Interest in keeping bodies limber and nimble and minds fresh through the regular challenge of navigating the beach and processing beached birds.</p> <p><i>Relaxation and Peace</i> Desire to escape from the responsibilities of home or work and find space for contemplation and respite.</p>
<p>Contributing to Society</p>
<p><i>Putting Science Skills/Knowledge to Use</i> A personal background in science leads to a desire to contribute to the field and stay in tune with the practice, often post retirement. Drawn to COASST because of a strong belief that any effort contributed would be put to good use.</p> <p><i>Giving Back Through Service</i> A desire to be involved in service that promotes positive change. A commitment to "do their part" to contribute to community. Drawn to COASST because it is rigorous and well-organized.</p>

A desire to learn more about coasts, birds, and science; conserve and protect the environment; and connect to wildlife and nature were the most common motives articulated by study participants. In part, the particular regional location of the program appears to play a role in these motivations for some COASSTers. Many COASSTers noted a sense of connection to what was described as a regional ethic of care and concern for "wild" places. In several instances, this was compared to a perceived indifference among East Coast residents towards conservation of such natural resources or places. Noting the perceived rate at which beaches along the Eastern U.S. are becoming developed or degraded, COASSTers often spoke of the beaches along the Pacific Northwest as the "last great protected beaches" in the United States. This shared regional ethic around valuing national coastal treasures and the conservation of those places factored into the motivations of some COASSTers to participate in the program. A desire to be a part of a community dedicated to the monitoring and protection of Pacific

Northwest birds and beaches elicits interest in learning, exploring, and protecting such resources.

A review of reported motivations against the descriptions of program outcomes provided above suggests a strong relationship between the motivations of participants and the outcomes of the program overall. Several of the outcome categories presented earlier show ties to this suite of motivations. Results concerning a sense of satisfaction and contribution, learning and knowledge gain, personal health, and connection to wildlife and nature demonstrate this link. Figure 4.4 illustrates these connections further, using examples provided by study participants to help demonstrate how COASSTer motivations help shape lived volunteer experiences.

Even still, a focus exclusively on the psycho-social processes in the form of motivation may overlook other elements of the lived experiences of PPSR participants, discounting how such interactions shape both motivation over time and volunteer outcomes. Recent evidence reveals that volunteer motivation is rarely static, demonstrating a temporal dimension that can change throughout participation (Rotman et al. 2012). Evidence of this change also exists in this study.

Before I was just looking for something to volunteer for, to be of service somehow. I'm not any less interested in the volunteer part of it, but having learned more about the program and the research involved, I'm definitely more interested in the science aspect of it. I've just added to my mission and what I get out of it. (Marian)

At first my motivation was maybe a little more selfish about learning, so that I could learn more about what is going on around here. It has changed into more loyalty to the program because of the scientific value of what we collect. Sometimes we say, 'oh gee, maybe we have done this enough. It is getting harder to get down to measure the birds and get back up.' You know, we use walking sticks now, for getting back up from kneeling down to measure the birds. So it is more program loyalty. It's like we are contributing something of value and we don't want to stop. (Johnie)

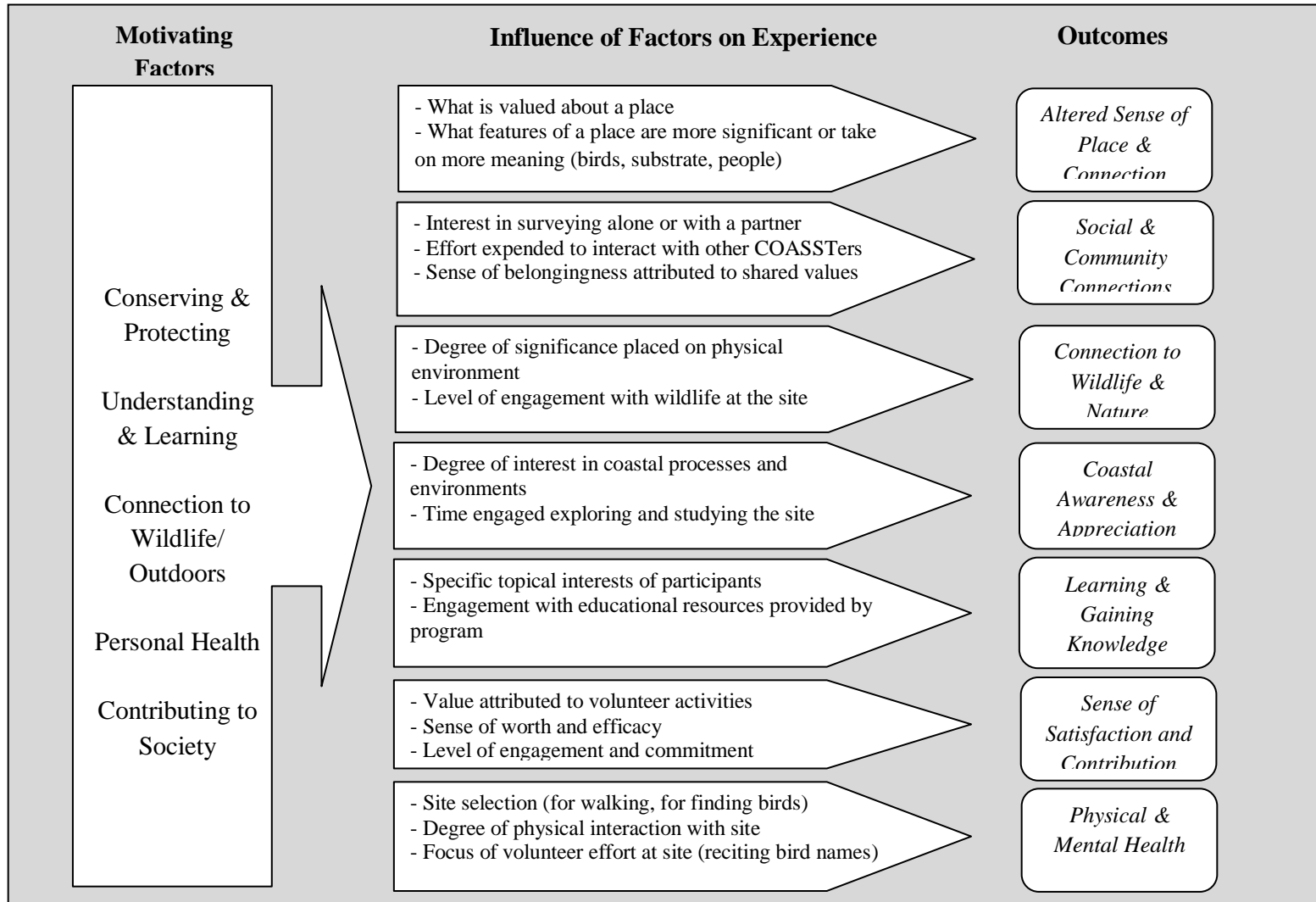


Figure 4.4: Volunteer Motivations and Influence on Experiential Outputs and Outcomes

As these quotes demonstrate, motivation to take part in COASST is not always stationary and can change based on the lived experiences of those in the program. What first motivated participation may turn into much more because of the satisfaction that comes with being outdoors, connecting with a particular place, or learning about the value of the long-term research involved in the project. In other words, while this study provides evidence that initial volunteer motivation influences the meaning and outcomes that result, these meanings can change and expand as engagement increases, facilitating additional and perhaps unanticipated outcomes. Such changes are a result not only of the interpersonal dynamics brought to these people-place experiences, but the socio-political context that informs participation and the biophysical setting in which such experiences are grounded.

Biophysical Setting

As a part of discussions about the value and significance of COASST survey sites, participants highlighted numerous physical properties of their survey beach and the surrounding area that they notice and appreciate. Follow-up questions during these discussions encouraged participants to consider the role such aspects play in shaping the meaning of that place and broader program outcomes. This information was coupled with the personal observation of the author, who, in addition to taking notes regarding the physical features of the landscape during data collection, also amassed audio recordings and photographs of the places in which COASST volunteers serve. The major biophysical aspects of these beach sites mentioned by participants include:

- Substrate/surface (sand, driftwood, rock, mud)
- Water (both ocean and freshwater input)

- Sunlight/moonlight
- Atmospheric properties (particularly clouds, fog)
- Geomorphic features (dunes, bluffs, surrounding forests, seastacks)
- Built landscape (homes, jetties, bridges, piers)
- Evidence of human influence (vehicles, stairways, driftwood forts, debris)
- Wildlife and tracks (marine mammals, invertebrates, and birds; vegetation; wildlife tracks)

These prominent features are a result of the specific biography of the Pacific Northwest area. Most COASST beaches experience a "marine west" climate, characterized by frequent rain (east of mountainous areas) and fog, as well as moderate temperatures. Lush and extensive evergreen conifer forests permeate the interior portion of most beaches, containing several riverine systems that flow to the ocean. Historic glacial processes and current volcanic and geologic faults contribute to drastic coastal cliffs and rocky beaches in some places, while prevailing tidal and wind patterns shape smooth, flat, and fine sand beaches in others. The nutrient rich waters along the coast that result from deep ocean currents and upwelling, attract a wide diversity of wildlife, including charismatic marine mammals like seals, otters, and sea lions, cetaceans like humpback, gray and killer whales, and hundreds of resident and migrating bird species.

Such biological diversity elicits fascination, curiosity, and a sense of adventure among COASST participants. The beach settings where COASSTers explore are engaged via multi-sensory mechanisms, experienced as unique sights, sounds, and smells. In particular, COASSTers noted the stimulation of five major senses during engagement with their beaches (Table 4.4).

Table 4.4: Biophysical Variables that Shape COASST Sensory Experiences

Sensory Mechanism	Aspects of Beaches Sensed by Participants
Visual Experiences	<ul style="list-style-type: none"> • Color of the sand, water, sky • Placement of the sun and clouds on the horizon or in the sky • Movement of the water • Color, movement, interaction of wildlife • Geometric patterns in the water, sand, sky • Distribution of objects in space
Auditory Experiences	<ul style="list-style-type: none"> • Shoes striding on the sand • Water lapping on the shore • Wind along the sand, water, or dunes and bluffs • Marine invertebrates creating air bubbles in the sand • Waves crashing onto a bluff • Fog or marine vessel horns in the distance • Seabird chatter, squawking, or calls • Marine mammal noises (sealion barks, whale spouts) • People talking, flying kites, listening to music • Residential or industrial noise (traffic, leaf blower, etc)
Olfactory Experiences	<ul style="list-style-type: none"> • Salt in the air • Bird guano • Decomposing marine vegetation • "Crisp," clean ocean air • Various foods (from beach BBQ, nearby homes) • Fresh rain "smell" on the sand
Tactile Experiences	<ul style="list-style-type: none"> • Friction associated with walking on sand • Air temperature, often impacted by water temperature and the presence of water vapor and sunlight • Wind and precipitation on skin • "Graininess" of sand • Smoothness of seashells, pebbles • "Stiffness" of beached birds • Fragility of bird feathers and bones
Tastes	<ul style="list-style-type: none"> • Salt • Organic material (e.g. sand blown in mouth) • Acidity or chemical properties of atmospheric water vapor

The colors, sounds, and smells of the settings in which COASST surveys are conducted help shape the success of surveys (the ability to find beached birds), the satisfaction (or dissatisfaction in the case of cold, wet, rain) of participation, and the

degree to which that place meets expectations for mental or physical health, connection to "nature", and learning. Participants themselves often recognize these influences.

When I started out I was curious and I wanted to do something different with my life. Now it has become a fun little routine. I've got much more enthusiastic about it, and that might be because it has been six months of perfect weather. For me, the whole thing has become a bit more interesting. It is a bit more emotionally extreme. I love thinking about going on the beach walk on a nice day. I now know what a nice day is going to look like - a nice day is going to be a hard packed beach with nice sun, no wind, and no eel grass. I know that now. And a margarita at the end! (Kent)

And I get out there and I literally open the door and I hear the waves, and it is just totally relaxing. I just love being down here, even if it is raining. It is just relaxing for me, just hearing the ocean and the waves. Being by the water gives me more internal peace. That sound is one of the reasons I can relax and connect to nature. (Eva)

I tried another beach in the area, to fill in for someone who couldn't do it and there were so many people out and about on the beach that I didn't feel, first of all, I didn't find any birds, and second of all, it was too highly trafficked, to feel like I was going to accomplish anything. For me, I don't feel like I'm gaining much knowledge if I don't have birds to process. (Jackie)

Using information provided by study participants, figures 4.5-4.8 are included to demonstrate the significant role the biophysical setting plays in shaping the lived experiences of participants. Each figure focuses on a specific volunteer outcome, reviewing the many ways in the which the biophysical variables highlighted above have shaped these outcomes for study participants. As these figures highlight, the unique biophysical setting in which each COASSTer surveys can substantially shape personal experiences and outcomes. In particular, because COASST beaches are all linked to the vast Pacific Ocean, the role the ocean plays in eliciting specific affective experiences, emotions, and thoughts helps demonstrate the global and local aspects of COASST beach places.



Figure 4.5: Influence of Biophysical Setting on Sense of Place and Social Connections

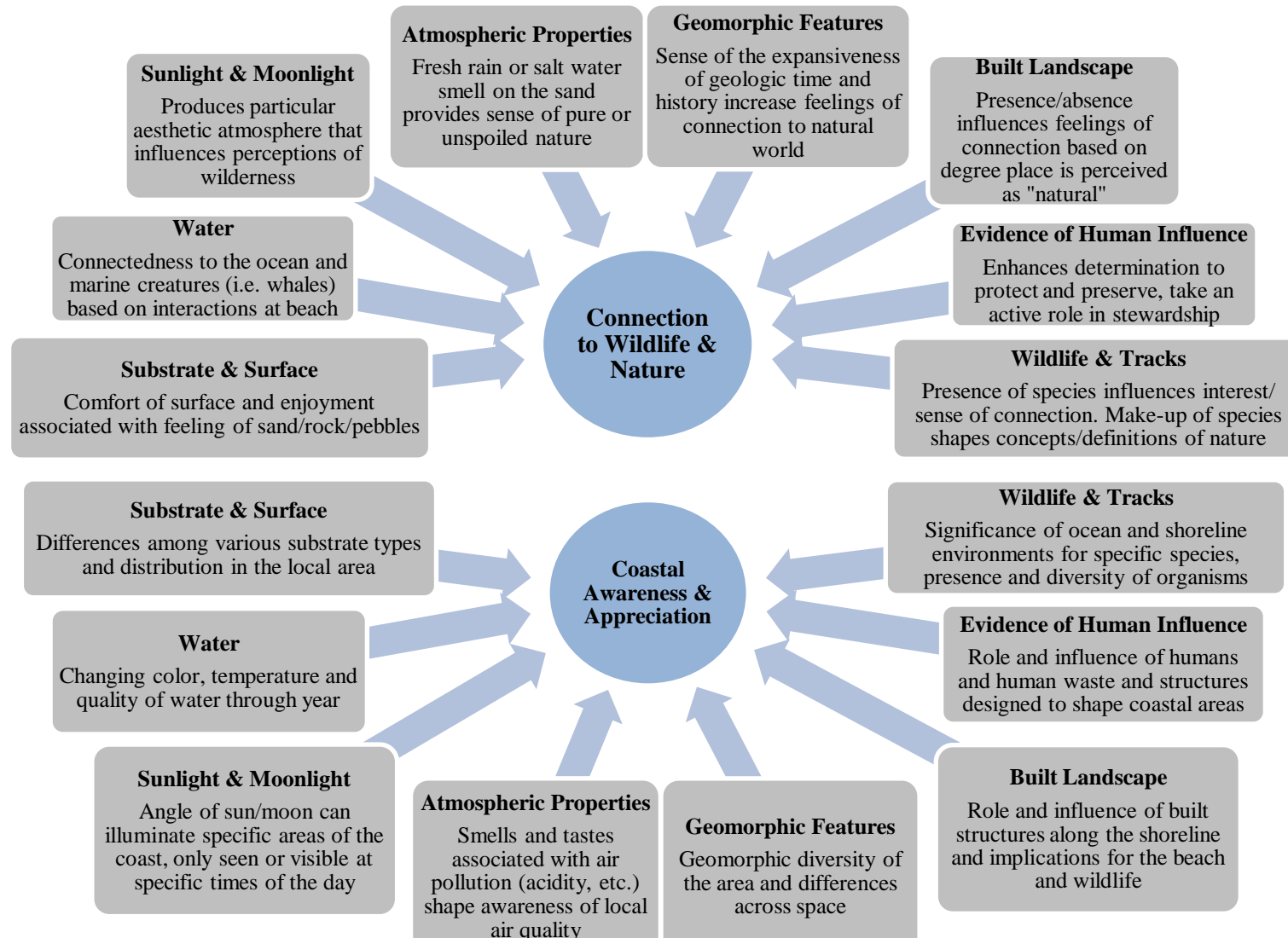


Figure 4.6: Influence of Biophysical Setting on Connection to Wildlife and Coastal Awareness

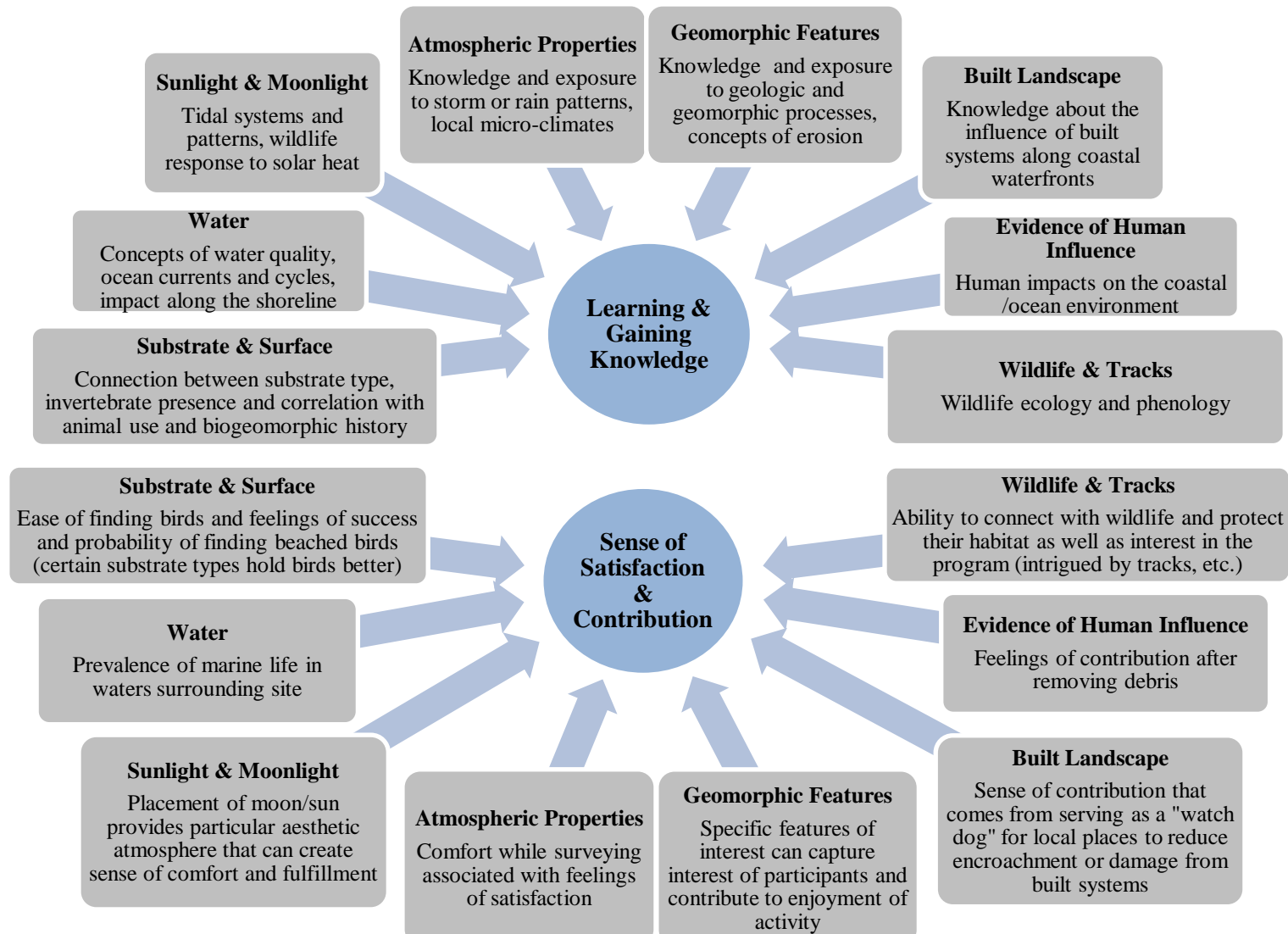


Figure 4.7: Influence of Biophysical Setting on Learning/Knowledge and Satisfaction

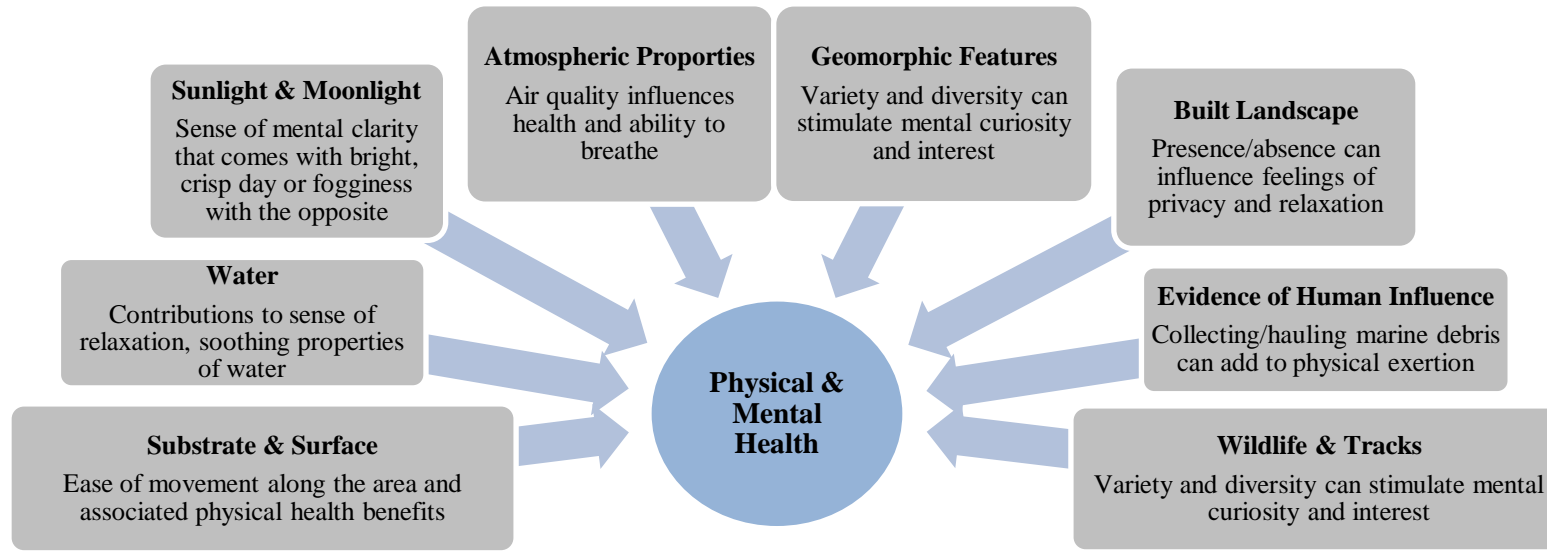


Figure 4.8: Influence of Biophysical Setting on Physical/Mental Health

Expanding Frameworks to Explore Experiences, Outcomes, and Impacts

Decades of PPSR assessment and evaluation have highlighted an impressive collection of the potential outcomes of PPSR experiences for science, social-ecological systems, and individual participants (Haywood and Besley 2014; Shirk et al. 2012). This research confirms a broad suite of volunteer outcomes in the COASST program, not only with regards to educational benefits, but also for more personal gain. Additionally, this research has explored several central dimensions of COASSTer lived experiences that shape program outputs and outcomes, an aspect of PPSR that has received little scholarly attention. Not only does this study shed light on the actors and processes that intersect to mold program outcomes, but it may also provide a useful framework to expand research on the long-term impacts of participatory science on volunteers.

As a whole, the body of literature on participatory science has struggled to make the connection between program outcomes and broader impacts. Impacts in this context are defined as "long-term and sustained changes that support improved human well-being or conservation of natural resources" (Shirk et al. 2012). In particular, PPSR practitioners are focusing more attention on cultivating lasting environmental or earth "stewardship" among volunteers (Dickinson et al. 2012). Even still, a number of studies have failed to demonstrate that PPSR outcomes have any impact on long-term (greater than three to five years past the experience) environmental attitudes and behaviors (Brossard, Lewenstein, and Bonney 2005; Jordan et al. 2011; Overdeest, Orr, and Stepenuck 2004). Haywood (2014) suggests this is, in part, due to the long-term cumulative nature of impacts versus the short-term, immediate standard of most evaluation procedures used to identify them.

More importantly, however, is the fact that most studies are based on programs that maintain a strong focus on environmental literacy and learning, as is common among contemporary PPSR. As a result, many PPSR efforts have relied on a narrow conceptualization of the factors which influence behavioral change, focusing primarily on "critical thinking", as "it is hoped that through engaging in such thinking during their research, participants will be better able to analyze information about environmental issues and to make sound decisions about the environment" (Krasny and Bonney 2005, p 192).

Yet educational psychology research suggests that increasing knowledge through education does not in itself lead to behavioral change, even when it comes to conservation (McKenzie-Mohr 2011; Schultz 2011). Instead, impacts around broader stewardship attitudes and behaviors are impacted by a suite of cognitive, behavioral, and affective variables, only one of which involves learning and knowledge (Bramston, Pretty, and Zammit 2011; Finger 1994; McKenzie-Mohr 2011). Although some PPSR initiatives are beginning to consider additional variables to understand the impacts of PPSR experiences on behavioral change (Dickinson et al. 2012), this is certainly not yet the norm among PPSR initiatives. And yet, PPSR projects as a whole overwhelmingly express an interest in enhancing environmental stewardship among participants, with many making claims, generally unsubstantiated, of such success. While this study was not designed to explicitly test the relationship between participant sense of place and stewardship attitudes and behaviors, it has clearly demonstrated the value of such inquiry. Links between multiple aspect of lived experience and outcomes associated with increased connection and feelings of responsibility for place, changes in the symbolism

and meaning associated with places, and awareness of the ecological significance and major threats to coastal ecosystems all suggest strong associations between these affective aspects of participation and wider stewardship impacts.

With a broader emphasis now placed on the cultivation of environmental stewardship via participatory science, this analysis supports a more detailed conceptualization of the lived experiences of volunteers to understand the various ways in which experiential aspects shape immediate program outputs, associated direct outcomes, and subsequent impacts. This approach will also necessitate adopting a more holistic definition of learning to consider the multiple modes and processes of learning involved in PPSR experiences. Instead of imagining the learning process as a unidirectional dissemination of subject matter, a place-based framework of analysis positions learning "as a process of change in the way we look upon the world - our thoughts, feelings, and actions - which is dependent on the learner, the object of learning, and the physical, biological, social, cultural, and economic situation and setting (Rickinson, Lundholm, and Hopwood 2009)" (Krasny, Lundholm, and Plummer 2011). Examining lived experience within a three-dimensional place-based lens not only enhances understanding about the role of the learning environment and what diverse factors influence that process, but also how learning combined with other experiential elements shape outcomes and impacts. Aashka helps demonstrate this point.

I find myself looking at marine debris differently now. I always knew it was an issue, but my background was more land-based and I know that sea turtles eat plastic bags and that sort of stuff, but I'm starting to learn a lot more about how much impact marine debris has. Not just on certain species, but on habitats. It is affecting a lot of different aspects of the marine environment. That is a big thing that I think I've noticed. I find myself changing. Around the fourth of July, my husband was saying something about fireworks, and I was like no way we are getting

fireworks, I hate fireworks, the little caps get out into the ocean. I've never liked fireworks, but for a different reason now. I didn't realize it switched my mindset so much.

For Aashka, the multimodal experiences of monitoring the beach shifted her thinking about marine debris. What was once an abstract concept became embodied in experience as she developed a sense of concern for her beach after discovering the enormity of the problem first-hand. These experiences would not have existed, had Aashka not initially been motivated to participate because of her interest in volunteerism and a desire to explore the community. In particular, she noted an interest and background in biology, which influenced her decision to engage in COASST versus other service opportunities. The COASST program itself provided a structured means in which to explore a particular beach, a beach which Aashka admitted she would have likely never visited if it weren't for the prompting of the program. Participation in the program requires a careful examination of the surface of the beach, situating Aashka's gaze on the beach substrate and not, for example, on the water. Becoming more aware of the marine debris that exists on her beach because of her regular presence and intentional focus on the ground, Aashka has subsequently elected to participate in an add-on marine debris survey project coordinated by COASST. This focused engagement with the beach positioned specific aspects of the environment (in this case debris from fireworks) front and center in Aashka's consciousness. Yet the setting itself also played a role in this increased awareness. Although the utilization of fireworks on beaches in the Pacific Northwest is not unusual, there are specific beaches (particularly those in more remote areas) that are known to attract large crowds of individuals at certain times of the year for this purpose. Aashka's beach happens to be one of those sites. The unique constellation of

networked, yet located socio-political context, psycho-social processes, and biophysical setting all shape Aashka's experience at her beach. As her comments suggest, her behavioral intentions have also changed through these experiences.

Conclusions

This research has utilized theoretical tenets from sense of place scholarship to bring lived experience and place into a conceptual framework to explore participatory science programs and their influence on volunteers. Volunteer lived experience is highlighted in three place-based dimensions to underscore the significance of social-political context, psycho-social processes, and the biophysical setting on program outputs and outcomes. These elements combined shape the emotions involved in volunteer service (feelings of belonging, stimulation, and relaxation), the way in which participatory science experiences are interpreted and remembered (sense of satisfaction, accomplishment, significance), and the type and extent of knowledge gained (what, why, and how).

The multilateral model of place utilized in this research advances integrated conceptualizations of place that rely on hybrid frameworks that envision place as both globally interconnected and locally situated. An exploration of the social-political contexts that govern COASST beaches and the psycho-social processes that mediate place experience are reminders that place is a networked phenomenon, connected to people, systems, and ecosystems far beyond a given location. Yet attention to the affective, sensual experience of place also highlights the located and embodied components of place. Places are expressed then as an amalgamation of fluid relational

interactions and grounded nodes of intersection, much like the ocean ecosystem that connects all COASST places (see chapter six).

As the results of this study demonstrate, maintaining a complex and balanced conceptualization of PPSR experiences can open up new pathways to explore the many ways through which participatory science programs and participants affect one another. Future research that attempts to link program outcomes and long-term impacts will also benefit from an extended structure of experiential analysis. Specifically, three fruitful areas of future research around place responsibility and public/private space, volunteer motivation and place connection, and the relationships between sense of place variables and environmental stewardship emerge from this study.

Building on findings regarding the significance of site ownership, access, and use, further studies might consider the relationship between the public or private nature of participatory research sites and the development of a sense of connection or responsibility for those places. COASSTers in this study indicated feelings of belongingness, inclusion, and shared accountability are sometimes mediated by who "owns" a place and how access and use are governed or managed at that site. Information regarding whether or not differences exist in this regard and how these relationships influence volunteer satisfaction and outcomes could foster useful practices to enhance program experiences and outcomes for programs with a primary emphasis on public or private lands.

More effort to explore psycho-social influences of participatory science volunteer motivation on place satisfaction and connection might boost practices utilized to pair volunteers with research sites that best suit their needs and interests. Is there a relationship between satisfaction with a particular type of program site (forested, urban,

etc.) and initial volunteer motivation and how does that influence overall program satisfaction? Perhaps more attention to where a person conducts participatory science research instead of just what and how they conduct that research would strengthen efforts to enhance participant experience and retain valuable volunteers. Additionally, this and other research has suggested that volunteer motivation evolves over time (Rotman et al. 2012). In what way might the evolution of a sense of and connection to place drive or mediate those motivational changes?

Finally, while I have argued that multiple facets of the lived experiences of participatory science volunteers play a role in the formation or evolution of attitudes and behaviors regarding environmental stewardship, more research is needed to determine which aspects may be most significant in that process. What is the relative importance of diverse forms of place meaning and attachment, the biophysical properties of place, or the policies and regulations that govern place in shaping engagement with sustainability or stewardship practices? Furthermore, how might the variables highlighted in this study also shape conceptualizations of science, technology, and research, as well as those around nature or wilderness? Such an emphasis would help advance the growing body of literature on the personal impacts of participatory science programs.

At an applied level, by shedding light on how volunteers experience participatory science and the ways those experiences shape program outcomes, this research has value for program assessment purposes, but also for program design, as many of the more experiential elements of participation are overlooked in program development manuals and guidance documents (see chapter five). Above all, this study serves as a salient reminder that research on PPSR outcomes and impacts is enriched when significant

attention is granted to the complex network of experiential factors that shape and mold these results. Accordingly, the study suggests a need to resist attempts to reduce explanation of participatory science phenomenon to universal causal chains, isolated analysis of homogenous variables, or unidimensional theory.

CHAPTER FIVE

PERSONAL MEANING AND VALUE ASSOCIATED WITH PUBLIC PARTICIPATION IN SCIENTIFIC RESEARCH AND THE PROGRAMMATIC VARIABLES THAT SHAPE THEM⁴

Abstract

As public participation in scientific research (PPSR) initiatives have expanded rapidly among private, public, and non-profit science research communities over the past decade, program managers and scholars regularly promote, evaluate, and manage such programs with a focus on the value and impact of PPSR efforts on the practice and relevancy of science. While many of these assessments rely on evaluation of individual participant knowledge and skill, they are driven by a broader interest in how such individual outcomes influence the form and function of science in society. Such a science-centered emphasis is neither surprising nor inappropriate. Nonetheless, such appraisals are generally not capable of interrogating the full range of program goals and outcomes. This article advocates for greater comprehensive examination of the effects of PPSR participation on program volunteers. A more integrated perspective is therefore assumed to report on research conducted with volunteers in the Coastal Observation and Seabird Survey Team (COASST) citizen science program to interrogate the inter- and intrapersonal outcomes of program engagement through narrative interviews and focus

⁴ Haywood, Benjamin. To be submitted to *Cultural Studies of Science Education*

groups. Findings highlight the various PPSR programmatic variables that shape volunteer experiences and how these variables may influence personal outcomes. These include the scope and scale of the project, program governance structure, the duration and frequency of volunteer activity, and processes involved in recruiting, training and motivating volunteers. Based on these findings, the article provides implications for advancing more intentional and meaningful PPSR efforts by focusing on the scale of engagement and interaction, cultivating community and connection, and developing tiered learning practices.

Introduction

The practice of public participation in scientific research (PPSR) has grown substantially within the natural science, informal science, and science education communities over the past several decades as a means of enhancing public understanding of basic science knowledge and skills (Dickinson et al. 2012; Shirk et al. 2012). Whereas the engagement of "amateurs" in scientific exploration and research is not a new occurrence, "citizen science" as it was traditionally performed as far back as the early 19th century, was often practiced informally by members of the public with a personal interest or ability to engage in such pursuits as a leisure activity (Silvertown 2009). Today, however, the engagement of non-expert citizens in scientific exploration has become a much more formalized process, involving structured collaborations between professional scientists and citizen volunteers who engage in some element or elements of the research process (Dickinson, Zuckerberg, and Bonter 2010).

Initially, the rise in popularity of PPSR initiatives was driven by professional science communities, who, motivated by a need for more efficient processes to collect

large-scale ecological data, seized on advancements in technology and geographic information systems to enroll citizens in research processes (Silvertown 2009; Miller-Rushing, Primack, and Bonney 2012). The continued growth of PPSR initiatives in recent history, however, is due in large part to the "twin goals" espoused by such initiatives to advance the scope and scale of scientific investigation *and* to enhance the understanding and relevancy of science in society (Brossard, Lewenstein, and Bonney 2005; Couvet et al. 2008). It is this latter goal of many PPSR initiatives that has helped facilitate a growing interest in the use of PPSR as a tool to enhance science literacy and broaden environmental awareness among participants. This objective is underscored by the belief that such outcomes will foster a more educated and informed public in which complex policies and decisions about environmental resources and ecosystems can be made. Thus, in recent years, research and assessment of PPSR program outcomes, both for science as a practice and society as a whole, have grown in number and thoroughness (Shirk et al. 2012).

What is the Value of PPSR? Significant Outcomes and Influences

The value of PPSR as an effective tool to advance complex natural science research and expand public involvement in research and policy processes has been widely documented (Dickinson et al. 2012; Haywood 2014; Shirk et al. 2012). So too, scholars note the advantages of PPSR for enhancing the role of science in society, underscoring benefits like increased science literacy, knowledge, and scientific thinking (Brewer 2002; Danielsen, Burgess, and Balmford 2005; Jordan et al. 2011; Kountoupes and Oberhauser 2008; Trumbull et al. 2000); a growth in 'understanding' and appreciation of science (Bonney 2004; Danielsen, Burgess, and Balmford 2005; Ellis and Waterton 2004; Jordan

et al. 2011; Sullivan et al. 2009; Trumbull, Bonney, and Grudens-Schuck 2005); and advancing the ways in which PPSR can make science research and practice more democratic and 'legitimate' (Cornwall and Jewkes 1995; Irwin and Wynne 1996; Lakshminarayanan 2007; Wooden 2006).

