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Coastal Resident Knowledge of New Marine Reserves in Oregon: The Impact of Proximity and Attachment

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Running head: Resident knowledge of marine reserves in Oregon

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Abstract

This article examines resident proximity and attachment to a new system of marine reserves in Oregon (USA), and the extent that these factors are related to both self-assessed and factual knowledge about these reserves. Data were from a survey of residents along the Oregon coast (*n* = 596). Residents reported higher self-assessed than factual knowledge about these reserves, which was low with 65% answering half or fewer of 16 factual questions correctly. Self-assessed and factual knowledge did not differ between communities proximate to (i.e., communities of place within 10 miles of these reserves) and more distant from these reserves (i.e., rest of coast). Factual knowledge also did not differ based on attachment to these areas, but place attachment was slightly related to aspects of self-assessed knowledge where those with higher attachment believed they were somewhat more knowledgeable about these reserves. Implications of these results for management and research are discussed.

Keywords: marine reserves, marine protected areas, residents, knowledge, place attachment, proximity

1. Introduction

Although a large proportion of the human population resides along coastlines, humans often neglect to consider their ties to marine issues and processes (Alessa et al., 2003; Steel et al., 2005; United Nations, 2005). Many humans interact with marine areas in fundamentally different ways than with terrestrial areas, and technology can influence these interactions (Shackeroff et al., 2009). Experiences with coral reefs, for example, are often constrained by the availability of scuba technology (Knowlton and Jackson, 2001). This separation from physically engaging with marine areas coupled with a general apathy toward many marine issues may factor into low public knowledge about these areas and their conservation (Duda et al., 2007; Steel et al., 2005).

There have been calls for increasing public literacy about marine areas and their conservation in the form of marine protected areas (MPAs).[1] Many people, however, remain unaware of issues and conservation efforts associated with these areas (Snider et al., 2010, 2011; Thomassin et al., 2010). Much has been said about the need to involve and account for local resident knowledge and attachment related to marine areas in MPA planning and management (Gray et al., 2010a, 2010b; Heck et al., 2011). Most studies, however, have focused on how to include stakeholders in MPA planning processes (Compas et al., 2007; Pita et al., 2011; Rosendo et al., 2011; Stevenson et al., 2012; Togridou et al., 2006), rather than assessing how proximity and attachment toward MPAs may factor into knowledge of these areas and their management.

This article examines resident proximity and attachment to a new system of MPAs in the in the state of Oregon, USA (known as marine reserves [MRs] in this context), and the extent that these factors are related to knowledge about these areas. Understanding and incorporating resident knowledge and attachment in early stages of MPA implementation may foster more inclusive and socially acceptable planning and management (Gray et al., 2010a, 2010b; Heck et al., 2011; Marshall et al., 2009; Pollnac et al., 2001; Stevenson et al., 2012; Togridou et al.,

2006; Xu et al., 2006). Given that stakeholders such as local residents often differ in their understanding of MPA goals (Heck et al., 2011), investigating relationships among proximity, attachment, and knowledge about these areas may elucidate reasons why understanding of some characteristics of these areas may be higher or lower than others.

2. Conceptual Foundation

2.1 Public Knowledge about Protected Areas

Managing natural resources is challenging, especially if the public lacks knowledge and understanding of these resources and managerial goals (Snider et al., 2010; Xu et al., 2006). Knowledge consists of personal, situational, and socially constructed dimensions (Guzman, 2009), and may have multiple meanings and interpretations depending on context. Knowledge, therefore, can be highly subjective (Guzman, 2009). There are two common measures of this concept (Wann and Branscombe, 1995). First, self-assessed or perceived knowledge is where a person believes that he or she is knowledgeable and providing the correct answer. This could be measured, for example, by asking "how aware do you feel about this issue?" Second, factual knowledge is more concrete where the person either does or does not know the information and there is a factually correct answer. Questions measuring factual knowledge may take the form of true / false or multiple choice answers, with only one answer being correct at the time.

Pubic knowledge about protected areas is generally low and even when it appears to be higher in some contexts, it is often cursory (Booth et al., 2009; Jones et al., 2011; Xu et al., 2006). Studies of knowledge about nearby protected areas, for example, have often reported high general knowledge about the mere existence or presence of these areas, but little knowledge of any specific features and management (e.g., size, goals, managing agency; Jones et al., 2011; Ressurreição et al., 2012). In addition, self-assessed knowledge about a protected area seldom translates into factual knowledge about that area. For example, although 85% of respondents in a

study in Croatia thought of themselves as knowledgeable about nearby protected areas, only 23% could correctly name the agency managing these areas (Sladonja et al., 2012).

Research has shown that knowledge of protected areas may vary by proximity with residents closer to protected areas often reporting greater general knowledge (e.g., name of protected area, location) than those living farther away (Jim and Xu, 2002; Mangun et al., 2009; Olomi-Sola et al., 2012). General knowledge concerning protected areas decreased with distance in these studies, suggesting a relationship between proximity and knowledge. This higher knowledge among more proximate populations may be due to a number of factors, including involvement in planning where local communities may have been more intensively sought after and included. Studies measuring knowledge in proximate and more distant communities around protected areas have also found, however, that although the majority of residents knew of these protected areas (i.e., general knowledge), there was little detailed knowledge of anything specific about these areas across both proximate and distant populations (Booth et al., 2009; Jim and Xu, 2002; Jones et al., 2011; Mangun et al., 2009; Olomi-Sola et al., 2012; Xu et al., 2006).

