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Title: A Study of Whale Watching Visitor's Cognitive Constructs in Relation to a Whale Watching Outreach Program: An Assessment of Past Experience, Value Orientations, Awareness of Actions, and Conceptual Knowledge Structure

Abstract approved:

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Given the current state of our oceans, the Pew Oceans Commission (1993) has strongly recommended that increased efforts be made towards ocean literacy. Informal education and outreach programs like the Whale Watching Spoken Here program are important contributors to life-long learning. However, there is little research looking at how these programs affect their audiences' knowledge structure, values, beliefs, and activators of behavior, all of which are important precursors to behavior. Since the ultimate goal of these programs is to encourage more environmentally friendly behaviors, an understanding of how these programs affect these cognitive constructs is needed. Based upon several methodological theories, this study looked at the relationship of three precursors to behavior, including visitors' past experiences, value orientations, and their awareness of actions surrounding the marine environment. It further looked at the influence the docent of the outreach program had on visitors' beliefs and conceptual knowledge structure. Lastly, it developed a concept mapping tool that could be used to analyze the conceptual structures of visitors in an informal marine education program. Results revealed that docents of the program did influence people's beliefs and conceptual knowledge structure, and that there was a positive relationship between

visitor's past experiences and their value orientations, and a positive relationship between their value orientations and awareness of their actions on the marine environment. The study also revealed what parts of visitors conceptual knowledge structure changed as a result of participation in the program.

A Study of Whale Watching Visitor's Cognitive Constructs in Relation to a Whale Watching Outreach Program: An Assessment of Past Experience, Value Orientations, Awareness of Actions, and Conceptual Knowledge Structure

by
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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

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CONTRIBUTION OF AUTHORS

Dr. Shawn Rowe assisted with the interpretation of the data and was involved with the design and writing of Chapter 4. Dr. Mark Needham assisted with the interpretation of the data and was involved with the design and writing of Chapters 2 & 3.

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Introduction

The oceans are no longer the vast expanses we once believed could take anything we threw at them. Global climate change, ocean pollution, toxic algal blooms, fisheries collapses, coral bleaching, and species endangerment are only some of the challenges our oceans are now facing. Though many of these issues have been covered more readily in the media over the past decade, as a society we are still vastly uninformed about the other 75% of the planet that is covered by water. For example, only 39% of Americans know that more plant and animal life is found in the oceans than on land. Only 21% of Americans know that oceans produce more of the earth's oxygen than forests. Furthermore, even more Americans (14%) are unaware that their own actions (runoff from yards, pavement, and farms) are responsible for the majority of pollutants that enter the ocean every year, and believe that pollution is primarily due to industry (66%) (Ocean Project, 1999). Because scientific concern about the marine environment has increased dramatically over the past decade, The Pew Oceans Commission (2003) and the U.S. Commission on Ocean Policy (2004) have both strongly recommended that an increase in ocean literacy needs to occur in order to sustain, and in many cases improve, the health of our oceans. The main goal of this ocean literacy initiative is to change human behavior by educating people about the ocean, the impacts that human actions have on the marine environment, and what can be done to decrease this impact.

Even though more public schools have started to include marine education in their curriculum, the topic still remains largely unexplored, particularly in those schools that

are far away from the ocean (USCOP, 2004). It has been suggested that an alternative way to inform people about the marine environment is through informal education, such as through aquariums, environmental education programs, and interpretive state park programs. In order to determine what influence these programs have on a visitor's knowledge, perceptions, and behaviors surrounding the marine environment, research should focus on finding ways to measure the relationship between informal marine education programs and these visitor cognitions.

A good example of an informal educational activity, whale watching, has experienced rapid growth in popularity in recent years (Hoyt, 2001; Muloin, 1998). Each year, more than nine million people participate in whale watching in over 87 countries, and participation in this activity is predicted to increase 3% to 4% per year (Finkler & Higham, 2004; Hoyt, 2001). In many countries, whale watching occurs primarily from boats. Shore-based viewing, however, is becoming more popular and offers educational opportunities to a wider audience. In addition, expenditures from these tourists have a substantial impact on revenue (Finkler & Higham, 2004), making whale watching both an important outlet for increasing marine literacy, as well as profitable. In Oregon USA, for example, shore-based whale watching generates over $1.9 million and attracts more than 126,000 participants each year, which is twice the number of boat-based whale watchers in the state (Hoyt, 2001). An activity that creates this much revenue and interest is a great resource for research on the influence of informal educational experiences on visitor cognition. Environmental educators believe that these types of programs and tours can: (a) increase visitors' knowledge about the environment and species that are the subject of programs, (b) influence visitors' experiences and perceptions surrounding this subject,

and (c) encourage responsible environmental behavior. Falk and Dierking (2000) suggest that these types of life-long and free-choice (learning that exists outside of captive environments and occurs based upon intrinsic rewards free of choice) learning experiences are the most important contributors to our overall knowledge during a lifetime.

Comparatively little research has focused on the human dimensions of whale watching (Duffus, 1996; Duffus & Dearden, 1993; Orams, 2000; Parsons, Lück, & Lewandowski, 2006). Research has examined, for example, whale watchers' economic expenditures (e.g., Findlay, 1997), trip expectations and satisfaction (e.g., Andersen & Miller, 2006; Malcolm, Duffus, & Rollins, 2002), and attitudes toward social and biophysical impacts of whale watching (e.g., Finkler & Higham, 2004). The studies reported here provide further insights into the human dimensions of whale watching by examining visitor perceptions that include value orientations, awareness of impacts, and past experiences of shore-based whale watchers. They also investigate the changes that occur in visitor conceptual knowledge structure surrounding whales before and after participation in an informal educational program. Past research has indicated that these perceptions indirectly, and sometimes directly, influence behavioral intentions, which in turn, directly affect behaviors (Hines et al 1986, Hwang et al 2000). It is important for managers of marine outreach programs to understand these dimensions so that they can better understand *what* parts of people's cognitions are influenced, and thereby decide *how* these programs can be catered to better meet the ocean literacy needs of the audience and encourage more environmentally responsible behavior.

Human Dimensions

The studies described here use surveys and concept maps to examine a range of attitudes, knowledge, beliefs, and precursors to behavior. Evidence suggests that a fundamental understanding of the environment is necessary for people to understand more complex and meaningful ideas such as being aware of how their own actions can hurt the environment, or being aware of the things they can do to be more environmentally responsible (Hines et al. 1986, Hwang et al. 2000). An individual's knowledge can influence any number of constructs that serve as precursors to behavior. For example, knowledge about how plastic can hurt marine animals and knowledge about how an individual can prevent this plastic from reaching the ocean by recycling is necessary before someone will perform the behavior to recycle *for this reason*.

Moreover, in order to learn meaningfully, or in other words, to learn information in such a way that it becomes a long-lasting part of our knowledge structure, individuals must choose to relate new knowledge to relevant concepts they already know. Knowledge is based in a structural context of prior experience and consists of a composite of propositions in which a concept to be acquired is embedded (Novak & Gowin 1984). Therefore, an understanding of visitors' conceptual knowledge structures can assist programs to present information in ways that will form connections with prior knowledge. A tool called a concept map can be used to analyze this conceptual knowledge structure. Concept maps are hierarchical, node-link diagrams that are intended to represent meaningful relationships between concepts (see Appendices B & D for examples).

Besides knowledge, this research also focuses on the roles that previous learning experiences, value orientations, and awareness of consequences play in leading to behavior change. Research has demonstrated the extent to which an individual's value orientations and awareness of impacts or consequences of behavior can influence his or her attitudes and actual behavior (e.g., Fulton et al., 1996; Vaske & Donnelly, 1999). In addition, research has shown that past experiences influence behavioral choices (e.g., McFarlane, Boxall, & Watson, 1998; Schreyer et al., 1984). Little empirical research, however, has examined the extent to which: (a) past experiences influence value orientations, and (b) value orientations influence awareness of consequences of specific behaviors (Joireman, Lasane, Bennett, Richards, & Solaimani, 2001). In the papers that follow, past experience is used to describe the amount and / or type of experiences that an individual has had in reference to a resource or activity (Hammitt, Backlund, & Bixler, 2004; Manning, 1999; Schreyer et al., 1984). It is possible that environmental beliefs and value orientations may be shaped by past experiences such as participation in environmental education and learning opportunities.

Past experience alone is not enough to understand how people's beliefs and behaviors are shaped. Research also suggests looking at value orientations and awareness of consequences. Value orientations "are defined by the pattern of direction and intensity among a set of beliefs" (Fulton et al., 1996). Value orientations are important because unlike values that are largely unchangeable over a lifetime, value orientations can be changed. Wildlife value orientations can be arrayed along a continuum from anthropocentrically to biocentrically oriented. Awareness of consequences (AC) is the tendency to become aware of consequences or impacts of our

behavior (Schwartz 1977) on others. Social psychologists have long argued that how an individual is likely to behave in a given situation can be predicted, in part, by whether he or she is aware of the consequences of engaging or not engaging in the behavior. There are most likely predictors of AC itself, such as beliefs about the environment. For example, if a person believes that the environment is important and should have equal rights as humans (e.g., Fulton et al., 1996), it is possible that this individual may be more aware of the consequences of his or her behavior (e.g., recycling) on the environment.

Information about whale watchers' past experiences, values, and awareness of impacts can provide private tour companies and public land management agencies such as Oregon Parks and Recreation Department with a better understanding of their audience's background and how these factors may influence client experiences and behavior. Beyond these pragmatic uses, studies of this kind help fill the gap that sometimes exists between studies of environmental behavior (often centered in the environmental education or leisure studies literature) on the one hand and studies of free-choice learning in informal education settings (often centered in education or museum studies literature) on the other.

Study Context

Every year, Oregon Parks and Recreation Department offers an educational program, "Whale Watching Spoken Here", free of charge to shore-based whale watchers. It is offered at 28 sites along the Oregon coast (Fig. 1.1) during the last week of March and December, and at four sites during the last week of August. These times coincide with the spring, winter, and summer breaks for Oregon schools, and some of the best times to view gray whales (*Eschrichtius robustus*) migrating along the Pacific Coast.

This program is carried out by volunteers (i.e., docents) who receive training to educate participants about whales and the marine environment. Docents carry binoculars and spotting scopes, a small collection of artifacts (e.g., models, baleen, food samples), and printed materials to use when communicating with visitors. Docents informally interact with visitors by asking and answering questions, explaining how to spot whales, pointing out locations and times of whale sightings, showing artifacts, and providing information about the marine environment, whales, and other wildlife. Approximately 25% of Oregon's shore-based whale watchers participate in this program. The program's purpose and goals are to educate people about the Gray whale migrations, provide a memorable experience for coastal visitors that will lead to enjoyment and appreciation of our natural resources, and facilitate awareness of the sustainability of, protection of, and human influence on the marine environment. A summary of the program's audience (summary of experiences and demographic background) can be found in Table 1.1 and Table 1.2.

Data for this study were obtained from on-site visitor surveys and concept maps administered during the last week of March 2005, December 2005, and March 2006 at seven sites along the Oregon coast between Cape Perpetua Scenic Area and Boiler Bay State Park (Figure 1.1). These sites included a Bureau of Land Management outstanding natural area, a scenic area, two interpretive centers, and several state parks. All sites were on the coast and high above the ocean to make it easier for participants to spot whales. Between 10:00 a.m. and 1:00 p.m., there were docents at each site with a sign indicating that they belonged to the "Whale Watching Spoken Here" program. Docents had binoculars / spotting scopes, a small collection of artifacts (e.g., models, baleen, food

samples), and printed materials to use when communicating with visitors. Docents informally interacted with visitors by asking and answering questions, explaining how to spot whales, pointing out locations and times of whale sightings, showing artifacts, and providing information about the marine environment, whales, and other wildlife.

Across the seven sites and three data collection periods, 229 visitors completed the survey on-site and 173 visitors completed the concept maps. For the surveys, respondents were asked the extent to which they disagreed or agreed with six belief statements related to environmental value orientations (e.g., marine environment requires protection, it is important to protect whales) and two statements measuring awareness of consequences (e.g., my daily actions affect whales) related to whales and marine environments (Table 1). Past experience was measured with eight items asking respondents how many times they had participated in activities related to whales or marine areas (e.g., visited an ocean, visited an aquarium, watched television shows about marine environments) within the last year. For the concept maps, visitors were instructed to construct one map during the pre-test, then participated in the program by talking to the volunteers and looking for whales, and then afterwards constructed a new map during the post-test. In order to look for trends within the participant population, several questions regarding motivations, age, gender, previous experience with concept mapping, and previous experience with the program were asked.

Study Purpose

There is a lack of this type of research in the eco-tourism, marine and environmental education, and free-choice learning literature primarily because it is difficult to asses people in a non-captive free-choice learning setting where visitor

motivations are much different to the motivations of school students in captive environments (visitor motivations may include: to have fun, spend time with family, on vacation, etc.; student motivations may include: grades, degrees, training to perform a task). Therefore, one goal of the following study is to identify and develop methods to evaluate audiences of free-choice learning programs so that these tools may be used by other researchers and program evaluators in these fields. The other goal of this study is to explore the cognitive changes that may or may not occur in visitors after participation in an environmental free-choice learning program. The studies together therefore address the following questions and hypotheses:

- What influence does the volunteer have on audience's biocentricity?
    - H1: Individuals that spoke with a volunteer will be more biocentrically oriented than those individuals that did not speak with a volunteer.
- What are the relationships between visitor's past experiences, value orientations, and awareness of the consequences of their actions?
    - H2: Whale watchers with substantial past experience will be more likely to have stronger biocentric value orientations.
    - H3: Whale watchers with stronger biocentric value orientations will be more likely to be aware of the consequences of their behavior on the marine environment in general and whales in particular.
- How do we develop a tool that can be used to analyze changes in informal educational audience's conceptual knowledge structure and what are those changes?

The three studies together represent both quantitative and qualitative methods, as is reflected in the research questions above. Such mixed-method studies allow the

researcher to both explore specific hypotheses related to prior research and to contribute to future research through exploratory and descriptive research in little-researched areas. The reader is directed to the methodology sections of each chapter for more information on the data collection, reduction, and analysis methods for each research question. As a review of the table of contents will reveal, chapters 2-5 are separate research reports submitted for publication in separate journals. The first two focus on the findings from the surveys related to attitudes, beliefs, and awareness of consequences. They are designed as quantitative studies and are written up primarily for environmental education and leisure studies audiences. Chapter 4 is a short "how-to" chapter written for an audience of aquarium and zoo educators and outlines the procedures for successfully carrying out a concept map study (information that is sorely lacking in the published material in the field). Chapter 5 outlines the findings from the concept map study using primarily qualitative methods and is written for an audience of professionals who do research on learning in informal settings.

Figure 1.1. Locations of Whale Watching sights along the Oregon coast.

Table 1.1. Summary of visitors' experiences who attended the Whale Watching Spoken Here Program.

Survey Question	Answer				%
Saw a whale on most recent trip				Yes	12
				No	88
Have you spoken with a Whale Watch Volunteer?				Yes	66
				No	34
How many times have you been to Whale Watch Week Before?				First time	54
				Once	13
				2-4 times	18
				5 or more times	15
I would like more information about whales and the environment from a museum, science center, aquarium, zoo, or state park visit.				Agree	66
				Do Not Know	23
				Disagree	11
How many times in the last year have you done the following?	%				
	None	Once	2-4 times	5-9 times	10+ times
Visited a zoo/aquarium	31	44	21	3	1
Visited a state park	11	23	36	14	16
Visited the ocean	6	25	33	13	23
Read a book/magazine about the marine environment	43	26	20	5	5
Volunteered to help the environment	67	18	9	1	5
Talked to others about something I learned about the marine environment	45	19	17	7	12
Watched a nature/animal T.V. show related to marine environments	11	23	27	11	28
Made a monetary donation to an environmental cause	59	20	15	4	2

Table 1.2. A demographic summary of visitors who attended the Whale Watching Spoken Here Program.

	%
Educational background (years of school)	
Mean: 14.8, Median: 16, Mode: 16, SD: 3.8	
0-12	29
13-16	39
17+	32
Age (years)	
Mean: 44.1, Median: 47, Mode: 50, SD: 16.2	
<20	12
20-29	8
30-39	14
40-49	24
50-59	26
60-69	14
70+	4
Sex	
Male	39
Female	61
Race	
Caucasian	95
Hispanic	2
Native American	2
Asian	2

Value Orientations, Awareness of Consequences, and Participation in a Whale Watching Education Program in Oregon

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Whale watching is a popular and economically important tourism activity that generates at least $1 billion in annual revenue worldwide (e.g., tours, accommodation, souvenirs) (Hoyt, 2001). Each year, more than nine million people participate in this activity in over 87 countries (Finkler & Higham, 2004; Hoyt, 2001). Although boat-based whale watching is prevalent in many countries, shore-based viewing is becoming popular, and expenditures from these tourists have a substantial impact on local revenue in several places. In Oregon, for example, shore-based whale watching generates over $1.9 million and attracts more than 126,000 participants each year, double the number of boat-based whale watchers in the state (Hoyt, 2001). Several studies have examined the human dimensions of boat-based whale watching (e.g., Duffus & Dearden, 1993; Orams, 2000). Comparatively little research, however, has focused on shore-based whale watching (e.g., Finkler & Higham, 2004). This findings abstract addresses this knowledge gap.