These outcomes are indeed cause for celebration and help highlight the many benefits of the practice. Yet, the outcomes most frequently assessed and reported among PPSR communities of practice reflect an overarching emphasis on those things perceived to be of most apparent value to the enterprise of science. PPSR efforts are more commonly managed by teams of professionals within the scientific community, and thus efforts to document and highlight programmatic outcomes are aligned with the disciplinary and professional cultures from which they emerge. Such a science-centered perspective is also driven by the need to justify and demonstrate the value of these programs for external funding organizations, many of which are deeply rooted in institutions dedicated to the advancement of science and environmental policy and decision-making. The outcomes of interest then, and, by extension, those more frequently assessed, are focused on variables selected to demonstrate how such programs enhance scientific data and inquiry and support participant learning, understanding, and engagement with science.

But such a narrow emphasis on outcomes most immediate among PPSR practitioners does not adequately assess the full range of personal outcomes experienced by the volunteers on which such programs rely. Although PPSR programs often espouse broader goals focused on cultivating environmental stewardship and engagement, very few assess such outcomes or the programmatic elements that support them. Accordingly,

this article seeks to expand assessment of the individual effects of PPSR on volunteer participants by considering not just the value of participation for science research and literacy, but also the many other potential inter and intrapersonal benefits of participation that mediate larger program impacts.

To do so, not only does this research consider what participants learn (cognitive effects) via PPSR programs, but what they feel and experience in their engagement as well (affective effects). Attention to both cognitive and affective dimensions of volunteer experiences is essential to understand the full range of participant outcomes as it is the interaction among these components of experience that influence human attitudes and behavior (Eagly and Chaiken 1993). Research from environmental social science highlights that cultivating engagement in research, decision-making, and political processes associated with environmental concerns involves equal attention to the affective and cognitive components of human experience (Wilson 2008). Such an integrated lens is particularly relevant as scholars have demonstrated that long-term commitment to environmental volunteering efforts is driven equally by affective and normative allegiances (Asah and Blahna 2013). Within PPSR settings, the affective dimensions of participation critical to motivating deeper engagement and behavioral change may play an integral role in shaping broader personal and programmatic outcomes associated with participation. Therefore, a sufficient assessment of the effects of PPSR on participants from a more integrated vs. science-centered perspective requires attention to the multi-faceted experience of volunteers in such programs.

PPSR Significance and Meaning for Participants

Lawrence (2006) suggests that the overall body of scholarship and assessment of PPSR practices has lacked sufficient attention to the "internal" value and impact of PPSR on participants, defined as benefits of personal growth and development. In particular, the personal significance and meaning attached to PPSR participation for volunteers is often overlooked in PPSR assessment because it is hard to document and because there is little research as of yet to draw connections between these dimensions and larger program outcomes and impacts for science.

Despite the current dearth of research on the personal outcomes of PPSR participation, a growing interest in what drives individuals to engage in PPSR efforts and what factors motivate them to remain committed highlights the need for more exploration of these components of volunteer engagement (Asah and Blahna 2013; Bonney, Ballard, et al. 2009; Ryan, Kaplan, and Grese 2001). Although these personal outcomes may be considered ancillary, given that they are not generally part of the primary goals and objectives of such programs, recent research suggests that they may yield unrecognized influence on the broader outcomes of PPSR programs, including the science produced, how science as a whole is perceived and understood by those who participate, and broader attitudinal or behavioral outcomes (chapter four).

Where internal aspects of participation have been considered, a few notable inter- and intrapersonal benefits are highlighted. Among them, participation has been linked with feelings of empowerment and self-efficacy (Danielsen, Burgess, and Balmford 2005; Lawrence 2006; Wilderman, Barron, and Imgrund 2004), increases in social capital, interpersonal bonds, and trust (Fernandez-Gimenez, Ballard, and Sturtevant 2008;

Overdeest, Orr, and Stepenuck 2004; Roth and Lee 2002), and increased awareness and perceptions of place and feelings of attachment to that place (Evans et al. 2005, chapter six).

A focus on the people-place relationships inherent in PPSR initiatives provides a particularly substantive opportunity to understand how program experiences shape broader impacts around environmental stewardship. A person's "sense of place" is noted as a prominent aspect of overall interest, attitudes, and actions related to ecological stewardship (Kudryavtsev, Krasny, and Stedman 2012). As a construct, sense of place is most often studied via the interrogation of two common sub-components, *place meaning* and *place attachment*. Place attachment represents the level and intensity of connection to place, often influenced by the degree to which a person feels dependent on that place to meet a functional, psychological, emotional, or social need (Scannell and Gifford 2010). Place meaning, alternatively, represents the symbolic value or significance of a place. As Massey (2005) reminds us, place meaning and attachment are relational phenomena, products of co-constructed meanings. Meaning is therefore material-semiotic, forming at the intersection of the setting of a place and what a person or group of people bring to it (Steele 1981).

Both place attachment and various types of place meaning have been linked with pro-environmental intention, attitudes, and behaviors. This includes correlations between sense of place and support for the mitigation of threats to environmental resources (Vorkinn and Riese 2001), being a champion for environmental policies, conservation, or protection (Manzo and Perkins 2006; Ryan 2005; Warzecha and Lime 2001), and engagement in environmental volunteering and advocacy (Halpenny 2010; Kaltenborn

1998; Payton, Fulton, and Anderson 2005; Vaske and Kobrin 2001; Walker and Chapman 2003). Connection with specific places has also been associated with general support for environmental causes and organizations (Lee 2011). Furthermore, there is evidence that specific types of place meaning can influence both the degree and nature of general concern for the environment and support for environmental policy (Henwood and Pidgeon 2001; Scannell and Gifford 2010; Stedman 2003b).

As discussed in chapter four, findings from this research project suggest that the place meaning and attachment cultivated by PPSR are informed and enlivened by multiple socio-political, psycho-social, and biophysical dimensions of the places in which PPSR exploration occurs. But just how do PPSR programs themselves influence the many dimensions of participant experiences and what might this tell us about how PPSR could be enhanced or improved to support more meaningful, intentional, and influential participant and programmatic outcomes?

Following a brief overview of the research methods employed in this study, the personal outcomes shared by participants in an expansive PPSR program in the Pacific Northwest U.S. are reviewed to demonstrate the breadth of participant experiences, followed by a discussion of the ways in which programmatic variables and structure shape these outcomes. Ultimately, connections are drawn between a number of key programmatic dimensions and the participant outcomes discussed to provide guidance and helpful information for those designing and managing PPSR programs and scholars interested in future research.

Methodology & Methods⁵

In order to explore the depth of volunteer experiences in PPSR, this research focuses on participants in a long-running and highly effective PPSR program called the Coastal Observation and Seabird Survey Team (COASST) (<http://depts.washington.edu/coasst/>). Beginning with a handful of participants based at select beaches in Washington state, the program started in 1998 with the aim to document seabird population health and mortality using information obtained from beached bird carcasses collected at regular intervals. Based at the University of Washington, the program has expanded now to encompass four states (AK, CA, OR, WA) and involve nearly 800 volunteers who "adopt" a local beach to survey at least monthly for beached birds and marine debris. The information collected by volunteers is submitted to professional staff involved in the project, where it is reviewed and analyzed to document annual ecological trends and consider long-term change. COASST was selected for this study because of the opportunity to evaluate volunteer benefits across a wide range of participants, who, although having received consistent training and program management and conducting similar PPSR activities, hail from a diverse range of backgrounds, geographic areas, and life positions. As such, data collected from this study helps to capture some of the more significant inter- and intrapersonal aspects of participation shared among a heterogeneous group of PPSR volunteers.

Beginning in April of 2013, a purposive sample of COASST volunteers was contacted to participate in this study, primarily targeted based on proximity to six distinct

⁵ To include the note: Portions of the methodology and methods section were first published in Haywood, B. Birds and Beaches: The Affective Geographies and Sense of Place of Participants in the COASST Citizen Science Program. The University of South Carolina

geographic "hubs". Selected because of both the density of program volunteers and geographic and participant diversity, these hubs included three areas in Washington state, two in Oregon and one in California. Recruitment, coordinated by COASST program staff, involved invitation emails and phone calls, with instruction for accessing further project material online. Those participants that opted in to the study were contacted personally by the author and asked to participate in either a focus group or guided tour narrative interview.

Guided tours, which involve participants guiding the researcher through a place of interest (in this case beach sites) while sharing narratives about the place or related activities, are particularly effective at uncovering knowledge, concepts, ideas, and attitudes associated with significant places (Everett and Barrett 2012). As a supplement, focus groups were included in this study to allow participants to compare and contrast experiences and to help identify the socially negotiated dimensions of program participation and meaning (e.g. local customs, cultures, beliefs). These qualitative methods were collectively employed to honor the subjective and context-specific experiences of study participants, and to encourage participants to tell stories and engage in dialog that might reveal the multi-faceted dimensions of participation.

Study participants were asked a series of questions in order to determine what personal outcomes they attribute to program participation. In both focus groups and guided tour interviews, a semi-structured open-ended question protocol was utilized to prompt conversation but not bridle responses (see chapter three for more detail). Personal outcomes here are interpreted broadly, not as measurable or tangible products like levels of literacy or skill. Such skill and literacy outcomes are usually assessed with quantified

metrics that track changes in the variables of interest and confine responses to a pre-established scale or list (Kudryavtsev, Stedman, and Krasny 2012). In this case, study participants were asked open-ended questions in an effort to draw out the many ways in which participants feel program participation has led to a personal outcome. These questions allowed participants to define outcomes on their own terms and consider the full range of influences of program participation. Four questions in particular prompted discussion on outcomes.

- *Why is participation in COASST important to you and what do you gain from the experience?*
- *For you personally, what is the value of what you are doing as a COASST volunteer?*
- *Do you feel like you have changed in any way since you started volunteering with COASST?*
- *What would you say are some of the greatest benefits of participation? What personal outcomes do you most appreciate?*

Over the summer of 2013, the author conducted all focus groups and interviews while traveling to each of the six study "hubs". While a total of one hundred and eighty individuals were invited to participate in the study, seventy-eight volunteers participated, for a forty-three percent participation rate. Three focus group events were held when sufficient participants were available with fourteen COASST volunteers electing to join these conversations. Seventy-one COASST volunteers agreed to participate in a guided tour narrative interview, while seven did both. Of the seventy-one narrative interviews conducted, twenty-one were conducted over the phone due to logistical constraints (e.g. weather, scheduling, etc.). All interviews were audio recorded.

Analysis

The author employed a general inductive approach to data analysis (Thomas 2006), following a thorough and detailed process to engage with and analyze study data (outlined in chapter three). All study materials, including interviews and focus groups and the personal notes and observations of the author were transcribed verbatim, allowing for rich immersion in the data. To protect the confidentiality of participants, all participant names were replaced with pseudonyms. Previous research on the personal outcomes of PPSR engagement (highlighted earlier) provided an initial framework through which to consider potential outcome themes and served as a template against which to consider outcomes expressed by participants more frequently overlooked in traditional assessment practices.

Based on the major outcome themes present among participant responses, data were segmented within categories for further analysis, including a large segment related to the personal outcomes expressed by study participants. Categories included those for motivation to engage in the program, perspectives on science and research, participant outcomes, and place meaning and attachment (see chapter three for more detail). QSR N'Vivo software (version 2.10) was utilized to partition data among these categories, to prepare the data for the next phase of analysis - textual coding. Using a grounded theory approach, text was coded by rereading each segment of text and assigning that text to a series of codes or themes that emerge from the data based on areas of similarity and difference. For example, the following three segments of text were coded within a category called "social connections and community," which includes the many ways in which participants noted this aspect of program engagement as a valued benefit.

I think to jump back on what we were talking about a while back, one of the things that I think for all of us, because we have this COASST community that other people don't have, one of the things that has really been a benefit for us is the ability to get together and have these kinds of conversations and have this community that has grown out of it. (Janae)

And she [COASST partner] was a very enjoyable person, part of it was the camaraderie. And once I did it by myself I could see the benefit of having a compatible partner when you are doing that sort of thing, although I didn't do it to be with other people, I just did it to volunteer in the first place to get to the beach. But that was an added benefit that I hadn't really expected. (Abby)

Another aspect for me is just the involvement with the people. And I've heard a lot of people in the program say that. The quality of people that are working with COASST is really high and I think people are attracted to that and just want to be involved. (Eva)

Once all data was coded, each category was examined to ensure consistency in coding by identifying the central themes and "take-away" messages indicated by the data in that node and reassigning text that did not align with major category themes. Major themes and findings from each category (i.e. program outcomes) were examined against other categories to identify relationships, similarities, or differences. When, for example, results from analysis of participant outcomes revealed a large majority of participants highlight place meaning associated with the birds and wildlife of that place, this was compared against information regarding the motivation of those participants to engage in the program. The individual motivations of volunteers, along with information about the particular influence of biophysical or social-political factors was utilized to situate major findings about outcomes within the personalized, place-based contexts of participation and to identify the elements of program participation that consistently appear to shape such outcomes.

Study results were synthesized and analyzed within existing theoretical frameworks of human-environment interactions that treat such relationships as multi-dimensional material-semiotic phenomena (Ardoin 2006; Scannell and Gifford 2010; Williams and Carr 1993; Williams and Patterson 1996). Specifically, findings were reviewed with attention to the affective and emotional aspects of these interactions in the COASST program and the degree to which such aspects shape both the personal and broader normative outcomes of PPSR projects. Utilizing narrative and focus group interviews provided a salient avenue through which to explore the "lived experiences" of PPSR participants and the affective component of PPSR participation.

COASST Participant Outcomes

The quotes below are representative of the three main outcome areas (and seven subcomponents) indicated among study participants and help to paint a picture of the range of outcomes participants attribute to program participation. This brief review of outcomes highlights those that respondents indicated to be of greatest value personally, not necessarily an exhaustive list. A more detailed description of these outcomes can be found in chapter seven. Only those outcomes indicated by multiple participants at all six interview hubs are included here.

Health and Satisfaction

Sense of Satisfaction and Contribution

I have so much satisfaction because there is value in what we collect as a whole. There is no other way, you know, you couldn't come down here for a week and count birds along this whole twelve mile peninsula and come up with much. But if you have different people recording each section, and over a year or two or three years time you start getting a pattern, and the pattern stays pretty much about the same, there is value there. (Gary)

Physical/Mental Health

It is just like going to the gym or going swimming or cycling. I try to keep track of my exercise days, and it keeps me honest. I have to go do that dead bird thing, no matter what the weather is. (Lucy)

Now everything is like, I forgot something, so I must have Alzheimer's and it is scary. It is very, very scary for people my age. So this is just one more thing I can do for my brain. Use it or lose it. That is what it comes down to. If you don't use your brain, it goes away, it has to constantly be exercised. And COASST helps me do that. (Daisy)

Building Connections

Social/Community Connections

I think that the four of us who do that mile now, we kind of keep each other motivated. We can keep it going because we have each other. And we actually all enjoy each other. I realize it is an interesting thing to form a friendship over - looking for dead birds - but if you are going to be walking all that time, you end up talking about whatever is on your mind and it actually has been a very nice friendship to develop over that. So I think that that actually is quite a nice thing. (Jenny)

Connection to Wildlife and "Nature"

People say there are just thousands and thousands and thousands of birds living on the water out there. It wasn't made real to me, until I saw them on the beach with COASST. One day at the beach, I was doing the survey by myself and it was September or October, last year, and there was a haze over the water, fog kind of just clearing off about 2pm in the afternoon maybe. And there I was in the sun and I looked out over the water and I saw a line of birds flying south. And it wasn't exactly single file, it was groups, but a constant line, like a train of railcars. And I kept walking and doing my mile and a half and I would keep looking up and they were still there flying south. And when I finished they were still flying! That is how many birds there were, there were thousands and thousands and thousands flying south. And I kept thinking, am I seeing an illusion? Does someone keep pushing rewind? And I stood on the dune as I was leaving, just thinking when is it going to end. And it didn't. I left before it finished. And so I saw that as a miracle. I have never seen anything like that before. Just all these birds heading south. And the numbers of them. Seriously, over the course of a half an hour. It was amazing, just amazing. I couldn't stop thinking about it for days and days and days. How great it was to be connected to something like that. (Brooke)

Altered Sense of Place & Connection

We had never visited that beach before COASST. Now we call it our beach and are kind of a little protective of it. I mean, when they do coastal cleanups, if we are around, we will go and sign up to do that beach. Because it is *our* beach. We keep the phone numbers of all the tribal biologists so if we see something out there in the beach that is wrong, like a stranded animal, we will call it in. It has become a part of our lives now, a really important place. (Martha)

Education and Awareness

Greater Awareness and Appreciation for the Coast

I've been a regular at the beach for years. But an added attraction that really we didn't anticipate when we started doing the survey was noticing the dynamics of the beach, how much it changes from month to month. And I used to think that change was a winter phenomenon, a major storm phenomenon. But no, it is summer and winter. You might have a feet of sand blown one way or the other from one month to the next. It just blows us away each time we go, the changes there. So I'm much more aware of what is going on now. (Ronnie)

Learning and Knowledge Gain

I had never seen or heard of a Common Murre before until I started doing this. A friend of mine, she got me this book, and it is a pop-up book and it was talking about the different pelagic shorebirds along the Oregon coast. And it was saying that the Common Murre is one of the most common birds here. And I thought, I've never even heard of a Common Murre, how can it be the most common bird here? And then I start doing these surveys and sure enough, I found out they are. (Wes)

Personal Outcomes, Lived Experiences, & Program Aspects that Shape Them

As a whole, these outcomes indicate that many participants in COASST value participation and appreciate the diverse ways engagement has led to personal gain. None of these outcomes were experienced in isolation, but instead all work in concert to influence the long-term impacts of PPSR participation. Such outcomes are the result of

the lived experiences of program volunteers, the deeply personal day-to-day program interactions that inform the "experiential outputs" of PPSR engagement (chapter four).

Yet the lived experiences of participants in the COASST program are inherently filtered through a particular programmatic lens. Psychological literature has demonstrated that all people maintain cognitive, social, and emotional heuristics and biases that filter everyday experiences (Strough, Karns, and Schlosnagle 2011). Within a citizen science context, the unique aspects of individual programs work to filter how participants engage with specific contexts and settings and what psycho-social influences are triggered and cultivated via participation. As shown below, such influences have substantial impact on the affective and cognitive dimensions of program engagement.

This next section highlights seven programmatic variables that appear to play a significant role in filtering the lived experiences of volunteer participants. As a whole, and often in concert with one another, these variables collectively structure the lived experiences of program participation (chapter four), setting the stage for the various personal outcomes reviewed above. Two groups of variables are identified, those issues more often negotiated in initial program development, and those involved in ongoing program administration. Although these observations are based exclusively on one particular citizen science program, the major categories of consideration are applicable among other citizen science initiatives.

Program Goals and Development

At the advent of any PPSR program, the four variables below must be negotiated alongside a host of additional decisions before a project is developed and launched. Among the suite of decisions and steps necessary to establish a PPSR initiative, these

four appear to play a central role in mediating the personal outcomes identified in this study. Although none of these aspects of initial program design and implementation should come as a surprise to those invested in program development, they are reviewed to draw attention to the substantial influence they have on the kinds of valued personal outcomes reviewed in this study.

Project Objectives

The COASST volunteer protocol outlines program objectives as follows:

The Coastal Observation and Seabird Survey Team (COASST) is a citizen science program originally established to track the deposition of beached bird carcasses along the coast of the Pacific Northwest... COASST believes citizens of coastal communities are essential scientific partners in monitoring marine ecosystem health in the Pacific Northwest. By collaborating with citizens, natural resource management agencies and environmental organizations, COASST works to translate long-term monitoring into effective marine conservation solutions. (Coastal Observation and Seabird Survey Team 2006).

As this statement suggests, the program has a clear goal of advancing natural science research on marine birds, with the ultimate hope of informing marine conservation. The primary objectives, therefore, relate to both advancing scientific knowledge and translating that knowledge into application. Program leaders have determined the most appropriate strategies to achieve these goals, including aspects like what "counts" as a bird and what specific anatomical variables are necessary for identification (tarsus, bill, and wing length). Program objectives therefore inherently shape the strategies employed to collect and aggregate data for COASST volunteers, influencing the particular biophysical elements of focus, the methods of data collection and frequency of environmental interactions, and the content and focus of preparatory volunteer instruction

and direction. As a result, the particular types of *learning and knowledge gain* expressed by participants and kinds of *connections to wildlife* shared are directly impacted by the focus, structure, and format of volunteer responsibilities and activities required of the program. In some cases, like with Chris below, not only has a focus on birds influenced what he has learned, but it has also influenced his broader experiences on the beach.

I have learned a lot more about the beaches, about the birds, about the ocean that I was kind of forced in by doing the job and would not have had it otherwise. Now every time I see a dead bird on a beach anywhere on the coast, I get the impulse to sit down and process it. (Chris)

Who sets PPSR program objectives and how priorities and goals are established is a topic of growing discussion among the broader literature on PPSR initiatives (Biegelbauer and Hansen 2011). Although more emphasis is now being placed on a process of mutual goal setting based on both the interests of science and scientists and the public, PPSR programs have traditionally been governed by members of the professional science community, who set the initial aims of the project before developing program infrastructure and recruiting volunteers. Regardless of who sets initial goals, evidence from this study underscores that not only do the project goals shape the specific types of learning and knowledge that emerge from participation, but that they also shape other significant personal aspects of participation like sense of place, connection to wildlife, and personal satisfaction.

Scope and Scale of the Project

While the project focus sets the objectives for the program, other factors like resource availability, volunteer capacity, and program organization may shape the scope and scale of the project as a whole. In the case of COASST, the project doesn't just target

a select few marine birds, but a large variety of pelagic and shorebirds. Additionally, although the project started at only a few pilot beaches in Washington, it has since expanded into three other states. This not only means that participants now have the opportunity to examine, observe, and learn about a wide variety of avian marine life, but to consider these species within a large geographical space. This broader geographic engagement is fostered by program tools to explore data submitted by all volunteers online and project leaders who are available to provide feedback to individual members regarding large-scale trends. The unique scope and scale of the project influences the kinds of information exposure and questions volunteers are prompted to ask during surveys. Because the scale of the project is rather expansive in this case, "big picture" questions are encouraged, which, according to Abby, impacts the overall satisfaction volunteers associate with program participation.

And we have learned some big picture ecosystem kind of things as well by watching the patterns up and down the coast. You get this pattern that, yeah, you very well might make it through the winter and nothing is going to die and that leads you to this question of well, why is that, and you figure out an answer and you start calling COASST and asking. You find out that in the next few months, we are probably going to have a huge die-off because that is the way it usually works. It gives you a bigger picture of how the whole world interacts and that has been really interesting. Now, if that annual pattern is off, all sorts of questions are raised. You compare what is going on elsewhere to your beach and you go and do more research. I enjoy being a part of that kind of analysis. (Abby)

Project Governance Structure

Shirk et al. (2012) note that PPSR projects can take many institutional forms, classified largely on the level of volunteer engagement in the project. Those projects that ask volunteers to simply contribute information to a team of science researchers are deemed "contract" or "contributory" in nature. In the middle are "collaborative" projects

which involve participants in both data collection and analysis, while "co-created" or "collegial" programs are fully co-managed and implemented. Although the scope and scale of the COASST project is expansive, it is designed as a collaborative project. Not only do program volunteers collect data, but they actively engage in portions of the data analysis. Specifically, once beached birds have been measured, tagged, and photographed, volunteers are asked to utilize program resources along with their own knowledge and expertise to identify the bird and make judgments regarding the state of the body and clues regarding its death (e.g., oil, hooks, etc.).

Something that I appreciate and I don't know if they realize it is that instead of COASST just asking for a photograph showing as much as possible, they allow you to use your own brain to say, 'I think this is this bird, or I think this is what it might be.' They don't just come out and say, just shut up and send us a picture and we will make a decision! (Chris)

The active analysis encouraged by the program activates the natural curiosities of participants and helps satisfy a personal interest many participants noted in making contributions to science. Such engagement not only influences the type of *learning and knowledge gain* participants experience and the mental *health benefits* such intellectual stimulation provides, but also may support a greater *awareness and appreciation of coastal ecosystems* and actors. Additionally, professional staff with the program review all data submitted for quality control, providing continual feedback between program staff and volunteers that fosters interpersonal communication, feelings of trust, and a sense of respect that, for many participants, facilitates additional *satisfaction* and commitment to the program. Such volunteer/project leader interaction is noted elsewhere as a influential aspect of PPSR engagement (Evans et al. 2005).

Duration of Project and Participation

Participants reported a wide range of years engaged in the program, spanning those involved for less than a year to some participating twelve years or more. Although COASST is designed to encourage long-term, ongoing engagement, PPSR programs as a whole are organized around diverse time frames, ranging from one-time experiences to multi-year efforts like COASST. The long-term nature of the COASST program is of value to many program volunteers.

Well I think the most valuable thing I gain from this comes about because of my commitment over time, that I know the knowledge that is coming out of this long-term study - statistics of what birds are washing ashore. You need a long-term count to tell which birds are coming ashore and I've been a part of that for many years. And now since we are getting pictures of other things that wash ashore, like trash, we are able to make even more contributions. (Gary)

The value placed on long-term service and the satisfaction that comes over time not only emerges from a sense of personal investment that materializes from repetitive engagement with a place but it also relates to the objectives and goals of the program. Because the program is dedicated to establishing a baseline of beached birds over time and identifying trends and changes, long-term observations that involve attention to specific biophysical elements (e.g., changing beach substrate, patterns of beached birds) are required but also the socio-political context as well (e.g., who uses the beach, what development is taking place).

Based on the COASST participants in this study, there appears to be a threshold at which sense of contribution to the program tends to increase. Participants who have engaged for at least a full year exhibited a more developed sense of program satisfaction, often noting the significance of viscerally exploring the beach in all four seasons.

Although study participants who had engaged for less than a year still indicated a sense of contribution, their overall assessment of that contribution and confidence in the value of it was not as strong as those who had engaged for multiple years. In this case, the influence of participant duration on the lived experience of participants appears to play a role in participant outcomes around a *sense of satisfaction and contribution* associated with program participation and *learning and gaining knowledge* about seasonal changes.

Program Administration and Management

Once a PPSR program has been designed and implemented, project leaders routinely make decisions that impact the way in which the program is administered and conducted. In order to accomplish project goals and enhance program outcomes, programs constantly evolve through changes in program management. The three variables below appear to exhibit noteworthy influence on participant outcomes.

Participant Recruitment

Although numerous volunteer recruitment strategies are employed by COASST program leaders, one key component of recruitment involves partnering with other regional or local organizations to encourage volunteer participation. Not only does this targeted recruitment strategy influence the types of people who engage in the program and their expectations of project experiences, but for many, this networked approach helps facilitate a sense of comfort and ease among participants, as interpersonal connections and friendships may already be established among volunteers. Pre-existing relationships among certain participants enhance the survey experience and help shape the *social and community* connections numerous study participants expressed as a program outcome. This particular strategy, therefore, builds on existing social networks,

influencing both the initial connections among program recruits and the sense of communal purpose and willingness to "pitch in". State-run "beachwatcher" programs as well as local Audubon chapters are two programs that often overlap significantly in membership with COASST.

Participant Training, Protocols, and Continuing Education

Once recruited, COASST requires an extensive initial training process for all volunteers, involving a multi-hour facilitated instruction session. Such training helps frame the program experience, structuring subsequent interactions with survey beaches. The guidelines provided via manuals and protocols foster specific behaviors regarding how often surveys should be conducted, at which point in the tide cycle to conduct surveys, where and how to walk on the survey site, what to look for, and both the physical and human use data to collect during the process. In this way, the program training serves to focus volunteer attention and emphasis. Because the COASST program is exclusively focused on locating beached birds, the program protocol outlines detailed procedures for physical engagement with beach survey sites. Participants are encouraged to walk in specific patterns ("zigzag" or "sawtooth") in order to focus attention on the three areas of the beach on which most birds will be found ("surf line", "wrack line" and the "extreme high tide line") (Coastal Observation and Seabird Survey Team 2006, p S-3).

In addition to the presence of birds, participants are asked to record information about the shoreline substrate, specifically noting the presence of oil, wood, or wrack (marine vegetation or debris cast along shoreline), along with notes about the weather. Finally, participants keep records of the presence or tracks of humans, dogs, horses,

cars/trucks, and ATVs and can submit additional reports of major marine debris or marine mammal strandings. These procedures are designed to maximize the potential for participants to locate and process beached birds in coastal environments and serve to draw participant focus to specific aspects of the beach and the surrounding biophysical environment.

Participant awareness and appreciation of coastal processes is certainly shaped by the specific aspects of focus demanded by the program. For some study participants, aspects of the beach that had not been noticed before, suddenly come into view because of the need to focus on the beach substrate itself. In some instances, increased attention to debris on the beach (important for locating birds) has raised participant awareness of the amount of human-created waste on beaches and inspired an interest in beach clean-up.

I've found that I need to take a large black plastic trash bag with me because of the amount of crud and garbage. The amount! There is so much little stuff. I mean sometimes it seems like, well of course fireworks now, but the plastic bags and the pieces of rope. I don't know, maybe that is normal for that beach, that I don't know, but boy. To stand at the end and look up, you wouldn't notice it [trash] because most is entangled in the sand and stuff but when you are looking for birds and really looking at the sand, yeah, there is a lot of junk there. (Dorothy)

It is indeed true that, for some participants, the focused attention of the program on birds, was an initial motivator to engage in the program, and not necessarily a result of the training received once engaged. However, this was not the case for all participants. Even still, an interest in live birds is not the same as an interest in dead birds. Searching for beached birds focuses attention on a completely different set of environmental variables. Instead of searching for trees on which birds might perch, COASSTers instead search for clumps of debris in the sand. Instead of keeping a gaze on the horizon in search of flying birds, COASST participants maintain a gaze on the wrack line on the beach.

This last distinction is a nice example of the potential such focused attention has to shape participant outcomes with regard to *learning and knowledge gain* and *awareness and appreciation for the coast*. A focus skyward (the horizon line over the water, the sky above the beach) is sure to reveal components of the beach environment that differ from those focused directly on the shoreline and abutting landforms. Because the COASST program demands a focus on the sand, shoreline debris, and external impacts on those components of the beach (presence of humans, dogs or horses), the type of awareness and knowledge participants gain from the program may rely more directly on these particular experiences of place. Indeed, this is the goal of many citizen science projects with regard to scientific education.

Frequency and Nature of Participant Engagement

COASST participants are asked to canvass their beach or beaches at least once a month, twelve months out of the year. The majority of participants in this study (and in the program overall) meet this target. Some COASST participants elect to conduct surveys more frequently (e.g. every two weeks) or survey more than one beach each month, while others may not survey their beach more often but will visit their beach at more frequent intervals. Many study participants indicated that this requirement to visit the beach at least once a month has been an invaluable part of their experience, leading to new avenues to explore and discover the outdoors. In fact, even among those that live near their beach site, many expressed an appreciation for the prod COASST provides, indicating they would likely not visit the beach as frequently otherwise.

It is that whole thing, wherever you live, usually you are the ones that participate in the local activities or facilities the least. If you live near Disneyland, you almost never go. And same thing, if you live at the beach

like we all do, at least for us, without a reason to go you just keep putting it off. Well we will just do it later, and before you know it, a whole lot of later have passed. (Dean)

Other PPSR programs require distinct levels of involvement, ranging from daily to annual or multi-year commitments. The frequency of engagement by participants in PPSR programs helps to mediate participant experiences. Several COASST participants in this study commented that once a month surveys were ideal for sensing the overall changing dynamics of the beach because they allow enough interaction with the beach to become familiar and notice changing variables, but not too much as to miss subtle changes. These volunteers realize the influence the frequency with which they visit their beach has on their overall experience of that place.

I've become much more aware because you go down there every month. And before, we might not go down there but once a year. So you are kind of forced to go, because you said you would, so you have to do it. And I was glad that we did. Sometimes it is really amazing how much it changes from month to month and we never really realized that before. Sometimes everything is sanded in and it is just a big sandy beach and sometimes there is no sand at all and it is just all rock. In the winter time especially, the storms change it. (Ian)

For these participants, the once-a-month experiences at the same survey site helps to foster a *rich sense of place and connection*, but also a continual sense of *connection to wildlife and nature*, impacting the specific items of interest at the beach and the *learning* that emerges from those interests. This is not to suggest that engagement in PPSR is the only means through which such repetitive experiences are achieved. However, for these study participants, this aspect of participation, coupled with the other factors outlined here, does seem to contribute to the personal outcomes expressed by study participants.

I definitely know more about shorebirds than I did before. Just going to the beach, I know more about the coast, because before I think I made most of my visits in the summer time and I also would not go to the same

place. So having a beach that you visit at least once a month means that I see the changes that occur. And I've been totally amazed by that too, I had no idea. I thought the beach was just sort of more or less the beach. And now I know, no, I can count on certain cycles because it has been a little over two years since I've been participating in COASST. (Kate)

Finally, because COASST participation does involve a monthly, long-term commitment, often experienced together with a partner, the program is ideal for fostering *social connections* among individual participants who might not otherwise have met. Such regular interaction around a shared task can foster strong bonds. Speaking of the person who first trained her when she started the program and has since become her friend and COASST partner, Marcie notes the connection she has established with her fellow volunteer because of specific experiences with mentoring.

She teaches up at the University, so I feel like that has made us have a stronger connection as well. We both have an appreciation for music, but she is also very good at instructing, in a very clear and precise manner and she is very respectful, so even if it takes you a few times to remember something, she is so patient. She is so casual too, I love it, we just talk and do our survey and just enjoy it. She has definitely become a friend. (Marcie)

Connections Among Lived Experiences and a Sense of Stewardship

Evidence from this study suggests that engagement in the COASST program does influence the sense of stewardship and environmental responsibility felt by participants. Seventy eight percent of study participants indicated a sense of responsibility for and stewardship of "their beach" place, although the strength of such feelings is inevitably varied. This was evident even in the manner in which participants elected to engage in this study, choosing much more frequently the option to provide a guided tour and interview at "my beach", as opposed to a group conversation off site. When asked about this further, many participants attributed this sense of responsibility to program

involvement, especially those members who had never or rarely visited their beach site before COASST. Even still, the reasons participants provided to explain their sense of stewardship were varied. Some participants indicated that learning more about the ecological value of their survey place enhanced feelings of responsibility. For others, a strengthened sense of familiarity and closeness impacted feelings of ownership more directly. For most, these feelings emerged as a result of multiple forms of meaning found and cultivated in place.

Most frequently, this sense of stewardship is enacted by COASST members through the collection of trash and marine debris. Although some participants shared that they have picked up trash on the beach long before COASST, others noted how the program helped facilitate that behavior.

One of the things COASST asks you to mark is whether or not you see birds with oil or entanglement and I found an entangled bird once. That was interesting to see, like wow, they really do get tangled in nylon fishing line or whatever it was. So seeing, you know you hear all these bad things about human influence and the six pack rings, we've all grown up knowing about that and all the things waste does to the wildlife. But I'd never seen an entangled bird before. And it is like, whoa, it is real, it is in your face. So that, to me, was impactful in a sad way. It confirmed that yeah, we do impact these creatures. Now, as I'm looking for dead birds, I'm always careful to pick up trash on my beach. (Ruby)

For Ruby, the desire to pick up trash on her beach was primarily facilitated by a very visceral affective experience with an entangled bird which cultivated a sense of concern for her beach and the birds that live there. Although she indicated possessing cognitive knowledge of the danger of marine debris before this experience, it was the personal engagement with a dead bird provided by the COASST program that encouraged her to conduct regular trash collection. Both cognitive knowledge and affective experience contributed to such an outcome.

While an increased sense of stewardship among COASST participants does not mean the COASST program is itself the sole cause of such an enhancement, in this case, the program provided the structure and scaffolding needed to facilitate such processes. Further still, the numerous programmatic variables reviewed above all played a role in cultivating both the cognitive and affective elements that contribute to program impacts such as these. Even so, the sense of stewardship indicated by participants in this study generally regarded feelings of responsibility for a particular place, and therefore does not necessarily indicate whether or not such feelings also translate into changes in a more universal sense of stewardship or commitment to environmental behaviors.

Discussion: Implications for Program Design and Management

Participants have articulated the substantial breadth of personal outcomes of PPSR engagement and have helped uncover the multiple programmatic variables that influence and shape such outcomes. With this information in mind, how then might this study inform efforts to develop, manage, and enhance current or future PPSR initiatives? Several principal implications for program leaders and managers are discussed below.

Attention to Scope and Scale

Study participants indicated that understanding the "big picture" in which the information collected for the program is situated adds to the *satisfaction* associated with participation, as well as the *learning and knowledge gain* participants attribute to the program and the unique *sense of place* associated with the areas in which participants engage when compared to other program sites. The ability of participants to conceptually consider collected data at multiple scales appears to add significance to the COASST experience. In the context of COASST, for example, participants might be encouraged to

consider why information about a dead bird in a remote outer coastal area is important overall? What might this tell us about distant places, species abundance and population status? Situating this very local phenomenon in a larger context is important for participants.