This trend of cursory and scant public knowledge about protected areas in general has also been found for MPAs in particular where knowledge of these areas has been consistently low (Dimitrakopoulos et al., 2010; Fiallo and Jacobson, 1995; Kafyri et al., 2012; Parnell et al., 2005; Snider et al., 2011; Stevenson et al., 2012). Some studies allude to this poor knowledge as one reason behind ineffectiveness of some MPAs (Gray et al., 2010a, 2010b). Although there have been investigations of visitor versus resident self-assessed knowledge about MPAs, studies specifically examining whether or not factual knowledge about MPAs varies between proximate and distant populations are less prevalent (Snider et al., 2010, 2011; Thomassin et al., 2010). Studies of local versus non-local visitors to MPAs show a wider distribution of knowledge among individuals compared to studies of visitors to terrestrial protected areas. Self-assessed

general knowledge levels, for example, have been reported as high as 90% for onsite MPA visitors (Petrosillo et al., 2007), but even within a MPA system there may be differences in knowledge of visitors at the site-specific level, suggesting specific and localized knowledge issues and factors (Dimitrakopoulos et al., 2010; Snider et al., 2010).

2.2 Public Knowledge about Marine Areas

Just as public knowledge about protected areas appears to be cursory, their knowledge of marine areas is also somewhat superficial; people generally know that issues are affecting the health of marine areas, but seldom report knowledge on specific details even when issues are put into a local context. In two studies, for example, Americans answered correctly an average of only two out of five factual knowledge questions about marine areas, and approximately 40% answered zero or only one question correctly (Belden, Russonello, and Stewart, and American Viewpoint, 1999; Steel et al., 2005). Public knowledge about marine areas is lacking compared to knowledge about terrestrial environments (Compas et al., 2007).

Although ocean literacy (i.e., ability to understand and communicate ocean science [Cudaback, 2008; West, 2004]) is generally low overall, there does appear to be a relationship between proximity to marine areas and this knowledge. Steel et al. (2005), for example, surveyed American households about coastal and marine issues, and found that what they called self-assessed "informedness" was not high for either coastal or inland populations, but residents of coastal states were statistically less likely to rate themselves as "not informed" compared to residents of non-coastal states. Another study grouped populations by driving distance to the coast and found that those within a two-hour drive were slightly more knowledgeable about marine issues (Belden, Russonello, and Stewart, and American Viewpoint, 1999). Both studies, however, reported low knowledge for factual or objective questions across both proximate and distant populations. In questions of self-assessed versus factual knowledge, research suggests

that familiarity with marine issues is limited to basic concepts, and subjective evaluations of knowledge are more optimistic than factual quiz-based results demonstrate (Belden, Russonello, and Stewart, and American Viewpoint, 1999; Booth et al., 2009; Steel et al., 2005).

This overall low level of ocean literacy, compounded by this disconnect between self-assessed and factual knowledge about issues related to marine areas, indicates a fertile area for understanding what factors perpetuate this low level of knowledge. Policy-relevant knowledge is important in democracies and as marine policy and management continues to be relevant, it is necessary to understand public knowledge about these issues (Steel et al., 2005). A need exists to explore variables that may be related to ocean literacy because there is a relationship between an individual's knowledge about marine areas and their support for the conservation and stewardship of these areas (Compas et al., 2007; Cudaback, 2008; Steel et al., 2005; West, 2004).

2.3 Place Attachment

In addition to proximity, place attachment is another variable that may be related to knowledge. Place attachment is concerned with the intensity of connections between humans and locations (Tuan, 1980; Wynveen et al., 2011). Attachment differs from sense of place in that attachment is concerned with strength of bonds to a place, whereas sense of place is concerned with factors creating these bonds (Stedman, 2002). Studies of place attachment have expanded from how people view built environments around them to how they interact with and develop special connections to places, including natural environments (Williams and Vaske, 2003). Although several related concepts have received attention (e.g., bonding, rootedness, sense of place), there are two main dimensions of place attachment with a strong foundation in the literature (Manning, 2011; Williams and Vaske, 2003). First, place identity refers to emotional ties to a place, can develop over time, and is related to symbolic meanings of an area. Second,

place dependence is the functionality associated with an area and is represented by its tangible physical characteristics and attributes (Manning, 2011; Williams and Vaske, 2003).

Dimensions of place attachment have been investigated in protected areas (Stedman, 2002; Warzecha and Lime, 2001), but literature is limited on if and how attachment is related to knowledge about these areas. Given that factual knowledge about a subject may be related to interest in the subject (Ressurreição et al., 2012; Wann and Branscombe, 1995), there may be a relationship between attachment and knowledge regarding a specific place (Ryan, 2005). Needham and Little (2013), for example, found that visitor attachment to a ski area was related to their factual knowledge about management approaches used at this area. Other studies, however, have suggested that attachment to a place may not correspond to specific knowledge about that place (Alam, 2011; Ressurreição et al., 2012; Smaldone, 2008). Over half of visitors to a terrestrial protected area in the USA (Smaldone, 2008) and most coastal residents adjacent to a MPA in Portugal (Ressurreição et al., 2012), for example, reported strong attachment to these places, yet the majority were unaware of issues at these places that management had deemed and communicated as critical. Given these mixed results, an individual's attachment to and knowledge about a place may be influenced by the site and other situation-specific factors.

In the context of attachment to marine areas, the seascape as a place rather than strictly a functioning biophysical environment has received limited attention (Gee and Burkhard, 2010). Some studies have focused on the importance of marine areas to particular user groups (Evans et al., 2011; Gray et al., 2010a, 2010b; Himes, 2007; Lédée et al., 2012; Pita et al., 2011; Salz and Loomis, 2004; Tallis et al., 2012; Teh and Teh, 2011). There is some indication that people may feel an identity associated with the ocean in a similar way that they feel attached to the concept of terrestrial wilderness. Individuals surveyed about offshore wind farming in Germany (Gee and Burkhard, 2010), seafloor exploration and mining in Australia (Mason et al., 2010), and boater

zoning in Canada (Gray et al., 2010a), for example, expressed views of marine areas as wild, mysterious places of both emotional and functional importance. Aesthetic values combined with specific functions of these areas (e.g., cultural heritage, ecosystem roles) can create a "sensual appreciation of the sea" in a manner that people may ascribe meaning, identity, and attachment with tangible and intangible values and associations (Gee and Burkhard, 2010, p. 354).

