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Mental models reveal diverse perspectives on marine resources management across racial/ethnic and gender social identities

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Abstract

As marine resource management fields continue to move toward more inclusive and collaborative processes, it is important to also examine the value of promoting the diverse perspectives of scientists and managers from different backgrounds throughout the decision-making process. An important objective of diversity initiatives is to acknowledge the value of diversity while providing opportunities to increase the representation of diverse communities in professional settings. However, focusing on diversity only at the surface can potentially overshadow benefits existing at a deeper level. This study used a mental model approach to explore the potential value of racial/ethnic and gender diversity in marine and fisheries science professions from a cognitive deep-level diversity perspective. The study included 112 participants across gender, who self-identified as one of the following racial/ethnic social identity groups: Black/African American, Latino/Hispanic, Multiracial, White, Asian/Asian American or /Pacific Islander, American Indian or/ Alaska Natives. Results revealed differences in how members of underrepresented groups and white men incorporated concepts associated with diversity into their mental models and distinctions in how racial/ethnic and gender social identity groups organized similar concepts within their mental model structures. These findings on diverse perspectives related to marine resources management across social identity groups, highlight the value of understanding diversity beyond just a numerical or surface level and the utility of incorporating deep-level diversity in the management and decision-making process.

KEYWORDS

Cognitive Mapping, Diversity, Ethnicity, Gender, Marine Resource Management, Mental Models, Race

1 | INTRODUCTION

The management of marine resources occurs in many forms and often involves a variety of stakeholders (e.g., scientists, community leaders, resource users, government, and nonprofit organizations) who play a valuable role in the decision-making process (Dalton, 2006). In addition to being driven by biological and or physical aspects of an environment or resource, the management of marine resources is also a politically and culturally driven process, that is shaped by the experiences and perceptions of stakeholders (Levine et al., 2015), including those with decision-making power. In recent years, there has been a transition from top-down management strategies to more inclusive interdisciplinary and collaborative approaches, for example, ecosystem-based management (Long et al., 2015) and community-based management (Beyerl et al., 2016). However, as the field continues to move toward more inclusive and collaborative processes, it is important to also examine the value of promoting the diverse perspectives of scientists and managers from different backgrounds throughout the decision-making process.

As the US sociodemographics continue to shift, the narrative of the importance of diversity, especially in science, technology, engineering, and mathematics (STEM), continues to take shape across fields and professions. However, despite these shifts, the STEM workforce does not reflect the diversity of the US population (National Center for Science and Engineering Statistics, 2021). Findings from a 2016 study on diversity in the US fisheries science workforce found that men accounted for 74% of federal fisheries scientists and managers, and 91% of federal fisheries scientists and managers included in the study identified as white (Arismendi & Penaluna, 2016). More broadly, men (49% of the US population) and individuals identifying racially as white (60% of the US population) account for an estimated 69 and 87%, respectively, of scientists employed earth, atmospheric, and ocean fields (National Center for Science and Engineering Statistics, 2021).

Effort to promote diversity in STEM education and professions, including marine resource fields, often focus on increasing the numerical representation of individuals or groups who are considered underrepresented based on socially constructed identities such as gender, race, ethnicity, and class (Banks, 2009; Hon et al., 1999; Lee Baker et al., 2016). Research on cultural diversity in management and organizational literature suggest that examining differences solely through gender or racial/ethnic social identity lens is an example of surface-level diversity (Jehn et al., 1999; Stahl et al., 2010; Stahl & Maznevski, 2021; Wang et al., 2019). Yet, research also highlights the importance of deep-level diversity, which relates to differences in cognitive frameworks, values, and perspectives across different social-cultural groups, such as race and ethnicity (Harrison et al., 1998; Stahl et al., 2010; Stahl & Maznevski, 2021; Wang et al., 2019). A 2019 meta-analysis examining the relationship between diversity (surface-level and deep-level) in teams and team creativity and innovation found that deep-level diversity was positively related to team creativity and innovation, while surface-level diversity was not related to creativity and innovation (Wang et al., 2019).