Whale watching tours and outreach programs provide information and education about marine, wildlife, and conservation issues. Environmental educators believe that these types of tours and programs: (a) influence participants' experiences and perceptions of the environment and species that are the subject of such programs, and (b) facilitate responsible environmental behavior. Environmental education studies have identified several factors that influence pro-environmental behavior including knowledge, attitudes, locus of control, personal responsibility, and verbal commitment (e.g., Hines, Hungerford, & Tomera, 1986; Hwang, Kim, & Jeng, 2000). The social psychology literature has demonstrated that similar factors directly or indirectly influence behavior such as values, value orientations, attitudes, awareness of consequences, and intentions (e.g., Fishbein & Ajzen, 1975; Fulton, Manfredo, & Lipscomb, 1996; Schwartz, 1977).

Value orientations, for example, strengthen fundamental values and are defined by the pattern of direction and intensity among a set of beliefs about an issue (e.g., Fulton et al., 1996). Research suggests that wildlife value orientations can be arrayed along a continuum from anthropocentric (i.e., human centered, utilitarian view of the world) to biocentric (i.e., nature centered view) (e.g., Vaske & Donnelly, 1999). Awareness of consequences is the tendency to become aware of consequences of our behavior on other people, places, and things, and may also shape or strengthen beliefs about how to behave and intentions to behave (Schwartz, 1977).

This findings abstract uses data from individuals who did and did not participate in Oregon's "Whale Watching Spoken Here" marine outreach program to examine the extent to which participation in this program is related to respondents' value orientations and awareness of consequences of personal actions toward the environment in general and whales in particular.

The "Whale Watching Spoken Here" outreach program is offered free of charge to shore-based whale watchers in Oregon. Every year, Oregon Parks and Recreation Department offers this educational program at 28 sites along the Oregon coast during the last week of March and December, and at four sites during the last week of August. These times coincide with the spring, winter, and summer breaks for Oregon schools, and some of the best times to view gray whales (*Eschrichtius robustus*) migrating along the coast. The program is carried out by volunteers (i.e., docents) who receive training to educate participants about whales and the marine environment. Approximately 25% of Oregon's shore-based whale watchers participate in this program.

Data were obtained from on-site visitor surveys administered during the last week of March 2005, December 2005, and March 2006 as part of a larger study conducted at seven sites along the Oregon coast between Cape Perpetua Scenic Area and Boiler Bay State Park. These sites included a Bureau of Land Management outstanding natural area, a scenic area, two interpretive centers, and several state parks. All sites were on the coast and high above the ocean to make it easier for participants to spot whales. Between 10:00 a.m. and 1:00 p.m., there were docents at each site with a sign indicating that they belonged to the "Whale Watching Spoken Here" program. Docents had binoculars / spotting scopes, a small collection of artifacts (e.g., models, baleen, food samples), and printed materials to use when communicating with visitors. Docents informally interacted with visitors by asking and answering questions, explaining how to spot whales, pointing out locations and times of whale sightings, showing artifacts, and providing information about the marine environment, whales, and other wildlife.

Across the seven sites and three data collection periods, 229 visitors completed the survey on-site (response rate = 75%). In total, 66% of respondents completed the survey after participating in the "Whale Watching Spoken Here" program by speaking with docents; 34% of respondents had not participated in this educational program before completing the survey.

Respondents were asked the extent to which they disagreed or agreed with eight belief statements about whales and the marine environment (e.g., the marine environment requires our protection, it is important to protect whales, my daily actions affect whales; Table 1). Responses were measured on 5-point scales of 1 "strongly disagree" to 5 "strongly agree." On average, respondents who spoke with a "Whale Watching Spoken

Here" docent were significantly more likely to agree that their daily actions affect whales and the marine environment, whales are important for Oregon, it is important to protect whales and the marine environment, and it is important to spend money to protect whales, t(189 to 193) = 2.01 to 3.87, p = .046 to < .001 (Table 1). Effect sizes (r_{pb} = .14 to .27) suggested that differences between those who did and did not participate in this program were small to medium (Cohen, 1988) or minimal to typical (Vaske, Gliner, & Morgan, 2002). Compared to respondents who did not participate in the program, those who did participate were also more likely to agree that the marine environment requires protection and that whales need a healthy environment to survive, but these differences were not statistically significant, t(191 to 194) = .15 to 1.29, p = .200 to .880, r_{pb} = .01 to .09.

A principal components exploratory factor analysis with varimax rotation was conducted on responses to these eight belief statements. This produced two underlying factors: (a) value orientations toward whales and the marine environment (6 items, eigenvalue = 3.97, Cronbach alpha reliability coefficient = .84), and (b) awareness of consequences associated with human behavior on whales and the marine environment (2 items, eigenvalue = 1.25, alpha = .81; Table 1). All variable loadings exceeded .40 and were significant at p < .001, and deletion of any item from its respective factor did not improve reliability. A K-means cluster analysis of these factor items revealed two groups of respondents – those who had: (a) a strong biocentric orientation and awareness of consequences (cluster 1, 46%), and (b) a weaker biocentric orientation and awareness of consequences (cluster 2, 54%). The majority of respondents who spoke with a "Whale Watching Spoken Here" docent (53%) belonged to cluster 1 and had a strong biocentric orientation and awareness of consequences (Table 2). Conversely, 66% of respondents

who did not participate in this program belonged to cluster 2 and had a weaker biocentric orientation and awareness of consequences. Differences among groups were statistically significant, $\chi^2(1, N = 183) = 5.39, p = .020, \phi = .17$.

Taken together, results showed that compared to visitors who did not participate in the "Whale Watching Spoken Here" program before completing the survey, those who did participate in this program by communicating with a docent were more likely to believe that whales and marine areas are important and require protection. Visitors who participated in the program also had stronger biocentric value orientations and were more aware of consequences of their own actions on whales and the marine environment. It is difficult to determine, however, if participation in this program had a causal influence on shifting respondents' beliefs to a stronger biocentric orientation and increasing awareness of consequences of human behavior on whales and the marine environment. It is possible that respondents with a strong biocentric orientation and awareness of consequences were more likely to participate in this program simply because they may have been more motivated to learn about marine and wildlife issues. Longitudinal or panel data (e.g., pre, post program) and experimental designs are needed to determine if, how, and to what extent participation in the "Whale Watching Spoken Here" outreach and education program actually changes participants' beliefs about whales and marine environments.

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Table 2.1. Differences in beliefs between visitors who did and did not speak to a "Whale Watching Spoken Here" volunteer / docent before completing the survey.

	Spoke with volunteer / docent [a]					
	No (34%)	Yes (66%)	*t*-value	df	*p*-value	Effect size (r_{pb})
Value orientation belief statements						
The marine environment requires our protection	4.50	4.51	0.15	191	.880	.01
It is important to protect the marine environment	4.46	4.62	2.01	193	.046	.14
It is important to protect whales	4.44	4.65	2.88	193	.004	.20
It is important to spend money to protect whales	3.95	4.19	2.12	189	.036	.15
Whales are important for Oregon	3.89	4.32	3.87	191	< .001	.27
Whales need a healthy marine environment to survive	4.52	4.63	1.29	194	.200	.09
Awareness of consequences belief statements						
My daily actions affect whales	3.49	3.78	2.19	190	.029	.16
My daily actions affect the marine environment	3.79	4.13	2.85	192	.005	.20

[a] Cell entries are means on a 5-point scale of 1 "strongly disagree" to 5 "strongly agree."

Table 2.2. Percentage of visitors in each cluster who did and did not speak to a "Whale Watching Spoken Here" volunteer / docent before completing the survey.

	Spoke with volunteer / docent [a]		
Cluster group	No (34%)	Yes (66%)	Total
Cluster 1: strong biocentric orientation and awareness of consequences	34	53	46
Cluster 2: weaker biocentric orientation and awareness of consequences	66	47	54

[a] Cell entries are percentages. $\chi^2(1, N = 183) = 5.39$, $p = .020$. $\phi = .17$.

Whale Watchers' Past Experience, Value Orientations, and Awareness of Consequences of Actions on Marine Environments

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Introduction

In the last few decades, marine mammal based tourism has experienced rapid growth in popularity (Hoyt, 2001; Muloin, 1998). Whale watching, for example, has become a popular and economically important tourism activity, generating over US $1 billion in annual revenue worldwide through expenditures on tours, accommodation, souvenirs, and related items (Hoyt, 2001). Each year, more than nine million people participate in whale watching in over 87 countries, and participation in this activity is predicted to increase 3% to 4% per year (Finkler & Higham, 2004; Hoyt, 2001). In many countries, whale watching occurs primarily from boats. Shore-based viewing, however, is becoming popular and expenditures from these tourists have a substantial impact on revenue (Finkler & Higham, 2004). In Oregon USA, for example, shore-based whale watching generates over $1.9 million and attracts more than 126,000 participants each year, which is twice the number of boat-based whale watchers in the state (Hoyt, 2001).

Although whale watching is often considered to be a form of non-consumptive wildlife oriented tourism, research has revealed biophysical impacts of this activity on whales such as disruption to feeding, resting, and courtship behavior (e.g., Corkeron, 1995; Jelinski, Krueger, & Duffus, 2002; Osborne, 1986; Richter, Dawson, & Slooten, 2006). Comparatively less research, however, has focused on the human dimensions of whale watching (Duffus, 1996; Duffus & Dearden, 1993; Orams, 2000; Parsons, Lück, & Lewandowski, 2006). Research has examined, for example, whale watchers' economic expenditures (e.g., Findlay, 1997), trip expectations and satisfaction (e.g., Andersen & Miller, 2006; Malcolm, Duffus, & Rollins, 2002), and attitudes toward social and biophysical impacts of whale watching (e.g., Finkler & Higham, 2004). This article

provides further insights into the human dimensions of whale watching by examining value orientations, awareness of impacts, and past experiences of shore-based whale watchers.

Study Context

Whale watching tours and outreach programs provide information and education about marine, wildlife, and conservation issues. In Oregon, for example, the "Whale Watching Spoken Here" program is offered free of charge to shore-based whale watchers. Every year, Oregon Parks and Recreation Department offers this educational program at 28 sites along the Oregon coast during the last week of March and December, and at four sites during the last week of August. These times coincide with the spring, winter, and summer breaks for Oregon schools, and some of the best times to view gray whales (*Eschrichtius robustus*) migrating along the Pacific Coast.

This program is carried out by volunteers (i.e., docents) who receive training to educate participants about whales and the marine environment. Docents carry binoculars and spotting scopes, a small collection of artifacts (e.g., models, baleen, food samples), and printed materials to use when communicating with visitors. Docents informally interact with visitors by asking and answering questions, explaining how to spot whales, pointing out locations and times of whale sightings, showing artifacts, and providing information about the marine environment, whales, and other wildlife. Approximately 25% of Oregon's shore-based whale watchers participate in this program. Environmental educators believe that these types of programs and tours can: (a) influence visitors' experiences and perceptions of the environment and species that are the subject of programs, and (b) encourage responsible environmental behavior.

Studies in the environmental education literature have identified factors that influence responsible environmental behavior such as knowledge, attitudes, locus of control, responsibility, and verbal commitment (e.g., Hines, Hungerford, & Tomera, 1986; Hwang, Kim, & Jeng, 2000). The social psychology literature has demonstrated that similar factors directly or indirectly influence an individual's behavior including his or her past experiences, value orientations, awareness of consequences, attitudes, and intentions (e.g., Fishbein & Ajzen, 1975; Fulton, Manfredo, & Lipscomb, 1996; Schreyer, Lime, & Williams, 1984; Schwartz, 1977; Stern & Dietz, 1994; Vaske & Donnelly, 1999). Schreyer et al. (1984), for example, showed that past experiences influence attitudes and perceptions, which ultimately influence behavior.

Research has demonstrated the extent to which an individual's value orientations and awareness of impacts or consequences of behavior can influence his or her attitudes and actual behavior (e.g., Fulton et al., 1996; Vaske & Donnelly, 1999). In addition, research has shown that past experiences influence behavioral choices (e.g., McFarlane, Boxall, & Watson, 1998; Schreyer et al., 1984). Little empirical research, however, has examined the extent to which: (a) past experiences influence value orientations, and (b) value orientations influence awareness of consequences of specific behaviors (Joireman, Lasane, Bennett, Richards, & Solaimani, 2001). This article helps to address this knowledge gap by focusing on Oregon's shore-based whale watchers and examining their past experiences related to whales and marine environments (e.g., visits to ocean, aquariums), environmental value orientations (e.g., biocentric, anthropocentric), and awareness of impacts associated with personal actions on whales and marine ecosystems.

Information about whale watchers' past experiences, values, and awareness of impacts can provide private tour companies and public land management agencies such as Oregon Parks and Recreation Department with a better understanding of their audience's background and how these factors may influence client experiences and behavior (Christensen, Rowe, & Needham, 2007). This information can also help these companies and agencies tailor marine education and outreach programs to certain audiences, and target specific ways of presenting information to influence factors that may encourage more environmentally responsible behavior.

Conceptual Foundation

Awareness of Consequences

A goal of many whale watching tours and marine education and outreach programs is to educate participants and encourage environmentally responsible behavior (Finkler & Higham, 2003). Social psychologists have long argued that how an individual is likely to behave in a given situation can be predicted, in part, by whether he or she is aware of the consequences of engaging or not engaging in the behavior (see Eagly & Chaiken, 1993 for a review). Schwartz's (1977) norm activation model, for example, suggests that intentions and actual behaviors are partially influenced by whether individuals are aware of the consequences (AC) or impacts that their behavior may have on other people, places, or things. Schwartz (1977) defined awareness of consequences as the tendency to become aware of consequences or impacts of our behavior. If an individual has information about how their actions may affect others, norms of how one should or should not behave in a given way are activated and feelings of moral obligation are induced (Kaiser & Shimoda, 1999). For example, if a person is aware that feeding

wildlife negatively impacts animal health and causes wildlife to become dependent on and habituated to humans, he or she is less likely to engage in the behavior of feeding wildlife (Orams, 2002).

Several studies have empirically examined the influence of awareness of consequences on behaviors related to natural resource issues such as recycling (Bratt, 1999; Hopper & Nielsen, 1991), littering (Heberlein, 1972), burning yard waste (Van Liere & Dunlap, 1978), and ocean dumping (Cottrell & Graefe, 1997). Only a few studies, however, have focused on determinants that may influence the extent to which an individual is aware of the impacts or consequences of his or her actions (e.g., Garling, Fujii, Garling, & Jakobsen, 2001; Joireman et al., 2001; Stern, Dietz, Abel, Guagnano, & Kalof, 1999). Stern et al. (1999), for example, showed that beliefs about the environment predicted awareness of consequences of engaging in environmentally responsible behaviors. If a person believes that the environment is important and should have equal rights as humans (e.g., Fulton et al., 1996), it is possible that this individual may be more aware of the consequences of his or her behavior (e.g., recycling) on the environment.

Value Orientations

A value is an "enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence" (Rokeach, 1973, p. 5). Values are basic modes of thinking that: (a) are shaped by family, peers, and life experiences; (b) are few in number, relatively stable, and change slowly; (c) reflect enduring characteristics of individuals; and (d) guide life decisions and transcend situations (see Manfredo, Teel, & Bright, 2004 for a review). Rokeach (1973), for example, listed 36 human values (e.g., polite, capable,

family security, honesty, peace). Values are mental constructs that are part of an individual's fundamental cognitive state and are known to influence higher order cognitions such as beliefs, attitudes, norms, intentions, and behaviors (Bem, 1970; Fulton et al., 1996; Stern et al., 1999). Values are an individual's way of evaluating situations and the environment around them, and serve as measures of the desirability of codes of conduct (Fulton et al., 1996; Manfredo et al., 2004; Rokeach, 1973).

An individual's values tend to represent values of society as a whole because they are difficult to change, shared widely among people, and difficult to measure for specific situations. As a result, values do not explain much variation in higher order cognitions (Fulton et al., 1996; Rokeach, 1973; Schwartz, 1992). Recent research, therefore, has empirically examined beliefs that strengthen and give meaning to fundamental values (e.g., Manfredo, Teel, & Bright, 2003; Vaske & Donnelly, 1999). Beliefs are cognitions, expectations, or knowledge about what is true or factual (Eagly & Chaiken, 1993). Beliefs can be subjective (i.e., what people think is true) or objective (i.e., actuality, facts). Belief statements include "humans should manage animals so that humans benefit" and "animals should have similar rights to humans" (Fulton et al., 1996).