2.4 Research Questions

This article builds on this literature by addressing four research questions examining the extent that proximity and place attachment are related to coastal resident knowledge of a new system of MRs in Oregon. First, does self-assessed knowledge about these MRs differ between proximate and more distant populations? Second, does self-assessed knowledge about these MRs differ based on attachment to one or more of these reserves? Third, does factual knowledge about these MRs differ between proximate and more distant populations? Fourth, does factual knowledge about these MRs differ based on attachment to one or more of these reserves?

3. Methods

3.1 Study Sites and Context

Data were obtained from residents living along the Oregon coast. Although definitions of "coast" vary, Oregon's Coast Mountain Range just a few miles inland provides a natural delineation and boundary. Three reasons make this an ideal location for investigating these research questions. First, Oregon is currently in the early stages of implementing a system of new MRs. Second, although a few specific interest groups have been involved in discussions about MRs in this state (e.g., commercial anglers), input from a representative sample of the public has not been ascertained. Third, the enabling legislation and monitoring plans for these MRs explicitly state that baseline social data will be collected and considered in tandem with biological data.

Over the past decade, Oregon has sought to increase conservation and public awareness of marine resources in the state's territorial sea (i.e., waters within three miles of the coastline). In 2000, the Ocean Policy Advisory Council (OPAC) examined the potential for state MR locations that "individually or collectively are to be large enough to allow scientific evaluation of ecological effects, but small enough to avoid significant adverse social and economic impacts on ocean users and coastal communities" (Oregon Ocean Policy Advisory Council [OPAC], 2008). With the states of Washington to the north and California to the south already having systems of marine protection, the ecological and geographical gap in Oregon's waters was noticeable. The main driver of conservation in these marine habitats is ground fisheries, especially recruitment and retention of rockfish. In 2009, six sites were selected for consideration as MRs in Oregon. Two of these sites (Otter Rock, Redfish Rocks) were implemented as pilot sites, and three of the other four (Cape Falcon, Cape Perpetua, Cascade Head) followed suite in early 2012.

During the MR creation process, multiple agencies and institutions sought stakeholder opinions to complement existing biological research. Sea Grant, National Oceanic and Atmospheric Administration (NOAA), and Oregon Department of Fish and Wildlife (ODFW) had responsibilities for gathering baseline social data about communities and livelihoods that may be impacted by the reserves. These data took the form of profiles for coastal communities (Norman, 2007; Package and Conway, 2010) and community evaluation teams comprised of select stakeholders (e.g., commercial anglers, scientists, government). In addition, town hall meetings and informal interviews were conducted with a small number of groups also potentially impacted by these MRs (Connor et al., 2007; Murphy, 2010). These data captured the opinions of a select portion of Oregon residents, interest groups, and other vocal citizens (Murphy, 2010). This study, however, attempted to gain a more comprehensive and representative perspective of coastal residents in Oregon, beyond only those who are most likely to be affected by these MRs.

3.2 Data Collection

Questionnaires were administered by mail to a sample of residents along the Oregon coast selected randomly from postal records. A sample of 2,600 addresses was equally divided into two main subpopulations: (a) residents of communities of place, and (b) residents along the rest of the coast. Communities of place implies a collective identity and perhaps different perceptions and reactions to a resource or its management (Winter et al., 1999). The 1,300 addresses in these communities of place were distributed equally among five area-specific frames (i.e., 260 addresses each) corresponding to each current MR location. A 10 mile radius was mapped around the nearest land point to the center of each MR. Addresses within this radius were included in the communities of place delineation. The other half (i.e., 1,300) of the sample addresses was spread throughout the rest of the coast and included areas seaward of the Coast Mountain Range excluding those in the five predefined communities of place.

This delineation by proximity is common for addressing public concerns regarding protected areas and other natural resource management issues. Studies have divided groups based on proximity to protected areas (Jim and Xu, 2002; Winter et al., 1999) with the division, although subjectively determined, set to investigate whether people who live geographically closer to a place differ from those living farther away. Issues with delineating a local community of place have been noted where delineations may not crisply capture people and their associated concerns in local versus distant communities (Cocklin et al., 1998). Although these delineations are generally subjective, they are set a priori and relate to the research questions and situational context. Distance is a common method and employed here, although there are other means of delineation such as by time-on-roads distance to a MPA (Thomassin et al., 2010) or affectedness to the marine issue and ocean dependence (e.g., fishing, tourism; Gee and Burkhard, 2010).

Questionnaires were administered using three mailings. The first and third mailings (November 9, 2012 and January 11, 2013, respectively) consisted of a cover letter, questionnaire, and prepaid reply envelope. The second mailing (November 30, 2012) consisted of a postcard reminder to those who had not responded to the first mailing. The third mailing was not sent to addresses that had responded or were returned undeliverable (e.g., moved, incorrect address) in the first or second mailings (Vaske, 2008). The total sample size was $n = 596$, with $n = 326$ (55% of sample) from communities of place and $n = 270$ (45%) from the rest of the coast, representing a 27% overall response rate after accounting for undeliverables. A telephone nonresponse bias check was administered to a large random sample of nonrespondents ($n = 202$) and there were no substantive differences between those who responded to the mail survey and those who did not (i.e., those who completed the telephone nonresponse check). To be representative of the appropriate scope of inference, however, the data were weighted by population proportions based on the most recent US Census information for communities along the Oregon coast.