Attention to both the very localized experiences of volunteers, as well as ensuring that participants have the opportunity to explore and understand how these local places influence and are influenced by regional, national, and global phenomena may be of value for program leaders. Thinking both locally and globally has unique educational advantages and can activate different types of questions and curiosities (Devine-Wright 2013). Even if the focus of the PPSR project is on localized events or processes, how can these issues be situated in a larger context for volunteers? If participants are collecting information for analysis at a global scale, how might that information be explored locally? Attention to these questions may enhance program *satisfaction and a sense of contribution*, even beyond the immediate localized context.

Provide Intellectual Challenge

Although several study participants indicated an initial interest in birds as a motivating factor to engage in COASST, others suggested that more than birds, participation was attractive because it allowed for mental stimulation and challenge, regardless of the specific object of focus. This suggests that when it comes to recruiting and retaining program volunteers, the degree to which the program fosters a sense of *intellectual stimulus and mental exercise* is also an important aspect of the initiative. Finding ways to engage participants in multiple aspects of the research process may encourage this type of engagement, leading to a more "collaborative" or "collegial"

program infrastructure (Shirk et al. 2012). The degree to which individuals are able to engage in multiple stages of the research process has been linked with additional program benefits around satisfaction, trust in science, and self esteem (Evans et al. 2005; Fernandez-Gimenez, Ballard, and Sturtevant 2008; Powell and Colin 2008; Shirk et al. 2012; Wilderman, Barron, and Imgrund 2004).

Even still, these governance systems are not feasible for all types of PPSR efforts. Regardless of the degree to which projects are managed collaboratively, project leaders could benefit from increased attention and evaluation of the intellectual stimulation of project participants. As one study participant in this study noted, one of the most appreciated aspects of COASST to him is the ability to use "his own brain". Finding opportunities for people to use their brains appears to be essential. However, it is also important to allow volunteers flexibility in this regard, as the pace of engagement and the challenge desired will vary. Providing options for volunteers to assume more detailed or complex responsibilities can ensure that participation does not become mentally stagnant for some or too overwhelming for others. Even in strictly contributory programs, however, tasks can be developed which encourage participants to utilize and stretch their brains.

Value and Cultivate Community

The interactions and relationships that develop among participants in the COASST program add significant value to participation and, in many cases, enhances a sense of commitment to the program and the longevity of engagement. These *social connections* are hardly a result of chance encounters and are, in some ways, intentionally fostered by program leaders and participants themselves. Overall, participants expressed

a desire to be a part of something "bigger", a greater purpose, and a collective mission. Efforts to build such community within PPSR programs can foster powerful connections, build rich relationships, and enhance both the quantity and quality of project participation (Bell 2009; Evans et al. 2005; Devictor, Whittaker, and Beltrame 2010; Overdeest, Orr, and Stepenuck 2004; Thornton and Leahy 2012).

Projects that manage participants as isolated data collection units may miss productive opportunities to build more efficient and effective programs, foster collective knowledge generation, and add meaning and value to volunteer participation. Beyond the basics like coordinating "after-hours" socials and interactive events, leaders might consider how to build special team-based research projects or tasks, utilize interactive web technology to foster volunteer interaction, or encourage participants themselves to engage with other project members to advance the research objectives and mission of the project. As with COASST, one way to jump-start these connections is to utilize existing networks within project communities to recruit participants.

Design Tiers and Thresholds for Learning & Commitment

Although people learn at different rates, all PPSR programs have specific thresholds at which individuals have amassed a certain amount of knowledge and experience to exhibit a particular level of competence and expertise. For participants in the COASST program, one of these early thresholds appears to be at least a year of program engagement. For PPSR program leaders, awareness of such thresholds could produce valuable information, not only to build towards them with specific types of support, but also to help understand how to "tier" specific opportunities that build on each other. Although study participants indicated increased learning and knowledge as a

significant outcome of participation, not all participants were motivated to participate initially for these reasons. Other personal goals like engaging in physical or mental exercise were just as important early on.

As research has shown, volunteers are motivated for a variety of reasons to engage in environmental volunteering, not always around an interest in learning or science (Measham and Barnett 2008). As such, a certain amount of caution may be useful as to not overwhelm participants early on with too much information or overly complex tasks (Bonney, Cooper, et al. 2009). A knowledge of the learning thresholds specific to individual programs can help leaders ensure that participation is not intimidating at the beginning, nor stagnant after time. New challenges, tasks, or information may be available to participants once they reach a particular threshold, enhancing the overall volunteer experience and the gradual sense of *satisfaction and commitment* to the program. This also helps ensure the reliability and validity of the data that emerges from the project, making certain a particular level of competence before enhanced engagement.

Allow Training and Protocols to Evolve

Just as project protocols and training shape participant experiences, so too do they shape the very science that results from such experiences. Protocols inherently direct the attention and focus of participants, and the types and degree of information collected. These systematic processes are a critical aspect of natural science inquiry, helping to isolate questions or hypotheses of interest and cultivating the consistent collection of information that will help answer relevant questions while reducing additional "noise". But particularly in PPSR settings, where participants are not always privy to information about why certain protocols are followed and what purpose they serve, participants may

develop a degree of tunnel vision, only focusing on the explicit variables emphasized within the program protocols and neglecting other potentially significant components (Naess 2010). PPSR participants are adept citizen sensors that may see, hear, smell, and sense extremely valuable information that is never recorded or considered because it was not a component of the program protocol.

As such, in addition to the constant assessment of program outcomes, PPSR initiatives would be well served to implement continual assessment of project protocols and research processes to examine whether or not the data collected is meeting the initial goals of the project (Shirk et al. 2012) while utilizing on-the-ground volunteers to highlight or identify data gaps or other areas of research opportunities. As discussed, participants in this study suggested they like to be *challenged intellectually* and to feel a *sense of contribution* to the program. What better way to foster those outcomes than to engage volunteers in the continual refinement of the protocols that govern participant experiences and the training that regulates new participants. This extends past a general, "what can we do to improve your experience" question to ask "what can we do to improve the science we are developing, or the methods by which we collect information"? Asking questions that challenge participants to broaden the scope of their inquiry, think "outside the box", and look past the sometimes narrow scope of data collection may enhance more collaborative or collegial projects. For example, "what are we missing that you think we ought to be paying closer attention to?" Not only might this provide a fresh and novel perspective to enhance the information collected, but it also encourages more holistic "ecosystem level" engagement with the program variables of interest.

Remember the Significance of Place and Connection

Another common benefit of PPSR engagement noted by participants in this study was the deep and abiding connections to the places and components of places that many participants experience. The significant meanings attached to these places and the connections felt for elements of "nature" in place, should not be overlooked by PPSR program leaders. In fact, of all six of the recommendations provided in this article, this is perhaps the most notable of them all. That is because these places, and the relationships between them and program volunteers appear to play a large role in the overall personal outcomes of participation (Evans et al. 2005; Devine-Wright 2013; chapter four). The sense of a place felt by participants can influence feelings of "connectedness to nature", shape beliefs and attitudes about the environment and natural resources, and influence broader feelings about environmental responsibility (Mayer and Frantz 2004; Schultz 2001; Schultz and Tabanico 2007).

As such, affective ties to places may motivate people to be better informed about the relationships between environmental health and community well-being, for example, or advance eco-justice concerns regarding the fair distribution of environmental benefits and burdens (Adams, Ibrahim, and Lim 2010). Despite the fact that PPSR participants engage with places in highly diverse ways based on specific program objectives, scales, and volunteer frequencies, this research suggests that project leaders might consider methods to more intentionally cultivate an enhanced sense of place among volunteers and foster more intimate connection between project participants and the places encompassed in the project. This might be achieved in any number of ways, from designing programs

that encourage more consistent interaction with specific sites, to cultivating or encouraging opportunities for participants to assume greater levels of place stewardship.

Conclusions

As this article has revealed, the feelings, emotions, and meaning making processes of participants involved in PPSR have critical impact on the inter and intrapersonal outcomes of projects. By extension, these outcomes can impact attitudes and perceptions about science and ecological phenomena, of central concern among PPSR practitioners and scholars. Given the consequence of these personal aspects of engagement, the lack of research and evaluation on the lived experiences of participants and the affective dimensions of engagement represents a significant gap. Bringing attention to the 'internal' dimension of PPSR volunteer participation, this study has focused on this gap by opening innovative avenues for understanding and enhancing the impact of PPSR on participants.

Although participant motivation was not discussed at length in this article, this study helps to shed light on those aspects of participation that may influence volunteer commitment and motivation to sustain PPSR engagement. As findings indicate, volunteers value a full range of outcomes associated with participation, many of which are influenced by affective experiences that inform participation. Not only is volunteer commitment sustained for many different reasons, but volunteers are motivated to participate in PPSR for many different reasons as well, finding value among a spectrum of potential outcomes.

This research signals that both cognitive and affective dimensions of participant experiences influence broader program impacts like behaviors associated with

environmental stewardship. Still, because of the complexity of these relationships, it is hard to speculate on the direct connections between a sense of ownership and responsibility and the various place meanings and levels of place attachment associated with sense of place. Questions remain, then, regarding what aspects of program participation most influence this process, what types of place meaning relate more closely to these feelings, and how specific kinds of place meaning may regulate participant attitudes towards and behavior in those places. Furthermore, opportunities exist to consider how changes in place-specific feelings of stewardship translate into more universal attitudes and behaviors.

With more and more citizens volunteering for PPSR programs and concentrated efforts among program leaders to reach groups who have traditionally been underrepresented in PPSR circles (Pandya 2012), practitioners as a whole will need to endeavor to meet such groups on their own terms. To do so, effort is required to understand the values and norms of those targeted for engagement, consider their motivations to participate, and foster those aspects of engagement they most appreciate. This will require PPSR leaders and scholars to consider not just the outcomes of participation valued by science professionals and science research communities, but also those that support participant growth and development. There is still much work needed to cultivate a community in which such outcomes are intentionally fostered and supported. Even still, it is the belief of the author that including cognitive, behavioral, and affective dimensions of PPSR experiences in program development, assessment, and analysis has the potential to help facilitate important change and improvements to PPSR development and practice, changes that will not only enhance participant experience and

personal outcomes, but the science that emerges from PPSR initiatives and the relevancy of that science for society.

CHAPTER SIX

SENSE OF PLACE AMONG CITIZEN SCIENCE VOLUNTEERS AND THE VARIABLE SPATIAL DEPENDENCY OF MEANING⁶

Abstract

Over the past two decades, citizen science has grown in popularity and complexity as a means to expand the scope and scale of scientific inquiry and enhance science and environmental literacy. And yet, the places in which citizen science occur have largely been overlooked in projects aimed at assessing program outcomes and impacts. While most citizen science initiatives are experienced in specific sites, contexts, and relational networks, the influence of these programs on people-place relationships and their material and symbolic encounters is often understudied. This study utilizes the concept of sense of place to explore how participants make meaning of place-based environmental science experiences to address this research gap. Pulling from scholarship within geography and environmental psychology, central research questions ask how PPSR experiences both shape and are shaped by place meaning and place attachment. Using a qualitative methodology to explore the Coastal Observation and Seabird Survey Team (COASST) citizen science program, findings stress the multidimensionality of place attachment and meaning. While these aspects are mutually constituted, they are not consistently predicted by one other. Elements of place meaning connected to symbolic,

⁶ Haywood, Benjamin. To be submitted to *Environment and Planning D: Society and Space*

social, and spiritual connection; sense of stewardship; physical and mental health; and memory and comfort are revealed along with catalysts of place attachment that include personal investment, knowledge, familiarity with place and distinct encounters or properties of a site. Sense of place is discussed as a material-semiotic phenomenon that mediates meaning along a continuum of spatial dependency, positioning place as simultaneously experienced, imagined, located, and relational.

Introduction

Projects and programs designed to facilitate public participation in scientific research (PPSR) continue to grow in popularity and scope in the U.S. These are organized efforts among citizens involved in aspects of the scientific research process, in collaboration with professional scientists and science institutions. A “new wave” of PPSR efforts first emerged in the middle of the twentieth century in the United States at a time when funding for natural science research was declining, all while concerns about global biodiversity and the health of the environment were increasing (Greenwood 2007; Silvertown 2009). This, coupled with the growing complexity of ecological research, facilitated a shift within scientific research communities from a closed system managed by the "scientific elite" to one in which participation and public input is sought and valued (Miller-Rushing, Primack, and Bonney 2012). As ecological research on global scale phenomena continues to grow, many research communities are now actively seeking ways to engage citizens in data collection and processing over large spatial and temporal scales (Conrad and Hilchey 2011b; Cooper et al. 2007; Dickinson, Zuckerberg, and Bonter 2010; Dickinson et al. 2012).

As the practice has become more wide-spread and sophisticated, most projects now place emphasis on both data collection and participant education, known as the "twin goals" of PPSR efforts. Many PPSR efforts maintain educational goals explicitly tailored to enhance scientific or environmental literacy (Bell 2009; Bonney, Ballard, et al. 2009; Bonney, Cooper, et al. 2009; Brossard, Lewenstein, and Bonney 2005; Jordan et al. 2011; Trumbull et al. 2000). In addition, research on PPSR participants has recently expanded to consider how engagement in these practices might also influence attitudes and behaviors with regard to environmental stewardship (Dickinson et al. 2012; Wolf et al. 2013). Such a focus on participant outcomes is emerging as research demonstrates that PPSR experiences often facilitate novel ways for people to interact with the physical environment, encouraging the exploration of new perspectives on science, ecology, and concepts of nature (Devictor, Whittaker, and Beltrame 2010; Evans et al. 2005; Overdeest, Orr, and Stepenuck 2004; chapter four).

Because most citizen science takes place and is grounded in specific sites and socio-ecological contexts, the relationships among citizen science participants and the places in which they engage are central to these experiences. These interactions have become increasingly valuable as research continues to highlight the fact that more and more people are farther removed from experiences with the natural world (Louv 2008). Recent literature suggests that, for many people, there is an absence of outdoor interaction in their daily lives, and researchers are only now beginning to uncover the impacts of such deficits (Wells 2000). In the absence of such interactions, PPSR efforts such as annual or ongoing bird counts, water quality monitoring, or the tracking of phenological shifts have become prominent ways to engage public audiences in natural

environments. These often have the paired goals of enhancing connection to nature, science learning, and an ethic of stewardship. As such, it is important to understand if and how such experiences facilitate connection to natural spaces. What types of connections and interactions do these experiences seem to facilitate well and what aspects are missing?

This article reports on research interrogating how experiences in natural science in-situ PPSR facilitates, shapes, and mediates sense of place among participants and the places in which they engage. People-place relationships provide the foundation on which beliefs, principles, and attitudes about the environment form and evolve, influencing both perceptions of and adherence to environmentally-sustainable practices (Halpenny 2010; Ramkissoon et al. 2012). As such, examining citizen scientists' "sense of place" provides a relevant entry point to study the relationships between scientific exploration and research, education and learning, and environmentally-sustainable behavior. Although the concept of sense of place has been used inconsistently among various academic disciplines (Devine-Wright and Clayton 2010; Manzo 2003), it can be described broadly as “an experiential process created by the setting, combined with what a person brings to it” (Steele 1981, pg. 9). Conceptually speaking, sense of place theory includes two principal aspects, place attachment and place meaning (Stedman 2003b). This research, therefore, focuses on sense of place attachment and meaning among PPSR participations, paying close attention to the various elements that coalesce to facilitate place meaning and the degree to which the character of that meaning influences attachment to specific places.

Significance of Place

Some of the most diverse and richly developed place-based scholarship has emerged from within the fields of environmental psychology and geography. Place has a deep history in the field of human geography, with roots that extend to researchers like cultural geographer Tuan (1975), who first integrated the writings of scholars like Heidegger and Merleau-Ponty to advance ideas about place in relation to space (Patterson and Williams 2005). Seeing himself as an advocate "for place," Tuan's ideas were a reaction to spatial-chorological approaches within geography that treated place as an object that is distributed among other objects on a flat spatial plane, being defined primarily by the unique physical characteristics of the site. Although the boundaries of such objects can be negotiated, place within the spatial-chorological tradition is defined as a physical site, characterized by specific features. Agnew and Duncan (1989) define this approach as viewing place as a *location* which can be objectively identified and explored. In contrast, Tuan (1974) has defined place as that which is opposite of space. Space being the blank canvass, place springs from that blank space when meaning emerges in a specific site, meaning created via interactions between individuals or groups who connect with and interpret the physical and social context of a setting via senses like sight, smell, and touch. Steele (1981) too has posited that places are not objects or ideas, but are instead experiential processes of interaction. For scholars like Steele and Tuan who assume a fully experiential approach to place, places themselves do not exist outside of first-hand experience. Place therefore, in this sense, is a product of subjective experience and meaning and not an objective reality.

On the other hand, this approach has been critiqued by those who contend that not all places are directly experienced (Campbell 2008). Photographs of a place, stories of a place, and information about a place can all conjure up images and ideas of place without ever having stepped foot in that place (Kudryavtsev, Stedman, and Krasny 2012). Such scholars assert that these imagined places are just as "real" as those empirically experienced.

As either empirically experienced or imagined, humanistic geographers like these generally theorize sense of place as constructed exclusively in the social realm, discounting the specific physical settings in which it forms (Stedman 2003a). Sense of place in this context exists in individuals and socio-cultural systems while the physical setting is more a backdrop on which that occurs (Agnew and Duncan 1989). As an example, theories that interpret place as a narrative text envision the physical environment as inscribed in human narrative to tell particular stories that lead to specific distributions of power and knowledge (Price 2004; Schein 1997; Till 2005). Places can thus be utilized to represent myths and to develop shared identities and stories (Daniels 2004), but the physical settings from which places emerge have little role in these processes. That is because most of these theories generally assume a subjective, anti-realist ontology, ascribing to the belief that all reality is socially constructed. While some scholars within this tradition assert that sense of place is an inherently individual experience that emerges from unique backgrounds, ideas, beliefs, and social processes, others have highlighted the collective social aspects of place, emphasizing that relationships between people, identity and cultural systems have social influences that go beyond individual experience (Brown and Raymond 2007).

And yet, not all place scholars conceive of place as purely subjectively constructed. Others have noted the significant role of specific material attributes in building and maintaining sense of place (Relph 1976; Richard Stedman 2003a), even though opinions differ on the degree to which such attributes play an active role in developing a sense of place. Those concerned about the lack of attention to material attributes in sense of place scholarship have warned of an general “placelessness” within such theory, critiquing an anthropocentric theorization focused primarily on the human construction of reality (Relph 1976). Some have even attempted to reinsert not just the physical but the metaphysical nature of places in place-based frameworks (Brace, Bailey, and Harvey 2006; Kruger and Jakes 2003; Lane 2002). Steele (1981, p 13) writes of the "spirit of place," an overwhelming potency of some places that can evoke similar responses from a broad diversity of individuals, like cemeteries or sites of cultural significance. Whether or not this spirit of place exists independently or is collectively interpreted or learned, place is constructed in social processes, both individually and collectively, by interactions that occur in specific material contexts.

The centrality of human actors that is typical in most sense of place scholarship is challenged via approaches like Actor-Network Theory (ANT) (Allen 2011). ANT shifts focus from central human agents to the broader networks that develop between the material and semiotic. In ANT, networks are viewed as multiple, overlapping, and ranging in size, shape, and membership (Allen 2011; Murdoch 1998). As such, inanimate objects and non-human actors are acknowledged as part of complex networks that come to ground in particular places. Places, then, are constructed within networks of phenomenological experiences, not just processes of human interpretation.

Place Meaning and Attachment

To explore the multiple dimensions of place among PPSR participants, two major components of sense of place scholarship, place attachment and place meaning, are of central focus in this study. *Place meaning* refers to the ascribed symbolic significance that develops between people and place. From a phenomenological perspective, such meanings form in an interconnected ‘feedback loop’ between the setting, as Steele (1981) calls it, and the individual or group interacting with that setting (Nassauer 1995). Meaning is influenced by cognitive/psychological processes that involve the development and integration of identity in place. Called place identity, this personal connection is seen as the degree to which one links his/her own identity and self with place or locates aspects of identity (i.e. childhood experiences) with a place (Proshansky, Fabian, and Kaminoff 1983). Personal interactions with a setting create place meaning in an integrated fashion, all while the meaning that develops there influences future behavior, relationships, and attitudes about that place. These perceptions, in turn, may lead to new types of interactions and new meanings. Place meaning, therefore, is negotiated from changing life positions, mediated by culture, politics, and the physical environment in an ongoing process.

Tuan (1977) has posited that although the degree and intensity might vary, as people accumulate meaningful experiences in place over time, they often develop “topophilia”, a strong bond between place and person. Such bonds also produce feelings of attachment to particular places. The environmental psychologists Low and Altman (1992) define *place attachment* as an affective bond between people and place, enveloping different human and non-human actors and social relationships. Because the

sense of place concept is built around the development and evolution of material-semiotic meaning, it is widely argued that people do not attach to the physical sites within which place is conceived, but instead attach to the meaning found in such places (Greider and Garkovich 1994). Conceptually, place attachment involves level of dependence on place and the intensity of affective experiences there.

Place dependence is typically defined as the degree to which a place uniquely facilitates a desired activity or condition, whether that relates to a specific emotional state, behavior or activity, or sense of identity and belonging (Stokols and Shumaker 1981). Previous studies have demonstrated that the degree to which one depends on a place for his/her identity can increase place attachment, protective behaviors, and feelings of dependence. (Devine-Wright 2009; Jorgensen and Stedman 2001; Stedman 2003a; Stedman 2003b).

Affect is generally treated as a concept that encompasses both the emotion associated with an idea or experience in a place as well as the 'pre-cognitive' nature of a place (Tuan 1975). The amount, intensity, and duration of experiences in a place (often called residence length) is the most consistent predictor of levels of place attachment, among a host of other variables that have been examined (e.g., age, social status, sense of security) (Lewicka 2011). This includes not only affective experiences, but cognitive and behavioral as well. In some instances, community ties and connections, as well as characteristics of the setting (such as access to nature) have also predicted increased place attachment.

Although place attachment and meaning are part of an overall sense of place, they are not identical concepts. Manzo (2003) has demonstrated that even though multiple

individuals may share similar levels of attachment, feelings, or relationships with a place, the meanings associated with that place are quite diverse, and can encompass both positive and negative dimensions. Place attachment therefore reflects the emotional intensity and nature of one's attraction to places, while place meaning helps expose the reasons for such an attraction.

Relating Place, Meaning, and Attachment

As this brief review has demonstrated, place-based scholarship has progressed through transitions from theories of place as objective sites distributed in space (location), as stage on which human actors play (locale), as purely socio-relational subjective experience or imagination, to a rematerialized hybrid concept which often intersects with phenomenological scholarship (Patterson and Williams 2005). Assuming an actor-network view, this study defines place via a phenomenological perspective, as a psycho-social-ecological phenomenon that is experienced in material-semiotic relational networks. Seamon (2012, p 3) summarizes such a phenomenological approach to place:

"As researchers work toward this encompassing framework, one aim is to facilitate an understanding of place that is neither *objectivist* (i.e., interpreting place as an objective environment *outside* experiencers) nor *subjectivist* (i.e., interpreting place as a subjective representation, whether cognitive or affective, *inside* experiencers). Rather, researchers need to understand place as incorporating a lived engagement and process whereby human beings afford and are afforded by the world of places in which they find themselves."

As Seamon notes, to assume only people have agency in the development of place meaning misses the complex interactions among multiple species and objects that ultimately shape the meaning that emerges in that setting. While the symbolism attached to place is a product of human culture and meaning, the behaviors and ecological make-

up of places themselves are an integral part of that symbolic meaning. Without the place and its unique shape, form, and behavior, there would be no symbol. Without people to interpret that information with meaning and the global forces which shape those values, the symbol would not exist either. It is the relationships *between* various people and non-human actors and the networks that they form that create such meaning.

Broadly speaking, current scholarship on place recognizes three major dimensions of place including the socio-political context, psycho-social processes, and the biophysical setting (Ardoin, Schuh, and Gould 2012; Brandenburg and Carroll 1995; Karrow and Fazio 2010; Kincheloe et al. 2006; chapter four). Steele (1981, p 12) has proposed that place exists when there is an integration of the biophysical/natural and social-cultural context (called the "setting) and the ontological/psychological factors an individual brings to that setting. Such interactions between humans and the physical landscape in which they engage are deeply phenomenological, informed by individual histories and experiences, leading to an organic and relational sense of place and influencing both place meaning and feelings of attachment (Jorgensen and Stedman 2001).

Even still, Lewicka (2011) claims, despite decades of place-based research, questions remain regarding how these dimensions of place shape meaning, and the processes that link meaning to place dependence and attachment. Specifically, she notes a "sad lack of theory" that connects affective geographies and experiences of place to the three dimensions of place reviewed above, particularly biophysical elements (Lewicka 2011, p 218). Examining the people-place relationships that form via citizen science experiences and the affective components of these interactions, this study seeks to

address theoretical gaps in place research by advancing knowledge about the place meaning-making process and the catalysts which lead to place attachment.

Methodology and Methods⁷

Scholars frequently contend that the complexity of place warrants a contextualized methodology, one that accounts for variation and diversity in experiences and perceptions (Brandenburg and Carroll 1995; Fishwick and Vining 1992; Lewicka 2011). While arguments exist regarding the most appropriate research methods to utilize in order to capture such complexity, both quantitative and qualitative approaches have been employed to explore sense of place, depending on the type of research question asked and the goals of the study (Kudryavtsev, Krasny, and Stedman 2012; Lewicka 2011). On the one hand, quantitative methods are often utilized for studies aimed at the investigation of systematic relationships between people and place to test for prediction and causality among various place-based constructs. On the other, qualitative practices are often the norm among those studies interested in the phenomenology of place, in particular as it regards the unique and heterogeneous "lived experiences" of place. While both approaches contribute valuable perspective, given the paucity of research on this topic, this study was designed to explore the variety, contextual influences, and unique attributes of sense of place among PPSR participants, necessitating an idiographic approach to explore such phenomena 'on their own terms' (Husserl 1970; Seamon 1982; 2000).

⁷ To include the note: Portions of the methodology and methods section were first published in Haywood, B. Birds and Beaches: The Affective Geographies and Sense of Place of Participants in the COASST Citizen Science Program. The University of South Carolina

To explore sense of place among citizen scientists, the Coastal Observation And Seabird Survey Team (COASST) citizen science program was selected for this study. The COASST project was established in 1998 by Dr. Julia Parrish of the University of Washington. COASST is an expansive PPSR program focused on marine ecosystem health and conservation via ecological monitoring and research as well as efforts to encourage local participation in coastal management and governance. The COASST program is well-established with strong records of consistent program management and success (<http://depts.washington.edu/coasst/>), providing a fitting opportunity to explore sense of place among PPSR participants.

With a distributed, team-based management approach, the program involves nearly 800 participants in monitoring and data collection at over 500 beaches in Pacific Northwest four states (WA, CA, OR, AK). Program participants select a specific beach to canvass (unique to each individual or team) at least once a month, identify and tag beached seabirds, record observations about the beach, and submit reports to a program database. By tracking the deposition of beach bird carcasses along the coast of the Pacific Northwest, the program is designed to create a "normal" baseline against which potential impacts can be assessed and overall patterns and trends identified. The beaches COASSTers adopt are highly diverse in size, shape, and location, as well as ecological and cultural character. Wedged between the Pacific Ocean to the east and several prominent mountain ranges to the west, COASST beaches are shaped by fluid atmospheric, geologic, and biographical processes.

In consultation with COASST program leaders, six geographic hubs across three states (WA, OR, CA) were selected as targets to recruit study participants because of

large concentrations of COASST volunteers and the geographic diversity of these sites (see chapter three). As such, a non-random, purposive study sample was recruited. Alaska was excluded because of the logistical difficulty in reaching the widely distributed participants.

Participants were contacted to participate in the study in the spring of 2013. An invitation letter describing the purpose of the research and opportunities to participate was sent to all COASST participants with study beaches within a 45 mile radius of each hub. Invitations were sent directly from COASST program leaders, with links to online documents explaining the project in more detail and an online form that allowed invitees to opt out or in to the study. For participants that opted-in, information was collected regarding participant resident length, length of service in the program, frequency of participation, and the average rate at which birds are found. Residence length has been suggested as a major predictor of place attachment and both the frequency and quality of participant engagement in the project has been noted as a factor influencing PPSR participant outcomes (Lewicka 2011; Shirk et al. 2012).

Study participants were given the option to participate in either a one-on-one survey team "guided tour" interview or a small group focus session. Guided tour interviews followed a narrative approach, allowing the participant/s to guide the author through his or her COASST survey site while engaging in a semi-structured interview format (Everett and Barrett 2012). Small group focus sessions involved a semi-structured facilitated discussion among a small group of participants (4-8) in a common public area. A consistent set of questions was asked of all participants around key themes (see chapter three for interview protocols), although interview format remained flexible as to allow

conversation to flow in areas pertinent to the study. Data collection occurred during the summer of 2013 as the author traveled to each of the six geographic hubs in succession over a period of three months. All interviews were audio recorded for analysis with the permission of study participants and a researcher observation log was maintained during and after each interview while digital photographs of the guided tour sites were collected.

Respondent Participation & Characteristics

In total, one hundred and eighty participants were invited to participate, with seventy-eight opting in to the study for a forty-three percent participation rate. Thirty-five percent of participants were male and sixty-five percent were female. A total of seventy-one participants engaged in a guided tour interview. A portion of these (twenty-one) occurred either over the phone or in places other than the COASST survey site of the participant in cases where availability or environmental factors prevented meeting at the participant's specific COASST beach. Additionally, fourteen participants engaged in one of three focus groups. In total, seventy-eight participants participated in the study, with a few individuals (seven) participating in both guided tour and small focus session interviews. As Table 6.1 indicates, residence length and the duration and nature of program engagement ranged substantially among participants.

Analysis

A “general inductive approach” (Thomas 2003, p 2) was used to analyze the raw data from the study (i.e. notes and observations and interview audio recordings). An inductive approach reflects frequently reported patterns as they emerge in the data, and involves data preparation (cleaning), immersion in the data, the creation of categories and definitions to use for segmentation and analysis, identifying themes and key variables,

Table 6.1: Select Participant Characteristics (n=78)

Participant Characteristic	Study Participant Average	Study Participant Median	Minimum Study Participant Value	Maximum Study Participant Value
Residence Duration <i>Years residing at location</i>	12.6 Years	10 Years	< 1 Year	49 Years
Program Participation <i>Years participating</i>	5.6 Years	5 Years	< 1 Year	12 Years
Survey Frequency	1.19/month	.92/month	.41/month	5.58/month
Average Find / Survey <i># of beached birds</i>	3.9 birds/survey	3.1 birds/survey	0 birds/survey	11.9 birds/survey

and integrating themes into analytical models and frameworks. All interview audio files were transcribed verbatim, while pseudonyms were given to each participant to ensure confidentiality.

Once all transcriptions were complete, each transcription was re-read for immersion and text was assigned to a series of broad categories of interest that corresponded with the interview protocols (e.g., participant motivation to engage, participant outcomes, place meaning and attachment). Within each category, key blocks of text were assigned specific descriptive codes to identify major themes, similarities, and differences among respondents. These codes were developed iteratively, based on constant comparison of other text within the category and previous scholarship and literature on place. As codes were developed, a coding dictionary was recorded to capture how each category was defined and interpreted. Once all the text within a category was coded, the text within each unique node was reviewed for consistency of segmentation and any necessary recoding or refinement of code categories and definitions was completed. Coding was accomplished using QSR N'Vivo software (version 2.10), a

qualitative analysis tool that allows the review, segmentation, and comparison of large sets of textual data. The methods employed allow for data and environmental triangulation, while a detailed coding dictionary provides both transparent and defensible coding strategies.

Although sense of place is inherently personal and contextual, similarities among participant responses allowed a thorough interrogation of the various influences and components that shape and build place meaning and attachment. Nonetheless, it is important to note that results from this particular study are themselves situated and idiographic. As such, they are not intended to represent the experiences of all PPSR programs, sites, or participants. In particular, research suggests that sense of place is mediated through specific cultural and socio-demographic positions (Kyle and Johnson 2008). Although detailed socio-economic information about study participants was not collected, preventing in-depth analysis of these characteristics, information regarding participant race suggests a degree of homogeneity among participants (96% of participants were Caucasian). Furthermore, although common descriptions, explanations, and expressions shared by participants were utilized to identify shared dimensions of meaning and drivers of attachment, there are inevitably differences in how individuals interpret the words "meaning" and "attachment". Therefore, while the research protocol was designed to provide common examples and explanations of these concepts, it cannot be assumed that all participants responded to questions with the same understanding of these two terms in mind.

Results

Study participants expressed a wide range of meanings connected to their program survey sites, and varying levels of attachment to those places. In the next section, participant responses regarding place meaning are first presented in categories alongside representative participant quotes for each. Next, place attachment is explored and the idea of attachment catalysts is presented within a conceptual model that links place meaning to feelings of attachment. Finally, a discussion regarding the relationships between these two dimensions of sense of place highlights a continuum of spatial dependency of place meaning. All participant names have been replaced with pseudonyms when used in quotes to protect confidentiality.

Place Meaning

Participants in the COASST program found and experienced diverse dimensions of meanings at their survey beach sites. The term "dimensions" is used here to underscore that these attributes do not exist in isolation. The dimensions of meaning outlined in Table 6.2 interact and integrate in a unique way for each study participant. Most participants expressed multiple dimensions of meaning connected with their study sites. In this sense, the totality of place is experienced as a personal phenomenon, irreducible to one single characterization of place meaning (Manzo 2008; Stedman et al. 2008). The dimensions of meaning below, therefore, are common elements and themes that emerged among study participants, as significant aspects of what COASST survey sites mean, not one-dimensional categorizations of place meaning.

Table 6.2: Dimensions of Place Meaning among COASST Participants

Category (frequency count) Description	Examples from Participants
<p><i>Ecological Value & Enacting Stewardship (50%)</i></p> <p>Survey site has meaning as a place in which participants find ecological value and are able to enact a sense of stewardship. The collection of marine/coastal debris was one major activity associated with this meaning.</p>	<p>"I see it as an obligation to honor those lives [of dead birds]. Even in death, we have to honor their lives, because just in collecting the data, hopefully that will resolve whether they died of natural causes or whether there is a reason for their death. Part of that stewardship I think is what draws me to that place. There is just something I can't describe that I feel to be honored to be around." (Owen)</p>
<p><i>Encounters with Wildlife and Nature (49%)</i></p> <p>Meaning related to the opportunity to study, investigate, and discover the natural world at the study site.</p>	<p>"I find human behavior is often appallingly awful and it is appallingly awful particularly in regard to how we treat species other than our own. I mean we don't even treat our own very well, but other species are simply not worthy of consideration. And I find that very annoying and so I find it is a whole lot more pleasant frankly to be out talking to a bird." (Sophia)</p>
<p><i>Establishing and Expanding Roots (42%)</i></p> <p>Meaning relating to a sense of familiarity and comfort with the survey site, in some ways expressed as a piece of the fabric of the participant's identity.</p>	<p>"And that is what I think has been a really good thing for me. I would come down to this beach, but I wouldn't necessarily come down on a regular basis. And now I do. And I think I know it a lot better and probably enjoy it a lot more than I would have if I hadn't done it. So it is good for me." (Lillian)</p>
<p><i>Physical and Mental Stimulation (29%)</i></p> <p>Meaning relating to the fact that the survey site serves as a place to exercise the body and mind.</p>	<p>"I'm getting old and more pieces of me come out and go into a jar at night. I'm 63 years old, my hearing is shot to shit, my vision is going. I have big holes in my memory. So I'm fading into the night and it is a place where you can use your senses." (Connor)</p>
<p><i>Finding Refuge (27%)</i></p> <p>Meaning relating to the survey site as a get-away, a sense of remoteness or privacy that allows for solitude and respite from other people or responsibilities.</p>	<p>"But I like it because it is remote and for that reason you can go there on a weekend even, and by the time you get to our outermost beach, you probably wouldn't see anyone, and it is nice to have that solitude." (Natalie)</p>
<p><i>Place of Memory & Comfort (27%)</i></p> <p>Meaning related to associations with previous meaningful experiences at that site</p>	<p>"I have a long history here. I've been alive a while. I sat on my beach at about age five and said someday I'm going to live here. I have pictures of my mom and dad standing in front</p>

<p>or memories jarred at the site that link to other important places. Connected to previous experiences or feelings associated with the coast.</p>	<p>of proposal rock and they were just newlyweds. In fact, twenty years ago, I came down looking for property and I found a piece of property that was across the highway from Neskowin on a little creek called Gibb Creek. And I love my creek. All the sudden one day I realized that my little creek flows down the east side of the highway for a little ways, goes underneath the highway, goes across the golf course, and goes right out to proposal rock!" (Sophia)</p>
<p><i>Symbolic Connection to the Ocean (20%)</i></p> <p>Meaning relating to the overall beauty, mystique, and wonder of the ocean and a deep desire to connect with the mystery and power of a coastal place.</p>	<p>"I just like the ocean, to me that is one of those places where when everything goes south, you hop in the car and you go out to the ocean and find a sand dune to sit on. It just sort of puts everything back in perspective." (Lucy)</p>
<p><i>Meeting Place (17%)</i></p> <p>Meaning relating to the social interaction that comes with participation at the survey site.</p>	<p>"We actually all enjoy each other and it is an interesting thing to form a friendship over, but if you are going to be walking all that time, you end up talking about whatever is on your mind and it actually has been a very nice friendship to develop over that. So I think that that actually is quite a nice thing. (Jokingly) I think we just don't know how to get out of it!" (June)</p>

These results are consistent with definitions of sense of place that embrace the complexity and multi-dimensionality of the concept. Participants in this study demonstrated a broad diversity of meaning attached to their COASST beach sites, even as the tasks performed in those sites, at least with regards to program participation, are similar and comparable. There were no clear patterns of association between specific types of meaning and the socio-demographic characteristics of participants. In fact, the results of this research highlight the deeply personal and contextual nature of sense of place among participants, influenced not only by what each person brings to a place, but

also the elements of program participation that hold the most value for them and the unique physical features of the places they canvass.