Value orientations "are defined by the pattern of direction and intensity among a set of beliefs" (Fulton et al., 1996, p. 28). Patterns of beliefs about an issue can be used to arrange individuals along a continuum from anthropocentric (i.e., human centered, utilitarian view of the world) to biocentric (i.e., nature centered view) value orientations (e.g., Vaske & Donnelly, 1999). These value orientations can then be used to identify and segment groups who have divergent preferences for information and management. In addition, they can help anticipate receptivity to and polarization over prevention and

mitigation strategies, and environmentally responsible behavior (Manfredo et al., 2003, 2004).

Studies have examined relationships among broad value orientations and more specific attitudes, norms, and behaviors related to natural resource issues such as wildlife viewing and management, wildland preservation, and forest management (e.g., Bright, Manfredo, & Fulton, 2000; Daigle, Hrubes, & Ajzen, 2002; Fulton et al., 1996, Manfredo et al., 2003, 2004; Purdy & Decker, 1989; Vaske & Donnelly, 1999). Little empirical research, however, has examined relationships between value orientations and awareness of consequences (Stern et al., 1999). This article, therefore, examines environmental value orientations of Oregon's shore-based whale watchers and the extent to which these value orientations influence awareness of consequences of personal actions toward the marine environment in general and whales in particular.

Past Experience

It is possible that environmental beliefs and value orientations may be shaped by past experiences such as participation in environmental education and learning opportunities (e.g., visiting aquariums, reading articles about environmental issues). Past experience describes the amount and / or type of experiences that an individual has had in reference to a resource or activity (Hammitt, Backlund, & Bixler, 2004; Manning, 1999; Schreyer et al., 1984). Although studies have used an assortment of items to measure past experience (e.g., Hammitt, Knauf, & Noe, 1989; Hammitt et al., 2004; Schreyer & Lime, 1984; Schreyer et al., 1984), this concept is typically measured by the total number of years or times that an individual has participated in an activity or visited a given resource (Hammit et al., 2004). Although it is possible to measure a multitude of experiences for a

specific activity or resource, Schreyer et al. (1984) noted that it is important that the combination of experiences provide a means for measuring differences among visitors that are most useful for the particular study. In this article, therefore, past experience is conceptualized as the number of times per year that whale watchers had experiences related to whales, marine environments, and related educational events (e.g., visit oceans or aquariums, watch marine education television shows, volunteer for environmental causes).

Past experience is an indicator of the amount and type of information that an individual has available in a given situation (Schreyer et al., 1984). This information, in turn, influences how people understand information and interpret current experiences (Hammitt & McDonald, 1983; Schreyer et al., 1984). Researchers have examined the influence of past experiences on place attachment, motivations for participation, perceptions of crowding and conflict, coping responses, behavior (e.g., site or activity choice), and acceptance of management actions (see Hammitt et al., 2004; Manning, 1999 for reviews). Little research, however, has focused on possible relationships between an individual's past experience and his or her value orientations. Past experiences related to whales and marine environments may influence whale watchers' environmental value orientations. This article empirically examines this issue.

One objective of this article is to measure Oregon's shore-based whale watchers' value orientations, past experience related to whales and marine areas, and awareness of consequences of their behavior on whales and the marine environment. A second objective is to examine relationships among these three concepts. Based on this literature, two hypotheses are advanced:

H_1: There will be a positive relationship between environmental value orientations and past experience related to whales and marine environments. Whale watchers with substantial past experience will be more likely to have stronger biocentric value orientations.

H_2: There will be a positive relationship between environmental value orientations and awareness of consequences of personal actions. Whale watchers with stronger biocentric value orientations will be more likely to be aware of the consequences of their behavior on the marine environment in general and whales in particular.

This article also tests the extent to which value orientations mediate any effect of past experience on awareness of consequences. In addition, it examines whether participation in Oregon's "Whale Watching Spoken Here" program moderates (i.e., interaction effect) relationships, if any, among past experience, value orientations, and awareness of consequences. In other words, this article also determines if any relationships between past experience and value orientations (H_1), and between value orientations and awareness of consequences (H_2) differ depending on whether whale watchers did or did not participate in this program (Baron & Kenny, 1986).

Methods

Data were obtained from short two-page on-site surveys administered to shore-based whale watchers in Oregon during the last week of March 2005, December 2005, and March 2006 as part of a larger study conducted at seven sites along the coast between Cape Perpetua Scenic Area and Boiler Bay State Park. These sites included a Bureau of Land Management outstanding natural area, a scenic area, two interpretive centers, and several state parks. All sites were on the coast and high above the ocean to make it easier

for participants to spot whales. Between 10:00 a.m. and 1:00 p.m., there were docents at each site with a sign indicating that they belonged to the "Whale Watching Spoken Here" marine education and outreach program. Across the seven sites and three data collection periods, 229 visitors completed the survey on-site (response rate = 75%). In total, 66% of respondents completed the survey after participating in the "Whale Watching Spoken Here" program by speaking with docents; 34% of respondents had not participated in this marine education and outreach program before completing the survey.

Similar to past research (e.g., Fulton et al., 1996; Vaske & Donnelly, 1999), respondents were asked the extent to which they disagreed or agreed with six belief statements related to environmental value orientations (e.g., marine environment requires protection, it is important to protect whales) and two statements measuring awareness of consequences (e.g., my daily actions affect whales) related to whales and marine environments (Table 1). Responses were measured on 5-point scales of 1 "strongly disagree" to 5 "strongly agree." Past experience was measured with eight items asking respondents how many times they had participated in activities related to whales or marine areas (e.g., visited an ocean, visited an aquarium, watched television shows about marine environments) within the last year. Responses were coded on 5-point scales of 0 "no times," 1 "1 time," 2 "2 to 4 times," 3 "5 to 9 times," and 4 "10 or more times" (Table 1).

Internal consistency of multiple-item indices measuring past experience, environmental value orientations, and awareness of consequences was examined with Cronbach alpha reliability coefficients. Confirmatory factor analysis was performed to test whether variables measuring the three latent factors / concepts (i.e., experience, value

orientations, awareness of consequences) provided a good fit and demonstrated construct validity. Structural equation modeling was then used to test hypotheses, examine predictive validity of the three-factor model, assess whether value orientations mediate any relationships between experience and awareness of consequences, and ascertain whether participation in the "Whale Watching Spoken Here" program moderates (i.e., interaction) any relationships among these three latent factors (Figure 1).

A variable may function as a mediator to the extent that it accounts for the relationship between the predictor (i.e., past experience) and criterion (i.e., awareness of consequences) (Baron & Kenny, 1986). Three separate models are required to demonstrate mediation (Hayduk, 1987). In a full mediation model, the predictor (i.e., past experience) only influences the criterion (i.e., awareness of consequences) indirectly through its effect on the mediator (i.e., value orientations). In a partial mediation model, the predictor influences the criterion directly and indirectly through its effect on the mediator. In a direct effects model, the predictor directly influences both the criterion and mediator, but the mediator does not affect the criterion.

Several conditions must be met for full mediation to occur. First, the predictor must be significantly related to the mediator, and the predictor must significantly affect the criterion (i.e., direct effects model). Second, the paths between the predictor and mediator and between the mediator and criterion must be significant in both the full and partial mediation models. Full mediation occurs when the direct path from the predictor to the criterion is not significant in the partial mediation model. Third, a comparison of the models using the change in chi-square statistics ($\Delta\chi^2$) indicates that the full mediation

model is better than the direct effects model, and the partial mediation model is no better than the full mediation model (Baron & Kenny, 1986).

Multigroup structural equation models were conducted to determine if relationships between past experience and value orientations, and between value orientations and awareness of consequences differed depending on whether whale watchers did or did not participate in the "Whale Watching Spoken Here" marine education program (i.e., moderation / interaction effect). One model examined factor loadings and path coefficients among these three concepts for non-participants. A second model examined factor loadings and path coefficients for participants. The first step in moderation analysis involves testing for measurement invariance to reveal any differences in factor loadings between the two groups (i.e., participants, non-participants). The second step is to run the structural model after imposing constraints so that the path coefficients among the three concepts are constrained to equality across the two groups. The final step involves running the model with no constraints, testing for differences in specific effects between groups, and comparing models (no constraints, constraints) using the chi-square difference test ($\Delta\chi^2$). An insignificant test suggests that moderation is not present (i.e., there are no interactions across groups in the model) (Baron & Kenny, 1986; Byrne, 1994; Chou & Bentler, 1995).

EQS 6.1 software and Satorra-Bentler robust estimation to correct for multivariate non-normality were used because data skewness and kurtosis indicated violations of the normal distribution assumption (Byrne, 1994; Chou & Bentler, 1995). Robust corrected (*) comparative fit index (CFI*), non-normed fit index (NNFI*), and root mean square error of approximation (RMSEA*) assessed model fit. CFI* and NNFI* values $\geq .90$ and

RMSEA* values ≤ .08 suggest acceptable fit (Browne & Cudeck, 1993). Robust standard errors were used for test statistics.

Results

Descriptive Findings

Mean ratings for the frequency that whale watchers had participated in activities related to whales and marine areas ranged from .61 (0 to 1 time / year) to 2.20 (2 to 4 times / year) among the eight past experience events (Table 1). Respondents, on average, visited an ocean and watched television programs on marine environments the most, whereas they were least likely to have volunteered to help the environment or made monetary donations for environmental causes. Respondents, on average, also moderately to strongly agreed that whales are important for Oregon, it is important to protect whales and marine areas, whales need a healthy environment to survive, and it is important to spend money to protect whales. In addition, whale watchers moderately agreed that their own personal actions impact whales and the marine environment.

Measurement Models

Confirmatory factor analysis demonstrated that the data provided an acceptable fit for the three latent concepts (i.e., past experience, value orientations, awareness of consequences). Figure 1 shows the standardized factor loadings associated with each multi-item concept. Factor loadings were acceptable (i.e., all above .40) and ranged from .40 to .76 for variables measuring past experience, .61 to .79 for beliefs associated with environmental value orientations, and .76 to .89 for items measuring awareness of consequences. All loadings were significant at $p < .05$. Fit indices indicated strong

construct validity and measurement model fit (S-B $\chi^2 = 150.68$, $p < .001$, χ^2 / df = 1.49, CFI* =.95, NNFI* = .94, RMSEA* = .05).

Reliability coefficients indicated high internal consistency for each concept: .79 for past experience, .85 for beliefs / value orientations, and .82 for awareness of consequences (Table 1). A Cronbach alpha coefficient ≥ .65 indicates that items are measuring the same concept and justifies combining items into a single index (Cortina, 1993; Nunnally & Bernstein, 1994). Deletion of any variable from its respective concept did not improve reliability.

Structural Models

As predicted by Hypothesis 1, a significant positive relationship was observed between environmental value orientations and past experience related to whales and marine areas. Whale watchers with substantial past experience were more likely to have stronger biocentric value orientations. The standardized coefficient was $\beta = .47$ and was significant at $p < .05$ (Figure 1). Past experience explained 22% of the variance in respondents' environmental value orientations.

Hypothesis 2 predicted a positive relationship between value orientations and awareness of consequences of personal actions. The standardized coefficient between value orientations and awareness of consequences was $\beta = .49$ and was significant at $p < .05$ (Figure 1). Environmental value orientations explained 24% of the variance in respondents' awareness of consequences. This finding supports Hypothesis 2; whale watchers with stronger biocentric value orientations were more likely to be aware of consequences of their own behavior on whales and marine areas.

The next step in the analysis was to examine whether value orientations mediate the relationship between past experience and awareness of consequences. In the direct effects model, past experience had a significant positive effect on awareness of consequences ($\beta = .34$, $p < .05$). In the partial mediation model, the path coefficient between past experience and environmental value orientation was positive and significant ($\beta = .47$, $p < .05$) and the path between value orientation and awareness of consequences was also positive and significant ($\beta = .49$, $p < .05$), but the direct path coefficient between experience and awareness of consequences was not statistically significant ($\beta = .13$, $p > .05$). These findings support the full mediation model.

Further support for the full mediation model was evident from the change in chi-square statistics (i.e., chi-square difference tests). The full mediation model had a significantly better fit than the direct effects model ($\Delta\chi^2 = 102.16$, $p < .001$), but was statistically equivalent to the partial mediation model ($\Delta\chi^2 = 1.95$, $p = .163$). Structural model fit for the full mediation model among the three latent concepts / factors was acceptable and strong (S-B $\chi^2 = 152.63$, $p < .001$, χ^2 / df = 1.50, CFI* =.95, NNFI* = .94, RMSEA* = .05).

The final step in the analysis was to conduct multigroup structural equation models to determine if relationships between past experience and value orientations, and between value orientations and awareness of consequences differed depending on whether whale watchers did or did not participate in the "Whale Watching Spoken Here" program (i.e., moderation / interaction effect). All tests for invariance of factor loadings and structural model paths were not statistically significant. The chi-square difference test indicated that the structural model paths did not significantly differ ($\Delta\chi^2 = 1.31$, $p = .520$)

between participants (past experience → value orientations β = .45; value orientations → awareness of consequences β = .52) and non-participants (past experience → value orientations β = .54; value orientations → awareness of consequences β = .37). Moderation was not present (i.e., no interactions across the two groups); relationships among past experience, value orientations, and awareness of consequences did not differ depending on whether whale watchers did or did not participate in this program.

The full mediation model, therefore, best described the relationships among Oregon's shore-based whale-watchers' past experience, environmental value orientations, and awareness of consequences (Figure 1). These relationships were not moderated by whether or not viewers participated in the "Whale Watching Spoken Here" marine education and outreach program.

Discussion

This article focused on Oregon's shore-based whale watchers and examined their past experiences related to whale watching and marine settings (e.g., visits to ocean, aquariums), environmental value orientations (e.g., biocentric, anthropocentric), and awareness of impacts associated with personal actions on whales and marine environments. Respondents, on average, believed that: (a) whales and marine areas are important and require protection, and (b) their daily actions affect whales and the marine environment. Respondents were most likely to have visited an ocean and watched television programs about whales and / or marine areas; they were least likely to have volunteered or made monetary donations for environmental causes.

Whale watchers' past experience associated with whales and marine environments positively influenced their environmental value orientations. These value

orientations positively influenced awareness of consequences of personal behavior on whales and marine areas. In other words, viewers with more past experience held stronger biocentric value orientations and were more aware of impacts of their actions on whales and the environment. Value orientations fully mediated the effect of past experience on awareness of consequences. In other words, experience was indirectly related to awareness of consequences through the effect of value orientations. Relationships among past experience, value orientations, and awareness of consequences did not differ between whale watchers who did and did not participate in Oregon's "Whale Watching Spoken Here" program. Findings have implications for theory, management, and research.

From a theoretical perspective, research has focused individually on the concepts of past experience, value orientations, and awareness of consequences (see Manfredo et al., 2004; Manning, 1999; Vaske & Whittaker, 2004 for reviews). In addition, studies have addressed relationships among some of these concepts (e.g., Bratt, 1999; Stern et al., 1999). Little research, however, has examined relationships among all three concepts, especially within the context of marine outreach and education in general and whale watching in particular (Christensen et al., 2007). This study helped to address this knowledge gap. Results showed that past experience influenced value orientations, which subsequently influenced awareness of consequences. When measuring beliefs and examining possible correlates or determinants of value orientations, therefore, future research should consider respondents' past experience related to the activity, resource, or issue. Likewise, researchers should consider the role of value orientations in predicting

respondents' awareness of consequences of a particular behavior, and the mediating relationship between past experience and awareness of consequences.

Given their high factor loadings and reliabilities, variables used here appear to represent an acceptable approach for measuring past experience related to marine areas and environmental issues, awareness of impacts on whales and marine environments, and environmental value orientations. One possible limitation of this study, however, was the lack of a comprehensive measure of awareness of consequences (i.e., only two variables) (Bratt, 1999; Joireman, 2001). Research on the human dimensions of whale watching, therefore, should continue examining reliability and construct validity of additional variables and dimensions related to these three concepts, and the extent to which results may be similar or different to those observed here.

Findings showed that 22% of the variance in environmental value orientations was explained by past experience and 24% of the variance in awareness of consequences was explained by value orientations. This suggests, however, that a proportion of value orientations and awareness of consequences remained unexplained by the model presented here. Empirical research is needed to continue examining other possible determinants and correlates (e.g., socio-demographic characteristics, efficacy, norms, attitudes) of these three concepts in the context of marine environments in general and whales and whale watching in particular.