3.3 Analysis Variables

Measures of place attachment were identical to those in past studies (Williams and Vaske, 2003) and answers were based on whether respondents had visited one or more of the five areas where the MRs were designated. A map showing these sites was provided and respondents were asked: "thinking about one or more of the five marine sites identified on the map, do you disagree or agree with each of the following?" Three place identity (e.g., "at least one of these marine sites is very special to me") and three place dependence variables were measured (e.g., "at least one of these marine sites is one of the best places for doing what I like to do"). These variables are listed in Table 2 and were measured on 5-point scales of 1 "strongly disagree" to 5 "strongly agree."

Both self-assessed and factual knowledge about the Oregon MRs were also measured. Self-assessed knowledge focused on informedness, perceived knowledge, and understanding.

Informedness was measured by asking "how well informed do you feel about the topic of MRs in Oregon" on a 4-point scale of 1 "not informed" to 4 "extremely informed." Perceived knowledge was measured by asking "how knowledgeable do you feel about the topic of MRs in Oregon" on a 4-point scale of 1 "not knowledgeable" to 4 "extremely knowledgeable." Understanding was measured by asking how much respondents felt they understood about six aspects of MRs in Oregon (e.g., their purpose, locations). These variables are listed in Table 1 and were measured on 9-point scales of 0 "do not understand" to 8 "fully understand."

Factual knowledge questions were informed by ODFW's website, newspapers, and other sources. Three types of questions measured this knowledge. First, 10 true / false (or unsure) questions about Oregon MRs were asked (e.g., "the government has established five MR sites"). These variables are listed in Table 4. Second, respondents were asked "what one agency or organization do you think is currently responsible for MRs in Oregon" with the following choices: National Oceanic and Atmospheric Administration, US Fish and Wildlife Service, US Coast Guard, Pacific Fishery Management Council, Oregon Parks and Recreation Department, Oregon Department of Fish and Wildlife (correct answer), Oregon Marine Board, and Unsure. Third, respondents were asked "both MRs and MPAs have been proposed for Oregon. These designations are not the same thing. Do you think each of the following activities are allowed in Oregon's MRs, MPAs, both of these types of areas, or neither of these areas?" Five variables were listed and are shown in Table 4 (e.g., commercial fishing, scientific research). Respondents could select MRs, MPAs, both MRs and MPAs, neither MRs nor MPAs, or unsure.

4. Results

The first research question focused on whether self-assessed knowledge about the new MRs in Oregon differs based on residential proximity to these reserves. The majority of respondents indicated some degree of feeling informed about these MRs, with 85% reporting themselves to

be slightly (41%), moderately (40%), or extremely informed (4%). In addition, 82% believed they were slightly (42%), moderately (37%), or extremely (3%) knowledgeable about the MRs. Mean self-assessed informedness and perceived knowledge were similar across the communities of place (M = 2.18 to 2.27) and rest of the coast (M = 2.27 to 2.37), with respondents feeling slightly informed and knowledgeable (Table 1). On average, respondents also felt they slightly understood issues related to these MRs. Respondents felt they most strongly understood the purpose of having MRs in Oregon (M = 3.74), whereas they least likely understood rules and regulations of these areas (M = 2.27). There were no significant differences between proximate (i.e., communities of place) and distant (i.e., rest of the coast) populations in mean responses to all of these variables measuring self-assessed knowledge, t = 0.07 to 1.58, p = 0.116 to 0.945. In addition, the point-biserial correlation (r_{pb}) effect sizes were less than 0.07, suggesting "small" (Cohen, 1988) or "minimal" (Vaske, 2008) relationships between proximity and this knowledge.

Table 1 about here

Reliability of these variables measuring self-assessed knowledge was examined with Cronbach alpha reliability coefficients. Reliability refers to the internal consistency of responses to a set of variables that are designed and intended to measure an unobserved concept (Vaske, 2008). An alpha greater than or equal to 0.65 suggests that variables are measuring the same concept and justifies combining them into a single index representing the concept (Vaske, 2008). These eight variables had a standardized alpha of 0.93 and deleting any of them did not improve reliability of the index (Table 2). There were no significant differences in this self-assessed knowledge index between residents in the communities of place and along the rest of the coast, t = 0.09, p = 0.925, r_{pb} = 0.01. Taken together, these results show that self-assessed knowledge about these MRs does not currently differ between proximate and more distant populations.

Table 2 about here

The second research question focused on whether this self-assessed knowledge differs based on attachment to one or more of the MR locations. The six variables measuring place attachment had an alpha of 0.92 and deleting any of them did not improve reliability (Table 2).[2] Consistent with other studies, K-means cluster analysis was then used for grouping respondents according to their degree of attachment (Warzecha and Lime, 2001). Cluster analysis classifies individuals into smaller and more homogeneous groups based on patterns of responses across variables (Vaske, 2008). A series of two to six group cluster analyses showed that the three group solution provided the best fit, revealing three subgroups of respondents with low (lowest scores on all variables, 13%), neutral (neither disagree nor agree on all variables, 60%), and high attachment (highest scores on all variables, 27%).[3]

For seven of the eight variables measuring self-assessed knowledge, those in the high attachment group considered themselves to be the most knowledgeable and informed, and have the highest level of understanding about Oregon's MRs (Table 3). This pattern in differences among place attachment groups, however, was statistically significant for only three variables, $F = 3.47$ to 6.74, $p = 0.032$ to 0.001. Tamhane's T2 post-hoc tests showed that those with highest attachment felt most informed and knowledgeable about MRs in Oregon, and were most likely to understand the role of public involvement in these reserves. The eta (η) effect sizes for these three significant variables were 0.14 to 0.19, suggesting "small" to "medium" (Cohen, 1988) or "minimal" to "typical" relationships (Vaske, 2008). Responses to the other five variables measuring self-assessed knowledge, however, did not differ among place attachment groups, $F = 0.42$ to 2.70, $p = 0.069$ to 0.657, $\eta = 0.05$ to 0.12. In addition, there were no differences in the self-assessed knowledge index (i.e., all eight variables combined) among attachment groups, $F = 2.91$, $p = 0.055$, $\eta = 0.13$. Taken together, these results show that attachment was related to

some, but not all, aspects of self-assessed knowledge about MRs in Oregon; those with high attachment believed they had slightly more knowledge about some aspects of these reserves.