However, researchers have caution against using definitive statements such as "diversity strengthens" or "diversity creates" and encouraged the use of qualifiers such as "diversity can strengthen" or "diversity can create" (Batavia et al., 2020) highlighting that while increased diversity has the potential to benefit natural resource management, it also has to potential to produce conflict (Stahl et al., 2010; van Knippenberg et al., 2004) and reveal differences that may exist beyond the surface-level diversity. For example, while studies have found that diverse teams often benefit from increased creativity, they are also subjected to increased task conflict, which refers to the awareness of differences in viewpoints and opinions related to a group task (Jehn & Mannix, 2001; Stahl et al., 2010).

Examining individuals' mental models may reveal deep-level diversity and potential differences in cognitive frameworks in marine resources professions. Mental models act as internal representations of how people see the external world around them (Craik, 1943; Johnson-Laird, 1989). Mental models are cognitive structures that represent an individual's understandings of the world, including their beliefs and assumptions, and have the potential to influence behaviors and decisions (Jones et al., 2011; Kearney & Kaplan, 1997). Each mental model contains mental objects (the mental model's content), which represent stored pieces of information that interact with one another based on their perceived relationships to create the mental model structure (Biedenweg et al., 2020). Each mental object, and the subsequent mental model, is context-dependent and constructed based on personal lived experiences (Jones et al., 2011). Research on collective or shared mental models suggests that people with shared cultural backgrounds and learning experiences related to a particular topic are more likely to share similar mental models, whereas differences are expected in mental models of people with different cultural backgrounds and learning experiences (Biedenweg & Monroe, 2013; Denzau & North, 2000).

This study examines the deep-level diversity and potential cognitive differences and similarities in mental models related to natural marine resources management. I chose to explore diverse perspectives of marine and fisheries science professionals across racial, ethnic, and gender social identities. I pose the following research question: How do perceptions of management of natural marine resources differ amongst social identity groups? I hypothesized that the mental models of natural marine resources management of white male marine and fisheries science professionals (represented) will differ in both content and structure of the mental models of underrepresented marine and fisheries science professionals. This study aims to contribute to the growing body of literature on diversity in natural resources, specifically focusing on race, ethnicity, and gender as it pertains to natural marine resources management and science fields using a deep-diversity cognitive approach.

2 | METHODS

Women and racial and ethnic groups such as Black/ African American, Latino/Hispanic, and American Indians or/ Alaska Natives are traditionally considered underrepresented in STEM professions, compared to their White and Asian peers (National Science Board, 2020). However, while in some STEM fields Asians and Asian Americans are considered overrepresented, this trend does not always carry over into the workforce of all natural science professions, for example, ecology (Kou-Giesbrecht, 2020) and the fisheries science work force (Arismendi & Penaluna, 2016). In addition, many individuals identify with more than one racial and ethnic identity. Therefore, for this study, I have defined underrepresented racial/ethnic groups as individuals who self-identify as Black/African American, Latino/Hispanic, American Indian or/ Alaska Natives, Asian/Asian American, Pacific Islander, and Multiracial.

2.1 | Study design

For this study, I focused on describing and comparing mental models of individuals who self-identified as professionals in marine or fisheries science careers, excluding individuals who were still in school as undergraduate students or graduate students. Participants self-identified their gender and race/ethnicity. Participants who identified with more than one racial/ethnic group were able to select multiple groups or manually enter how they chose to identify before completing an in-person or online cognitive mapping card sorting exercise. I identified participants through snowball sampling, in which key informants were contacted and asked to share the study's recruitment information with additional marine and fisheries science professionals within their networks (Bernard, 2013).

2.2 | In-person sampling and recruitment

I began sampling in April of 2019 and continued through July 2020. I conducted 17 in-person interviews, before the global COVID-19 pandemic, at scientific conferences and meetings throughout the United States and US Territories including The American Fisheries Society, Society for Freshwater Science, Association for the Science of Limnology and Oceanography, Society for Advancement of Chicanos/Hispanics and Native Americans in Science, and Coastal and Estuarine Research Federation. I identified additional participants through two government-sponsored programs, including NOAA Educational Partnership with Minority Serving Institutions and National Sea Grant Sponsored fellowships.