From an applied perspective, findings here showed that an individual's past experiences with educational programs and participation in marine and environmental activities have a direct affect on his or her value orientations and an indirect (i.e., mediated) effect on awareness of consequences of behavior. Theory suggests that value

orientations and awareness of consequences can influence other cognitions such as attitudes, intentions, and behaviors (e.g., Eagly & Chaiken, 1993; Fulton et al., 1996; Schwartz, 1977; Vaske & Donnelly, 1999; Vaske & Whittaker, 2004). For programs such as "Whale Watching Spoken Here" that seek to influence individuals' environmental attitudes and behaviors, it is important to know if these programs influence their audiences and if so, what types of cognitions are impacted by the programs. Understanding this information can assist outreach and education programs in determining how much and what types of interpretation to provide, and how to tailor this information to clients.

To illustrate, many shore-based whale watchers surveyed in this study had somewhat biocentric beliefs about marine areas and the environment, but were slightly less likely to be aware of consequences of their actions on these areas. One goal of the "Whale Watching Spoken Here" program involves explaining to visitors how they can help protect whales by recycling, reducing pollution, and understanding reasons why whales and marine areas are threatened by humans. To achieve this goal, results suggest that it may be useful to increase and improve information and education opportunities that are provided to visitors, with the expectation that they will influence value orientations and increase awareness about consequences of human actions on whales and marine ecosystems. As a result, individuals may be more likely to engage in more responsible environmental behavior.

The need for understanding how these types of marine education and outreach programs influence the public is increasing, as attention on the condition of oceans has become more prevalent (PEW Oceans Commission, 2003, U.S. Commission on Ocean

Policy, 2004). According to PEW Oceans Commission (2003), for example, there is a "need to provide the public with understandable information about the structure and functioning of coastal and marine ecosystems, how ecosystems affect daily lives, and how we affect ecosystems" (p. 11). Andersen and Miller (2006) found that a large percentage of whale watchers look forward to informational and educational aspects of whale watching trips, and viewer satisfaction increases when they learn about whales and the marine environment. Findings here take this one step further and suggest that experiences involving learning about marine environments can influence beliefs and awareness of impacts, which, in turn, may promote more responsible environmental behavior. In other words, experiences such as visiting aquariums or participating in opportunities such as the "Whale Watching Spoken Here" program influence environmental value orientations, promote more awareness and responsibility of human impacts on whales and marine areas, and may help reduce impacts on species and ecosystems by encouraging responsible environmental behavior.

This study should be viewed as a starting point for understanding whale watchers' past experiences, environmental value orientations, and awareness of consequences related to whales and marine areas. Findings here are limited to shore-based whale watching in Oregon. Results may not generalize to whale watchers in other locations or viewers of other wildlife species. Researchers are encouraged to implement various theoretical and methodological approaches to improve understanding of the human dimensions of whale watching.

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Table 3.1. Reliability analyses of items measuring past experience, value orientations, and awareness of consequences.

	Item code	*M*	*SD*	Item total correlation [a]	Alpha if item deleted [b]	Cronbach alpha [c]
Past experience [d]						0.79
Visited a zoo / aquarium	V_1	0.97	0.84	0.36	0.79	
Visited a state park	V_2	1.97	1.19	0.49	0.77	
Visited the ocean	V_3	2.19	1.23	0.47	0.77	
Read a book / magazine about the marine environment	V_4	1.00	1.32	0.50	0.77	
Volunteered to help the environment	V_5	0.61	1.07	0.42	0.78	
Talked to others about the marine environment	V_6	1.18	1.38	0.66	0.74	
Watched television show on marine environments	V_7	2.20	1.37	0.56	0.76	
Made monetary donation to environmental cause	V_8	0.70	0.99	0.53	0.77	
Environmental value orientation belief statements [e]						0.85
The marine environment requires our protection	V_9	4.50	0.51	0.67	0.81	
It is important to protect whales	V_{10}	4.56	0.55	0.66	0.81	
It is important to protect the marine environment	V_{11}	4.56	0.51	0.69	0.81	
Whales are important for Oregon	V_{12}	4.16	0.75	0.60	0.83	
Whales need a healthy marine environment to survive	V_{13}	4.60	0.58	0.58	0.83	
It is important to spend money to protect whales	V_{14}	4.12	0.71	0.63	0.82	
Awareness of consequences of actions on environment [e]						0.82
My daily actions affect whales	V_{15}	3.70	0.86	0.69	--	
My daily actions affect the marine environment	V_{16}	4.00	0.83	0.69	--	

[a] Pearson correlation coefficient between score on individual item and sum of scores on remaining items.
[b] Cronbach alpha when item removed from scale.
[c] Reliability coefficient for how well a set of items (variables) measures a single unidimensional latent construct.
[d] Variables coded on 5-point scale: 0 "no times," 1 "1 time," 2 "2 to 4 times," 3 "5 to 9 times," 4 "10 or more times."
[e] Variables coded on 5-point scales from 1 "strongly disagree" to 5 "strongly agree."

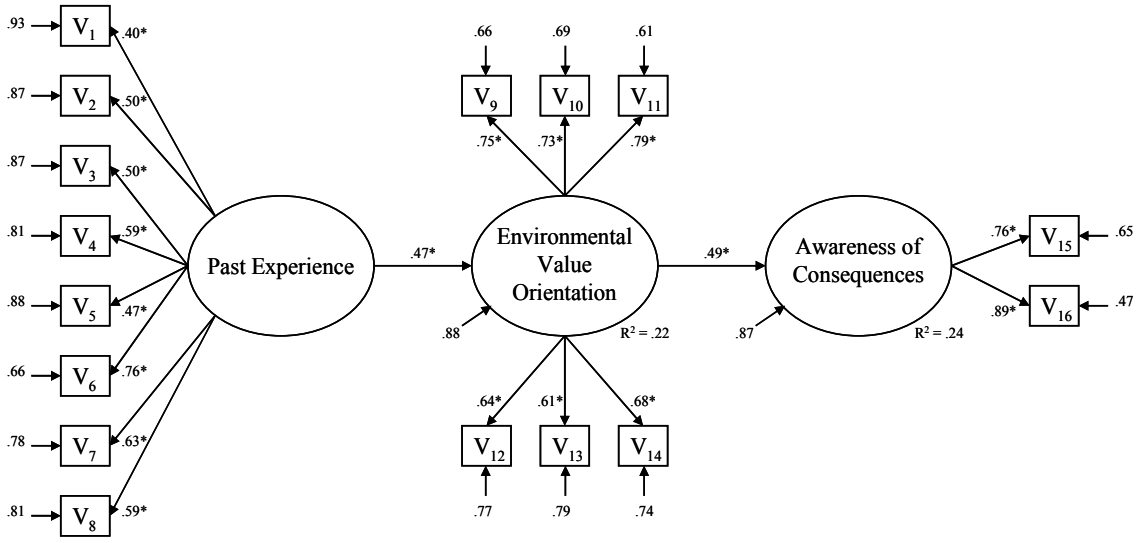

Figure 3.1. Structural model of relationships among past experience, environmental value orientation, and awareness of consequences. Asterisk (*) indicates path significant at $p < .05$. Based on Satorra-Bentler robust estimation for multivariate non-normality, final model fit indices: S-B $\chi^2 = 152.63$, $p < .001$, χ^2 / df = 1.50, NNFI* = .94, CFI* = .95, RMSEA* = .05. See Table 1 for variables / items corresponding to codes (e.g., V_1).

Interested in Learning How to Use Concept Maps in Your Institution?

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In order to understand what impact educational programs have on their audience members, a variety of tools can be used. If you are interested in gaining insight into what variety of prior knowledge and misconceptions your audience has surrounding a specific topic, and how that knowledge structure may change after participation in an educational program, concept maps may be your answer. Though they have been used for several decades in formal classroom settings to analyze a student's understanding of meaningful conceptual relationships, informal educators are just starting to realize their potential.

Concept maps are web-like diagrams that show meaningful relationships between related concepts, which are often arranged hierarchically (Appendix B and D). These relationships are usually linked by words to form propositions that together make up an approximation of the structural complexity of a learner's understanding of a specific topic (http://www.msu.edu/~luckie/ctools/). These relationships are usually centered around a theme, or prompt, that you would like your visitors to focus their thoughts around. Understanding how these pathways for organizing information are formed can suggest ways that the educator may connect new information to prior knowledge and facilitate meaning making.

In order to make concept maps useful for an informal audience that typically has a short period of time to spend both learning how to and making a concept map that is hierarchically constructed, we made adjustments to the tool and tested it on an informal audience of Oregon State Parks and Recreation's outreach program "Whale Watching Spoken Here." These adjustments included showing a sample map (unrelated to the program topic) to participants (Appendix B), simplifying instructions (Appendix A), and analyzing maps for preconceptions, misconceptions, analogies, affective words, scientific

language, and changes to propositional structure (this is a slightly different form of analysis compared to traditional concept maps which measure the number of hierarchical levels, conceptual nodes, and linkages between concepts).

We found that after participation in the program, visitors used more analogies, scientific language, and complex propositions to describe concepts in their maps, indicating that their knowledge structure surrounding gray whales right after participation in the program had become more complex. Concept maps also provided a basic understanding of participants' preconceptions, misconceptions, and reflected information that was being provided by the program, thereby serving as a useful evaluation tool that could be used to make changes and adjustments to the program to better meet their audience's needs.

Some methodology to get you started…

1) Use a simple set of instructions such as "Please write down as many words, ideas, images, phrases, or thoughts that come to mind related to the term "Grey Whale" (see Falk et al. 2003). "Draw lines between these concepts to show how they are related to one another. Write linking words between concepts to explain how they are related to each other."

2) Show visitors a sample map that is unrelated to your topic to give them an idea of what a concept map should look like.

3) Test your prompt to decide what information you want to collect from your visitors. For example, you will get very different maps depending on whether you use the prompt "gray whale" or the prompt "Whale Watching Spoken Here Program."

4) Decide if you want visitor maps made before they participate in a program, after they participate in a program, or both. Pre-maps will indicate the preconceptions and misconceptions a visitor has about a certain topic. Post-maps may indicate specific concepts the visitor has picked up after participating in your program. A comparison of the two may show you if the visitor corrected certain misconceptions after participating in your program. (Note: You may decide that instead of having visitors produce a new map after the program, you would like to have them add or make changes to their first map. Both methods should be tested and decided based upon what type of information the visitor maps reveal.)

5) Have a team of evaluators read at least a subset of the maps and establish a common list of basic concepts that are present in the maps. These evaluators should be able to read each map and classify each word into one of these basic concepts (for example, the words 'baleen' and filter-feeder" can be classified under the basic concept of 'eating'). Evaluators can then code each map by these general concepts, and compare concept usage across maps.

6) If you are really ambitious, start a database, numbering each map, and listing the concepts that are used on each map. Establishing this database can help you search for patterns in conceptual similarities and differences between groups (such as educational background, age, gender, etc.).

7) You can also code specific concepts you would like to see in each map, or misconceptions (ex. Gray whales eat sea lions), or analogies (ex. size of a school bus), or use of emotional words (ex. amazing!), or evidence of anthropomorphizing (ex. "nice

mothers"), which may give you information about what your audience is confused about or how your audience is connecting with the information.

8) If you are comparing a pre-map to a post-map, you may be interested in finding out how their knowledge might have become more detailed and specific surrounding a certain concept. Two ways of doing this are 1) looking for an increase in the use of scientific language and specific facts (for example, in describing a gray whale on a pre-map, someone writes "huge" but on a post-map writes "45 feet long"), and 2) looking for an increase in propositional structure (for example, on a pre-map, someone might write "eats small animals" and on their post-map, they might write "Whales eat by filtering plankton through their baleen.")

9) Finally, by making a list of common connections that are made between concepts, you can also start to understand how people are structuring their knowledge, what types of concepts they tend to relate together, and what types of concepts may be related incorrectly.

So, what information can be gained from these maps?

- An understanding of the initial preconceptions and misconceptions of your audience about a certain subject. How can you gear your program to build off of the audience's prior knowledge and address misconceptions?
- An understanding of the types of concepts people leave the program with. Are people leaving the program with the concepts you emphasized in your program? Do they have an understanding of the ideas you hoped they would?

- A basic understanding of the complexity of their knowledge. Are they making connections between concepts? If so, what ideas and concepts are they associating together?
- An understanding of how people are connecting to the information. Are they using analogies to better understand the information? Are they using "wow" facts? Are they relating the information to past experiences or prior knowledge in their own lives? Are they expressing words in terms of an emotion? Are they anthropomorphizing any of the concepts? If so, these connections can indicate a step towards storing information into long-term memory.
- An understanding of what concepts the audience's knowledge has deepened in. Is there an increase in the use of detail and scientific language for specific concepts? Is there an increase in propositional structure? This is not an exhaustive measure of the depth of their understanding but can give you clues into which concepts they are starting to master.
- An understanding of the differences in maps between different demographic groups of people (educational background, females vs. males, home schoolers vs. public school, family groups vs. individuals, age, etc.). This information enables you to more easily match your programs to your audience.

Concept Mapping as a Visitor Evaluation Tool in an Informal Marine Science Program

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Introduction

Environmental educators have long understood the value of focusing public attention on charismatic megafauna in order to facilitate conservation of the natural environment. Whale watching, in particular, has increasingly become a popular and economically important tourist activity, with over 9 million people whale-watching in roughly 87 countries per year, and producing at least one billion in total revenues (including travel, accommodation, food, souvenirs) (Hoyt 2001). An increasing majority of these experiences facilitate educational experiences about whales and the marine environment, making these activities not only important economically, but significant in creating a more ocean literate public for which the U.S. Commission on Ocean Policy says there is an "urgent need" (2004). Environmental educators for years have believed that these types of programs help to shape their audiences' meaningful learning experiences surrounding a particular subject of interest. However, only recently have educators and researchers begun to search for ways to evaluate the impact of these programs on their audiences as a desire to improve programs and develop a more ocean literate public has increased, in part because accountability and competition for funding has also increased.

Informal educators have struggled with how to measure the affects their programs have on their audiences because their programs address free-choice [1], non-captive audiences with very different motivations than those of classroom audiences. Traditional paper and pencil tests do not measure the types of complex, meaningful learning

[1] Learning that is self-motivated and guided by the interests of the learner; the learner chooses what he/she will learn

experiences that occur in informal[2] learning settings characterized by various amounts of choice over learning (Escalada and Zollman 1997), and thus different tools are needed. Concept maps have been used to analyze a person's knowledge structure in many environments (Rafferty & Fleschner, 1993; Gonzalvo et al. 1994; Baldissera 1993), and most relevant to this paper, in science learning environments (Novak 1990, Briscoe 1991, Brody 1993, Coleman 1998). Research has found that this knowledge structure is an important construct of science literacy (eg. Bybee, 1996; Moore, 1995). This paper will address the use of concept mapping in an informal ocean science outreach program to measure knowledge structure and meaningful learning experiences on multiple levels (Novak, 1984).

Concept maps are hierarchical, node-link diagrams that are intended to represent meaningful relationships between concepts (see Appendices B & D). These relationships are usually linked by words to form propositions that together make up an approximation of the structural complexity of a learner's understanding of a specific topic (Novak and Gowin 1984, Novak 1998). As Novak describes, they are "tools for negotiating [cognitive] meanings" in that the learner must consult prior knowledge and negotiate a new understanding that is often facilitated by a group of learners that together produce meaning making. Constructivist theory further suggests that concept maps can be used by educators to determine pre-conceptions and misconceptions, and by understanding the pathways used to organize information, can be used to suggest ways that the educator may connect new information to prior knowledge and facilitate meaning making (Mason 1992, Stoddart et al. 2000, Novak & Gowin 1984, Ausubel et al. 1978).

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[2] Informal educational settings are those places people come to learn that are not part of traditional school environments; examples include aquariums, zoos, museums, parks, etc.

For years teachers and educational researchers have used concept maps in formal classroom settings to measure these relationships, but they have been used limitedly in free-choice learning settings, such as aquariums, zoos, museums, parks, etc. (eg. Barney et al. 2005). Traditional concept mapping requires that students be trained in the construction of a concept map so that the hierarchical structure of the maps can be reliably and validly assessed according to traditional measures of hierarchical conceptual understanding. This training time usually takes a minimum of 30 minutes, an amount of time that few researchers can have with free-choice learners. However, concept mapping lends itself to being a useful assessment tool for learners that choose what they will learn because by its very nature it provides people with a choice of what to write down, focusing on "what they do know" rather than "what they don't know." It also has the ability to show how new knowledge has been analyzed, synthesized, and evaluated by students (Novak and Gowin 1984).

In recent years, researchers and evaluators working in informal learning settings have become interested in using concept maps as part of research and evaluation, both formative and summative. They have been used to look at visitor knowledge and learning around science topics such as dolphins (Sickler et.al., 2006) and anatomy (Gieseke and Stafford, 2006). However, even in most of these studies, the tools were used with an audience who spent significant time in an exhibit in a museum and experienced some training. Because many researchers and evaluators find that training visitors to use a tool as part of a free-choice visit to an informal learning setting is cumbersome, likely to cause significant loss of subjects, and threatens the ecological validity of the research, they have adapted concept mapping ideas to the realities of research in these settings.