Table 3 about here

The third research question focused on whether factual knowledge about MRs in Oregon differs based on proximity to these reserves. The factual knowledge question answered correctly the greatest number of times (80% correct) was that scientific research would be allowed in both MPAs and MRs in Oregon, whereas the question answered correctly the least was that commercial fishing would be allowed in MPAs, but not MRs (7% correct; Table 4). The factual knowledge questions were recoded to give a standardized score for each respondent representing the number of correctly answered questions out of 16 (i.e., 0 to 16). This approach is consistent with other studies (Needham and Little, 2013; Vaske et al., 2006). The total factual knowledge score out of 16 showed that this knowledge was low with 65% of respondents answering half or fewer of the questions correctly, only 1% answering 15 questions correctly, and no respondents answering all 16 questions correctly. The average score was only 6.80 out of 16 (43% correct).

Table 4 about here

There were no clear differences between residents in the communities of place and rest of the coast for these factual knowledge questions. There was a significant difference between these groups for only one of the 16 questions, with those in the communities of place (17%) slightly more likely than the rest of the coast (10%) to know where recreational fishing is allowed, $\chi^2 = 5.28$, $p = 0.022$ (Table 4). The phi (ϕ) effect size of 0.10, however, suggested that this difference between groups was "small" (Cohen, 1988) or "minimal" (Vaske, 2008). There were no significant differences between groups for the other 15 questions, $\chi^2 = 0.01$ to 2.17, $p = 0.141$ to 0.954, $\phi = 0.01$ to 0.06. In addition, the total factual knowledge score out of 16 questions did not differ between communities of place (6.72 / 16; 42% correct) and rest of the coast (6.83 / 16;

43% correct), $t = 0.37$, $p = 0.713$, $r_{pb} = 0.02$. These results show that factual knowledge about MRs in Oregon does not currently differ much between proximate and more distant populations.

The fourth research question examined whether this factual knowledge differs based on place attachment. Those who reported low attachment to the MR areas answered 11 of the 16 questions correctly slightly more often than those with neutral or high place attachment (Table 5). However, there were statistical differences among place attachment groups for only two of the 16 questions, both of which addressed aspects of non-extractive recreation, $\chi^2 = 6.21$ to 10.37, $p = 0.006$ to 0.045, $V = 0.13$ to 0.18. For the other 14 questions, there were no differences among attachment groups in the proportions of respondents who answered correctly, $\chi^2 = 0.30$ to 4.86, $p = 0.088$ to 0.861, $V = 0.03$ to 0.12. In addition, the total factual knowledge score did not differ among low (8.00 / 16; 50% correct), neutral (7.00 / 16; 44% correct), and high attachment groups (7.48 / 16; 47% correct), $F = 1.79$, $p = 0.168$, $\eta = 0.10$. Taken together, these results show that attachment was not substantially related to factual knowledge about MRs in Oregon.

Table 5 about here

5. Discussion

This article examined resident proximity and attachment to a new system of MRs in Oregon, and the extent that these factors are related to self-assessed and factual knowledge about these areas. Residents reported higher self-assessed than factual knowledge, which was low with 65% answering half or fewer of the 16 factual questions correctly. Self-assessed and factual knowledge did not differ between communities proximate to and more distant from these MRs. Factual knowledge also did not differ based on attachment to these areas, but place attachment was related to some aspects of self-assessed knowledge where those with higher attachment felt they were slightly more knowledgeable about these MRs. These results have implications for both management and research.

5.1 Implications for Management

From a management perspective, understanding potential characteristics (e.g., proximity, attachment) that may be related to how knowledgeable people are or perceive themselves to be is important in natural resource management. In the context of Oregon's MRs, managers may value knowing what the public feels they are knowledgeable about, what they actually know, and if there are any disconnects in knowledge. Results, for example, showed that people adjacent to the MRs and along the rest of the coast believed they understood the purpose of the MRs and the role of science in these areas more than other aspects of these reserves. Questions measuring factual knowledge also showed that most residents know that agencies have considered MRs in Oregon and scientific research would be allowed in these areas. With increasing calls for public ocean literacy and conservation, these areas where people feel knowledgeable and have factual knowledge may serve as an appropriate starting point for further public engagement in MR implementation and management. Managers may benefit from examining the methods by which these subject areas were presented to coastal residents and employ them for other MR topics.

Information dissemination strategies in natural resources are routinely tailored to specific audiences and settings, often with different communication avenues for groups with more or less understanding about an issue (Cudaback, 2008). Results here, however, showed a generally low level of factual knowledge across both geographic distances from the MRs and attachment to these areas. Coastal residents are generally not highly knowledgeable about the MR system in Oregon, so information campaigns are needed to inform and educate people about these areas. Education and engagement catering to different audiences and settings, however, may not be needed because similarities in factual knowledge among attachment groups and proximate and more distant populations suggest that managers may not need to invest in communications aimed at different audiences based solely on proximity or attachment. The results also suggest that any

targeted communications thus far to the most proximate residents (Murphy, 2010) may not have succeeded in increasing this population's knowledge in comparison to more distant populations.

Feeling highly attached to a MR location was not enough by itself to account for whether respondents had greater self-assessed or factual knowledge about these sites. This result suggests that even though people may identify and depend on these areas, they may not be any more able to retain factual knowledge about protection of these sites. Given that the MR creation process in Oregon did elicit themes of attachment from interest groups (e.g., commercial and recreational anglers), managers may want to examine what specific aspects of attachment beyond those tested here factor into facilitating a connection to and greater understanding of these reserve locations.