Before each meeting, I identified contacts and asked them to share an Institutional Review Board (IRB) approved recruitment email with conference attendees and professionals within their networks. The recruitment email provided potential participants with a copy of the study's IRB approved informed consent form, followed by the option to opt-in to participate in the study via a short online survey that collected race/ethnicity, gender, career level, and contact information. One week before the start of each conference or meeting, I contacted opt-in participants and scheduled in-person meetings. Additional snowball recruitment occurred at each conference, in which I distributed recruitment flyers to participants and asked them to share them with others attending the conference. The flyer contained a description of the study, IRB consent information, and a link to the opt-in survey.

2.3 | Online sampling recruitment

Due to the COVID-19 pandemic and social distancing restrictions, I continued sampling and data collection using online platforms. Recruitment for online participants occurred April through July of 2020. Similar to the in-person sampling techniques, I used snowball sampling to recruit online participants. I contacted approximately 20 marine and fisheries science professionals via email, including individuals from government and academia, and invited them to participate in the study and share the recruitment email with others within their networks.

2.4 | Cognitive mapping concept cards generation

First, I generated concepts by reviewing reports and documents from multiple agencies and organizations related to marine resource management and selected commonly used terms. Next, I used free-listing techniques with a small group of marine and fisheries science students and professionals (Bernard, 2013). Free-listing participants were asked to list all terms that come to mind when responding to the following prompt: *what factors do you perceive to be important when considering the management of natural marine resources?* All of the terms from the free-list and text analysis were combined into a list of possible concepts. I then condensed the list by removing concepts that were similar to other concepts. Finally, I pilot tested the concepts with additional marine and fisheries science students and professionals and narrowed to 30 final concepts, to prevent cognitive overload (Kearney & Kaplan, 1997; Wade & Biedenweg, 2019). Free-listing and pilot testing participants included individuals from the social identity groups compared in this study. Each concept was written on a physical card (in-person) or virtual card for the online cognitive mapping card sorting exercise.

2.5 | Cognitive mapping card sort exercise

For in-person card sorting, I read the following statement to each participant: *from these cards, please select the concepts that best represent your response to the following prompt: what factors do you perceive to be important when considering the management of natural marine resources?* I then read each concept card, at random, and placed in front of the participants. I provided blank cards to the participants if there were any concepts that they would like to add. After participants selected all the cards that they felt best represented their response to the prompt, I removed unselected cards and asked participants to organize their cards into groups according to how they thought the concepts go together. Participants were encouraged to describe their thought processes throughout the experiences. I recorded the information obtained from each card sort via audio recordings and written notes.

Online card sorting followed a similar process to the in-person exercise. Participants were provided with a link to the online card sorting exercise which utilized QualtricsXM. First, participants were provided with a description of the activity followed by demographic questions including gender and race/ethnicity. Then participants were presented with the same statement and prompt as the in-person participants and a screen containing images of all 30 concept cards. The order of cards was randomly generated for each participant. Blank cards were also provided to participants if there were any concepts that they wanted to add. Using a drag and drop tool, participants selected the concepts cards that best represented their response to the prompt. Once concepts were selected, participants organized the concept cards into groups according to how they thought the concepts go together. Next, the participants were asked to label each group. Finally, participants had the option to provide any additional information about their process before completing the survey.

2.6 | Statistical analyses

I analyzed data using the Statistical Package for Social Science (IMB SPSS 26). While no noticeable differences between in-person and online data observed, I performed an ANOVA test to compare the number of cards selected by in-person and online participants before analyzing data across social identity groupings. There was no significant difference between the number of concepts selected by in-person and online participants.

I calculated frequencies (selected, not selected) for each concept card (Table 1), then performed chi-square analyses to test for differences in the selection of individual cards by white men and underrepresented participants (racial/ethnic groups and women). Results including the chi-squared value, p-value, and Cramer's V effect size. The Cramer's V effect size provides a measure of association ranging from small/minimal (0.1), medium/typical (0.3), and large/substantial (0.5) effect size (Cohen, 1988; Vaske, 2008). To explore the structure of mental models for each social identity grouping, I used exploratory hierarchical cluster analyses (HCAs), using Ward linkages and squared-Euclidean distances, which produce dendrograms that reflect measures of similarity. Concepts are reflected on the vertical axis of the dendrogram and distance on the horizontal axis. Each concept starts as its own cluster and is then joined into larger clusters based on similarities in how the concepts were grouped by participants. The resulting dendrogram contains a classification tree of all the concepts, that branches into multiple clusters. The shorter the distance the more similarity in the concept grouping (Fonseca, 2013).