Falk and Dierking (Falk, 2003) invented a tool related to concept mapping, called personal meaning mapping (PMM) that uses an interview style approach to concept mapping. PMM has been successfully used in free-choice learning settings to measure how a "specified educational experience uniquely affects each individual's conceptual, attitudinal and emotional understanding" (Falk, 2003; Rebar, 2004). PMM though has similar constraints to interviewing in that it can be limiting for large groups because it requires a lot of time and self-selects those people who are willing to be interviewed[3].

Based upon the theories and concepts developed in traditional concept mapping, ideas presented by Falk and Dierking in PMM, and through modifications made in the pilot study, this study develops a framework of analysis that can be used in informal settings with free-choice learning audiences. Secondly, this analysis is used to gain an understanding of the Whale Watching Spoken Here audience as well as the affect this program has on its audience. Throughout the paper, affordances and constraints of such a tool are also explored. Finally, we investigate the use of the tool by peer and family groups as a possible measurer and facilitator of shared meaning making (Novak and Gowin 1984).

Methodology

Site

Oregon State Parks provides an outreach program to its shore-based whale watchers, reaching approximately one-fourth (34,000 visitors) of Oregon's shore-based whale watchers in just three weeks out of the year (WW program 2007, Hoyt 2001). The

[3] Observations in pilot study revealed people were much more liable to agree to do maps when they were not interviewed: several visitors made comments about how little they knew and appeared to be self-conscious. Constructing maps on their own seemed to make them less self-conscious.

Whale Watching Spoken Here program has been running since 1978 and was created to take advantage of the Gray whale migrations off the Oregon Coast coinciding with the spring, winter, and summer school breaks in Oregon. It runs out of 28 sights mostly situated outdoors in state parks right on the edge of the coast, usually from a high vantage point to make it easier to spot whales. Four indoor facilities also provide education and activities during whale watch weeks. Visitors are comprised mostly of families that may or may not know of the presence of the program. A sign is set up at each of these sites to inform people of the program. Volunteers are at sites from 10 a.m. to 1 p.m. daily during whale watch weeks. There is no fee for the program, although there is a small fee to enter and use a few of the sites. The program's purpose and goals are to educate people about the Gray whale migrations, provide a memorable experience for coastal visitors that will lead to enjoyment and appreciation of our natural resources, and facilitate awareness of the sustainability of, protection of, and human influence on the marine environment.

Several volunteer training sessions are offered by the Whale Watch Volunteer Coordinator throughout the year. The training sessions teach volunteers about Gray whales and other marine mammals they will see along the coast and effective ways to interpret this information to the general public. During whale watch weeks, volunteers use what they have learned to educate people about the whales and how to look for them. Interactions with volunteers are usually one-on-one or in small groups. Volunteers facilitate informal discussions with visitors that are largely question/answer routines and "show and tell". Many of the volunteers provide binoculars and telescopes to visitors to help them see the whales. They also have a box full of educational props (such as

samples of baleen, pictures, mysid shrimp, etc.) that they use in their interpretation. Interactions on average are approximately 10 minutes, but can last from 30 seconds all the way up to half an hour.

In order to ensure that claims could be generalized to the entire program, sampling was done across a wide variety of sites and settings. 6 separate sites were used, both indoors and outdoors with a variety of volunteers at them on any given day. Sampling occurred during rain, wind, and shine, though days with very rough weather sampling occurred at the indoor sites because of lack of interest by visitors in the outdoor sites. Evaluators were set up with a table and clipboards approximately 10 meters away from the volunteers and approached visitors as they approached the site and before they spoke with any of the volunteers, explaining briefly about the program itself and then the research study.

Pilot Study

A very important part of the development of this tool was the pilot study, which was done to determine the best methods for explaining directions and to develop a tool that would successfully obtain the best data. It is worthwhile spending some time discussing the pilot study in order to put the findings in context and to provide readers with information they can use for using concept maps in similar settings[4]. The pilot study was run over a 1-week period in spring of 2005 and included 65 participants. The pilot study tested four main elements including the pre-test and post-test map design, the

[4] One of the most serious difficulties for this study was the lack of readily available descriptions of procedures in the literature for how to administer and analyze the concepts maps. This lack of generally available instructions and procedures may be part of what keeps concept mapping as a tool from spreading among researchers and evaluators in any reliably reproducible way.

central theme of the maps, the use of seed words, procedures for providing directions, and map analysis.

Firstly, when sampling visitors in a pre-test/post-test design, concept mapping can be done in two ways: 1) A map is created in the pre-test and this same map is added to or changed in the post-test, or 2) A map is created in the pre-test and a new map is created in the post-test with an option to refer to the pre-test map. We found that when visitors were asked to make additions or changes, participants rarely changed anything, and added very little to their map. This method prevented us from obtaining information about the wide variety of preconceptions visitors had about the program, which was an important component for understanding visitor's prior knowledge. Concept maps can further be defined as open-ended (Stoddart et al. 2000, Ruiz-Primo et al.1997), in which maps are constructed from scratch, or constrained, in which people are given a set of concepts to use (Markham et al. 1994, Osmundson et al. 1999) and/or a skeleton map with a "fill-in-the-blank" map structure of empty circles and lines (Zeilik et al. 1997, Coleman 1998). In the open-ended technique, people often corrected misconceptions and added new material. Past research also supports the use of the open-ended technique, as maps that were constructed from scratch better reflected differences in students knowledge structure (Ruiz-Primo et al. 2001) and providing samples of concepts seemed to lead students towards one direction Ruiz-Primo et al. (1997). Therefore, the initial "maps" that were given to participants were composed of a single prompt in the center of a mostly blank piece of paper, with several sentences of directions at the top.

Secondly, a concept map is always constructed around a central theme, or prompt, that should be tested in order to obtain data on the subject that is desired by the program

(Falk, 2003). For example, we tested the prompt 'whale', 'Whale Watching Spoken Here', and 'grey whale,' finding that 'grey whale' produced maps that were most focused on themes presented in the program.

Thirdly, because we had limited time with participants as noted earlier, directions needed to be clear and concise. We used directions very similar to those used in PMM, as well as concept mapping: "Please write down as many words, ideas, images, phrases, or thoughts that come to mind related to the term "Grey Whale" (Falk, 2003). We added the following to these directions: "Draw lines between these concepts to show how they are related to one another. Write linking words between concepts to explain how they are related to each other." Additionally, these directions were also explained to visitors in the same manner. A script was developed that all evaluators referred to when explaining directions in order to standardize as much as possible the procedure (Appendix A). However, many people were still confused by these directions, so we presented them with some sample maps that were completely unrelated to the subject that they could look at to get an idea of what their map might look like (Appendix B). Though the first sample map on airplanes is much more complex, we found that it discouraged people from participating in the study, whereas the second sample map on dogs seemed to facilitate concept maps that contained similar types of structural complexity.

Additionally, we also found a higher response rate when instructions were only provided for the pre-test map when visitors were first approached by the evaluator. Visitors were asked to return after the program and they would be given additional instructions for the post-test at that time. At that point, they were given the same instructions they received during the pre-test. When instructions for completing both

maps were provided before the program, visitors often declined to participate and when they did participate, they often completed the maps incorrectly by completing both maps before the program or constructing a second map while talking to a volunteer.

Lastly, and most importantly, because the conditions under which maps were created were quite different from classroom or even museum conditions, analysis of maps had to be done in a different way to that of traditional concept map analysis. Traditionally, the levels of hierarchy are assigned points, nodes and numbers of correct connections between concepts are counted, and total number of vocabulary and concepts are scored. Those maps that include many levels of hierarchy, many nodes, and many concepts are assigned the most points and rated as the most complex (Novak and Gowin 1984). In many studies, an "expert" or "correct" map is created, and maps are assigned points based upon how closely they resemble the expert map (Stoddart et al. 2000, Ruiz-Primo et al. 2001). These methods are largely used in classroom settings because they allow the instructor to assign total points relative to other student maps or an expert map. When this method is used to analyze pre and post lesson maps, post-lesson maps that have higher levels of hierarchy and increased numbers of nodes are taken to indicate an increased level of understanding of the material.

However, Ruiz-Primo et al. (1997) noted that concept map instruction does not necessarily have to include the process for developing a hierarchical map if the structure of the content domain is not hierarchical. Post-maps in our study often did not exhibit extensive and complex levels of hierarchy and nodes, which is most likely a combination of a lack of extensive training for visitors, a lack of the content domain not being hierarchical in nature, and a lack of interest in spending more than 5-10 minutes

constructing maps. It is possible that the program had no effect on knowledge complexity, however, we observed several phenomenon in the post-maps that led us to believe that people's conceptual understanding was changing, including a change in use of misconceptions, affective (emotional) words, analogies, common (every-day) and scientific words. Additionally, there was a marked change in the use of propositions (see Methods section for definition). Therefore, alternative measures of conceptual complexity were developed based upon methodology from Ruiz-Primo et al. (1997), Stoddart et al. 2000) and PMM (Falk, 2003).

Data Collection

Visitors were randomly sampled over two one-week periods during winter and spring breaks (end of December 2005 and end of March 2006). A total of 287 visitors participated in the study and of these, 173 fully completed both the pre and post tests. Using the protocols developed in the pilot study, visitors were instructed to construct one map during the pre-test, then participated in the program by talking to the volunteers and looking for whales, and then afterwards constructed a new map during the post-test. In order to look for trends within the participant population, several questions regarding motivations, age, gender, previous experience with concept mapping, and previous experience with the program were asked (Appendix C).

Participants constructed maps as either individuals (N= 56) or together in groups (N= 107) and marked this accordingly on their maps. The reasoning behind this methodology is two-fold. First, the tool can be used to measure group meaning-making (Novak and Gowin, 1984). This kind of socially mediated learning (Wertsch, 1998; Wenger, 1998; Rogoff, 1990) is perhaps the most common type of learning in informal

settings (Leinhardt,Crowley and Knutsun, 2002; Rowe, 2002) where families and other multi-generational groups are the most common types of visitors (Bitgood, Serrell, and Thompson, 1994). The Whale Watching Spoken Here program attracts a large number of family groups on vacation Since the program is attracting and affecting family groups, it follows that an evaluation of these effects should in part look at shared meaning-making. Secondly, the tool takes advantage of the fact that families are participating in the program together by allowing all of them to work together on the evaluation. This process not only encourages the coalescing of knowledge into a much more complex structure, and thereby serves as a learning tool in itself, but also becomes an evaluation tool that is attractive to families because it suddenly becomes a fun and creative activity to participate in together instead of a survey instrument that may be seen as taking away time from the family's joint activity. Parents in particular reported enjoying doing the maps because it was seen as a learning activity for their children. Additionally, this method improves the chances that at least one person in the group has had prior training in concept mapping (usually the children), or can pick it up very quickly[5] (usually the adults).

In order to determine the degree to which concept maps documented actual volunteer-visitor interactions, we also used observational rubrics developed in other settings to code talk. One evaluator at each site took notes to record what concepts volunteers and visitors talked about. A list was generated of the most common concepts used in interactions between volunteers and visitors, though unlike the maps, these interactions were not analyzed for breadth due to time constraints. Special note was also

[5] These claims are based upon comments made through informal communication with participants in the study.

made on the length of interactions, and the types of interactions (inquiry based, show and tell, story telling, use of lots of affective words and analogies). This information allowed evaluators to understand why and how participants were combining certain concepts. In many studies using concept maps, these combinations are explained through the use of linking words; however, we found that on many of the maps, participants did not use linking words[6]. According to Novak and Gowin (1984), this may either be a result of not having a good grasp of the material, or not enough experience creating concept maps. As participants were unwilling to spend a lot of time and effort on the maps and were unwilling to undertake a half hour training session, we assumed that the lack of the use of linking words was mostly due to the latter, though, the former was no doubt also a player.

Analysis

Because of the nature of the setting and the design of the concept map tool, a mixed method approach of qualitative and quantitative analysis was used. Because of the nature of the data, analysis used in this study was consistent with a grounded theory approach (Patton 1990, Strauss and Corbin 1990): evaluators read concept maps, developed categories of concepts and properties from these, and studied their interrelationships in order to uncover themes and generate general theory. Like methodology used to measure breadth in PMM (Falk et al. 1998, Adelman et al. 2000, Falk, 2003), vocabulary words were assigned into broad conceptual categories by three separate reviewers to ensure inter-rater reliability for validity purposes (table 5.1). Each

[6] Novak and Gowin originally did not use linking words in their formation of concept maps, but found them to be necessary for researchers that were unfamiliar with the topic to understand the reasoning behind concept linkages. Because many participants did not utilize linking words, evaluators attended the same training session as volunteers and observed and took notes of volunteer-participant interactions. We found this approach allowed evaluators to understand the vast majority of concept linkages.

broad conceptual category could contain any number of sub-concepts (eg. broad category = migration; sub-concepts = Alaska, Baja, residents, etc.) that indicated a deeper understanding of the broad more general concept. Differences between pre and post maps were then evaluated based upon the total amount of different conceptual categories used (breadth).

In order to look for trends in the data between populations based upon breadth, each individual map was assigned a number and data from the map was entered into an excel spreadsheet and included the following experience and demographic categories: site, date, whether or not visitors had come to the Whale Watching program before, if they came specifically for the Whale Watching program, if they had seen a whale, if so if it was there first whale, if they spoke with a volunteer, if they made the concept maps as a group or individually, if they were male or female (individual) or both (group), their age, and if they had done a concept map before. SPSS was then used to look for differences in conceptual breadth between different populations (ex. The concept breadths of those maps completed by people with a high educational background were compared with those of a low educational background).

To measure conceptual structure, several methodologies were used that were based upon research by Stoddart et al. (2000), Novak & Gowin (1984), and Ruiz-Primo et al. (1997 & 2001). In these studies, propositions were scored according to accuracy, explanation, and propositional structure. Propositions in concept maps are the basic units of meaning used to judge the validity of the relationship drawn between two concepts. Traditionally, they are represented by a line and a linking word on this line that relate two concepts together (Novak & Gowin, 1984). This definition is useful for those maps that

exhibited this basic level of hierarchical branching; however, many propositions in our study were constructed without the use of lines using linking words instead as parts of phrases and full sentences. We argue that Novak's use of the term proposition can also be applied to propositions structured as sentences because findings from the pilot study revealed that those visitors that did *not* use linking words and lines connecting concepts *instead* used phrases and sentences to describe a concept, and in a sense, were using 'linking words' in place of lines to form complete sentences connecting two concepts together within a concept (eg. "grey whale --------- migrate ---------- Alaska ---------- food --------- plankton" is the same as "Grey whales *will* migrate *to* Alaska *to* feed *on* plankton").

These propositions were then scored as to whether or not they contained misconceptions, affective words, and/or analogies. Misconceptions for this study, or inaccurate statements, are defined as those propositions that are considered scientifically incorrect by the scientific community (Stoddart et al. 2000). Labeling misconceptions allowed us to determine what types of prior knowledge people were attending the program with that might be considered inaccurate from the program standpoint and how these might be changed as a result of the program. Affective words were defined as words of emotion and expression (nice, cool, etc.). Affective words were looked at for two reasons: a) they represent a way people are connecting to the information to form meaningful connections, and b) they can be used as a substitute when a person is unable to describe a concept more specifically and scientifically (Stoddart et al. 2000). These former two are part of Stoddart et al.'s level of accuracy. Analogies were defined as use of words like "like" or "as" to draw an explanatory or descriptive connection between one

concept or vocabulary item and another (eg., "as big as a school bus"; "baleen is like a comb"). Analogies are a pervasive feature of scientific reasoning and communication about science.

Conceptual categories, misconceptions, analogies, and affective words were entered into the spreadsheet for each pre-map and each post-map in order to compare mean differences between pre and post. Each of the conceptual categories was rated nominally, as a no (0) not present in the map, or yes (1) present in the map. Misconceptions, analogies, and affective words were assigned numbers based upon the total number of misconceptions, analogies, or affective words found on each pre and post map. Data was transferred into SPSS and paired sample t-tests were done between pre and post tests on misconceptions, analogies, affective categories, and single item concepts. Further qualitative analysis was then used to measure overall concept breadth by looking at overall mean differences in breadth between pre and post maps. Chi-square analysis using Pearson coefficient was done to test for significant differences among experience and demographic categories in terms of breadth of concept usage.

