

**A COASSTal Sense of Place: Birds,
Beaches, and Relationships between
People and Place in the Coastal
Observation And Seabird Survey Team**

Penn Cove Beach , WA - Haywood, 2014



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ABOUT THE AUTHOR



Benjamin Haywood just recently earned his Ph.D. in Environmental Geography from the University of South Carolina, where he focused his dissertation research on the experiences of participants in the COASST citizen science program. Utilizing the concept of sense of place to explore how COASSTers make meaning of place-based experiences and the outcomes that emerge, Ben's work advances efforts aimed at understanding why volunteers engage in citizen science, what those experiences mean to participants, and how such programs shape relationships between people and place. Beginning in the fall of 2014, Ben will be joining the faculty in the environmental science department at Allegheny College (PA), where he will teach courses in environmental geography, the political ecology of birds and people, and the geography of birds.



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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 members and leaders of COASST. Of the thousands of citizen science programs I could have engaged for this research, I know of none more impressive than this organization. Julia, Jane, Liz, and Charlie run a tight ship with intention and compassion. I appreciate the way they welcomed me into the fold. Equally as hospitable were the nearly 80 COASSTers whose stories are the foundation of this work. They taught me much about birds, beaches, places, and community, but even more about life. Their voices, wholesome and strong, have enriched my spirit.

Ben

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RESEARCH OVERVIEW

With new citizen science programs emerging en masse across diverse fields of scientific inquiry, the growth of the practice is outpacing understanding and evaluation of the impacts of participation on volunteers (Bonney et al., 2009a; Dickinson, Zuckerberg, & Bonter, 2010; Lawrence, 2006). Much of the research on citizen science over the past two decades has focused on the 'external' value of the practice, concentrating on the rising amount of biogeographical data made available for research via such efforts and the expanding scale at which research can be conducted (Lawrence, 2006). Research on the 'inner' value of citizen science, defined as participant benefits of personal growth and development, while growing, still lags behind (Lawrence, 2006). Bringing attention to the 'inner' affective dimension, this study, conducted in the summer of 2013, was designed to open innovative avenues for understanding and enhancing the impact of citizen science via a sense of place window.

RESEARCH GOALS AND OBJECTIVES

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). Citizen science efforts have been noted as efficient strategies to expand the range and complexity of scientific inquiry, enhance knowledge and understanding of science and ecology among citizens, and increase the relevance of science for society (Couvet et al. 2008; Jordan et al. 2011; Trumbull et al. 2000).

Even with all of the purported benefits of citizen science research and participation, there has been little in the way of scholarship focused explicitly on the experiences of citizen science volunteers from a multi-dimensional perspective. 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. Given the growing numbers of citizens who are now engaging in citizen science efforts, this dissertation research advances a new direction of citizen science 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 citizen science projects.

This dissertation research is therefore designed to take a look at the personal experiences of volunteers involved in natural citizen science programs. Such experiences (called "lived experiences in the field of human geography) 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 citizen science experiences both influence and are influenced by the people involved in citizen science (psycho-social processes), the socio-political context that surrounds citizen science programs, and the biophysical settings in which citizen science 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 citizen science experiences and participant outcomes. Utilizing a place-based lens through which to consider the experiential aspect of citizen science participation provides a helpful point of entry to study the personal volunteer outcomes of citizen science participation as well as the processes involved in the development of human-environment relationships. Three primary research questions guide this study:

1. How do citizen science 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 citizen science participants and how do these factors interact with program outcomes and impacts?
3. How does participant sense of place inform citizen science experiences and visa versa and how might this advance knowledge on the relationships between place meaning and attachment?

WHAT DO YOU MEAN WHEN YOU SAY PLACE AND SENSE OF PLACE?

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. Seamon (2013, p 150) has defined place as "any environmental locus that draws human experiences, actions, and meanings together spatially". 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). (See Figure 1)

The *socio-political context* in which a place is situated (e.g. laws that regulate site, power dynamics of place) form the boundaries that govern that place and the communal aspects that contribute to it. What a person brings to a site 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. Finally, several researchers argue that *biophysical* components (e.g. trees, water, birds) play an active role in the formation of place (Manzo 2003; Shumaker and Taylor 1983; Trentelman 2009).

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 in the field of human geography. Because the majority of citizen science initiatives involve in situ interactions between people and a particular site, examining the relationships between program volunteers and the places they explore provides a unique window into the everyday experiences of participants.

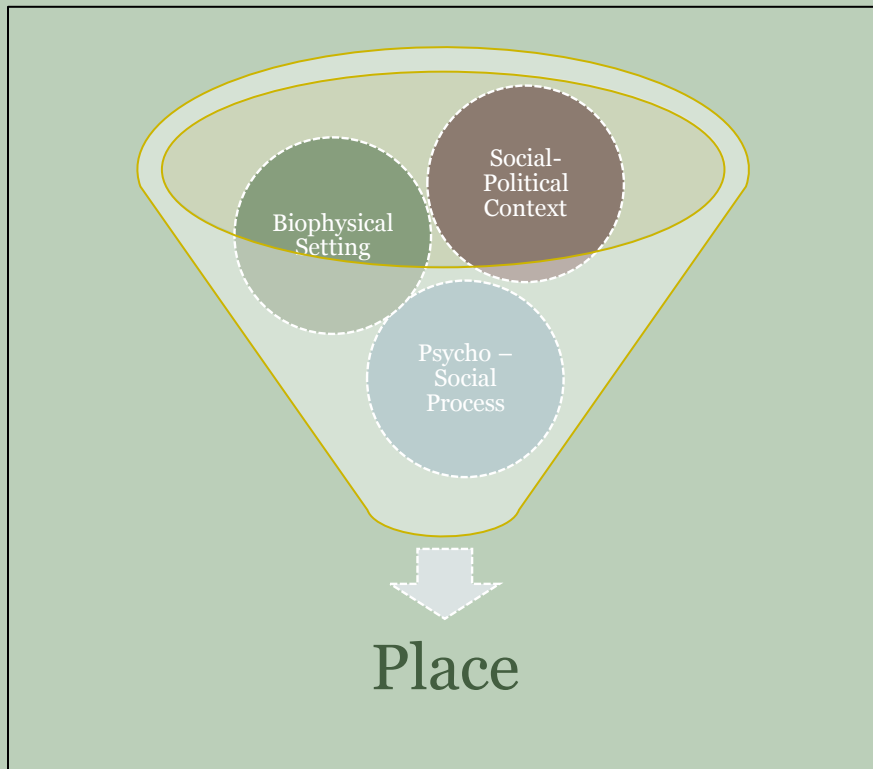


Figure 1: Three Components of Any Place

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.