The dimensions of meaning shared by study participants provide support for conceptualizations of place and place meaning as material-semiotic phenomena. Particularly in coastal settings, the symbolism associated with marine environments evokes deep philosophical meaning for many people (Wynveen, Kyle, and Sutton 2012). This is evident in meaning among COASSTers associated with the symbolism of the ocean, memory and comfort associated with marine settings, and feelings of refuge and rejuvenation connected to coastal environments. Such meaning is the result of intimate interactions between people, their backgrounds, perspectives, and motivations; the contextual aspects (i.e., laws, social norms) that govern places, and the visual, auditory, olfactory, and tactile experiences mediated by the biophysical setting (chapter four).

The importance associated with the ocean influences place meaning in other ways as well. As noted in Table 6.2, many COASSTers also find meaning around the perceived ecological value of their beach, eliciting a sense of importance around the ability to serve as a steward of such a place. This is particularly the case after survey experiences that expose or highlight problems associated with marine debris and human refuse. Almost uniformly, COASSTers shared how their experiences conducting surveys has contributed to a sense of alarm or concern upon discovering the amount and impact of discarded waste, fishing gear (nets, hooks, etc.), and plastics along the shoreline of the Pacific Northwest. This demonstrates that, at times, participants develop a sense of place that is not necessarily positive, but troubling, influencing a willingness to engage in particular

behaviors (i.e., collect debris) that, in turn, influences the meaning and significance of place.

Regional dynamics play a role in shaping place meaning as well. Espousing the belief that this area of the country contains the "last great unspoiled" forests and beaches, many COASSTers find deep significance in the beauty, uniqueness, and shared ethic of conservation embodied in program beaches. In some cases, a sense of pride associated with the area was juxtaposed against a perceived lack of concern for similar resources in other parts of the country. This diverse, yet generally shared, regional ethic of conservation permeated meaning connected to stewardship. Similarly, COASSTers frequently referenced their connection to feelings of fierce independence and exploration associated with the American West to explain the meaning they find through the exploration of "wild" or "wilderness" places. Meaning associated with encounters with/in "the wild" are, at least partially, rooted in these aspects of regional identity.

Although the significance and symbolism of coastal settings is a product of human culture and interaction, the unique ecological make-up of each coastal environment is an integral part of that symbolic meaning, constantly shaping and reshaping meaning. The U.S. Pacific Northwest region is part of a highly complex coastal system, supporting a wide variety of terrestrial and aquatic communities. The region is dominated by the atmospheric pressure systems and nearshore ocean currents of the Pacific Ocean, which create moderate year-round temperatures and seasonal precipitation. Evergreen coniferous forests abut the coastal landscape, supporting numerous woodland species alongside a significant number of pelagic and maritime ecological communities. As such, while this study indicates that people do indeed attach

to the meanings that form place, such meanings are not strictly socially constructed, but form within specific material assemblages.

Place Dependence & Attachment

To further explore place meaning among PPSR participants and how such meanings influence the intensity of connection to place, participants were asked to reflect on the second major component of sense of place, place attachment. In addition to asking participants what meaning they find in their COASST sites, they were also asked whether or not they felt attached to their particular beach in order to assess the degree to which the meaning found at their survey sites was more or less dependent on that specific spatial setting.

Noted earlier, the concept of place dependence helps understand how place attachment forms and develops. Participant responses suggest that the dimensions of place meaning ascribed to beaches can be more or less spatially dependent on the places where they are found, based on their intensity and unique character. In other words, in some cases, the spatial dependency of meaning tends to increase with the number of meanings found or uniquely tied to the specific characteristics of a place. As place meaning becomes more dependent on the setting of a place, participants noted a growing attachment that develops between person and setting to enact that particular type of meaning.

An individual with an affinity towards snowy plovers, for example, may find spatially dependent meaning at his/her specific beach because this endangered bird is only found at this one site throughout the region. In other cases, the meaning found at a COASST site may not be nearly as dependent on that specific setting. Someone who

finds meaning at a COASST site because it is a place where a participant is able to catch up with a good friend may be able to find such meaning in many other places, reducing the dependency that individual exhibits towards that place to enact that meaning.

As another example, multiple participants in this study noted that the sound of the waves on the beach provide a sense of calmness, contributing to the meaning of the place as a site for refuge and comfort. However, for some, this meaning was not at all dependent on a specific beach. The sound of waves overall, to be found at any beach, was of value. Yet for a few participants, the particular geomorphology of their particular beach, from their perspective, created a unique and special sound, which resonated in an intimate way with those participants. According to these individuals, that particular sound cannot be replicated at "just any beach," and the meaning associated with that sound was much more dependent on that place. As the spatial dependency of place meaning increases, so too does the situatedness of that meaning.

Findings from this study suggest a connection between more spatially dependent place meaning and the development or activation of attachment catalysts. Attachment catalysts are specific activities, interests, knowledge, or feelings associated with a place that facilitate place attachment and emerge from the meaning found there. COASSTers become dependent on places because they allow a specific activity or interaction, provide a particular feeling or emotion, or meet a certain psychological need like a desire to belong and express intimacy. Such dependency may be the result of both social and physical dimensions of place experiences, influenced by the unique regions, institutions, and community cultures and norms of an area. Participants commented on features such as the shape of the beach, the color of the sand, the type of birds found at the site as well

as behaviors or symbolic interpretations only possible at that site. This aligns with evidence from other research which has shown that attachment results from connection with both social and physical aspects of special places (Eisenhauer, Krannich, and Blahna 2000).

Among those who did articulate a particular attachment to their beach site (some expressed no attachment at all), five major attachment catalysts were identified (Table 6.3). Although these catalysts emerge from the unique combinations of place meaning held by each COASSTer, some meanings appear to play a more significant role in shaping particular catalysts. These are highlighted in the third column of Table 6.3, although these should not be interpreted as exhaustive or exclusive.

Table 6.3: Place Attachment Catalysts among COASST Participants

<i>Attachment Catalyst & Description</i>	Example from Study Participants	Significant Dimensions of Place Meaning
<i>Personal Investment</i> Strong emotional sense of pride and attachment to the survey beach because of the investments made to canvas that particular kilometer of beach and document birds	"I've certainly clocked in more hours here so I've got more time under my belt. So I'm more attached because I've spent a lot of time on it so far. I've invested energy." (Ina)	<ul style="list-style-type: none"> • Enacting stewardship • Physical/mental stimulation • Establishing and expanding roots
<i>Unique Knowledge/Consistency</i> Attachment to a specific beach because of confidence that they know that beach better than most, and can document the phenomena of focus in a more thorough and reliable fashion	"By going to the same place with some discipline, you become more observant, more of an expert in that area, more able to see things that are out of the ordinary and different." (Connor)	<ul style="list-style-type: none"> • Physical/mental stimulation • Enacting stewardship • Encounters with wildlife/nature
<i>Familiarity/Intimacy/History</i> Attachment due to a sense of	"Now that I've been doing it, it is now my beach. And I have kind of five years of seeing it in	<ul style="list-style-type: none"> • Establishing and expanding roots • Finding refuge

comfort that comes with familiarity and deeper connection to a place, leading to a sense of belonging	all seasons and pictures that I've taken of how the creeks that come into the beach change in the seasons. So I've gotten more and more invested in that particular spot. And that kind of deeper, richer connection to a place is something that I value." (Caleb)	<ul style="list-style-type: none"> • Place of memory/comfort • Symbolic connection with ocean • Meeting place
<i>Distinct Wildlife Encounters</i> A particular attachment and affinity to the survey beach site because that site produces just the right amount of wildlife encounters (especially with birds) per survey trip	"And these guys. If there were no little black and white birds with these trills out here in the summer time, my heart would just sink." (Ina)	<ul style="list-style-type: none"> • Symbolic connection with the ocean • Encounters with wildlife/nature • Enacting stewardship
<i>Distinct Aesthetic or Physical Properties</i> Specific attachment to the survey beach because of the unique aesthetic or physical appeal of the site	"You know there really is an emotional connection and if you are on that beach, you just see so much going on. It is a really enjoyable beach. So I have that kind of attachment to it. And the sunsets are beautiful, it is really just a very emotional connection." (Stella)	<ul style="list-style-type: none"> • Symbolic connection with ocean • Encounters with wildlife/nature • Finding refuge

Findings from this research suggest there may be a relationship between the spatial dependency of meaning, the presence of specific attachment catalysts and the strength and intensity of place attachment (Figure 6.1). This supports similar findings that place dependence is a major dimension of place attachment (Bricker and Kerstetter 2000; Prayag and Ryan 2012; Ramkissoon, Smith, and Weiler 2013), yet builds on such work to highlight how the different dimensions of place meaning influence this process. Of note, two of the six catalysts of attachment outlined above (personal investment, unique knowledge/consistency) are directly tied to the nature of the COASST program itself, suggesting salient avenues through which participation in COASST may have influenced

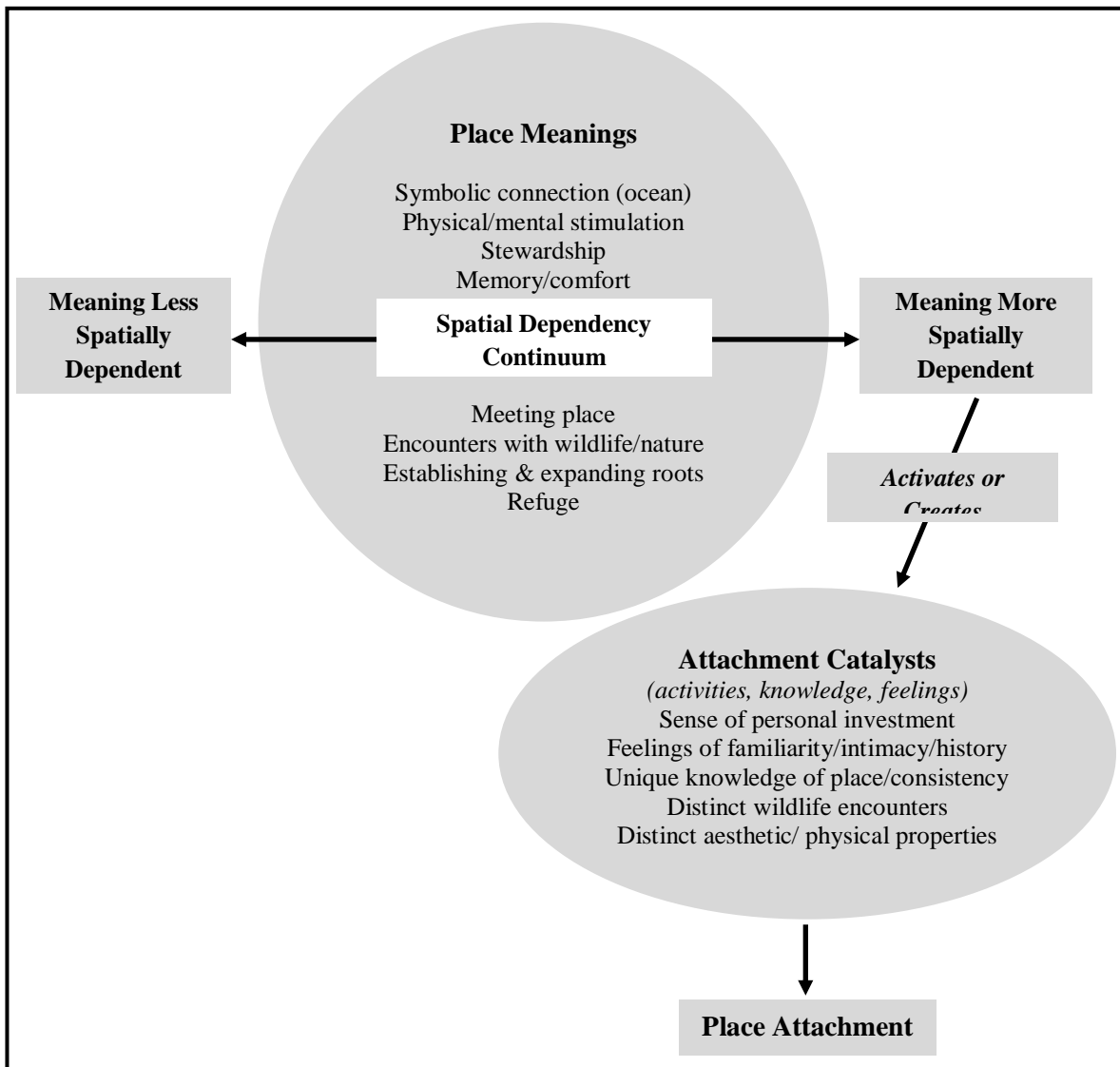


Figure 6.1: Conceptual Relationship Between Place Meaning & Attachment

feelings of place attachment. These findings demonstrate how place meaning is intimately connected to attachment catalysts and overall intensity of attachment. Attachment to a particular site because of a distinct frequency or quality of wildlife encounters is only salient because meaning is found in that place around encounters with wildlife, connection to the ocean, the mental stimulation of learning facilitated by such encounters, or the degree to which such encounters contribute to a sense of stewardship.

Had those specific dimensions not influenced meaning in that place, distinct wildlife encounters would likely be less of a catalyst for attachment to that place. On the other hand, a COASSTer who finds meaning at his/her site because it facilitates social bonding with another COASSTer may not develop the same kind of personal investment or intimacy with his/her beach if the social interaction that takes place there is not exclusively dependent on that place.

Interestingly, level of attachment varied among a wide range of residence length (see Table 6.1 for residence duration statistics) and no clear relationship was evident among a higher residence duration and specific types of meaning or feelings of attachment. One of the reasons for this could be that participants were asked specifically to reflect on their sense of attachment to their specific COASST survey beach and not attachment to the larger community or area. Even if participants hold a level of broad community-based place attachment often associated with residence duration, this may not necessarily translate to attachment to a specific location. Indeed, several studies have demonstrated that place attachment is sensitive to geographic scale and can vary even among individuals depending on the scale at which such attachment is measured (e.g. neighborhood, city, state, region) (Lewicka 2011).

Although overall feelings of place attachment for a community or area likely influence attachment to specific beach sites for some participants in this study, for the purpose of this research, attachment was intentionally considered at a small scale to concentrate on COASST sites more exclusively. This study reveals the multi-faceted nature of place meaning and the variable influence of those dimensions of meaning on feelings of place attachment. At least in this case, residence length alone is not enough to

predict place attachment. Instead, a host of additional experiential components combine with socio-demographic characteristics like residence length to produce place meaning and attachment (see chapter four).

Overall, results from this study suggest that these five catalysts, precipitated by specific place meanings, appear to be more apparent and intense among participants who noted strong attachment to specific COASST survey sites. Just like the meaning COASST participants find in the places where they engage in the program, the level of attachment felt for these places is also influenced by socio-political context, psychosocial processes and biophysical elements of participant experiences (Karrow and Fazio 2010; chapter four). However, while these catalysts of attachment emerge from various place meanings, the meanings themselves do not inherently lead to attachment. As the discussion below suggests, the specific attachment catalysts outlined in Figure 6.1 appear to emerge as meaning is more regularly enacted and situated in a particular place, although this study was not designed to test this relationship for statistical correlation or causation.

Connections and Changes Among Place Meaning & Place Attachment

The spatial dependency of the meaning PPSR participants find at their survey sites appears to be low in instances where the place meaning is influenced by either a temporarily located or mobile aspect of the place or a connection to a broader scale phenomenon that encompasses not only that place, but many others like it. Much like Massey's (2005) idea of "spatial becoming", place meaning here is more fully open, molded by any number of trajectories within and beyond the setting and mediated by other spaces, places, and time. Accordingly, the specific aspects which interact to form

meaning in a place can influence the dependency of meaning on that place. Making a similar assertion, Wyneveen, Kyle, and Sutton (2012) have also found that different aspects of meaning have unequal influence on place attachment.

While there are varying degrees of spatial dependency of meaning and place attachment, place meaning cannot be fully static, because the socio-political context, psycho-social processes, and biophysical settings that form place are always changing. But meaning can be more or less integrated into the fabric of the setting where it exists, enhancing the degree to which such meaning is more dependent on a particular constellation of actors and interactions in a specific place. However, most research on place meaning and attachment does not consider places that people are dependent on for basic needs or livelihoods, which would likely influence the level and nature of meaning and attachment. Instead, research like this study focuses on dependence on place to meet other higher order needs.

Meaning Does Not Always Produce Attachment

A common assumption among those invested in efforts to (re)connect people with place is that if you spend time in place, explore place, and learn about place, you will find more meaning or become more attached to that place. The relationship between the fixity of meaning and place attachment also suggests that the presence of place meaning does not necessarily lead to a sense of place attachment. Instead, this study indicates it may be the spatial place dependence of meaning that more directly influences such attachment. In fact, some study participants shared that they are not particularly attached to their specific site even though they find meaning there. For these individuals, the meaning is connected

less to the setting of the place and more to the events or narratives associated with the site.

But as far as attachment, you know for me at least that makes it seem like all the rest of the beaches don't count so much. And I don't know if I could really say that. My beach is important because it is a place where I can learn more about birds. Because I'm there, I've come to appreciate beaches in general more. But I don't quite have that attachment to the little kilometer. I can't honestly say that I feel more attached to that one mile of beach than I do the rest of the beaches. I think that you could perhaps say that, in general, I do appreciate beaches a lot better, but that is because I understand that the ocean as a whole is important, not that one specific place. (Dean)

For Dean, the meaning found at his particular COASST site relates to the way in which his beach has allowed him to learn more about birds and the ocean (mental stimulation; encounters with wildlife/nature). Yet for him, the meaning he has found there is not spatially dependent on that place, it can be found and experienced elsewhere. If, for example, the particular frequency with which birds were encountered at the site was of particular significance to Dean or if the aesthetic nature of the ocean at that site produced specific feelings of connection or symbolic meaning, the level of spatial dependency of that meaning, and thus place attachment, might change.

This lower level of spatial dependence was also more often the case with regards to meaning associated with COASST sites as social meeting places. This is likely because while participants find deep meaning around these places as social gathering spots, the meaning associated with social interaction was not exclusively dependent on those specific sites. The place itself may still hold meaning, but the meaning is not uniquely found or bound by that unique setting. For these participants, a sense of ownership and investment in place were no less than others, but the overall attachment to a specific site was not as strong.

Interestingly, length of service in the program was not a consistent indicator of the presence or absence of place attachment feelings, suggesting that meaning does not necessarily become more spatially dependent over time. Some individuals who have engaged for less than three years expressed strong site-specific place attachment, while others having engaged for ten or more years did not indicate that level of place attachment. Again, this would indicate that the amount of experience or degree of meaning found in place is not necessarily a direct predictor of increased attachment to that place. Instead, the type of experience and meanings ascribed to that place and the ways in which such meanings contribute to attachment catalysts, may have greater bearing on levels of attachment. This should not be taken to suggest that time and investment in place does not play a role in place attachment altogether, but that they may not contribute to attachment in a consistent or linear fashion. Kaltenborn (1997) has suggested that as a place begins to hold a broader diversity of meaning, attachment can grow. The results of this study do not speak directly to that hypothesis, although participants did express that place meanings evolved over time.

Temporal Changes in Place

As mentioned above, people change, interests change, and places change, feeding into a continuous meaning-making loop. Given these changes, level of connection, the presence of attachment catalysts, and feelings of attachment may change as well and not always with growing intensity. As this research has demonstrated, the dimensions of meaning found in place and the degree of attachment felt for that place are influenced by multiple and often overlapping factors. If the influence of one of these factors was to change over time (e.g. interest in birds and wildlife), overall place meaning and

attachment might change as well, influencing the degree to which meaning is situated in that place. COASSTers like Julie and Ruby indicated that their interests and motivations have changed over time:

Before I was just looking for something to volunteer for, to be of service somehow. I'm not any less interested in the volunteer part of it, but having learned more about the program and the research involved, I'm definitely more interested in the science aspect of it. I've just added to my mission and what I get out of it. (Julie)

You know when I first started the bird surveys I didn't pick up trash, I was more occupied with the birds. Now I feel like it is my beach. I do feel more ownership and now it is just a given that I pick up trash. If I have someone come with me, like my son and brother, I hand them a trash bag too and I ask them to pick up the trash. So it has definitely become more personal to me and the trash has become more important. (Ruby)

Although Julie entered the program because of an interest in volunteer service, over time, she has developed more interest in the science about birds, avian mortality, and ecosystem health. Similarly, Ruby indicated an initial interest in birds, but has become more invested in debris removal on her beach. These changing interests directly influence the lived experiences of COASST volunteers, which play a role in shaping place meaning and attachment (chapter four). Kent also noted a change in his motivation and interest in engaging in COASST:

My motivation has totally changed. When I started out I was curious and I wanted to just do something different with my life. Now I work for margaritas. I mean I do. It has become a fun little outing. So, for me, the whole thing has become a bit more interesting. It is a bit more emotionally extreme. I love thinking about going on the beach walk on a nice day. (Kent)

Motivated initially for a change of pace, Kent now engages in COASST partly because he enjoys the routine and satisfaction he finds in walking on his beach. If his level of satisfaction was directly connected to his specific beach, his attachment to that place may

increase over time. On the other hand, if his satisfaction comes more from getting out on the beach in general, he may be no less attached to his beach today than when he first started the program.

In a broader sense, the temporal nature of place meaning, attachment, and spatial dependency are noteworthy, suggesting caution with regards to attempts to quantify and interpret future behavioral outcomes or intentions based on a static assessment of intensity of place attachment at any given moment in time.

Conclusions

For COASST participants in this study, the beaches they survey serve as sites at which multiple meanings interact, at times providing opportunity for new meaning to emerge and attachment to grow and at others strengthening existing meaning and connection. A landscape of shifting and organic meaning is evident. COASST volunteers may engage with a specific place to find one meaning early on, increase the frequency and nature of interactions due to growing attachment, and give life to new meaning altogether. What originally entices a participant to a site at the start of the program may lose value and meaning over time, all while other forms of connection catalyze attachment for completely different reasons. As attachment to place grows, that place may become more of an actor in the development of new place meanings. This is the agency of place and the power of in situ PPSR. Although this type of change can occur for any person in any place, PPSR programs provide unique avenues and structured processes through which this occurs, with the potential to greatly influence the sense of place outcomes for participants (chapter five).

At a basic level, some aspects of this study support the idea that the more time an individual spends in a place, the more he or she will find meaning there or attach to that site. As COASST participants shared stories of the meaning they find at their beach sites and the degree of attachment they feel for those sites, many indicated the power of repetitive interaction in place, as well as the knowledge gained through such interactions in shaping the meaning and connection felt for that place. However, by exploring sense of place among participants in this geographically diverse and long-term PPSR program, this study demonstrates that the development and evolution of sense of place and its major components (meaning and attachment) is much more complex than this simple linear model implies.

In particular, findings provide evidence that place meaning can fall along a continuum of spatial dependency that influences the presence and intensity of place attachment. This suggests that such places are neither fully socially-constructed relational entities disconnected from physical sites, nor bounded locations completely removed from distant people, customs, or processes. Instead, these beach places are a combination of the two, where meaning can be more or less located and spatially dependent. The ocean that connects all COASST sites provides a useful metaphor to illustrate this point. Connected to people and process around the world, from Japan, to Australia, to Peru, the Pacific Ocean is a immense interconnected entity, always fluid and flowing in multidimensional ways. Yet this enormous system is also grounded in infinite places with fully unique constellations of actors. For COASSTers, place meaning found in the ocean is mediated by the specific history, people, and trajectories of the U.S. Pacific Northwest, in many ways located in a regional identity aligned with an ethic of conservation but also

connected to larger global processes that inform beliefs about the metaphysical properties of water.

Place, then, can be defined as *a constellation of relational networks that come to ground in a spatially concentrated area, with meaning more or less materially grounded*. In this case, the relational networks include various social-political contexts comprised of local, state, and federal land use laws; psycho-social processes influenced by social and individual customs, beliefs, values, and norms; and biophysical elements governed by micro and macro ecological systems embodied in unique COASST survey beaches along the U.S. Pacific Northwest.

To conceptualize the link between the spatial dependency of meaning and place attachment, the concept of an attachment catalyst is introduced, offering new insight into people-place relationships. Findings stress the multidimensionality of place meaning and attachment, while highlighting how these aspects are both connected to each other, yet, due to differences in place dynamics and the spatial dependency of meaning, are not consistently predicted by one other.

Additionally, this study supports the assertion that as spatially concentrated relational networks, places are both experienced *and* imagined. The unique places participants adopt to survey for COASST are fully organic, active, and evolving places that are experienced directly via physical interaction. Yet because the program involves a network of over 500 beaches, where information about program sites is shared and communicated via online platforms, program literature, and personal communication, many participants also develop a sense of place of other survey beaches. Pictures of places in other states, stories of the experiences of volunteer colleagues, and data on what

is found at each site all contribute to the development of imagined place, even if those places have never been experienced. The way in which a COASST participant in California imagines the survey place of his/her colleague in Alaska is inherently based on that person's personal experiences at his or her beach. Where beached birds are found, what it feels like to process a bird in the rain, and the smell of the water all shape how other COASST volunteer survey places are imagined.

As PPSR continues to serve as a strategy to connect people with place, more research will need to follow that asks questions regarding if and how the development of place meaning and attachment via PPSR may specifically influence environmental stewardship attitudes and behaviors. The link between place attachment and "pro-environmental behavior" exists in other settings (Brehm, Eisenhauer, and Stedman 2013; Halpenny 2010; Ramkissoon et al. 2012; Ramkissoon, Graham Smith, and Weiler 2013; Raymond, Brown, and Robinson 2011), but looking more closely at the interactions and relationships between the learning that is taking place in PPSR and affective outcomes, such as sense of place, will increase understanding of these impacts even further. Furthermore, from a programmatic standpoint, PPSR leaders would benefit from collective efforts to codify those strategies or practices that may best facilitate connection to place among PPSR participants to inform a rich sense and understanding of place. Coupled with more research to best articulate the impact of PPSR on place meaning and attachment, these efforts may help inform and enhance PPSR practices that are now serving as a critical link between people and place.

CHAPTER SEVEN

DISCUSSION AND CONCLUSION

This research is motivated by practical and theoretical considerations and draws on sense of place theory to advance understanding of the value of PPSR to participants and potential avenues to improve PPSR program design. In addition to much attention to how PPSR initiatives contribute to science research and data collection, PPSR scholars and practitioners have also become more interested in asking what people gain from these experiences. Yet as this dissertation research has highlighted, much of this inquiry stems from a science-based utilitarian perspective, focusing on those outcomes that demonstrate the value of PPSR with regard to expanding science knowledge, understanding, and social relevancy. As suggested in this study, there is much more to the story. While more and more individuals are drawn towards PPSR volunteer experiences for their recreational and educational value, understanding the impact of such experiences on the lives of those that participate is essential. Instead of confining analysis to the participant outcomes deemed useful for science, it is also useful to consider what these experiences *mean* to participants. After all, PPSR participant motivation and commitment to program participation rests on their belief in the *value* of the program and level of engagement. Otherwise, once the thrill of initial involvement subsides, what sustains program participation?

An experiential framework from which to explore volunteer experiences is therefore necessary, considering both the scientifically and personally meaningful outcomes of participation. Not only does this honor PPSR participants and their experiences, but it also adds an additional layer of understanding to the nascent conceptualizations of the development and evolution of PPSR outcomes. The questions raised in such inquiry regarding how to enhance personal value and meaning can assist program developers, managers, and evaluators to build more effective, intentional, and impactful PPSR programs.

I have argued that a place-based framework provides a salient window from which to interrogate personal PPSR volunteer experiences and outcomes. This vantage point enhances understanding of how such experiences are formed, what elements influence the process, and why such variables are important. Following an overview of my research aims and questions in chapter one, chapter two highlights the history and growth of PPSR, as well as the various scholarly and practitioner communities that have shaped and advanced the practice. A sense of place theoretical lens is explored as a fitting entry to explore volunteer experiences and outcomes, followed by an overview of research methodology and methods in chapter three.

In chapter four, I outline a need for more research on the lived experiences of PPSR volunteers and highlight how these experiences are shaped by socio-political context, psycho-social processes, and biophysical settings. Of the seven major categories of outcomes identified by study participants, only two (greater environmental awareness, and scientific learning and knowledge gain) have been explored in depth within PPSR literature. Although other studies have noted additional outcomes like community ties

and sense of place tangentially, none have explored these outcomes in similar depth, to consider from where they emerge and what factors influence them the most. In addition to the review provided in chapter four, detailed descriptions of each of the seven outcomes highlighted in this study can be found in Appendix F.

Findings highlighted in chapter four demonstrate the significance of contextual factors like land ownership, access, and use; the motivational factors of participants; and the unique sights, sounds, tastes, and smells of in situ PPSR survey sites. Utilizing a subjective anti-realist ontology, most assessment of PPSR outcomes thus far has generally neglected non-human agency in these experiences, and, for the most part, has ignored aspects of place like prior essence, metaphysical interactions or phenomenological relationships. Given the strong physical and social dimensions of PPSR experiences and the fact that such experiences are deeply personal, this study has offered a framework to broaden the scope of experiential outcome assessment to focus largely on the role of multifaceted actors in these human-environment interactions. By highlighting the influence of these often overlooked variables in forming participant experiences, this chapter exposes a number of new pathways through which to both assess program outcomes and success, and manipulate variables to enhance the influence of such experiences, particularly with regard to outcomes around environmental stewardship.

Even still, as chapter five highlights, the social-political context, psycho-social processes, and biophysical setting that inform lived experiences are all filtered through the particular programmatic variables which govern and shape each individual PPSR program. Aspects like the scope and scale of the project, project governance structure,

participant duration, and the frequency and nature of participant engagement mediate volunteer experiences, influencing several major outcomes. These findings inform discussion of several practical implications of this research for program development and administration, with potential influence on the way in which participants are recruited and trained, the use of technology and social media, and the methods by which networks and connections are facilitated among members. In particular, observations regarding the significance of learning from local to global scales and recommendations for a tiered learning and skill development approach may provide positive advancements in PPSR practice.

To round out my analysis, I take a step back in chapter six to evaluate how this place-based approach to understanding PPSR participant experiences and outcomes may speak to broader theoretical questions within sense of place scholarship. Focusing more directly on the sense of place of participants in the COASST program, I expose the range of place meanings associated with program survey sites and the various ways through which such meanings form and evolve. Although changes in sense of place have been noted in other research on PPSR outcomes (Evans et al. 2005), such research has not yet explored the specific elements that contribute to sense of place among participants or how those perceptions and attachments form and develop. This study explores the characteristics and relationships that influence sense of place among PPSR participants, leading to a more integrative conceptual model of meaning-making.

Participants expressed a wide range of meaning associated with project survey sites, including both interpersonal (e.g. site as a meaningful meeting place) and intrapersonal (e.g. site as a place to seek refuge) dimensions. These findings highlight

that meaning itself is always changing and is a multi-dimensional phenomena, often the result of the sum of many collective parts. In some cases, participants also expressed a sense of attachment to their survey site, informed by the particular type of meaning that defines that place and the degree to which that meaning is more or less spatially dependent. A detailed description of the dimensions of place meaning and catalysts of place attachment can be found in Appendix G.

Not only does this analysis help elucidate the "lived experiences" of PPSR participants, but it also speaks to broader theory on sense of place. Findings stress the inherent connections between and multi-dimensionality of place meaning and attachment but challenge assumptions about the causal linkages between the two concepts. A continuum of spatially dependent place meaning is suggested as a framework in which to understand this relationship. Results highlight the relationships between spatially dependent meaning and place attachment, enhancing conceptual exploration and clarity with regard to sense of place as a phenomenon. Even more than the spatial dependency of place meaning among study participants, this chapter underscores that place is a dynamic aspect and actor of PPSR engagement, resonating with central tenets in actor-network theory. As a whole, this research has demonstrated that sense of place has both an influence on the experiences, outcomes, and meaning associated with PPSR engagement and is also formed and changed by those interactions.

Final Observations and Reflections

This next section includes reflections of this research project as a whole, summarizing the key overarching lessons learned with regards to the particular nature of the COASST program, the PPSR movement in general, and the concept of sense of place.

COASST as PPSR Exemplar

While no program is perfect, the opportunity to work with COASST administrators and participants for several months allowed a window into a highly efficient and effective PPSR program. The program is well regarded by a number of PPSR experts with whom I spoke in preparation for this project. Although recommendations for improvements and enhancements were collected among participants and will be provided to COASST leaders in a separate report, this research also identified several essential elements of COASST's success. As I review some of these "best practices" below, I have highlighted those aspects that may be of greatest benefit to a broad community of PPSR managers and scholars.

Responsiveness

It is no small feat to communicate and coordinate volunteer activities among nearly 800 volunteers, yet COASST leaders prioritize prompt and satisfactory responsiveness. As soon as requests from volunteers for more survey supplies are received, they are dropped in the mail to participants. When questions regarding survey protocols are phoned in or emailed, they are met with swift and thorough replies. The organizational cultural of COASST values timely and thorough responses to the needs and concerns of volunteers and study participants consistently noted this a major factor of program satisfaction.

Two-Way Feedback

Beached bird identification can be difficult on a good day. But when very few clues are available to determine an identification, the process can be a hefty challenge.

Because all data collected by volunteers is verified by COASST staff, when a

misidentification has been made, COASST leaders work to provide feedback to volunteers that can help to prevent further confusion. Instead of just telling volunteers the identification is incorrect, they make much effort to explain why that is the case. Such continual education is of value to participants. Additionally, program leaders regularly seek volunteer feedback about the program, not just on a basic level to gauge program satisfaction, but in a more integrative fashion, to seek ideas, float proposals, or try out a new procedure. For example, when a new wing cord was being developed to assist in the identification of birds based on specific wing features, participants were asked to try out the guide and provide feedback for improvement. This two-way feedback enhances the rigor and accuracy of the data collected via the program, but also fosters greater community and inclusion in the project.

Genuine Appreciation

Although it is true in almost any context, demonstrating appreciation of effort is even more essential for programs that rely on volunteers. Yet volunteers often can sense when gestures of thanks are obligatory in nature. COASST volunteers in this study noted among all else, the value they find in the feeling of being authentically appreciated by program staff. More often than not, the sense of appreciation is cultivated through small, yet consistent gestures of gratitude and celebration. Hand-written notes to celebrate program milestones (e.g. five years in the program), postcards of holiday greeting, and intentional efforts to highlight the significance of volunteer achievements (in publications, online, in public addresses) all resonate with volunteers in a tangible way. These small efforts reinforce the value of each individual contribution to the COASST program, but also highlight how each contribution plays a part in a much larger whole.

High Quality, Usable Training and Field Protocols

One of the things that surprised me most about my on-site interviews with COASST participants was the enthusiasm with which most volunteers quickly wanted to show me the program materials used to support volunteer activities. In particular, numerous volunteers were eager to "show off" the impressive field guide provided to all volunteers for finding, processing, and documenting beached birds. *Beached Birds: A COASST Field Guide* (Hass and Parrish 2002) is just one of many well-organized, professional, and user-centered publications developed by the COASST program. When asked what ultimately persuaded a commitment to volunteer, to my surprise, a few study participants said assuredly that the quality and expert nature of the training and field resources convinced them this was the program for them. Although I did not expect this element of the program to hold such significance, it does make sense when one considers that the materials utilized to guide both the training and implementation of volunteer responsibilities can drastically shape the degree to which those experiences are productive, enjoyable, and meaningful. I have come to understand that high quality, thorough, yet easy to understand protocols are a hallmark of successful PPSR programs.

Rigor, Respect, and Value

Because many PPSR monitoring projects like COASST contribute to research on species distribution, prevalence, and population dynamics, it is important that such research demonstrate both accuracy and precision to ensure that management decisions or policy outcomes from the research are most effective. A measurement or observation is believed to be more accurate when it is closer to the nature of the actual event or phenomenon. On the other hand, precision indicates the consistency of

measurements/observations over time, under unchanged conditions. COASST data collection and management protocols are not just usable and easy to understand, but they are also extremely precise, thorough, and consistent. The rigor of such methods adds a level of respect to the program as a whole, and enhances the sense of contribution volunteers associate with participation. The level of scientific precision and validity built into the program protocols and the value of the robust data that results is not lost on participants. Study participants regularly noted an appreciation that they are part of "real science" that is both informative and reliable.