Of particular relevance to managers is how to engage non-locals and disinterested locals who may have visited the reserve locations, but do not express an attachment to these places. In total, 13% of residents had low attachment and 60% had a neutral level of attachment to these areas (i.e., neither disagreed nor agreed with the attachment variables). Managers may find that this neutral attachment group in particular represents individuals with whom the greatest advances in education and engagement could be made. This large group of coastal residents who have visited at least one of these areas in the past, but do not indicate any clear attachment, may not see or understand the salience of these areas to their experiences. By emphasizing biological and social aspects of these areas, and building a narrative around the importance of these places that perhaps do not have identifiable emotional or physical characteristics, managers may be able to increase understanding about the MRs and their connections to conservation and stewardship.

5.2 Implications for Research

From a research perspective, this article explored relationships among proximity, place attachment, and self-assessed and factual knowledge regarding marine areas. Although these concepts have been examined individually in terrestrial protected areas and for specific interest

groups in MPAs, this article examined whether these concepts can be transferred to marine settings where human interactions are often fundamentally different than with land (Shackeroff et al., 2009**)**. Results suggest that these concepts have some relevance in marine environments.

Similar to other research on factual knowledge about protected areas and related natural resources (e.g., Booth et al., 2009; Jones et al., 2011; Needham and Little, 2013; Vaske et al., 2006; Xu et al., 2006**)**, public knowledge of facts about the MRs in Oregon is generally low. Residents were knowledgeable about some general facts, such as MRs have been considered for the Oregon coast for several years, but were less knowledgeable of specific details about these reserves (e.g., if commercial fishing is allowed, if these areas include beaches and coastlines). This pattern of cursory knowledge where broad facts are known but specifics are not supports studies on this phenomenon at terrestrial (Jones et al., 2011, Ressurreição et al., 2012, Sladonja et al., 2012) and other marine protected areas (Dimitrakopoulos et al., 2010; Fiallo and Jacobson, 1995; Kafyri et al., 2012; Parnell et al., 2005; Snider et al., 2011; Stevenson et al., 2012). This article builds on this literature by showing that this limited detailed factual knowledge about protected areas exists despite both attachment and proximity to the areas. The lack of differences in factual knowledge by proximity to these reserves does contradict findings of some studies mostly conducted in terrestrial areas (Jim and Xu, 2002; Mangun et al., 2009; Olomi-Sola et al., 2012; Steel et al., 2005) and indicates that perhaps there may be situational factors making this context unique. This result, for example, may be attributed to the relatively short time the Oregon MRs have been in existence, that they are marine and not terrestrial protected areas, or that they are temperate rather than tropical MRs. Research is needed to investigate these issues in detail.

The finding of higher self-assessed than factual knowledge is consistent with research on public knowledge of oceans and protected areas (Belden, Russonello, and Stewart, and American Viewpoint, 1999; Steel et al., 2005). Studies in terrestrial protected areas have also shown higher

subjective knowledge and also some understanding of overarching facts about an area, but not specifics about its management (Jim and Xu 2002; Mangun et al., 2009; Olomi-Sola et al., 2012). This article found the same phenomenon and suggests people may feel that acquaintance with an area through mere exposure creates a subjective or perceived level of knowledge, but this is not borne out when examined using a factual test. The recent establishment of the MRs in Oregon may factor in why factual knowledge is not prevalent among the public yet and self-assessed knowledge in this case may be higher. The newness of the legislation and process to implement these MRs have heightened exposure of this issue in the media (Murphy, 2010) and, as a result, people may feel that they are more aware of the topic than they are in actuality.

Although relationships between proximity to and knowledge about MPAs have been examined in various contexts (Dimitrakopoulos et al., 2010; Fiallo and Jacobson, 1995; Kafyri et al., 2012; Parnell et al., 2005; Snider et al., 2010, 2011; Stevenson et al., 2012; Tomassin et al., 2010), research on attachment to these areas has been less prevalent. This study sought to add to the knowledge of whether the concept of place attachment was transferrable to a marine setting where direct interaction with the resource is limited (because MRs in Oregon are offshore). In total, 60% of respondents who had visited at least one of these areas did not agree nor disagree with the place attachment measures. Instead, they indicated a neutral or somewhat ambivalent attachment to these locations. Given that people tend to remember information about areas and issues they have a stronger interest in or attachment to (Ressurreição et al., 2012; Wann and Branscombe, 1995), it follows that the 27% of respondents who expressed an attachment to these MRs should be more knowledgeable about these areas. Instead, there were few differences in factual and self-assessed knowledge based on attachment. Past studies have reported mixed relationships between place attachment and knowledge (e.g., Alam, 2011; Needham and Little,

2013; Ressurreição et al., 2012; Smaldone, 2008), and the results presented here add to this complexity and the potential role of site-specific factors in these relationships.

The concept of place attachment and connections that people make to marine environments may not be the same as in terrestrial studies, especially among a wide range of stakeholders with different motivations for attachment and specificity of use. The insignificant relationships between attachment and knowledge suggest that other factors may be related to assessments of knowledge. Empirical research is needed, therefore, on whether place attachment to marine environments facilitates connections to these areas that influence knowledge levels, if established protected area status influences attachment, and whether people who do not express strong attachment are apathetic to the importance of a particular marine site or all marine areas. Future research should also examine the extent that findings in this study generalize beyond coastal residents to other potential stakeholders and interest groups (e.g., environmental organizations, recreation interest groups, commercial anglers, management agencies).