To explore the multiple dimensions of place among citizen science 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.

Tuan (1977) has posited that although the degree and intensity might vary, as people

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.

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.

RESEARCH POPULATION AND METHODS

A sample was recruited in the spring of 2013 among Coastal Observation And Seabird Survey Team (COASST) participants. The COASST program was targeted because it 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 citizen science 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 its 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)



Figure 2: Geographic Hubs for Study

were selected after considering which places would offer geographic and participant diversity and contain a high density of COASST volunteers (Figure 2). 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

Research methods comprised two primary means of data collection, focus groups and guided tour narrative interviews. Citizen science 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.

Additionally, guided narrative tours have been used in other leisure and recreation settings as a context-based form of research (Everett and Barrett 2012). These involve the participant providing a personal tour of a place, while telling stories and sharing information. Such an approach is useful in efforts to understand the *processes* involved in the development and evolution of citizen science participant experiences alongside a deeper exploration of the contexts in which participatory science is enacted and thus, provides a rich foundation for further evaluation of the topic.

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 1 indicates, residence length and the duration and nature of program engagement ranged substantially among participants. Pseudonyms are used in the quotes for this report to ensure anonymity.

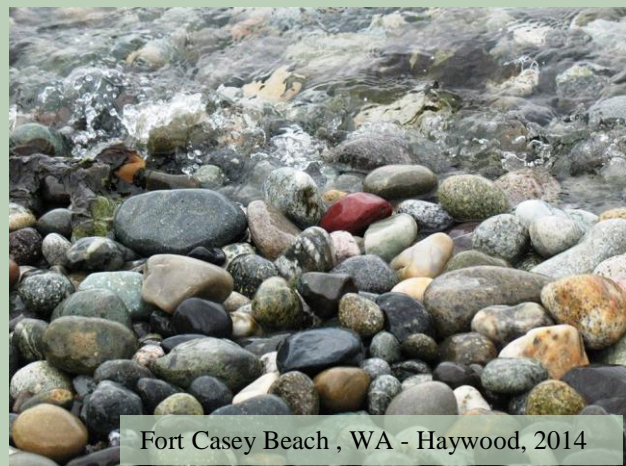


Table 1: Select Study Participant Characteristics

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

FINDINGS

Participant Outcomes

COASST participants were encouraged to share what they most appreciate personally about volunteering with the program, instead of responding to pre-determined outcome categories. Volunteer participation outcomes fell within three major areas, including building connection, education & awareness, and satisfaction & health. In total, seven significant outcomes were identified, each reviewed below in detail with statements from 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 Murres 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 2).



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Table 2: Prominent Areas of Learning & Knowledge Gain

Area of Knowledge Gain	Description
<p>Learning about Beaches and Coastal Processes</p>	<p>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.</p>
<p>Learning about Bird Biology</p>	<p>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.</p>
<p>Learning about Science Processes and Skills</p>	<p>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.</p>
<p>Learning about Socio-Ecological Systems and Human Impact</p>	<p>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).</p>

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 a 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 exclusively 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 in COASST. 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 [birds] 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 grown 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, is 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 consist 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, 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)

Place Meaning

To explore how relationships between COASSTers and their beach sites change via program engagement, participants were encouraged to share what their beach means to them and how COASST engagement has shaped that meaning. Not surprisingly, 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 3 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 3: Dimensions of Place Meaning Among COASST Participants

Category (frequency count) Description	Examples from Participants
<p>Ecological Value & Enacting Stewardship (50%)</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>Encounters with Wildlife and Nature (49%)</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>Establishing and Expanding Roots (42%)</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>Physical and Mental Stimulation (29%)</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>Finding Refuge (27%)</p> <p>Meaning relating to the survey site as</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</p>

<p>a get-away, a sense of remoteness or privacy that allows for solitude and respite from other people or responsibilities.</p>	<p>beach, you probably wouldn't see anyone, and it is nice to have that solitude." (Natalie)</p>
<p>Place of Memory & Comfort (27%)</p> <p>Meaning related to associations with previous meaningful experiences at that site or memories jarred at the site that link to other important places. Connected to previous experiences or feelings associated with the coast.</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 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>Symbolic Connection to the Ocean (20%)</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>Meeting Place (17%)</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 of place meaning. 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.

Place Dependence & Attachment

To further explore place meaning among citizen science 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.

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.

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 4). 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). 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 4, although these should not be interpreted as exhaustive or exclusive.

Table 4: Place Attachment Catalysts Among COASST Participants

Attachment Catalyst Description	Example from Study Participants	Significant Dimensions of Place Meaning
<p>Personal Investment 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</p>	<p>"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)</p>	<ul style="list-style-type: none"> • Enacting stewardship • Physical/mental stimulation • Establishing and expanding roots
<p>Unique Knowledge/ Consistency 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</p>	<p>"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)</p>	<ul style="list-style-type: none"> • Physical/mental stimulation • Enacting stewardship • Encounters with wildlife/nature
<p>Familiarity/Intimacy/History Attachment due to a sense of comfort that comes with familiarity and deeper connection to a place, leading to a sense of belonging</p>	<p>"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. So I've gotten more and more invested in that particular spot. And that kind</p>	<ul style="list-style-type: none"> • Establishing and expanding roots • Finding refuge • Place of memory/comfort • Symbolic connection with ocean • Meeting place

	of deeper, richer connection to a place is something that I value." (Caleb)	
<p>Distinct Wildlife Encounters</p> <p>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</p>	<p>"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)</p>	<ul style="list-style-type: none"> • Symbolic connection with the ocean • Encounters with wildlife/nature • Enacting stewardship
<p>Distinct Aesthetic or Physical Properties</p> <p>Specific attachment to the survey beach because of the unique aesthetic or physical appeal of the site</p>	<p>"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)</p>	<ul style="list-style-type: none"> • Symbolic connection with ocean • Encounters with wildlife/nature • Finding refuge

Findings from this study suggest a connection between more spatially dependent place meaning and the development or activation of attachment catalysts (Figure 3). 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 and the presence of particular attachment catalysts.