Roles, Responsibilities, and Partnership Structure

Part of the reason COASST works so well is that it is organizationally structured like a true partnership. Each part of the whole has a role to play, based on the expertise, interests, and specialized training of program members. Unlike a fully co-created PPSR model, not all members of the partnership are involved in every aspect of the initiative. In fact, no member of the partnership is involved in *every* element of the program. Program managers coordinate logistics, student interns manage databases, academic scientists analyze and sort through data, and of course, local expert volunteers monitor and record information about their beach. COASST abides by the idea that the whole is greater than the sum of its parts. Each part has a clear role, set of responsibilities, and is supported as best as possible to execute those responsibilities most effectively. As one program manger noted:

COASST is a partnership between citizens who are there, at their beaches, who know what is going on, who are the eyes and ears to supply incredibly good data that no one could collect except in that way, and the scientists who spend time in offices running through models, never visiting a beach, but

being able to see a larger pattern that they could never do without those people on the ground. Instead of a model where everyone does everything, we work on a model where everyone does something really well.

Because of this approach, each spoke in the wheel has a better sense of his/her role in the process and how it fits in the bigger picture. Responsibilities and expectations are communicated early on in program training. No one tries to do it all, allowing the strengths of individual contributors to be utilized most effectively.

Spirit of Open Access

Finally, most volunteers that contribute both time and energy to participate in a project want to know that their efforts are worthwhile. For COASSTers, this was often conveyed as a desire to know that the information collected by the program is of academic and practical use. Although COASST provides organizational reports and publications to demonstrate major findings and results of the research, even more than that, a number of participants commented on how much they appreciate the spirit of open access COASST has when it comes to the information collected by program volunteers. COASST regularly partners with private, public, and nonprofit groups to share information and resources and work collaboratively on targeted projects. Volunteer data is published online for anyone to access, even down to the records for a specific beach. Several study participants noted that they had participated in other PPSR projects in which there was a general sense that the data collected was "hoarded" by a few elite program managers or scientists. This is not the case for COASST and participants widely value the degree to which the program as a whole provides information and engages in partnerships with external groups. That spirit of open access is well regarded among

participants and community partners alike, again cultivating respect for the program and garnering support for the research objectives of the project.

The Diversity of PPSR Participants

From counting ants to counting stars, PPSR programs are growing rapidly. As PPSR initiatives become more common across a broad spectrum of science research disciplines and focus on an even broader range of topics, the diversity of volunteer participants is likely to increase as well. Unlike recreational or leisure pursuits around outdoor activities, PPSR programs today attract a wide range of individuals, for highly variable reasons. Even within the COASST program, this appears to be the case. Of the nearly eighty participants who engaged in this study, significant differences exist with regard to personal background, occupation, education level, political affiliation, and motivation. Some participants consider themselves environmentalists, others don't. Some have an interest in birds or a history of bird watching, others find it difficult to distinguish even the most common of birds. Further still, some have a background in science or a science-related occupation, while others have no scientific training at all. And yet all have committed significant time and energy to the systematic collection of beached birds along the coastline of the Pacific Northwest. This is both a remarkable achievement and a challenge to manage. While PPSR initiatives are enriched and enlivened by the heterogeneous perspectives and personalities that come together to support such programs, the range of personal motivations, goals, and objectives of participants means these programs must cultivate an assortment of experiences and outcomes in order for volunteers to remain invested and satisfied.

This observation is significant for two reasons. The first serves as a warning for program leaders to resist assumptions about why PPSR participants are motivated to participate and what they value about volunteer engagement. Incorrect assumptions might lead to a suite of detrimental choices, from the manner and strategies utilized to recruit certain "types" of people to the program support provided to participants. Not all participants want to learn, not all want to make friends, and not all want to be involved in in-depth project procedures or activities. This leads to the second important point here. Successful PPSR projects take time to understand the reasons why their volunteers participate and what they most value about engagement. With this knowledge in hand, such programs can cultivate opportunities and institutional support systems that ensure participant goals are met alongside those of the research itself. Periodic assessment of volunteer motivations and values or procedures that collect this information as an individual joins a program may provide a fruitful means to invest not only in the research and data that is collected, but the participants who are responsible for that collection. At the same time, this information could help guide strategic efforts to recruit or target individuals from traditionally underrepresented groups, focusing more on the full range of reasons individuals participate and the suite of holistic benefits of participation.

On the flip side, care should be taken to clearly articulate the institutional and research motivations and objectives of the project, and the targeted outcomes of the effort. Communicating this information helps participants understand the everyday procedures and tasks involved in the project and how they relate to overarching goals, potentially adding meaning and value to even mundane practices like measuring the length of a bird foot or bill. Together, this enhanced shared understanding of motivations,

objectives, and intended outcomes can allow PPSR actors a more personalized yet communal sense of purpose, while enhancing volunteer experiences and the care participants afford to ensuring research protocols and objectives are met.

New Lenses + Local Expertise

As I met with study participants on their beaches, I would often joke that they had become such local experts at that specific beach they should start charging a fee for tours and interactive walks. I don't remember one interview where I didn't learn, see, or experience something new about the place I was visiting. Each COASST volunteer was able to share detailed information about the geomorphology of their survey location; prevailing currents, wind patterns, tidal processes, and deposition of birds, trash, and sand. Although all of these beaches are under constant flux, these volunteers recognize what is "normal" at their beach and what is not. Even though COASST participants were quite modest in discussing their level of expertise, it was clear that each has mentally mapped out every nook and cranny of their beach and possess impressive knowledge of the local environment, including who, what and how other creatures interact with the place. Even though COASST is focused primarily on birds, according to these volunteers, the program has helped facilitate a deeper knowledge and awareness of the intricacies of the survey beach itself.

At the same time, participants often commented that the COASST program has provided them with a new "lens" through which to see and explore their beach. Because volunteer engagement helps cultivate certain patterns of observation, recording, and comprehension, COASST participants become more accustomed to certain "habits of

mind" that focus attention on specific elements of the beach. Mary explains one of these habits:

My parents live in Santa Rosa and so I'll go out to the beach and you can't help but notice the dead birds. It is strange that that becomes part of your consciousness, looking at them along the beach. It is like after you've participated in COASST you become really sensitive because you can just see like a lump, and you know what that is.

Developing this type of "scientific lens" that allows participants to think more "like a scientist" is a major focus within both formal and informal science education initiatives (Shanahan and Shanahan 2008).

I experienced this kind of disciplinary sensitivity myself after having engaged in several program surveys with volunteers. Like Mary, I now am much more in tune with the surface of any beach place I visit. I notice dead birds, marine debris, and clumps of "wrack" that I've never been aware of before. Even now, after having spent considerable time away from my field research, searching and investigating dead birds is a regular part of any visit to a beach, as odd as that may sound. That new framework through which to see and discover places, coupled with the kind of insight about a place and its natural history that comes only through intimate, repetitive interaction with it, has enormous potential for ecological research. Combine that with the detailed knowledge of a species, environment, or ecological process held by vocational researchers and the potential exists for novel science research and revelation; a partnership of discovery, learning, and conservation with benefits for all involved.

Enacting Scientific Citizenship

Back in the mid-nineteen-nineties, science and technology scholars Irwin and Wynne (1996) first coined the term "scientific citizenship" to describe what they believed

was a necessary form of public engagement in the twenty-first century. Even then, they noted that science and scientific research was driving so much of our modern societies, from medical advances and engineering inventions to novel environmental management and adaptation, all the way to the manner in which people communicate and connect via emerging technology. So much so was science a part of our everyday lives, that these social theorists proposed that basic science competence (observing, measuring, inferring, communicating) would become more important for all citizens to have, just to understand the world around us. As such, they assert that in order to be an engaged and active citizen, it is increasingly important to become acquainted with science, even if only at a fundamental level.

It was an interest in what one might call "scientific citizenship" that first drew COASST member Kate to the program several years ago. With no professional background in science and a child who was moving into a science-based career, Kate was more and more interested in the natural sciences and felt it necessary to expand her own understanding of the science process. Utilizing the informative protocols COASST has in place for volunteers and finding herself more in tune with her COASST beach after multiple trips, Kate has greatly expanded not only what she knows and understands about birds and beaches, but also just how biological research is conducted, what it can tell you, what it can't, and how it might be used to make decisions about policy or management. For Kate, her intentional engagement in the COASST program is a way to remain an informed citizen, to understand the role of science in our lives, and to play an active part in that process. And, living inland nearly 45 minutes, her commitment to the program is a great reason for Kate to visit the outer coast every month. PPSR then, for individuals like

Kate, is an intentional platform on which to become more aware of a particular topic or issue, but beyond that, a means to become a more engaged citizen.

Defining and Understanding Place

Scholars have attempted to define place for decades and even today it can be understood and interpreted in many different ways (Williams 2008). This study has exposed some of the various ways in which place as a concept is conceived and engaged, revealing differences in how place is defined even among the participants who contributed to this study. Responding to questions about the places in which COASST surveys are conducted, some participants reflected on place as the activities that take place there, while others talked more of the physical site on which those activities occur. Some went so far as to include place as a part of the "soul", an extension of self or spirit. These responses underscore that the mere idea of place is highly variable. Nonetheless, several common "principles of place" appear to hold fast. Although these assertions are not necessarily new ideas in themselves, as they are reviewed below, they are analyzed with respect to how this study advances, and in some places adds complexity, to these principles.

Places are Interconnections Between Experience and Imagination, Near and Far

The binary assumption that either places are empirically experienced *or* imagined doesn't provide a satisfactory explanation for the way in which the places in this study are born, enacted, and experienced. Instead, the beach places reviewed in this study are always simultaneously experienced empirically *and* imagined, both idea *and* lived process. Empirics and imagination aren't so much two opposing elements of a binary concept of place as they are the simultaneous reality of all places. Although this

dissertation focused more exclusively on the lived aspect of place, evidence of the imagined dimension exists as well.

When asked to share the significance of their survey place, knowing of my travels across much of the geographic scope of COASST territory, COASSTers often would describe the value of their survey place compared to both their experiences *and* ideas about other places in the program, even if those places had never been visited personally. Many participants distinguished their beach early on, with statements like, "this place is special because I've heard the beaches further south are much more flat, but this beach has beautiful sea-stacks." Or, "I imagine this beach is so much more pleasant to walk on as I bet the beaches up north are all rock and debris." As such, the significance and meaning of one place experience is shaped, in part, by other imagined places. Alternatively, when participants imagine other COASST survey places based on pictures, stories, or similar experiences, those imaginations themselves are informed by the empirical experiences of participants.

As referenced in chapter two, Edward Soja (1999) has written about the multi-dimensional nature of all places. He suggests that places involve the empirical "first spaces" of experience combined with the conceived "second spaces" of our imaginations that together lead to lived "third spaces" (Soja 1999). Although Soja posits that all places are both "real and imagined", his theory relates only to how any one place is shaped by the way in which that one site is experienced and imagined concurrently, not how the experiences or imaginations of that place are also shaped by the imagined elements of other places never experienced. This research suggests that all places, to some degree, are inherently connected to other places, *both* those experienced and imagined. In the context

of the COASST program, what a participant knows about the amount and type of birds being found at a beach nearby is likely to shape both what that participant looks for on his/her beach, and perhaps even what is found in that place. At the same time, what a participant senses and feels at his/her beach will color how he/she imagines the beaches of others nearby, or those with similar environments. Even places we haven't yet seen or experienced influence our lived experiences of place, if only in the way in which such unknown places are present in our mind's eye.

Places are Holistic and Multi-Sensual

All places are experienced via sensual processes, even those imagined. In this research, I've contended that, in particular, the lived sensual experiences of place should not be neglected in broader frameworks that seek to interrogate PPSR processes from start to finish, that is from the initial inputs that facilitate such initiatives to the long-term impacts that result from them. This is because the lived experiences of volunteers, which are inherently place-based, mediate subsequent programmatic and personal outcomes and impacts and are filtered in various ways by the unique constellation of program variables that structure PPSR experiences.

Beyond demonstrating the significance of PPSR lived experiences of place and calling for more inclusion of this aspect in program development and assessment frameworks, I've provided a basic scaffold from which such experiences can be interrogated, conceptualized via a geographic lens to focus on socio-political context, psycho-social processes, and biophysical setting. As the participants in this study have highlighted, any investigation into the lived experiences of place in PPSR programs should extend beyond the customary ocular-centric perspective of human experience.

Martin Jay (1993) has contended that, within western societies, there is a deep connection between seeing and knowing, so much so that visual experiences and images are often understood to fully represent an empirical reality. But participants in this study revealed that beach places in particular are experienced by far more than the eyes alone. Participants noted deep significance associated with the sounds and smells they encountered at their COASST beaches, as well as the tactile inputs like the feel of wind on the face or sand in your hair. These sensory elements intimately shape experiences and conceptions of place, and by extension, the influence and pull such places have on our lives.

The multi-sensory aspects of place are a pertinent reminder that experiences of place are not just cognitive impressions, but affective encounters as well. Within a PPSR context, this study has helped exhibit the profound interconnectedness of cognitive and affective components of volunteer engagement. This is particularly the case when it comes to learning, a very significant aspect of PPSR programs. As a whole, COASST participants were highly motivated to participate in the program because of a desire to learn more about the places and concepts of focus in the project. Even among those participants who expressed a pre-existing connection or attachment to place prior to COASST involvement, the desire to learn more about those places of value was a large part of motivation to engage in the program.

But learning in informal education environments is highly dependent on and influenced by the context in which it occurs and the way in which that context is interpreted sensually. In this case, learning about a place, and the meaning associated with that place, appear to be closely linked. What is valued about a place and what

aspects elicit positive feelings or curiosities will naturally inform cognitive interest and knowledge development. Considering the affective experiences of PPSR participants as part of scholarship on learning in PPSR may prove helpful for efforts aimed at enhancing the degree and rate of learning that occurs in these experiences. The affective environments in which PPSR participants learn can be just as significant as the content they are learning.

Even still, evidence from this study also indicates that we must not confine our evaluation of PPSR outcomes to those associated with learning alone. Even participants who did not indicate an increase in new science knowledge or skills as an outcome of COASST involvement were able to articulate multiple significant personal outcomes of engagement. Among these outcomes were more refined and significant place meaning and attachment, even in the absence of a notable increase in knowledge gain. Because these "ancillary" benefits of engagement are rarely studied or investigated fully, there is little understanding of the extent of their significance both for participants themselves and for understanding the role of science in society.

Accordingly, how to cultivate more positive and satisfactory affective PPSR experiences is an area ripe for future research. Opportunities to extend engagement past the customary sight-oriented method of data collection might enhance this scholarship. Such research has the potential to inform new avenues through which to engage participants in PPSR activities, enhance the significance and meaning generated through PPSR experiences, and improve the extent and quality of information collected for scientific research. What sounds, scents, or tactile inputs might inform critical science questions? Evidence already exists in PPSR programs like Frogwatch

(www.aza.org/frogwatch) and eBird (www.ebird.org) that auditory information can be of major value for scientific research. Even still, how do these senses engage, activate, and enhance the minds, bodies, and spirits of participants, and what program infrastructure, systems, and technology is needed to support these processes? What might seem like minor aspects of place, if granted proper attention, could richly enhance PPSR volunteer experiences, learning, and the detail and rigor of the information collected.

Places are Co-Created Meaning

As Tuan (1975) reminds us, space being an open canvass, place forms when meaning emerges at a particular site within space. The defining component of place, according to this definition, is that it is imbued with meaning. I too have contended that, for COASST participants, the three dimensions reviewed in this dissertation interact to form meaning and a sense of place. Places then are comprised and defined by the shifting meanings they hold over time. Even still, as both experienced and imagined, place is much more than a site in space where meaning has been assigned or attributed by an individual. The meanings that define places revealed in this study are always being generated, enacted and shared among multiple actors. As Massey (2005) writes, places are always "becomming". No matter how unique and personal such meanings are, they are never fully independent. In other words, the meaning embodied in all places is inherently co-created. Place is experienced with other things, imagined through interactions with other things, and evolves in concert with a network of other things and people. Therefore, places are always simultaneously globally interconnected and locally grounded.

Chapter six emphasizes that the meaning that informs a sense of place yields influence over the degree of place attachment felt to that place. Nonetheless, not all places and the meanings found there, elicit feelings of attachment. Place attachment, according to this research, appears to relate more to the spatial dependency of meaning. While participants in this study could sense meaning in a place and not be attached, there was no evidence that participants could be attached to a place without sensing meaning. Therefore, while sense of place may involve both place meaning and attachment as separate constructs, I would argue that place itself, and the sense one has of it, is not possible without place meaning, yet can exist without place attachment. As a result, while I believe place attachment can help inform investigation of sense of place and the impact that has on human experience, attitudes, and behavior, I would caution that any evaluation that does not also thoroughly consider place meaning as a part of these relationships may miss a highly significant aspect of the way in which places mediate human experience and the influence of PPSR.

For a majority of participants in this study, attachment to place was not a major motivator for program engagement. But, a desire to connect with place and the elements that shape it (such as the ocean, wind, waves, birds, or people) was a prominent motivational theme among many participants. While attachment to a particular place doesn't seem to play a major role in volunteer motivation in this study, place itself, and a desire to explore and understand it, does. Further still, place attachment does not appear to be an inevitable consequence of COASST participation. Again, this suggests that it is not participation itself, but the type and range of meanings that imbue survey places that appear to influence place attachment the most. Naturally, the odds increase that the type,

range and intensity of meaning that envelops a particular survey place expand with more time and experience at that place. This may result in an overall correlation between length of program engagement and place attachment, but that does not mean participation *causes* attachment. Findings from this research indicate that it is the meaning that informs such attachment that is more important when it comes to understanding program outcomes and impacts.

As chapter six highlights, a significant research opportunity exists to look more deeply at the relationships between these different types of place meaning, volunteer experiences, level of satisfaction, and program outcomes. I believe attention to each of the three dimensions of place highlighted in this dissertation would only strengthen such scholarship. In the context of place connection and responsibility, the socio-political aspects of land ownership and designation (e.g. private land, national park, state park) may help explain how outcomes around sense of community, shared responsibility, and possession are regulated by the different types of places where PPSR activities occur.

Places are Multi-Dimensional Networks

Finally, with the risk of overstating this assertion, it is worth noting once more that the fabric of places is multidimensional networks. The meaning that establishes place is fostered by a range of actors, systems, and processes, largely grouped within three general categories in this dissertation. The complexity of place cautions us not to assume that all meaning stems solely from the individual experiencing or imagining place, the contextual factors that govern place boundaries and character, or the biophysical elements that enliven the setting. Places are inherently comprised of manifold factors and influences and the complexity of place revealed in this study elicits the further

development of multifaceted theory to help conceptualize the complex yet networked phenomenon of place.

Because participants in this study were able to reflect on place meaning on their own terms, several broad shared dimensions of meaning were revealed, despite variations in the meanings themselves. Many forms of place meaning were evident, some spiritual, some practical or utilitarian, and some ecological. In some cases, place meaning was influenced temporally as well, like when participants noted the ecological meaning of place increasing over time as more seasons and cycles were experienced in that place. These various dimensions collectively inform both the intensity of meaning associated with a place and the spatial dependency of that meaning.

From a practical PPSR management vantage point, why might this observation matter? In general, as with most organizations and programs, PPSR initiatives, out of both interest and necessity, are invested in exploring and demonstrating the value, significance, and outcomes of such programs. Questions like why are they important, what do they achieve, and why should they be supported are rampant in a world in which limited resources and support facilitate a need for constant justification and validation. Naturally, PPSR programs want to demonstrate that whatever activities they facilitate or experiences they provide yield particular results. As a consequence, programs often end up treating PPSR volunteer experiences as if they are contained and controlled, neglecting to consider the suite of factors external to the explicit components of program participation that both influence and interact with PPSR experiences. When these external factors are considered, they are most often only with regards to select demographic characteristics of participants (e.g. age, gender, education level, etc). And yet, as this

research has demonstrated, PPSR experiences are far more than the specific program tasks and outputs volunteers are asked to contribute. Not only are these experiences mediated by the people that engage in them and the programs in which they engage, but they are also inherently mediated by place.

I believe the findings from this research demonstrate the immense value in expanding place-based scholarship on PPSR to focus on program experiences as an integrated place-based phenomena, influenced by multiple dimensions (chapter five). This is not only because it provides a much richer perspective from which to explore the personal outcomes of participation and enhance the science such programs advance, but because it opens an even greater lens into that fascinating world of people-place relationships. These relationships ultimately govern PPSR experiences, outcomes, and impacts. Thus, expanding the perspective from which PPSR programs are developed, implemented, and managed may yield unanticipated results.

Consider these two examples. Perhaps PPSR leaders were to explore the socio-political forces that have governed the spaces in which individual programs are coordinated and, as a result, reveal helpful information regarding who has been included or excluded from those places historically. This might influence efforts to target underrepresented groups in those areas, not only to enhance diversity and inclusion in the programs themselves but to foster environmental research and decision-making efforts that include participants that more accurately represent the communities impacted by such inquiry and the policies that result.

Second, considering the biophysical differences of the places encompassed in PPSR programs might encourage efforts that build on these differences to enhance

opportunities for program instruction or learning. Taking COASST as an example, some survey sites provide much more exposure to birds than others, both dead and alive. At the same time, some places exhibit extreme seasonal change, others may not. What if these unique biophysical aspects of place could be utilized for all participants, not just those who have adopted that place? Understanding how the unique place features impact program experiences and outcomes might lead to innovative practices which utilize the aspects of one place to educate or enhance the experience of others. Perhaps certain beaches are designated as training sites for specific program tasks (finding birds, identifying birds with only a wing, etc.). Or maybe online webinars could be developed that highlight these concepts for members at places which lack the biophysical features that support the development of that particular skill or experience. These two examples combined help exhibit the potential value that exists when more attention is granted to the specific contexts of PPSR programs and the holistic experiences of program participants.

As a whole, these "principles of place" imply that efforts to define the precise meaning of place in a static or bounded manner may be unwise. Each of the numerous parts that shape the places explored in this study have a central role in mediating material and symbolic experiences for participants in the COASST program. To understand the meaning encompassed in place, and how such meaning shapes human experience and behavior, requires a flexible methodology which allows space for context, personal experience and physical and social properties. Granting that space by expanding the scope of PPSR assessment, research, and evaluation via a place-based lens may also elicit important changes in the way in which natural resources are conceived and inscribed within PPSR research.

Because PPSR programs most often emerge from natural science communities of practice, they frequently assume the dominant framework from which most all natural science research is conducted. This particular epistemological approach is guided by an overall focus on the economic or ecological significance of the objects of focus. Yet, as this research has highlighted, the ecological components of focus in the COASST program (i.e., birds, ocean, etc.) not only hold economic and ecological significance, but also cultural, social, and spiritual significance as well. Birds are not just important for the ecological services they provide. The value of birds, and the influence and impact they have on the human experience and psyche, are far greater. Efforts that can help expose and document the full range of services such natural resources provide align well with approaches like the "new ecosystem management" movement which seeks to foster an integrated socio-ecological approach to resource management and scholarship (Williams and Carr 1993; Williams and Patterson 1996).

Future Research Directions

This dissertation research study has not only provided an opportunity to advance both sense of place theory and practice, but it has exposed a number of potentially fruitful prospects for future research and exploration. I envision opportunities to expand this current research agenda around four major topics outlined below. These topics broadly focus on the further exploration of personal PPSR outcomes and impacts and the means to evaluate them; PPSR in the context of environmental policy and decision-making and the practice of science; and relationships between science, place, and birds.

The “Nature” of Participatory Science

This research project has exposed complex discourses and narratives with regards to the sometimes conflicting or competing notions of “nature” and the many ways in which such concepts shape human impacts on ecosystems and environmental behaviors. Participants shared conceptualizations of nature as a spiritual haven, an object for recreational enjoyment, a friend, a fierce and unforgiving force, or a source of true beauty. As such, this could be extended to consider more directly the ways through which engagement in participatory science may influence concepts of nature and the degree to which nature, however defined, is considered part of the self or community.

I envision this scholarship affording novel avenues through which to ask fundamental questions in the field of environmental sustainability and geography. This includes where and how individuals and societies construct boundaries between man and “nature”, the processes through which such boundaries change or transform, and the physical and psycho-social consequences of such material-semiotic constructions (Castree and Braun 1998; Soper 1995). Scholarship in environmental psychology suggests that individual and collective definitions of “nature” both inform and are informed by place meanings and attachment. Additionally, “connectedness to nature” has been noted as an influential variable when it comes to ecological behavior and subjective wellbeing (Brugger, Kaiser, and Roczen 2011; Mayer and Frantz 2004).

One potential area of inquiry here regards how negative experiences of place associated with increased exposure or awareness of environmental risk, hazards, or degradation may shape a sense of place and connection to nature and in what ways these unpleasant interactions inform attitudes about the environment. This study indicates that

experiences with marine debris can elicit frustration and concern and influence a sense of determination or commitment to solve the problem. More research is needed, however, to explore sense of place among, for example, citizen scientists who engage in highly degraded or ecologically contaminated sites. In what ways do these experiences shape perceptions of place, nature, and human-environment interactions? How do individuals mediate connection, meaning, and attachment within these settings and what might this tell us about the role of place and people-place relationships in environmentally compromised areas?

Further still, considering differences among various cultural or ethnic groups with regards to interpretations of nature will inform efforts to enhance outreach and educational practices targeted at groups traditionally underrepresented in scientific research or environmental efforts. Understanding how environmental values become materialized in particular places and how those places, in turn, influence broader environmental attitudes and behaviors can bring light to the scalar networks that support the enactment of values and from where such values emerge. These questions will only become more critical in the coming decades as societies continue to wrestle with the implications of environmental degradation, uncertainty and climate change.

Evaluating Personal Outcomes of Participatory Science

Historically, as this study has reviewed, place meaning and place attachment have been measured using opposing methodological approaches. An important task in the further exploration of the place-based outcomes of participatory science involves investigating tools and strategies that could be utilized to more systematically evaluate or document participant outcomes with regards to lived experiences, sense of place, place

connection, and other affective place-based aspects like connection to nature and the development or evolution of spiritual or philosophical place meaning. This study was designed as an intimate exploration of place and experience in order to interrogate context, possibility, and subjective experience. The research methods utilized were deemed necessary and essential given the lack of pre-existing research on the topic and idiographic nature of the research topic. Even still, with the findings from this research as a foundation, a practical next step would be to consider the potential for more systematic evaluation of the influence of PPSR on sense of place, place meaning, and place attachment.

Given the material-semiotic conceptualization of place espoused in this study, part of this research would necessarily explore ways to highlight the role of the spiritual, aesthetic, and metaphysical nature of places and associated PPSR place-based outcomes. Lane (2002) has been a prominent leader when it comes to the exploration of the spiritual essence of place. Not only has he argued that positivism created a secularization of nature and misplaced religion, he has also asserted that post-structuralist notions of people-place interactions completely ignore the existence of metaphysical agents beyond ourselves. How do these agents shape PPSR experiential outputs and in what ways might these dimensions be incorporated into research frameworks and outcome evaluation processes?

Inquiry here could focus on how to develop evaluation tools that allow for consistent and feasible use by participatory science managers or researchers in multiple contexts, while also honoring the contingent and unique experiences of people-place relationships. Additionally, this inquiry might then include a collection of information

regarding "best practices" among the community of participatory science leaders with regards to the cultivation of a rich sense of place or connection to nature.

Finally, the place meaning and attachment expressed by participants in this study most clearly highlight the biophysical and psychological components of sense of place. Likely a result of the particular objectives of the COASST program, the socio-cultural and political-economic aspects of place were not expressed as frequently by study participants, although this may partly be connected to the specific aims and research questions included in this study. Even still, COASST is one of many PPSR projects available to volunteers, and the diversity and range of topics and formats should not be overlooked. This raises additional questions for future research that might interrogate whether or not diverse types of PPSR programs contribute to these four dimensions of sense of place differently and to explore more deeply how these various dimensions interact and influence to form sense of place and feelings of attachment.

Participatory Science Actor-Networks and the Production, Negotiation, and Enactment of Scientific Knowledge

In order to consider how this research might contribute to inquiry into the influence of PPSR on science research and practice and to build on research findings within an environmental policy and decision-making context, I envision a third area for future research. With the growth of participatory science in the U.S. and Europe over the past decade, diverse and non-traditional networks of actors have developed to facilitate scientific research and environmental decision-making at a variety of scales. Rapidly developing multi-dimensional participatory science networks offer an occasion to interrogate the structure of these networks, how they differ from traditional systems of

scientific research and environmental policy development, and what impact that may have on the perceived efficacy or credibility of science, sustainability practices, and public policy. I expect spatial-relational perspectives like ANT will provide a unique avenue to identify significant actors, networks, and nodes that influence participatory science practices and behaviors in a variety of topical areas.

With a more decentralized, collaborative form of scientific research, participatory science is changing the way scientific knowledge is produced, leading to novel processes that facilitate negotiation of elite and local ecological knowledge. Because such knowledge undergirds scientific research and the policies and projects it supports, I anticipate that this research stream will help uncover how twenty-first century participatory science may be advancing fundamental changes in the way in which scientific knowledge is conceived, shaped, and tested. Attention to ‘positionality’ of actors in the knowledge production process will require that such research investigates who participates in participatory science, how they identify with place, what narratives inform such identities, and, just as importantly, who isn’t participating in these experiences.

One area to consider in particular will be the role of socio-economic status on the motivation to participate in citizen science (influenced by time, access, money), but also the relationship between narratives of belonging and responsibility of place that may be associated with larger customs and discourses about access to land and land ownership (Schein 2009). Information obtained from this analysis will further understanding of why certain groups or individuals participate in participatory science, yielding clues regarding

strategies that might enhance the inclusion and participation of underrepresented groups in these initiatives.

Furthermore, such inquiry will help to interrogate the distribution and channels of power and influence among the various actors in these networks, advancing scholarship within political ecology aimed at challenging the unequal distribution of environmental risks and benefits, while grounding such analysis in material settings. Paying close attention to the ways in which discourses, representations, and systems of power interact in participatory science networks to create material realities may also demonstrate how specific environmental behaviors are both facilitated and constrained by contemporary systems of scientific knowledge production.

Birding as "Intimate Exploration of Place"

Birds and their relationships with people are at the heart of the focus of the COASST program. While not all COASST participants consider themselves birders by any means, the task of searching for birds (albeit dead ones) is the central focus of program participation. This final area of research would expand beyond the world of PPSR to consider the relationship between the hobby of birding and the significance of place. Bonta (2010) has noted that through a deep interest and search for birds, bird enthusiasts "gather much, much more" about the environment around them when they engage in birding. Drawing from scholars like Deleuze and Guattari, Bonta suggests that birds often add a layer of significance to previously bland and inconsequential landscapes, forging deeper connections to and knowledge of birds ("ornithophilia") and landscapes ("topophilia"). As a consequence, therefore, of birding, individuals may either

intentionally or unintentionally acquire additional familiarity with and knowledge about other environmental phenomena (i.e. tree species, phenological change, invasive species).

This study provides evidence of this assertion. Changes that occur along the coast during different seasons, the arrival and departure of species during different times of the year, variations in species mortality based on the seasons and life cycles of marine mammals, and the impact of storms during winter are just a few of the areas of knowledge participants expressed increasing over time. All of this from a monthly search for beached birds. As such changes are observed and documented over time, natural curiosity, coupled with program resources, materials, and continuing education, foster increased learning.

Along these lines, this area of research could focus on the sociology and spatiality of birding to concentrate specifically on the role and potential of birds and birding to expand other forms of environmental education. While investigating the phenomenology of what Bonta suggests birders experience when they "become bird," this research might identify the major aspects of birding that often impact ecological knowledge and connection on both micro and macro scales. What are those ecological concepts most often commensurate with birding experiences? For those operating birding clubs, organizations, and networks, what types of strategies or practices might enhance the diversity and types of environmental knowledge birders obtain? Furthermore, how might the ecological knowledge birders obtain while birding be gathered in a systematic way alongside bird observations (in applications like eBird for example)?

Concluding Thoughts

As the geographer Goodchild (2007) has noted, despite the massive growth in technology that can aid in the survey and analysis of biogeographic information, the “human sensory system” is still one of the best tools available for the study and investigation of the natural world. Even with the sophisticated technology available today, most data on species-level occurrence still must be gathered by humans. PPSR programs have recognized the substantial power dedicated "human sensors" have when it comes to investigating natural science phenomena. Even still, I've contended that the processes and experiences involved in gathering the data so crucial to meet PPSR research objectives and the influence of those activities on the people involved and the science that results has not yet sufficiently been theorized or comprehensively explored. While this dissertation research in no way covers the full scope of territory necessary to illuminate these processes, I believe it has provided a meaningful and theoretically sound perspective from which to begin such a task. Above all, this study emphasizes that because all in-situ PPSR projects are place-based, the relationships among participants and the meanings contained in the places in which they investigate are central to the experience.

Celebrating the spirit of place meaning, I conclude this dissertation with a personal note about the significant meaning I found at two unexpected places at the bookends of my field research journey. Only a day after my arrival in Washington in June of 2013, I found myself surrounded by the towering Douglas Firs of the Columbia River Gorges National Scenic Area in Stevenson, Washington. Rising early to see what I could find outdoors, not ten minutes upon entering a wooded trail in the gorge, did I come upon



Figure 7.1: Pileated Woodpeckers

a family of Pileated Woodpeckers, two adults and one juvenile. I snapped this quick photo (Figure 7.1) of one of the adults (L) and the young learner (R). Woodpeckers are beautiful birds, and the Pileated is one of the largest and most ornate of them all. Seeing those birds provided an immediate sense of comfort, as I often happen upon Pileated Woodpeckers in the Congaree National Forest near my home in South Carolina. The dense and foreign wooded area I was only just exploring quickly assumed a much more friendly, familiar atmosphere at the sight of those birds.

As someone who values animal medicine, their presence brought even more than a reminder of my home. Woodpecker medicine teaches that opportunity waits if only you are willing to follow the knocks at the door and open it. The sound of the woodpecker

searching for morsels among the bark and pith of trees is an auditory reminder that a new journey awaits, and it is time to gather up the strength and courage to walk through the door. It was a evocative start to my field research journey that would take me over 3,000 miles and three states, allow me to meet with nearly eighty people that collectively survey over 70 beaches and engage in approximately 150 hours of interview conversation. The journey was to be great, but I indeed needed all the strength and energy I could muster. The very place where those woodpeckers appeared in Stevenson would serve as a powerful and comforting motivator for me throughout my field research. My sense of that place was enlivened by their presence and enhanced by their symbolism.

How fitting then that as I neared the end of my field work journey, I happened upon another Pileated Woodpecker in the Arcata Community Forest (Arcata, CA), only the second encounter during my entire trip. It was the day before I was to leave California to travel back to South Carolina in mid-August 2013 and I was able to venture into the stunning Redwood trees that line this small woodland preserve in the communal town of Arcata. It was because of a chance encounter with a COASST volunteer only a day before that I found out about this hidden gem. After walking many of the trails in the protected area, I sat down to soak in the colors of the forest. In the stillness, I heard the resonate thump that only a woodpecker makes. With a quick turn of my head, there it was, a beautiful adult Pileated Woodpecker. I was lucky enough to have my camera with me and took a swift picture (Figure 7.2). Here I was, having traveled all the way to northern California from the top of Washington State and guess what had shown up to bid me farewell?



Figure 7.2: Second Pileated Friend

After taking a few pictures, I sat and watched and listened to my visitor for several minutes. The sound of the woodpecker's cadent pecking in the forest also holds great meaning within animal medicine. It is often likened to the beat of life, or earth's heartbeat. My experience with this woodpecker at the conclusion of my trip was an emotional and spiritual one. My time exploring the coast up and down the Pacific Northwest had most certainly connected me to the heartbeat of the earth. It had connected me also to the lives of dedicated and inspiring citizens who scour beaches for bird carcasses, trudge through cold, wet, and windy conditions to identify and tag specimens, and lug bags of trash off of beaches to make their own small mark on the world. These

volunteers had invited me into their homes, walked with me on their beaches, and shared some incredible stories. How lucky I was to have experienced all of that in just two short months. The place that was born for me there in the Arcata Community Forest, co-created by my woodpecker teacher at my side, was the perfect place for my journey to end. My woodpecker visitor was an apt tribute to the work that COASST does to monitor and conserve the coastal cousins of this woodland species. For me, these two places serve as poignant bookends for my journey, forever a part of me and my research experience, forever shaping my future.