3 | RESULTS

The study's 112 participants identified as the following racial/ethnic social identity groups: Black/African American (9%, $n = 10$), Latino/Hispanic (6%, $n = 7$), Multiracial (5%, $n = 6$), White (71%, $n = 79$), Asian/Asian American or /Pacific Islander (7%, $n = 8$), American Indian or/Alaska Natives (2%, $n = 2$); and the following genders: men (48%, $n = 54$) or women (52%, $n = 58$). To test my hypothesis (*the mental models of natural marine resources management of white male professionals will differ in both content and structure of the mental models of underrepresented professionals*), I examined the similarities and differences in content and structure of mental models produced by marine fisheries science related professionals, across racial and gender identities. Of the 112 participants, 13 identified additional concepts (1–2 per participant) (Table S1). However, during the card sorting exercise, participants were not presented with additional concepts identified by other participants.

TABLE 1 List of 30 concepts presented to participants and the frequency of selection for each concept

	Social identity groupings[a]			
Concept cards	Women[b] (%)	Underrepresented[c] (%)	White men (%)	Overall (%)
Science-driven	81	67	88	81
Sustainability	72	73	78	75
Data	74	70	73	73
Conservation	64	64	70	65
Adaptive management	67	67	55	63
Stakeholders	60	64	65	63
Future generations	67	64	53	61
Climate change	66	55	58	59
Communication	62	61	55	59
Monitoring and enforcement	55	58	58	57
Collaborative decision-making	59	48	48	54
Stock assessment	47	48	60	53
Cultural significance	57	55	40	50
Communities	53	55	43	49
Public input	50	52	40	47
Traditional ecological knowledge	57	55	30	46
Recreational use	43	42	45	45
Subsistence use	47	36	48	45
Resource depletion	43	42	43	44
Diversity	50	52	28	43
Economic benefits	43	36	48	43
Equity	52	45	28	43
Buy-in/willingness	38	33	50	42
Policy	36	48	43	41
Protection	41	45	35	40
Commercial use	36	36	43	38
Funding	41	39	28	37
Justice	35	36	13	28
Coastal development	26	24	23	24
Conflict	29	15	13	21

Note: Frequencies of selection were calculated for each social identity groups as well as the overall frequency of selection across all participants.

[a]Cells entries are percentage (%) of participants from each group who selected each concept. Concepts are listed in order of their total frequency, how often the concept was selected overall across all participants.

[b]Women refer to all participants who self-identified as women regardless of their racial or ethnic backgrounds.

[c]Underrepresented refers to participants form underrepresented racial/ethnic groups.

Therefore, I did not include the additional concepts in the comparison analysis.

3.1 | Mental model content

I first examined the content of mental models (the concept cards selected) across represented and underrepresented groups, with a focus on gender. I divided the sample into two social identity groups, White men (41%, $n = 40$) and women (59%, $n = 58$) (total $n = 98$) to reflect the consideration of women as underrepresented in STEM. Women refer to all participants who self-identified as women regardless of their racial or ethnic backgrounds. There was no significant difference between the number of cards selected (white men, $M = 14.12$ and women, $M = 15.64$)

TABLE 2 Differences in the selection of concept cards by women and white male participants

Concept cards	Social identity groupings[a] Women	White men	χ^2	*p*-Value	Cramer's V effect size
Conflict	29	13	4.065	.044*	.20
Diversity	50	28	5.073	.024*	.23
Equity	52	28	5.843	.016*	.24
Justice	35	13	6.436	.011*	.25
Traditional ecological knowledge	57	30	7.036	.008*	.27

Note: Statistically significance differences ($p < .05$) were observed the following concepts when comparing the women and white men.
[a]Cell entries are percentages (%) of participants from each social identity grouping who selected each concept.