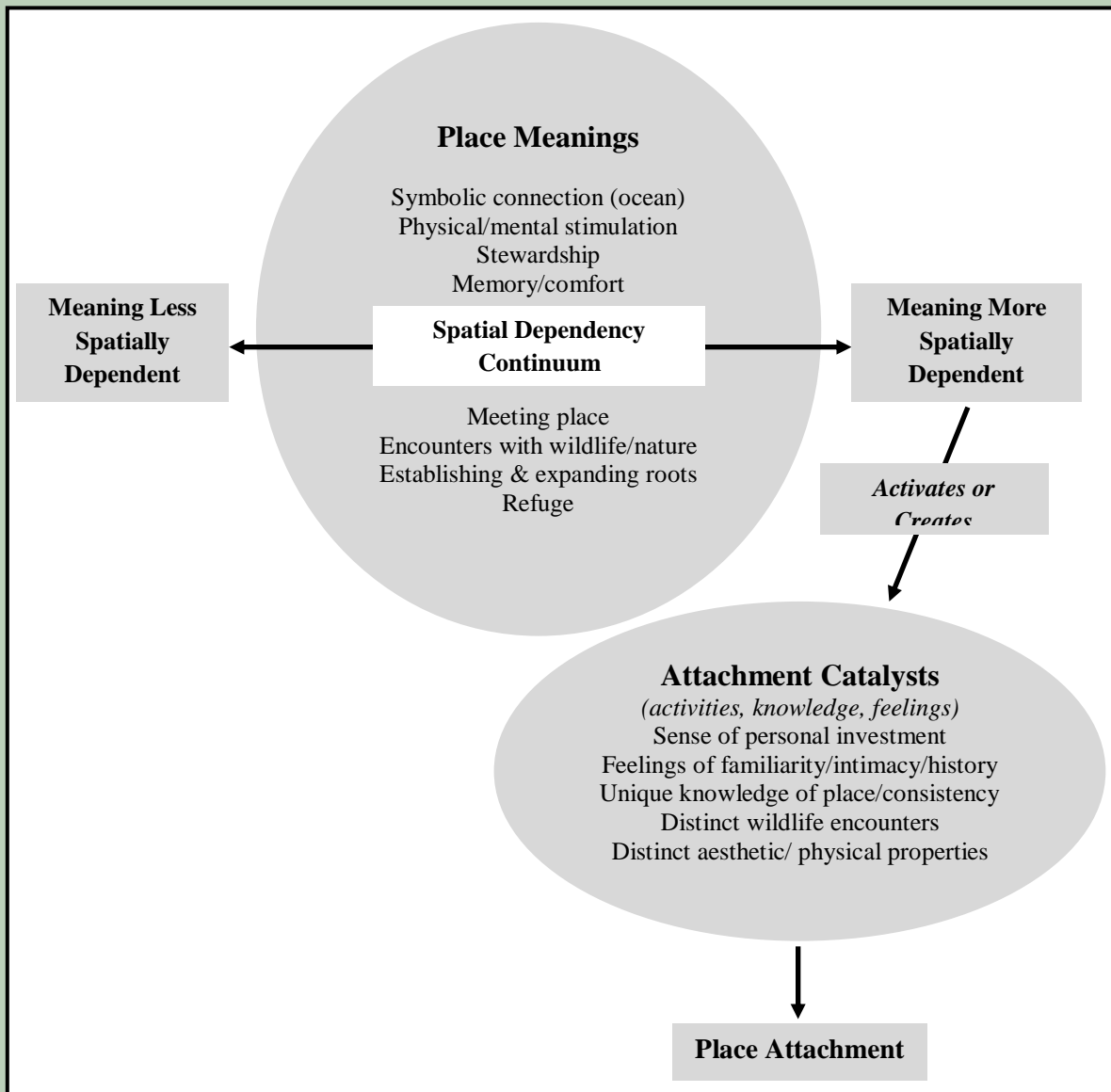


Figure 3: Conceptual Relationship Between Place Meaning, Spatial Dependency & Place Attachment

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 citizen science. Although this type of change can occur for any person in any place, citizen science programs provide unique avenues and structured processes through which this occurs, with the potential to greatly influence the sense of place outcomes for participants.

The Role of Lived Experiences in Shaping Participant Place Meaning & Outcomes

Although a network of actors are involved in initiating, managing, and implementing citizen science projects, the volunteers that are the life-blood of citizen science efforts provide the core of such programs. Accordingly, their engagement and experience plays a fundamental role in the outcomes and impacts of participatory science. Considering the prominent role of volunteers in citizen 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 citizen science 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 citizen science 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). The way in which individuals experience place and the activities that occur there, how meaning is developed via



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such experiences, and the networks of variables that influence them are of principal concern. Because the majority of citizen science 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.

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 (Figure 4) (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). Below, each of these three aspects of place are reviewed in the context of the COASST program.

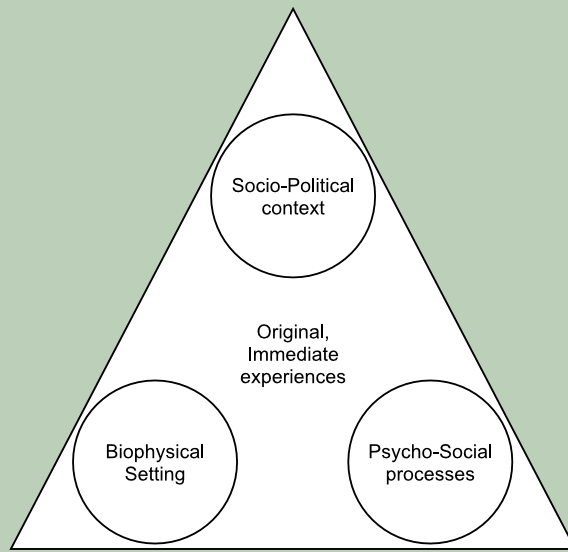


Figure 4: 3 Dimensions of Citizen Science Lived Experience

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 5 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.