BIBLIOGRAPHY

- Abbott-Chapman, Joan, and Margaret Robertson. 2009. "Adolescents' Favourite Places: Redefining the Boundaries between Private and Public Space." *Space and Culture* 12 (4): 419–34.
- Adams, J.D., S Ibrahim, and M Lim. 2010. "Invoking the Ontological Realm of Place." In *Cultural Studies and Environmentalism: The Confluence of Ecojustice, Place-Based (Science) Education, and Indigenous Knowledge Systems*, edited by D.J. Tippins, M.P. Mueller, M van Eijck, and J.D. Adams, 215–28. New York, NY: Springer.
- Agnew, J, and J Duncan, ed. 1989. *The Power of Place: Bringing Together Geographical and Sociological Imaginations*. Boston: Unwin Hyman.
- Aiken, L. 2002. *Attitudes and Related Psychosocial Constructs: Theories, Assessment, and Research*. Thousand Oaks, CA: SAGE Publications.
- Allen, Casey. 2011. "On Actor-Network Theory and Landscape." *Area* 43 (3): 274–80.
- Anderson, B, and P Harrison, ed. 2010. *Taking-Place: Non-Representational Theories and Geography*. Burlington, VT: Ashgate.
- Anderson, Jon. 2010. "The Place of Nature." In *Understanding Cultural Geography: Places and Traces*. Routledge.
- Ardoin, N. 2006. "Toward an Interdisciplinary Understanding of Place: Lessons from Environmental Education." *Canadian Journal of Environmental Education* 11 (1): 112–26.
- Ardoin, Nicole, Janel Schuh, and Rachelle Gould. 2012. "Exploring the Dimensions of Place: A Confirmatory Factor Analysis of Data from Three Ecoregional Sites." *Environmental Education Research* 18 (5): 583–607.
- Asah, Stanley, and Dale Blahna. 2013. "Practical Implications of Understanding the Influence of Motivations on Commitment to Voluntary Urban Conservation Stewardship." *Conservation Biology* 27 (4): 866–75.
- Bachelard, G. 1969. *The Poetics of Space*. Translated by M Jolas. Boston, MA: Beacon Press.
- Bachelard, Gaston. 1994. *The Poetics of Space*. Translated by M Jolas. Beacon Press.
- Bakker, K, and G Bridge. 2006. "Material Worlds? Resource Geographies and the 'Matter of Nature.'" *Progress in Human Geography* 30 (1): 5–27.
- Ballard, Heidi, and Jill Belsky. 2010. "Participatory Action Research and Environmental Learning: Implications for Resilient Forests and Communities." *Environmental Education Research* 16 (5-6): 611–27.
- Bang, M, D Medin, and S Atran. 2007. "Cultural Mosaics and Mental Models of Nature." *Proceedings from the National Academy of Sciences* 104 (35): 13868–74.
- Batson, C.D., N Ahmad, and J Tsang. 2002. "Four Motives for Community Involvement." *Journal of Social Issues* 58: 429–45.

- Bauer, Martin, Nick Allum, and Steve Miller. 2007. "What Can We Learn from 25 Years of PUS Survey Research? Liberating and Expanding the Agenda." *Public Understanding of Science* 16: 79–95.
- Beckley, T, R Stedman, S Wallace, and M Ambard. 2007. "Snapshots of What Matters Most: Using Resident-Employed Photography to Articulate Attachment to Place." *Society and Natural Resources* 20: 913–23.
- Bell, Philip. 2009. "Learning Science in Informal Environments: People, Places, and Pursuits". Committee on Learning Science in Informal Environments, National Research Council. Washington D.C.: National Research Council.
- Berkes, F. 2009. "Evolution of Co-Management: Role of Knowledge Generation, Bridging Organizations and Social Learning." *Journal of Environmental Management* 90 (5): 1692–1702.
- Biegelbauer, Peter, and Janus Hansen. 2011. "Democratic Theory and Citizen Participation: Democracy Models in the Evaluation of Public Participation in Science and Technology." *Science and Public Policy* 38 (8): 589–97.
- Bonney, R. 2004. "Understanding the Process of Research." In *Creating Connections: Museums and Public Understanding of Current Research*, edited by D Chittenden, G Farmelo, and B Lewenstein. Walnut Creek, CA: Altamira Press.
- . 2007. "Citizen Science at the Cornell Lab of Ornithology." In *Exemplary Science in Informal Education Settings: Standards-Based Success Stories*, edited by R Yager and D Falk. Arlington, VA: NSTA Press.
- Bonney, R, and A Dhondt. 1997. "Project FeederWatch." In *Internet Links to Science Education: Student Scientist Partnerships*, edited by K Cohen. New York: Plenum Press.
- Bonney, Rick. 2004. "Understanding the Process of Research." In *Creating Connections: Museums and Public Understanding of Current Research*, edited by D Chittenden, G Farmelo, and B Lewenstein. California: Altamira Press.
- Bonney, Rick, Heidi Ballard, R Jordan, E McCallie, T Phillips, J Shirk, and C Wilderman. 2009. "Public Participation in Scientific Research: Defining the Field and Assessing Its Potential for Informal Science Education." A CAISE Inquiry Group Report. Washington, DC: Center for Advancement of Informal Science Education (CAISE).
- Bonney, Rick, Caren Cooper, Janis Dickinson, Steve Kelling, and Tina Phillips. 2009. "Citizen Science: A Developing Tool for Expanding Science Knowledge and Scientific Literacy." *BioScience* 59 (11): 977–84.
- Bonta, M. 2010. "Ornithophilia: Thoughts on Geography and Birding." *The Geographical Review* 100 (2): 139–51.
- Brace, C, A Bailey, and D Harvey. 2006. "Religion, Place and Space: A Framework for Investigating Historical Geographies of Religious Identities and Communities." *Progress in Human Geography* 30 (1): 28–43.
- Bramston, Paul, Grace Pretty, and Charlie Zammit. 2011. "Assessing Environmental Stewardship Motivation." *Environment and Behavior* 43 (6): 776–88.
- Brandenburg, A, and M Carroll. 1995. "Your Place or Mine? The Effect of Place Creation on Environmental Values and Landscape Meanings." *Society and Natural Resources* 8: 381–98.

- Braschler, Brigitte, Kirsten Mahood, Natasha Karenyi, Kevin Gaston, and Steven Chown. 2010. "Realizing a Synergy between Research and Education: How Participation in Ant Monitoring Helps Raise Biodiversity Awareness in a Resource-Poor Country." *Journal of Insect Conservation* 14: 19–30.
- Brehm, Joan, Brian Eisenhauer, and Richard Stedman. 2013. "Environmental Concern: Examining the Role of Place Meaning and Place Attachment." *Society and Natural Resources* 26: 522–38.
- Brewer, Carol. 2002. "Outreach and Partnership Programs for Conservation Education Where Endangered Species Conservation and Research Occur." *Conservation Biology* 16 (1): 4–6.
- Bricker, Kelly, and Deborah Kerstetter. 2000. "Level of Specialization and Place Attachment: An Exploratory Study of Whitewater Recreationists." *Leisure Sciences* 22: 233–57.
- Brossard, Dominique, Bruce Lewenstein, and Rick Bonney. 2005. "Scientific Knowledge and Attitude Change: The Impact of a Citizen Science Project." *International Journal of Science Education* 27 (9): 1099–1121.
- Brown, Gregory, and Christopher Raymond. 2007. "The Relationship between Place Attachment and Landscape Values: Toward Mapping Place Attachment." *Applied Geography* 27: 89–111.
- Brugger, Adrian, Florian Kaiser, and Nina Roczen. 2011. "One for All? Connectedness to Nature, Inclusion of Nature, Environmental Identity, and Implicit Association with Nature." *European Psychologist* 16 (4): 324–33.
- Burns, T.W., D.J. O'Connor, and S.M. Stocklmayer. 2003. "Science Communication: A Contemporary Definition." *Public Understanding of Science* 12: 183–202.
- Campbell, S. 2008. "The Complexity of Places." In *Teaching About Place: Learning from the Land*, edited by L Christensen and H Crimmel. Reno, NV: University of Nevada Press.
- Carson, R. 1965. *The Sense of Wonder*. New York, NY: Harper & Row.
- Casey, E. 1993. *Getting Back Into Place*. Bloomington, IN: Indiana University Press.
- Castree, Noel, and Bruce Braun. 1998. *Remaking Reality: Nature at the Millennium*. London: Routledge.
- Cheng, Antony, Linda Kruger, and Steven Daniels. 2003. "'Place' as an Integrating Concept in Natural Resource Politics: Propositions for a Social Science Research Agenda." *Society and Natural Resources* 16: 87–104.
- Clandinin, DJ, and FM Connelly. 2000. *Narrative Inquiry: Experience and Story in Qualitative Research*. San Francisco: Jossey-Bass.
- Clary, E, and M Snyder. 1999. "The Motivations to Volunteer: Theoretical and Practical Considerations." *Current Directions in Psychological Science* 8 (5): 156–59.
- Cloke, P, and R Johnston. 2005. *Spaces of Geographic Thought: Deconstructing Human Geography's Binaries*. London: SAGE Publications.
- Coastal Observation and Seabird Survey Team. 2006. "COASST Protocol: A Guide for COASST Volunteers". Coastal Observation and Seabird Survey Team.
- Conrad, Cathy, and Krista Hilchey. 2011a. "A Review of Citizen Science and Community-Based Environmental Monitoring: Issues and Opportunities." *Environmental Monitoring & Assessment* 176: 273–91.

- . 2011b. “A Review of Citizen Science and Community-Based Environmental Monitoring: Issues and Opportunities.” *Environmental Monitoring & Assessment* 176: 273–91.
- Cooper, Caren, Janis Dickinson, Tina Phillips, and Rick Bonney. 2007. “Citizen Science as a Tool for Conservation in Residential Ecosystems.” *Ecology and Society* 12 (2).
- Cornwall, Andrea, and Rachel Jewkes. 1995. “What Is Participatory Research?” *Social Science & Medicine* 41 (12): 1667–76.
- Couvet, D, F Jiguet, R Julliard, H Levrel, and A Teysseire. 2008. “Enhancing Citizen Contributions to Biodiversity Science and Public Policy.” *Interdisciplinary Science Reviews* 33 (1): 95–103.
- Czarniawska, B. 2004. *Narratives in Social Science Research*. London: SAGE Publications.
- Daniels, Stephen. 2004. “Marxism, Culture, and the Duplicity of Landscape.” In *Cultural Geography: Critical Concepts in the Social Sciences*, edited by Nigel Thrift and Sarah Whatmore, 17–44. New York: Routledge.
- Danielsen, Finn, Neil Burgess, and Andrew Balmford. 2005. “Monitoring Matters: Examining the Potential of Locally-Based Approaches.” *Biodiversity and Conservation* 14: 2507–42.
- Davenport, M.A., and D.H. Anderson. 2005. “Getting from Sense of Place to Place-Based Management: An Interpretive Investigation of Place Meaning and Perceptions of Landscape Change.” *Society and Natural Resources* 18 (7): 625–41.
- Davis, S. 2005. “Representing Place: ‘Deserted Isles’ and the Reproduction of Bikini Atoll.” *Annals of the Association of American Geographers* 95: 607–25.
- Devictor, Vincent, Robert Whittaker, and Coralie Beltrame. 2010. “Beyond Scarcity: Citizen Science Programmes as Useful Tools for Conservation Biogeography.” *Diversity and Distributions* 16: 354–62.
- Devine-Wright, Patrick. 2009. “Rethinking NIMBYism: The Role of Place Attachment and Place Identity in Explaining Place-Protective Action.” *Journal of Community and Applied Social Psychology* 19 (6): 426–41.
- . 2013. “Think Global, Act Local? The Relevance of Place Attachments and Place Identities in a Climate Changed World.” *Global Environmental Change - Human Policy Dimensions* 23 (1): 61–69.
- Devine-Wright, Patrick, and Susan Clayton. 2010. “Introduction to the Special Issue: Place, Identity and Environmental Behaviour.” *Journal of Environmental Psychology* 30: 267–70.
- Dickinson, Janis, Jennifer Shirk, David Bonter, Rick Bonney, Rhiannon Crain, Jason Martin, Tina Phillips, and Karen Purcell. 2012. “The Current State of Citizen Science as a Tool for Ecological Research and Public Engagement.” *Frontiers in Ecology and the Environment* 10 (6): 291–97.
- Dickinson, Janis, Benjamin Zuckerberg, and David Bonter. 2010. “Citizen Science as an Ecological Research Tool: Challenges and Benefits.” *Annual Review of Ecology, Evolution, and Systematics* 41: 149–72.
- Dominy, M. 2000. *Calling the Station Home: Place and Identity in New Zealand’s High Country*. Lanham, MD: Rowman & Littlefield.

- Droseltis, O, and V.L. Vignoles. 2010. "Towards an Integrative Model of Place Identification: Dimensionality and Predictors of Intrapersonal-Level Place Preferences." *Journal of Environmental Psychology* 30 (1): 23–34.
- Eagly, A, and S Chaiken. 1993. *The Psychology of Attitudes*. Fort Worth, TX: Harcourt Brace Jovanovich.
- Eisenhauer, Brian, R Krannich, and D Blahna. 2000. "Attachment to Special Places on Public Lands: An Analysis of Activities, Reasons for Attachments and Community Connections." *Society and Natural Resources* 12: 421–41.
- Elbroch, M, T Mwampamba, M Santos, M Zylberberg, L Liebenberg, J Minye, C Mosser, and E Reddy. 2011. "The Value, Limitations, and Challenges of Employing Local Experts in Conservation Research." *Conservation Biology* 25: 1195–1202.
- Ellis, Rebecca, and Claire Waterton. 2004. "Environmental Citizenship in the Making: The Participation of Volunteer Naturalists in UK Biological Recording and Biodiversity Policy." *Science and Public Policy* 31 (2): 95–105.
- Emel, Jody, Chris Wilbert, and Jennifer Wolch. 2002. "Animal Geographies." *Society and Animals* 10 (4): 407–12.
- Evans, Celia, Eleanor Abrams, Robert Reitsma, Karin Roux, Laura Salmonsens, and Peter Marra. 2005. "The Neighborhood Nestwatch Program: Participant Outcomes of a Citizen-Science Ecological Research Project." *Conservation Biology* 19 (3): 589–94.
- Everett, Michele, and Margaret Barrett. 2012. "'Guided Tour': A Method for Deepening the Relational Quality in Narrative Research." *Qualitative Research Journal* 12 (1): 32–46.
- Falk, John. 2004. "The Director's Cut: Toward an Improved Understanding of Learning from Museums." *Science Education* S1: S83–S96.
- Fernandez-Gimenez, Maria, Heidi Ballard, and Victoria Sturtevant. 2008. "Adaptive Management and Social Learning in Collaborative and Community-Based Monitoring: A Study of Five Community-Based Forestry Organizations in the Western USA." *Ecology and Society* 13 (2).
- Finger, Matthias. 1994. "From Knowledge to Action? Exploring the Relationships between Environmental Experiences, Learning, and Behavior." *Journal of Social Issues* 50 (3): 141–60.
- Fishwick, L, and J Vining. 1992. "Toward a Phenomenology of Recreation Place." *Journal of Environmental Psychology* 12: 57–63.
- Foster-Smith, J, and S Evans. 2003. "The Value of Marine Ecological Data Collected by Volunteers." *Biological Conservation* 113: 199–213.
- Georgia, Y, D Neale, V Van Horne, and S Malcom. 2001. "In Pursuit of a Diverse Science, Technology, Engineering, and Mathematics Workforce: Recommended Research Priorities to Enhance Participation by under-Represented Minorities". Washington, DC: American Association for the Advancement of Science. <http://ehrweb.aaas.org/mge/Reports/Report1/AGEP/>.
- Goodchild, M. 2007. "Citizens as Sensors: The World of Volunteered Geography." *GeoJournal* 69: 211–21.
- Goss, J, and T Leinbach. 1996. "Focus Groups as Alternative Research Practice: Experience with Transmigrants in Indonesia." *Area* 28 (2): 115–23.

- Greenwood, Jeremy. 2007. "Citizens, Science and Bird Conservation." *Journal of Ornithology* 148 (S1): S77–S124.
- Greider, T, and L Garkovich. 1994. "Landscapes: The Social Construction of Nature and the Environment." *Rural Sociology* 59 (1): 1–24.
- Halpenny, Elizabeth. 2010. "Pro-Environmental Behaviours and Park Visitors: The Effect of Place Attachment." *Journal of Environmental Psychology* 30: 409–21.
- Haraway, D. 1991. "A Cyborg Manifesto: Science, Technology, and Socialist Feminism in the Late Twentieth Century." In *Simians, Cyborgs and Women: The Reinvention of Nature*, edited by D Haraway, 149–81. New York, NY: Routledge.
- Harvey, K. 2006. "Monitoring Change: Citizen Science and International Environmental Treaty-Making." In *Papers on International Environmental Negotiation: Ensuring a Sustainable Future*, edited by W Moomaw and L Susskind, 77–90. Cambridge, MA: Harvard University Press.
- Hass, Todd, and Julia Parrish. 2002. *Beached Birds: A COASST Field Guide*. Seattle, WA: Wavefall Press.
- Haywood, Benjamin. 2014. "A 'Sense of Place' in Public Participation in Scientific Research." *Science Education* 98 (1): 64–83.
- Haywood, Benjamin, and John Besley. 2014. "Education, Outreach, and Inclusive Engagement: Towards Integrated Indicators of Successful Program Outcomes in Participatory Science." *Public Understanding of Science* 23 (1): 92–106. doi:10.1177/0963662513494560.
- Henwood, Karen, and Nick Pidgeon. 2001. "Talk about Woods and Trees: Threat of Urbanization, Stability, and Biodiversity." *Journal of Environmental Psychology* 21: 125–47.
- Hidalgo, Carmen, and Bernardo Hernandez. 2001. "Place Attachment: Conceptual and Empirical Questions." *Journal of Environmental Psychology* 21: 273–81.
- Hitchings, Russell. 2003. "People, Plants and Performance: On Actor Network Theory and the Material Pleasures of the Private Garden." *Social and Cultural Geography* 4 (1): 99–114.
- Hobbs, S, and P White. 2012. "Motivations and Barriers in Relation to Community Participation in Biodiversity Recording." *Journal for Nature Conservation* 20 (6): 364–73.
- Hubbard, P, R Kitchin, B Bartley, and D Fuller. 2002. *Thinking Geographically: Space, Theory, and Contemporary Geography*. London: Continuum.
- Husserl, E.G.A. 1970. *The Crisis of European Sciences and Transcendental Phenomenology*. Evanston: Northwestern University Press.
- Irwin, A, and B Wynne. 1996. *Misunderstanding Science? The Public Reconstruction of Science and Technology*. Cambridge, MA: Cambridge University Press.
- Jackson, Peter. 2000. "Rematerializing Social and Cultural Geography." *Soical & Cultural Geography* 1 (1): 9–14.
- Jay, Martin. 1993. *Downcast Eyes: The Denigration of Vision in Twentieth Century French Thought*. Berkeley, CA: California University Press.
- Jones, Martin. 2009. "Phase Space: Geography, Relational Thinking, and beyond." *Progress in Human Geography* 33 (4): 487–506.

- Jordan, Rebecca, Steven Gray, David Howe, Wesley Brooks, and Joan Ehrenfeld. 2011. "Knowledge Gain and Behavioral Change in Citizen-Science Programs." *Conservation Biology* 25 (6): 1148–54.
- Jorgensen, B, and R Stedman. 2001. "Sense of Place as an Attitude: Lakeshore Owners Attitudes towards Their Properties." *Journal of Environmental Psychology* 21: 233–24.
- Kaltenborn, Bjorn. 1997. "Nature of Place Attachment: A Study among Recreation Homeowners in Southern Norway." *Leisure Sciences: An Interdisciplinary Journal* 19 (3): 175–89.
- . 1998. "Effects of Sense of Place on Responses to Environmental Impacts." *Applied Geography* 18 (2): 169–89.
- Karrow, D, and X Fazio. 2010. "Educating-within-Place: Enactments of Care within Citizen Science for Ecojustice." In *Cultural Studies and Environmentalism: The Confluence of Ecojustice, Place-Based (Science) Education, and Indigenous Knowledge Systems*, edited by D.J. Tippins, M.P. Mueller, M van Eijck, and J.D. Adams, 193–214. London: Spring.
- Kearns, Robin, and Damian Collins. 2012. "Feeling for the Coast: The Place of Emotion in Resistance to Residential Development." *Social and Cultural Geography* 13 (8): 937–55.
- Kellert, S. 2005. "Nature and Childhood Development." In *Building for Life: Designing and Understanding the Human-Nature Connection*, 63–89. Washington D.C.: Island Press.
- Kelling, S. 2008. "Significance of Organism Observations: Data Discovery and Access in Biodiversity Research". Report for the Global Biodiversity Information Facility. Copenhagen, Denmark: Global Biodiversity Information Facility. http://www.gbif.org/orc/?doc_id=1642.
- Kincheloe, J, E McKinley, M Lim, and A Barton. 2006. "Forum: A Conversation on 'Sense of Place' in Science Learning." *Cultural Studies of Science Education* 1 (1): 143–60.
- Knez, I. 2005. "Attachment and Identity as Related to a Place and Its Perceived Climate." *Journal of Environmental Psychology* 25: 207–18.
- Kountoupes, Dina, and Karen Oberhauser. 2008. "Citizen Science and Youth Audiences: Educational Outcomes of the Monarch Larva Monitoring Project." *Journal of Community Engagement and Scholarship* 1 (1): 10–20.
- Krasny, Marianne, and Rick Bonney. 2005. "Environmental Education through Citizen Science and Participatory Action Research: The Cornell Laboratory of Ornithology and Garden Mosaics Examples." In *Environmental Education or Advocacy: Perspectives of Ecology and Education in Environmental Education*, edited by M.J. Mappin and E.A. Johnson, 292–319. Cambridge University Press.
- Krasny, Marianne, Cecilia Lundholm, and Ryan Plummer, ed. 2011. *Resilience in Social-Ecological Systems: The Role of Learning and Education*. Abingdon, Oxon: Routledge.
- Krueger, R. 1994. *Foucs Groups: A Practical Guide for Applied Research*. 2nd Edition. Thousand Oaks, CA: Sage Publications Inc.
- Kruger, Linda, and Pamela Jakes. 2003. "The Importance of Place: Advances in Science and Application." *Forest Science* 49 (6): 819–21.

- Kudryavtsev, Alex, Marianne Krasny, and Richard Stedman. 2012. "The Impact of Environmental Education on Sense of Place among Urban Youth." *Ecosphere* 3 (4): 1–15.
- Kudryavtsev, Alex, Richard Stedman, and Marianne Krasny. 2012. "Sense of Place in Environmental Education." *Environmental Education Research* 18 (2): 229–50.
- Kyle, Gerard, Alan Graefe, Robert Manning, and James Bacon. 2004. "Effects of Place Attachment on Users' Perceptions of Social and Environmental Conditions in a Natural Setting." *Journal of Environmental Psychology* 24: 213–25.
- Kyle, Gerard, and C.Y. Johnson. 2008. "Understanding Cultural Variation in Place Meaning". General technical report PNW-GTR-744. Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- Lakshminarayanan, S. 2007. "Using Citizens to Do Science versus Citizens as Scientists." *Ecology & Society* 12 (Response 2): 1.
- Lane, B.C. 2002. *Landscapes of the Sacred: Geography and Narrative in American Spirituality*. Baltimore, MD: Johns Hopkins University Press.
- Lawrence, Anna. 2006. "'No Personal Motive?' Volunteers, Biodiversity, and the False Dichotomies of Participation." *Ethics, Place & Environment: A Journal of Philosophy & Geography* 9 (3): 279–98.
- Lee, Tracy, Michael Quinn, and Danah Duke. 2006. "Citizen, Science, Highways, and Wildlife: Using a Web-Based GIS to Engage Citizens in Collecting Wildlife Information." *Ecology & Society* 11 (1).
- Lee, Tsung Hung. 2011. "How Recreation Involvement, Place Attachment and Conservation Commitment Affect Environmentally Responsible Behavior." *Journal of Sustainable Tourism* 19 (7): 895–915.
- Leopold, A. 1949. *A Sand County Almanac and Sketches Here and There*. New York, NY: Oxford University Press.
- Lepczyk, Christopher. 2005. "Integrating Published Data and Citizen Science to Describe Bird Diversity across a Landscape." *Journal of Applied Ecology* 42: 672–77.
- Lewenstein, Bruce. 1992. "The Meaning of 'public Understanding of Science' in the United States after World War II." *Public Understanding of Science* 1: 45–68.
- Lewicka, Maria. 2011. "Place Attachment: How Far Have We Come in the Last 40 Years?" *Journal of Environmental Psychology* 31: 207–30.
- Louv, Richard. 2008. *Last Child in the Woods: Saving Our Children from Nature-Deficit Disorder*. Algonquin Books.
- Low, S, and I Altman. 1992. "Place Attachment: A Conceptual Inquiry." In *Place Attachment*, edited by I Altman and S Low, 1–12. New York: Plenum Press.
- Manzo, L. 2005. "For Better or Worse: Exploring Multiple Dimensions of Place Meaning." *Journal of Environmental Psychology* 25 (1): 67–86.
- Manzo, Lynne. 2003. "Beyond House and Haven: Toward a Revisioning of Emotional Relationships with Places." *Journal of Environmental Psychology* 23: 47–61.
- . 2008. "Understanding Human Relationships to Place and Their Significance for Outdoor Recreation and Tourism." In *Understanding Concepts of Place in Recreation Research and Management*, edited by L.E. Kruger, T Hall, and M Stiefel, 135–73. Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Research Station.

- Manzo, Lynne, and Douglas Perkins. 2006. "Finding Common Ground: The Importance of Place Attachment to Community Participation and Planning." *Journal of Planning Literature* 20 (4): 335–50.
- Marshall, N, D Kleine, and A Dean. 2012. "CoralWatch: Education, Monitoring, and Sustainability through Citizen Science." *Frontiers in Ecology and the Environment* 10 (6): SI332–SI334.
- Massey, Doreen. 1991. "A Global Sense of Place." *Marxism Today* 38: 24–29.
- . 2005. *For Space*. Sage Publications Ltd.
- Mayer, Stephan, and Cynthia Frantz. 2004. "The Connectedness to Nature Scale: A Measure of Individuals' Feeling in Community with Nature." *Journal of Environmental Psychology* 24: 503–15.
- McCleery, Alison. 2004. "So Many Glasgows: From 'Personality of Place' to 'Positionality in Space and Time.'" *Scottish Geographical Journal* 120 (1-2): 3–18.
- McKenzie-Mohr, D. 2011. *Fostering Sustainable Behavior*. 3rd Edition. Gabriola Island, British Columbia: New Society Publishers.
- Measham, Thomas, and Guy Barnett. 2008. "Environmental Volunteering: Motivations, Modes and Outcomes." *Australian Geographer* 39 (4): 537–52.
- Mejlgaard, Niels, and Sally Stares. 2010. "Participation and Competence as Joint Components in a Cross-National Analysis of Scientific Citizenship." *Public Understanding of Science* 19 (5): 545–61.
- Melchior, A, and L Bailis. 2003. "2001-2002 Earth Force Evaluation: Program Implementation and Impacts". Waltham, MA: Center for Youth and Communities, Heller Graduate School at Brandeis University.
- Miller-Rushing, Abraham, Richard Primack, and Rick Bonney. 2012. "The History of Public Participation in Ecological Research." *Frontiers in Ecology and the Environment* 10 (6): 285–90.
- Montell, F. 1999. "Focus Group Interviews: A New Feminist Method." *NWSA Journal* 11 (1): 44–70.
- Mordue, Tom. 2009. "Angling in Modernity: A Tour through Society, Nature and Embodied Passion." *Current Issues in Tourism* 12 (5-6): 529–52.
- Morgan, D. 1997. *Focus Groups as Qualitative Research*. 2nd Edition. Thousand Oaks, CA: Sage Publications Inc.
- Morrell, L, and R Jin Bee Tan. 2009. "Validating For Use and Interpretation: A Mixed Methods Contribution Illustrated." *Journal of Mixed Methods Research* 3 (3): 242–64.
- Moss, D, E Abrams, and J Kull. 1998. "Can We Be Scientists Too? Secondary Student Perceptions of Scientific Research from a Project-Based Classroom." *Journal of Science Education and Technology* 7 (2): 149–61.
- Murdoch, J. 2006. *Post-Structuralist Geography: A Guide to Relational Space*. London: SAGE Publications.
- Murdoch, Jonathan. 1998. "The Spaces of Actor-Network Theory." *Geoforum* 29 (4): 357–74.
- Naess, Peter. 2010. "The Dangerous Climate of Disciplinary Tunnel Vision." In *Interdisciplinarity and Climate Change: Transforming Knowledge and Practice for Our Global Future*, edited by Roy Bhaskar. Taylor and Francis.

- Nassauer, J.I. 1995. "Culture and Changing Landscape Structure." *Landscape Ecology* 10 (4): 229–37.
- Newman, C, C Buesching, and D Macdonald. 2003. "Validating Mammal Monitoring Methods and Assessing the Performance of Volunteers in Wildlife Conservation." *Biological Conservation* 113: 189–97.
- Nov, Oded, Ofer Arazy, and David Anderson. 2011. "Dusting for Science: Motivation and Participation of Digital Citizen Science Volunteers." In *Proceedings of the 2011 iConference*, 68–74.
- "Oregon Beach Bill." 2013. *Wikipedia, the Free Encyclopedia*.
http://en.wikipedia.org/w/index.php?title=Oregon_Beach_Bill&oldid=519648600
- Overdeest, Christine, Cailin Huyck Orr, and Kristine Stepenuck. 2004. "Volunteer Stream Monitoring and Local Participation in Natural Resource Issues." *Research in Human Ecology* 11 (2): 177–85.
- Pallasmaa, J. 2005. *The Eyes of the Skin: Architecture and the Senses*. West Sussex, England: John Wiley and Sons, Ltd.
- Pandya, Rajul. 2012. "A Framework for Engaging Diverse Communities in Citizen Science in the US." *Frontiers in Ecology and the Environment* 10 (6): 314–17.
- Patterson, Michael, and Daniel Williams. 2005. "Maintaining Research Traditions on Place: Diversity of Thought and Scientific Progress." *Journal of Environmental Psychology* 25: 361–80.
- Payton, Michelle, David Fulton, and Dorothy Anderson. 2005. "Influence of Place Attachment and Trust on Civic Action: A Study at Sherburne National Wildlife Refuge." *Society and Natural Resources* 18 (6): 511–28.
- Peet, R, P Robbins, and M Watts, ed. 2010. *Global Political Ecology*. Oxford, England: Routledge.
- Phillips, T, R Bonney, and J Shirk. 2012. "What Is Our Impact?" In *Citizen Science: Public Participation in Environmental Research*, edited by J Dickinson and R Bonney, 82–95. Ithaca, NY: Comstock.
- Pion Ltd. 2014. "Welcome to the Society and Space Website."
<http://www.envplan.com/D.html>.
- Pitkanen, Kati, Riikka Puhakka, and Matthew Sawatzky. 2011. "The Role of Nature in the Place Meanings and Practices of Cottage Owners in Northern Environments." *Norwegian Journal of Geography* 65 (3): 175–87.
- Podeschi, Christopher, and E Howington. 2011. "Place, Sprawl, and Concern about Development and the Environment." *Sociological Spectrum* 31 (4): 419–43.
- Pooley, J.A., and M O'Conner. 2000. "Environmental Education and Attitudes." *Environment and Behavior* 32: 711–23.
- Powell, Maria, and Mathilde Colin. 2008. "Meaningful Citizen Engagement in Science and Technology: What Would It Really Take?" *Science Communication* 30 (1): 126–36.
- Prayag, G, and C Ryan. 2012. "Antecedents of Tourists' Loyalty to Mauritius: The Role and Influence of Destination Image, Place Attachment, Personal Involvement and Satisfaction." *Journal of Travel Research* 51 (3): 342–56.
- Pred, Allan. 1984. "Place as Historically Contingent Process: Structuration and the Time-Geography of Becoming Places." *Annals of the Association of American Geographers* 74: 279–97.

- Pretty, G, H Chipuer, and P Bramston. 2003. "Sense of Place amongst Adolescents and Adults in Two Rural Australian Towns: The Discriminating Features of Place Attachment, Sense of Community and Place Dependence in Relation to Place Identity." *Journal of Environmental Psychology* 23: 273–87.
- Price, Patricia. 2004. *Dry Place: Landscapes of Belonging and Exclusion*. Minneapolis: University of Minnesota Press.
- Proshansky, H. 1978. "The Self and the City." *Environment and Behavior* 10 (2): 147–69.
- Proshansky, H, A Fabian, and R Kaminoff. 1983. "Place Identity: Physical World Socialization of the Self." *Environmental Psychology* 3: 57–83.
- Ramkissoon, Haywantee, Liam Graham Smith, and Betty Weiler. 2013. "Testing the Dimensionality of Place Attachment and Its Relationships with Place Satisfaction and pro-Environmental Behaviors: A Structural Equation Modeling Approach." *Tourism Management* 36: 552–66.
- Ramkissoon, Haywantee, Betty Weiler, Liam David, and Graham Smith. 2012. "Place Attachment and pro-Environmental Behaviour in National Parks: The Development of a Conceptual Framework." *Journal of Sustainable Tourism* 20 (2): 257–76.
- Raymond, Christopher, Gregory Brown, and Guy Robinson. 2011. "The Influence of Place Attachment and Moral and Normative Concerns on the Conservation of Native Vegetation: A Test of Two Behavioural Models." *Journal of Environmental Psychology* 31: 323–35.
- Relph, E. 1976. *Place and Placelessness*. London: Pion.
- . 1985. "Geographical Experiences and Being-in-the-World." In *Dwelling, Place and Environment: Towards a Phenomenology of Person and World*, edited by D Seamon and R Mugerauer, 15–31. Springer Netherlands.
- Rennie, Leonie, and David Johnston. 2004. "The Nature of Learning and Its Implications for Research on Learning from Museums." *Science Education* 88 (S1): S4–S16.
- Rickinson, M, C Lundholm, and N Hopwood. 2009. *Environmental Learning: Insights from Research into the Student Experience*. Amsterdam: Springer Verlag.
- Robbins, P. 2004. *Political Ecology: A Critical Introduction*. Malden, MA: Blackwell.
- Rodman, M. 1992. "Empowering Place: Multilocality and Multivocality." *American Anthropologist* 94 (3): 640–56.
- Rose, Gillian, Monica Degen, and Begum Basdas. 2010. "More on 'Big Things': Building Events and Feelings." *Transactions of the Institute of British Geographers* 35: 334–49.
- Roth, Wolff-Michael, and Stuart Lee. 2002. "Scientific Literacy as Collective Praxis." *Public Understanding of Science* 11: 33–56.
- Rotman, Dana, Jennifer Preece, Jennifer Hammock, Kezee Procita, Derek Hansen, Cynthia Parr, Darcy Lewis, and David Jacobs. 2012. "Dynamic Changes in Motivation in Collaborative Citizen-Science Projects." In *Proceedings of the ACM 2012 Conference on Computer Supported Cooperative Work*. New York, NY: ACM.
- Rowe, Gene, and Lynn Frewer. 2005. "A Typology of Public Engagement Mechanisms." *Science, Technology, & Human Values* 30 (2): 251–90.