Notes

1. A MPA may refer to many different areas, protection levels, and conservation strategies (Pita, et al., 2011). Many types of MPAs exist, from "multiple use" allowing fishing in some areas and protection in others, to "no-take" marine reserves (MRs) prohibiting all extractive uses. MPAs usually have less stringent restrictions than MRs and are "areas of the ocean designated to enhance conservation of marine resources" (Lubchenco et al., 2003, p. S3), where prohibitions and allowances exist only on a case-by-case basis. This article uses the term MPA as a broad inclusive term referring to many types of protected areas, and the term MR when specifically discussing areas where there are restrictions on extraction.

2. Principal components exploratory factor analysis with varimax rotation showed that all six variables loaded on a single factor (eigenvalue = 4.23, variance explained = 71%), so place identity and dependence variables were grouped here and in further analysis.
3. Two analyses validated and confirmed the stability of this cluster solution. First, the data were randomly sorted and a cluster analysis was conducted after each of four random sorts. These analyses supported the solution identifying three distinct groups of individuals based on their attachment. Second, discriminant analysis was conducted to determine how well the place attachment variables predicted the three cluster groups. All of the variables significantly predicted the clusters, Wilks' lambda $U = 0.347$ to 0.514, $F = 166.04$ to 330.85, $p < 0.001$. The attachment variables correctly classified 96% of low attachment residents, 98% of the neutral attachment group, and 99% of highly attached residents. Overall, 98% of respondents were correctly classified. These analyses demonstrate that the place attachment variables were capable of separating the clusters and support the stability of this three cluster solution.

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Table 1. Comparison of self-assessed knowledge about marine reserves (MRs) in Oregon by proximity to these MRs.

Self-assessed knowledge questionnaire variables	Communities of place (55%)	Rest of coast (45%)	Total	*t*	*p*	r_{pb}
How well informed do you feel about the topic of MRs in Oregon [1]	2.27	2.37	2.34	1.51	0.133	0.06
How knowledgeable do you feel about the topic of MRs in Oregon [2]	2.18	2.27	2.25	1.37	0.172	0.06
How much do you understand about purpose of MRs in Oregon [3]	3.94	3.67	3.74	1.58	0.116	0.07
How much do you understand about how MRs would be managed in Oregon [3]	2.41	2.42	2.42	0.07	0.945	0.01
How much do you understand about rules / regulations of MRs in Oregon [3]	2.30	2.25	2.27	0.31	0.757	0.01
How much do you understand about where MRs are located in Oregon [3]	2.69	2.61	2.63	0.44	0.661	0.02
How much do you understand about role of science in MRs in Oregon [3]	3.37	3.22	3.25	0.83	0.405	0.04
How much do you understand about role of public involvement in MRs in Oregon [3]	2.62	2.65	2.64	0.16	0.873	0.01

[1] Cell entries are means on 4-point scale of 1 = Not Informed to 4 = Extremely Informed.
[2] Cell entries are means on 4-point scale of 1 = Not Knowledgeable to 4 = Extremely Knowledgeable.
[3] Cell entries are means on 9-point scale of 0 = Do Not Understand to 8 = Fully Understand.

Table 2. Reliability analyses of self-assessed knowledge and place attachment related to marine reserves (MRs) in Oregon.

Questionnaire variables	Item total correlation	Alpha if deleted	Cronbach alpha
Self-assessed knowledge			0.93
How well informed do you feel about the topic of MRs in Oregon [1]	0.66	0.92	
How knowledgeable do you feel about the topic of MRs in Oregon [2]	0.68	0.92	
How much do you understand about purpose of MRs in Oregon [3]	0.77	0.91	
How much do you understand about how MRs would be managed in Oregon [3]	0.82	0.91	
How much do you understand about rules / regulations of MRs in Oregon [3]	0.83	0.90	
How much do you understand about where MRs are located in Oregon [3]	0.83	0.90	
How much do you understand about role of science in MRs in Oregon [3]	0.78	0.91	
How much do you understand about role of public involvement in MRs in Oregon [3]	0.78	0.90	
Place attachment [4]			0.92
At least one of these marine sites is very special to me	0.76	0.90	
At least one of these marine sites is one of the best places for doing what I like to do	0.76	0.90	
I am very attached to at least one of these marine sites	0.84	0.89	
I would not substitute any other area for doing the types of things I do in at least one of these marine sites	0.68	0.91	
I identify strongly with at least one of these marine sites	0.83	0.89	
Doing what I do in at least one of these marine sites is more important to me than doing it any other place	0.71	0.91	

[1] Measured on 4-point scale of 1 = Not Informed to 4 = Extremely Informed.
[2] Measured on 4-point scale of 1 = Not Knowledgeable to 4 = Extremely Knowledgeable.
[3] Measured on 9-point scale of 0 = Do Not Understand to 8 = Fully Understand.
[4] Measured on 5-point scale of 1 = Strongly Disagree to 5 = Strongly Agree. Principal components exploratory factor analysis with varimax rotation showed that all six variables loaded on a single factor, so place identity and dependence variables were grouped in the analysis.

Table 3. Comparison of self-assessed knowledge about marine reserves (MRs) in Oregon by place attachment to these MRs.