Table 5: Socio-Political Influences on Participant 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	-Strength of connection -Feelings of belongingness or exclusion -Sense of duty or responsibility -Symbolism of place	-Formation of friendships/ relationships -Interactions with visitors -Support of local management practices	-Level of advocacy for natural resources -Investment in sustainable behavior -Connection to nature	-Value attributed to coastal ecosystems -Opinions about who should "own" the site and how it should be used	-Degree and type of information exposure -Frequency of engagement topics of interest	-Feelings of pride and efficacy -Frequency of use of existing skills/abilities	-Duration and nature of physical activity -Level of mental stimulation -Feelings of comfort and relaxation
Socio-Political Forces	<i>Ownership</i> -Do I belong? -Should I have a voice here? -Am I responsible for this place? <i>Access</i> -Would I be excluded or included without COASST? <i>Use</i> -What do people do here and does that shape the nature of place?	<i>Ownership</i> -Is this ours, mine, or theirs? -Are the people or entities that own this place 'like-minded'? <i>Access</i> -Will I see the same people regularly? -Can my friends or family visit ? <i>Use</i> -What role does this place play in the community?	<i>Ownership</i> -Who owns "nature" here? -Who manages the natural resources? <i>Access</i> -Who is able to enjoy wildlife here and are we like-minded? <i>Use</i> -How do the visitors interact with wildlife? -How is wildlife treated?	<i>Ownership</i> -Is this a place I would see without COASST? -Who makes decisions about this place? <i>Access</i> -What does this place mean to others? -Who benefits from this place? <i>Use</i> -What services does this place provide and how is it used?	<i>Ownership</i> -What resource management practices govern this place? <i>Access</i> -Do distractions or hazards prevent me from focusing on learning? <i>Use</i> -Is this place popular for birding, or finding agates?	<i>Ownership</i> -Am I serving a public or private good? -Do I have an obligation to care for this place? <i>Access</i> -Who else would monitor and report here? <i>Use</i> -Do I contribute something unique to the users here through my service?	<i>Ownership</i> -Can I relax and escape here legally? <i>Access</i> -Can I visit without too many people around , so I can enjoy the place? <i>Use</i> -Am I safe here? -Will I run into families with children or people with dogs?

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 citizen science 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 program changed over time, and how such motivation influences what they value most about program participation. Table 6 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 6: Reported Motivations to Participate in COASST

Conserving and Protecting
<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.
<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.
Understanding and Learning
<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.
<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.
<i>Learn more about Science</i> An interest in science and science research and a desire to explore via hands-on processes.
Connection to Wildlife/Outdoors
<i>Interact with Nature</i> Desire to spend more time outdoors and connect with natural environments. Drawn to the beauty or stimulation "nature" provides.

Interact with Beaches

A specific draw to the ocean or water compels an interest in connecting with coastal environments.

Interact with Birds

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.

Personal Health

Mental/Physical Health

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.

Relaxation and Peace

Desire to escape from the responsibilities of home or work and find space for contemplation and respite.

Contributing to Society

Putting Science Skills/Knowledge to Use

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.

Giving Back Through Service

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.

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 5 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 citizen science 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)

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.



Sea Lion Caves, Florence , OR - Haywood, 2014

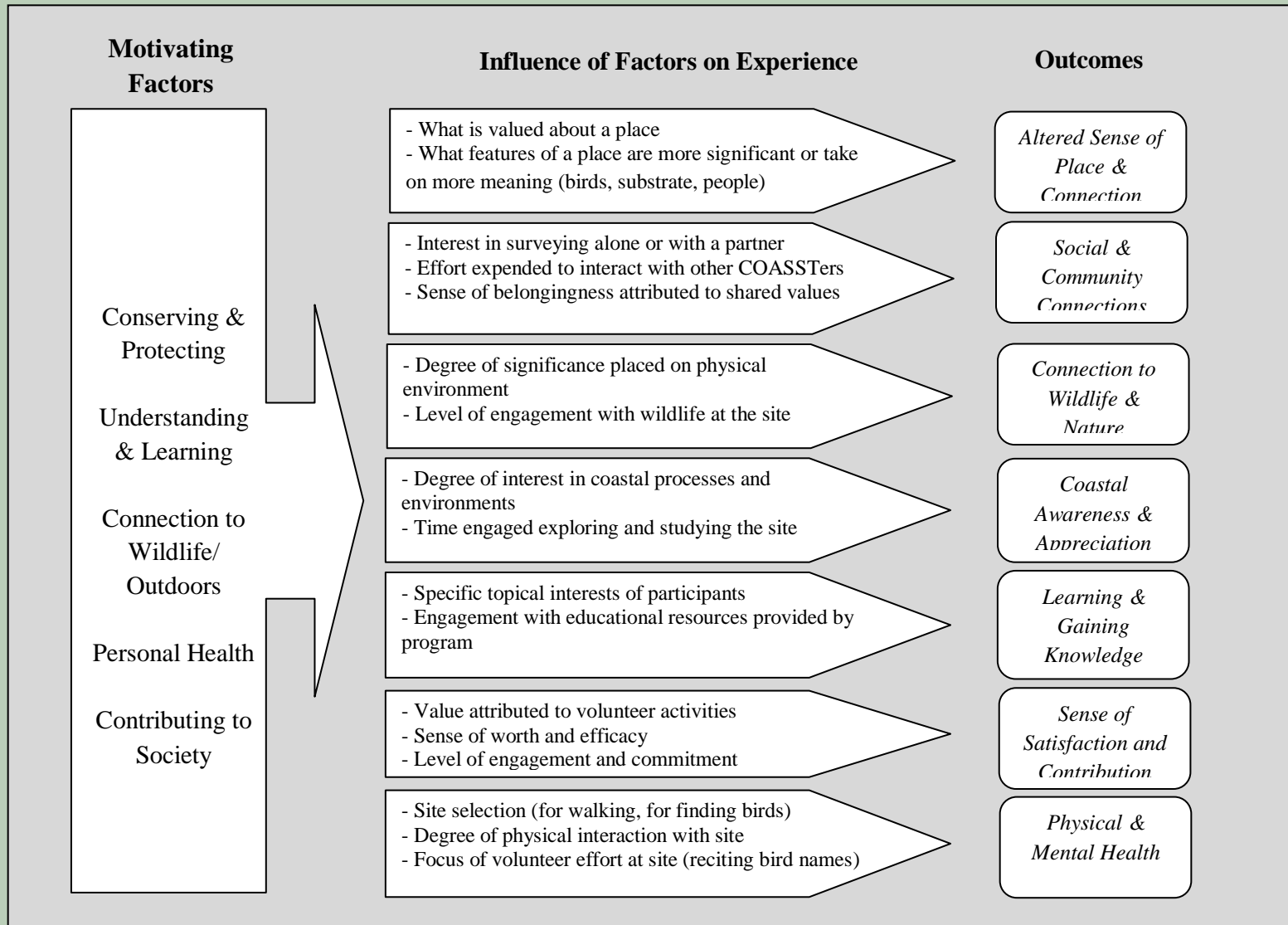


Figure 5: Volunteer Motivations and Influence on Experiential Outputs and Outcomes

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 key biophysical features highlighted by COASSTers during this research are included in the central circle in Figure 6 below.

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 (Figure 6).