TABLE 3 Differences in the selection of concept cards by underrepresented racial/ethnic groups and white male participants

Concept cards	Social identity groupings[a] Underrepresented	White men	χ^2	*p*-Value	Cramer's V effect size
Diversity	52	28	4.433	.035*	.25
Justice	36	13	5.835	.016*	.28
Science-driven	67	88	4.625	.032*	.25
Traditional ecological knowledge	55	30	4.528	.033*	.25

Note: Statistically significance differences ($p < .05$) were observed the following concepts when comparing the underrepresented racial/ethnic groups and white men.
[a]Cell entries are percentages (%) of participants from each social identity grouping who selected each concept.

($F = .712$, $p = .401$, Eta $= .086$). Of the 30-concept cards, there was a statistically significant difference in the selection of five concepts: *conflict* ($\chi^2 = 4.065$, $p = .044$, Cramer's $V = .20$); *diversity* ($\chi^2 = 5.073$, $p = .024$, Cramer's $V = .23$); *equity* ($\chi^2 = 5.843$, $p = .016$, Cramer's $V = .24$); *justice* ($\chi^2 = 6.436$, $p = .011$, Cramer's $V = .25$); and *traditional ecological knowledge* ($\chi^2 = 7.036$, $p = .008$, Cramer's $V = .27$) (Table 2). All concepts were selected more frequently by the women.

Second, I examined the content of mental models across represented and underrepresented groups, with a focus on race/ethnicity. I divided the sample into two social identity groups, White men (55%, $n = 40$) and underrepresented racial/ethnic groups (45%, $n = 33$) (total $n = 73$). There was no significant difference between the number of cards selected (white males, $M = 14.12$ and underrepresented racial/ethnic groups, $M = 15.06$) ($F = .244$, $p = .623$, Eta $= .058$). Of the 30 concept cards, there was a statistically significant difference in the selection of four concepts, *diversity* ($\chi^2 = 4.433$, $p = .035$, Cramer's $V = .24$); *justice* ($\chi^2 = 5.835$, $p = .016$, Cramer's $V = .28$); *science-driven* ($\chi^2 = 4.625$, $p = .032$, Cramer's $V = .25$); and *traditional ecological knowledge* ($\chi^2 = 4.528$, $p = .033$, Cramer's $V = .25$). All concepts were selected more frequently by underrepresented racial/ethnic groups (Table 3).

3.2 | Mental model structure

Using exploratory HCA, I further investigated the structure of participants' mental models across gender and race/ethnicity (women and white men, underrepresented racial/ethnic groups, and white men). I limited my analysis to the four clusters level for each comparison group, the points at which all 30 concepts were within one of four branches in the resulting dendrograms (Figure S1), based on the average number of groups produced by participants when asked to organize the concept cards into groups according to how they thought the concepts go together (3.73). Similarities in the structure were determined by whether different comparison groups, on average, co-allocated concepts into the same distinct clusters.

The greatest similarities in concept clusters existed between women and white men. Of the 30 concepts, the following 22 concepts were clustered similarly: *commercial use*, *recreational use*, and *subsistence use* (Figure 1, cluster 1); *buy-in/willingness*, *public input*, *stakeholders*, *communities*, *conflict*, *communication*, *collaborative decision-making*, *equity*, *justice*, *diversity*, and *traditional ecological knowledge* (Figure 1, cluster 2); *conservation*, *protection*, *sustainability*, *resource depletion*, and *climate change* (Figure 1, cluster 3); and *data*, *stock assessment* and *science-driven* (Figure 1, cluster 4). Cluster 4 was the

FIGURE 1 Hierarchical cluster analyses comparing mental models of women and white male participants across four clusters. Each number represents a different cluster. Concepts in green boxes (top) represent concepts that were grouped into each cluster by only white men. Concepts in teal boxes (bottom) represent concepts that were grouped into each cluster by only women. Concepts that were shared in each cluster by both comparison groups are represented in the center white boxes (center).