A more qualitative approach was taken to analyze the maps for changes in conceptual structure between pre and post maps based upon pilot findings. Several studies/theories have shown that a change from the use of everyday to scientific language may serve as indicators of mastery (Gee, 2001; Rowe, 2002; Stoddart et al, 2000). Every day language is defined as non-scientific language used commonly every day. Examples of every day language include ‘whales are big’ or ‘whales live in the ocean.’ Scientific language, however, is defined as words that are learned in science classes (often nominalizations (Gee, 2001), science programs, or used by the scientific community that

tend to be more specific in nature, and may include exact numbers and measurements. Examples of scientific language include ‘whales use baleen to sift out food’, or ‘a whale calf weighs 1 ton.’ Another part of Stoddart et al.’s ‘level of accuracy’ is the use of correct statements about scientific content. In our study, each pre-map was compared to its post-map to determine if use of scientific language noticeably increased, decreased, or stayed relatively the same. Use of scientific language was measured relative to the total amount of words used on each map in order to correct for the decrease in time spent, and thus concepts listed, on post maps.

As noted earlier, propositions may not be organized hierarchically if the structure of the content domain is not hierarchical. Because many maps in the pilot study did not exhibit a hierarchical structure, we determined that a lack of hierarchical structure was in part a result of the fact that the content domain was not hierarchical. A hierarchical content structure implies that there will be concepts within concepts within concepts. For example, the content domain ‘ecology’ can be broken down further into any number of concepts (eg. producers, consumers, decomposers) which can further be broken down into any number of concepts (eg. from decomposers, fungi & bacteria). However, as shown by concept maps in our study, ‘grey whale’ was broken down into 18 separate conceptual categories that could not be considered sub-categories of each other. Though there were many maps that did show a basic level of hierarchical structure indicated by the tendency to expand within a specific broader general concept, visitors did not tend to expand beyond one level of hierarchy within these broader general concepts. Because of these reasons, propositions were analyzed instead based upon Stoddart et al.’s

Explanation (a measure of concept depth) and Propositional structure (a measure of complexity).

Depth of explanation is rated on a scale from basic descriptions to higher-order explanations. Basic descriptions are often factual in nature and answer 'what' questions. An example of this includes 'whales are mammals.' Higher-order concepts describe function or purpose, such as 'whales use baleen to sift for food.' Propositional structure describes the elaboration of an idea within a proposition and can range from simple to complex. A simple proposition is made up of only one subject-object clause, where as a compound proposition contains one or more dependent clauses. For example, a simple proposition might be 'whales migrate' where as a compound proposition might be 'whales migrate to Alaska to feed.' For the purposes of our study, each pre-map was compared to its post-map to determine if the depth of explanation and propositional structure noticeably increased, decreased, or stayed relatively the same. Conceptual structure was measured relative to the total amount of concepts used on each map in order to correct for bias from the decrease in time spent, and thus decrease in concepts on post maps. Because these measures are related and depth of explanation increased as propositional structure increased, we decided to combine these measurements together into one measure called conceptual structure.

Finally, linkage between broader concepts was taken as an indicator of an attempt by the learner to coalesce information into a "bigger picture" understanding. A full analysis of these connections for each map fell outside the scope of the study, so this paper will only make comments on and provide a list of the most common relationships

observed between concepts. This information will allow us to understand some of the main themes that visitors are walking away with from the program.

Results

Interactions between volunteers and visitors averaged approximately 8 minutes, though some interactions lasted only 30 seconds, while others lasted up to 30 minutes. Reviewers produced a list of 18 concepts that were contained in the maps (table 5.1). Inter-rater reliability was 93%. Comparison of this concept list to the coding of talk concept list revealed that for the most part visitors were including the same concepts on their maps as the concepts they discussed with volunteers. However, there were two noticeable differences; use of affective words was present in nearly all interactions between visitors and volunteers though very little was included on post maps, and there was a large amount of talk of past experiences regarding whale watching that was not present at all on pre or post maps.

The most common concepts in the pre maps included 'physical characteristics' (88% of maps), 'eating/food' (61%), 'migration' (59%), 'classification' (49%), and 'life history characteristics' (44%). The most common concepts in the post maps included 'physical characteristics' (75%), 'eating/food' (62%), 'migration' (59%), and 'life history characteristics' (47%). The use of most of these concepts in the pre-maps significantly decreased in the post maps, indicating a decrease in total breadth. Only the use of the 'life characteristics' concept, the 'eating/food' concept, the 'spotting' concept, and the 'population' concept increased in the post maps, and of these, only the increase of the use of 'population' from pre to post was significant.

Several patterns emerged when concept breadth was compared across experience and demographic categories. Concept breadth tended to be much higher among females than among males in both pre and post maps, and when both males and females constructed maps together, concept breadth was the highest. Concept breadth was also much higher among groups in pre-maps, which would explain the increase in concept breadth when both males and females constructed maps together. Groups utilized more concepts than individuals in all but three conceptual categories (threats, spotting, and human uses) in pre-maps but were not higher in overall breadth in post-maps. Finally, visitors that spoke with volunteers tended to show a slightly higher breadth of concepts on both pre and post maps than those visitors that did not talk to volunteers.

There were no obvious patterns in breadth observed between age groups, motivations, presence of whales, or previous experience with concept maps, though some smaller patterns were observed across specific concepts. Groups with children, especially below the age of ten, tended to include the 'physical characteristics', 'where live', and spouting concepts much more often than groups with no young children or older individuals. These observations make sense given that what a whale looks like, where it lives, and how to spot it, are some of the easiest types of concepts for children to understand. This younger age group also tended to have the most experience with concept maps. Older age groups tended to talk more about threats to whales and migration than younger age groups. Those people that came specifically for the whale watch program showed significantly less use of the 'physical characteristics' concept and significantly more use of the 'spotting' and 'social' concepts compared to those visitors that did not come specifically for the program. These observations also make sense given

that people that came specifically for the program likely had more of an initial interest in the topic, and as a result, probably had a higher level of understanding of the topic as well as an increased desire to spend a long time looking for them.

Paired sample t-tests revealed a significant decrease in misconceptions ($p < .001$) from the pre to post maps. Most common misconceptions were about social patterns of grey whales (many visitors thought grey whales traveled in pods), spouting (many visitors thought grey whales spout water rather than air), eating/food (many visitors thought grey whales ate fish rather than very small crustaceans), migration and where they live (many visitors mentioned Hawaii and deep water, though grey whales migrate along the coast from Alaska to the Baja peninsula and tend to remain in relatively shallow water compared to other whales) communication (visitors were unsure about how grey whales communicated), endangerment status (visitors were unclear about whether or not grey whales are endangered; they are currently not listed as endangered), and beaching and breaching behaviors (though visitors used these words on maps, they often misunderstood their meanings). Approximately 50% of visitors made efforts to correct misconceptions on their post maps, most notably indicating that grey whales traveled mostly as individuals or as mother/calf pairs and that they did not eat fish.

A significant decrease in the use of affective words ($p < .005$), and a significant increase in the use of analogies ($p < .001$) between pre and post maps was observed. Examples of affective words included ‘awesome’, ‘magnificent’, ‘cool’, ‘scary’, ‘cute’, ‘nice’, and ‘gentle’. Examples of analogies used included ‘as big as a school bus’, referring to baleen as a ‘filter’ system, baleen made out of same stuff as ‘fingernails’, calf

size of ‘car’, throat size of a ‘grapefruit’. The large majority of analogies used on post maps were analogies presented by the volunteers (determined from talk coding).

67 % of maps increased in the relative amount of scientific language from pre to post maps. Examples of these types of maps can be viewed in appendix D1. Interestingly, of those that either decreased in usage of scientific language or stayed roughly the same between pre and post, 30% did not speak with a volunteer. Furthermore, this 30% made up 65% of the total number of respondents that did not speak with a volunteer. In other words, the majority of respondents that did not talk with a volunteer also did not construct maps that increased in scientific language from pre to post.

55% of maps showed an increase in conceptual structure (see appendix D2 for an example). 11 % of maps exhibited no evidence of conceptual structure (appendix D3), 20% showed no relative change, and 14% showed a decrease in conceptual structure. Furthermore, of those that did not increase in structure, 26% had not spoken with a volunteer, which represented 77% of the total number of individuals that had not spoken with a volunteer. In other words, the majority of respondents that did not talk with a volunteer also constructed maps that did not increase in conceptual structure. Finally, 85% of maps that increased in structure also increased in scientific language, which represents 70% of total maps that increased in scientific language. Interestingly, previous experience with concept maps did not have a significant difference on map structure.

An analysis of these measures also revealed that concept maps tended to be constructed in two main ways. Those maps that tended to show a low amount of scientific language and conceptual structure were constructed by placing words and

concepts around the central theme ‘grey whale’ in a circular pattern without linking words to each other (Appendix D3). These types of maps were further distinguished by their tendency to appear completely random in word/concept placement around the circle (Appendix D3), or to consist of related words geographically close to each other within the circle (Appendix D4). These “circular” maps tended to be most common in the pre-maps, or those maps created by visitors that did not speak with volunteers. The second type of map grouped a variety of words together through the use of linking lines or linking words within phrases and sentences, and was most common in post-maps (Appendix D1, D2, D5). These maps looked much closer to the traditional idea of a concept map because they showed a basic level of hierarchical construction and propositional structure.

Finally, the most common linkages between broad concepts were noted in order to examine where people were making connections in their cognitive understandings. These linkages included the following: ‘migration’ & ‘food/eating’, ‘migration’ & ‘life history characteristics’, ‘migration’ & ‘social’, ‘classification’ & ‘life history characteristics’, and ‘threats/conservation’ & ‘human uses’. Generally, the former three linkages made up the majority of connections across broad concepts in the post maps, where as the latter two linkages made up the majority of connections across concepts in the pre-maps (see Appendix D5 for an example).

Discussion

Overall, analysis indicated that visitors showed a change in knowledge structure after participating in the Whale Watching Spoken Here program. Furthermore, not only did concept maps provide a basic understanding of preconceptions, they also reflected the

information that was being provided by the program, thereby serving as a useful evaluation tool for understanding the types of concepts different groups of visitors left the program with.

Though previous research has indicated that the breadth of concepts should increase after instruction, the overall breadth in this study decreased. However, this is not necessarily an indication that individuals' conceptual knowledge decreased. As noted earlier, the effects of a "hurry up and go" factor of a non-captive audience most likely confounded this variable. Also, as discussed earlier, visitors were most likely treating post-maps as a way to include only new information, and did not want to take the time to redraw concepts already mentioned on their pre-map. However, though breadth went down, the level of structural complexity increased, indicating a more in depth understanding of particular concepts.

The fact that groups utilized a higher breadth of concepts than individuals indicates that these maps reflected a group's ability to produce more complex information than each of its parts alone, as many socially mediated learning theorists would argue (Rogoff, 1990; Wenger, 1998). Secondly, because the differences in breadth between groups and individuals decreased in the post maps, the program seems to be narrowing visitor's focus down to several key concepts, most notably migration, feeding, life history characteristics, and more specific physical descriptors. Thirdly, an unexpected result of group map construction revealed that the process of making the map facilitates learning itself, in that it serves to collate group knowledge before the program perhaps by placing these 'prior knowledge' concepts at the forefront of a person's mind (cuing), thereby making them more available to connect new information with prior knowledge. It also

serves as a summary for individuals at the end of a program, an important step not only in many pedagogical methods, but also potentially in the process of transferring short-term memory to long-term memory. Furthermore, people were much more willing to participate in the study when they realized they could work on the activity together as a group, making this tool a fun learning activity that can be used in free-choice learning environments that are by their nature perceived as fun learning spaces.

A decrease in misconceptions, an increase in the use of scientific language, and an increase in the use of analogies indicated that overall, maps increased in measures of accuracy between pre and post maps. Though one might expect affective words to increase as more emotional connections were made with grey whales (indicated by the use of many affective words during the program as recorded in the talk coding of volunteer-visitor interactions), the use of affective words decreased. However, as affective words decreased, maps seemed to become more focused and more scientific in nature. This phenomenon makes sense if people are substituting affective words for more descriptive words when they don't have a good understanding of a topic (Stoddart et al 2000).

The overall increase in conceptual complexity indicates that overall, visitors were walking away from the program with a more in depth and complex understanding of grey whales. Because traditional concept mapping requires extensive training, it follows that as an individual has more practice with constructing concept maps, the level of propositional complexity should also go up to some degree. However, because many children (and thus also many of their parents) have had training in concept mapping in school settings, many of the participants had prior training experience with concept

mapping. If prior practice had an effect upon propositional structure, we would have expected there to be a difference in propositional structure between those maps constructed by individuals that had prior experience to those that did not. However, this was not the case, indicating that training did not appear to have a significant impact on map structure. Therefore, the short training provided to visitors in this study appeared to be suitable for use of this tool in free-choice learning settings. However, this is a broad claim, and should be explored further. A limitation of this study is that concept maps could only be analyzed for the measures described in this study. The plethora of research on concept mapping suggests many ways in which concepts maps can be analyzed in order to gain a complete understanding of knowledge complexity. Therefore, it is important to remember that the use of the tool developed in this study in a free-choice learning setting can only be used to measure the items recognized in this study and is by no means a complete measure of knowledge complexity.

Finally, interactions with volunteers appeared to have an effect on overall concept breadth, use of scientific language, and conceptual complexity. The Whale Watching Spoken Here program would not be possible without these volunteers. These concept maps have revealed the important role volunteers play in presenting a program that increases the public's understanding of grey whales. Not only do these volunteers contribute to the program, they are also contributing to ocean literacy in general by contacting over 30,000 people a year in Oregon alone. This study shows that educational outreach programs do indeed have an effect on people's knowledge structure and can serve as valuable facilitators to increase ocean literacy.

Because relatively little research has looked at the use of concept mapping in free-choice learning settings, and relatively little research has discovered methods for evaluating outdoor marine education programs, there is a tremendous opportunity for research in these settings. Future research should focus on defining other factors that may be used to look at conceptual complexity, such as determining a way to measure conceptual relationship between broad concepts. This study also was only able to look at short-term changes in knowledge complexity. In order to look at long-term changes, research is needed to understand how well these changes last; this can be an indication of learning that contributes to long-term memory. An understanding of how these marine outreach programs affect their visitors in the long term is needed, since many components of these programs, including knowledge, affects behavior (Hines et al. 1986, Hwang et al. 2000). A change to more environmentally friendly behaviors is ultimately what many of these programs seek to accomplish.

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Table 5.1 Concept map general code list. Words that fit descriptions on the right were scored by a team of evaluators into broad conceptual categories on the left.

Broad Concepts List	**Descriptions of Each Concept**
Physical Characteristics	size, color, weight, fins, skeleton, blubber, what they look like
Spout	what it looks like
Feeding/Eating	baleen, krill, mysid shrimp, teeth, related behavior
Migration	south, north, Baja, Alaska, NW coast, semi-"resident" whales
Life history characteristics	includes calving, Baja, gestation period, nursing, length of life, breeding, related behavior
Spotting	how to see, binoculars, number seen, how long between spouts
Where they live	ocean, Oregon, deep or shallow, characteristics of ocean
Communication	sonar, echolocation
Social relationships	pods, mother and calf, family, related behavior
Population size	use of numbers to indicate pop. size
Breathing	water vs. air, length they can hold their breath
Swimming and movement behavior	breeching, speed
Predators	humans, great white sharks, killer whales
Classification	mammal, what they are related to, mammal characteristics; hair, live young, etc.
Whale history	hunting
Human impacts and uses	whaling, oil, blubber, food, Native American uses
Conservation/Threats	strandings, pollution, endangerment
Other marine wildlife	barnacles, lice, other types of whales or marine mammals
Media	books, television, movie, etc.
Whale watching experience	fun time, volunteers great, etc., saw no whales, wet, windy, prior experience watching whales

Conclusion

As a result of the Whale Watching Spoken Here Program, visitors' knowledge structure and beliefs about the marine environment and grey whales in particular changed to become more complex and biocentrically orientated respectively. These findings indicate that the program is at least in part meeting its goals to educate visitors about marine wildlife, foster an appreciation for whales, and help visitors understand that they have a responsibility towards protecting whales. It also identified that some visitors to the program remain unsure about the effects their own actions have on the marine environment. Now that the program has a better understanding of its audience's prior knowledge, past experiences, and basic beliefs, more successful ways can be developed to educate visitors about their own actions on the marine environment. Furthermore, the program also has a better understanding of the types of beliefs and knowledge structure its visitors are leaving the program with and can cater its programming to better meet the needs of its audience in the future.

This study has also identified several ideas that can be applied to future research in marine ecotourism, education, and free-choice learning. Most notably, it has suggested a model for looking at the interactions between past experiences, value orientations, and awareness of consequences, and developed a tool that can be used in informal settings to analyze different aspects of knowledge structure about marine wildlife. Past research has shown that these various cognitive constructs interact together to produce behaviors (Hines et al 1986, Hwang et al 2000). In order to gain a better understanding of *how* these constructs interact to influence behaviors, future research should look at the causal

interactions between past experiences, knowledge structure, beliefs, and activation of behaviors.