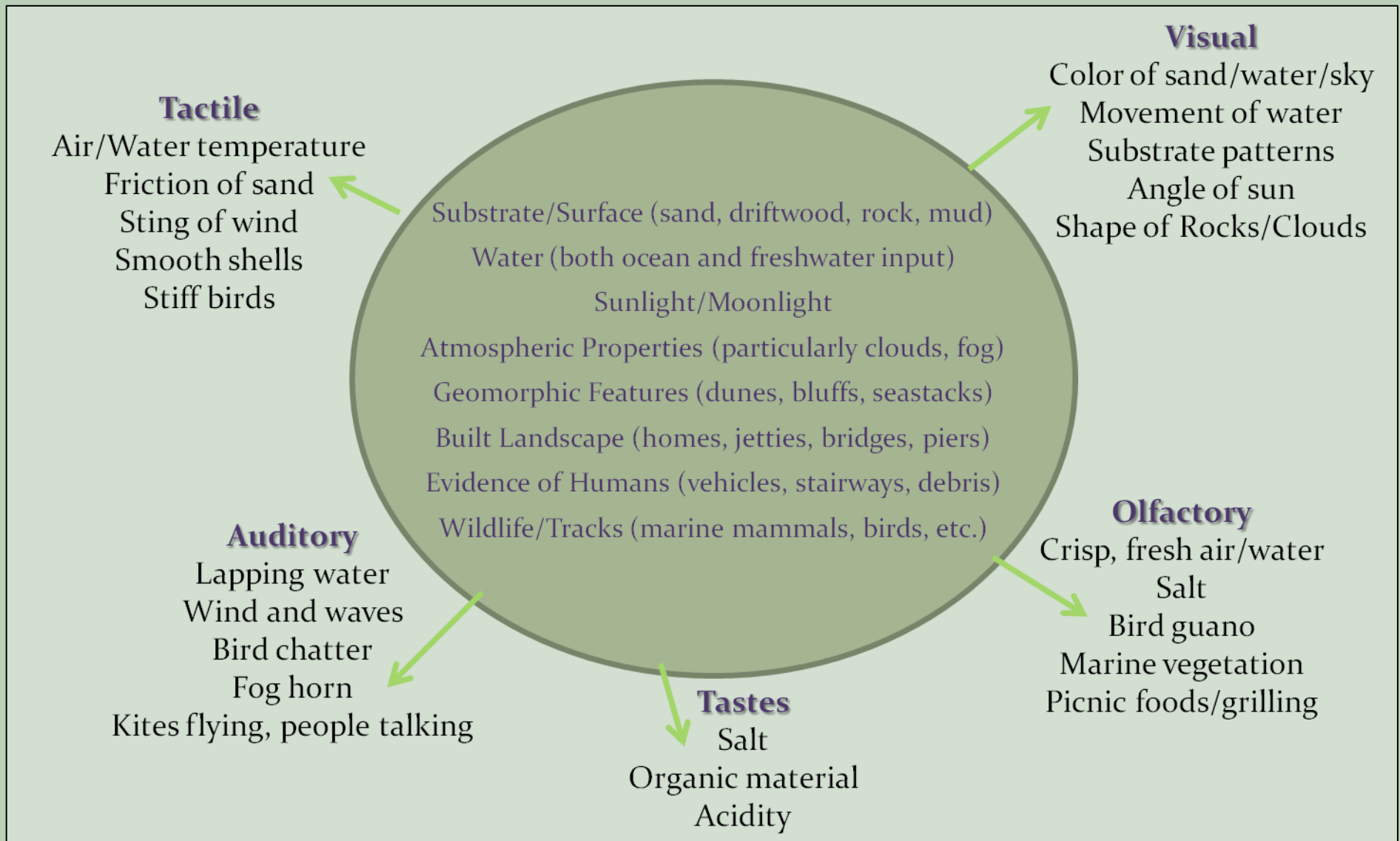


Figure 6: Biophysical Variables that Shape COASST Sensory Experiences

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 7-10 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.