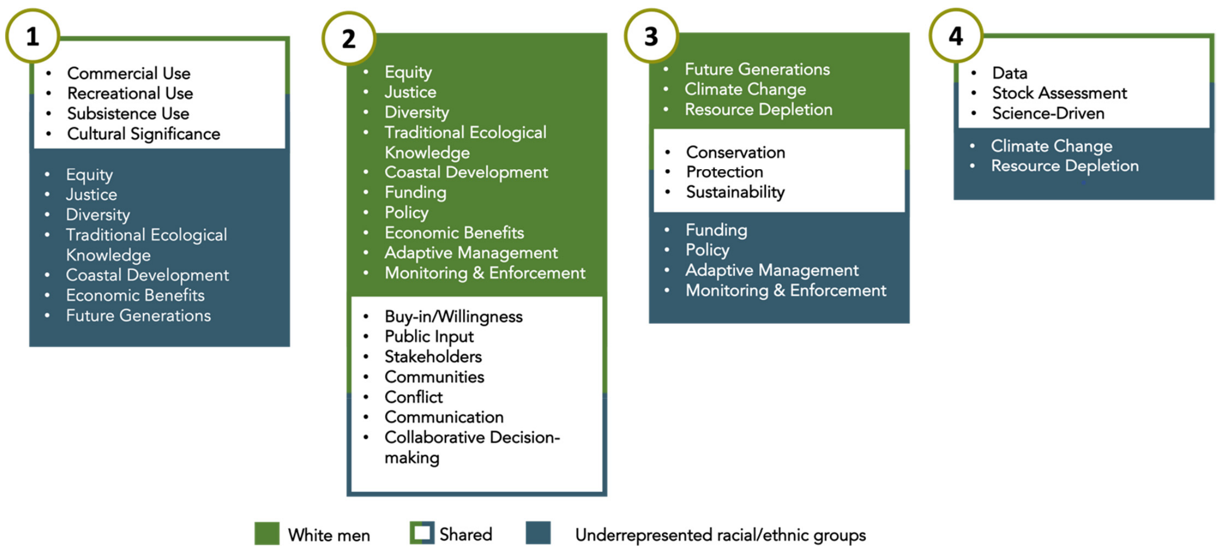

FIGURE 2 Hierarchical cluster analyses comparing mental models of underrepresented racial/ethnic groups and white male participants across four clusters. Each number represents a different cluster. Concepts in green boxes (top) represent concepts that were grouped into each cluster by only white men. Concepts in blue boxes (bottom) represent concepts that were grouped into each cluster by only underrepresented racial/ethnic groups. Concepts that were shared in each cluster by both comparison groups are represented in the center white boxes (center).

only cluster that did not differ between the two groups. For all other clusters, differences existed in the clustering of the following concepts: *coastal development*, *funding*, *policy*, *adaptive management*, and *monitoring and enforcement* (women: cluster 3, white men: cluster 2); *future generations* (women: cluster 2, white men: cluster 3); *economic benefits* (women: cluster 1, white men: cluster 2); *and cultural significance* (women: cluster 2, white men: cluster 1) (Figure 1).

When comparing the mental model structure of white men to underrepresented racial/ethnic groups, only 17 of the 30 concepts were clustered similarly: *commercial use*, *recreational use*, and *subsistence use*, (Figure 2, cluster 1); *buy-in/willingness*, *public input*, *stakeholders*, *communities*, *conflict*, *communication*, and *collaborative decision-making*; (Figure 2, cluster 2); *conservation*, *protection*, *and sustainability* (Figure 2, cluster 3); and *data*, *stock assessment*, and *science-driven* (Figure 2, cluster 4). Differences exist in the clustering of the following concepts: *equity*, *justice*, *diversity*, *traditional ecological knowledge*, *coastal development*, and *economic benefits* (underrepresented: cluster 1, white men cluster 2); *funding*, *policy*, *adaptive management*, and *monitoring and enforcement* (underrepresented: cluster 3, white men cluster 2); *climate change* and *resource depletion* (underrepresented: cluster 4, white men: cluster 3); and *future generation* (underrepresented: cluster 1, white men cluster 3) (Figure 2).