Finally, because there is a strong need for educational opportunities that will increase ocean literacy, research should focus on studying programs that serve to meet this need. This study has attempted to fill in a small part of this knowledge gap. The author hopes that this study will facilitate additional research in this area so that more programs like the Whale Watching Spoken Here program will continue to expand their programming to better meet both the needs of their audience and society, and the needs of a future sustainable healthy ocean.

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Appendix A

Verbal script and actions to follow for surveyors in recruitment, instruction, and debriefing of participants:

Hello, how are you today? Would you like to help us out with some research we are doing for the Whale Watching Spoken Here Program? *Some people may not be familiar with this program. Explain to them what it is, letting them know about the grey whale migration and the volunteers that are assisting people to spot whales.*
We're asking people to either fill out a survey or complete a concept map. The survey is pretty straightforward. The concept map requires a bit of explanation, but is fun and you can work on it as a family if you would like. In exchange for helping us out today we'll let you pick out one of these beautiful pictures, posters, octopus tattoos, candy, hot chocolate, etc.

Let them decide what they would like to do. If they say they'll do it when they get back, explain to them that the concept map must be done before they go watch for whales/participate in the program (we really want to try to get as many people as we can to do the concept maps so try to make it sound appealing). The survey can be completed before or after the program. We need both.

If they say they would like to do the survey, hand them a clipboard with a survey and a consent letter. Briefly explain the letter and let them know they may take a copy of it with them. Explain to them that their survey will not be linked to any information that identifies them.

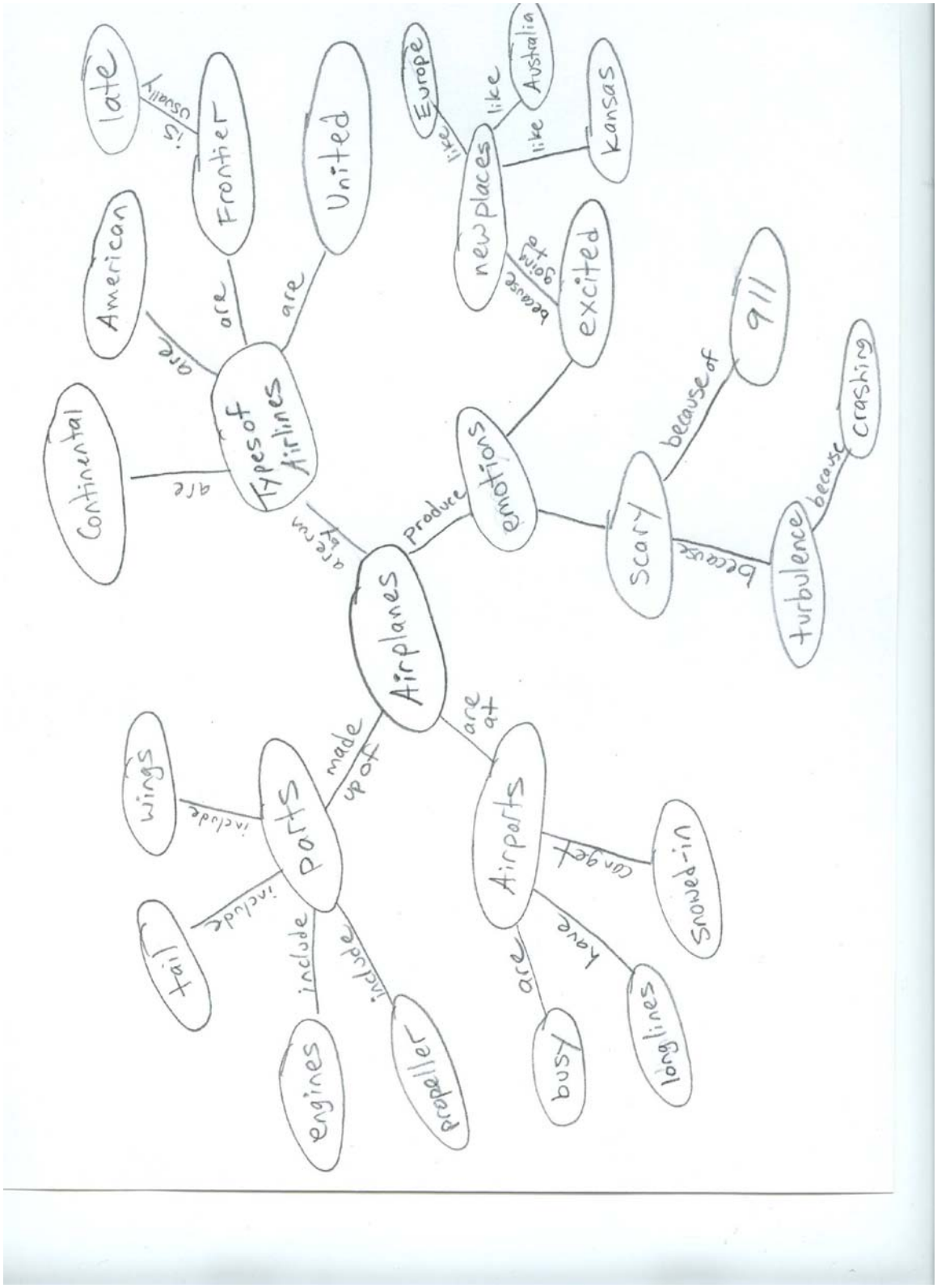
If they say they are interested in doing the concept map:
Give them a clipboard with a concept map form, a consent letter, and a blue pen. Briefly explain the consent letter, letting them know they may take a copy with them. Explain to them that their concept map will not be linked to any information that identifies them.
Here's what you are going to do. We would like you to write down as many words, ideas, images, phrases or thoughts that come to mind related to the term *Grey Whale.* Draw lines between these concepts to **show** how they are related to one another. Write linking words between concepts to **explain** how they are related to each other. Just right down words that first come to mind; you don't have to spend a lot of time on this. *Show them the example concept map to explain further.*
This is the first part. When you are finished, hand the map back to me, and I will keep it with me here while you go look for whales and talk to the volunteers. Then, on your way back, we would like you to stop again and make a new map, doing the exact same thing you did before. You can pick out a thank you gift at that time.

When they come back, hand them back their map, turning it over to the backside, and handing them a red pen.
Now we would like you to do the same thing you did before, but on the other side. You may use the same words you used the first time if you would like.

When they are finished, thank them and tell them they can pick out a thank you gift.

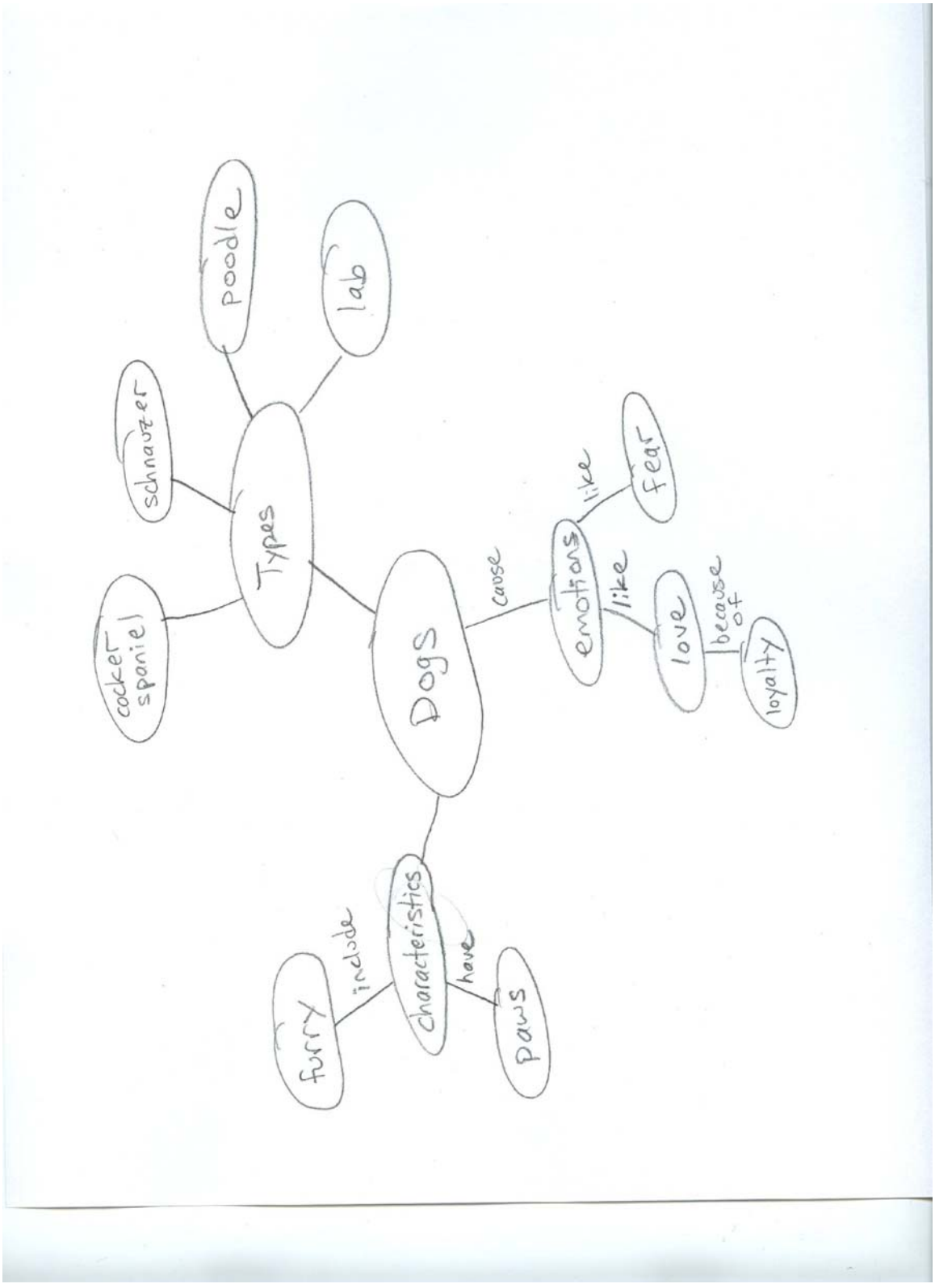
Appendix B1

Airplanes



Appendix B2

Dogs



Appendix C

Questions on Concept Maps

1. Did you come here today for the Whale Watching Spoken Here program?

2. Have you been to the Whale Watching Spoken Here program before ?

3. Did you see a whale today? If so, was it your first whale?

4. Did you talk with a Whale Watch volunteer today (excluding the surveyors)?

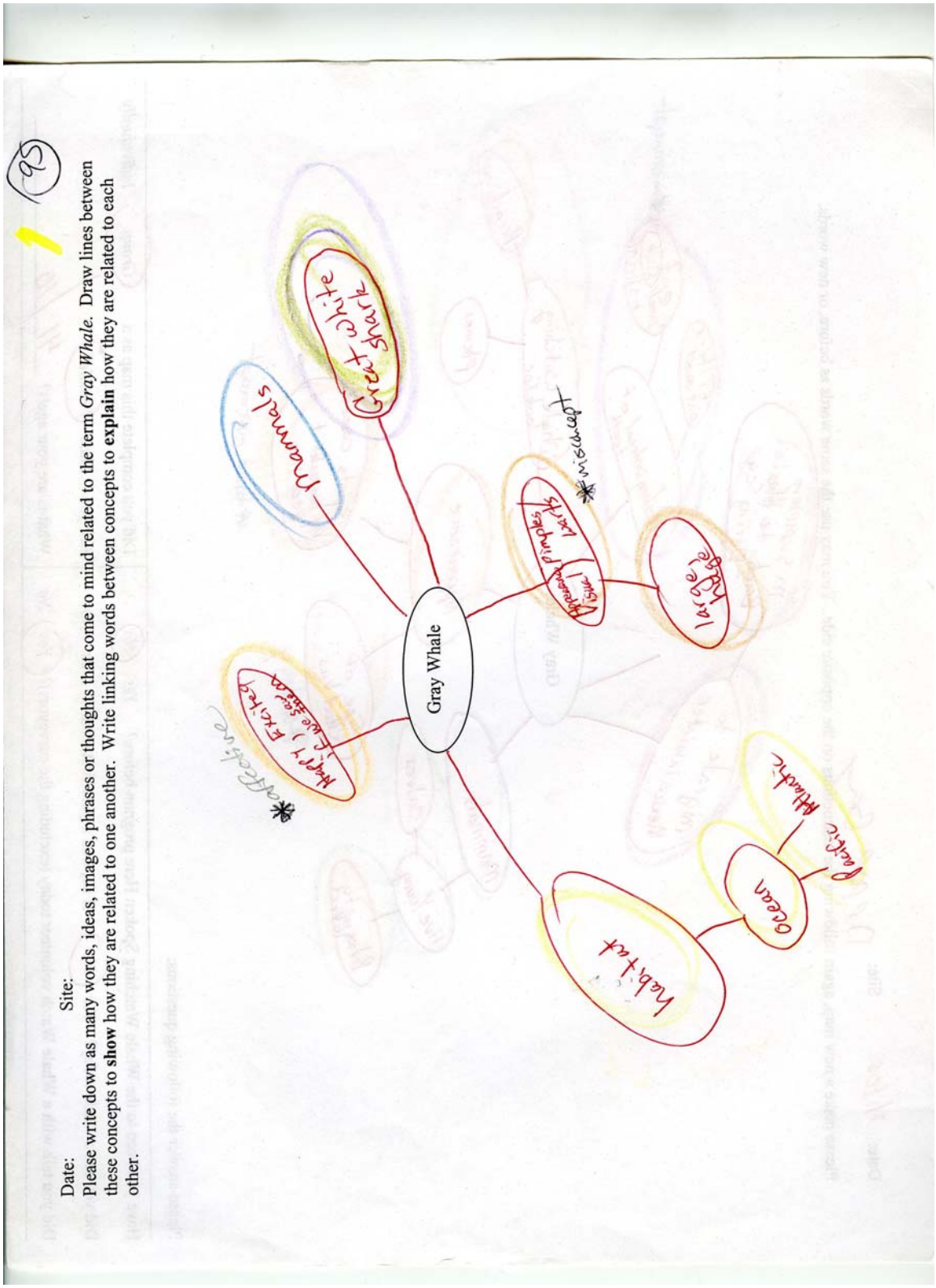
5. Did you complete this map as a group or individually?