	Place attachment clusters [4]					
Self-assessed knowledge questionnaire variables	Low attachment (13%)	Neutral attachment (60%)	High attachment (27%)	*F*	*p*	η
How well informed do you feel about the topic of MRs in Oregon [1]	2.32 [a]	2.35 [a]	2.67 [b]	6.74	0.001	0.19
How knowledgeable do you feel about the topic of MRs in Oregon [2]	2.25 [ab]	2.27 [a]	2.53 [b]	4.01	0.019	0.15
How much do you understand about purpose of MRs in Oregon [3]	4.47	4.01	4.10	1.10	0.334	0.08
How much do you understand about how MRs would be managed in Oregon [3]	2.62	2.59	2.86	0.73	0.484	0.07
How much do you understand about rules / regulations of MRs in Oregon [3]	2.44	2.38	2.88	2.32	0.100	0.12
How much do you understand about where MRs are located in Oregon [3]	2.82	2.93	3.13	0.42	0.657	0.05
How much do you understand about role of science in MRs in Oregon [3]	3.65	3.45	4.08	2.70	0.069	0.12
How much do you understand about role of public involvement in MRs in Oregon [3]	2.70 [a]	2.73 [ab]	3.36 [b]	3.47	0.032	0.14

[1] Cell entries are means on 4-point scale of 1 = Not Informed to 4 = Extremely Informed.
[2] Cell entries are means on 4-point scale of 1 = Not Knowledgeable to 4 = Extremely Knowledgeable.
[3] Cell entries are means on 9-point scale of 0 = Do Not Understand to 8 = Fully Understand.
[4] Cell entries with different letter superscripts across each row differ at $p < 0.05$ using Tamhane's T2 post-hoc tests for unequal variances.

Table 4. Comparison of factual knowledge about marine reserves (MRs) in Oregon by proximity to these MRs.

Factual knowledge questionnaire variables	Correct response [1]	Percent answered correctly (%): Communities of place (55%)	Rest of coast (45%)	Total	χ^2	*p*	ϕ
Are the following statements related to MRs in Oregon true or false?							
The government has been considering MRs for the past several years	True	68	72	71	0.97	0.326	0.04
The government has approved MRs for this state	True	43	47	46	1.18	0.278	0.05
Commercial fishing would be allowed in all MRs	False	62	68	67	2.02	0.155	0.06
All MRs would include coastal lands such as beaches and coastlines	False	36	34	34	0.40	0.589	0.03
The government has established five MR sites	True	29	30	30	0.13	0.718	0.02
New developments such as wave energy or fish farms would be allowed in all MRs	False	36	36	36	0.01	0.954	0.01
Non-extractive recreation / tourism activities (e.g., surfing, swimming, diving) would be allowed in all MRs	True	32	34	34	0.16	0.688	0.02
Keeping fish caught in MRs would be allowed in all reserves	False	59	57	58	0.07	0.797	0.01
Only scientists and no other people would be allowed in all MRs	False	54	54	54	0.01	0.942	0.01
There have been opportunities for public involvement in agency discussions about MRs	True	60	58	58	0.29	0.588	0.02
What agency / organization is currently responsible for MRs in Oregon?	ODFW	30	35	34	1.75	0.186	0.06
Would the following activities be allowed in Oregon's MRs, MPAs, both of these types of areas, or neither of these types of areas?							
Commercial fishing would be allowed in…	MPAs	8	6	7	1.04	0.309	0.04
Recreational fishing would be allowed in…	MPAs	17	10	12	5.28	0.022	0.10
Scientific research would be allowed in…	Both	79	80	80	0.07	0.789	0.01
Removing any species or habitat would not be allowed in…	MRs	13	9	10	2.17	0.141	0.06
Non-extractive recreation / tourism activities (e.g., surfing, swimming, diving) would be allowed in…	Both	38	40	39	0.23	0.631	0.02
Total factual knowledge score (average % correct) [2]		42	43	43	0.37	0.713	0.02

[1] Questions also included an "unsure" response category, which was coded as "incorrect" in the analysis.
[2] Test of statistical significance is a *t*-test with point-biserial correlation effect size.

Table 5. Comparison of factual knowledge about marine reserves (MRs) in Oregon by place attachment to these MRs.

Factual knowledge questionnaire variables	Correct response [1]	Percent answered correctly (%): Low attachment (13%)	Neutral attachment (60%)	High attachment (27%)	χ^2	*p*	*V*
Are the following statements related to MRs in Oregon true or false?							
The government has been considering MRs for the past several years	True	80	75	72	1.15	0.562	0.06
The government has approved MRs for this state	True	60	46	52	3.60	0.166	0.10
Commercial fishing would be allowed in all MRs	False	82	68	73	4.02	0.134	0.10
All MRs would include coastal lands such as beaches and coastlines	False	29	41	29	4.64	0.098	0.12
The government has established five MR sites	True	44	31	36	3.12	0.210	0.10
New developments such as wave energy or fish farms would be allowed in all MRs	False	46	40	33	2.60	0.272	0.09
Non-extractive recreation / tourism activities (e.g., surfing, swimming, diving) would be allowed in all MRs	True	44	31	44	6.21	0.045	0.13
Keeping fish caught in MRs would be allowed in all reserves	False	62	56	67	3.42	0.181	0.10
Only scientists and no other people would be allowed in all MRs	False	67	59	59	1.09	0.579	0.06
There have been opportunities for public involvement in agency discussions about MRs	True	69	65	66	0.30	0.861	0.03
What agency / organization is currently responsible for MRs in Oregon?	ODFW	40	35	29	1.98	0.372	0.08
Would the following activities be allowed in Oregon's MRs, MPAs, both of these types of areas, or neither of these types of areas?							
Commercial fishing would be allowed in…	MPAs	11	9	4	3.55	0.169	0.10
Recreational fishing would be allowed in…	MPAs	19	14	27	4.13	0.127	0.11
Scientific research would be allowed in…	Both	79	86	83	1.45	0.484	0.07
Removing any species or habitat would not be allowed in…	MRs	16	11	5	4.86	0.088	0.12
Non-extractive recreation / tourism activities (e.g., surfing, swimming, diving) would be allowed in…	Both	48	35	56	10.37	0.006	0.18
Total factual knowledge score (average % correct) [2]		50	44	47	1.79	0.168	0.10

[1] Questions also included an "unsure" response category, which was coded as "incorrect" in the analysis.
[2] Test of statistical significance is ANOVA (*F*) with eta effect size.