4 | DISCUSSION

This study contributes to the growing body of literature on diversity in marine resource management by utilizing mental models to highlight cognitive differences that exist across social identity groups. Acknowledging that there are many ways to conceptualize diversity in a professional setting, I focused specifically on cognitive deep-level diversity across gender and racial/ethnic representation in natural marine resources fields. Supporting my hypothesis, my findings suggest that while similarities in mental models around the management of marine resources were observed, on average white male marine and fisheries science professionals differed in both content and structure of their mental models compared to underrepresented marine and fisheries science professionals. Findings reveal that individuals from underrepresented racial/ethnic and gender social identities, held different concepts and ways of organizing ideas regarding marine resources management in their mental models.

Overall, there were more similarities than differences in the mental model content across social identities. This could be attributed to the sampling methods that focused on marine and fisheries science professionals. All of the study participants had multiple years of experience working in marine and fisheries science professions. This included experience in job sectors that typically require a postsecondary education background related to a field of study, such as nonprofits, government, and academia, therefore creating similar professional experiences to develop similar mental model content (Jones et al., 2011). This supports previous research on collective or shared mental models which suggests that people with shared learning experiences related to a particular topic are more likely to share mental objects within their mental models (Biedenweg & Monroe, 2013).

However, results also revealed that significant differences existed in the frequency of mental objects commonly associated with diversity and traditional knowledge (*diversity*, *justice*, *equity*, *traditional ecological knowledge*) with white men incorporating these concepts in their mental models less frequently than both women and underrepresented racial/ethnic groups. In this case, groups may have different conceptualizations of the terms associated with diversity and their level of importance. Previous findings concluded that from a racial and ethnic perspective, diversity means different things to members of represented and underrepresented groups and is more likely to be defined broadly by members of represented groups (Unzueta & Binning, 2010, 2012). Depending on the context, its meaning may even be strategically broadened or narrowed to justify one's interest (Unzueta et al., 2012; Unzueta & Binning, 2012). While calls for diversity are commonly associated with arguments suggesting that diversity is good for the profession (Batavia et al., 2020), the lack of association with the term by white men in my sample may suggest that calls for diversity in natural resources professions are not trickling down into their perceptions of factors that are important for marine resources management and decision-making processes. This finding supports the need to better understand the value of diversity beyond surface-level or numerical perspectives.

The mental model content also sheds light on how participants viewed the importance of different sources of knowledge. While the concept card *science-driven* was frequently selected concepts by all groups, it was selected more frequently by white men. In contrast, white men incorporated *traditional ecological knowledge* in their mental models less frequently than women and underrepresented racial/ethnic groups. These findings suggest that while underrepresented groups (racial/ethnic and women) viewed *science-driven* as an important factor to consider when managing natural marine resources, they were also more likely to view *traditional ecological knowledge* as another important source of knowledge. While there is a growing body of research related to utilizing traditional ecological knowledge in natural resources management decisions (Drew, 2005; Lertzman, 2010; Menzies, 2006), traditional ecological knowledge has historically been viewed as being separate from western science, which could be one possible explanation for it being less frequent in the mental models of white men.

Previous research suggests that differences in mental models can be expected when differences exist in cultural backgrounds (Denzau & North, 2000). Possible examples of these differences were observed when analyzing the structures of mental models across social identity groups, which revealed differences in how groups conceptualized interactions of concepts. For example, while, *science-driven* and *data* were two of the three most frequently selected concepts and grouped together by all groups, underrepresented racial/ethnic groups were the only group to commonly clustered climate change and resource depletion within the same cluster as these top concepts (*science-driven* and *data*). Previous research suggests that people of color are generally more concerned about climate change than whites as a result of differences in experiences with the environment such as the inequitable rates at which people of color are exposed to environmental hazards, including those associated with climate change (Ballew et al., 2020; Finney, 2014; Taylor, 2002). While there was not a significant difference in the selection of climate change between the two group differences, it is possible that there are differences in why the concept was selected (e.g., resulting from differences in lived experiences). These results highlight the value of understanding the "why" and how it influences how different groups prioritize topics such as climate change within decision-making processes.