6. Gender and age of yourself, or if completed as a group, all members of your group?

7. Have you ever done a concept map before?

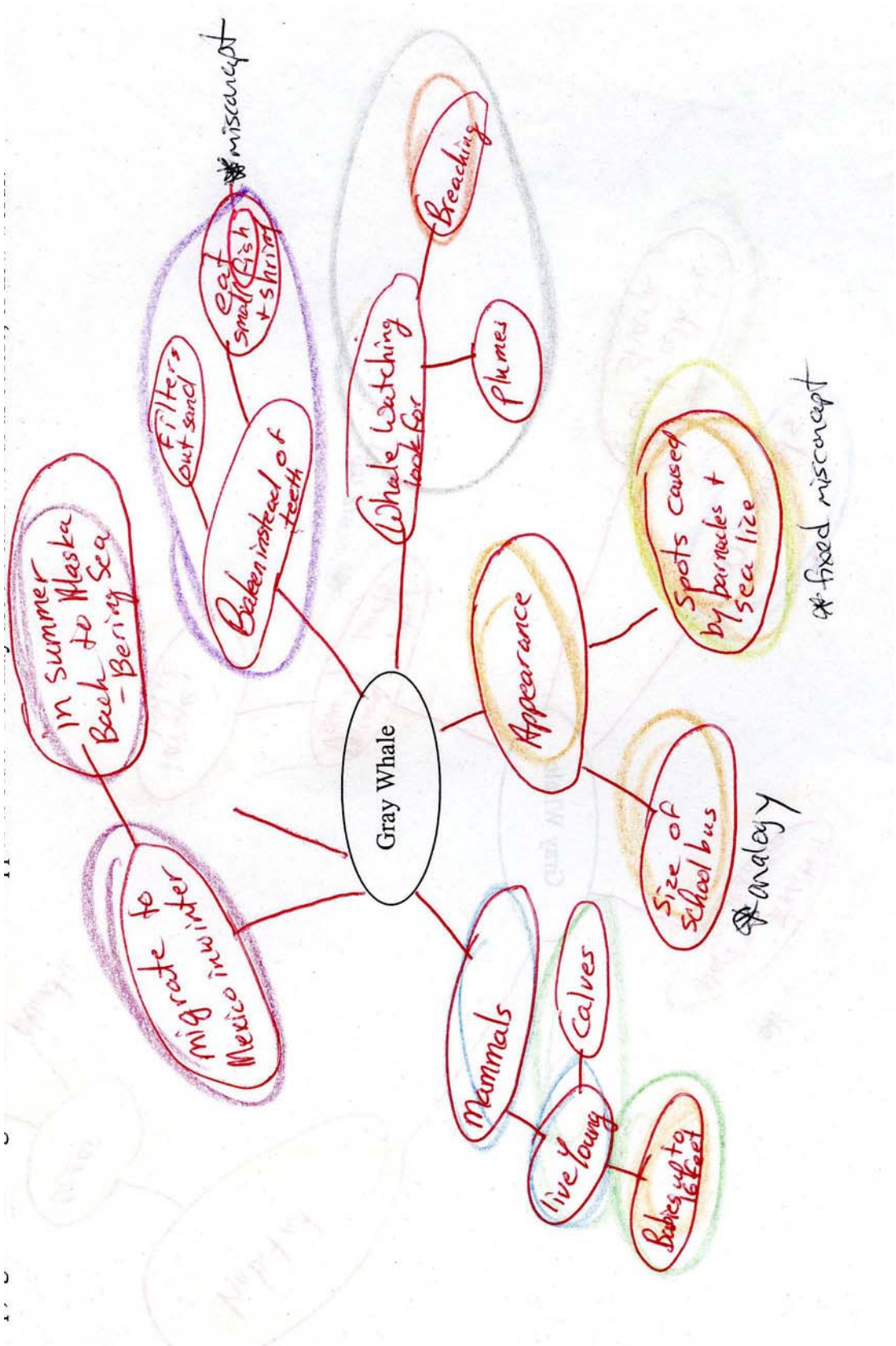
Appendix D1

Scientific Language Pre-Map



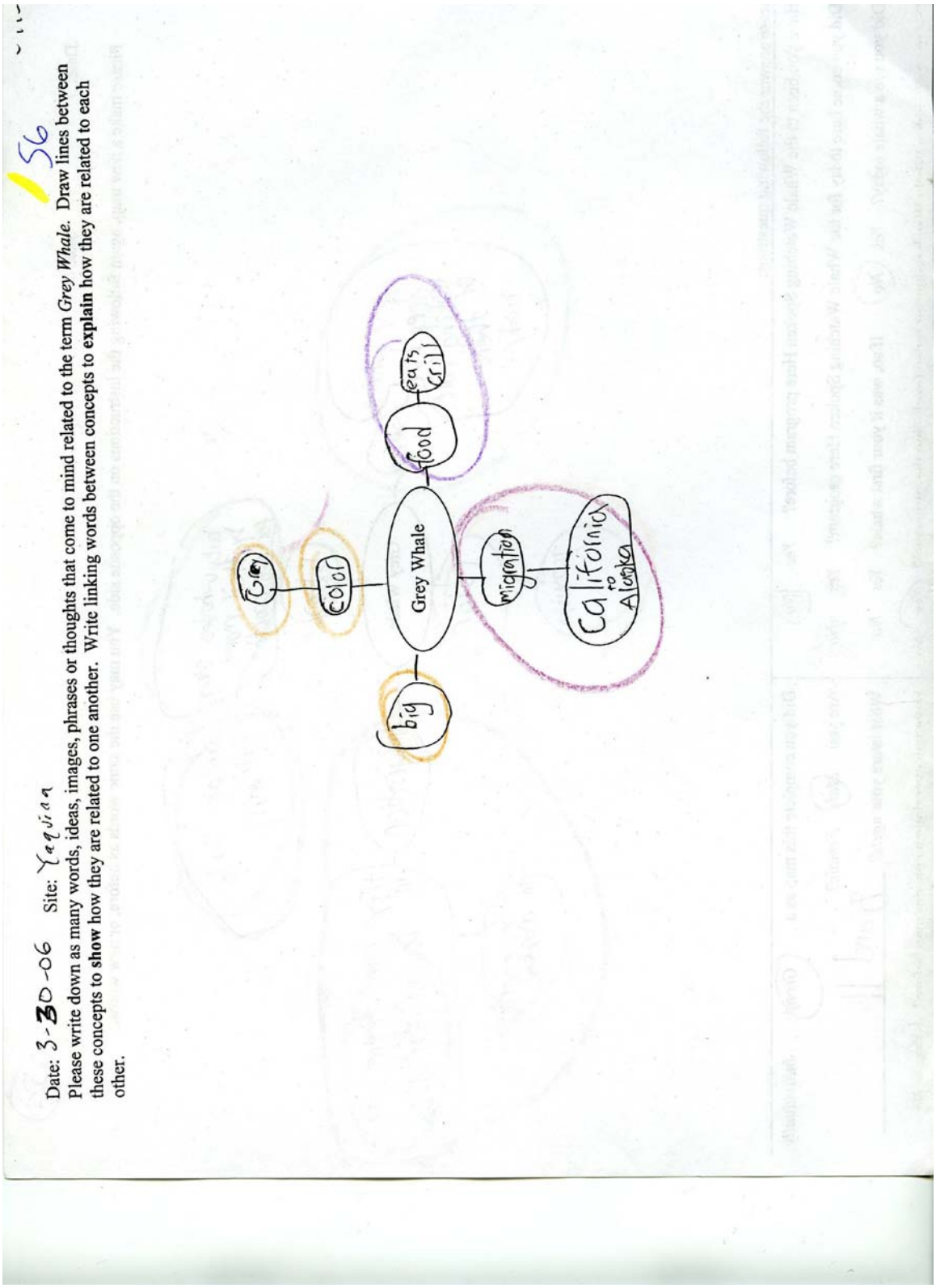
Appendix D1

Scientific Language Post-map



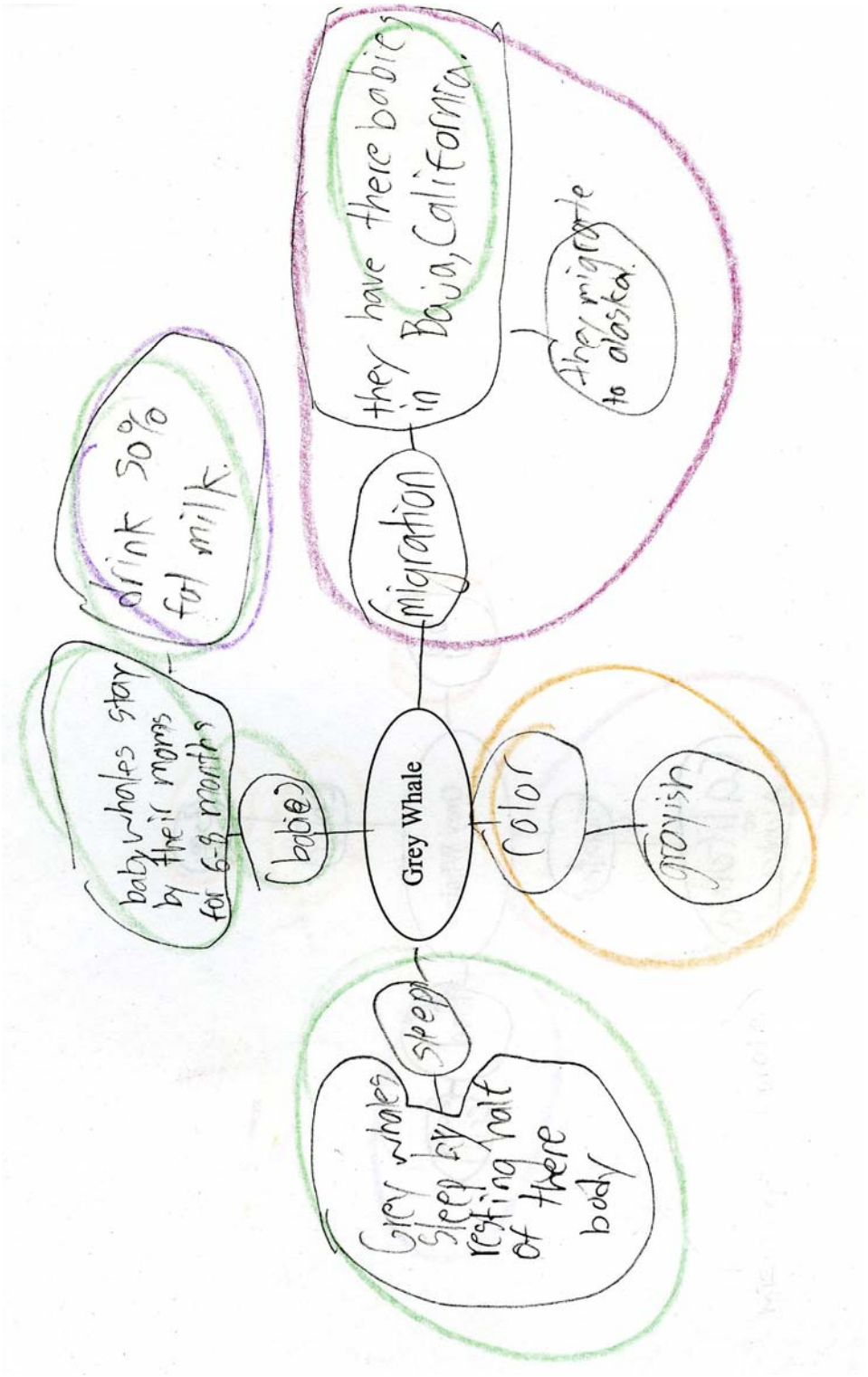
Appendix D2

Explanation & Structure: Pre-Map



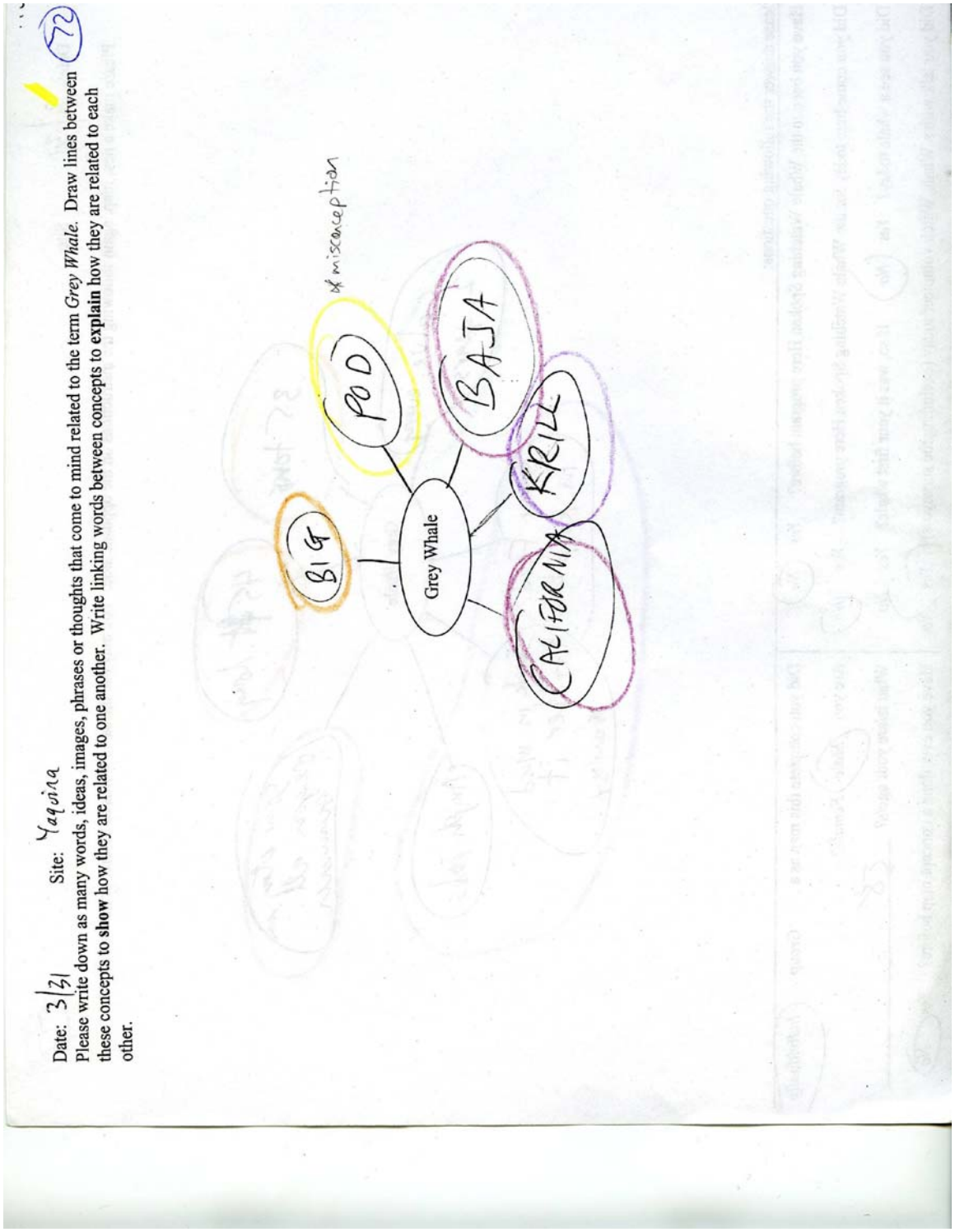
Appendix D2

Explanation & Structure : Post-map



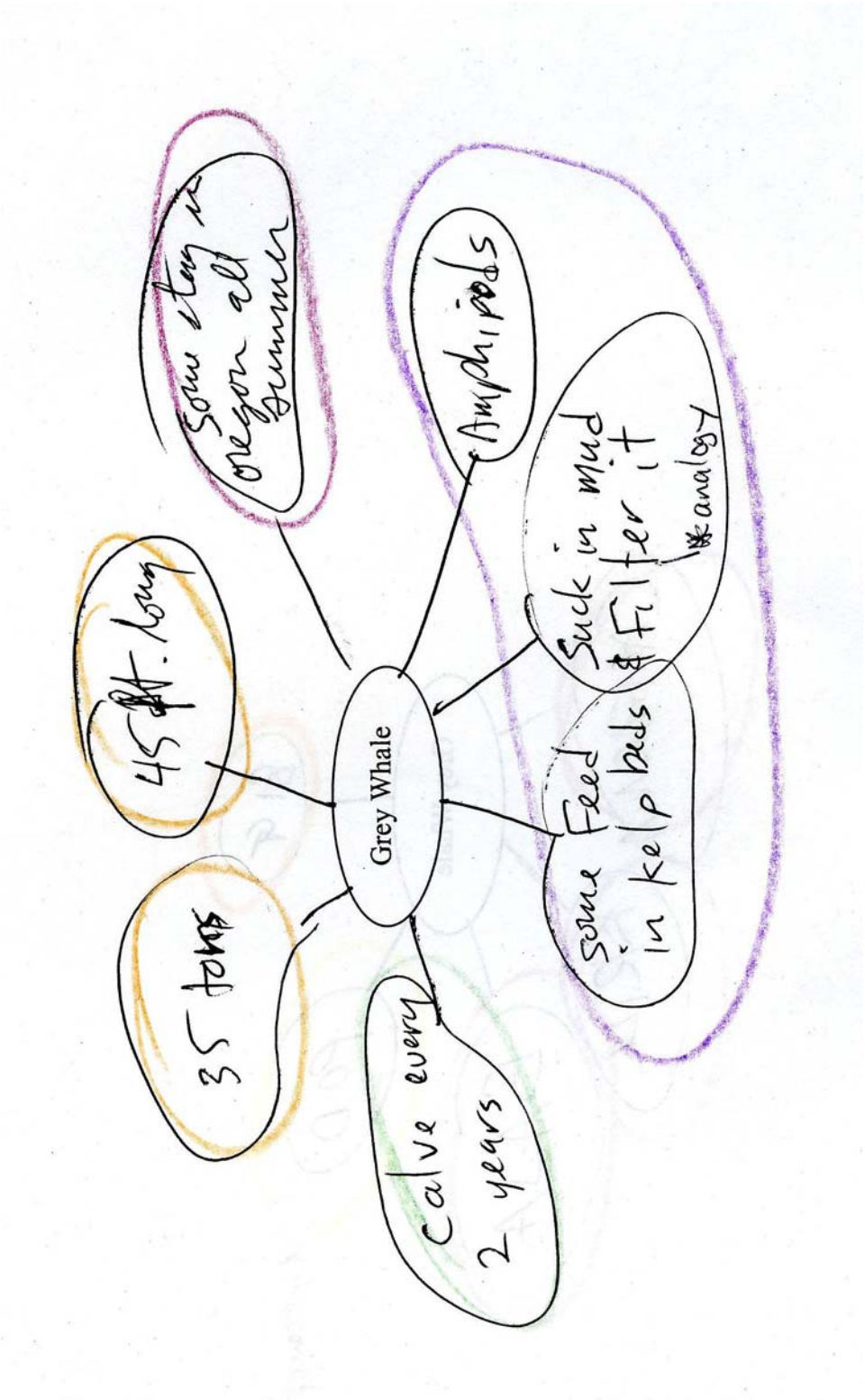
Appendix D3

Circle Pattern Random : Pre-map



Appendix D4

Circle Pattern Geographically Close : Post-Map



Appendix D5

Connections between broad concepts: Post-map