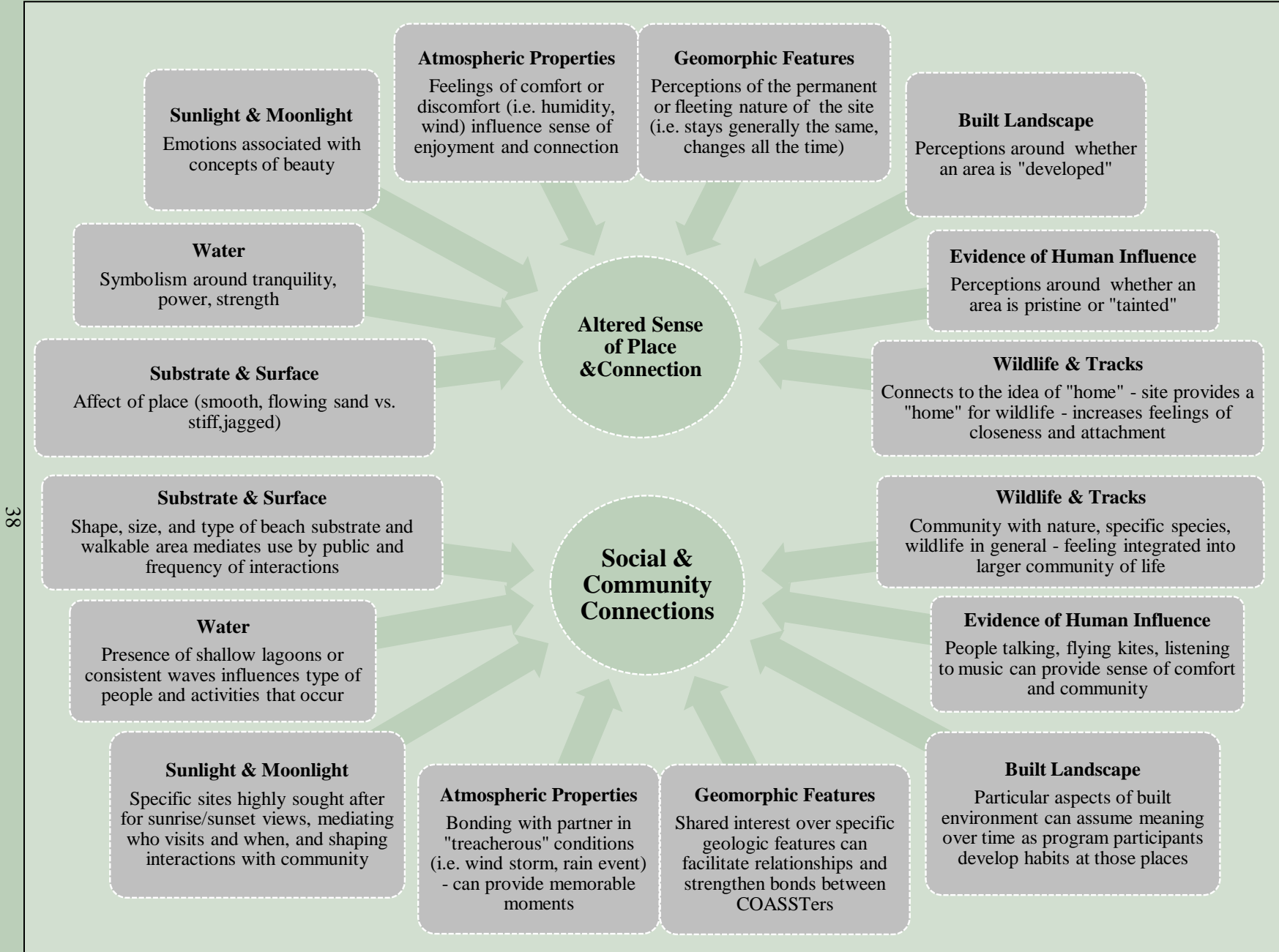


Figure 7: Influence of Biophysical Setting on Sense of Place and Social Connections



Figure 8: Influence of Biophysical Setting on Connection to Wildlife and Coastal Awareness

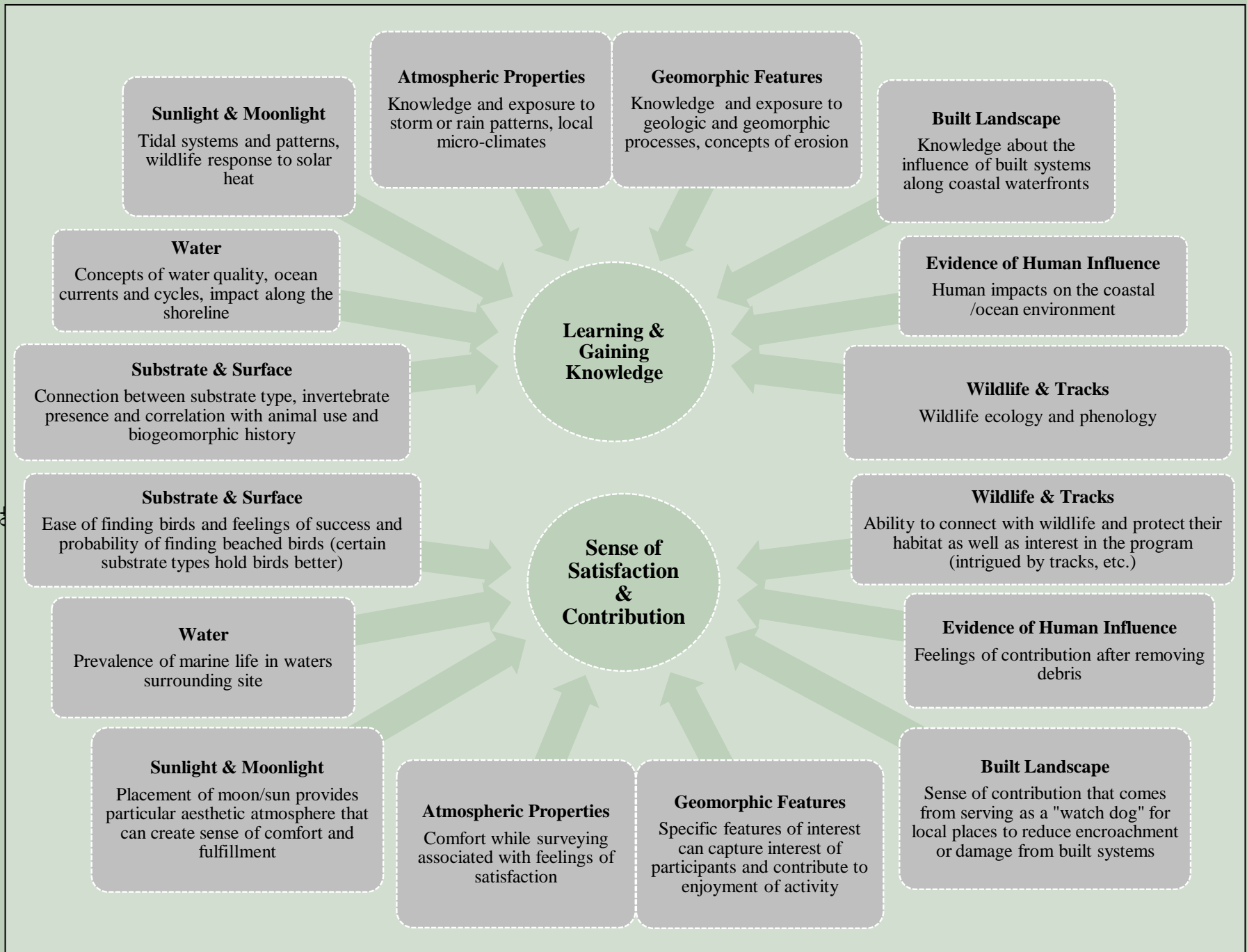


Figure 9: Influence of Biophysical Setting on Learning/Knowledge and Satisfaction