The location of *science-driven*, *data and stock assessment* within the structure of mental models revealed additional differences. For white men, the cluster containing these concepts were distant from all the other clusters (Figure S1) suggesting that they saw this cluster as distinct and dissimilar from the other concepts. However, the clustering of mental objects became less concise, specifically in the cluster containing concepts commonly associated with the human dimension of management (e.g., stakeholders, communities, public input, economic benefits, etc.). In recent decades, there have been efforts to adopt community-based management and ecosystem-based management approaches, which require the incorporation of human dimensions characteristics (Garcia, 2003; Long et al., 2015; Pikitch et al., 2004). Yet, a 2019 review of the incorporation of human dimension indicators in ecosystem-based fisheries management, found that while the operationalization of ecological indicators in the management process tends to be clear, the path from understanding and operationalizing human dimension indicators into the process still needs work (Hornborg et al., 2019). My findings suggest that the presence of diverse perspectives maybe benefit management strategies such as ecosystem-based management in furthering the incorporation and operationalization of human dimension-related concepts into the decision-making process.

Identifying and acknowledging diverse perspectives, including differences in how groups perceive concept interactions, has the potential to benefit the management and decision-making process by providing additional ways of addressing and prioritizing the management of natural marine resources. Previous research identified a positive relationship between deep-level diversity and team creativity and innovation (Wang et al., 2019), which suggest that the incorporation of diverse perspective into management and decision-making has the potential to support collaboration and interdisciplinary work and lead to the development of more creative solutions and strategies to address environmental problems.

The findings of this study focused on the diversity of perspectives, revealing differences across specific social identity groups, yet it is important to note that the validity of the data collected is context-dependent and based on a sample that may not reflect the perspectives of all marine and fisheries science professionals. However, the purpose of this study was to highlight the potential that the exploration of deep-level cognitive diversity has for furthering the diversity conversation in natural resource management. The results presented in this article provide a glimpse of the participant's mental models within a specific time and context; however, mental models are dynamic and constantly changing based on experiences (Jones et al., 2011). While the online approach used in this study allowed me to reach more participants than I anticipated, one limitation to this was that I was not present to ask follow-up questions that may have provided additional clarification and or context to some of the responses.

In this study, I grouped participants from multiple underrepresented racial/ethnic groups into one underrepresented racial/ethnic group. While it is not uncommon for individuals from multiple social identities to be labeled as underrepresented, the decision to analyze responses together as one group limited my ability to identify differences that may have existed between specific underrepresented racial/ethnic groups and my ability provide additional context on a cultural experience that are common or unique to a specific racial/ethnic group. Future research can benefit from comparing differences at a finer scale, as well as, incorporating an intersectionality approach that looks at differences across intersecting identities.

As the explorations of the importance of diversity continue to evolve across STEM fields and professions, it is essential to explore ways in which different conceptualizations of diversity have the potential to impact institutions, management strategies, and decision-making processes. Without clarity, research has the potential to overlook the value of diversity that exists beyond just numerical or surface levels of representation. While the outcomes of this study provide insight into the value of deep-level diversity, these findings do not necessarily translate into inclusion in decision-making and management actions. Simply acknowledging that differences in perspectives exist across social identity groups, without providing appropriate mechanisms for the integration of these perspectives into decision-making processes, has the potential to result in superficial diversity or negate diversity efforts altogether. Future research should focus on the inclusion and incorporation of diverse perspectives, across a variety of social identity groups, into decision-making processes. For organizations and institutions to truly live up to their commitments to promote diversity, they must first recognize the potential and genuine value that people from diverse backgrounds and lived experiences bring into the decision-making process and prioritize meaningful inclusion. Management actions impact stakeholders and communities across social identities and lived experiences; therefore, representation must exist throughout the management process.

AUTHOR CONTRIBUTIONS

Brittany D. King obtained funding for this project, conceived the study design, analyzed data, and wrote the paper.

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CONFLICT OF INTEREST

The author declares no conflict of interests within this study.

DATA AVAILABILITY STATEMENT

Deidentified data and materials used in this study may be made available upon request from the author, Brittany D. King, and by IRB approval.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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