- Ryan, Robert. 2005. "Exploring the Effects of Environmental Experience on Attachment to Urban Natural Areas." *Environment and Behavior* 37 (1): 3–42.
- Ryan, Robert, Rachel Kaplan, and Robert Grese. 2001. "Predicting Volunteer Commitment in Environmental Stewardship Programmes." *Journal of Environmental Planning and Management* 44 (5): 629–48.
- Scannell, Leila, and Robert Gifford. 2010. "Defining Place Attachment: A Tripartite Organizing Framework." *Journal of Environmental Psychology* 30: 1–10.
- Schein, R. 1997. "The Place of Landscape: A Conceptual Framework for Interpreting an American Scene." *Annals of the Association of American Geographers* 87 (4): 660–80.
- . 2009. "Belonging through Land/scape." *Environment and Planning A* 41: 811–26.
- Schmeller, Dirk, Pierre-Yves Henry, Romain Julliard, Bernd Gruber, Jean Clobert, Frank Dziock, Szabolcs Lengyel, et al. 2008. "Advantages of Volunteer-Based Biodiversity Monitoring in Europe." *Conservation Biology* 23 (2): 307–16.
- Schreyer, R, G Jacob, and R White. 1981. "Environmental Meaning as a Determinant of Spatial Behavior in Recreation." In *Proceedings of the Applied Geography Conferences*, edited by J Frazier and B Epstein, 4:294–300. Kent, OH: Applied Geography Conferences, Inc.
- Schultz, P.W. 2001. "The Structure of Environmental Concern: Concern for Self, Other People, and the Biosphere." *Journal of Environmental Psychology* 21: 327–39.
- Schultz, P.W., and J Tabanico. 2007. "Self, Identity, and the Natural Environmet: Exploring Implicit Connections with Nature." *Journal of Applied Social Psychology* 37 (6): 1219–47.
- Schultz, Wesley. 2011. "Conservation Means Behavior." *Conservation Biology* 25 (6): 1080–83.
- Seale, C, G Gobo, J Gubrium, and D Silverman, ed. 2004. *Qualitative Research Practice*. Thousand Oaks, CA: Sage Publications Inc.
- Seamon, D. 1984. "Emotional Experience of the Environment." *American Behavioral Scientist* 27: 757–70.
- Seamon, David. 1979. *A Geography of the Lifeworld*. New York: St. Martins.
- . 1982. "The Phenomenological Contribution to Environmental Psychology." *Journal of Environmental Psychology* 2: 119–40.
- . 2000. "A Way of Seeing People and Place: Phenomenology in Environment-Behavior Research." In *Theoretical Perspectives in Environment-Behavior Research*, edited by S Wapner, J Demick, T Yamamoto, and H Minami, 157–78. New York: Plenum Press.
- . 2012. "Place, Place Identity, and Phenomenology: A Triadic Interpretation Based on J.G. Bennett's Systematics." In *The Role of Place Identity in the Perception, Understanding, and Design of Built Environments*, edited by Hernan Casakin and Fatima Barnardo, 3–21. Bentham Books.
- . 2013. "Lived Bodies, Place, and Phenomenology: Implications for Human Rights and Environmental Justice." *Journal of Human Rights* 4 (2): 143–66.
- Semken, S, and E Brandt. 2010. "Implications of Sense of Place and Place-Based Education for Ecological Integrity and Cultural Sustainability in Diverse Places." In *Cultural Studies and Environmentalism: The Confluence of Ecojustice, Place-*

- Based (Science) Education, and Indigenous Knowledge Systems*, edited by D Tippins, M Mueller, M van Eijck, and J.D. Adams, 193–214. New York, NY: Springer.
- Semken, Steven, and Carol Butler Freeman. 2008. "Sense of Place in the Practice and Assessment of Place-Based Science Teaching." *Science Education* 92: 1042–57.
- Shanahan, Timothy, and Cynthia Shanahan. 2008. "Teaching Disciplinary Literacy to Adolescents: Rethinking Content-Area Literacy." *Harvard Educational Review* 78 (1): 40–59.
- Shirk, Jennifer, Heidi Ballard, Candie Wilderman, Tina Phillips, Andrea Wiggins, Rebecca Jordan, Ellen McCallie, et al. 2012. "Public Participation in Scientific Research: A Framework for Deliberate Design." *Ecology and Society* 17 (2): 29.
- Shumaker, S.A., and R.B. Taylor. 1983. "Toward a Clarification of People-Place Relationships: A Model of Attachment to Place." In *Environmental Psychology: Directions and Perspectives*, edited by N.R. Feimer, S Geller, and E.S. Geller, 219–51. New York: Praeger.
- Silvertown, Jonathan. 2009. "A New Dawn for Citizen Science." *Trends in Ecology and Evolution* 24 (9): 467–69.
- Smith, N. 1984. *Uneven Development: Nature, Capital, and the Production of Space*. New York: Blackwell.
- Sobel, D. 2005. *Place-Based Education: Connecting Classrooms and Communities*. Great Barrington, MA: The Orion Society.
- Soja, Edward. 1999. "Thirdspace: Expanding the Scope of the Geographical Imagination." In *Human Geography Today*, edited by Doreen Massey, J Allen, and P Sarre, 261–78. Wiley-Blackwell.
- Soper, K. 1995. *What Is Nature? Culture, Politics and the Non-Human*. Oxford: Blackwell.
- Stedman, R, L.E. Kruger, T Hall, and M Stiefel. 2008. "What Do We 'Mean' by Place Meanings? Implications of Place Meanings for Managers and Practitioners." In *Understanding Concepts of Place in Recreation Research and Management*, 61–81. Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Research Station.
- Stedman, Richard. 2002. "Toward a Social Psychology of Place: Predicting Behavior from Place-Based Cognitions, Attitude, and Identity." *Environment and Behavior* 34 (5): 405–25.
- . 2003a. "Is It Really Just a Social Construction?: The Contribution of the Physical Environment to Sense of Place." *Society and Natural Resources* 16: 671–85.
- . 2003b. "Sense of Place and Forest Science: Toward a Program of Quantitative Research." *Forest Science* 49 (6): 822–29.
- Steele, F. 1981. *The Sense of Place*. Boston, MA: CBI Publishing Co.
- Stokols, D, and S Shumaker. 1981. "People in Places: A Transactional View of Settings." In *Cognition, Social Behavior, and the Environment*, edited by D Harvey, 441–88. Hillsdale, NJ: Erlbaum.
- Strough, JoNell, Tara E. Karns, and Leo Schlosnagle. 2011. "Decision-Making Heuristics and Biases across the Life Span." *Annals of the New York Academy of Sciences* 1235 (1): 57–74. doi:10.1111/j.1749-6632.2011.06208.x.

- Sullivan, Brian, Christopher Wood, Marshall Iliff, Rick Bonney, Daniel Fink, and Steve Kelling. 2009. "eBird: A Citizen-Based Bird Observation Network in the Biological Sciences." *Biological Conservation* 142: 2282–92.
- Szabo, Judit, Peter Vesk, Peter Baxter, and Hugh Possingham. 2010. "Regional Avian Species Declines Estimated from Volunteer-Collected Long-Term Data Using List Length Analysis." *Ecological Applications* 20 (8): 2157–69.
- Taylor & Francis. 2014a. "Social and Cultural Geography: Aims and Scope." <http://www.tandfonline.com/action/journalInformation?show=aimsScope&journalCode=rscg20#.UtK5WPRDtx0>.
- . 2014b. "Studies in Science Education: Aims and Scope." <http://www.tandfonline.com/action/journalInformation?show=aimsScope&journalCode=rsse20#.UtK6WPRDtx0>.
- Thomas, David. 2006. "A General Inductive Approach for Qualitative Data Analysis." *American Journal of Evaluation* 27 (2): 237–46.
- Thornton, Teresa, and Jessica Leahy. 2012. "Changes in Social Capital and Networks: A Study of Community-Based Environmental Management Through a School-Centered Research Program." *Journal of Science Education and Technology* 21 (1): 167–82.
- Till, Karen. 2005. *The New Berlin: Memory, Politics, Place*. Minneapolis: University of Minnesota Press.
- Trentelman, Carla Koons. 2009. "Place Attachment and Community Attachment: A Primer Grounded in the Lived Experience of a Community Sociologist." *Society and Natural Resources* 22: 191–210.
- Trumbull, Deborah, Rick Bonney, Derek Bascom, and Anna Cabral. 2000. "Thinking Scientifically during Participation in a Citizen-Science Project." *Science Education* 84 (2): 265–75.
- Trumbull, Deborah, Rick Bonney, and Nancy Grudens-Schuck. 2005. "Developing Materials to Promote Inquiry: Lessons Learned." *Science Education* 89: 879–900.
- Tuan, Y.F. 1975. "Place: An Experiential Perspective." *Geographical Review* 65: 151–65.
- . 1977. *Space and Place: The Perspective of Experience*. Minneapolis: University of Minnesota Press.
- Uzzell, D, E Pol, and D Badenas. 2002. "Place Identification, Social Cohesion, and Environmental Sustainability." *Environment and Behavior* 34: 26.
- Vaske, J.J., and K.C. Kobrin. 2001. "Place Attachment and Environmentally Responsible Behavior." *The Journal of Environmental Education* 32 (4): 16–21.
- Vorkinn, Marit, and Hanne Riese. 2001. "Environmental Concern in a Local Context: The Significance of Place Attachment." *Environment and Behavior* 33 (2): 249–63.
- Walker, B, and D Salt. 2006. *Resilience Thinking: Sustaining Ecosystems and People in a Changing World*. Washington, DC: Island Press.
- Walker, G..J., and R. Chapman. 2003. "Thinking like a Park: The Effects of Sense of Place, Perspective-Taking, and Empathy on pro-Environmental Intentions." *Journal of Park and Recreation Administration* 21: 71–86.

- Warzecha, C.A., and D.W. Lime. 2001. "Place Attachment in Canyonlands National Park: Visitors' Assessment of Setting Attributes on the Colorado and Green Rivers." *Journal of Park and Recreation Administration* 19: 59–78.
- Wells, N. 2000. "At Home with Nature: Effects of 'Greenness' on Children's Cognitive Function." *Environment and Behavior* 32 (6): 775–95.
- Whatmore, Sarah. 2002. *Hybrid Geographies: Natures Cultures Spaces*. London: Sage Publications Ltd.
- Wilderman, Candie, Alissa Barron, and Lauren Imgrund. 2004. "Top down or Bottom up? ALLARM's Experience with Two Operational Models for Community Science". Dickinson College, Carlisle, PA.
- Williams, D, and D Carr. 1993. "The Sociocultural Meanings of Outdoor Recreation Places." In *Culture, Conflict, and Communication in the Wildland-Urban Interface*, edited by A Ewert, D Shavez, and A Magill. Boulder, CO: Westview Press.
- Williams, D, and M Patterson. 1996. "Environmental Meaning and Ecosystem Management: Perspective from Environmental Psychology and Human Geography." *Society and Natural Resources* 9 (5): 507–21.
- . 2007. "Snapshots of What, Exactly? A Comment on Methodological Experimentation and Conceptual Foundations in Place Research." *Society and Natural Resources* 20: 931–37.
- Williams, D, and J Vaske. 2003. "The Measurement of Place Attachment: Validity and Generalizability of a Psychometric Approach." *Forest Science* 49: 830–40.
- Williams, Daniel. 2008. "Pluralities of Place: A User's Guide to Place Concepts, Theories, and Philosophies in Natural Resource Management". Technical Report GENERAL TECHNICAL REPORT PNW-GTR-744. Understanding Concepts of Place in Recreation Research and Management. US Forest Service.
- Wilson, Robyn. 2008. "Balancing Emotion and Cognition: A Case for Decision Aiding in Conservation Efforts." *Conservation Biology* 22 (6): 1452–60.
- Wintle, Brendan, Michael Runge, and Sarah Bekessy. 2010. "Allocating Monitoring Effort in the Face of Unknown Unknowns." *Ecology Letters* 13: 1325–37.
- Wolch, J, and J Emel. 1998. *Animal Geographies: Politics, Place, and Identity in the Nature-Culture Borderlands*. London: Verso Press.
- Wolch, Jennifer. 2002. "Anima Urbis." *Progress in Human Geography* 26 (6): 721–42.
- Wolf, Kathleen, Dale Blahna, Weston Brinkley, and Michele Romolini. 2013. "Environmental Stewardship Footprint Research: Linking Human Agency and Ecosystem Health in the Puget Sound Region." *Urban Ecosystems* 16: 13–32.
- Wooden, Ruth. 2006. "The Principles of Public Engagement: At the Nexus of Science, Public Policy Influence, and Citizen Education." *Social Research*, 1057–63.
- Wynveen, Christopher, Gerard Kyle, and Stephen Sutton. 2012. "Natural Area Visitors' Place Meaning and Place Attachment Ascribed to a Marine Setting." *Journal of Environmental Psychology* 32: 287–96.
- Yuksel, A, F Yuksel, and Y Bilim. 2010. "Destination Attachment: Effects on Customer Satisfaction and Cognitive, Affective and Connative Loyalty." *Tourism Management* 31: 274–84.

Zimmerer, Karl. 2007. "Cultural Ecology (and Political Ecology) in the 'Environmental Borderlands': Exploring the Expanded Connectivities within Geography." *Progress in Human Geography* 31 (2): 227–44.

APPENDIX A

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APPENDIX B

FOCUS GROUP INTERVIEW PROTOCOL

These interviews seek to elicit information about networks of human and non-human actors grounded in a specific place in a group setting, information that is inherently qualitative and idiographic. Primary guiding prompts and questions (underlined) are included to elicit responses around key themes. The researcher will rely on these primary guiding questions and general follow-up probes like those below to elicit further responses from the primary question. Additionally, central follow-up probes (*italics*) are included under each primary question.

You mentioned _____. Tell me more about that.

You mentioned _____. What was that like for you?

You mentioned _____. Can you give me a specific example of that?

You mentioned _____. Why is that so important?

Introducing the Focus Group:

Good afternoon and thanks for being here! I'll start us off by providing a brief ten minute overview of my research in a broader context and then we will move into a group discussion. I expect the discussion to last about an hour and 45 minutes. We will take a ten minute break about half way through. Feel free to get up and move around if needed. During this focus group, I will ask a series of open-ended questions of the group. Feel free to share as much or as little as you would like. You are not obligated to answer any of the questions.. For those of you who participated in a small group interview, you will

likely notice some of the same themes and areas of discussion, although the questions are somewhat different. With your permission, I'd like to audio record our conversation so that I might transcribe it for review. Is everyone comfortable with that?

- To start our conversation, I'd like to ask each of you to share just a little bit about yourself with the group – your name, your beach site, how long you have been with COASST and your favorite seabird. Please try to keep this brief.
- Next I'd like to talk about your experiences as a citizen scientist with COASST. What would you say are some of the greatest benefits of participation? What personal outcomes do you most appreciate? Any major drawbacks?
 - *Why do you feel it is important to be involved in citizen science? Is it worth the effort you put into it?*
 - *Why is participation in COASST important to you and what do you gain from the experience?*
 - *Do any of you engage in other citizen science projects or is COASST your primary citizen science project?*
 - *What sort of community is there among COASST volunteers?*
 - *Has being involved in the COASST citizen science project influenced the way you think about scientific research or the relevancy of research efforts?*
 - *What do you enjoy the most about your citizen science work? Least? Are there specific parts of the program that you feel like you get more out of than others?*
 - *After you complete a COASST survey, do you usually feel satisfied? Why or why not?*

- *I know there is a training process for new COASST volunteers that reviews information about the proper techniques used to collect information about seabirds. However, I'm wondering if there are certain aspects of your survey work that you feel like you've had to learn along the way? In other words, have experiences at your beach or the creatures there taught you things that you didn't or couldn't learn via your training program (i.e. how to age a bird)?*
- *How do you think your work with COASST helps to inform the management of your beach or seabird conservation overall?*
- Now I'd like for everyone to focus on your specific volunteer beach site. When you think of your site, what are some of the first words or feelings that come to mind? They can be positive or negative. I'd like for us to keep track of what is stated and try to group them in similar categories.
 - *Can anyone tell me when you get that feeling at your beach? What are the circumstances? Do parts of the physical environment contribute to it? Have you always felt that way at your beach? Do you have to be in a certain mood to feel that way?*
 - *Take a moment to think about some of your favorite places (familiar or not – e.g. childhood home, vacation spot, etc.). Where does your COASST beach fit among your favorite places, is it close at all?*
 - *Would you say your beach is one of your favorite places?*
- Now I'd like for you to think about what you have learned about your beach since you first started participating in COASST. What do you know now that you didn't

know when you first started? For example, do you understand more about the birds and animals at the site, the threats to the ecosystem, how communities utilize the area?

- *Thinking more broadly, are there other topics that you feel like you've learned more about since you started volunteering with COASST (i.e. seabird anatomy, migration patterns, environmental toxins, etc.)?*
- *Considering all that you have learned about your beach site, do you think this new information has influenced your thoughts or feelings about the place? How so? Has your new knowledge influenced the way you interact with or behave at the beach?*
- So far, we've talked about what you've learned about your volunteer site and what feelings you have when you are there, now I'd like to turn our attention to the meaning you associate with your beach. Let's start though, by talking about what you think your beach means to the people that use it (i.e. a space to relax, a space to gather with family, etc.)? For the broader community, why do you think your beach is important?
 - *Thinking on a personal level then, does your beach also have the same meaning/s to you? Are there differences in what your beach means to you versus what you think it means to the rest of the community?*
 - *How so? Why do those differences exist? Has being involved in the COASST project changed what this place means to you in any way?*

- *Let's think more deeply about the meaning you associate with your beach. I'm specifically interested in whether or not particular aspects of your beach contribute to the meaning you feel. Let's consider:*
 - *Biological/Ecological Dimensions (e.g. ecosystem services, animals, ecological value) How do those influence meaning for you?*
 - *Aesthetic (e.g. scenery, colors, textures, beauty)*
 - *Cultural/Historical (e.g. cultural history of the place, historical significance)*
 - *Community/Social (e.g. role the place plays as a setting for social or community interaction or events)*
 - *Personal (e.g. spiritual or philosophical value, recreational or leisure benefits of place)*
 - *Other aspects?*
- *If I were to ask you to tell me how much your beach means to you using a scale from 1-10, how would you respond?*
- *Would you say that since you started volunteering with COASST, your beach has come to mean more to you or has that changed at all?*
- *Is there something about your beach that you can't find anywhere else?*
- *Are there elements about your beach that have become more important to you over time?*
- I'm also interested in whether or not you feel like your beach is a part of you in some way – like an extension of who you are. There are a couple questions I'd like you to consider.

- *Do you feel like your beach is a part of you in any way? If so, what is it about your beach that is a part of you (e.g. culture, climate, people)?*
- *Do you feel like you can be yourself when you are at your beach?*
 - *If so, why do you feel such freedom here? More so than other places? What constrains you from being yourself elsewhere?*
- *Do you think the meaning associated with your beach influences your engagement in the COASST program in any way (motivation to participate, how often you want to participate, etc.)?*
- I've got a better sense of what your beaches mean to you at this point so I'd like to ask more about the strength or intensity of your connection to your beach. I'll refer to this as your level of *attachment* (generally meaning special connection, affiliation or commitment). Although this is certainly related to the meaning you associate with your beach, instead of focusing on what your beach means, I'm interested in how strongly you feel connected or attached to that beach. Many of you may feel very strong connections, but for very different reasons.
 - *Let me start by asking how easy would it be for you to go without visiting your beach? What would be missing? Do you think you could find what you would miss somewhere else?*
 - *If you do feel an attachment to your beach, can you tell me more about how your attachment developed? Were there specific causes or events? For how long have you felt attached? Do you feel like this happened suddenly or more gradually?*

- *Would you say your attachment to your beach has grown stronger since you first started volunteering with COASST or weaker?*
- *Compared to other places, how attached are you to your beach?*
- *Do you consider yourself to be an advocate for your beach?*
- Now let me ask a few questions that relate to how your feelings of attachment impact your volunteer participation and commitment. Consider the following two survey questions.
 - *Would you say your attachment to your beach was a big part of why you decided to participate in COASST?*
 - *What else motivated you to participate? Let's generate some categories.*
 - *If you do feel attached to your beach is that attachment a part of why you remain committed to COASST?*
- Finally, because your survey work with COASST occurs outdoors and is part of an environmental monitoring project, I'm interested in your thoughts, ideas, and feelings about nature or the natural environment more broadly. If you participated in a guided tour interview, you've already thought about these questions somewhat.
 - *I'd like for you to take a minute to think about what comes to mind when I say the words nature, natural environment, or use the phrase natural world.*
 - *What images do you associate with those words or phrase?*
 - *What feelings do you associate with those words or phrase?*
 - *What objects do you associate with those words or phrase?*
 - *What sounds or smells do you associate with that word or phrase?*

- *With those images, feelings, objects, and sounds and smells in mind, can you share with the group what nature or the natural environment means to you and whether or not it is important or central in your daily life (e.g. enjoying a cup of coffee on the back porch listening to the birds starts my day off right)?*
 - *Has the meaning of nature or the natural environment changed over time for you? What about your feelings of connection to nature?*
- *Do you often feel that you are a part of nature or close to the natural world around you?*
- *Do you consider yourself to be an advocate for the natural world?*
- *Would you say that your involvement with the COASST project has influenced what nature means to you or how you interact with it? How so? Do you think you would have responded differently to the four questions I just asked before you started COASST? If so, which ones?*
- *Would you say your passion for the natural world was a big part of why you decided to participate in COASST?*
- What are some of the more prominent aspects of nature or the natural environment that you find at your beach site (e.g. certain smells, objects, etc.)?
 - *How do you think those natural aspects impact the feelings we discussed earlier that you get when you visit your beach (e.g. the waves make me feel calm)?*
 - *In what ways do they influence the connection, attachment, or meaning you associate with your beach?*

- *Have these natural elements helped you learn more about the beach or the ecosystem? How?*
- *Do you think your connection or attachment to your beach would change in any way if these natural elements were no longer there or had changed? How so?*
- *When you go to your beach, do you feel like you are connected to the natural world?*
- *Is there anything else about the natural environment at your beach site that you would like to share?*

APPENDIX C

NARRATIVE INQUIRY GUIDED TOUR PROTOCOL

Much like the focus groups, these interviews are intended to explore the material-symbiotic relationships between people, places, and animals. As such, they are designed to interrogate phenomenological interactions. As the interviews unfold and the meaning that exists among people, places, and animals are investigated, essential questions and avenues not anticipated prior to the experience may reveal themselves and need to be followed. This protocol therefore includes primary guiding prompts or questions (underlined) that will serve to elicit responses around key themes. The researcher will rely on these primary guiding questions and general follow-up probes like those below to elicit further responses from the primary question. Additionally, central follow-up probes (*italics*) are included under each primary question.

You mentioned _____. Tell me more about that.

You mentioned _____. What was that like for you?

You mentioned _____. Can you give me a specific example of that?

You mentioned _____. Why is that so important?

Introducing the Interview:

Thank you for your willingness to speak with me today regarding your experiences in the COASST program. I look forward to learning more about your experiences as a COASST volunteer. I've got several general questions I'd like to discuss for the next hour to hour and a half concerning your role as a volunteer, what

volunteering means to you, your thoughts and feelings about this beach, and your interactions with the environment. There are no right or wrong answers, so please feel free to share as much or as little as you'd like. Don't hesitate to ask for clarification if needed. With your permission, I'd like to audio record our conversation so that I might transcribe it for review. You are under no obligation to answer any question you are not comfortable with and can ask me to turn off the audio recorder at any time.

- To start out, could you share a little bit about yourself and your history with this place or area? How long have you lived here? For how long have you visited this beach? What brought you to this area or beach initially?
 - *Could you tell me a little more about what keeps you busy these days? Do you currently work? Do you have children? What kinds of hobbies, projects, or efforts do you invest much of your time in?*
 - *How did you get involved with the COASST project? How did you find out about the program and why did you decide to participate?*
 - *What interested you most about the program initially? What would you say was your primary motivation to volunteer to begin with? Did you have an interest in birds before you started the COASST project?*
 - *How do you juggle your COASST volunteer work with all the other things you do?*
- For your personally, what is the value of what you are doing as a COASST volunteer? Why is participation in COASST important to you and what do you gain from the experience?

- *Is the opportunity to learn new skills or knowledge important? How about the social aspects of volunteering (interacting with other people)? Or the feelings you get when you are here?*
- Now thinking in a broader context, what is the value of what you are doing as a COASST volunteer for science or society?
 - *Do you know how the information you collect is used? What kinds of questions does it help answer? How does it contribute to scientific research?*
 - *Why is it important that this beach be a part of the project? What is unique about this place or the way it is managed?*
- Do you feel like you have changed in any way since you started volunteering with COASST?
 - *What about the things you know about the coastal ecosystem? Have you learned new skills or information?*
 - *In general, what has this beach or the creatures here taught you that you don't think you could have learned in any other setting?*
 - *How about your thoughts about the value of coastal ecosystems or the role humans should play in managing coastal areas?*
 - *Any personal changes, like with your attitudes, perspectives, values, or behaviors?*
 - *Has your motivation to participate (i.e. the reason you are willing to volunteer) changed since you have been a part of the program? Have your interests changed since then (i.e. initially you were interested in the birds, now you are interested in the causes of coastal pollution)?*

- *Where do you think these changes have come from? What do you attribute them to?*
- Now I'd like to focus a bit more on your specific survey beach site. I'll start out with an open-ended question that you may need some time to think about: Can you tell me if your beach has any special meaning to you? Do you find any particular meaning at your beach and where does that come from? What factors influence the meaning you find at your beach and how has that changed since you started volunteering with COASST?
 - *Is your beach the only place that you find that kind of meaning or can you get it elsewhere? Is there anything unique about your beach?*
 - *If I were to ask you to try to describe the kind of connection you feel to your beach using a metaphor of another place, what might you say? Does it feel more like the connection you feel to your home, to your office space, to a classroom, vacation spot, recreational venue, or something else?*
 - *What is most significant to you about your beach? Is it the birds and animals, the physical properties of the beach, the history or culture of the place, the community or social dimensions, or something else?*
 - *Can you tell me if and how your beach influences the kind of person you are. Do you consider your beach to be a part of you? Is there any spiritual or philosophical connection you feel to your beach?*
 - *Has the way you think or feel about your beach changed since you first started the COASST program? How? In what ways?*

- *Is there anything about your beach now that you understand or are aware of that you weren't before you started COASST participation? Does your growing scientific understanding about the area impact the way you feel about it?*
- *I'd like to ask you to think about something that you are very attached to (i.e. a person, a place, a thing). For a reference point, let's say on a scale of 1-10, that will be a 10. Now think of something that might be more like a 5, something you are connected to and might advocate for, but that you aren't really attached to.*
 - *Now consider those same reference points while thinking of a scale from 1-10 with 10 being very attached and 1 being not at all attached. Where does your beach fall on that scale?*
 - *Would you say this level has changed at all since you first started volunteering with COASST? If so, what level would you say you started at?*
- Finally, I'd like to talk more about your thoughts about nature or the natural world. There are many ways to think about nature, and different people may define the concept in diverse ways. Most of us don't think about it that often so I realize this may be a tough question to begin with. Keep in mind that there is no right or wrong way to define nature and I'm not looking for a specific answer here. Take as much time as you need.

- *When you think of the concept of nature or the natural world, what does it mean to you? Can you tell me about what you think or feel about the natural world?*
- *Are there particular parts of the natural world that make your beach important to you (i.e. the colors of the water, the types of plants or birds found here, etc.)?*
- *Again thinking of that scale of 1-10, how attached would you say you feel generally to the natural world? Have you always felt this way?*
- *Do your thoughts or feelings about the natural world influence the degree to which you value your COASST volunteer work that we discussed earlier?*
- Is there anything else you'd like to share about the topics we've discussed today or any question or topic you would like to revisit before we finish up?

APPENDIX D

PROJECT LEADER INTERVIEW PROTOCOL

- *History & Scope of the Project*
 - Can you give me a bit of background on the COASST program? How long has it been around? How was it started? Why was it started?
 - How has COASST changed and grown since it first started?
 - What are the major goals and objectives of the program?
 - Have these changed over time? How do you meet these goals?
 - Why is the project important? What kind of information does it provide, or outcomes does it aspire to create?
 - Are there aspects of the program that are designed to create an ethic of care for the environment? For a specific environment or place?
- *Organizational Process & Management*
 - Can you describe your program management team or process? Do you have regional leaders/coordinators or individual team leaders?
 - What does the structure of administration or coordination look like?
 - How do you select beaches for the study? Can volunteers suggest a beach? Are they pre-selected? Do volunteers often come to you with suggestions for new beaches to add to the program?

- Considering the beaches that are part of the program today, what percentage would you say were added because of a volunteer suggestion?
 - What is the process involved in training your volunteers? What elements does training include? How long does it take?
 - Can you tell me more about the purpose behind the various elements of the training program?
 - Who supports this project from an organizational standpoint? Are there major organizations, funding streams that have played a key role?
- *Volunteer Characteristics & Experience*
 - How do you recruit volunteers for the program? Are there particular groups of individuals you generally target?
 - In your experience, are there specific groups of folks that tend to be more drawn towards the program?
 - Can you tell me more about your volunteers? How much time do they commit to the program on average?
 - If you had to characterize them in some way, what characteristics might you describe (personality, socio-economic, education level, etc.?)
 - Do you have any data on volunteer characteristics?
 - What would you say are some of the more common motivators for volunteers who choose to participate in the COASST program?
 - Do they volunteer for specific reasons do you think? Why do people tell you they volunteer?

- Have you ever measured volunteer satisfaction with the program? If so, what kinds of things did you find?
 - What tend to be those things that volunteers enjoy the most about participation? What do they seem to value the most about their participation?
- Once you have trained volunteers and they are certified to begin service, do you have any trouble keeping them involved or committed to the program?
- What types of volunteers have you found are more reliable, more invested over time?
 - Do these folks share any specific characteristics that you've noticed?
- *Project Outcomes & Connection to Place*
 - What do you think are some of the greatest outcomes/benefits volunteers in this program receive from their work?
 - Are these outcomes immediate or do they develop over time?
 - Based on your experience with volunteers, do any develop significant bonds with the places they survey for the project? If so, how do you know these bonds have developed?
 - From your experience, what do you think the beaches in the project mean to the program volunteers? What about the birds or other coastal animals/ecosystems?
 - Have you noticed any changes that occur among volunteers the more they engage in the program or the longer they participate? Have volunteers themselves communicated any of these changes/impacts to you?

- How important do you think the specific beaches where volunteers participate in COASST are to the volunteers themselves? Does this change over time as the volunteers continue to engage in the program?

APPENDIX E

PERMISSION TO REPRINT FIGURE 4.1

Figure Cited in: Shirk, J. L., Ballard, H.L., Wilderman, C.C., Phillips, T., Wiggins, A., Jordan, R. ... Bonney, R. (2012). Public participation in scientific research: a framework for deliberate design. *Ecology and Society* 17(2), 29.

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Correspondence with First Author:

From Benjamin K. Haywood (haywoodb@email.sc.edu) on 1/18/2014

Dear Jennifer,

I am writing to request permission to use a figure in a recent article of yours in my dissertation. I'd like to use Figure 1 in the article cited below in one of my chapters. According to the information on the Ecology and Society webpage, permissions for use are determined by the article author, so I thought I would check with you as you are the first author. My dissertation will be created and stored in electronic form, so the figure (with appropriate attribution) would be included in the full electronic version of my dissertation.

Sincerely,
Ben

Response from Jennifer L. Shirk (jls223@cornell.edu) on 1/21/2014

As for the figure, I'm glad you find this useful. I'm happy to have you use it and cite it, and I'm excited to see how you draw on this in your work. Let me know if you need any more formal permission for the purposes of your committee/grad school.

Best, Jennifer

APPENDIX F

COASST PARTICIPANT PROGRAM OUTCOMES EXPANDED

Volunteer participation outcomes fell within three major categories, including building connection, education & awareness, and satisfaction & health. In total, seven significant outcomes were identified, reviewed below in detail with evidence from the statements of COASSTers to demonstrate each.

Education and Awareness

- *Greater Awareness & Appreciation for the Coast*

If you don't go to a place like that on a regular basis, then you don't recognize the actual change of the physical structure of the beach as much as we do. (Karl)

Perhaps in part because of more frequent visits to the beach, COASST volunteers in this study noted an increased awareness and appreciation of coastal environments overall. Awareness outcomes are slightly different than outcomes around knowledge as articulated below. Awareness implies a heightened perception or consciousness of a phenomenon, but not necessarily an understanding of that phenomenon. Sensory experiences in specific places allow COASST participants to become more aware of those places and the inhabitants, processes, and characteristics of that place. Martha, Dean, and Chris help explain the nature of increased awareness outcomes.

It makes you more aware I think. Just paying attention. Just like now, every time we go to our beach, no matter what month it is, we count how many eagles are on the way to the beach, because you can see them changing every month. (Martha)

Actually it is funny because when we started this, I had to think really hard to think if I have ever seen a dead bird on the beach. Now, you are so sensitized to it, you see them everywhere, and not just beaches. (Dean)

I used to do surf fishing and I would look for different coves and stuff and shallow spots and I was in tune with that. Now that I'm at a fixed beach, it changes, and I can't figure out why it changes, but I realize it has been doing that long before I was born obviously. It has been doing it the whole time and I never knew that, never saw that. All these things that were going on that were always happening that you just never saw. (Chris)

For participants like Chris, the sense of surprise and excitement that comes with a greater attentiveness to beaches and coastal processes is evident. Chris was not alone in expressing a sense of amazement that you could recognize so little of a phenomenon right under your nose. Of course such awareness was not always positive. A greater awareness of marine debris was a common theme among study participants, leading to a sense of frustration and concern.

That [marine debris] is another thing we've become more aware of, based on the currents out in the ocean and what is going on out there. The plastics have been very distressing. It is just, I mean, we find them everywhere. We were down in Oregon a couple of springs ago and on one of the beaches down there, it was just all these little squares of plastic. You could tell where the last tide was, this big row of plastic. And they say that we've all got plastic in us because it never breaks down. It gets smaller, but it never goes away. So some of those things we've become more aware of. (Deloris)

Like Deloris, many participants spoke of seeing the beach with a completely new "lens" after participating in COASST, a perspective that provided a new appreciation for the dynamics of coastal environments and the services they provide. For some, a growing appreciation for the beach itself amplified appreciation for the data COASST volunteers collect in the aggregate.

This has certainly led to an appreciation for some of the information that COASST volunteers have collected, like the terrible decline of western grebes and common murrelets and marbled murrelets, you name it. When

you tell people there has been a significant decline of seabirds in the Puget Sound, they would say how do you know that? And it is always really impressive when you say, the data is being collected by a number of local people, including myself and other COASST volunteers. (Zoe)

- *Learning & Gaining Knowledge*

The mental exercise that so many COASST volunteers appreciate results from the stimulation provided by learning in the COASST program. Even before volunteers are able to start surveying beaches, they go through an intensive training process, where participants learn basics about bird biology and anatomy, the life cycles of specific species, coastal geomorphology, and deposition processes and rates. Additionally, new volunteers are exposed to scientific research processes and strategies with regards to collecting, measuring, and identifying beached birds, novel concepts for many participants who do not have a background in science or science research. That is all before data collection starts! As a whole, when asked what personal outcomes have resulted from COASST participation, increased learning and knowledge was the most frequently expressed outcome among study participants. Participants attribute the knowledge gain obtained from the program to initial and ongoing volunteer training, the expertise of program staff, the support materials provided to volunteers (manuals, guides), and to on-the-ground experiential learning processes. Four broad areas of learning were noted by study participants (Table F.1).

Table F.1: Prominent Areas of Learning and Knowledge Gain

Area of Knowledge Gain	Description
<i>Learning about Beaches and Coastal Processes</i>	Knowledge about general coastal ecology, including tides and tide patterns; marine species (fish, mammals, birds) and distribution; geological formations, components, and influences; aeolian processes and change; and offshore variables (e.g. nutrient upwelling). An overall increase in

	understanding related to the processes that shape the beach environment, including the influence of water and waves, wind, and erosion, is a part of this category.
<i>Learning about Bird Biology</i>	Knowledge about pelagic and shorebird populations, species distribution and status, and threats to coastal bird survival from a individual to population level. Increased ability to identify and recognize bird species, understand bird anatomy, and distinguish among diverse morphological types. More detailed knowledge about the life cycles of species of interest, the phenological patterns associated with specific species, and the unique behavior or occupied niche of targeted species is included in this category.
<i>Learning about Science Processes and Skills</i>	Knowledge about the scientific process, data reliability and validity, and the aspects and particularities involved in data collection and analysis. In addition, cultivating habits of mind and behavior that improve the accuracy of observation and monitoring is a part of this learning category. Familiarity with the use of specific instrumentation, methodological systems (e.g. identification keys), and sampling protocols is also relevant.
<i>Learning about Socio-Ecological Systems and Human Impact</i>	Knowledge about the broader role of coasts in ecosystems and human societies, including the influence of ocean systems on land surface precipitation and temperature, near-shore species and environments, as well as the role oceans play in human economies and cultural traditions. Additionally, this includes learning associated with the impact human societies have had and continue to have on coastal environments (e.g. marine debris).

Naturally, the specific learning outcome areas expressed by study participants and the level of learning indicated ranged among study respondents. COASST participants come to the program with a wide range of pre-existing knowledge in any number of the areas outlined above. In some cases, participants noted the program was a window into a new world of learning and understanding altogether.

I had never seen or heard of a Common Murre before until I started doing this. A friend of mine, she got me this book, and it is a pop-up book and it was talking about the different pelagic shorebirds along the Oregon coast. And it was saying that the Common Murre is one of the most common birds here. And I thought, I've never even heard of a Common Murre, how can it be the most common bird here? And then I start doing these surveys and sure enough, I found out they are. (Wes)

In other instances, the information encountered by volunteers was not necessarily novel, but presented or experienced in a nuanced fashion.

We get to see pelagic birds more than we would otherwise. They are dead, but unless you go out on a boat, you don't see pelagic birds hardly. So we are able to see birds up close that we normally wouldn't on land. But also, whether they are pelagic or some local birds that we know well, like gulls, we get to see them up close and learn the subtleties of identification when you can have them in the hand. You see the birds in a new way. (Mason).

While this study was not designed to test specific change in the rate or level of knowledge among participants, the stories and expressions shared by study participants regarding program outcomes suggests a major outcome of the program involves changes in levels of knowledge and understanding on a range of topics.

Health and Satisfaction

- *Sense of Satisfaction and Contribution*

I feel as though I'm contributing. I mean I don't feel as though I'm being lazy. I feel as though I'm fully an active contributor, so that makes me feel virtuous. (Brooke)

For many different reasons, participants expressed a common sense of satisfaction as a personal outcome of participating in COASST. Not only for the evidentiary value of the data collected, as expressed by Brooke above, but given the scope and scale of the project, participants are also aware that the data collected wouldn't be available were it not for committed volunteers.

I think there is value in what we collect as a whole. There is no other way, you know, you couldn't come down here for a week and count birds along this whole twelve mile peninsula and come up with much. But if you have different people recording each section, and over a year or two or three years time you start getting a pattern, and the pattern stays pretty much about the same, there is value there. (Gary)

Because COASST is dependent on volunteer contributors up and down the Pacific Northwest, participants take pride in contributing their small part of the overall large-scale project. Volunteers like Gary develop a strong sense of contribution because they find value in what they are doing and the mission and goals of the COASST research project overall. Contributing to such a "worthy cause" brings much fulfillment for many participants. A majority of the participants in this study were retired (a trend among COASST participants in general), and the fulfillment found through COASST participation in many ways connected to the unique aspects of that life stage.