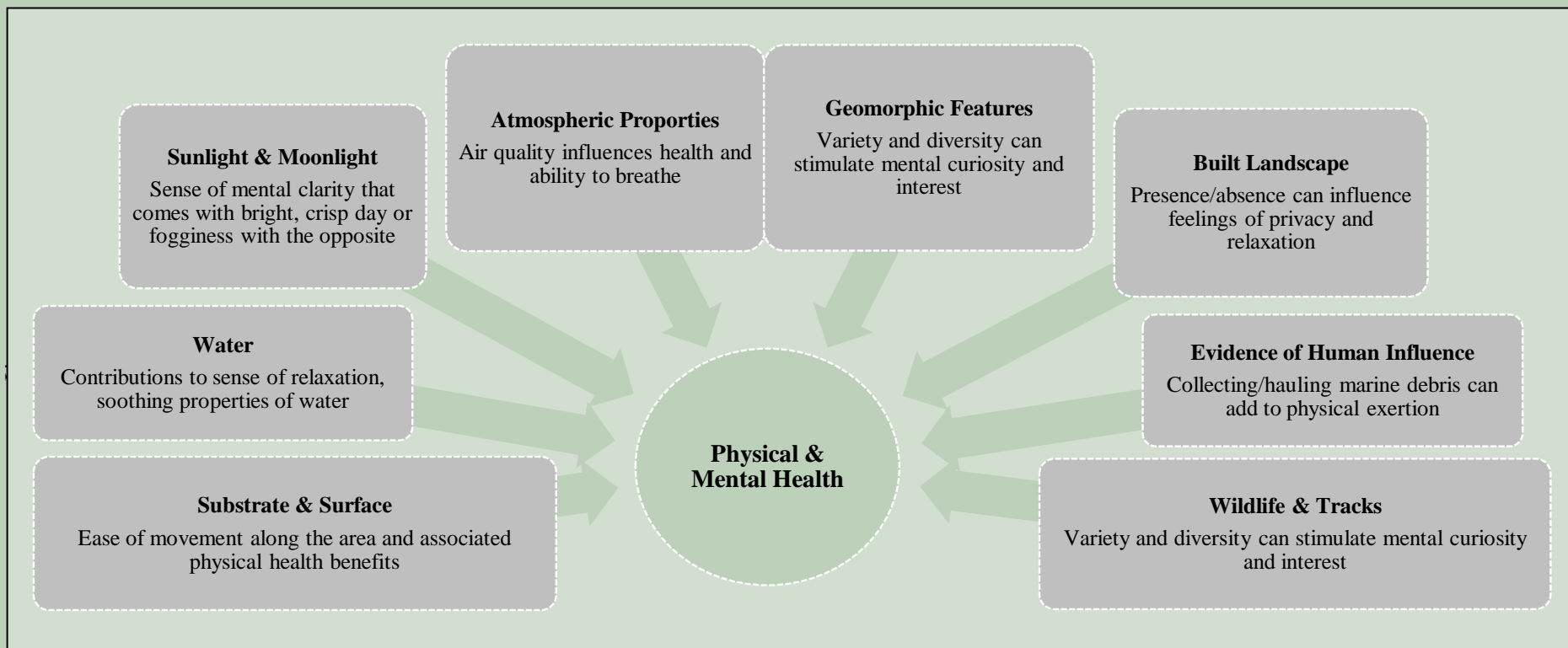


Figure 10: Influence of Biophysical Setting on Physical/Mental Health

Citizen Science as a Filter for Lived Experience



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 highlighted 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, 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 citizen science program, the four variables below (Table 7) 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 citizen science 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.

Table 7: Program Goals and Development Variables that Filter Lived Experience

<p>Project Objectives</p> <p>Program objectives 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 <i>learning and knowledge gain</i> expressed by participants and kinds of <i>connections to wildlife</i> shared are directly impacted by the focus, structure, and format of volunteer responsibilities and activities required of the program.</p>
<p>Project Scope and Scale</p> <p>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. 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.</p>
<p>Project Governance</p> <p>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. 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 <i>learning and knowledge gain</i> participants experience and the mental <i>health benefits</i> such intellectual stimulation provides, but also may support a greater <i>awareness and appreciation of coastal ecosystems</i> and actors.</p>
<p>Duration of Project & Participation</p> <p>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).</p>

Program Administration and Management

Once a citizen science 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 in Table 8 appear to exhibit noteworthy influence on participant outcomes.

Table 8: Program Administration and Management Variables that Filter Lived Experience

<p>Participant Recruitment</p> <p>One key component of COASST 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 <i>social and community</i> connections numerous study participants expressed as a program outcome.</p>
<p>Participant Training, Protocols, and Continuing Education</p> <p>Searching for beached birds focuses attention on a unique 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 <i>learning and knowledge gain</i> and <i>awareness and appreciation for the coast</i>. A focus skyward 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.</p>
<p>Frequency and Nature of Engagement</p> <p>Many study participants indicated that the requirement to visit their 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. 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.</p>

OBSERVATIONS & CONCLUSIONS

COASST as Citizen Science 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 citizen science program. The program is well regarded by a number of citizen science 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 citizen science 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 citizen science programs.

Rigor, Respect, and Value

Because many citizen science 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 citizen science 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 manager 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 citizen science 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.

Enhancing the COASST Experience: Recommendations from Volunteers

While collecting information about volunteer experiences in the COASST program, COASSTers were asked to offer ideas that might enhance the overall COASST experience, support deeper connections with place, or add to the value of the program. Among these comments, six potential enhancements were identified.

Continuing Education & Building Advanced Skills

One thing is for certain about COASST volunteers - they love to learn by gaining new knowledge and skills! Many noted how much they appreciated the thorough and professional nature of initial volunteer training and the impressive field key and guidance provided for volunteers while monitoring beaches. COASSTers expressed opportunities, however, to enhance continuing education opportunities for volunteers once initial training and orientation has been completed. Although they noted much support in this area over the past few years, several COASSTers spoke of a desire for more feedback about bird identification accuracy. Some suggested the use of the internet to provide this information, perhaps via an online system in which volunteers are able to log in and see their ID accuracy for each report submitted and review information regarding incorrect submissions. Because correct bird identification is an essential aspect of data accuracy, COASSTers are keenly interested in any effort dedicated to helping them with this fundamental task.

Additionally, while volunteers are always welcome to join new training sessions to "refresh" their knowledge, many recommended the development of "advanced" training opportunities to reinforce key concepts or protocols or introduce more complex topics

or monitoring tasks. Perhaps this could take place at regular intervals (e.g. 2 year refresher course) or be designed in an a la carte fashion with various topics from which volunteers could select (e.g. gull identification).

While advanced "hands-on" training would be ideal, many acknowledged the logistical difficulty this would provide for a small program staff that manages nearly 1,000 volunteers across four states. Instead, COASSTers suggested the development of online training modules or videos, or the use of networked technology like webinars to conduct trainings without the significant burden of time and travel. One alternative might enlist senior volunteers to develop and conduct trainings for their peers (regionally or across the program) on topics about which they are particularly qualified.

Program beaches within distinct geographic regions could be identified and labeled as ideal settings to learn how to identify cormorant species, for example, or as an ideal sites to learn how to canvass a dense wrack line. Using the unique characteristics of each beach place and the local knowledge of volunteers, a continuing education program might be established that enlists members in peer-to-peer instruction and development.

Real-time Observations and Documentation of Wildlife

Even though COASST volunteers are dedicated to finding beached birds during regular site visits, they also become acutely aware of the overall ecology of their beach area. In many cases, COASST volunteers become known as local naturalist experts at their site. As such, COASSTers are highly in-tune with the wildlife at their beach - noticing when the first Brown Pelican arrives each year and when the last leaves, or the amount of migrating Whimbrels that pass through every spring and fall.

For many COASSTers, these local observations are a valuable thing to waste. It is why several volunteers recommended finding a way to enhance the program by encouraging or supporting the real-time collection of ecological or phenological data at program beach sites for those that might be interested. This wouldn't necessarily need to be developed or managed by COASST, but could involve a partnership with a program like ebird, for example, that would allow participants the opportunity to record and document information about both dead and living wildlife.

Data Collection and Submission

Speaking of the use of real-time digital technology, one aspect many COASSTers noted as an area for potential program enhancement regards the manner in which data is

collected by volunteers. Currently, data is collected by volunteers on hand-written documents and paired with digital photograph before being submitted online or via snail mail. With the prevalence of highly functional, lightweight mobile technology, COASSTers indicated that the development of a real-time mobile application might enhance the ease and efficiency of regular data collection.

Each beached bird could be processed in real time, with the submission of immediate measurements, fields notes, and photographs. Not only would this potentially cut down on time spent converting paper notes to digital format, but it would also reduce the resources needed for regular data collection and improve the speed at which information is collected. This real-time submission process might be particularly valuable in a time-sensitive situation like those connected with mass die-offs or disease.

Outreach and Education

COASSTers are passionate about what they do and the value of "their" citizen science program. As much as possible, they share information about the initiative, why it is needed, and what kind of information is collected with friends, family, and those they meet on the beach. This enthusiasm drives many COASSTers to want to engage in more targeted outreach or education initiatives. Many expressed interest in developing efforts geared towards community education that are designed to harness the experience and knowledge COASSTers have of local beach ecosystems to share that with students, civic organizations, or community groups that may have an interest or be able to impact positive change. The development of an outreach component of COASST program engagement for those volunteers who might have an interest was suggested. Such a component would include additional training or resources for education or outreach-inclined volunteers to ensure professional and consistent efforts and messaging. Again, COASST members do not expect program staff



to serve in this capacity, but envision volunteers themselves stepping up to serve as program ambassadors. Even still, not all outreach efforts have to be complex. Numerous COASSTers noted an interest in the development of some type of program "gear" like a tee-shirt or vest that clearly identifies the program and entices passersby to engage in conversation. Further utilizing the passion and local expertise of COASST volunteers could continue to expand the value and efficacy of the program.

Information About Data Use and Application

In order to be prepared to share the value and outcomes of the COASST program with the communities in which COASSTers live, volunteers need to have access to information about how data collected is used and applied. The COASST program makes much information available online, in addition to publishing regular reports and newsletters for participants about the status of the program overall, major advancements or milestones, and new components. However, many COASSTers noted a desire for more regular or thorough updates or education regarding the many ways in which data on beached birds or beach ecosystems and use is analyzed and utilized for research and/or application.

What stories do the data tell and what questions do they raise? Who uses or has access to the information and for what? How might program data be applied to local resource management or policy decisions? Although COASSTers consistently expressed confidence in the value and significance of the program and the usefulness of the information they help collect, they also often indicated a desire to know more about the details of data use and application. Furthermore, some COASSTers suggested that such information might be especially useful within a local action context, highlighting the many ways in which the information collected by COASSTers might be utilized by local officials or community members to enhance the health and protection of coastal ecosystems.

Regional Volunteer Networking, Connections, and Interaction

Many COASSTers spoke positively about the sense of community they feel being a part of such a large, extensive, and dedicated group of volunteers. Still, others noted a lack of knowledge regarding who their COASST colleagues are, even those that live within the same community. Accordingly, COASSTers regularly noted a desire for more frequent and institutionalized processes through which to connect and engage with other COASSTers in their area. In places where this kind of interaction has taken shape, it was often noted as a highly meaningful aspect of program participation.

Initiatives designed to encourage networking with fellow volunteers in distinct geographic regions was offered as an idea by numerous volunteers as a means through which to enhance program engagement. Whether this is achieved via social networking applications and communities or by recognizing regional "social coordinator" volunteer captains who would be responsible for facilitating regular interaction, such coordinated community-oriented action is desired among participants. Not only was this recommended as a way to enhance a broader sense of community and mission among volunteers, but even more so as a strategy to facilitate peer-to-peer instruction and education. More regional interaction could easily aid in the sharing of local and program knowledge, best practices, and common observations or experiences.

Lessons Learned and Best Practices

COASSTers articulated the substantial breadth of personal outcomes of citizen science 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 citizen science initiatives? Several principal implications for program leaders and managers are reviewed in Table 9 below.

Table 9: Implications for other Citizen Science Programs

<p>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 <i>satisfaction</i> associated with participation, as well as the <i>learning and knowledge gain</i> participants attribute to the program and the unique <i>sense of place</i> associated with the areas in which participants engage when compared to other program sites. Thinking both locally and globally has unique educational advantages and can activate different types of questions and curiosities (Devine-Wright 2013). The ability of participants to conceptually consider collected data at multiple scales appears to add significance to the COASST experience.</p>
<p>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 <i>intellectual stimulus and mental exercise</i> is also an important aspect of the initiative.</p>
<p>Value & 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</p>

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.

Tiered Learning

A knowledge of the learning thresholds specific to individual programs (i.e. when participants are ready to take on a more complex task) 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.

Evolving Volunteer Training & Protocols

In addition to the constant assessment of program outcomes, citizen science 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. 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"?

Remember Significance of Place

Another common benefit of citizen science 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 citizen science program leaders. Specifically, the COASST program allows participants to select the beach they wish to adopt, encouraging connections between people and specific places, settings, and contexts and providing spaces for individuals with pre-existing place connections to deepen those relationships. Building such flexibility into the program protocol increases the potential for volunteers to make stronger connections to places of interest and engage more fully in those places.

COASST & Environmental 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 the sense of responsibility further, many participants attributed this 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.

Concluding Thoughts

This research was motivated by practical and theoretical considerations to draw on sense of place theory to advance understanding of the value of citizen science to participants and potential avenues to improve citizen science program design. In addition to much attention to how citizen science initiatives contribute to science research and data collection, citizen science 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 citizen science 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 citizen science 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, citizen science 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?

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 place 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.

Not only does this analysis help elucidate the "lived experiences" of citizen science 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 on 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 research underscores that place is a dynamic aspect and actor of citizen science engagement. As a whole, this research has demonstrated that sense of place has both an influence on the experiences, outcomes, and meaning associated with citizen science engagement and is also formed and changed by those interactions.

New Lenses + Local Expertise

As I met with COASST 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. Citizen science 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.

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