Thinking about citizen science. I think there are lot of people who don't want to be in the workforce any more. They've done their stint, which may or may not have been rewarding to them. But now that they are retired, they may still want to contribute in some way. And COASST is one way that some of us can. Others will find another way to contribute to society. (Lillian)

In the greater picture, I am 74 years old, my mother and aunt and another aunt both went down at age 80, which tells you that actuarially, I've probably got about six years left, give or take. Lord willing it is sixteen, but who knows. So I don't want to mess around with stuff that means nothing. Well ok, I do. The stuff I like. But this has value, and I'm very happy to do this. We are sort of saying no to things that don't have a lot of value. But I like the idea, long range type stuff with COASST, decades going back, you can see changes. One of the big values of the CBC with the Audubon is the distance that is has gone. And you can see how things change. I like being a part of that. (Leah)

For participants like Leah and Lillian, the satisfaction that results from participation in COASST is greater than a fleeting sense of emotional fulfillment (like contentment after a good meal) and assumes a more existential nature. COASST is a way

to contribute to society, or science, or conservation in a way that has the potential for lasting impact. This satisfaction stems from the perceived value of participant observations and the goals of the program, and is reinforced by the appreciation volunteers feel from COASST administrators, as well as other beach residents and visitors. In fact, the public education benefits provided to members of the community that utilize COASST beach sites can also provide a sense of contribution for participants. Not only does participation allow the contribution of valuable observations and insight, but may also expand the knowledge and awareness of those that utilize the beach as well. Sharing about her role as public educator, Zoe shares her delight that she has become somewhat of a resident naturalist at her beach.

There are a lot of people always very curious about what you are doing down there. So I'm always fascinated by the numbers of people that want to know what you are seeing. And I enjoy sharing information with them. It is not uncommon for someone to be out doing yard work or whatever but they always want to know what is happening. Somebody asked me one day, how often I give tours. I said really I don't give tours. I'm just down here looking around for COASST. I guess I could start a little small business here! (Zoe)

- *Physical/Mental Health*

Although time spent with COASST colleagues can be rewarding for participants, the surveys themselves aren't always a stroll in the park. Many of the beaches surveyed by participants can be challenging to traverse due to the mixture of sand, rock, and wood that comprises many beaches in the Pacific Northwest. Each survey site is at least one kilometer in length, meaning an up and down walk involves traversing a mile and a quarter at a minimum. Because of the physical nature of volunteer responsibilities, many study participants expressed an appreciation for the way in which engagement in the

program encourages physical health. Monthly surveys provide a reason to get up and get moving for these volunteers. Again, because many of the volunteers in this program are of retirement age, this beneficial outcome of participation adds additional weight to the value of program participation.

It is just like going to the gym or going swimming or cycling, I try to keep track of my exercise days, and it keeps me honest. I have to go do that dead bird thing, no matter what the weather is. (Lucy)

The aging community now doesn't want to just sit around in their EZ chair and watch a TV. There are other things to do. If you want to live longer, you have to keep moving. So that helps. Oh gee, I gotta go out in this storm and look at dead birds. You have a better mind if you exercise it a lot and you can stay above things like dementia. (Daisy)

Here, Lucy and Daisy stress the physical benefits of having an obligation to conduct a survey at least once a month. Very few study participants suggested that they were motivated to participate in the program because of the health benefits, yet this added bonus is a valued outcome for COASST volunteers. And it isn't just the cardiovascular or muscular-skeleton outcomes participants value. As Daisy and Jackie point out, the program helps exercise the brain a well.

Now everything is like, I forgot something, so I must have Alzheimer's and it is scary. It is very, very scary for people my age. So this is just one more thing I can do. Use it or lose it. That is what it comes down to. If you don't use your brain, it goes away, it has to constantly be exercised. And COASST helps me do that. (Daisy)

I'm not a science person and for me, I just haven't been part of this kind of a project. It was a lot more new and difficult for me than I think of it as being for people that have been trained in the physical sciences. So I think of it as an anti-Alzheimer's activity. It has forged new pathways in my old sagging brain. (Jackie)

Not only did participants note an appreciation for outcomes associated with physical health, but engaging in COASST can also facilitate mental health benefits. For

many participants, this was an unanticipated outcome of volunteering. Several participants spoke of initial concerns about committing to the program for fear of becoming too tied down or overburdened by volunteer activities. A majority of study participants are involved in any number of other community volunteer efforts in addition to their COASST engagement. Often, these commitments can be demanding and tiring and most participants expressed an assumption that COASST would be no different. And yet, a common response among participants asked about the outcomes of participation included comments relating to increased mental health. For these volunteers, completing a monthly survey provides a chance to escape and unwind, relieving stress and improving mental outlook. The particular nature and setting of COASST sites undoubtedly has something to do with this as does the fact that human societies often associate natural places with calmness and relaxation. Even still, beyond these influences, the monthly habit that COASST encourages where individuals can get away from their daily routine, set an intentional and purposeful walking pace, and connect with an outdoor environment can provide value with regards to overall mental health.

Building Connection

- *Social/Community Connections*

Satisfaction not only comes from the perceived scientific value of COASST, but also from the social outcomes often expressed by study participants. In some instances, a broader sense of community and belonging was felt among study participants in spite of the diffusion of participants across geographic space.

Other than the science aspect, I'm really a big believer in community and to have all these people, all these various people, working on a project from so many different places. And that is a community of people. I've

met so many people in this county that do this [COASST], and they are great. This is an odd thing that we have in common and so we are very different people, but we are just a large family really. That is very appealing to me. The connection to community is a huge benefit of it. (Lucy)

On a more local level, a number of COASST volunteers have developed connections with other volunteers in their immediate area, forming bonds and friendships that are of great value. Although the degree of such local connection and cohesion varied widely among participants in the various geographic hubs included in this study, several smaller social groups have formed among COASST participants in localized areas. In particular, members of one study community have initiated more regular interaction among program participants, reinforcing social bonds and enhancing program participation. This connection to local community was part of the draw of the program for some.

It took me almost a year [from moving here] to get into COASST but I have met some really cool people and I'm at the point now where I can walk around town and recognize people that I know. That is a good feeling. I'm not a huge social person but it is nice to feel like you are a part of something. You know people are out here, if you needed something you would have an idea about who to talk to. (Aashka)

Finally, at a micro-level, COASST participation has facilitated friendships among survey partners as well. The program encourages participants to partner with at least one person to survey each beach site. Although not all participants have partners, having two people involved substantially improves the efficiency at which surveys can be conducted and enhances the safety of volunteers. For some participants, the connections forged with other people via engagement in the COASST program have been meaningful and affirming, in many cases enhancing the overall responsibility felt for the program itself.

I think that the four of us who do that mile now, we kind of keep each other motivated, we can keep it going because we have each other. And we actually all enjoy each other. I realize it is an interesting thing to form a friendship over, looking for dead birds, but if you are going to be walking all that time, you end up talking about whatever is on your mind and it actually has been a very nice friendship to develop over that. So I think that that actually is quite a nice thing. (Jenny)

- *Connection to Wildlife and Nature*

Several study participants expressed the development of a rich sense of connection to wildlife or "nature" because of more frequent experiences outdoors. Recognizing that the concept of "nature" is defined and interpreted in many different ways, this study did not attempt to have participants define what nature means to them. Nonetheless, participants spoke of how program experiences at their survey beach have helped facilitate a connection to nature, however defined, that has grown in intensity and import. Brooke shared the intensity of an experience she had during migration season that she suggested helped forge a strong tie with wildlife.

People say there are just thousands and thousands and thousands of birds living on the water out there. It wasn't made real to me, until I saw them on the beach. One day at the beach, I was doing the survey by myself and it was September or October, last year, and there was a haze over the water, fog kind of just clearing off about 2pm in the afternoon maybe. And there I was in the sun and I looked out over the water and I saw a line of birds flying south. And it wasn't exactly single file, it was groups, but a constant line, like a train of railcars, that just goes on for miles. But it was just beyond, in the haze, just beyond my ability to see them clearly. And I kept walking and doing my mile and a half and I would keep looking up and they were still there flying south. And I kept walking, and I looked up, and when I finished they were still flying! That is how many birds there were, there were thousands and thousands and thousands flying south. And I kept thinking, am I seeing an illusion? Does someone keep pushing rewind? And I stood on the dune as I was leaving, just thinking when is it going to end, this line of birds. And it didn't. I left before it finished. And so I saw that as a miracle. I have never seen anything like that before. Just all these birds heading south. And the numbers of them. Seriously, over the course of a half an hour. It was amazing, just amazing. I couldn't stop

thinking about it for days and days and days. How great it was to be connected to something like that. (Brooke)

This type of connection is not necessarily novel for participants, as some expressed life-long interest and fascination with wildlife and natural spaces. But for some, participation in the program seems to have heightened feelings of connection to the natural world or strengthened bonds with a particular dimension of wildlife. For Harmony, the birds on her beach have even entered her dreams.

I dream about them sometimes. Sometimes I am dreaming I am here on the beach. I dreamt that there was one [bird] on my property, like it followed me home. Like 'what are you doing here, wrong habitat?' So they have certainly entered my subconscious mind as I've grow more connected. It is nice to be more in touch with the diversity of other beings. (Harmony)

Although a small sub-set of study participants expressed that consistent and frequent outdoor activities were already a major part of their routine before COASST participation, more often than not, participants credited the program with just the extra nudge needed to get out of the house or office and explore outdoor spaces. Even among those that do get outdoors more often, many expressed an appreciation for the fact that COASST prompts regular interact with a specific beach, or beaches in general.

Before I started COASSTing I probably went to the beach about once a year. If the world is divided into ocean people and mountain people, I'm a mountain person. I would go hike in the redwood forests. So this was a requirement to go to a different place and that was kind of interesting too because otherwise I still don't go to the beach much for fun, ever. (Janae)

Other participants, even those who had lived in and around their beaches for decades, noted the ease at which they are able to put off time outdoors, filling schedules and routines with other experiences and neglecting to engage regularly in outdoor spaces. For some, this is particularly the case given the less than ideal weather of many outer

coastal beaches in the Pacific Northwest during certain parts of the year.

And that is what I think has been a really good thing for me. I would come down to the beach, but I wouldn't necessarily come down on a regular basis. And now I do. And I think I know it a lot better and probably enjoy it a lot more than I would have if I hadn't done it. So it is good for me. (Lillian)

The weather stinks so much of the year. Even in the summer, there is the fog until mid-afternoon and so it is such a different coast from the east coast. So that is why I wanted COASST to force me to go out there, because it is easy to say, ah, I bet it is still foggy there this morning. (Brooke)

Like Brooke, the word "force" was used by many participants to describe how the program pushes them to get up and go to the beach, an outcome that is much appreciated, but, at least according to these participants, less likely to occur if it weren't for the commitment and obligation that comes with program participation. Thorough program training, publications, and even a participant "contract" between the volunteer and COASST administration reinforce the essential nature of regular and consistent surveys to enhance the validity and rigor of participant observations. As such, volunteers exhibit a dedication to the research process and protocol that facilitates a minimum of monthly trips to experience the coastal environment.

- *Altered Sense of Place and Connection*

Finally, highlighted in detail elsewhere (see chapter six), some participants pointed towards an increased sense of connection to the specific beach area where they survey as an outcome of program participation precipitated by altered or enhanced meaning associated with that place.

We had never visited that beach before COASST. Now we call it our beach and are kind of a little protective of it. I mean, when they do coastal cleanups, if we are around, we will go and sign up to do that beach.

Because it is our beach. We keep the phone numbers of all the tribal biologists so if we see something out there in the beach that is wrong, like a stranded animal, we will call it in. It has become a part of our lives now, a really important place. (Martha)

But we walk it every month and we clean it. So we look at the changes that are made and everything. But it is "MY" beach. Nobody else has been on that beach to do it. So it is like I own that beach and then a couple of neighbors that live around there, they keep their eye on it and they say, 'Marian and them will be down there and they will pick that stuff up' and so they know, they know who's beach that is. I'm a keeper of the beach. (Marian)

APPENDIX G

DIMENSIONS OF PLACE MEANING AND CATALYSTS OF PLACE

ATTACHMENT EXPANDED

1. *Symbolic Connection to the Ocean*

Beaches, oceans, and coastal environments often hold particular emblematic meanings in human societies. Scholars within emotional geography have closely explored relationships between people and coastal environments to uncover common symbolic meanings ascribed to coastal areas (Kearns and Collins 2012). Similarly, Kellert (2005) writes of a shared sense of sacredness and reverence that many societies relate to the ocean. This first dimension of meaning uncovered among COASST volunteers relates to the overall beauty, mystique, and wonder of the ocean and a deep desire to connect with the mystery and power of a coastal place.

I will find that sometimes it is really stressful to get out to my beach. And I get out there and I literally open the door and I hear the waves, and it is just totally relaxing. I just love being down here, even if it is raining. It is just relaxing for me, just hearing the ocean and the waves. Being by the water gives me more internal peace. (Eva)

As Eva expressed, her COASST site serves as a location in which to connect to this vast body of water to become inundated in the sensual experiences of the beach. The meaning found there relates to an overall interpretation of the affect of the coastal environment, combined with an emotional response of the participant. While many participants spoke of the need to be near water in general, several went further to suggest

that it isn't just any water they prefer, but that saltwater "runs in their blood". For some, this connection to the ocean was related to a history or background with the coast, as in those that reflected on the many ways in which their lives had been tied to the ocean. Others expressed a more intrinsic connection to hydrological environments, suggesting that something about who they are is inherently connected to the water.

I just like the ocean, to me that is one of those places where when everything goes south, you hop in the car and you go out to the ocean and find a sand dune to sit on. It just sort of puts everything back in perspective. (Lucy)

Others still noted that COASST served as an avenue to connect to the magic of the ocean in a new or unsuspecting way. Either because COASST requires regular interaction with a shoreline environment or focuses attention on the environment in a novel way, these participants expressed a greater appreciation for the beauty and vastness of the place.

The water is very cold here and the sea is very rough and I really don't like going in the water and so having the opportunity to go to the beach and feel like I'm doing something important because it is not all that much fun being there, it gave me a reason to go. And then once I started going I realized, you know, how enjoyable the experience would be. And now I appreciate the weather change and the beauty of the change in the place - the fog comes in, the fog goes out... (Kent)

Few participants in this study travel long distances from their inland home to their COASST site on the open water, ranging from 80 to 150 miles one way. A desire to connect to the immense ocean was particularly evident among these participants, who all indicated that the meaning found at the ocean was a big component of their willingness to travel that far on a monthly basis.

2. Physical and Mental Stimulation

I'm getting old and more pieces of me come out and go into a jar at night. I'm 63 years old, my hearing is shot to shit, my vision is going. I have big holes in my memory. So I'm fading into the night and it is a place where you can use your senses. (Connor)

Speaking of his COASST site, Connor finds meaning in the fact that his survey site serves as a place to exercise his body and mind. The COASST program as a whole is comprised of a high number of retired individuals, many of whom appreciate the health benefits associated with the regular walks required for the monthly beached bird survey. In fact, a number of participants indicated that the program as a whole was enticing initially because of the opportunity for mental or physical exercise. COASST sites are an average of a kilometer long, which means each survey involves walking about two kilometers total, and often more than that given the pattern of up and down walking utilized by many participants in order to canvass more beach area. Through repetitive physical exercise in a place, participants ascribe meaning to those sites related to personal health benefits.

But the health benefits aren't just physical. Just as often, participants expressed appreciation for the mental stimulation that occurs on their particular beach during a COASST survey. One participant shared her feelings that each survey was like conducting a "treasure hunt" on the beach, while others noted an appreciation for the mental challenge of searching for clues, recording observations of the environment, and utilizing resources to identify and process beached birds. For many study participants, COASST beaches, and the birds found there, become significant sites for a pretty simple reason - they help people stay young.

You have a better mind if you exercise it a lot and you can stay above things like dementia. Now everything is like, I forgot something, so I must have Alzheimer's. And it is scary. It is very, very scary for people my age.

So this is just one more thing I can do. Use it or lose it. That is what it comes down to. If you don't use your brain, it goes away. It has to constantly be exercised. (Daisy)

3. *Meeting Place*

Although some COASST participants adopt a beach and conduct surveys alone, volunteers are encouraged to conduct surveys with a partner. For one reason, finding and processing beached birds is much more convenient and efficient with at least two people. But having a partner also encourages safety (sneaker waves are a real threat on many beaches) and accountability when it comes to ensuring monthly surveys are completed and data submitted. For many participants, the social interaction that comes with participation also adds to the meaning of their COASST survey site. Speaking of the small team of individuals who canvass a particularly active beach, this participant noted the value of interacting with her volunteer colleagues.

There is a social element too. I truly enjoy going out to the beach with the group that we go out with. And I truly enjoy meeting new people all the time and learning about their interests and their expertise as we walk the beach. That is a fun thing about it. (Marian)

For participants like Marian, the beach becomes a valuable meeting place. Many participants expressed that their COASST site has become a special "hang-out" spot for regular interaction among partners and their families, even outside the monthly survey obligation. Further still, for many participants who credit COASST with getting them out on the coast more often, the beach has become a site for enhanced and more frequent community connection. With regular walks on the beach, other habitual visitors become familiar and interactions are more regular. The nature of COASST participant responsibilities (processing and tagging dead birds) often serves as a springboard for curious onlookers to inquire about the activity, providing COASST participants with

meaningful opportunities to share more about the program, the birds of the area, or the overall goals of scientific research. Such social interactions with program partners, community members, or beach visitors add to the meaning participants ascribe to their survey sites, an aspect many participants noted was an unanticipated benefit of the program. Having engaged in COASST at the same site for over a decade, Jenny shared that although age has slowed her team down and caused them to question whether or not they should continue in the program, they can't let go of their beach because it has been such an important part of regular meaningful interactions among each other.

We actually all enjoy each other and it is an interesting thing to form a friendship over, but if you are going to be walking all that time, you end up talking about whatever is on your mind and it actually has been a very nice friendship to develop over that. So I think that that actually is quite a nice thing. (Jokingly) I think we just don't know how to get out of it!
(Jenny)

4. *Encounters with Wildlife and "Nature"*

Novelists and writers have long relied on natural settings as backdrop for grand adventures and exploration. For many COASST participants, this same sense of escapade is found at their survey site. These sites present the opportunity to study, investigate, and discover the natural world around them. Although personal interests vary, many participants shared the excitement they find while exploring their COASST site; the site is always changing, with new secrets available each visit. Study participants expressed satisfaction with repetitive visits to the same site, as this allows them to notice more subtle changes and shifts along the beach over time, inspiring curiosity and interest. These ever evolving landscapes always present something new and contain meaning because they become laboratories of learning, providing plenty of opportunity to explore new concepts, ideas, and creatures. Specifically, COASST sites are valued because they

are places which allow the interaction, in many cases intimate interaction, with birds and other wildlife, both dead and alive.

But this beach, I just feel so tied to because the [pigeon guillemot] colony is here. I've clocked over 500 hours watching these birds, I don't know how many hours sitting here looking at these waters and birds. (Harmony)

Not surprisingly, many participants have a pre-existing interest in birds. The COASST program is focused on birds and naturally draws a certain group of individuals who participate for that reason. However, the level of pre-existing interest and engagement with birds was quite variable among study participants. For some, birds have been a lifelong passion, and engagement in the COASST program was a means to expand knowledge and see birds up close. For others, a nascent interest in birds existed, but COASST presented the opportunity to take a first foray into bird identification. Given this connection to birds and other wildlife, participants shared that COASST survey sites hold meaning because they provide a place in which to connect with and engage more deeply with wildlife.

I find human behavior is often appallingly awful and it is appallingly awful particularly in regard to how we treat species other than our own. I mean we don't even treat our own very well, but other species are simply not worthy of consideration. And I find that very annoying and so I find it is a whole lot more pleasant frankly to be out talking to a bird. (Sophia)

With more engagement over time, many participants noted an increase in knowledge about the annual phenology of species that utilize that place. Accordingly, participants learn to expect specific species, varieties, or certain frequencies of species on their beach at different times of the year and come to depend on these regular delights. Others still find value in their survey sites because they are good areas to see marine mammals like whales, seals, or otters, even if no birds are seen. In fact, many participants

indicated that part of their criteria in selecting a survey site initially was to find a place that provided the most potential for interaction with wildlife. Those individuals that believe their specific site presents a unique or unusual opportunity in this regard (e.g. more birds than the neighboring beach), expressed an increased attachment to that place (see the related section below). Similarly, numerous participants noted finding a larger connection with "nature" or "the environment" at their site. For these individuals, their COASST site is a symbolic representation of "nature" and a special site in which COASSTers can reconnect or engage with natural phenomenon.

5. Ecological Value & Stewardship

Evans et al. (2005, p 589) have suggested that one of four components of sense of place is a "disposition to care" about a particular site. Typifying such an ethic, a number of COASST participants expressed a rich sense of meaning around the stewardship associated with their survey site.

For me, it gets so that you get to know the beach and you start thinking of it as your own. That part of the beach is my beach. "Hey everybody, keep it clean." "What is that person doing on my beach?" You kind of take possession of it. (Peyton)

Not only is the desire to engage in stewardship of their beaches part of larger feelings of environmental ethics, but for many COASST participants, the desire to care for their specific beach is connected with the significance of that site as a place on which valuable information is collected.

I see it as an obligation to honor those lives [of dead birds]. Even in death, we have to honor their lives, because just in collecting the data, hopefully that will resolve whether they died of natural causes or whether there is a reason for their death. Part of that stewardship I think is what draws me to that place. There is just something I can't describe that I feel to be honored to be around. (Owen)

Not only then does the site itself contain meaning as a place in which participants can enact a larger sense of responsibility for natural resources, but the activity performed in that place contributes even greater weight to the significance of the place as a site which deserves care and concern. Repetitive experiences documenting bird mortality, observing change, and, for most participants, collecting trash off the beach, have contributed to a sense of special meaning between participant and place expressed in feelings of responsibility and stewardship. For these participants, their survey beach represents a natural resource worthy of careful management and protection and the meaning that emerges in those places results from the specific behaviors performed in those places that are interpreted to achieve such goals (i.e. documenting long-term change, species health, etc.). Accordingly, many participants expressed more intense meaning around feelings of stewardship the longer they had conducted surveys at their beach. For some, the knowledge of and longevity of service in a place was connected to a sense of stewardship for that place. For these individuals, as participant interaction with and knowledge of the beach increases over time, so does confidence that the participant is enacting stewardship in a meaningful way by contributing valuable observations, documentation, and knowledge of place. As Teresa said, "when people say, what do you do for the environment, I say I count dead birds."

6. *Finding Refuge*

COASST survey sites can also serve as personal refuges for participants in the program. For many participants their survey site has meaning because it provides a get-away, a sense of remoteness or privacy that allows for solitude and respite from other people or responsibilities. Many of the beaches in the COASST program are either

remote, private, or generally less frequented than more popular tourist destinations. While there are some program sites that are regularly frequented by greater amounts of visitors, study participants are often accustomed to visiting their beaches without encountering any other people, particularly in the cooler winter months. Such isolation can be incredibly rejuvenating for program volunteers.

To me, I might be sad or hurt or upset or somebody I loved to pieces died.
But I can come to my beach, this is my beach, and I think of it as mine.
Because many times I'm out here and there is nobody here but me. (Anna)

While the privacy and solitude associated with survey sites was most often expressed by those who monitor less populated beaches, even those in more populous areas noted that the vastness of the ocean can provide a sense of solace even among other people. These places become sites in which program participants are able to remove themselves from the hussle and bussle of life and find a sense of rest and quite.

But I like it because it is remote and for that reason you can go there on a weekend even, and by the time you get to our outermost beach, you probably wouldn't see anyone, and it is nice to have that solitude.
(Natalie)

For some participants, such privacy allows a chance for spiritual renewal or connection, forging strong metaphysical ties to the place because of spiritual or philosophical encounters or experiences. As such, COASST sites become places in which participants can engage with a sense of heightened awareness and connectedness.

For me, even though nature is raw and tooth and claw, and there is death there just as much as anywhere, that is where I find God, which is a huge word of course, but it is where I feel part of the creation. I feel the life force is humming. A web of life and death. (Brooke).

The meaning derived from the refuge found in these beaches certainly connects with the meaning participants associate with the ocean, particularly with regards to the

ocean as a tranquil and nourishing place. But even more than a connection to the ocean, participants noted the value of these places because they allow one to get away, occupy the mind, and leave the rest of the world behind. Several participants noted that their selection of a beach was, in part, based on the remoteness or level of privacy of the site, indicating that some volunteers may have entered the program seeking that type of connection.

7. Place of Memory and Comfort

Geographers have written about the power of nostalgia to forge emotional bonds between people and significant places. Some have suggested that past spaces or experiences “speak” in present places, going so far as to contend that all meaning in place is tied to the memories of past experiences. Such formative life experiences often include memories with close family and friends, lifetime milestones, or poignant moments. COASST participants demonstrate that meaning associated with survey sites can emerge from associations with previous meaningful experiences at that site or links to other important places. In many of these cases, nostalgic connections to specific beaches provide important meaning for COASST participants. Several study participants expressed survey site meanings associated with a connection between that place or a particular element of that place and significant personal memories that bring comfort and contentment.

I've camped out on those beaches a lot over the years. It is a recreational theatre for me. My kid and I camped out in those beaches and I did beach patrols when I worked there. Good memories out there. And when I was married, my wife and I camped out there a few times and now that I'm divorced, I've been out there with a few other women. I've had some romances out there. (Connor)

COASST sites are meaningful in this case because they connect participants with a particular special life experience, childhood memory, an event with cultural or historical value. For these participants, their survey site is significant because of how it conjures memories of family, growing up, or important people or other places. The COASST site itself may be the place where these events happened, but it also might be a close reminder of another important place, stirring memories of other far away people-place experiences. Either way, the site has special meaning because of the nostalgic or sentimental feelings associated with that place.

I grew up on the east coast, in Rhode Island. I'm a new Englander and I grew up on a large inland body of saltwater called Merganser Bay. And this area reminds me very much of where I grew up. So, my connection to my beach I think is historical, kind of my own family history, living near the shore, and living on the shore. (Zoe)

8. *Establishing and Expanding Roots*

Relph (1976) once wrote about the need people have for "existential insidedness" or the desire to be rooted in a place that creates a sense of "homeness." The metaphor of home is a powerful and often cited one in place studies (Manzo 2003), relating to the need to be understood and belong. Gaston Bachelard (Bachelard 1994, p 6) avers the home as "one of the greatest powers of integration for the thoughts, memories and dreams of mankind." Part of the comfort associated with home connects to feelings of familiarity and comfort, which allows a sense of safety and normalcy. There is something satisfying about being familiar with a place and knowing it intimately. Many COASST participants indicated their survey sites had meaning because they were familiar and comfortable, in some ways expressed as a piece of the fabric of their own identity. This kind of close connection and intimacy with place creates a sense of rootedness that

participants noted was extremely meaningful. Regardless of the imperfections of that particular site, the fact that repeated interaction and investigation of the site has produced a deep acquaintance of place was of value.

The site therefore holds meaning as a place to establish roots and reinforce those ties. For some participants, these feelings existed before involvement in the COASST program and connecting to the site via COASST is like visiting an old friend. Others expressed this type of meaning as a result of increased awareness, knowledge and experience in the place. The deep sense of rooted experience that forms in these places appears to influence the sense of ownership and stewardship felt for place as noted earlier.

Now that I've been doing it, it is now my beach. And I have kind of five years of seeing it in all seasons and pictures that I've taken of how the creeks that come into the beach change in the seasons and over the years. So I've gotten more and more invested in that particular spot. And that kind of deeper, richer knowledge of a place is something that I value. Perhaps a little more so because I have not been able to stay in one place, in one community, more than about twelve years or so. (Caleb)

Place Attachment

As a measure of the emotional intensity of the bond one feels for place, place attachment exposes the strength of relationships between people and specific places. Individuals attach to places when they develop a sense of identity connected to place, dependence on that place, or strong emotional connections with a site. Such attachment can have cognitive, emotional, and functional characteristics. Feelings of attachment are naturally influenced by the meaning and value an individual assigns or finds in place. In addition to asking participants what meaning they find in their COASST sites, they were also asked whether or not they felt attached to their particular beach. Although place

attachment is certainly influenced by and interacts with place meaning, for more information about the differences between these two concepts see chapter six.

Some study participants did suggest a certain level of attachment to their specific beach site, although the nature of this attachment was quite diverse, influenced by varied components of participation as reviewed below. Undoubtedly, the strength of attachment varies as well, although a particular quantitative measure of this strength was not a part of this study given the objectives of understanding the complexity and dimensionality of attachment. Nonetheless, without prompting, nearly all of the participants in this study explicitly used the term "my beach" to reference their specific COASST site. In many cases, these references were more than a descriptive adjective like "let me take you to my beach," but were rather emphatic and emotive.

I wouldn't want anyone else, I mean, I hate it when someone else ever asks to do my beach. Because that is my territory. I mean that pretty much in a fun way, but I'm pretty jealous of that. That is my beach, I've got to do it.
(Mason)

The presence of feelings around possession or custody of the beach suggests that many participants do develop a degree of personal attachment to their COASST sites. As discussed later, two of the six attachment catalysts outlined below (personal investment, programmatic) are directly tied to the nature of the COASST program itself, suggesting salient avenues through which participation in COASST may have influenced feelings of place attachment. Many of these catalysts may also provide clues regarding the overall motivation of participants to volunteer in the COASST program (i.e., previous connection to beach)

1. Personal Investment & Pride

The first attachment catalyst develops as participants consistently invest time and energy at their COASST site. Study participants have accumulated hours walking the beach, canvassing every part, recording detailed observations, and spending time at the site when no one else is around. Many volunteers spoke of experiences on their beach that were less than pleasant - freezing rain, fierce wind, cold breezes, yet these challenging experiences seem to elicit a sense of accomplishment and pride in and of themselves. Such effort in non-idealistic conditions underscores the type of investments participants have made to canvas that particular kilometer of beach and document the birds found there. These regular and dedicated acts of service at a beach, for some, have led to a strong emotional sense of pride and attachment to that place. When asked if her attachment to her beach had grown since she first started the program, Harmony noted:

I've certainly clocked in more hours here so I've got more time under my belt. So I guess I'm more attached, because I've spent a lot of time on it so far. I've invested energy. (Harmony)

A sense of accomplishment associated with watching, documenting, and caring for a specific place over time was evident among these participants, leading to a deep sense of ownership. Among those indicating this type of attachment, all of them shared a commitment to picking up trash on their beach as a part of their COASST work (a common phenomenon for most COASSTers), perhaps also influencing the sense of pride and investment in the place. Sticking with a beach, through good and bad, has strengthened the sense of attachment between person and place for many COASST volunteers.

2. Unique Knowledge/Consistency of Data in Place

Consistency in research protocols and data collection processes is an essential component of long-term biological studies. Regularity in the timing of observations, methods used to collect observations, and categories of classification and analysis can yield powerful results. With this in mind, several study participants expressed attachment to their specific beach because of their confidence that they know that beach better than most, and can document the phenomena of focus in a more thorough and reliable fashion.

By going to the same place with some discipline, you become more observant, more of an expert in that area, more able to see things that are out of the ordinary and different. (Connor)

Study participants routinely noted how unique and dynamic each of the COASST beaches are, only revealing secrets to those that have long-term and frequent observations. In visiting the same beach time after time to search for dead birds, study participants expressed a keen sense of awareness of that beach, including what some describe as the "personality" of the beach. Over time, they have established detailed and systematic routines to canvass the beach, including strategies to ensure that all areas of the beach are thoroughly searched and that any usable material is uncovered.

And then I've done a little bit more, just personal, every year in the spring I go with my camera and take a picture of the bluff and see if there is any changes. So just in the early spring before the leaves come out on the trees, I take a picture of the whole bluff. And I guess if there is going to be any contribution I make sometime in the future, it is the photographs I make every year. (Kylie)

COASSTers know where birds tend to wash in and where they get covered by the sand. They know which rocks or slabs of wood to be sure to check under. Each has developed specific strategies to deal with the microclimate and physical features of the area. These include strategies like adapting the direction and timing of their walk to coincide with prevailing wind or tide patterns, negotiating the predominant substrate of

the area by testing various shoes or personal walking assistance devices like hiking sticks, and designing just the right type of collection kit for the amount of walking, climbing or moving expected on that beach. It is this exact type of local area expertise that is so powerful in citizen science data collection. Realizing this, many COASST participants noted an attachment to their survey beach largely because they are aware that they have a unique and impressive knowledge of the place and the dead birds that wash up there. Naturally, these participants are confident that they make a particularly exceptional contribution to the program because of their ability to consistently find, document, and process birds on that specific beach as accurately as possible.

3. *Familiarity/Intimacy/History with Place*

I have a long history here. I've been alive a while. I sat on my beach at about age five and said someday I'm going to live here. I have pictures of my mom and dad standing in front of proposal rock and they were just newlyweds. In fact, twenty years ago, I came down looking for property and I found a piece of property that was across the highway from Neskowin on a little creek called Gibb Creek and I love my creek. All the sudden one day I realized that my little creek flows down the east side of the highway for a little ways, goes underneath the highway, goes across the golf course, and goes right out to proposal rock! (Sophia)

History. It is the word most commonly used among study participants who indicated attachment to their beach because of a previous connection or significant experience/s on their beach. These connections pre-date participation in COASST, and for many, were part of the original draw to participate in the program; a means to reconnect with or serve a place of value. COASST program leaders have recognized this dimension of attachment as well, initially assigning new recruits beaches, yet switching tactics many years ago to allow participants to select their own beach as a way to encourage folks who had an existing relationship with a beach to engage with the

program at that site. Several study participants have years of experiences on their COASST beach, leading to a strong sense of place identity with the site.

It is just a beautiful place. And we have decades of memories from surfing there. We halibut fish there. We salmon fish there. We have a real connection to it. (Nora)

When asked how to describe the connection she felt with her beach, Manali said the beach was "part of my soul". Numerous other participants in this category stated a portion of their heart could be found at their beach. With such a strong attachment to place, one of the ways through which participants elect to "give back" to "their" beach is by participating in the COASST program. COASST provides a structured means for these individuals to remain connected with the beach, learn more and explore the intimate details of the site, keep an eye on the changes and use of the place, and work to document a component of the health of the area as well. As these study participants reveal, the historical meaning that exists between person and place can yield strong feelings of attachment.

4. Distinct Wildlife Encounters (especially birds)

As discussed earlier, many COASST participants enjoy the places in which they survey because of the opportunity to find and interact with birds, albeit dead birds, more purposefully. However, several study participants expressed a particular attachment and affinity to their survey site because that site produces just the right amount of birds per survey trip. This isn't necessarily a magic number and ranges greatly depending on the person, but participants who expressed this dimension of attachment believe their beach has the perfect amount of birds, dead or alive. For some, this means regular beached bird finds in high numbers (10 or more) while others are quite satisfied with two to three

beached bird discoveries per visit. In a few cases, participants expressed an affinity for their beach because they hardly ever found any dead birds at all, which was just fine for them.

If ever I found a bird, I would go oh my gosh. It would take me a while to sit down and hope that the weather is decent and bring your reading glasses and make sure you have your camera. It is going to take me a bit of time to actually go through the process correctly and identify the bird. So I tell [my husband], I hope I don't find a bird today but I pack all my stuff with me just in case. (Isabelle)

Despite the specific amount, an attachment was often expressed to a specific beach because of this component of interaction with that place. In many cases, participants would compare their beach to other nearby beaches that they either know or assume have less or more beached bird activity (participants can review monthly reports of any beach in the program online).

No, I don't think I would think about a different beach, because as far as I know, any of the really active ones are taken. (Chris)

In most cases this attachment related to the amount of beached birds found on their beach. When discussing this type of attachment, participants would frequently comment on the admittedly odd and somewhat morbid fascination they have developed with finding dead birds. However, several participants also suggested an attachment to their beach because of the ability to encounter live birds or a particular species of live bird (peregrine falcon, snowy plover, etc.). Regular or frequently occurring bird sightings or interactions seem to strengthen the level of attachment many participants have for their beaches.

And these guys. If there were no little black and white birds with these trills out here in the summer time, my heart would just sink. (Harmony)

5. Unique Aesthetic and Physical Properties

Finally, although many participants expressed special meaning attached to coastal environments in general, a small sub-set of participants indicated specific attachment to their survey beach because of the unique aesthetic or physical appeal of the site. The site may be one of only a handful of places to find an endangered coastal plant, a beach with a particular color of sand, or even a beach shaped in a unique formation. That specific beach site provides unique scenery, an especially evocative landscape, or a individual constellation of physical attributes to which participants are emotionally attached. This may stem from a preference for a favorite species, the unique noises found at a site, or the feel of the sand or water in a specific place. Whether it be a color, a shape, or a unique topological feature, these study participants expressed an attachment to place because of the exceptional make-up of the site. Describing the attachment she feels to her COASST beach, this participant notes:

You know there really is an emotional connection and if you are on that beach, you just see so much going on. You can look at Port Townsend on the horizon, and then sometimes there is a little group of islands you can see called Smith and Minor Islands that is a bird reserve. You can look out there and you can see that. You also can see a lot of marine activity going on. We see submarines go by, and you know cruisers sometimes, and of course sailboats and kayaks and things like that. It is a really enjoyable beach. So I have that kind of attachment to it. And the sunsets are beautiful, it is really just a very emotional connection. (Stella)